

RADIO & TELEVISION NEWS

**FEBRUARY
1953**

IN THIS ISSUE

**GUIDED MISSILE DATA
RECORDING**

**A THERMOCOUPLE
A.C. WATTMETER**

ULTRASONIC MICROSCOPE

COMPUTER RELIABILITY

**CHARACTERISTICS OF
DIGITAL AND ANALOG UNITS**

**BUILD THIS
TRANSISTOR RECEIVER**

**IMPROVING THE
WILLIAMSON AMPLIFIER**

**COMPACT BANDSWITCHING
V.F.O. MULTIPLIER**

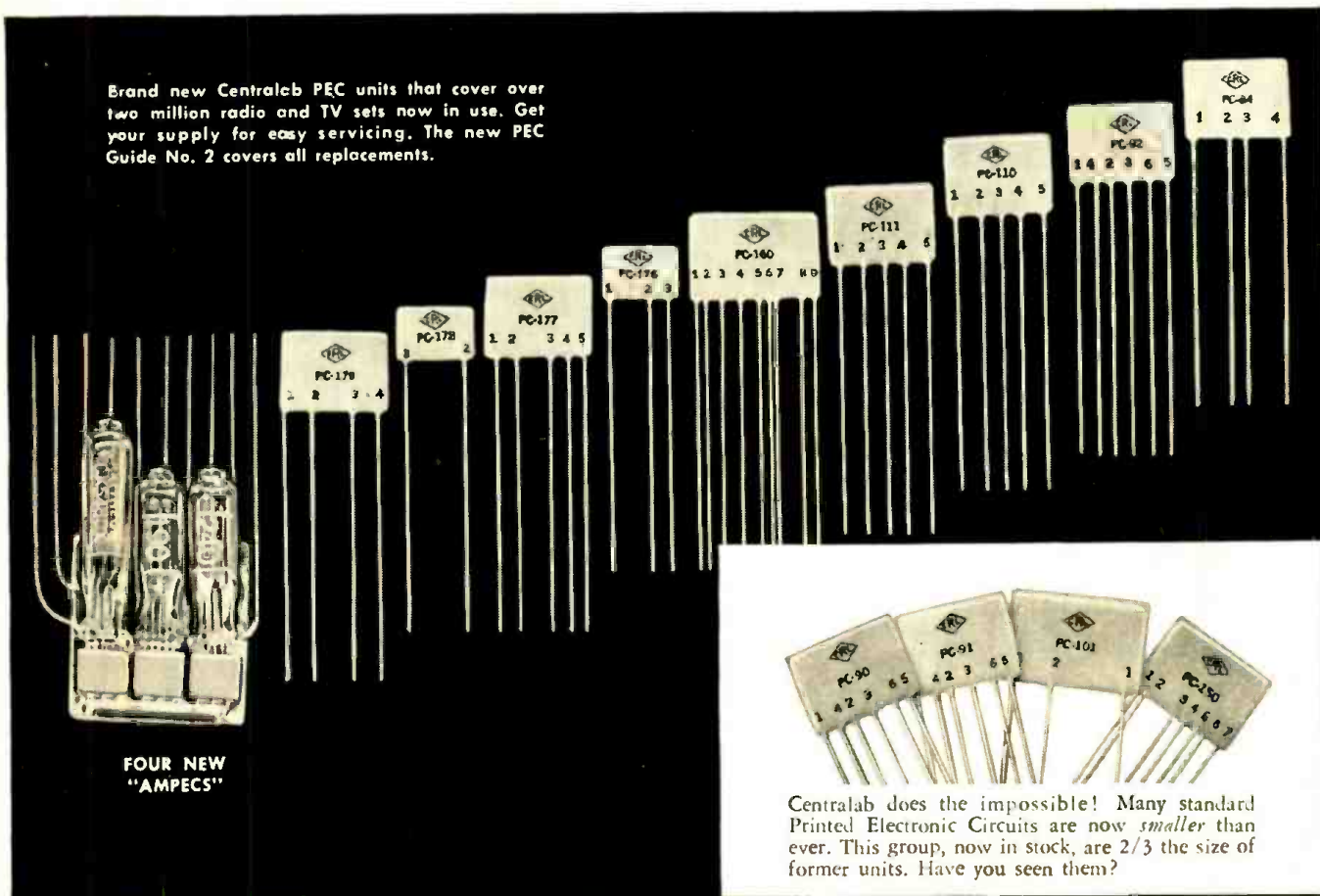
**V.H.F. & U.H.F.
ANTENNA DESIGN** ▶

(See Page 42)



Thirteen NEW CRL Printed Electronic Circuits for replacement service!

Brand new Centralab PEC units that cover over two million radio and TV sets now in use. Get your supply for easy servicing. The new PEC Guide No. 2 covers all replacements.



FOUR NEW "AMPECS"

Centralab does the impossible! Many standard Printed Electronic Circuits are now smaller than ever. This group, now in stock, are 2/3 the size of former units. Have you seen them?

Now Available from your Centralab Distributor

THESE thirteen new Printed Electronic Circuits are now in use in thousands of radio and TV sets. You should have a complete stock on hand for shop work and service calls. Centralab Circuits are safest and easiest for servicing. In most cases, the replacement PC number is the same as shown on the original part.

These new PEC units replace whole Pentode Coupling, TV I. F., Triode Coupling, or Pentode Detector networks. Four new plates, too, to replace *special* manufacturer's parts. Together with the other CRL stock Printed Electronic Circuits, these parts will cover 95% of all PEC replacements. Over 15 million circuits are now in use . . . are you ready to service them?

Don't overlook the new smaller sizes in older PEC units. Small size is not enough . . . Centralab makes Printed Electronic Circuits even smaller! For complete information on parts, replacements, and test data, see the *new* Printed Electronic Circuit Guide No. 2. Ask your distributor for a copy, or use the coupon.

**Make your Centralab distributor
headquarters for
exact electronic replacements**

Centralab

A Division of Globe-Union Inc.

Milwaukee 1, Wisconsin

In Canada, 635 Queen Street East, Toronto, Ontario

Centralab Printed Electronic Circuits are among the more than 470 new items listed in Centralab's new Catalog 28. Get your copy of this 32-page index to the latest developments in the fast-changing electronic field, plus the 20 page Printed Electronic Circuit Guide No. 2. See your distributor or use coupon.



CENTRALAB, A Division of Globe-Union Inc.
910 E. Keefe Avenue, Milwaukee 1, Wisconsin

Please send me my copy of:

P.E.C. Guide No. 2 Centralab Catalog 28

Name..... Position.....

Company.....

Address.....

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

RADIO & TELEVISION NEWS is published monthly by the Ziff-Davis Publishing Company at 185 N. Wabash Ave., Chicago 1, Ill. Entered as second-class matter, July 21, 1948 at the Post Office, Chicago, Ill., under the act of March 3, 1879. Authorized by Post Office Department, Ottawa, Canada, as second-class matter. SUBSCRIPTION RATES: Radio & Television News—one year, U. S. and Possessions, Pan-American countries, and Canada \$4.00; all other foreign countries \$5.00; Radio-Electronic Engineering Edition—one year, U. S. and Possessions, Pan-American countries, and Canada \$8.00; all other foreign countries, \$7.00. Postmaster—Please return undelivered copies under form 3589 to 64 E. Lake St., Chicago 1, Ill.

Editor
OLIVER READ, D.Sc., WIETI

Managing Editor
WM. A. STOCKLIN, B.S.

Technical Editor
H. S. RENNE, M.S.

Service Editor
CHARLES TEPFER

Amateur Radio Editor
NICHOLAS ROSA, W1NOA

Assistant Editors
P. B. HOEFER
M. C. MAGNA

Television Consultant
WALTER H. BUCHSBAUM

Short-Wave Editor
KENNETH R. BOORD

Staff Artist
FRANK SAYLES

Draftsman
A. A. GANS, W2TSP

Advertising Manager
L. L. OSTEN

Midwest Adv. Manager
JOHN A. RONAN, JR.

Western Adv. Manager
JOHN E. PAYNE



COVER PHOTO: Every new antenna that reaches the market represents hours of engineering time and exhaustive testing like this new "Vee-D-X" unit by LaPointe-Plascomold Corp. (Ektachrome by James Pickands)

Chairman of the Board and Publisher
WILLIAM B. ZIFF

President
B. G. DAVIS

Secretary-Treasurer
G. E. CARNEY

Vice-Presidents
H. J. MORGANROTH
Production Director

LYNN PHILLIPS, JR.
Advertising Director

H. G. STRONG
Circulation Director

BRANCH OFFICES
 CHICAGO (11)
 185 N. Wabash, AN 3-5200
 LOS ANGELES (14)

Staller Center, 900 Wilshire Blvd., Mich. 9850

First in
radio-television-electronics
 Average Paid Circulation over 220,000

RADIO & TELEVISION NEWS

Reg. U.S. Pat. Off.

Radio News Trademark Reg. U. S. Pat. Office • Television News Trademark Reg. U. S. Pat. Office.

CONTENTS

FEBRUARY, 1953

Build this Transistor Receiver.....	Robert K. Dixon	35
Oil-Cooled Load Wattmeter.....	Robert M. See, W9OCL/5	38
Care of Transistors.....	Rufus P. Turner, K6AI	40
V.H.F.-U.H.F. Antenna Design.....	L. F. B. Carini	42
Improving the Williamson Amplifier.....	David Hafler & Herbert I. Keroes	43
TV Signal Distribution Methods.....	Edward M. Noll	46
An Improved Corner Horn Speaker System.....	George L. Augspurger	48
Current TV Topics.....	Walter H. Buchsbaum	50
A Compact Bandswitching V.F.O. Multiplier.....	Earl Snader, W0ZFO	52
Sound System for Your TV Set.....	John Potter Shields	54
U.H.F. Antennas (Part 3).....	Milton S. Kiver	56
Writing for Profit and Prestige.....	Louis E. Garner, Jr.	59
A Vest-Pocket Receiver.....	E. G. Louis	60
Single-Channel Remote Broadcast Amplifier.....	Leon A. Wortman	62
Mac's Radio Service Shop.....	John T. Frye	64
3-Element 14 mc. Rotary Beam Antenna.....	C. A. West, W2IYG	66
New TV Grants Since Freeze Lift.....		70
Eliminating Oscillator Hum in FM Receivers.....	Herbert Michels	82
Radio-TV Service Industry News.....		104

DEPARTMENTS

For the Record.....	The Editor	8	What's New in Radio.....	85
Spot Radio News.....		16	Manufacturers' Literature.....	116
Within the Industry.....		24	Technical Books.....	155
Short-Wave.....	K. R. Boord	65	New TV Products.....	158



COPYRIGHT 1953
ZIFF-DAVIS PUBLISHING COMPANY
 Editorial and Executive Offices
 366 Madison Ave., New York 17, N. Y.
 VOLUME 49 • NUMBER 2



Member
 Audit Bureau of
 Circulations

SUBSCRIPTION SERVICE: All communications concerning subscriptions should be addressed to Circulation Dept., 64 E. Lake St., Chicago 1, Ill. Subscribers should allow at least two weeks for change of address.

CONTRIBUTIONS: Contributors are advised to retain a copy of their manuscripts and illustrations. Contributions should be mailed to the New York Editorial Office and must be accompanied by return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to whatever adaptations and revisions are necessary to meet the requirements of this publication. Payment covers all author's, contributor's, and contestant's rights, title, and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of the material purchased.

RADIO & TELEVISION NEWS

Prepare Now... in spare time at Home ... for a New,

PROFITABLE, INTERESTING FUTURE

TELEVISION
RADIO - ELECTRONICS

RADIO CHIEF OF ILE DE FRANCE
FRENCH LUXURY LINER PRAISES D. T. I.

Radio Chief—Jean Desmas Says:

"DeForest's Training, Inc., of Chicago, is known not only throughout Europe, but also in many parts of the world as one of America's finest Television, Radio and Electronics training centers."



JACK DEMPSEY
Former World's Heavyweight Champion
TELLS WHY HE'S PROUD
TO BE WITH **D.T. I.**

- I have been greatly impressed with D.T.I.'s wonderful spirit of friendliness and sincere determination to help its students make good in Television-Radio-Electronics.
- I admire its remarkable 20 year record of helping men build brighter futures.
- I also admire the business policy of its management and the thoroughness of its large faculty of instructors.
- Never have I heard young men praise a school as enthusiastically as do the students and graduates of D.T.I. They are its best boosters.



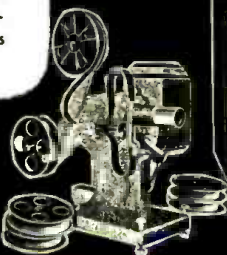
Prepare At Home Or In Our Chicago Laboratory!

See for yourself how readily you may prepare at home, or in our modern Chicago laboratories, for a better job or business of your own in one of America's fastest-growing fields—TELEVISION-RADIO-ELECTRONICS.

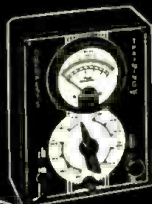
If you train at home you get (1) the use of a 16-mm. movie projector and 16 reels of animated movies to help you learn important points faster . . . easier, (2) modern lessons and (3) sixteen shipments of electronic parts enabling you to get valuable practical experience from over 300 projects—including building and keeping the electronic equipment shown below. And upon completing training, you have the optional privilege of building and keeping a big 17-INCH TV set at moderate added cost. Get the full story. Mail coupon today!

LAUD D. T. I.'s HOME MOVIES IN CONGRESS

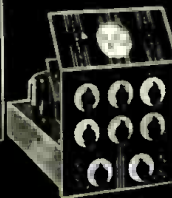
D.T.I.'s remarkable home training benefit of visual training MOVIES has been praised from the floor of the House of Representatives in Washington, D. C. and recorded in The Congressional Record.



HOME MOVIES



MULTIMETER



OSCILLOSCOPE



6-TUBE RADIO

R-F SIGNAL GENERATOR



MILITARY SERVICE!

If subject to military service, the information we have for you should prove very helpful. Mail coupon today.



De FOREST'S TRAINING, INC.
AFFILIATED WITH
De VRY Technical INSTITUTE
CHICAGO 14, ILLINOIS



MAIL COUPON TODAY!

Dept. RN-2-J
DE FOREST'S TRAINING, INC.
2533 N. Ashland Ave., Chicago 14, Ill.

I would like your Opportunity News Bulletin showing "89 Ways to Earn Money in Television-Radio-Electronics"; also, the folder showing how I may prepare to get started in this thrilling field.

Name _____ Age _____
Address _____ Apt. _____
City _____ Zone _____ State _____

G-C HAS MADE... 125 MILLION STAND-OFFS FOR THE TELEVISION INDUSTRY

125 MILLION STAND-OFFS! Yes, G-C recently completed the manufacture of its 125,000,000th Stand-Off... made possible by the fact that the entire radio-TV service industry recognizes the value, the top quality built into every G-C Stand-Off—available from your jobber in 24 popular styles.



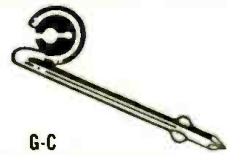



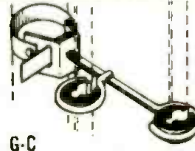
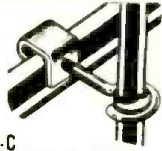



All G-C Stand-Offs are supplied with genuine Polyethylene insulators like this... featuring the exclusive G-C reinforcing rib that keeps the insulator from collapsing.



G-C KANT-STRIP MAST STAND-OFFS

Exclusive, improved mast stand-offs with strip-proof extruded threads. Extra strong; no flimsy light metal used; no loose nuts to fall out. Galvanized strap has round end for easier threading. Genuine Polyethylene insulator, unique G-C design.

No.	Size
8253	3 1/2" Single
8257	7 1/2" Single

 <p>G-C UNIVERSAL STAND-OFFS (Machine Screw Type)</p> <table border="0"> <tr> <th>No.</th> <th>Length</th> </tr> <tr> <td>8031</td> <td>3 1/2"</td> </tr> <tr> <td>8032</td> <td>5 1/2"</td> </tr> <tr> <td>8035</td> <td>7 1/2"</td> </tr> </table>	No.	Length	8031	3 1/2"	8032	5 1/2"	8035	7 1/2"	 <p>G-C UNIVERSAL STAND-OFFS (Wood Screw Type)</p> <table border="0"> <tr> <th>No.</th> <th>Length</th> </tr> <tr> <td>8027</td> <td>3 1/2"</td> </tr> <tr> <td>8028</td> <td>5 1/2"</td> </tr> <tr> <td>8029</td> <td>7 1/2"</td> </tr> <tr> <td>8030</td> <td>12"</td> </tr> </table>	No.	Length	8027	3 1/2"	8028	5 1/2"	8029	7 1/2"	8030	12"	 <p>G-C NAIL-IN STAND-OFFS</p> <p>New, speed-type nail-in stand-offs save installation time, labor and cost on each job. Easy to use. Genuine Polyethylene insulators.</p> <table border="0"> <tr> <th>No.</th> <th>Length</th> </tr> <tr> <td>8343</td> <td>3 1/2"</td> </tr> </table>	No.	Length	8343	3 1/2"	 <p>G-C DUPLEX IN-LINE STAND-OFFS</p> <p>Two styles, wood screw and machine screw types. Heavily zinc plated to prevent rust.</p> <table border="0"> <tr> <th>No.</th> <th>Size and Type</th> </tr> <tr> <td>8225</td> <td>7 1/2" Wood Screw</td> </tr> <tr> <td>8226</td> <td>7 1/2" Machine Screw</td> </tr> </table>	No.	Size and Type	8225	7 1/2" Wood Screw	8226	7 1/2" Machine Screw
No.	Length																														
8031	3 1/2"																														
8032	5 1/2"																														
8035	7 1/2"																														
No.	Length																														
8027	3 1/2"																														
8028	5 1/2"																														
8029	7 1/2"																														
8030	12"																														
No.	Length																														
8343	3 1/2"																														
No.	Size and Type																														
8225	7 1/2" Wood Screw																														
8226	7 1/2" Machine Screw																														
 <p>G-C SNAP-ON STAND-OFFS</p> <p>NEW, improved snap-on that is easier to install, then stays on. Snap... and it's on; that's all there is to it! Two standard sizes. Feature exclusive G-C reinforced insulators.</p> <table border="0"> <tr> <th>No.</th> <th>Size</th> </tr> <tr> <td>8797</td> <td>For 1" Masts</td> </tr> <tr> <td>8798</td> <td>For 1 1/4" Masts</td> </tr> </table>	No.	Size	8797	For 1" Masts	8798	For 1 1/4" Masts	 <p>G-C "WIRE-GRIP" GUY WIRE STAND-OFFS</p> <p>TV lead-ins and rotator wires can be brought down long guy wires. Fasten permanently; easy to use. Genuine Polyethylene insulators.</p> <table border="0"> <tr> <th>No.</th> <th>Size and Type</th> </tr> <tr> <td>8255</td> <td>3 1/2" Single</td> </tr> <tr> <td>8256</td> <td>Double Type</td> </tr> </table>	No.	Size and Type	8255	3 1/2" Single	8256	Double Type	 <p>G-C DUPLEX KANT-STRIP MAST STAND-OFFS</p> <p>Heavy steel stand-off with strip-proof extruded threads. A deluxe stand-off at a really low price. Galvanized strapping. For both 300-ohm and coaxial lines.</p> <table border="0"> <tr> <th>No.</th> <th>Type</th> </tr> <tr> <td>8258</td> <td>Double</td> </tr> </table>	No.	Type	8258	Double	 <p>G-C EAVE TYPE CLAMP-ON STAND-OFFS</p> <p>New type, clamp-type stand-off that quickly fastens to eaves. Easy to install. Genuine Polyethylene insulators.</p> <table border="0"> <tr> <th>No.</th> <th>Type</th> </tr> <tr> <td>8811</td> <td>Single</td> </tr> <tr> <td>8812</td> <td>Double</td> </tr> </table>	No.	Type	8811	Single	8812	Double						
No.	Size																														
8797	For 1" Masts																														
8798	For 1 1/4" Masts																														
No.	Size and Type																														
8255	3 1/2" Single																														
8256	Double Type																														
No.	Type																														
8258	Double																														
No.	Type																														
8811	Single																														
8812	Double																														
 <p>G-C TEE-TYPE STAND-OFFS</p> <p>Heavy zinc plated for permanent installation. Two types, wood screw and machine screw. For both 300-ohm and coaxial lines.</p> <table border="0"> <tr> <th>No.</th> <th>Size and Type</th> </tr> <tr> <td>8809</td> <td>7 1/2" Wood Screw</td> </tr> <tr> <td>8810</td> <td>7 1/2" Machine Screw</td> </tr> </table>	No.	Size and Type	8809	7 1/2" Wood Screw	8810	7 1/2" Machine Screw	<p>FREE G-C's big, illustrated Catalog, chock-full of hundreds and hundreds of radio-TV service aids. Send a postcard for your copy today!</p> <div style="text-align: center;">  <p>GENERAL CEMENT MANUFACTURING CO. 904 TAYLOR AVENUE ROCKFORD, ILLINOIS</p> </div> <div style="text-align: right;">  </div> <p style="text-align: right;">RADIO & TELEVISION NEWS</p>																								
No.	Size and Type																														
8809	7 1/2" Wood Screw																														
8810	7 1/2" Machine Screw																														

**Accepted and praised by
the most critical expert in the world**

...the American Amateur Radio Operator



hallicrafters



A Ham's Dream—The SX-71—Planned with you, the advanced amateur, in mind, Communications Receiver SX-71 is a double conversion set, built-in NBFM limiter stage. 538 kc to 34 mc. in 5 bands. Plus A 46 to 55 mc band. Temperature comp.; voltage regulator. 1 r-f, 2 converters, 3 i-f stages. Xtal. filter, 3-position selectivity. 115 V AC, 11 tubes, regulator, rectifier **\$224.50**



Precise Selectivity—The S-76—Amazingly selective! Crisp station separation. Double conversion with 50 kc 2nd i-f. Giant 4-in. "S" meter. 540-1580 kc, 1.72-32 mc in 4 bands. 1 r-f, 2 converters, 2 i-f stages. 5 position selectivity. Phono input jack, 3 watt output. 115 V AC, 9 tubes, regulator, rectifier **\$179.50**



Low Price—High Performance!—S-40B—540 kc to 43 mc in 4 bands. Electrical band spread. Temperature compensated. 1 r-f, 2 i-f. 3 watt output. Built-in speaker. 115 V AC only, 7 tubes, plus rectifier. (S-77—same as S-40B, for 115 V AC or DC) **\$119.95**

The first Hallicrafters radio was built specifically for the ham operator more than twenty years ago. Today, Hallicrafters sell more communications sets to the armed forces, professionals and hams, than *all other manufacturers combined*. Yet today, these Hallicrafters sets are still designed *specifically* for the most critical expert in the world—the American amateur operator. There is no higher standard.

hallicrafters

"The Radio Man's Radio"

World's Leading Manufacturer of Precision Radio and Television • Chicago 24, Illinois

The Finest Buy in SW!—The S-38C—Best performance per dollar you'll find, the S-38C is the outstanding low priced set on the market. 540 kc to 32 mc in 4 bands. Maximum sensitivity per tube,—far outperforms ordinary broadcast sets. Built-in speaker. 115 V AC or DC. 4 tubes plus rectifier **\$49.50**



E-V

**for PA
LIKE ON TV**

**636
Slimair
DYNAMIC
MICROPHONE**

Gives you features similar to those in the famous E-V Slim-Trim TV Microphones. That's why it is so outstanding for Public Address, Recording and other general-purpose use.
List Price \$70

SMOOTH RESPONSE
60-13,000 CPS
HIGH OUTPUT
OMNIDIRECTIONAL
ACOUSTALLOY
DIAPHRAGM
BUILT-IN
BLAST FILTER

Can be used
in the hand,
on a stand
or overhead

SEND FOR BULLETIN

Electro-Voice
410 CARROLL ST. • BUCHANAN, MICH.
Export: 13 E. 40th St., N. Y. 16, U.S.A.

For the RECORD.

BY THE EDITOR

THE TELEVISION SERVICE OPERATOR

MANY letters coming to our desk are from technical trainees attending classes in our trade schools and colleges. These students, generally, state that they are learning radio or television theory and practice as preparation for a career in the servicing business. Typical questions asked include: "What do I need to start a service shop?", "Should I specialize in television service exclusively or should I consider both radio and television?" and "What test equipment will I need for television servicing?"

It is a well established fact that television installation and service requires considerably more test instruments and other equipment than does radio. Such equipment can be very costly and, in the case of the independent service technician, almost prohibitive in areas of limited clientele. TV test equipment must be sensitive and accurate. In many cases it is too massive or heavy for home servicing and belongs on the test bench where it can be conveniently and effectively used. A well-equipped shop is a prerequisite for television servicing.

The service shop, however well equipped, is but one link in the chain of equipment required by the progressive service operator. Successful TV service contractors have learned that to cope with the many problems that arise in TV areas they must not only have a well trained staff of technicians but that their men must be properly equipped with the tools of the trade.

Paul Forte of the *Television Contractors Association* recently named several important components that are required to render good service. They include a panel truck or specially fitted car. In it must be carried a supply of tools, equipment, and spare parts that are in most common need. When a television set can't be repaired with these facilities, the car or truck must be suited so that a chassis and/or cabinet can be brought back to the shop for bench work. Such vehicles cost money and represent another investment on the part of the service contractor.

Since there are, roughly, about eighty different makes of television sets and thousands of models, the effectively operating contractor must have a complete library of diagrams, schematics, and service notes. These cost money, and taking care of them, adding to them, and using them costs time and money. Without them no man can claim that he is ready to service television.

A service operator cannot properly

function unless he has records of all service calls. These are not things he keeps in his wallet. He's got to have files and forms and he's got to have somebody work on them to keep them up-to-date. That means he has to have an office and someone in it to handle service requests and dispatch them promptly. These things cost money, a cost that can't be borne by the independent technician. If he does bear them, then he isn't an independent technician any longer; he's either a contractor or a service operator.

He must have special equipment and facilities for installations which include the erection of antennas. This, definitely, requires a truck. He can contract the antenna installation to someone else but that is hardly a good method of conducting a business. Trucks, too, cost money and are an integral part of the investment that must be put into a television service operation, as well as into the cost of service.

Since he's dealing with expensive television equipment in the customer's home, he has to carry Public Liability and Property Damage Insurance. He has to carry other insurance on his vehicles, test equipment, parts stock, and other facilities. It costs more money! It's all part of the investment that goes into a properly handled service business.

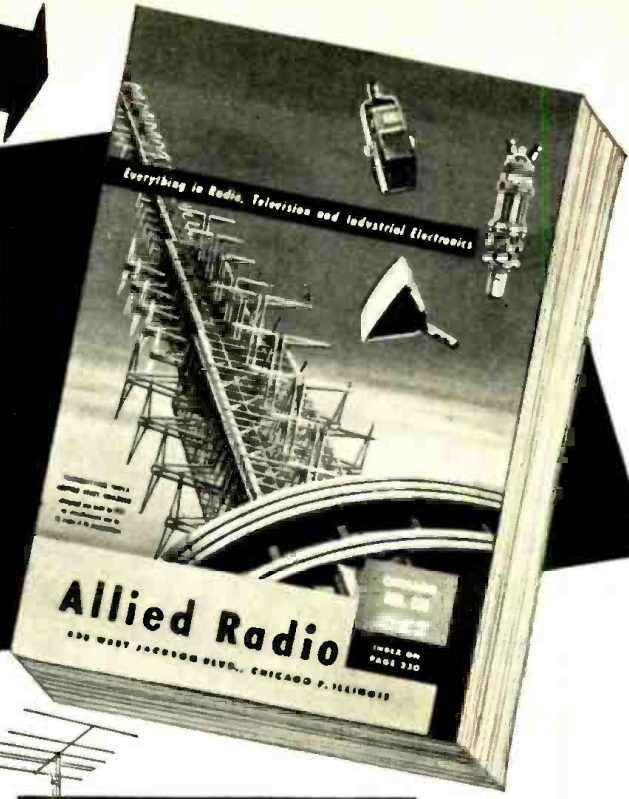
If the so-called independent technician says he doesn't need these things in order to maintain himself in the television service business, he is kidding himself. Certainly he won't kid the public, upon whom he depends for business.

There is little time, if any, for the aggressive technician to relax and sit back with a hope that he can keep pace with the fastest growing industry in our time. Instead, he must constantly keep abreast of new developments, in addition to performing his routine tasks as each day passes. He must continually study new circuits, new products, new applications, and new techniques.

He must learn all that he can about u.h.f. behavior, circuitry, antenna theory, and troubleshooting. He must employ common sense in his relationship with the public he serves. He must conduct himself as a successful business man and be ethical.

If he trains himself NOW and if he builds a firm foundation based on the experience of other technicians—the television service operator can certainly look to a future of interesting opportunities in this industry we choose to call electronics. O.R.

THE ONLY COMPLETE CATALOG FOR
EVERYTHING IN TV, RADIO AND
INDUSTRIAL ELECTRONICS



get your 1953 **FREE**

ALLIED

236-PAGE CATALOG

it's complete
it's value-packed

THE WORLD'S LARGEST STOCKS

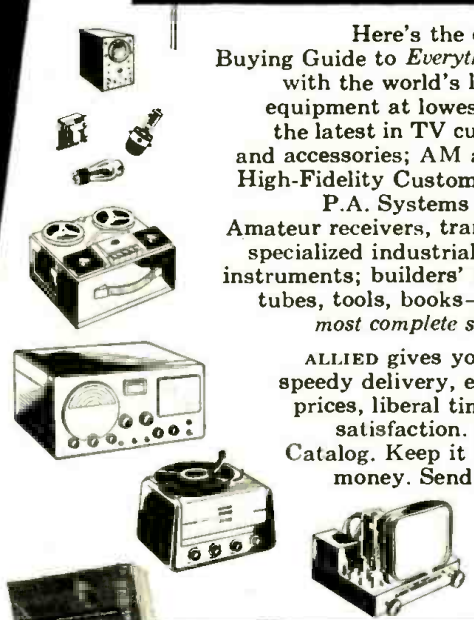
- TV and Radio Parts
- Test Instruments
- Hi-Fi and P.A. Equipment
- Custom TV Chassis
- AM, FM Tuners & Radios
- Recorders and Supplies
- Amateur Station Gear
- Builders Supplies
- Equipment for Industry

**QUICK
EXPERT
SERVICE**

Send for it today!

Here's the *one* authoritative, complete Buying Guide to *Everything in Electronics*—packed with the world's largest selections of quality equipment at lowest money-saving prices. See the latest in TV custom chassis, TV antennas and accessories; AM and FM tuners and radios; High-Fidelity Custom Sound components; latest P.A. Systems and accessories; recorders; Amateur receivers, transmitters and station gear; specialized industrial electronic equipment; test instruments; builders' kits; huge listings of parts, tubes, tools, books—your choice of the world's *most complete stocks* of quality equipment.

ALLIED gives you every buying advantage; speedy delivery, expert personal help, lowest prices, liberal time payment terms, assured satisfaction. Get the latest 1953 ALLIED Catalog. Keep it handy—and save time and money. Send for your FREE copy today!



**EVERYTHING IN
ELECTRONICS**

**SEND TODAY FOR RADIO'S
LEADING BUYING GUIDE**



ALLIED RADIO

World's Largest Electronic Supply House

EASY-PAY TERMS

Take advantage of ALLIED's liberal Easy Payment Plan—Radio's best terms—only 10% down, 12 months to pay—no interest if you pay in 60 days. Available on Hi-Fi and P. A. units, recorders, TV chassis, test instruments, Amateur gear, etc.

TV & HI-FI SPECIALISTS

To keep up with developments in TV and High-Fidelity, look to ALLIED! Count on us for *all* the latest releases and largest stocks of equipment in these important fields. If it's *anything* in Television or High-Fidelity equipment—we have it in stock!

ALLIED RADIO CORP., Dept. 1-B-3
833 W. Jackson Blvd., Chicago 7, Illinois

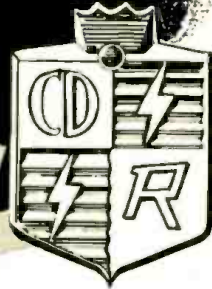
Send FREE 236-Page 1953 ALLIED Catalog.

Name

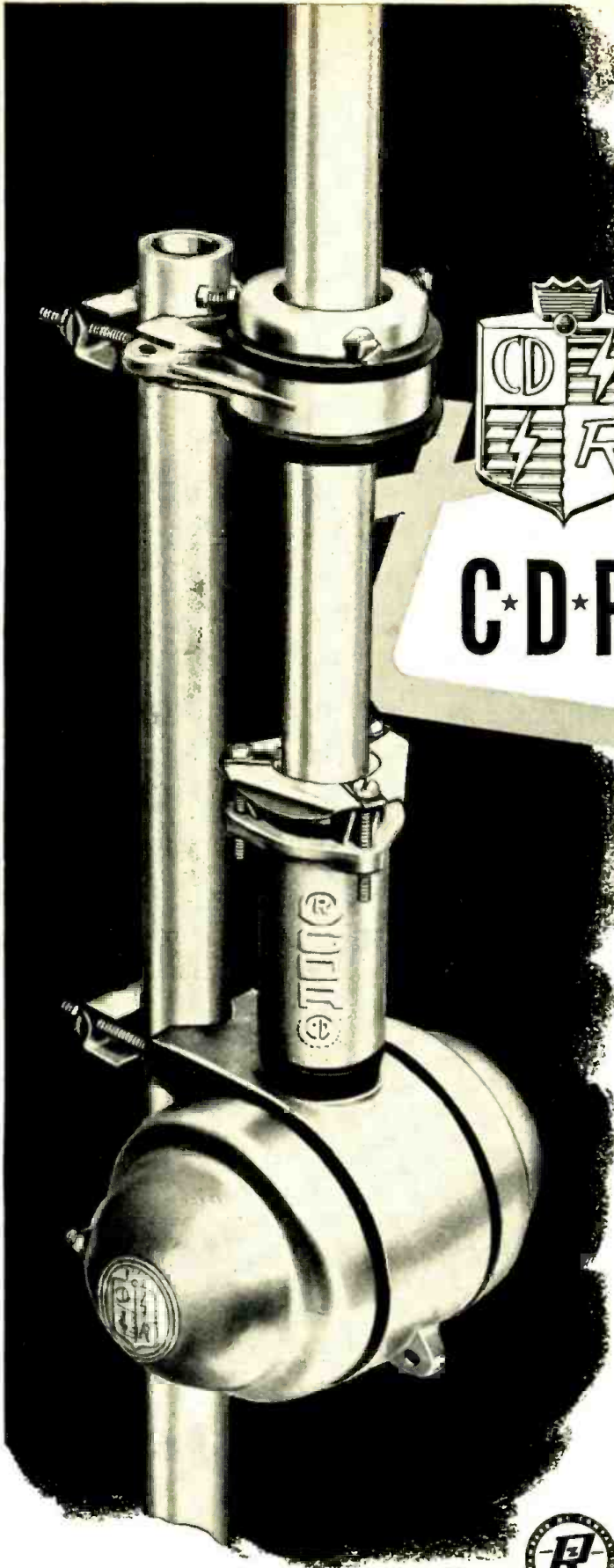
Address

City Zone State

In a Class
by Itself



the
CDR Rotor



Speedy Installation ... the servicemen's dream come true! No loose parts to assemble ... no kits with loose washers, nuts and bolts ... quick mounting antenna mast collet plus four wire cable hookups!

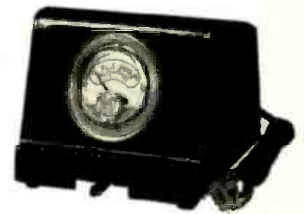
Dependable ... experience has proven that once a CDR ROTOR is up ... it's THERE TO STAY! No costly call-backs! Completely weather-sealed and streamlined ... it's the outstanding value in the field!

Powerful ... sturdy in design to support and TURN ANY TV ANTENNA array ... never a worry about the CDR rotor working! Locking instantly it will not drift! Instantly reversible ... makes a complete revolution in 45 seconds!

MODEL TR-12 A special combination value consisting of complete rotor including thrust bearing ... handsome modern design plastic cabinet with meter control dial, only \$47.95

MODEL TA-6 Thrust bearing accessory, separately \$4.95

MODEL TR-11 Same as TR-12 without thrust bearing.. \$44.95



SUBSIDIARY OF



THE **RADIART** CORPORATION
CLEVELAND 13, OHIO

CORNELL-DUBILIER
SOUTH PLAINFIELD, NEW JERSEY
RADIO & TELEVISION NEWS



EARN MORE MONEY AS AN EXPERT

Get Shop-Method
Training at Home in

RADIO TELEVISION ELECTRONICS

One Master Course - One Low Tuition
LEARN ALL PHASES - EARN WHILE YOU LEARN

AS A NATIONAL SCHOOLS GRADUATE THERE'S A PLACE FOR YOU IN THIS EXPANDING INDUSTRY...*Never before* such a demand for you! For *never before* such a *growing* industry as today's Television, Radio and other Electronic fields. This industry needs you... TODAY... and it needs you as a *trained* man... the kind of man you will be as a National Schools graduate. So don't wait. Start your National Schools training NOW...and enjoy big money, job security, SUCCESS!

LEARN from EXPERTS! BE A SUCCESSFUL MAN YOURSELF! You learn from men who are themselves successful Radio, Television and Electronics technicians. You learn the *practical* way... by *doing*... with equipment we send you. And you *advance* quickly, step by step. Get ALL the facts from FREE book and sample lesson. Mail coupon below NOW. Absolutely no obligation.



All yours at
no extra cost!

You can qualify **FAST** for these big-pay jobs...plus many more

Radio Station Technician • Your own Sales and Service Shop • District Service Manager • Inspector Technician • Aircraft Radio Inspector • Special Govt. Positions • Service Specialist • Sound Truck Operator • and many others!

ONLY NATIONAL SCHOOLS
GIVES YOU THIS PROFESSIONAL



MULTI-TESTER
Ready to use.
Easy to operate. Light enough to carry on service calls.

DRAFT AGE? National Schools training helps you get into special service classifications—get higher grades, better pay!

GET YOUR TRAINING FROM
THE RADIO-TV CAPITAL OF
THE WORLD

Let National Schools—a resi-



dent technical trade school for nearly 50 years—train you at home for today's unlimited opportunities in Radio-TV.



NATIONAL SCHOOLS GRADUATES IN BIG DEMAND. You'll find National Schools graduates in good jobs everywhere. For these are the jobs National Schools *trains* you for. Such complete, shop-method home training can be *your* ticket to success...your key to the job happiness you've always wanted. It's up to you. Mail coupon NOW!

FRIENDLY GUIDANCE AS STUDENT AND GRADUATE. Our special Welfare Department is constantly at your service. Helps you with your technical and personal problems. Gives you the benefit of its wide industry contacts and experience in helping you after graduation. **BOTH RESIDENT AND HOME STUDY COURSES OFFERED.**

NATIONAL SCHOOLS APPROVED FOR G. I. TRAINING

Los Angeles, Calif. • Est. 1905 • In Canada: 193 Hastings St., Vancouver, B.C.

YOU GET ALL THE PARTS INCLUDING TUBES for this superheterodyne receiver... and lots of other equipment...to keep!

NATIONAL SCHOOLS, Dept. RH-23
4000 South Figueroa Street
Los Angeles 37, California

Mail in envelope or paste on postal card

Send me FREE book "My Future in Radio-Television and Electronics." Also a FREE sample lesson. I understand no salesman will call on me and that there is no obligation.

NAME _____ AGE _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

VETS! Check here if you are a veteran.

ACT NOW

Don't put it off! Mail coupon NOW!

DEALERS GETTING WESTINGHOUSE TUBES PROFIT FROM HEAVY LOCAL ADVERTISING AT NO COST

Service dealers are getting powerful local advertising support from new Westinghouse RELIATRON™ Tube Distributors. In cities now served by Westinghouse Distributors, dealers get local newspaper advertising, a complete kit of store display and imprinted mailing material.

All of it—local ads and kits—are designed to build TV-radio service business in the dealer's local area.

Best of all, none of it costs the dealer a penny!

You can get your store listed in two local newspaper ads at no charge, and get a kit to boot. If Westinghouse Tubes are now sold in your area, see your Westinghouse Distributor and take advantage of this \$900-worth-of-advertising-at-no-cost offer.

NEWSPAPER ADS



MAILERS

STICKERS

COMING YOUR WAY

If Westinghouse Tubes are not yet distributed in your area, be patient. Distributors are being established in all market areas as fast as product availability and good service permit.

You'll soon have the chance to buy RELIATRON Tubes. Keep this tremendous opportunity in mind: you'll get newspaper advertising at no cost! Imprinted material for mailings! Imprinted signs for your window!

All of it is local advertising which sells your service in your own area where it counts.

For the name of your Westinghouse Distributor, or the approximate date when Westinghouse Tubes will be available in your area, drop a postal card to Dept. G-202 or have your regular distributor contact Dept. G-202 for information on how he can better serve you.

**YOU CAN BE SURE...IF IT'S
Westinghouse**

RELIATRON TUBES
TM

WESTINGHOUSE ELECTRIC CORPORATION, ELECTRONIC TUBE DIVISION, ELMIRA, N. Y.



**TRAIN FASTER—TRAIN BETTER—TRAIN EASIER
 IN 10 MONTHS—OR LESS—FOR
RADIO-TELEVISION
 Our 21st Year Training Men for Greater Incomes and Security in Radio-Television**

**I SEND YOU
 18 BIG KITS**

of Radio Television parts and equipment. Much of your training will be actual construction and experimentation . . . the kind of truly PRACTICAL instruction that prepares you for your Radio-Television career.

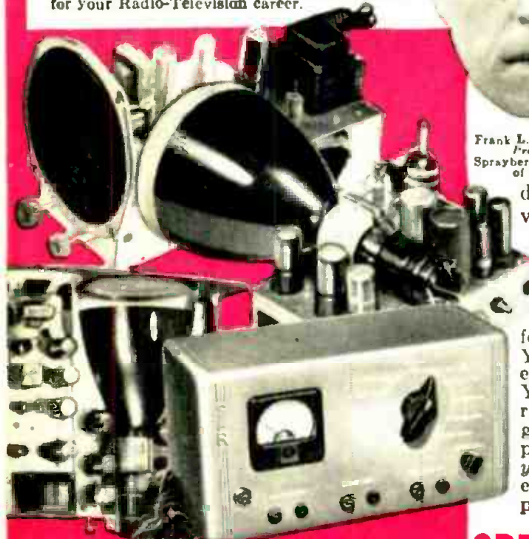


Frank L. Sprayberry
 President
 Sprayberry Academy
 of Radio

NEW! NO OBLIGATION PLAN

**You Have No Monthly Payment Contract to Sign
 Pay For Your Training as You Earn and Learn**

You can get into Radio-Television, today's fastest growing big money opportunity field, in *months* instead of years! My completely new "package unit" training plan prepares you in as little as 10 months or even less! *No monthly payment contract to sign—thus NO RISK to you!* This is America's finest, most complete, practical training—gets you ready to handle any practical job in the booming Radio-Television industry. Start your own profitable Radio-Television shop . . . or accept a good paying job. I have trained hundreds of successful Radio-Television technicians during the past 21 years—and stand ready to train you, even if you have no previous experience! Mail coupon and get all the facts—FREE!



**Valuable Equipment Included
 With Training**

The new Sprayberry "package" plan includes many big kits of genuine, professional Radio-Television equipment. You perform over 300 demonstrations, experiments and construction projects. You build a powerful 6-tube 2-band radio set, multi-range test meter, signal generator, signal tracer, many other projects. All equipment and lessons are yours to keep . . . you have practically everything you need to set up your own profitable Radio-Television service shop.

Earn Extra Money While You Learn!

All your 10 months of training is IN YOUR HOME in spare hours. Keep on with your present job and income while learning. With each training "package" unit, you receive extra plans and "Business Builder" ideas for spare time Radio-Television jobs. New television stations everywhere, open vast new opportunities for trained Radio-Television Technicians—and those in training. If you expect to be in the armed forces later, there is no better preparation than practical Sprayberry Radio-Television training.

YOU BUILD the Television set and the powerful superhet radio receiver shown above. IN ADDITION to the other test units shown here (many are not shown because of lack of space). All equipment I send you is **YOURS TO KEEP.**

Approved for Veterans under the G. I. Bill

**SPRAYBERRY ACADEMY OF RADIO 111 NORTH CANAL ST.
 Dept. 25-S, Chicago 6, Ill.**

**MAIL COUPON
 TODAY!
 NO OBLIGATION**

I invite you to get all the facts—
**FREE TO 3 BIG
 RADIO-TELEVISION BOOKS**

I want you to have ALL the facts about my new 10-MONTH Radio-Television Training—without cost! Rush coupon for my three big Radio-Television books: "How to Make Money in Radio-Television." PLUS my new illustrated Television Bulletin PLUS an actual sample Sprayberry Lesson—ALL FREE. No obligation and no salesman will call. Mail coupon NOW!



**SPRAYBERRY ACADEMY OF RADIO, Dept. 25-T
 111 North Canal St., Chicago 6, Ill.**

Please rush to me all information on your 10-MONTH Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me. Be sure to include 3 books FREE.

Name..... Age.....

Address.....

City..... Zone..... State.....



**We rest our case
on evidence
you can hear**



Words can't prove the performance of this superb High Fidelity Tuner. Neither can witnesses. When it's time for a decision, your judgement of the CRAFTSMEN 10 is based on one thing: evidence you hear with your own ears. Listen—and the conclusive evidence of incomparable sensitivity and flexibility will turn your trial into a lifetime of distinctly better listening.

the
craftsmen 10
high fidelity
FM-AM tuner

- Two cathode followers furnish both audio output and detector output for remote installations.
- Built-in pre-amplifier, compensated for variable reluctance pick-ups.
- Automatic Frequency Control entirely eliminates drift, simplifies tuning.
- 5 microvolts sensitivity on both FM and AM.
- 10 kc filter on AM eliminates inter-station squeal.
- Bass and treble tone controls for boost, cut, or 20-20,000 cycle flat response.

**JUDGE
THE C-500 TOO!**
Williamson all-
triode circuit—
99.99% distortion-free!



high fidelity by craftsmen
means distinctly better listening

For information, write to:

The radio CRAFTSMEN, Inc.

Dept. R-2, 4401 N. Ravenswood Ave.,
Chicago 40, Ill.

Spot Radio News

* Presenting latest information on the Radio Industry.

By RADIO & TELEVISION NEWS'
WASHINGTON EDITOR

THE PROJECTED TV SPAN across the nation, with stations in practically all of the states, often enthusiastically described by many in Washington and industry, seemed to be well on its way to becoming a firm reality, as the closing days of '52 appeared. With nearly 140 grants already issued to new TV operators in four-fifths of the states, and sincere promises from the Commission that hundreds more in all states would soon receive building permits, the prospects for the robust growth of TV looked bright indeed to everyone.

Whereas, only a few months ago, a few states seemed to be favored in the allocation race, nearly all were now receiving a share of the rich prize. The interesting expansion is illustrated in the partial listing of grants issued, at this writing, in the table on page 70.

In studying the table it will be noted that some existing TV areas, with v.h.f. stations, have received new stations which will be operated on the higher bands. One such market is Philadelphia, which now has three stations, and will soon have a u.h.f. station operated by WIP on Channel 29. Other cities in the new and old role are Greensboro, North Carolina and Johnstown, Pennsylvania. Here, Channels 57 and 56, respectively, will compete with the present very-high installations. The Channel 29 grant to the "City of Brotherly Love" was the first u.h.f. authorization to a major metropolitan center and represented an important trend in approvals from the processing staff. It had been felt that grants of this type would be delayed and perhaps not issued until '53. The earlier issuance was described as a major change in philosophy toward large city high-low band operation which would serve to spark sales of TV sets in areas believed riding close to a saturation point among viewers. In Philadelphia, dealers and distributors beamed when the high channel announcement appeared in the local papers. Notwithstanding the fact that the new station will not be placed in operation for some time, interest soared and sales jumped.

THEATER TV, which had a very brief airing during the late winter months of '52, became steeped in gloom as the official hearings began in '53. Many in

the theater industry felt very doubtful about the ultimate success of allocations of channels for theater circuits.

According to the general counsel for motion picture exhibitors, the Commission has shown little enthusiasm for the assignment of channels to the theater. He indicated that most of the questions asked by the Commission during the hearing seemed to indicate that the legislators were not too keen about the proposed system. It was hoped, he said, that the facts presented during the lengthier hearings will convince the Commission that the theaters should have the requested channels, and as soon as possible.

THE ROARING DEBATE in the hearing offices of the Commission concerning the merger of ABC and Paramount, which it was generally felt would taper off with the release of Hearing Examiner Leo Resnick's approval of the merger, flared up with the objections filed by the broadcast bureau of the Commission.

The Resnick report was an extremely interesting document, covering every phase of the case and revealing some intriguing data on Paramount's role in the television industry. It was noted that the motion picture producer began to study the possibilities of TV as early as 1937, when it invested in *Du Mont*. They then applied for experimental television licenses in both Los Angeles and Chicago from which developed the present stations KTLA and WBKB. The transmitters for these stations were said to be among the first built, and the antenna and transmitter at Mount Wilson near Los Angeles was noted as being the first to be established at that focal point.

The report also indicated that the flicker maker has been instrumental in the development of video recording and large-screen TV, too. They have developed a camera and projector which can record TV images almost instantaneously, after they are received, on film said to be suitable for almost immediate projection on large screens used in theaters. In addition to these activities in TV, it was said, the company has become interested in color TV, through participation in the company formed by Dr.

RADIO & TELEVISION NEWS



Here's The New

Model TO-4 **TEL-OHMIKE**[®] CAPACITOR-RESISTOR ANALYZER

- You'll be proud to have this completely new instrument on your service bench!
- The result of a nationwide survey of radio and television technicians makes the new TO-4 Tel-Ohmike meet your capacitor test needs to a capital "T". Trim and trustworthy, it has instant push-button range selection, magic-eye bridge balancing, safety discharge feature, direct meter readings of leakage current and insulation resistance, and a continuously adjustable test voltage for checking electrolytics at exact rated voltages.
- Two especially valuable features are the provision of a special low capacitance circuit for checking small ceramics and "gimmick" capacitors down to 1 mmf (in addition to a top capacitance range of 2000 mf) and the simplified insulation resistance circuit with a top reading of 20,000 megohms.
- See a demonstration of this new instrument at your distributor without delay!
- And the price of this new improved Tel-Ohmike is still the same Only **\$73.50** NET.



Write for full descriptive bulletin today

SPRAGUE PRODUCTS COMPANY

(Distributors' Division of Sprague Electric Co.)

51 MARSHALL STREET, NORTH ADAMS, MASS.

ANOTHER NEW DEVELOPMENT BY THE WORLD'S LARGEST CAPACITOR MANUFACTURER

EVERYBODY'S TALKING ABOUT NEWCOMB'S "AUDI-BALANCE"

PATENT APPLIED FOR

"The greatest amplifier improvement in recent years" . . . A godsend to both owner and service man." . . . "It used to take me hours to do what Audi-balance does in seconds." . . . "Does even better than I've been able to do with meters, this balances tubes dynamically." . . . "The problem has plagued us for years, it is now possible to keep perfect balance in output tubes consistently for lowest distortion." . . . "Audi-balance is the perfect solution."

Just one of the features that make the brand new Classic amplifiers by Newcomb so exciting. Write for catalog of 8 completely new home music amplifiers priced from \$39.50 to \$269.50 audiophile net.

The Classic 25

For the sound thrill of a lifetime this superb new 25 watt custom amplifier has every practical operational feature electronic engineering can offer you. Even more important is the incomparable listening pleasure it provides.



The Classic 15

This outstanding 15 watt amplifier is unique in luxury features and technical perfection at a surprisingly moderate cost. Its smartly designed remote control unit is a superlative piece of engineering, beautifully finished in brushed brass.

Substantial Installation Savings

Savings of as much as, or more than, the entire cost of these fine amplifiers are being reported by enthusiastic purchasers. This is due to their unique design which removes the usual necessity of a remote control being near the amplifier, tuner and changer. These items can now be installed in a hall closet or any similar out of the way location leaving only the beautiful remote control and

the speaker, with no messy confusion of wires, in the living room. No accessories connect directly to the remote control. All inputs connect only to the main amplifier. The savings in cabinetry and of installation labor are obvious and very real to those who take advantage of this new complete remote control design.

NEWCOMB

DEPT. F 6824 LEXINGTON AVENUE, HOLLYWOOD 38, CALIF.

15 years of quality leadership

Write for Catalog



Ernest Lawrence, who has developed a simplified tri-color tube, which will soon be demonstrated in New York again; the original model was shown a year ago. According to Resnick, *Paramount* has invested well over a half-million dollars in this color tube, and \$300,000 in another TV development, a subscription system, which employs a coin box to unscramble scrambled pictures as they are received over a wire or otherwise.

As this column is being prepared, the merger issue is still deadlocked and appears to be a long way from settlement.

LONG DISTANCE overseas transmission is not only a project of our Voice of America, but many European countries, too. In Belgium, two 100-kilowatt transmitters are used for French and Flemish transmissions.

Several types of antennas are used; curtains directed toward the Belgian Congo and rhombics also directed to this zone and to this country, too. A reversible rhombic is also used to beam signals to Scandinavia.

TV is attracting the attention of many new European countries, reports from the continent indicate. In Norway, a substantial sum of money has been appropriated for experimental tests on a 7-megacycle and 625-line system. It is expected that the tests will last about two years.

Extensive tests are also being conducted in Spain over the Chamartin de la Rosa station. Under consideration are the erection of TV stations at Barcelona and Bilbao.

France will expand its TV activities, and by 1958 will probably have a nationwide service featuring their 819-line system.

A NOVEL LISTENING plan is in use in Northern Rhodesia, according to *EBU*. About ninety community receivers are hooked up for group listening in the Lusaka area.

In the early summer of '52 a 15-kilowatt short-wave transmitter was placed in service in Rhodesia. In addition, a mobile recording unit was sent out and covered over sixteen-thousand miles, making over 1300 discs of tribal choirs and other native music.

Community listening has also been reported to be very popular in Ceylon. By the end of September of 1950, 825 receivers had been installed at different community centers, rural development society offices, preaching halls, schools, temples, cooperative stores, etc.

Community broadcasting has also been used in Bombay, Madras, and Delhi. Today there are over 4000 receivers in operation all over the country.

Most receivers are operated from batteries and thus maintenance is a problem. To provide battery power, a network of battery-charging centers is used. In Madras, there are 67 such
(Continued on page 147)

RADIO & TELEVISION NEWS

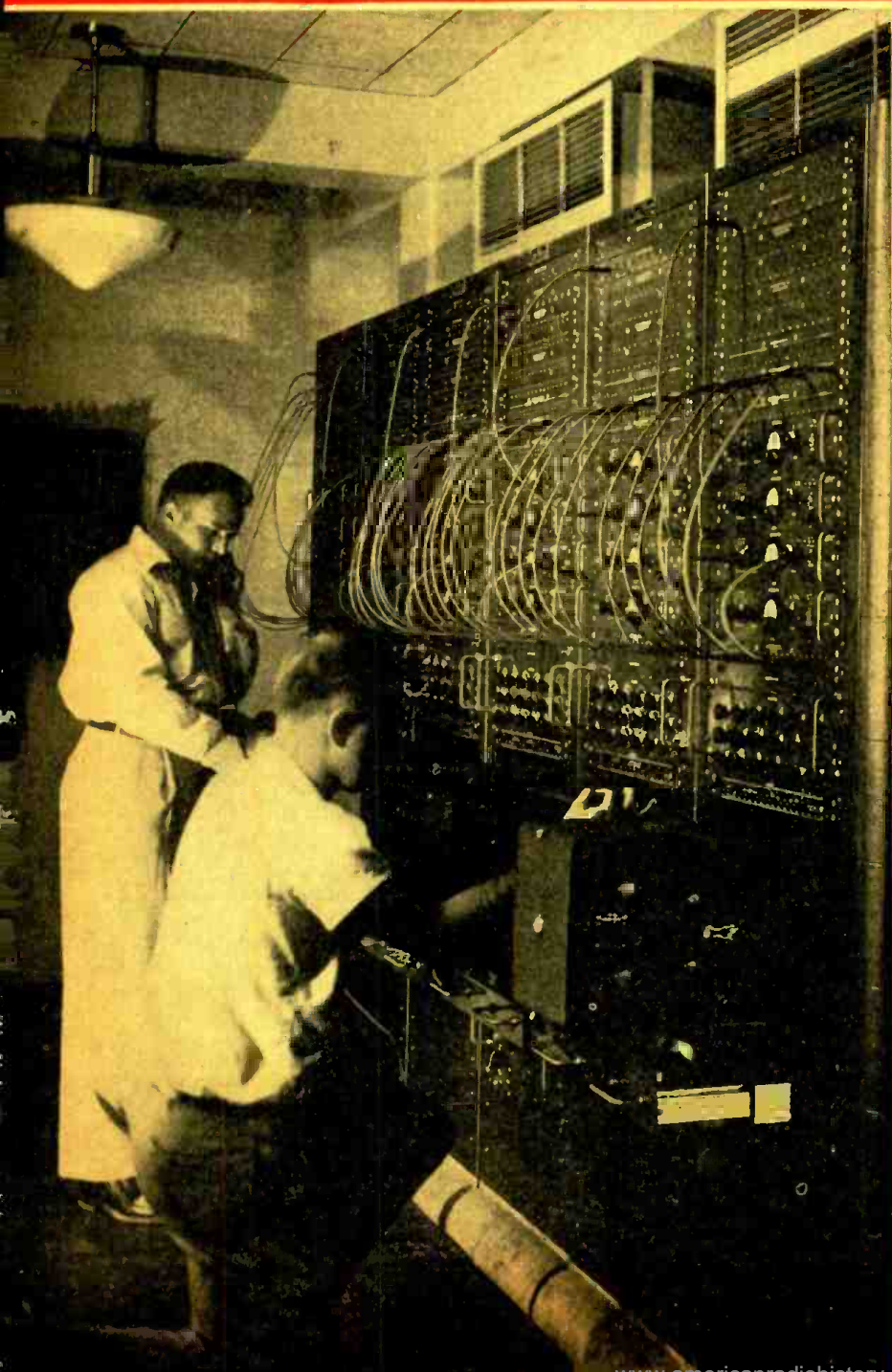
RADIO-ELECTRONIC *Engineering*

S E C T I O N

**RADIO &
TELEVISION
NEWS**

Reg. U. S. Pat. Off.

TELEVISION • RADAR • ELECTRONICS • RESEARCH • COMMUNICATIONS • MICROWAVES



FEBRUARY, 1953

GUIDED MISSILE DATA RECORDING
3

A THERMOCOUPLE A.F. WATTMETER
6

ULTRASONIC MICROSCOPE
8

COMPUTER RELIABILITY
10

FUNDAMENTAL CHARACTERISTICS
OF DIGITAL AND ANALOG UNITS
13

IRE CONVENTION PROGRAM
32

DEPARTMENTS

NEW PRODUCTS 16

NEW TUBES 18

PERSONALS 20

NEWS BRIEFS 22

NEW LITERATURE 24

LOOKING AT TUBES 26

TECHNICAL BOOKS 30

CALENDAR 30



Copyright, 1953, by Ziff-Davis Publishing Co.

RADIO-ELECTRONIC ENGINEERING is published each month as a special section in a limited number of copies of RADIO & TELEVISION NEWS by the Ziff-Davis Publishing Company, 866 Madison Avenue, New York 17, N. Y.

Edited by H. S. RENNE
and the Radio & Television News Staff

Technicians making final oscillograph calibration adjustments on guided missile data recording equipment at Patrick Air Force Missile Test Center. Mr. J. Wynn, Jr., co-author of article on P. 3, is at left.



PERMALLOY DUST TOROIDS FOR MAXIMUM STABILITY...

The UTC type HQ permalloy dust toroids are ideal for all audio, carrier and supersonic applications. HQA coils have Q over 100 at 5,000 cycles... HQB coils, Q over 200 at 4,000 cycles... HQC coils, Q over 200 at 30 KC... HQD coils, Q over 200 at 60 KC... HQE (miniature) coils, Q over 120 at 10 KC. The toroid dust core provides very low hum pickup... excellent stability with voltage change... negligible inductance change with temperature, etc. Precision adjusted to 1% tolerance. Hermetically sealed.



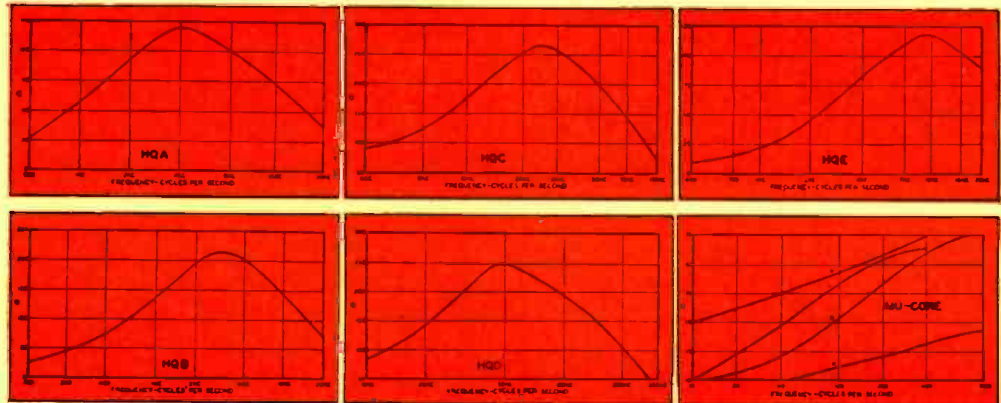
HQA, HQC, HQD CASE
1 13/16" Dia. x 1 3/16" High



HQB CASE
1 5/8" x 2 5/8" x 2 1/2" High



HQE CASE
1/2" x 1 5/16" x 1 3/16" High

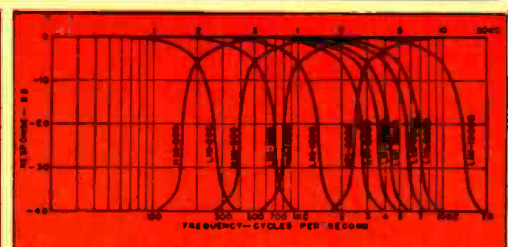
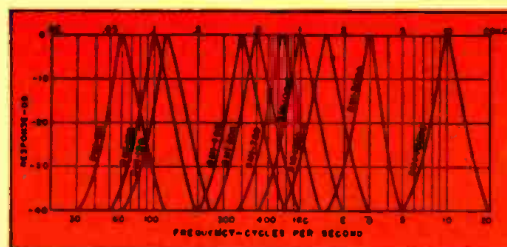


Type No.	Inductance Value	Net Price	Type No.	Inductance Value	Net Price	Type No.	Inductance Value	Net Price
HQA-1	5 mhy.	\$7.00	HQA-16	7.5 hy.	\$15.00	HQC-1	1 mhy.	\$13.00
HQA-2	12.5 mhy.	7.00	HQA-17	10. hy.	16.00	HQC-2	2.5 mhy.	13.00
HQA-3	20 mhy.	7.50	HQA-18	15. hy.	17.00	HQC-3	5 mhy.	13.00
HQA-4	30 mhy.	7.50	HQB-1	10 mhy.	16.00	HQC-4	10 mhy.	13.00
HQA-5	50 mhy.	8.00	HQB-2	30 mhy.	16.00	HQC-5	20 mhy.	13.00
HQA-6	80 mhy.	8.00	HQB-3	70 mhy.	16.00	HQD-1	.4 mhy.	15.00
HQA-7	125 mhy.	9.00	HQB-4	120 mhy.	17.00	HQD-2	1 mhy.	15.00
HQA-8	200 mhy.	9.00	HQB-5	.5 hy.	17.00	HQD-3	2.5 mhy.	15.00
HQA-9	300 mhy.	10.00	HQB-6	1. hy.	18.00	HQD-4	5 mhy.	15.00
HQA-10	.5 hy.	10.00	HQB-7	2. hy.	19.00	HQD-5	15 mhy.	15.00
HQA-11	.75 hy.	10.00	HQB-8	3.5 hy.	20.00	HQE-1	5 mhy.	6.00
HQA-12	1.25 hy.	11.00	HQB-9	7.5 hy.	21.00	HQE-2	10 mhy.	6.00
HQA-13	2. hy.	11.00	HQB-10	12. hy.	22.00	HQE-3	50 mhy.	7.00
HQA-14	3. hy.	13.00	HQB-11	18. hy.	23.00	HQE-4	100 mhy.	7.50
HQA-15	5. hy.	14.00	HQB-12	25. hy.	24.00	HQE-5	200 mhy.	8.00

UTC INTERSTAGE AND LINE FILTERS



FILTER CASE M
1 3/16 x 1 11/16,
1 5/8 x 2 1/2 High



These U.T.C. stock units take care of most common filter applications. The interstage filters, BMI (band pass), HMI (high pass), and LMI (low pass), have a nominal impedance at 10,000 ohms. The line filters, BML (band pass), HML (high pass), and LML (low pass), are intended for use in 500/600 ohm circuits. All units are shielded for low pickup (150 mv/gauss) and are hermetically sealed.

STOCK FREQUENCIES
(Number after letters is frequency)
Net Price \$25.00

BMI-60	BMI-1500	LMI-200	BML-400
BMI-100	BMI-3000	LMI-500	BML-1000
BMI-120	BMI-10000	LMI-1000	HML-200
BMI-400	HMI-200	LMI-2000	HML-500
BMI-500	HMI-500	LMI-3000	LML-1000
BMI-750	HMI-1000	LMI-5000	LML-2500
BMI-1000	HMI-3000	LMI-10000	LML-4000
			LML-12000

United Transformer Co.
150 VARICK STREET • NEW YORK 13, N. Y.

EXPORT DIVISION, 13 EAST 40th STREET, NEW YORK 16, N. Y. CABLES: "AR AD"

www.americanradiohistory.com

GUIDED MISSILE DATA RECORDING

By
JAMES B. WYNN, JR.*

and

SAM L. ACKERMAN**

Air Force Missile Test Center
Patrick Air Force Base

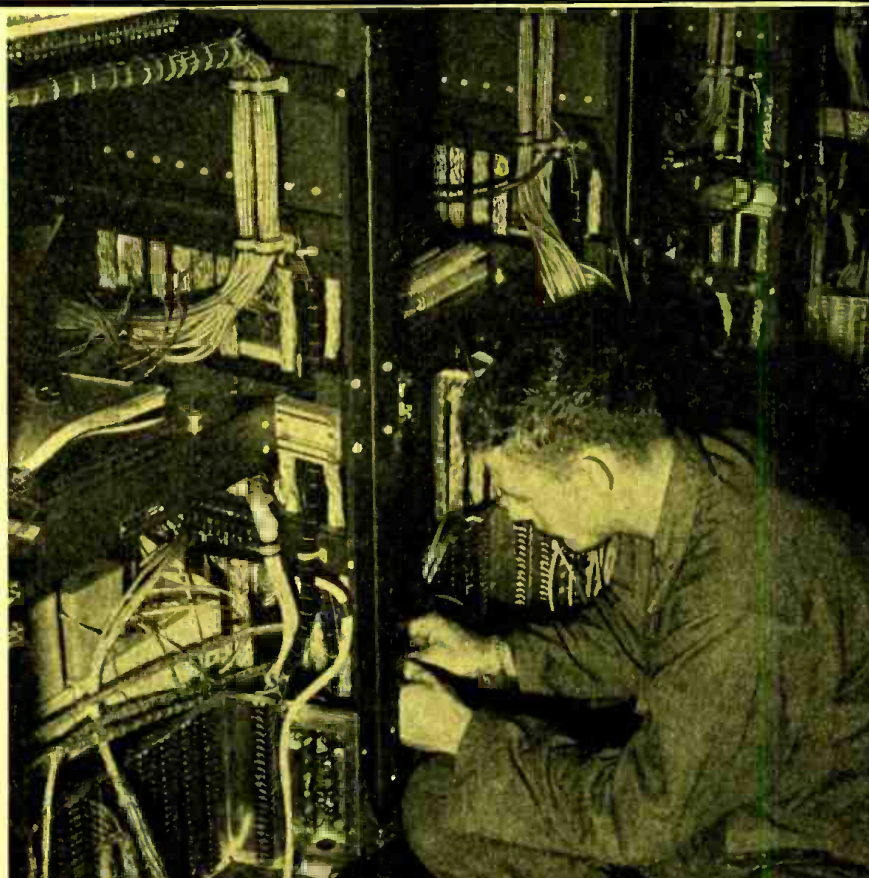
THOSE in nearly every craft or profession have at one time or another had the occasion to record data. In the fields of electricity and electronics, perhaps the furthest advances have been made in precision data indicating and recording of scientific phenomena. The recording oscillographs, utilizing galvanometer elements, provide an ideal means for observing and recording static and dynamic data, and will be the main subject of this article. Auxiliary or accessory equipment recently developed to provide flexibility and standardization of installation and operating techniques at one of the advanced missile radio telemetry stations at the Air Force Missile Test Center, Patrick Air Force Base, Florida, will be discussed in detail.

The Recording Oscillograph

For those not familiar with this type of recorder, it may be well to describe in some detail the fundamental aspects of this instrument. No doubt the oscillograph which would normally come first to mind would be a conventional electronic unit with a scope tube on the front, similar to the common TV set, and with a camera focused on the oscilloscope tube. However, as mentioned before, the equipment to be discussed uses a galvanometer as the active indicating element. The recording oscillograph is really quite simple—it is composed of a light source, a mirror moved by a sensitive meter movement to reflect the light, and a photosensitive medium to record the reflected light beam.

A review of the recording galvanometer oscillograph manufacturers listed in business guides indicates that this is a multi-million dollar enterprise. However, only a few of the available manufacturers produce recorders satisfactory for extensive use, and for precise measurements in the field of missile or aircraft testing. Most of the reasons for this will become self-evident, and a survey will show that

*Chief, Telemetry Section, Technical Systems Lab.
**Major, USAF; Chief, Internal Electronic Engineering Branch, Technical Systems Lab.



A bay of oscillograph racks being installed at the telemetry receiving site.

Photographic oscillographs are widely used to record data obtained from telemetering systems.

some of the mechanical and electrical characteristics of a few far surpass the others.

The Galvanometer

The galvanometer element, which on occasion may have been presented too mysteriously, is in reality a d'Arsonval meter movement without any pointer; a small mirror replaces the pointer. The movement of a current-carrying wire in a magnetic field is one of the basic concepts of electromagnetic theory and this principle is utilized in converting the electrical energy into mechanical energy in the galvanometer. Degree of force or motion produced is mostly dependent upon the flow of electrons, the number of turns of the conductor, and the strength of the magnetic field. Thus, with the present design, a compact element exists which very conveniently converts the flow of electrons to the proportional movement

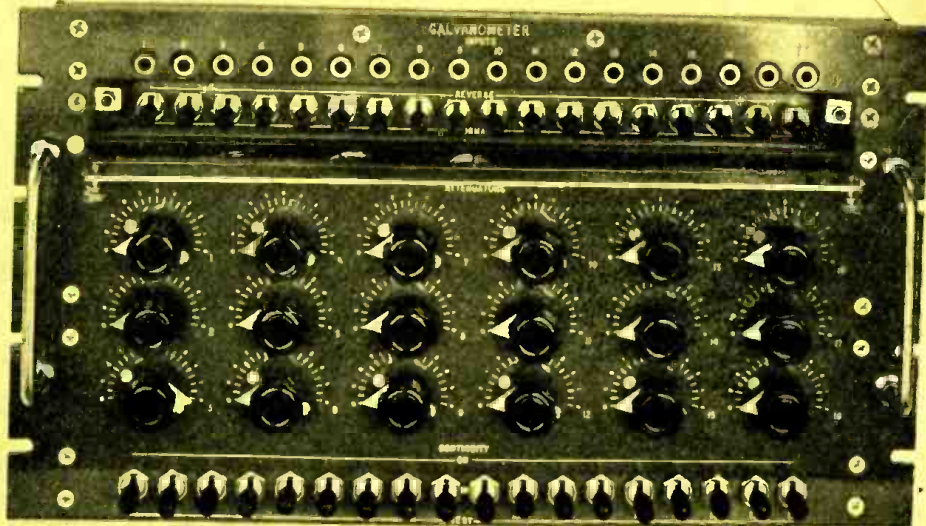
of a mirror. The moving beam of light reflected from the mirror is then projected on a ground glass screen for viewing, calibration and setup purposes, and is simultaneously projected onto photographic material to preserve the data permanently.

Main components required to make up the galvanometer are: a coil of wire, a suspension for positioning the coil of wire, a mirror, and a case or shell. Of course, the galvanometer must be positioned in a magnetic field for operation, but this magnet is separate and external for operational reasons. A photo-optical system is used in conjunction with the mirror since it provides the means for producing a record without extracting any appreciable energy from the galvanometer. Characteristics of the galvanometers in general use conform to the following:

1. Small size (approximate dimensions: $\frac{1}{8}$ " to $\frac{3}{16}$ " by 2" to $2\frac{1}{2}$ ")



A technician is adjusting the position of a galvanometer in the oscillograph.



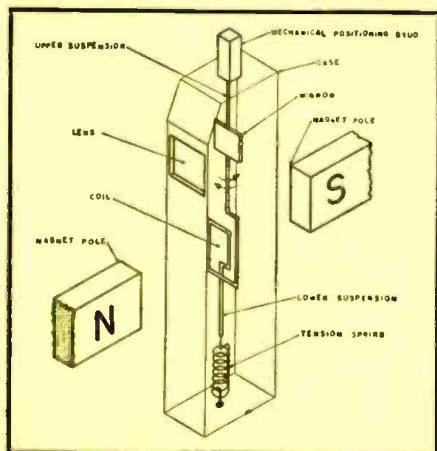
Front view of galvanometer panel, showing function controls as well as polarity switches which are recessed and normally protected by the hinged cover plate.

2. Good sensitivity (low frequency, 0.033 ma./in.; high frequency, 40 ma./in.)
3. Wide frequency response (0-2000 cps)
4. Rugged construction (suitable for field, mobile or airborne installations)
5. Accuracy (1%)
6. Replaceability (electrically and mechanically interchangeable)
7. Cost (\$100 to \$150 each)

Damping

The suspension of the galvanometer is a free moving element, so that its action under forced vibration follows all the theory and formulas pertaining to such motion. Of primary concern to the user is the motion of the element when a signal is applied. The mass of the movement and its inertia will distort the motion of the recorded output in relation to the input if rapid changes occur. Thus, the damping

Pictorial cutaway illustration of a typical D'Arsonval galvanometer element.



characteristics of the element as associated with its circuitry should be understood.

Basically, two fundamental damping mediums are used: (1) fluid damping, i.e., the suspension rotates within a viscous fluid, and (2) electromagnetic damping, which utilizes the back emf generated by the coil moving in a magnetic field. Actually, any galvanometer has additional damping effects produced by both mediums since the air in which an electromagnetically damped galvanometer moves produces some of the fluid damping effects, and the source impedance of a fluid damped galvanometer furnishes electromagnetic damping. The total damping is the arithmetical sum of all the per-unit dampings of the particular system.

Damping is used mainly to control the frequency response but it also introduces a phase shift (very slight), protects the galvanometer from violent over swings, and controls the time required to respond to sudden changes in current.

Normally, 0.64 per-unit damping or 64% of critical damping is used since it produces maximum frequency range with minimum inherent error. Unfortunately, many users procure galvanometers and standard shunts without realizing that circuitry associated with the galvanometer may at times seriously alter the damping characteristics.

Frequency Response

Whether electromagnetic or fluid damping should be used is mainly determined by the frequency response required and the driving current available. The electromagnetic type is generally more desirable since it normally has higher sensitivity and a far lower temperature coefficient. With the pres-

ent manufacturing techniques, it can be shown by the following basic formula that the limiting factor for electromagnetic galvanometers is the frequency response:

$$R = K/F$$

where R is the shunt resistance in ohms, K a constant of construction and installation, and F the frequency.

From the above, it is easy to understand how the shunt resistance R becomes lower in value as the frequency F is increased. Table 1 has been prepared from values in one of the instruction manuals furnished with a commercial recording oscillograph. Actually, the shunt resistance will never become zero but its value will become less than the internal resistance of the galvanometer and its low sensitivity will render it useless, fluid damping then being necessary.

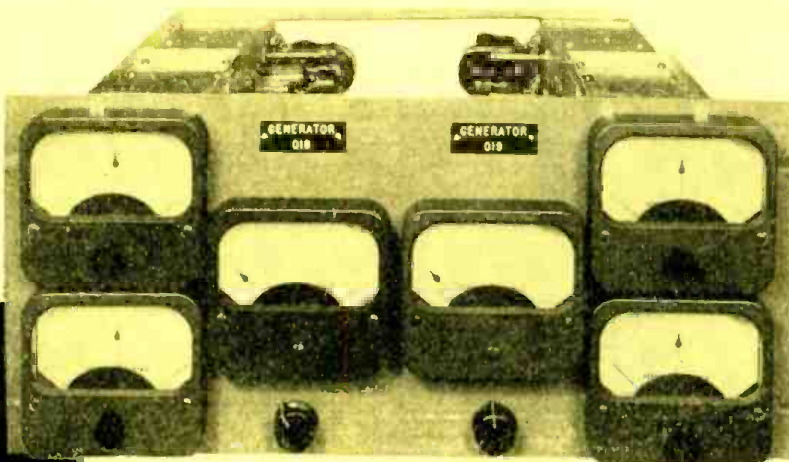
The present oscillographs utilize a magnetic block to provide proper flux density for all the galvanometers in the instrument. Thirty-six galvanometer element installations are common in blocks of about four or five inches long. The frequency response range, linear $\pm 5\%$ at 64% of critical damping, of commercially available galvanometers is from 0-2000 cps. Greater sensitivity is obtainable by selecting elements—whenever possible—that have a flat re-

Table 1. Relationship between response, the shunt resistance, and sensitivity.

Frequency Response (cps)	Shunt Resistance (ohms)	Sensitivity (ma./in.)
0- 60	350	0.033
0-100	180	0.035
0-180	83	0.040

A THERMOCOUPLE A.F. WATTMETER*

By
J. D. RYDER
 and
M. S. McVAY
 University of Illinois



Instrumentation for an analog computer. Central instruments are electronic voltmeters and outer vertical pairs are wattmeters.

By using electronic amplification, many disadvantages of the thermocouple for measuring power are overcome.

AUDIO-FREQUENCY power measurements have usually been made by dissipation of the power in a known resistive load, since few audio-frequency wattmeters have been available. Numerous proposals appear in the literature covering low-burden electronic instruments which usually employ some form of square-law circuit, as in Fig. 1, but practical forms of the instrument have rarely appeared.

Usual Theory

It can be seen that the input to diode (or triode) V_1 in Fig. 1 is:

$$e_1 = e - iR_2 \quad (1)$$

and the input to diode V_2 is:

$$e_2 = e + iR_2 \quad (2)$$

where e is the instantaneous value of voltage applied to the load, and i is the instantaneous value of current flowing to the load. Resistors R_2 are assumed small and equal.

In the usual manner, if the diodes

have identical volt-ampere curves given by:

$$i = a_0 + a_1 e + a_2 e^2 \quad (3)$$

then the anode current of V_1 is:

$$i_1 = a_0 + a_1 e - a_1 i R_2 + a_2 e^2 - 2a_2 e i R_2 + a_2 i^2 R_2^2 \quad (4)$$

The anode current i_2 of V_2 differs only in that the two negative signs become positive.

The output or load circuit is acted upon by the difference of currents i_1 and i_2 , and it is apparent that all positive terms appearing in both equations will cancel, leaving only a result equal to twice that of the negative terms in (4). Thus:

$$i_{out} = i_2 - i_1 = 2a_1 i R_2 + 4a_2 e i R_2 \quad (5)$$

If the applied electromotive force is sinusoidal, or $e = E_1 \sin \omega t$ and $i = I \sin (\omega t + \theta)$, where θ is the power factor angle of the load, then the output current is:

$$i_{out} = 2a_1 I R_2 \sin (\omega t + \theta) + 4a_2 E_1 I R_2 \sin (\omega t) \sin (\omega t + \theta) \quad (6)$$

If $IR_2 = E_2$, the above becomes by expansion:

$$i_{out} = 2a_1 I R_2 (\cos \theta \sin \omega t + \sin \theta \cos \omega t) + 2a_2 E_1 I R_2 (\sin \theta \sin 2\omega t - \cos \theta \cos 2\omega t) + 2a_2 E_1 I R_2 \cos \theta \quad (7)$$

If this difference current is applied to a d.c. or average reading instrument M , only the last term of (7) will deflect the meter, since the first two terms represent a.c. currents. These may be bypassed around M by a suitable capacitor.

If $IR_2 = E_2$, then the instrument M is deflected by a d.c. current of value:

$$i_M = 2a_2 E_1 E_2 \cos \theta \quad (8)$$

which is proportional to the average load power, angle θ being the load power factor angle. Thus meter M becomes an indicator of average load power.

Reasons for Dissatisfaction

Certain assumptions have been made in reaching the above results, and these are:

- (a) The two tubes have identical volt-ampere curves, or pass identical currents for all values of applied voltage.
- (b) The matching of (a) exists throughout the life of the tubes, and for all values of heater voltage.
- (c) The tube volt-ampere curve is accurately expressed by (3), and no higher power terms are present.

In practice, it has been impossible to find or to maintain tubes or crystals meeting these assumptions, such that power measurement accuracies of better than 5% can be achieved without severely restricting the load current or voltage to a very small range. Two tubes or two crystals may be matched to equal quiescent currents or values of a_0 , by adjustment of the tap on R_3 , but balanced currents will probably not be obtained at other applied voltages. This action, of course, indicates unequal values of a_1 and a_2 .

*This article is based on a paper presented in Chicago at the 1952 National Electronics Conference, held Sept. 29, 30 and Oct. 1.

Fig. 1. Basic form of the square-law circuit used for power measurement.

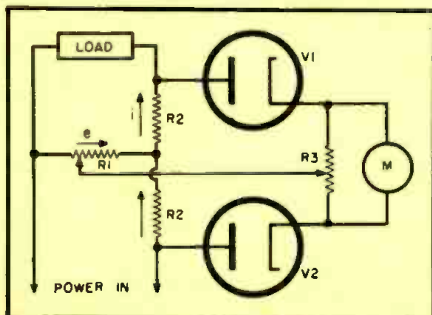
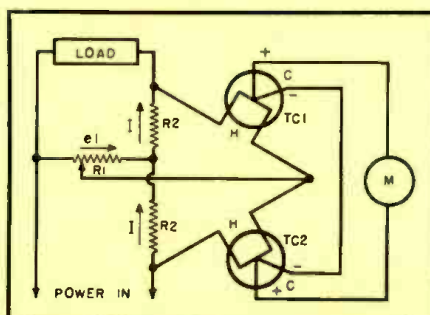


Fig. 2. Schematic diagram showing basic principles of thermal converter.



Controls may be added for additional individual adjustment, usually taking the form of resistors in the circuit. However, it should be noted that coefficient a_2 of (3) appears in the results of (7) and (8). Any additional resistance added to the circuit for adjustment purposes has the effect of linearizing the circuit, reducing the value of a_2 , and thus lowering the sensitivity of the circuit when used as a wattmeter.

Since three coefficients appear in the series (3), three independent adjustments are theoretically needed. These additional adjustments may be obtained by use of triodes or pentodes with grid bias controls, but the over-all result is not changed—to achieve and maintain a match of volt-ampere characteristics over an applied voltage range of possibly 50 to 1 is not a practical matter with commercial tubes.

Use of Thermocouples

It should be noted that the important property required of this circuit is its ability to square, or cross-multiply, the input voltages, since it is only the squared term of (3) which leads to the result of (7) or (8). Another electrical device that inherently employs this squaring property is the thermocouple, as its output is obtained from heat or i^2R input to its heater.

Actually, the thermocouple has been employed for many years as a squaring device in a wattmeter, sometimes used in the electric utility industry. When so used, the device is known as a Lincoln "thermal converter" wherein a d.c. electromotive force is generated proportional to load watts, this d.c. electromotive force then being telemetered or transmitted over telephone lines to a distant point where the power is indicated or recorded.

The desired squaring property is present in the thermocouple together with certain disadvantages, such as limited overload capacity, slowness of response, low heater resistances, and thus rather large current inputs. By using electronic amplifiers and techniques in the thermal converter circuit, it is possible to overcome all of these disadvantages except the slowness of response. This can be controlled to some extent by the selection of very small thermocouples of low heat capacity, and an anticipating electrical circuit can be added if needed.

Thermal Converter

The principle of the thermal converter is illustrated in Fig. 2, from which it can be seen that this unit is fundamentally the same as the electronic unit of Fig. 1. Thermocouples are employed to square the respective sum and difference input voltages, and to subtract the outputs, leaving a net

current through the microammeter M which is proportional to power in the load circuit. In Fig. 2, H indicates heater connections, C the couple connections; vacuum-mounted thermocouples are preferred.

There is one objection to the use of the simple circuit of Fig. 2. Theory indicates that the circuit has maximum power sensitivity when voltages E_1 and E_2 of (8) are equal. Since it is not usually desirable to make the series voltage drop of IR_2 equal to the line voltage E_1 , because of excessive losses, some form of amplification of voltage $E_2 = IR_2$ is desirable. In order to reduce the loading effect of the wattmeter on the circuit to a minimum, an electronic amplifier is indicated. It should be pointed out, however, that the amplifier will only be required to be linear, all squaring or nonlinearity of characteristics being a function assigned to the thermocouples.

The Wattmeter Circuit

The circuit of the amplifier incorporated between the shunts and the two thermocouples is shown in Fig. 5. A 50:1 step-up transformer is used across the shunts, as this seemed an easy way to obtain isolation and a voltage increase. Shunt values are chosen to produce 20 millivolts at full-load current, and the line voltage is taken off the shunted potentiometer at a point providing one volt maximum. It is realized that the use of good transformers is necessary at this point if wide frequency response is to be obtained. However, if a poor transformer is used, its performance can be considerably improved by shunting the secondary with a loading resistor.

The first amplifier stage is conventional. The second stage employs two

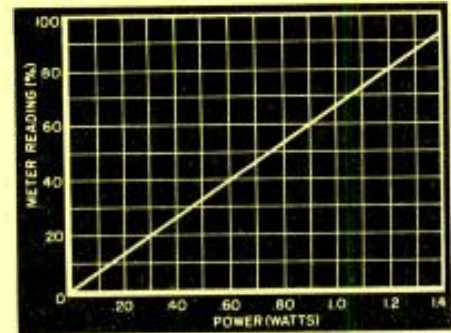


Fig. 3. Typical calibration curve.

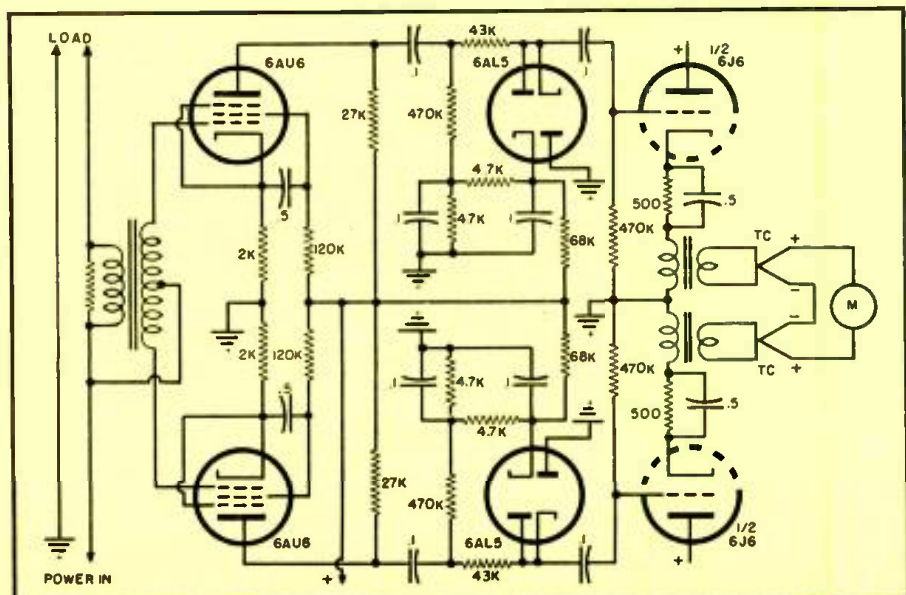


Fig. 4. Performance of vacuum tube limiters in preventing the thermocouples from burning out.

6J6 tubes, with halves paralleled, and with cathode-follower output. This form of output provides much wider frequency response from a given transformer than if the more usual plate output were used. In this case, the transformers are needed for matching the relatively low-resistance thermocouple heaters (2 ohms, 100 ma.) to the 6J6 tubes, and low-cost tube-to-voice coil transformers were found to be satisfactory.

It should be noted that this is not a push-pull amplifier since the two side channels are amplifying different signals ($e - iR_2$ and $e + iR_2$), and no cou-
(Continued on page 20)

Fig. 5. Schematic diagram and parts values for the complete instrument.



ULTRASONIC MICROSCOPE*

Translated by
GILBERT B. DEVEY
Office of Naval Research

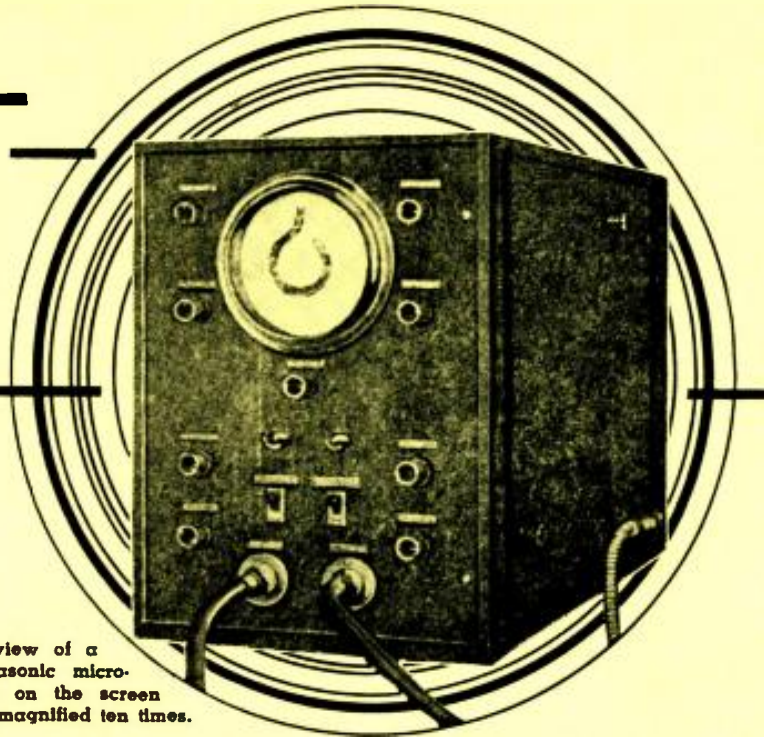
THE successful development of ultrasonics and the obtaining of very short ultrasonic waves, of the order of the wavelength of visible light, has led to the development of an ultrasonic microscope with which it is possible to view the picture of an object in magnified scale. Inasmuch as nearly all bodies in nature are transparent to ultrasonic waves, the ultrasonic microscope is expected to have a very wide field of application. Its principle of operation may be found in the proposal of S. Y. Sokolov in 1936 (U. S. patent 2,164,125, issued June 27, 1939).

Operation of the ultrasonic microscope may be described as follows. A narrow beam of ultrasound is bunched (Fig. 2), and radiated by a piezoelectric quartz plate (1) to illuminate the object under examination (2). Reflections of the ultrasonic beam from the object fall on an acoustical collector lens (3), the focus of which is set for reception at (4), consisting of a piezoelectric (e.g., quartz) plate.

The reception plate is located at the base of the tube (8). The narrow beam of the cathode rays (7), inside the cathode ray tube, falls on the inner surface of the narrow plate and dislodges secondary electrons, which are then collected by the anode (9).

Under the action of the charge, the image on the inner surface of the narrow plate comes from the region of the ultrasound, and secondary electrons are emitted when the surface of the plate is made to undergo a change. This change of secondary emission results in greater current acting on the anode (9), the magnitude being increased by special amplifiers and passed to the modulator arrangement of the cathode of the tube (6). Then the intensification of the cathode beam in the tube (6) causes a fluctuation which conforms to the variation of secondary emission from the

Fig. 1. Over-all view of a developmental ultrasonic microscope. The picture on the screen shows a wire loop magnified ten times.



Ultrasonic waves have been successfully used as the source of illumination in a microscope.

surface (4). This is accomplished by the television method of synchronism of motion by lines and frames of the cathode beams of the tubes (6) and (8). The screen of the cathode tube (6) then shows the semblance of a picture as distributed by the electrical charge on the receiver plate (4).

Piezoelectric charges appear on the surface of the quartz plate at the same points where deformation has taken place. Therefore, a picture is distributed on the surface of the quartz plate in exact conformance to the ultrasonic field in the focal plane of the lens (3).

Inasmuch as the configuration of the ultrasonic field in the focal plane in its line of conformance portrays the object, this object is immediately seen on the screen of the tube (6). Transposition of the object understandingly gives the appearance of transference of its image to the screen.

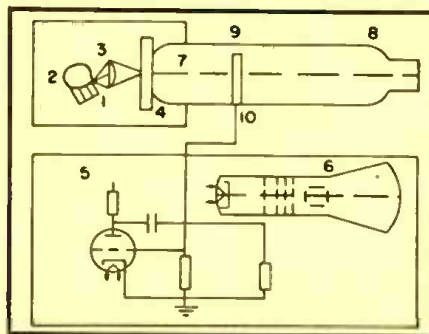
Magnification of the image, given in the description of the system, is determined by the ratio of the linear dimensions of the cathode tubes (6) and (8). Calculations show that in the ultrasonic microscope magnification approaches the order of tens of thousands of times. The resolving capacity depends on the cross-sectional area of the cathode beam in the tube (8), parameters of the piezoelectric plate, and length of the ultrasonic waves.

Experiment shows that a frequency of 10^9 cycles can be obtained without particular difficulty and that there is a good possibility of obtaining a frequency of 10^{10} cycles. In water, the length of ultrasonic waves at a frequency of 3×10^9 cycles is equal to 5×10^{-5} cm., i.e., the wavelength of visible light. At that frequency, the resolving power of the ultrasonic microscope may reach an extreme, close to the resolving power of the optical microscope.

For capillary waves, the speed of diffusion is considerably less; and the wavelength accordingly is much smaller than the wavelength of visible light. Consequently, if the radiation type of capillary waves can be obtained at higher frequencies in the future, there will be an opportunity to increase the resolution capacity of the ultrasonic microscope by one or two orders to compare with the best optical microscope.

The objects under examination can be illuminated with a continuous ultrasonic beam as well as with single im-

Fig. 2. Diagram illustrating the principle of operation of the microscope.



*Translated from an article entitled "The Ultrasonic Microscope," by S. Y. Sokolov which appeared in the Russian Journal "Progress in Physical Science," Vol. XL, Jan., 1950.

pulses. For amplification of the secondary emission, it is expedient for the inner surface of the receiving plate to be covered by a special layer which possesses great secondary emission.

The method of obtaining a visible picture may be altered, as shown in Fig. 3(A). Here, the piezoelectric quartz plate (1) serves as the base of the vacuum triode (2). An ultrasonic beam falls on the outer surface of the piezoelectric plate (1), the inner surface of which is covered by a photosensitive layer. Under the action of the ultraviolet beam (3), uniformly illuminating the inner surface of the plate, photoelectrons are emitted which—accelerated by the application of an electrical field—pass through the system of magnetic and electrical lenses (4) and fall on the fluorescent screen (5). On the screen, as in the usual electron microscope, only the image of the source of electrons may be seen—in this case, the image of the distribution of photoelectric emission from the surface of the piezoelectric plate (1). Distribution of photoemission on the surface of the plate is in precise conformance to the distribution of the piezoelectric charge, which reproduces the configuration of the ultrasonic field. On the screen (5), the image of the ultrasonic field can be seen; this is a repetition of the image of the object, established by the ultrasonic field, in conformance with the magnified scale.

The resolution capability in this case is dependent on the length of the ultrasonic wave, on the thickness and dielectric property used in the piezoelectric plate, and on the construction of the lens system. Ultraviolet radiation, illuminating the quartz plate, can be replaced by a homogeneous electron cluster.

Another version of the ultrasonic microscope is illustrated by Fig. 3(B). This, as in the preceding version, depicts the object received in magnified scale on the screen (5). However, in

this scheme, the screen (5) consists of a thin plate on which a photosensitive mosaic layer is drawn, causing secondary electrons under the action of falling electrons to be collected on the annular anode (6). Electrons in the beam (7) fall on the screen (5) and, as in the usual television tube, move line and frame, equalizing in such a manner on the screen (5) as to form an image of the object by electrical potential. The change in secondary-electron emission is amplified and passed to the second tube, in which the cathode beam movement is synchronized with the cathode beam (7). In this case, the image of the object is received on the screen of the second tube.

It should be noted that the capabilities have to be determined not only from the facts mentioned above but also by additional factors of another kind, primarily by the complexity of the vibrations of the quartz plate which is excited by different types of ultrasonic beams; the action of these beams induce not merely longitudinal waves but also transverse and surface waves, which will distort the image. Use of the quartz plate is accomplished by special cuts and choice of the proper method of strengthening (border conditions), which may be diametrical, and the surface waves in the quartz plate are greatly attenuated to increase the clearness of the picture. Applications for the ultrasonic microscope evidently are diversified enough and have sufficient possibilities to warrant rapid growth in this field.

Now to the description of the experimental performance of the ultrasonic microscope in scientific laboratories:

In Fig. 4, a metallic object is shown immersed in an opaque liquid (magnified ten times).

Figure 5 illustrates a glass rod and glass tube of equal dimensions. In the rod, the clear space shows ultrasonic waves partially suppressed. The tube displays uniform illumination, as the

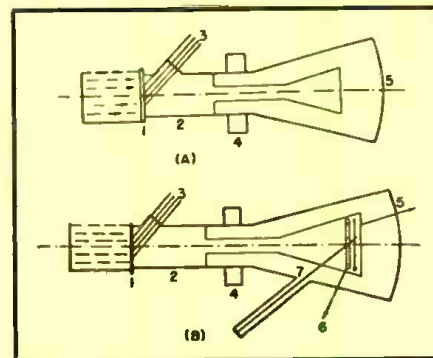


Fig. 3. Two alternate versions of the ultrasonic microscope. (A) Image is formed by acceleration of secondary electrons from treated surface of quartz plate 1. (B) Image is formed by electron beam 7 which scans element 6.

ultrasonic ray does not pass across the tube. Therefore, the shape, with the help of the ultrasonic microscope, may be distinguished by the presence of a capillary.

In Fig. 6, the rod and tube are again shown, illuminated by a different type of ultrasonic ray. This discriminates between particles illuminated with different intensities and therefore depicts alterations.

With the ultrasonic microscope, especially good observations may be made of structures. It must be determined which structure of the ultrasonic wave will give exactness of transmission without a type of deformation. When the radiating quartz plate oscillates in the fundamental mode, and no object is being examined, a light even spot is obtained. For oscillations above the fundamental, a nonuniform illumination results.

In the ultrasonic microscope, the object conforms to the tube, bound with the ultrasonic wave, and the image conforms to the transmission tube, on the screen of which the object is seen. One form of an ultrasonic microscope is shown in Fig. 1.



Fig. 4 Ultrasonic microscope image of metallic loop immersed in opaque liquid.

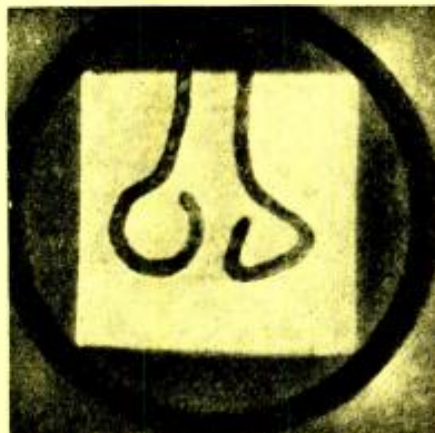


Fig. 5. Image of glass rod (left) and tube (right) in a homogeneous field.



Fig. 6. Glass rod (left) and tube (right) in a nonhomogeneous ultrasonic field.



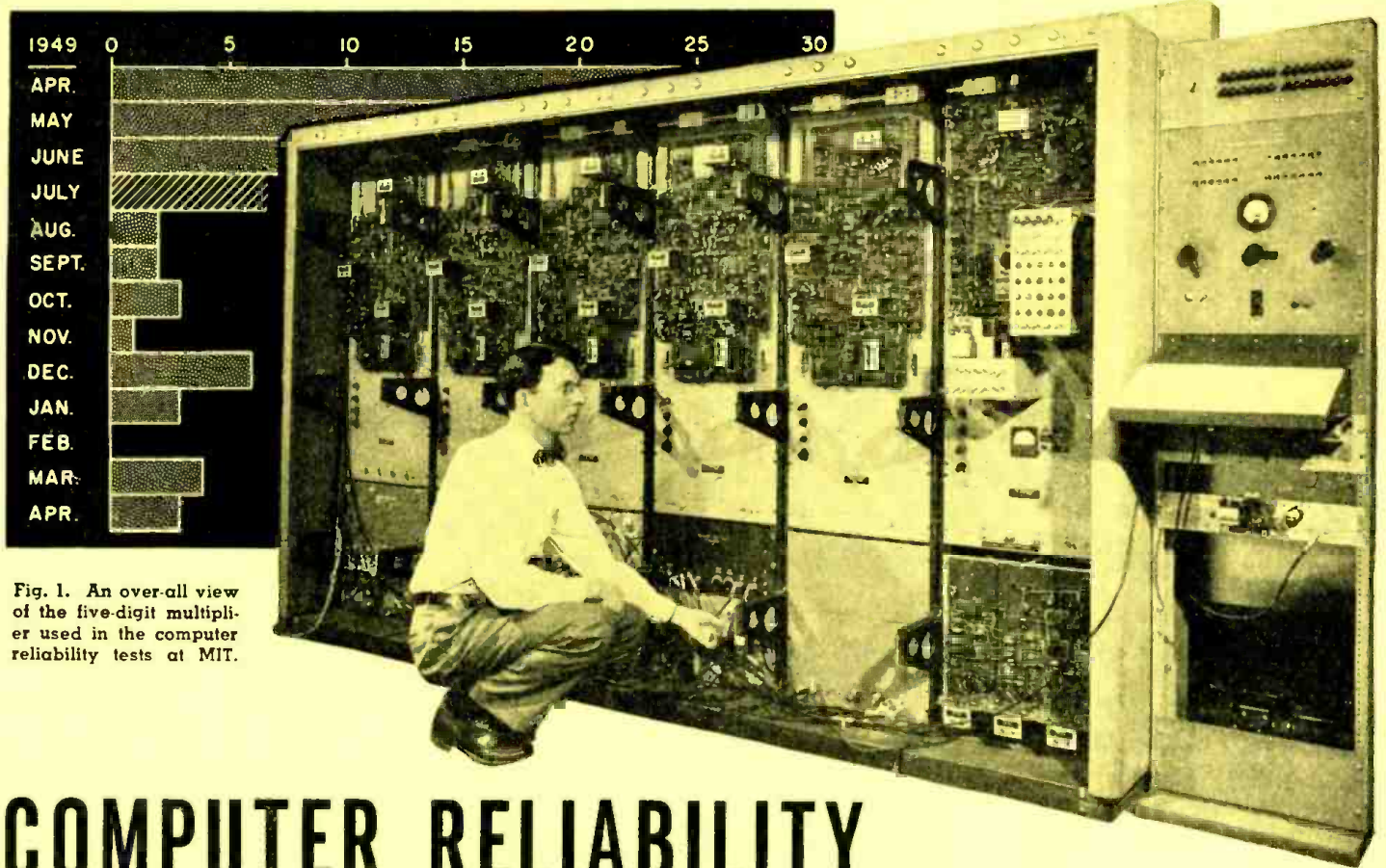


Fig. 1. An over-all view of the five-digit multiplier used in the computer reliability tests at MIT.

COMPUTER RELIABILITY

By

EDWIN S. RICH and ROBERT R. RATHBONE

Digital Computer Lab., Massachusetts Institute of Technology

Performance criteria of electronic digital computers based on results of an extended 27-month life test.

MAINTAINING system reliability in a large digital computer is a far different problem from that encountered in the operation of radar, television, and other communication systems. A stray pulse or an intermittent failure of any one of thousands of electrical components, for example, may cause a circuit to function improperly and thereby invalidate all subsequent calculations. The engineer who enters the field of electronic computation must therefore adopt an entirely new concept of system reliability, based on the elimination of single errors. Unfortunately, he cannot find the criteria for implementing this concept in any textbook; he must learn them gradually from the experience of others and through his own cut-and-try methods.

The purpose of this article is to place on record the results of a 20,000-hour reliability run of a prototype digital computer, in which the goal was error-free operation for extended periods. Although this life test does not offer a specific answer to every question

it raises, the findings may give the reader a point of departure for developing his own philosophy on the subject.

Five-Digit Multiplier

Before the construction of the MIT Whirlwind I electronic computer* could be completed, it was essential that pertinent data be obtained on the reliability of basic circuits and the life expectancy of vacuum tubes and other components. Since no information on the extended operation of a system such as the Whirlwind could be found in the literature, a five-digit multiplier (Fig. 1) was built as the proving ground for the new pulsed circuits and components.

A short description of the multiplier will aid the reader in understanding the discussion of the life test which follows. The logical design of this prototype computer is shown in Fig. 2. The arithmetic element uses 275 vacu-

um tubes, 350 crystal rectifiers, 800 resistors, 675 capacitors, 100 pulse transformers, and 80 r.f. chokes. Design was limited to one arithmetic process because the circuits and techniques are similar for each process; multiplication was chosen because of the strict circuit requirements it imposes. Storage and input-output elements were not stressed and appear in the simplest forms: toggle switches, push buttons, and indicator lights. The control was built from special pulse-control test equipment developed at MIT* and contains approximately 100 vacuum tubes and 950 other components.

When two numbers are to be multiplied, they are inserted manually into the registers of toggle-switch (T-S) storage. The numbers are read into the arithmetic registers and multiplication is executed by 0.1-microsecond pulses. A control switch provides for either automatic (2-mc.) or step-by-step (push-button) operation. Results are displayed in binary notation by flip-flop indicator lights.

A preventive-maintenance scheme, called "marginal checking," was built into the system in order to detect deteriorating components before they could cause errors in computations. (The rack at the extreme right in Fig. 1 holds these circuits.) The function of marginal checking is to vary certain

*A high speed digital computer sponsored by the Office of Naval Research.

*Described in the Aug., 1951, through February, 1952, issues of RADIO-ELECTRONIC ENGINEERING.

voltages, generally screen voltages, in selected circuits of the multiplier so that the components operate under great stress. Any component with a low operating margin will effectively lose this margin during the check and the circuit will not operate. When a test problem is run, the operator can then isolate the weak component and replace it.

Power for the multiplier is supplied from three motor-generator sets whose d.c. outputs are -100, +150, and +250 volts. Power for marginal checking is obtained from a *G-E* amplidyne whose d.c. output can be manually varied from -100 to +100 volts. During marginal checking this generator is switched in series with the d.c. supply to the circuits which are to be checked.

Extended Reliability Run

On April 1, 1949, the multiplier started a reliability run which extended for 27 months. During this time, the machine continuously multiplied two five-binary-digit numbers and checked for a correct result at the end of each multiplication. The multiplications required about 8 microseconds each and were repeated at the rate of 15,000 times a second. When errors occurred, they were recorded by electro-mechanical counters and an *Esterline-Angus* inking recorder. Three counters were used as a "two-out-of-three" check; twice a day they were tested carefully to be sure they would respond to a single-error pulse.

Performance requirements were rigorous. All errors of undetermined origin and those from failures of defective, deteriorating, or accidentally damaged components were counted. Those resulting from failures of power supplies were also charged against the system. The only exceptions were errors caused directly by two failures in city power, two power line failures, and a transient introduced into the power line by a local thunderstorm.

For the first 18 months, about half an hour of each working day was spent in preventive maintenance. During the last nine months, as performance improved, this checking was reduced to twice a week. In addition, troubleshooting for intermittent failures, not isolated by marginal checking, was necessary—especially for the first six months.

A log was kept during the entire run, with entries stating when errors occurred and what remedial action was taken. An operation chart was drawn daily from the information in the log to provide an over-all picture of the multiplier's reliability. The longest error-free run extended for 143 days, or nearly five months. It was interrupted when, for some unknown rea-

son, a power supply fuse burned out.

The test was terminated June 30, 1951, because operating experience on the Whirlwind I computer had reached a point where little benefit could be obtained from further studies of the five-digit multiplier.

Error Periods

Figure 4 summarizes the number of error periods that occurred during each of the 27 months. An "error period" is defined as the discrete period during which any number of errors occur without interruption. This number may range from one to several thousand, but since single errors, as well as multiple errors, can invalidate results and require the attention of an operator, each error period is considered as having the same weight regardless of the number of errors recorded. The total number of error periods over the 27 months was 142, or an average of one every 136 hours.

Work During Shutdown

Over half of the error periods (78) occurred during the first 96 days (April 1 through July 5, 1949). Considerable dependence had been placed on the marginal-checking facilities as a means of obtaining and keeping a high level of system performance, but this large number of error periods indicated that the new maintenance technique alone was not sufficient.

Because daily checking ensured that all circuits basically had wide operating margins, it was concluded that the frequent errors were caused by transient disturbances rather than by slow drifts in circuit tolerances. Intermittent connections were suspected first, and for lack of more refined methods, the search for such connections was made by

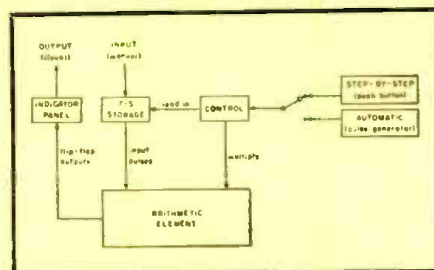
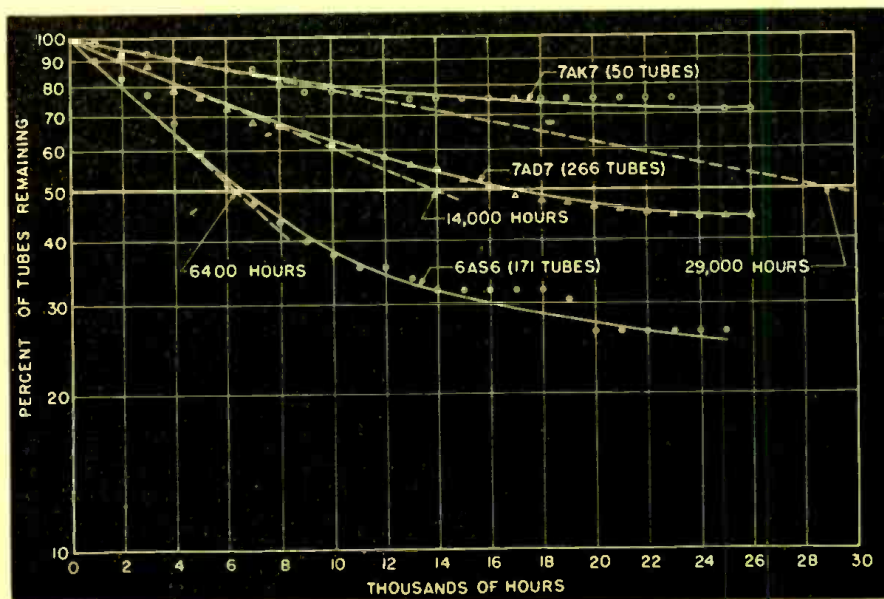


Fig. 2. Block diagram showing logical design of the five-digit multiplier.

painstakingly tapping panels and components. Within a short time sufficient weaknesses were found to indicate that a shutdown for overhaul was necessary. Nearly all of the faults discovered were ones which caused momentary rather than permanent failure. Furthermore, they would have been overlooked if evaluated by the usual criteria of performance; they were shown up in this case by the extreme sensitivity of the multiplier acting as a detecting instrument. The defects found were (1) insufficient spring pressure in cartridge-type fuse holders, (2) inadequate contact pressure in power distribution relays, (3) momentary shorts or leakage between elements within vacuum tubes, (4) poor connections in adapters which had been provided to permit use of lock-in-base tubes in circuits built for octal-base tubes, (5) loose screws on power-wiring terminal strips, and (6) unsoldered or cold-soldered component connections. The shutdown was utilized to correct all of the faults that had been discovered and to guarantee reliability further by eliminating all unnecessary contacts (such as relays and manual switches) and by replacing all fuse holders and tube adapters with

Fig. 3. Graphs of vacuum tube life in the five-digit multiplier.



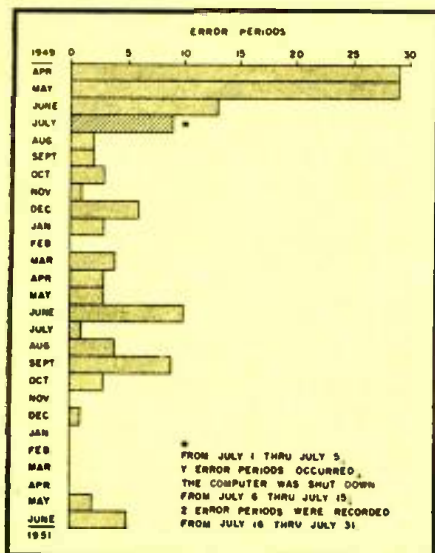


Fig. 4. Performance of the five-digit multiplier during the reliability run.

more rugged units. It is not known that all of these weaknesses would have caused operational failures if they had remained, but as a conservative measure they were regarded as potential faults and were therefore corrected.

During the 96 days following shut-down, the number of error periods decreased to seven. The error rate for the remainder of the 27-month run was an average of one every 286 hours.

Vacuum Tube Life

Significant information on vacuum tube life has been obtained from records on tubes used in the five-digit multiplier. The multiplier contains about 375 tubes (sockets) of which approximately half are types extensively used in the Whirlwind computer (40% of type 7AD7 and 10% of type 7AK7). About 18 per cent of the tube complement is type 6AS6, while small numbers of other types comprise the remainder.

Figure 3 shows the life characteristics of (1) the 7AK7, a dual-control-grid pentode which was manufactured under pilot plant conditions, (2) the 7AD7, a video amplifier pentode purchased from commercial production, and (3) the 6AS6, a miniature dual-control-grid tube also from commercial production. The plot is percentage survival vs. length of service for original and replacement tubes. The criterion for the end-of-life of a tube is the tube's failure to perform satisfactorily in the circuit to which it is assigned. Life of the 6AS6 tubes is apparently much shorter than that of the other two types, because the 6AS6's are used in circuits that have smaller operating margins and the effective life of tubes in a given piece of equipment is closely related to circuit design. If it had been possible to build circuits in which

changes in tube characteristics had no effect on circuit performance, then the percentage of survival would have been much higher than these curves show.

A question sometimes raised in discussions of tube life is whether tubes tend to have a definite period of usefulness and therefore should be replaced as a group after a certain length of time or whether the failures occur at a fixed rate so that nothing would be gained by wholesale tube replacement. Experience with the multiplier seems to point to the latter type of behavior and certainly indicates that wholesale replacement is not warranted within the period of time shown on these curves. In Fig. 3, the data are shown on a semi-log plot with smooth curves (the solid lines) drawn through the points so that the slope of a curve is a measure of the rate of tube failure. For all three types the rate of failure decreases for increasing length of service, as indicated by the flattening out of the curves. However, the samples are probably too small for this fact to be considered significant. To get a conservative measure of tube life in this equipment, points have been determined where 50 per cent of the tubes would have remained if failures had continued at their initial rates, as shown by the broken lines. These figures are 6400 hours for the 6AS6, 14,000 hours for the 7AD7, and 29,000 hours for the 7AK7.

Other Components

No capacitors or r.f. chokes failed during the test and only two pulse transformers had to be replaced. On the other hand, it was necessary to replace 29 of the 120 carbon resistors selected to less than 1% tolerance for use in flip-flop circuits. Crystal clamps were also troublesome in flip-flop circuits, where a back resistance of at least 0.5 megohm is essential. One hundred clamps of a special high-back-resistance type similar to the 1N38 were used in these circuits, and a total of 78 replacements was necessary because of the small tolerances. By comparison, 386 crystals (type 1N34 or equivalent) used in other less critical circuits required only 32 replacements.

Because a guarantee of maximum reliability was the intended goal, this sensitive clamp circuit should have been redesigned. However, rather than interrupt the test, a simple marginal-checking routine was applied periodically to the clamp circuits and the deteriorating crystals were quickly located. In this case, then, the desired reliability was ensured at the expense of additional preventive maintenance.

The importance of extensive operating experience in discovering unpre-

dictable factors that influence reliability was emphasized on several occasions. Two examples are of interest. As originally designed, the multiplier had pilot lights to indicate the presence of the +150-volt and +250-volt power inputs to each panel. These lights were 110-volt lamps fed from the respective supply points through appropriate dropping resistors. During the reliability run, it was discovered that occasionally an error count was caused by the burning out of one of these lamps. A search revealed that the dropping resistors were mounted near the filter circuits at the bottom of the panel and that the leads at the top of the panel were cabled for some distance with several wires which distributed power to the circuits on the panel. Under these conditions, interruption of current to a lamp caused a sudden jump in voltage on the wire to that lamp. This voltage jump, capacitively coupled into the power distribution circuits, was responsible for the errors observed. Relocating the dropping resistors at the lamps rather than at the filters eliminated the trouble.

The second example of unpredictable factors which can affect reliability was discovered accidentally. A metal coat tree in the multiplier room was habitually used by a few employees who worked in that portion of the building. One employee observed that a static discharge from hanging his new plastic raincoat on the coat tree caused multiplier errors. The exact way in which these were introduced was not determined. Previously, qualitative tests had been made to discover whether the system was sensitive to radiated signals and negative results were obtained. A commercial r.f. bomber was used for these tests and no attempt was made to cover the complete r.f. spectrum.

Noise Measurements

One of the aims of the multiplier reliability test was to examine the adequacy of maintenance techniques and, if possible, to discover new techniques which might be applicable to the Whirlwind I computer. Toward this end, some experiments were carried out to determine the sensitivity of the system to noise signals.

In the majority of electronic circuit applications outside the computer field, an occasional transient disturbance whose amplitude is comparable to that of the wanted signal is of little or no consequence. Interpretation of signals within these systems, whether by human beings or electrical equipment, involves an averaging or filtering process which effectively discriminates against noise. In a digital computer, however, interpretation of signals is done by memory

(Continued on page 31)

FUNDAMENTAL CHARACTERISTICS

OF

DIGITAL

AND

ANALOG

UNITS*

THOSE who are familiar with various complex present-day computers will have no difficulty in classifying a specific one as being either "analog" or "digital." This classification into analog or digital computation is apt to be considered both exclusive and exhaustive. It is not difficult to put such two-valued faith to task. This faith may have been strained (though not broken) for the first time, perhaps, when the digital differential analyzer appeared on the scene. Some described it as a digital computer programmed in an analog fashion. Future computers may require, not a single, but a repeated employment of both of these words.

However, no revolutionary developments in the computer field are necessary to cause hopeless entanglement with this limited vocabulary. Suppose a novice were to ask humbly for an explanation of the difference between digital and analog. It would be natural to try to clear up this difference once and for all with a few simple examples. Take the speedometer of a car. The speed indication is by means of a shaft whose angular position is the analog of the speed of the car. This is a fine example of an analog unit, although an innocent reference of the novice to the numerical calibration of the dial might leave an uneasy doubt in the mind. The mileage indicator, on the other hand, is an excellent example of a digital unit: the leftmost wheel counts one for each 10,000 miles, the next wheel for each 1000 miles, and so on down the line. Unfortunately, the purity of this example is rudely shattered by the rightmost wheel; this black wheel of the family turns in a continuous fashion as any decent analog shaft would and seems to carry those large numerals only for the sheer purpose of confusion.

By this time there would probably be a distressed expression on the beginner's face, and, in search of a better example, the electric clock on the wall might be considered. Both hands of such a clock are mounted on continuously rotating shafts whose positions are the analog of time. When about to call the clock an analog unit, however, the beginner might suddenly announce that the two hands of the clock seem to be related to each other in a manner very similar to the wheels of the mileage indicator. In fact, are not the hands of the clock like digits, one showing finer details of the measured quantity than the other?

At this juncture, it might seem like a good idea to execute a strategic retreat and call the clock a unit consisting of

By **JOHN M. SALZER**

Hughes Research & Development Labs.

The terms "digital" and "analog" by themselves are not adequate to describe a computer fully.

analog elements combined digitally. Indeed, it could even be said that this description would fit all clocks and watches. But then the pupil might point out that his watch says "tick-tock" and really measures time by counting the ticks and the tocks, that somebody had told him counting was an action characterizing a digital unit, and that this would make at least the second hand of his watch digital rather than analog! If this is not obvious, it is certainly clear that a stop watch moves in discrete jerks. To add to this burden of proof, it is only necessary to recall the big clock in any high school corridor, which jumps at one minute intervals.

After such an unhappy encounter with a novice, it would certainly be appropriate to re-examine the situation and it would not take very long to find that "digital" and "analog" are about as fortunate classifications for physical units as straw hats and round hats would be for men's headgear. Just as almost every hat is round in some respects, so is any measuring device or computer the analog of something in some respects. The analog of temperature, for example, could be a voltage in an analog unit or a number in a digital unit—in both cases within a certain accuracy. If an analog computer is the analog of a differential equation, a digital computer is the analog of a difference equation.

Whereas the analog class seems to be basically unrestricted, the digital class has more definite boundaries, as will be pointed out below. The real difficulty

with the use of these words is caused by an endeavor to make them describe too much at once. Properties which are more fundamental should be reverted to and the equipment classified in terms of these properties. The writer has proposed¹ the following three features as a basis:

1. Positional notation
2. Quantization
3. Sampling

A purebred digital computer would incorporate all of these features, a thoroughly analog one none. But now examine each quality separately.

Positional Notation

Positional notation is a feature that is fundamentally digital. In the number 888, there are three identical digits; however, they carry different weights according to their relative positions. The high precision attainable in a digital unit is closely tied in with this positional notation. It is only necessary to use more digits of the same kind to increase the accuracy.

There are two ways in which the relative positions of the digits of a number can be recognized: in space or in time. A parallel machine handles all digits simultaneously and requires identical equipment (arranged in space) for each digit. On the other hand, a serial machine recognizes the weight of a digit by the relative time of its appearance at a particular point.

If it is agreed that "digital" means that which consists of digits—and how could it not be so?—, then it is clear that positional notation is a cardinal property of a digital unit. A binary relay register, for instance, is surely a digital

*This article is based on a paper presented at the National Electronics Conference which was held in Chicago, Sept. 29, 30 and Oct. 1, 1952.

$\omega_0 t$ In Degrees		$y(t) = \sin \omega_0 t$
From:	To:	
.	.	.
.	.	.
44.72	44.81	0.704
44.82	44.86	0.705
44.87	44.95	0.706
44.96	45.03	0.707
45.04	45.11	0.708
45.12	45.19	0.709
45.20	45.27	0.710
.	.	.
.	.	.

Table 1. Indication of how an unsampled quantity can be represented digitally.

unit; each relay is twice as significant as one of its neighbors, although it is physically identical. Or take the time clock at the entrance of a factory; the hour wheel has a much greater effect on the weekly pay check than the physically identical minute wheel.

Now consider a gas meter. One type of gas meter in existence shows about five small dials, like small clocks. Each dial is calibrated from 0 to 9 and boasts one hand only. The gasman reads the total consumption as a five-digit number. Although the five indicators are identical, they have different influence on the gas bill. So far, everything that has been said about the meter would class it a digital unit. Only when the individual digits are examined will any doubt arise, for each hand moves in a continuous fashion. As the gas flows, so moves each hand; therefore, each hand (with its own scale factor) is the analog of the gas consumed. Were the movements of the hands rigged with some escape mechanisms so that they would go through a revolution in ten distinct and equal jumps, the gas meter would be called digital without a doubt.

Quantization

This difference in the mechanism of an individual digit belongs in the discussion of the second basic feature, *quantization*. Assume an n -digit binary relay register; then for any finite n

greater than one, it will certainly be a digital unit. Even when n goes to one, the single-relay register is still likely to be considered digital because it can occupy only two possible states, i.e., it gives a quantized measure of whatever it represents. Had a decimal register been assumed, the individual digit would again be considered a digital unit because it is capable of assuming only ten different states.

As the number of possible states increases, the quantized nature of a unit becomes obscure and it is finally called analog. Indeed, some people say an analog unit is that which is quantized into an infinite number of states. Actually no shaft, however well machined, can stop at any of an infinite number of possible angles. The voltage on a condenser is generally considered a good example of an analog; yet it cannot change in smaller steps than the voltage due to a charge of a single electron.

To have faith in quantum theory, the fact that everything is quantized must be accepted in the final analysis. If so, how many possible states must a single-digit unit be capable of occupying—a hundred, a thousand, or a million—before it should be called analog? A direct answer to this question could only be arbitrary. The important factor is that quantization introduces an uncertainty into a physical quantity.

When a three-digit decimal counter reads 115, it may indicate that the value of the represented physical quantity is between 114.5 and 115.5. Therefore, the quantized representation is accurate within a tolerance. However, so is a nonquantized representation. If the indicator of a voltmeter stops at the 115-volt mark, it may only be known that the voltage is, for example, 115 ± 0.3 .

Thus, an error is associated with both quantized and continuous indications. In what respect do these errors differ? They differ in their statistical distributions. Figure 1 shows possible distributions of errors in the examples used above. A quantized representation of 115 volts may mean anything between 114.5 and 115.5 with equal probability. If so, the error is uniformly distributed, as illustrated in Fig. 1(A). On the

other hand, the nonquantized representation generally has a less definite error distribution, which is often assumed to be normal. The tolerance limits may then correspond to the probable error, and such a distribution corresponding to the above example is shown in Fig. 1(B).

Just as statistical methods have recently been applied to noise analysis in communication engineering, they have long been applied to quantization errors or roundoff errors. The use of the same methods in both cases is not accidental; rather it underscores the fundamental connection between uncertainties due to varied causes.

Sampling

The third aspect that is bound to enter a discussion of this kind is the process of *sampling*. Sampling can be defined as the act of taking specimens of a dependent quantity at particular values of the independent quantity. If time is the independent quantity, sampling implies that data are measured, defined, or examined only at particular instants of time.

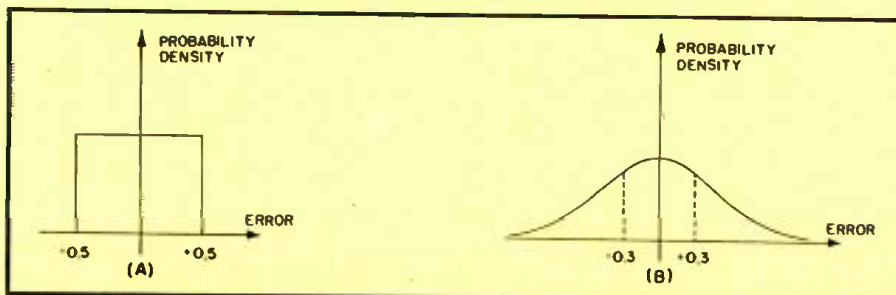
Thus, sampling is basically related to the time and manner of observing data, rather than the type of unit involved. It is true that most kinds of digital units, such as digital data transmission equipment and conventional digital computers, require the sampling of data; nevertheless, digital units can be built that operate in a continuous fashion. It is further true that information approaching or leaving an analog unit is usually continuous; however, for technical convenience, sampled data are sometimes employed in analog systems. The only generality that can be stated is that when equipment is time-shared or when the observation of data takes a discrete length of time, the data involved must be sampled.

The process of sampling is illustrated in Fig. 2. Part (A) shows a continuous function of time, which may be displayed on an oscilloscope. The height of the luminous line above the base line is the analog of $y(t)$. If the grid of the cathode-ray tube is pulsed on periodically, the sampled display of part (B) results. In part (C), the same sampled function is expressed digitally.

This simple illustration may raise two questions. First, although analog sampling is possible, why would it be used? Second, how can sampling be avoided in the digital case?

Consider pulse communication. It is well known that if it is desired to transmit a band of B cps, it will be necessary to use a pulse repetition rate of at least $2B$. The pulsed transmission of data has the advantage that the same channel may be used for several sets of information by time-multiplex-

Fig. 1. Possible distributions of errors in the examples given. (A) Uniformly distributed error. (B) Nonquantized representation of error distribution.



ing. The amplitude, the width, or the time of the pulse may be the analog of the function transmitted. On the other hand, in pulse code modulation the samples of the transmitted function are represented digitally.

Besides the time-sharing of equipment, another reason for sampling data is that an observation or a measurement may take a specific length of time to make. In radar, the time needed to receive an echo at maximum range defines the highest permissible pulse rate. The measured range is represented by an analog distance on the face of the oscilloscope. A motion picture is another example of sampled analog representation. Each frame is a sample of the object's illumination in terms of a chemical analog. The limitation of bandwidth due to sampling is vividly illustrated in movies when the wheel of the stage coach seems to rotate backward.

In order to indicate how an unsampled quantity can be represented digitally, Table I has been prepared. A portion of the sine wave is described in a continuous fashion within an accuracy of three decimal digits. This is done by indicating the degrees (or times) at which the function changes by a quantizing unit. No sampling is involved because the function is defined at all values of the independent variable.

One can build digital units or even digital computers to operate in a continuous manner, but time-sharing of equipment is precluded. This means that a separate element is needed for each digit (parallel unit) and for each operation. A dozen additions would call for a dozen parallel static adders. Such designs are possible and may be practical. A complex diode matrix may be designed to give the binary sum of two binary inputs, which energize the matrix. An experimental tube, the computer³, has been partly developed to perform static arithmetic operations. At a recent computer symposium in Pittsburgh, a paper was presented on a special-purpose continuously operating digital computer⁴.

Elaboration on the difference and the relation between quantizing and sampling may be in order. Both processes introduce discontinuities, but while quantization produces a discontinuity in the value of a quantity, sampling produces a discontinuity in the times at which a quantity is specified. Figure 3 shows a portion of a sine curve quantized but not sampled in part (A) and sampled but not quantized in part (B). The step-discontinuities of quantization depend on the magnitude of the dependent variable, while the impulse-discontinuities of sampling depend on the independent variable.

Although quantization and sampling are fundamentally different effects,

they are interrelated. For example, it would be foolish to tabulate (sample) a sine wave at every millionth of a degree if it is defined only to three decimal places. Similarly, if sampling is done at every ten degrees, there is little advantage in a quantizing accuracy of ten decimal places. In numerical analysis, quantizing errors are called roundoff errors, while the errors arising from sampling are called truncation errors. In an efficient numerical procedure, these two types of errors are balanced.

The analogous situation has been commonplace in conventional analog equipment design. The counterparts of quantizing noise and sampling delay are respectively noise and response lag. Resulting errors (called respectively static and dynamic) should be of the same order in a well-designed analog unit.

Conclusion

It has been indicated that the division of units into digital and analog classes is often obscure and sometimes confusing. Three features have been proposed—positional notation, quantization, and sampling—as more fundamental in characterizing the nature of particular equipment.

Understanding these basic characteristics is not just of academic interest; it can also help in orienting engineers in new avenues of endeavor. By combining these basic properties in various degrees, new ideas and equipment may be more easily created than by thinking in terms of what is conventionally meant by digital and analog. Consider the future problems and solutions which may be ahead of us.

An interesting problem is the balancing of errors due to sampling and errors due to random noise. In serial digital computers, adjustable word lengths may be thought of as a means of changing the quantizing error and the real-time sampling rate simultaneously. Halving the word length could almost double the machine speed and would increase the quantizing error while de-

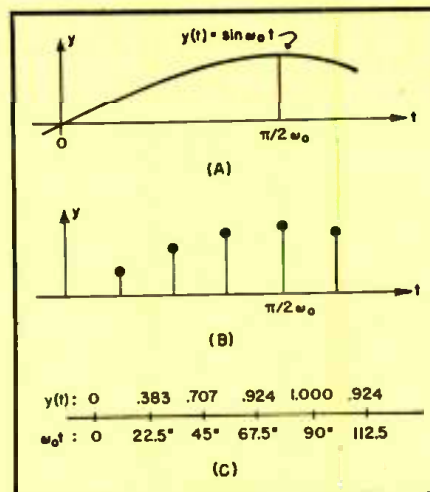


Fig. 2. The process of sampling. (A) A continuous function of time. (B) Result of periodic pulsing. (C) Sampled function displayed digitally.

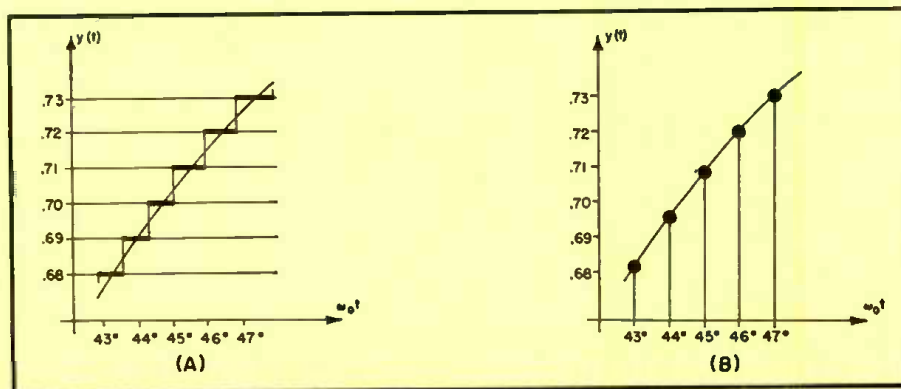
creasing the sampling error. The corresponding design change in an analog case makes the unit less accurate but also less sluggish at the same time.

A fascinating possibility is the use of units consisting of analog (nonquantized) elements combined in a digital manner, just as in the examples of the electric clock and the gas meter. For the transmission of data, such representation is not new. The coarse and fine dials with corresponding selsyns have been used in numerous cases. Could some kind of a computation be done on data so represented?

As techniques in designing compact digital equipment improve, the use of digital schemes for special purposes will become more and more popular. For fixed programs, the magnetic drum may prove a much more efficient and rapid storage element than for general purposes. Digital computations with non-sampled data may also be expected. In addition to the examples already cited, new developments, such as the perfection of ferroelectric techniques, might make such static computers generally practical. These computers will have

(Continued on page 30)

Fig. 3. (A) Portion of a sine curve quantized but not sampled. and (B) portion of a sine curve sampled but not quantized.



NEW PRODUCTS

ULTRA-LOW FREQUENCY OSCILLATOR

An ultra-low frequency oscillator with standard rack panel construction has been announced by the *Krohn-Hite Instrument Company*. Model 400-C simultaneously provides both sine- and square-wave voltages at any frequency

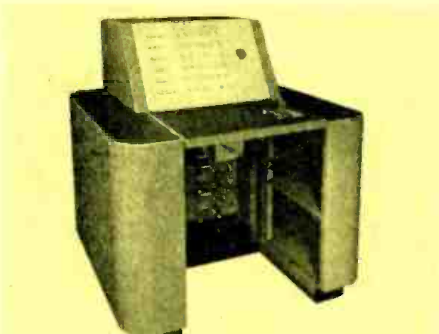


between 0.009 and 1100 cps. The sine-wave output may be used either balanced or single-ended. Maximum output is 30 volts peak-to-peak across a 1000-ohm load.

Special circuitry to eliminate tuning and bandswitching transients has been incorporated in this RC bridge oscillator. Descriptive pamphlet is available on request from the *Krohn-Hite Instrument Co.*, 580 Massachusetts Avenue, Cambridge 39, Mass.

TV MASTER SWITCHBOARD

Increased operating control and flexibility are made possible by the television master switchboard recently developed by *Federal Telecommunication Laboratories, Inc.*, Nutley, N. J. Completely self-contained, the unit permits the channeling of six separate inputs to six destinations by means of indirect relay



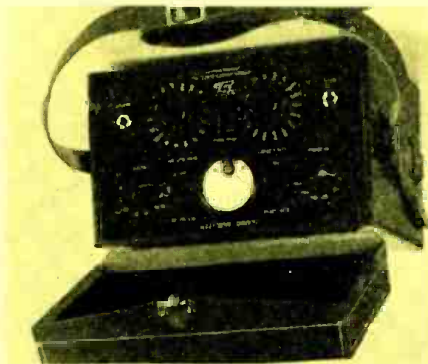
switching. These relays may be located in the console or at a remote rack.

Automatic clearing, termination and holding features have been incorporated

in the switchboard, as well as adjustment of the gap or lap switching interval. The built-in fader employs a two-channel video amplifier through which any two incoming signals may be routed; the output signal may then be reinserted as an additional signal source. Tally lights and internally illuminated push buttons aid in operating effectiveness.

NOISE ANALYZER

Hermon Hosmer Scott, Inc., has announced a versatile sound analyzer which separates noise, sound and vibration signals into their component frequency bands. The high- and low-pass filters can be independently adjusted in steps of $\frac{1}{2}$ octave, and a simple interlock permits the passband width to be fixed in any multiple of $\frac{1}{2}$ octave. The



position of this passband can then be adjusted throughout the audible range by a single control.

Housed in a saddle-leather case with a shoulder strap for portable use, Type 420-A includes a calibrated attenuator, an indicating meter meeting ASA standards, and an output jack for general purpose filter applications.

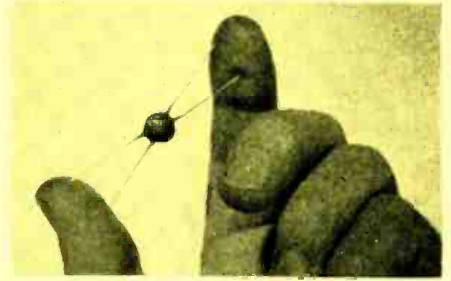
Inquiries should be sent to V. H. Pomper, *Hermon Hosmer Scott, Inc.*, 385 Putnam Avenue, Cambridge 39, Mass. Bulletin is available on request.

MINIATURE PULSE TRANSFORMER

The smallest pulse transformer now commercially available was recently developed by *P C A Electronics, Inc.* Weighing less than .03 ounces, the MPT 101-0.1 is slightly smaller than a pea, making it specially suited to miniature assemblies; it will, however, operate equally well in conventional circuits. New design techniques and a special

iron core make possible 0.1-microsecond pulse widths and rise times of less than .005 millimicroseconds when used in recommended P C A circuits.

MPT 101-0.1 meets MIL-T27 test specifications. It can operate indefinitely



at temperatures ranging from -70°C to $+125^{\circ}\text{C}$., and will operate normally for a short time at $+150^{\circ}\text{C}$.. Although it is designed for pulse forming, it can also be used for pulse coupling. For further information, write to *P C A Electronics, Inc.*, 6368 De Longpre Avenue, Hollywood 28, Calif.

WAVE ANALYZER

Analysis of the frequencies and amplitudes of signal components in a complex waveform is accomplished in a simple and direct way with the new *Sierra Model 121* wave analyzer. Signal components are read directly on a 4" indicating instrument calibrated in decibels. Voltage is calibrated with an internal 100-kc. injection oscillator, and a listening jack is provided for monitoring the signal being measured.

Just introduced by the *Sierra Electronic Corporation*, 813 Brittan Avenue, San Carlos, Calif., this 15 to 500 kc. wave analyzer incorporates a novel two-attenuator design which permits a wide range of measuring amplitudes without the introduction of instrument



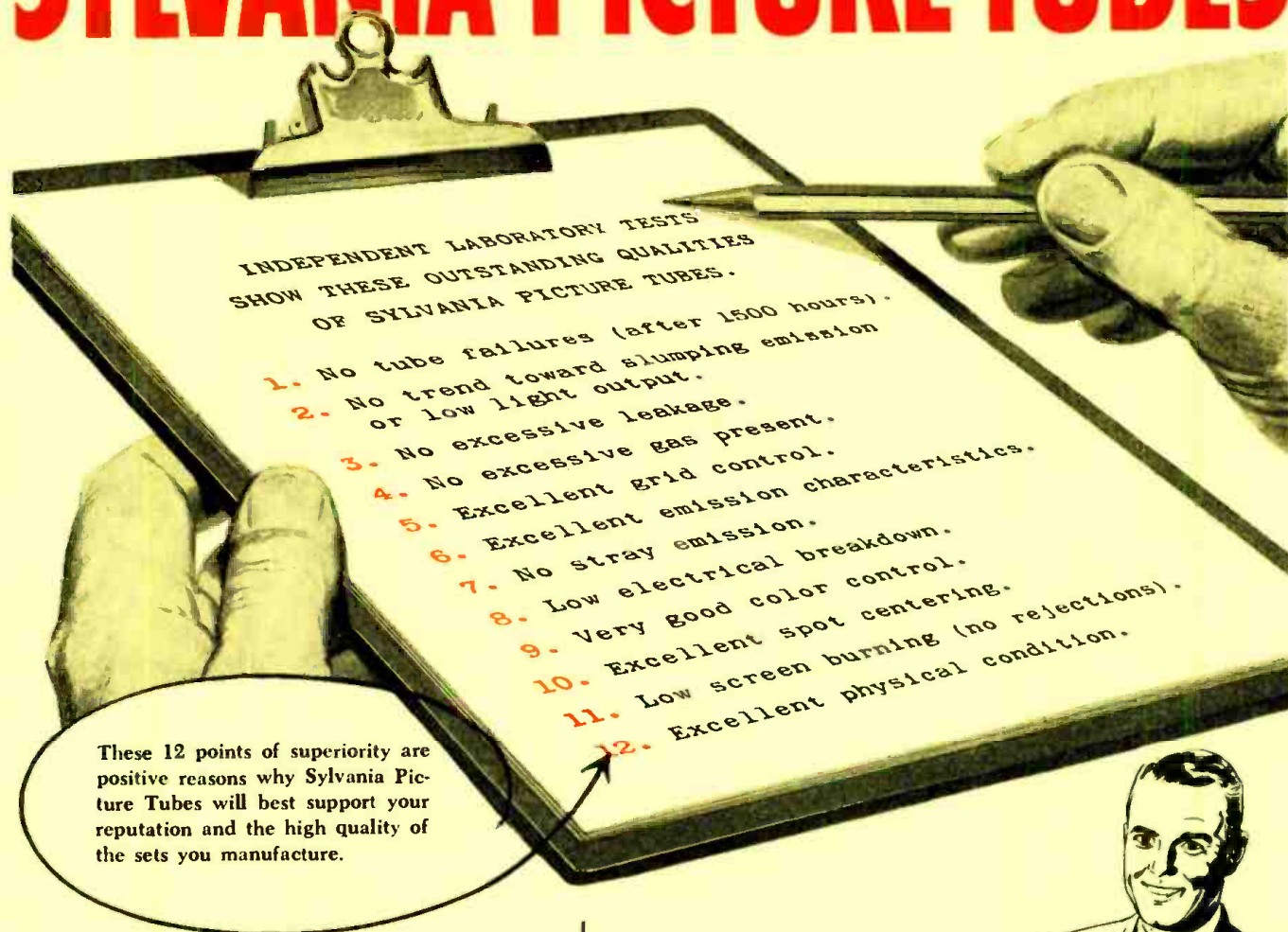
distortion. It has an input level range of from +42 dbm to -70 dbm at a 600-ohm impedance level; input impedance is 10,000 ohms in the passband.

SCINTILLATION DETECTOR

A new scintillation detector, Model DS-1, has been announced by *Nuclear Instrument & Chemical Corporation*, 229 West Erie Street, Chicago 10, Ill. Designed for efficient gamma-ray counting in clinical and laboratory applications, the detector is provided with a

(Continued on page 30)

12 Reasons why Electronics Engineers should specify **SYLVANIA PICTURE TUBES**



To definitely establish the superiority of Sylvania Picture Tubes, in comparison with other brands, Sylvania called an outside research organization . . . the United States Testing Company.

Eight picture tubes of nine different manufacturers were selected and submitted to identical electrical and mechanical tests.

Shown above is Sylvania's outstanding record. The test results showed that Sylvania Picture Tubes outlasted and outperformed all others tested. For the detailed report of these significant tests, write to: Sylvania Electric Products Inc., Dept. 3R-3502, 1740 Broadway, New York 19, N. Y.

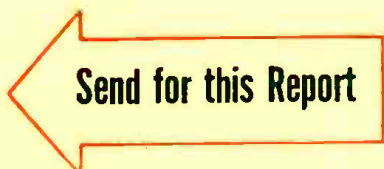
**"SYLVANIA'S
SUPERIOR
QUALITY
IS BASED ON
PROVED
PERFORMANCE!"**



SYLVANIA



RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

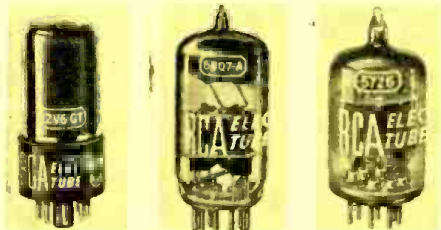


NEW TUBES

RCA TUBES

The Tube Department of *Radio Corporation of America*, Harrison, N. J. has released three new tubes: a beam power amplifier, a medium-mu twin triode, and a "premium" twin diode.

Intended primarily for use in the output amplifier of automobile radio receivers operating from a 12-volt storage battery, the 12V6-GT is a beam power tube of the heater-cathode type. A single 12V6-GT operated with a plate and



screen voltage of 250 volts can deliver a maximum-signal output of 4.5 watts.

The 6BQ7-A is a medium-mu twin triode of the miniature type designed for use as the first r.f. amplifier tube in

a v.h.f. television-receiver tuner or as a low-noise i.f. preamplifier tube in a u.h.f. television receiver employing a crystal mixer. It supersedes the 6BQ7.

Especially useful as a detector in circuits utilizing wide-band amplifiers, the 5726 is a high-perveance, miniature twin diode. Constructed to give dependable performance under shock and vibration, this is a "premium" version of the 6AL5W.

HYTRON TUBES

Hytron Type 27EP4 is a 27" rectangular, 90°, all-glass, magnetically focused picture tube which provides an effective area of over 400 square inches. Features include an aluminized screen, single ion-trap gun design, and a neutral-density, spherical face plate.

Type 1N64 is a germanium diode designed to meet the requirements for a video detector in television applications. It is application-tested at both the low and high intermediate frequencies.

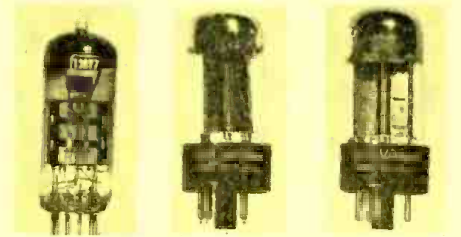
Both of these tubes are manufactured by the *Hytron Radio & Electronics Co.*, Salem, Mass.

TV PENTODE AND TWO DIODES

A new television pentode, the 12BY7, and two diodes for use in television

horizontal frequency damper circuits have been announced by the *Radio Tube Division of Sylvania Electric Products Inc.*, at Emporium, Pa.

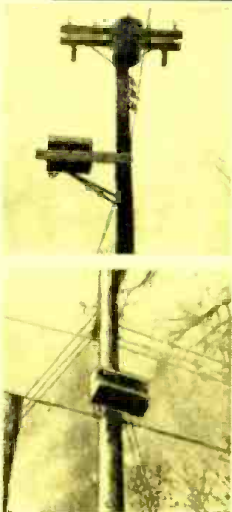
The 12BY7 is a high-transconductance sharp-cutoff video pentode de-



signed for service in television receivers. It features miniature T-6½ construction, and will furnish large output voltages across low values of load resistance and supply voltage.

Types 6AX4-GT and 12AX4-GT are half-wave, indirectly heated diodes contained in T-9 envelopes. They are designed to withstand the extremely high voltage pulses of line frequency between cathode and both heater and plate elements normally encountered in direct drive circuits. The 6AX4-GT and the 12AX4-GT are identical except for heater characteristics: the 6AX4-GT requires 6.3 volts at 1.2 amperes, while the heater of the 12AX4-GT requires 12.6 volts at 600 ma.

SKL WIDE-BAND DISTRIBUTION SYSTEM FOR TELEVISION

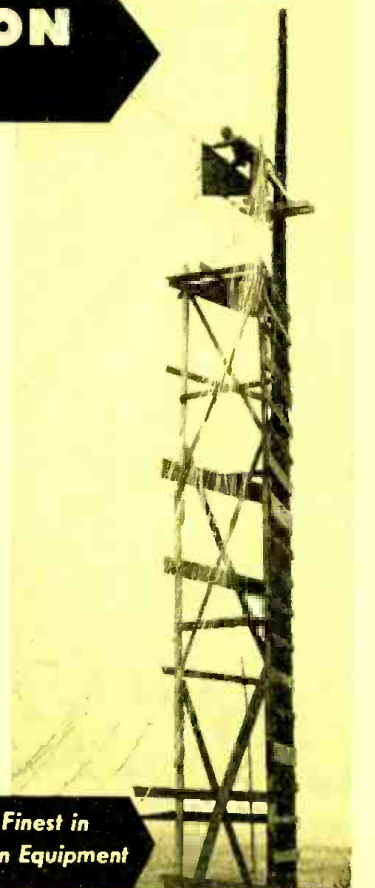


Two views of SKL Model 212TV Amplifier mounted in Model 420 Amplifier Cabinet, mounted on a telephone pole crossarm (top), pole (bottom). Courtesy Vermont Television, Inc.

The -SKL- Distribution System provides simultaneous distribution of up to thirteen television channels, FM signals, and, if required, broadcast signals. Although the -SKL- system is inexpensive in initial cost, no effort has been spared to provide high quality, long lasting, low obsolescence designs and equipment. An unusual feature of the -SKL- system is the Model 212TV Chain Amplifier. These broadband amplifiers continue to operate even though a tube fails, which insures the high reliability so necessary in such a system. The -SKL- system is designed to have the lowest maintenance cost of any system on the market today, not only because of the reliability of the amplifiers which require no tuning or adjustment, but also because vacuum tubes have been eliminated in all other parts of the system. Only the -SKL- system can offer the long life, low obsolescence and low maintenance costs that are required for the long, profitable operation of distribution systems.

Write today for further information.

Right: Photo of erection of one of the two Horn Antennas at Barre, Vermont, for Vermont Television, Inc. These antennas, having 20 db gain, provide good signals from WBZ-TV Boston, 140 air miles, and WRGB Schenectady, 130 air miles.



SKL SPENCER-KENNEDY LABORATORIES, INC.
186 MASSACHUSETTS AVE., CAMBRIDGE 39, MASS.

The Finest in Precision Equipment

an oyster never advertises



He seems to think you ought to like him for his shell, in spite of the fact that it looks no different from a million other oyster shells. If he's got a pearl inside, why doesn't he say so.

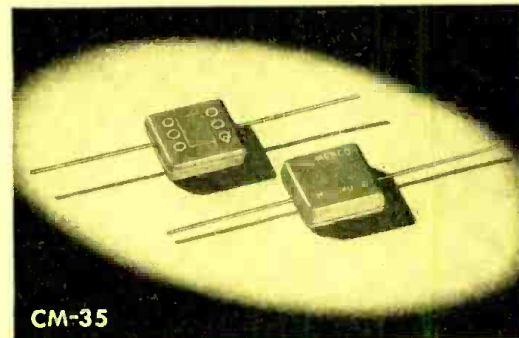
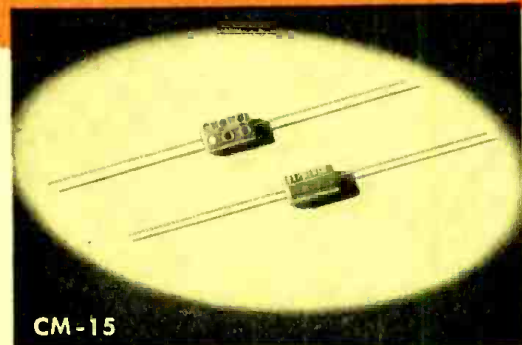
CAPACITORS LOOK PRETTY MUCH ALIKE FROM THE OUTSIDE, BUT EL-MENCO'S HAVE SOMETHING IN THEM *and we want the world to know it.*

Into every El-Menco Capacitor goes superb design, precise workmanship and the finest of materials. The finished unit is then factory-tested at *double* its working voltage to *insure* satisfactory performance on whatever job it is given.

No wonder we are *proud* to put our name on these capacitors—no wonder they have won the highest praise for their absolute reliability.

The range runs from the smallest (CM-15-2-525 mmf. cap.) to the largest (CM-35-3300-10000 mmf. cap.)

Write on business letterhead for catalog and samples.



Jobbers and Distributors: For information write to Arco Electronics, Inc., 103 Lafayette St., New York, N. Y.—Sole Agent for Jobbers and Distributors in U.S. and Canada.

MOLDED MICA **EL-MENCO** MICA TRIMMER
CAPACITORS

Radio and Television Manufacturers, Domestic and Foreign, Communicate Direct With Factory—

THE ELECTRO MOTIVE MFG. CO., INC.

WILLIMANTIC, CONNECTICUT

Personals



DR. ROBERT ADLER, who joined *Zenith Radio Corporation*, Chicago, Ill., in 1941 as a member of its research division, has just been appointed associate director of research. During the intervening years, Dr. Adler has made numerous contributions to the advancement of the electronics industry and to the improvement of communications equipment used by the armed services. He was awarded a Fellowship by the Institute of Radio Engineers in 1951.



F. CLARK CAHILL is now chief engineer of the Engineering and Production Division of *Airborne Instruments Laboratory, Inc.*, Mineola, L. I., N. Y.; he formerly served in the *Laboratory's* Research and Engineering Division as supervisor of the Radar Section. During World War II, Mr. Cahill was associated with the Radio Research Laboratory at Harvard University as head of a war research work division. He has been with *Airborne* since 1945.



EDWARD L. COCHRANE, Vice Admiral, U.S.N., (Ret.), and Dean of the School of Engineering at Massachusetts Institute of Technology, has again been elected a director of *Raytheon Manufacturing Company*, Waltham, Mass. Admiral Cochrane first served in this capacity for *Raytheon* from 1948 until 1950, at which time he took a leave of absence from M.I.T. to direct the maritime administration in Washington as chairman of the Federal Maritime Board.



L. F. HICKERNELL, chief engineer of *Anaconda Wire & Cable Co.*, Hastings-On-Hudson, N. Y., was recently elected a member of the board of directors of the American Institute of Electrical Engineers. Mr. Hickernell served as the chairman of the Detroit-Ann Arbor Section from 1929 to 1930; since then he has worked on many AIEE committees, both general and technical. His term as director will extend from January, 1953, through July, 1954.



DR. URNER LIDDEL has joined *Bendix Aviation Corporation* to direct product development in applied physics and atomic energy. Prior to his most recent position as chief of the physics branch of the U. S. Atomic Energy Commission, Dr. Liddel served as a civilian in the Office of Naval Research where he was director of the Division of Physical Sciences. He is a Fellow of the American Physical Society and the New York Academy of Sciences.



WILLIAM C. LUPFER has been appointed director of contract relations for *Avion Instrument Company*, Paramus, N. J., where he will be responsible for technical representation of all products. In 1943, Mr. Lupfer became associated with *Sylvania Electric Products Inc.*, as contract and facilities supervisor for the Central Engineering Division, and more recently he was with *Allen B. Du Mont Laboratories, Inc.*, as government contracts administrator.

A.F. Wattmeter

(Continued from page 7)

pling is employed between the two output transformers. The difference of the outputs is taken by reversing the connections of one thermocouple.

Protection against thermocouple overload and burn out is provided by the double-diode 6AL5 clippers interposed between the two amplifiers. These are adjusted to clip or cut off the output at a voltage value just below the point at which the thermocouple heater currents reach 125% of rated value. Since the couples are rated to stand 150% current, a small safety factor is included here.

A calibration curve of meter reading vs. input power to resistive or reactive loads is shown in Fig. 3. For a given power input, change of load power factor over a wide range of capacitive or inductive angles makes no change in the reading. For all values of load voltage between zero and 150% of rated value, and with the load current circuit open, the meter stays at zero power.

The particular couples chosen for speed of response have heater ratings of 100 ma., 2 ohms, and couple ratings of 25 millivolts, 7 ohms. The indicating instrument used has a range of 50 microamperes and a coil resistance of 160 ohms. Full scale readings with a load power of 1.5 watts can be obtained.

Speed of response is not as slow as might be expected, full scale being reached from zero in slightly less than one second. For small change from a median reading, the response is even more rapid. Because of the protection given by the diode clippers, there is no fear of burn out or damage due to overload, and the instrument becomes as foolproof as a vacuum tube voltmeter.

Frequency range depends on the selection of the input step-up transformer and coupling capacitors, and to a very limited extent on the choice of the output transformer. The range of 50 to 15,000 cycles can be easily covered with conventional design, and this can be extended through the selection and loading of the input transformer. For extreme frequency ranges, the input transformer can be eliminated and input taken directly from the shunt. Additional voltage gain of about 50 can then be provided with another amplifier stage of conventional design.

Assembly of vacuum thermocouple pair.



Specify *Bliley*... For 22 Years The Foremost Name In Crystals



Military types CR15, CR16, CR18, CR19, CR23, CR24, CR27, CR32, CR36, CR47 are representative of current production by Bliley. Complete range of types and cross reference index is given in Bulletin 43.

MILITARY



SHIP-TO-SHORE



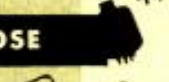
Types MC7, SR5 and SR8 are suggested for shipboard dependability. Price and details given in Bulletin 44.

BROADCAST



Types BC46T, MO3B, TC92 are first choice for automatic temperature control in AM, FM and TV transmitters. Consult Bulletin 43 for basic details.

SPECIAL PURPOSE



Types SR10 and MC9 provide wide range frequency choice for TV service, diathermy and citizens band. Request Bulletin 44 for price and description.

COMMUNICATIONS



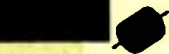
Type BH6A is the predominant choice for land mobile and airborne applications. Consult Bulletin 43 for basic information.

STANDARD



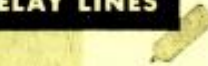
Types KV3, MC9, SMC100 and MS-433 cover reference frequencies from 100 kc through 10.7 mc. Price and "stock tolerances" given in Bulletin 44.

AMATEUR



Types AX2 and AX3 together with Bliley packaged oscillator Model CCO-2A were designed to bring precision and price together in the Ham Bands. Price and details are given in Bulletin 44.

ULTRASONIC DELAY LINES



Custom built fused quartz delay lines provide high stability and precision time intervals for manipulation of pulsed or pulse modulated signals. Consult Bulletin 45 for technical information.

FREQUENCY STANDARDS



Model BCS-1A is a high stability instrument for precision reference at 100 kc. Ideal choice for research and development laboratories. Descriptive information given in Bulletin 43.



BLILEY ELECTRIC COMPANY
UNION STATION BUILDING • ERIE, PENNSYLVANIA

70. that the rise of \$100,000,000 in money for gas-er cent early per the

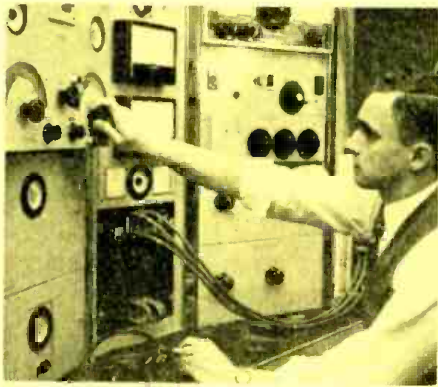
Fat... wor... serves were a let... rise of \$100,000,000 in money circulation to a record high of \$103,350,000 in 1947. In 1948, it was \$100,000,000, and a decrease of \$2,265,000 in system findings of the government...

... statements... ses in cash remunerati... certain officers last year ran... \$6,000,000 annually. ... increase in remuneratio... the individuals is princ... plan heretofore in effect provid... for the purchase of single pre... annuities...

NEWS BRIEFS

COAXIAL CABLE SYSTEM

A revolutionary coaxial cable system, with triple the telephone circuit capacity of those now in use, has been de-



veloped by Bell Telephone Laboratories and is undergoing exhaustive field trials prior to its installation in the Bell

System. It is expected to go into actual service on circuits between New York and Philadelphia early in 1953.

Known as "L-3" carrier, the new system will enable one pair of coaxial pipes (pencil-size tubes of copper within the cable itself) to handle simultaneously more than 1800 telephone conversations or 600 telephone conversations plus one television program in each direction. It will be the first carrier system on which both television signals and regular telephone conversations can be sent over the same pair of coaxial pipes at the same time. (Photograph shows a Bell engineer testing transmission characteristics.)

IEC STANDARDS

Nineteen countries were represented by 418 delegates at a series of meetings of the International Electrotechnical Commission at Scheveningen, Holland, last September, to discuss international agreement on electrical standards. The United States participated in almost all of the technical meetings.

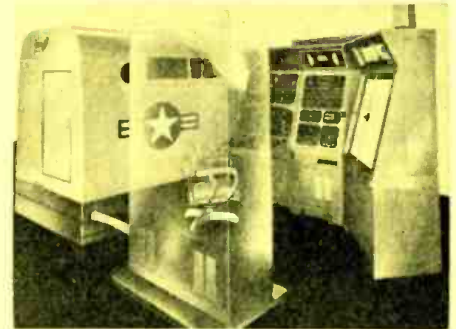
Among the important actions taken was the authorization of a new technical committee to develop standards for electronic tubes. A number of standards were completed for submission to the national committees, including safety rules for amplifiers and loudspeakers, several standards for radio components, and a revision of standards for power capacitors.

Arrangements were made for extending cooper-

ative action on standards of joint interest to IEC and the International Commission on Rules for the Approval of Electrical Equipment (CEE).

TWIN-ENGINE FLIGHT TRAINER

U. S. Navy airmen will now "fly the beam"—including the new omni-range—in twin-engine ground trainers as the



new ERCO Flightronic trainer takes its place in the fleet's All Weather Flying School at Corpus Christi. Designed by the Engineering and Research Corporation, Riverdale, Md., under contract to the Special Devices Center, Office of Naval Research, this instrument trainer features generalized twin-engine type cockpit and performance, the new Navy color- and shape-coded control knobs, and the Special Devices Center's new standard radio aids simulator and flight plotting board.

GIANT TV ANTENNA

Resembling "Big Bertha" herself, this 86-foot television transmitting antenna is undergoing preshipment tests at General Electric Company's Syracuse, N. Y., plant. Only half of the antenna is pictured, the other half being behind the test building.

This 8500-pound giant soon will boost by 12 times the transmitter power of



Station WCPO-TV in Cincinnati, Ohio. The preshipment tests are made to insure that the antenna will efficiently accept and radiate TV signals from the station's Channel 9 transmitter.

Z

OPHAR

WAXES COMPOUNDS


Zophar waxes, resins and compounds to impregnate, dip, seal, embed, or pot, electronic and electrical equipment or components of all types; radio, television, etc.

Cold flows from 100°F. to 285°F.

Special waxes non-cracking at -76°F.

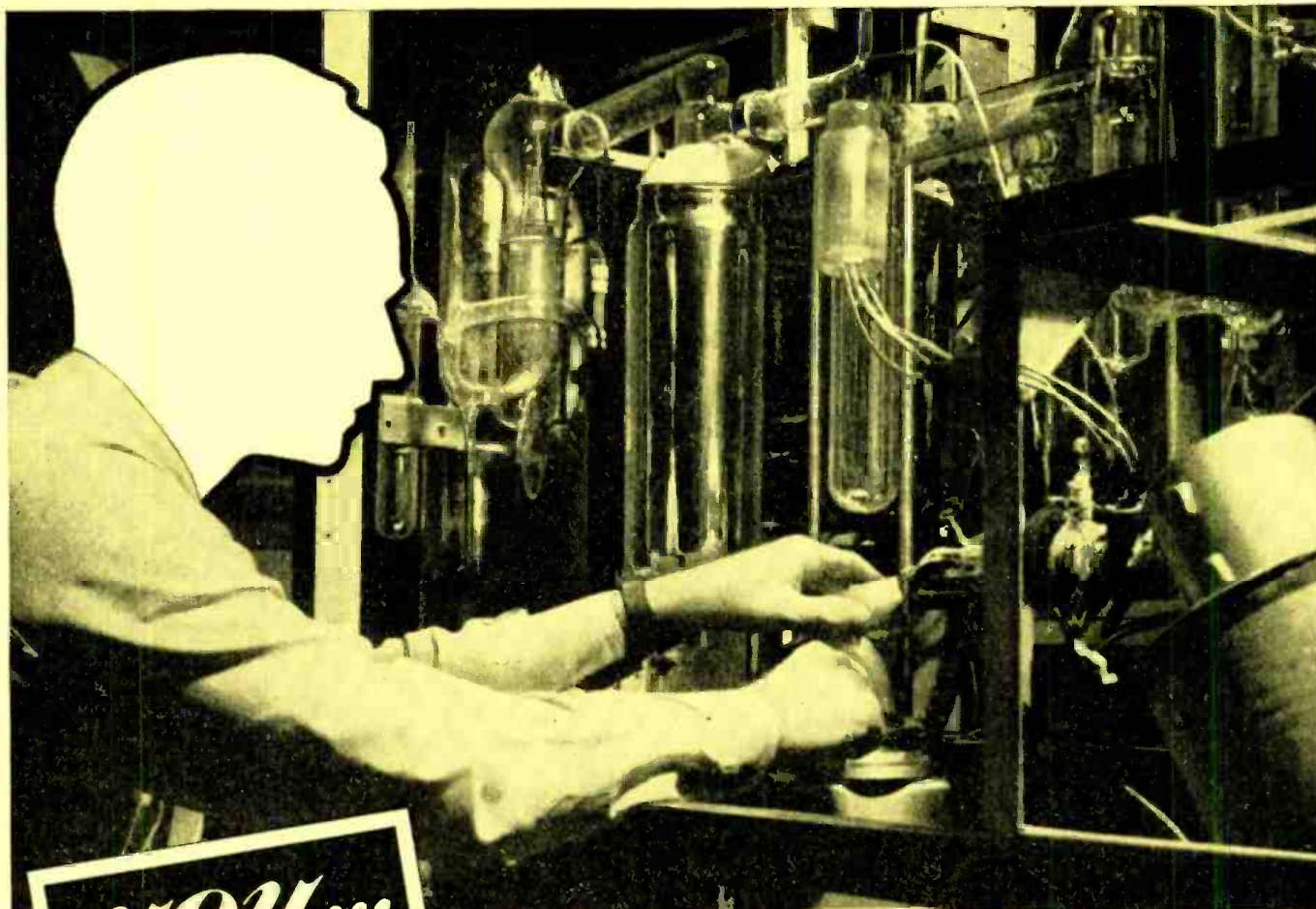
Compounds meeting Government specifications, plain or fungus resistant.

Let us help you with your engineering problems.



ZOPHAR MILLS, INC.

112-130 26th Street,
Brooklyn 32, N. Y.



you...

**... are headed for a better future
—when you come to RCA**

If you want to work where you enjoy the highest professional recognition among your colleagues, come to RCA. Here your accomplishments are recognized and rewarded. Here your future is brighter, through challenging assignments that lead to better opportunities, better positions. Here you set goals for future attainment at advanced levels.

If your talent and skill are not being used in a way for which your education and experience has equipped you, come to RCA. Here you will find unusual opportunities to work in close association with distinguished scientists and engineers in research . . . development . . .

design . . . and application of specialized electronic equipment for military projects as well as for an ever-increasing line of diversified commercial products.

Positions open are lifelong *career* opportunities. They are not "temporary" jobs. Unlike "feast or famine" industries,

RCA has forged ahead regardless of war or depression. You can continue advanced study at recognized universities under RCA's modern tuition refund plan. You and your family enjoy outstanding Company benefits. Yes, your future is better at RCA.

LIFETIME OPPORTUNITIES FOR

ENGINEERS—Electronic . . . Electrical . . . Communication . . . Mechanical . . . Computer . . . METALLURGISTS and PHYSICISTS

In Research—Development—Design—Application: in the following fields:

- RADAR • MISSILE GUIDANCE • SERVO MECHANISMS • COMPUTERS • TRANSFORMERS AND COILS • NAVIGATION AIDS • TELEVISION • ELECTRON TUBES • COMMUNICATIONS TECHNICAL SALES • ELECTRONIC EQUIPMENT FIELD SERVICE**



Send a complete résumé of your education and experience.

Personal interviews arranged in your city.

Send résumé to:
Mr. ROBERT E. McQUISTON, Manager
Specialized Employment Division,
Dept. 204B
Radio Corporation of America
30 Rockefeller Plaza, New York 20, N. Y.

RADIO CORPORATION of AMERICA

NEW LITERATURE

TRANSISTOR PROGRESS

The November, 1952, issue of the Proceedings of the Institute of Radio Engineers was completely devoted to the multitude of advances which have been made in transistor research and development. The 528-page journal, containing 51 individual articles, covered all phases of transistor progress. Many of the articles described new applications of transistors in amplifiers, oscillators, rectifiers, electronic computers, and switching circuits.

Copies of this transistor issue are available from the Institute of Radio Engineers, 1 East 79th Street, New York 21, N. Y., at \$3.00 each.

TV EQUIPMENT COMPLEMENTS

All equipment used in a television station is arranged into a few functional groups in the bulletin entitled "Television Equipment Complements for Station Planning" which has been published by the Television Transmitter Division of *Allen B. du Mont Laboratories, Inc.* 1500 Main Avenue, Clifton, N. J.

The detailed complement of each group is listed with prices and each complement is given a number for easy reference. A short description of the function of the complement is also in-

cluded in each case so that the station planner using this bulletin can select equipment for any size station, large or small, and arrive at the approximate total cost of his equipment.

TWO-WAY RADIO

Use of two-way radio for better coordination of men, materials and machines is discussed in an eight-page illustrated booklet published by the *General Electric Company*. Entitled "Instant Communication," the booklet is slanted to those who use materials handling and emergency service equipment, and others who have plant protection problems.

Also contained in this publication is a list of 27 *G-E* offices throughout the United States from which advisory service is now available on communication problems. Copies are free on request to the Advertising Inquiry Section, *General Electric Company*, Electronics Park, Syracuse, N. Y.

RADIOTELEPHONES

Eight radiotelephone models, two radio direction finder models, and various accessory units are described in a new eight-page catalog. Identified as Form 852, it is available from *Applied*

Electronics Company, Inc., 1236P Folsom Street, San Francisco, Calif.

Besides a description of the basic design features of these instruments, the catalog includes a full tabulation of models showing number and types of channels, frequency ranges, receiver sensitivities, transmitter power outputs ranging from 40 to 500 watts peak, tube complements, power requirements, dimensions, and weights.

ELECTRONIC INSTRUMENTATION

In a 32-page booklet, the *Berkeley Scientific Division of Beckman Instruments, Inc.*, 2200 Wright Avenue, Richmond, Calif., briefly describes electronic instruments which provide direct reading digital presentation of information together with their principal industrial applications. "Electronic Instrumentation" covers high-speed counting; counting plus control; precise interval timing; and measurement of rpm, pressure, temperature, flow, viscosity, velocity, frequency, distance, etc.

EMBEDDED SELENIUM RECTIFIERS

The Rectifier Division of *Sarkes Tarzian, Inc.*, located at 415 North College Avenue, Bloomington, Ind., announces publication of a new four-page folder dealing with embedded selenium rectifiers. Designated as Catalog B1, this folder gives detailed information on the various types of embedments made by *Sarkes Tarzian, Inc.* A copy will be mailed free upon request to the manufacturer.

"VIBRATRON"

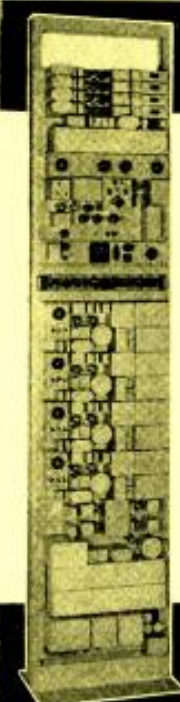
Model 652 "Vibratron" is a portable instrument for vibration analysis and dynamic balancing. It can be used for balancing practically any rotating part, of any size, without removing the part from its installation, in the range from 500 to 40,000 rpm.

A four-page bulletin describing this device in detail is available from the *International Research and Development Corp.*, Columbus, Ohio.

THERMOPLASTICS

"Custom Extrusions in Thermoplastics" is a new service folder prepared by the *Anchor Plastics Company* which contains comprehensive information on the characteristics of thermoplastics. Forms and shapes of extruded plastics are discussed, and a general summary of how thermoplastics may be used by industry is given.

This folder may be obtained by writing to *Anchor Plastics Company*, 36-36 36th Street, Long Island City, N. Y.



4 CHANNEL CARRIER TELEPHONE TERMINALS CFD-B

and Pilot Regulated CARRIER REPEATERS (for use in conjunction with the CFD-B Terminals on long haul circuits.)

COMPLETELY AUTOMATIC PILOT REGULATION OVER A 20 db RANGE. Built-in "SLOPE CONTROL" includes an extra 10 db equalization for non-conforming telephone pairs.

RYCOM'S CFD-B is assembled from Western Electric component parts, and is mounted COMPLETE with ringing, terminating and power supply equipment in ONE STANDARD AAR 8-FOOT RACK. Standard commercial performance is guaranteed. • Basic line Equalization of 15 db by manual controls. • The range of operation is through a maximum of 30 db over an operating range of 3 to 32.3 kilocycles. • Two-way pilot-regulated repeaters are available for circuits having more than the allowable 30 db loss. • 1000/20-Cycle Voice Frequency Ringers are available for one-, two-, three-, or four-channel ringing. A FULL LINE OF ACCESSORIES is offered, including: • Voice Frequency Repeater Balancing Nets, • Cable Matching Transformers, • Universal Way Station Filters, and • Mounted Sub-cycle Ringing Power Supplies.

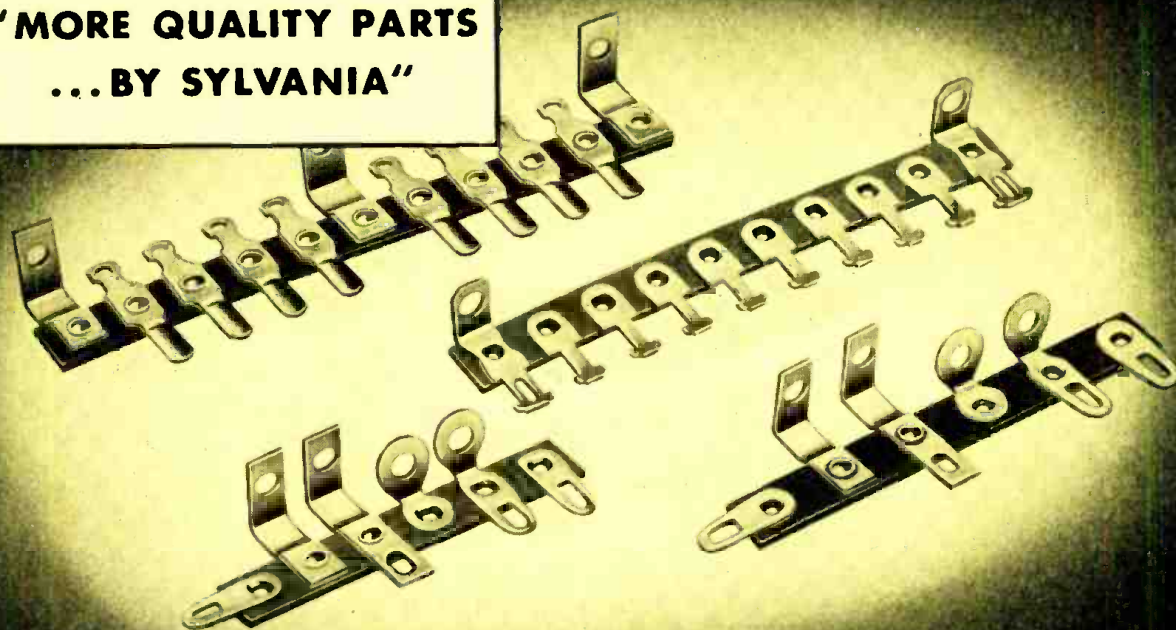
RYCOM'S CFD-B provides FOUR DUPLEX VOICE CHANNELS AND RINGERS at a LOWER COST to you than most three-channel carriers now on the market! And WE CAN MAKE IMMEDIATE DELIVERY!

RAILWAY COMMUNICATIONS INCORPORATED
FLEMING 2121 • RAYTOWN, MISSOURI • FLEMING 2122

MAKE BETTER CONNECTIONS

with Sylvania's improved terminal strips

**"MORE QUALITY PARTS
...BY SYLVANIA"**



Sylvania now offers you a wide variety of highest quality terminal strips . . . equipped with from 2 to 14 lugs . . . suitable for many different applications.

Insulators are made from laminated phenolic. Contacts are brass or cadmium-plated steel. Sylvania Terminal Strips can be supplied to your specifications.

Today, with enlarged, modern plastic molding equipment and metal stamping facilities, Sylvania offers you precision-built components of highest quality at lowest possible cost. For new illustrated catalog showing the long line of Sylvania Terminal Strips and other radio and electronics components now available, write to: Sylvania Electric Products Inc., Dept. 3A-3502, 1740 Broadway, N. Y. 19, N. Y.



**SEND FOR THIS
CATALOG**

SYLVANIA

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

LOOKING at TUBES

By WILFRID B. WHALLEY

Adjunct Professor of Electrical Engineering
Brooklyn Polytechnic Institute

The development of the image orthicon.

LAST month's article dealt with the development of the *orthicon*. This pickup tube provided quite stable operation, due to the use of low velocity electron beam scanning. It also had higher sensitivity than the *iconoscope*.

Still higher sensitivities were necessary, so that studios could operate with lower light levels, and so that outdoor scenes could be satisfactorily transmitted on cloudy days. Even with the improved characteristics of the *orthicon*, more lighting was required for good studio pickup than was comfortable for the performers. Further, the coming field of color television would require higher pickup tube sensitivity because of the fundamental loss of light through color filters or dichroic mirrors.

Another important requirement was that of smaller volume, particularly a reduction in the area of the light target so that lenses of sizes similar to those used in moving picture cameras might be employed. Then, too, for a lens of a given *f* number, greater depth of focus could be obtained with a smaller mosaic area; this, despite the fact that a smaller mosaic area reduces the photosensitivity. Also, to increase the depth

of picture focus, it was important that the mosaic or light sensitive surface be close to the end of the tube, and therefore adjacent to the lens.

Increasing Sensitivity

Starting with the *orthicon*, which had a sensitivity already higher than that of the *iconoscope*, consider what additional methods might be employed to increase the light-to-signal sensitivity further.

First, secondary-emission multiplication of the photoelectrons emitted by the light target might be used. This could follow techniques used in the image-*iconoscope* and infrared viewing tubes where the mosaic is placed some distance away from and parallel to the semitransparent photoelectron emitting surface (called a photocathode). By operating the photo surface at a negative d.c. potential with respect to the mosaic, and enclosing the device within an axial d.c. magnetic focusing field, the photoelectrons arrive at the mosaic with sufficient velocity to release several secondary electrons for each photoelectron, hence increasing the signal output current from the mosaic.

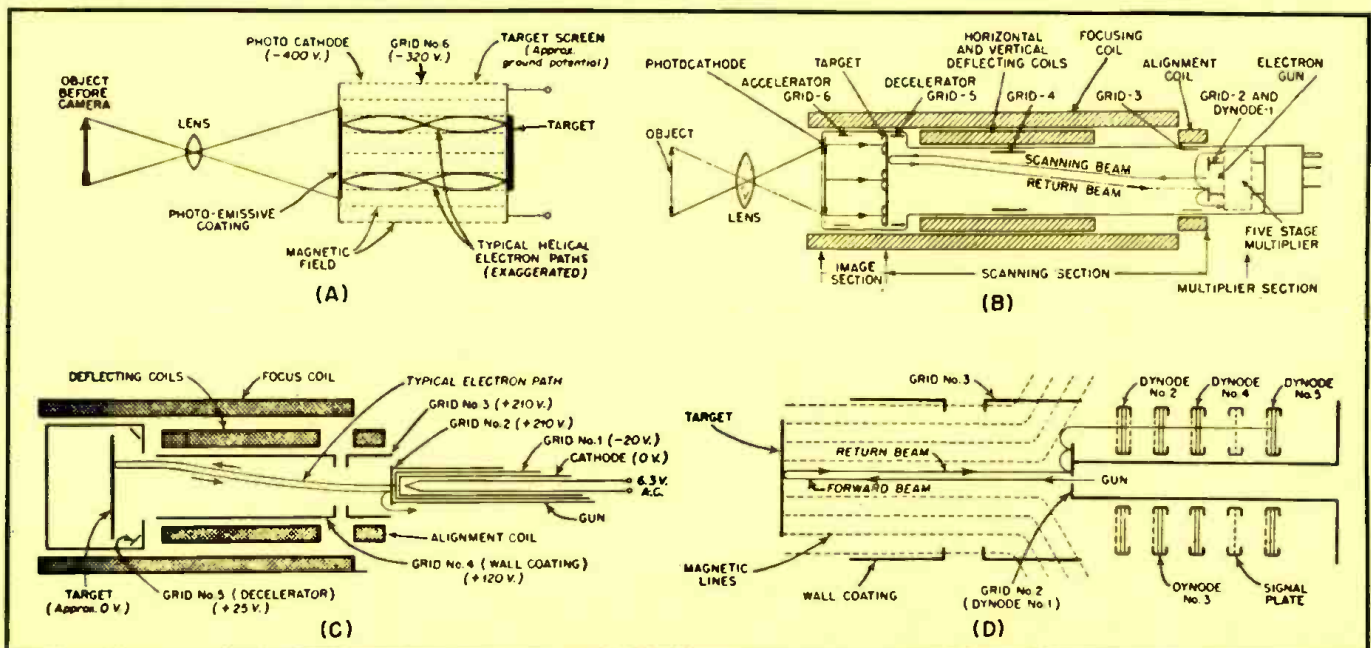
The *iconoscope*, image-*iconoscope* and *orthicon* used video preamplifiers with conventional pentode tubes. Such pentode tube amplifiers had been brought to a high level of efficiency by 1940. The product of voltage gain times mc. bandwidth reached a value of 180. Yet, for very small input signals and bandwidths of 4 mc. or more, these amplifiers gave relatively high noise factors, and were also critical with regard to microphonism and 60-cycle leakage currents. The basic limitation on sensitivity, common to all radio and radar systems, was the fluctuation noise component of plate current in the first-stage tube, combined with the thermal noise current of the input circuit.

Multistage secondary-emission multiplier tubes had noise levels several orders below those of conventional receiving tubes. For example, the input dark "target" current of a good nine-stage electron multiplier type phototube was less than 10^5 electrons per second (less than 10^{-11} ma.). This is approximately 10,000 times lower than the equivalent input noise current of a conventional video tube amplifier. However, to make use of secondary-emission multiplication, the primary signal electrons must be inserted into the evacuated envelope containing the secondary multiplication surfaces.

Secondary Electron Amplification

With *iconoscopes* and *orthicons*, the electron flow produced by the sequential discharging of the mosaic elements (with the scanning electron beam) went to a terminal in the glass wall. Hence, it was impossible with these pickup tubes to insert the primary electrons into a secondary-emission amplifier.

Fig. 1. Operation of image orthicon. (A) Image multiplier; (B) complete tube; (C) scanning section; (D) electron multiplier.



However, further examination of the orthicon operation suggested the possibility of using the electron scanning beam. As was discussed in last month's article, when the electron beam approached the surface of the mosaic, electrons were collected in proportion to the potential of each part of the surface (as determined by the degree of illumination). The uncollected electrons in the scanning beam were turned back. Therefore, this returning beam had a density varying, in time, with the degree of darkness of the surface being scanned. Also the noncollected electrons moved through the magnetic deflection region over a path almost identical to that of the forward scanning beam.

If the horizontal scanning were controlled by electromagnetic fields instead of electrostatic as in the orthicon, and this would be practicable if the tube were smaller, then the returning electrons could arrive at a point close to the aperture of the electron gun. Further, it might be possible to have a suitable secondary-emitting surface at the point of arrival so a secondary-emission multiplier could be used.

The *image orthicon* is such a device making full use of secondary-emission multiplication, both at the image and at the signal output.

The Image Orthicon

As may be seen from Fig. 1 (from "Practical Television Engineering" by Scott Helt), the image orthicon contains image multiplication, scanning and secondary-electron multiplier sections. The tube is also physically smaller than the orthicon. The conducting shield, grid No. 6, in combination with the very fine mesh screen adjacent to the mosaic, maintains a uniform electric field in the image multiplier region. Hence, the photoelectrons from the photocathode are accelerated toward the mosaic or target, and kept in focus by the axial magnetic field. The two-sided target or mosaic is a unique development and consists of an extremely thin piece of special glass having a conductivity sufficient to allow electron charges to be neutralized in the time of one picture frame (one-thirtieth of a second). Glass thickness is between 5 and 10 wavelengths of visible light. The target is about two-thousandths of an inch distant from the very fine mesh screen. Because of the close spacing and thin structures, both the target and the screen must be mounted under tension.

In addition to stabilizing the field in the image region, the fine screen also collects any secondary electrons which are emitted from the target, and therefore avoids possible random distribution of electrons over the target surface. The decelerating ring, grid No. 5, together with the conducting wall coating, grid No. 4, between the target and the gun, reduces the arrival velocity of the electrons in the scanning beam to a suitably low value.

The five-stage electron multiplier is built around the electron gun. Each section consists of a disc of many vanes, each vane being inclined at 45° to the axis of the gun, and treated to give high secondary-electron emission. As the returning electrons strike the surface of grid No. 2, (which is effectively also dynode No. 1), secondary electrons are emitted and these are collected by the first ring, dynode No. 2. The secondary electrons produced on the surfaces of dynode No. 2 are accelerated to dynode No. 3, and similarly through the following stages to the collector (or signal plate) to which the video preamplifier is connected. In order to prevent retrace "smear" of the signal, negative blanking pulses are applied to the target.

The image orthicon is now the most used tube for television studio and outdoor cameras. When carefully adjusted, it has a sensitivity approximately 100 times as great as that of the orthicon. Due to its high complexity, however, great care is required in setting the various electrode voltages and the currents for the d.c. magnetic focusing and alignment fields.



The STERLING indicating meter used on Alliance Manufacturing Company's Model DIR ALLIANCE TENNA-ROTOR always shows the Right Direction to television set owners everywhere. (Over a million in successful operation)

STERLING engineers can show you the right direction, too, when your problem is with indicating meters. Years of production experience with a complete line of high quality meters for the automotive, electrical and radio fields enables STERLING to produce indicating meters to meet your exact requirements at lower cost.

It may even be a standard model voltmeter, ammeter or milliammeter, readily available, that will meet your requirements. Write for further details.

STERLING
MANUFACTURING COMPANY
7201 Wentworth Ave.
CLEVELAND, OHIO

miniaturize!

with

GRAYBURNE

FERRITE-CORE RF CHOKES

Miniaturized dimensions and high efficiency are made possible by use of Ferrite cores. Grayburne specializes in ferrite-core inductances, which feature low DC resistance, high "Q", minimum distributed capacity and smallest possible physical dimensions.

PI-WOUND FERRI-CHOKES



Electrical comparison between Grayburne Ferrite-Chokes and conventional RF Chokes proves the superiority of the Ferrite-Chokes. Available in following stock types:

Model #	L	I
F-25	2.5 mh	125 ma
F-50	5.0 mh	125 ma
F-100	10 mh	125 ma
HD-25	2.5 mh	300 ma

Other values to specifications.

HIGH-RATIO VARI-CHOKES

Grayburne offers a series of variable inductances with a range as high as 10 to 1 within physical dimensions not considered possible until the introduction of Ferrite cores. Stock types:

Model V-6: 0.65 to 6 mh
Model V-25: 5.0 to 43 mh
Model V-60: 30 to 130 mh

Other values to specifications.



SINGLE-SECTION FERRI-CHOKES



Grayburne single-section RF coils are the most compact available. "Q" is maximum, resistance and distributed capacity are at a minimum. Stock types:

Model #	L	I
SL-25	2.5 mh	125 ma
SL-50	5.0 mh	125 ma
SL-100	10.0 mh	125 ma
SL-250	25.0 mh	100 ma
SL-500	50.0 mh	100 ma
SL-800	80.0 mh	100 ma

Other values to specifications.

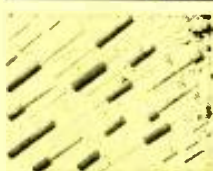
ADJUSTABLE VARI-FORM RF COIL FORMS

In response to great demand for an assembled Cosmolite coil form employing an adjustable Ferrite core, Grayburne offers a series of 4 coil forms for developmental applications. Stock types:

C-1: 1/4" x 1 1/8"
C-2: 1/4" x 2"
C-3: 3/8" x 1 1/8"
C-4: 3/8" x 2"



EXPERIMENTER'S FERRITE CORE KIT



The new Grayburne Ferrite Core Kit contains an assortment of 27 various-sized Ferrite cores adapted for experiments in IF and RF coils, solenoids, linearity, width and other variable controls, and in many electro-mechanical applications.

Write for free newest Catalog REE-2

GRAYBURNE

Grayburne means Quality Electronic Components

GRAYBURNE CORP., 103 Lafayette St., N. Y. 13

Guided Missile Data

(Continued from page 5)

circuit flexibility for recording oscillographs or similar instruments and in no way limit their construction features to telemetry alone.

Communication facilities and remote control are provided for the supervisor of oscillograph recording as well as duplicate control points directly tied in at the telemetry stations. Panels providing for information to be patched into the oscillographs enable recordings to be made of the following data:

1. FM/FM telemetry discriminator outputs
2. FM/FM telemetry decommutator outputs
3. PW/FM telemetry decommutator outputs
4. Land line telemetry (from the missile launcher, such as first motion, squid firing, etc.)
5. Timing signals

The oscillograph rack and all its component units were furnished under a development and fabrication contract (AF-33(038)24908) between the Air Force Missile Test Center at Patrick Air Force Base and Spar Engineering and Development, Inc., Jenkintown, Pennsylvania. Specifications, drawings, and technical exhibits of the contract established the design and layout of the panels and units.

Each panel or unit is separate, removable and essentially complete in itself. The panels provide for patching by means of recessed Western Electric type female jacks. An aluminum channel frame is formed to extend in a deep "U" from the front panel to a depth of about 14 inches. Across the outside of the aluminum extrusion in the rear, a Jones strip is mounted which terminates all the jacks mounted on the front panel. Thus, a panel may be easily removed by loosening all the screws on the Jones strip so that the barrier strip securing all the rack cable harness falls free when the front panel screws are removed. This type of construction places all the rear terminals and cable harnesses at a convenient depth in the rack and, since none of the terminal strips are mounted on the front panel, it can be of minimum size. All panels are of standard height or multiples of 1 3/4", and 19" wide.

Amplifiers are also available to drive galvanometers properly from equipment having low signal outputs, or to provide sufficient levels for high frequency elements, and to provide isolation and sensitivity controls for incoming land line functions. The "amplifier panel" specifications are as follows:

Input impedance—100,000 ohms p.p.
Input level for rated output—5, 10, 50, and 100 volts

Input connector—Western Electric jack type 246A

Frequency response—0-10,000 cps
Output impedance—330 ohms balanced

Output current—maximum ± 10 ma.
Output connector—Western Electric jack type

Front panel indicators—meter to show relative output, amplifier balance and jeweled power lamp

Front panel controls—input attenuator, amplifier balance, meter selector switch, power switch and fuse

Power input—110-120 v., 60 cps

The "galvanometer panel," as the name suggests, provides a means of applying signals to the galvanometer elements. It is mounted directly above the oscillograph for operational ease. Since this "galvanometer panel" has been designed to work in conjunction with an 18-element oscillograph, it provides circuitry for the full 18 galvanometers. Information to be fed to a galvanometer is patched in its respective numbered jack. But, current flowing to any galvanometer must pass through its polarity reversing switch, attenuator, and continuity switch. This arrangement permits the recording technician to present several conditions to the oscillograph and, with the continuity switch open, to keep any or all of the galvanometer circuits open. To check operation, he can flip the switch to "momentary" position. For recording the flight, the desired continuity switches would be set in "continuous" position. The attenuators permit the setting of desired sensitivities directly at the recorder while viewing its limits of deflection. It is true that most of the telemetry equipment provides for level adjustment at the telemetry station itself, but it is not practical to adjust the levels remotely without excessive adjustment time and additional personnel. Polarity reversing switches are required to provide proper direction of deflection in order to permit closer correlation with similar events and easier data reading by deflecting the traces in parallel movement and reducing the times when traces cross, or adjusting channels so that the crossing angle will be great. These switches are recessed and are under a cover plate to maintain a neat appearance and to prevent accidental switching. The "galvanometer panel" specifications are as follows:

Input impedance—330 ohms constant
Input connector—Western Electric jack type 246A

Output impedance—330 ohms constant

Front panel controls—polarity reversing switches, attenuators and continuity switches

The feature of this rack assembly

which permits oscillographs to be operated in a minimum of space is the slide rack chassis unit. This type of support for the oscillograph makes it possible for the instrument to be contained within the rack. For operational ease, it can be extended six inches and locked securely for adjustment, calibration or servicing. Continuous operation is achieved in any position. The galvanometer and power leads are twisted pair shielded cables.

An oscillograph phone unit was designed so that voice communications via hand phone or line amplifier would be available between the telemetering stations and missile checkout or launching areas. It also provides remote control facilities for operating the oscillographs, and an operations "hold fire" switch and indicator. The remote control circuits of the oscillograph permit a technician to supervise the operation of a bay of oscillograph racks, or permit it to be remotely operated and monitored at the telemetry receiving station. Control indicators show the standby condition of each oscillograph and any malfunction which may occur during an operation. Since the oscillograph racks are under the surveillance of one supervisor, only one oscillograph rack in a bay requires a phone unit.

The "hold fire" circuit is peculiar only to the missile test ranges. The usual techniques of firing a missile or projectile in any test program involve considerable instrumentation, coordination and safety precautions, and the only way every group involved or affected may be ready is to count down in seconds for the last interval before firing. In a development and test program, it is essential that all instrumentation be operating correctly at the time of launch. Yet, if the inevitable malfunction occurs a short time before firing, it must be reported immediately so that steps may be taken to prevent useless firing and loss of the missile as well as operation of equipment that requires considerable time to adjust or reload. For this purpose a switch, with safety cover, is located on the phone panel to indicate remotely and locally that a malfunction which the supervisor considers of a serious nature has occurred. A buzzer is also energized locally on the panel so that in the event the visual indication from a jeweled lamp is overlooked, the aural indication will alert everyone. Each indication of the "hold fire" system is on a separate electrical circuit.

The hand phones used with the units are Signal Corps Type EE-8. Again, this is equipment common to the majority of missile test ranges in the country today; it is a very fine handset for land line communications. Audio bridging amplifiers are provided so that


the messages may be monitored without holding a handset all the time or requiring another man as a "talker." The amplifier has an input for balanced or single-ended lines with an impedance of 50,000 ohms from either side to ground. Output power is 4 watts across a 500-ohm line with 0-db input.

In conclusion, it should be stated that the equipment and design provide professional reliable operation of oscillograph recording equipment. It has been pointed out that each unit, or group of functions which are separate from the others, is fabricated complete in itself. This permits standardization of techniques and layout.

In some applications, several oscillographs are required to operate simultaneously from the same information. This occurs when instruments must be operated in tandem, as in cases where the instruments must be alternately reloaded with magazines for long or fast records. This follows the present planning since an oscillograph rack as described can be supplemented by racks on either side containing two or three oscillographs, each mounted on the oscillograph slide rack chassis assembly. Galvanometer panels may be associated with each oscillograph, or when the same data are on similar galvanometers, they may be controlled from the same panel if the elements are driven in series or parallel.

Proper damping is maintained on all elements at all times with the use of the galvanometer panel. The "T" pad attenuators feed the galvanometers with a constant 330-ohm resistive input, and all galvanometer shunts are made up to provide 64% damping when operating across the 330-ohm load.

Proper isolation and drive for galvanometers, when required for recording data from circuitry or equipment not suitable for direct connection to the elements, are provided by stable d.c. amplifiers. In addition to furnishing a means of setting up proper deflections, the limiting characteristics of the vacuum tube circuits prevent damage to many galvanometers by accidental hookup errors.

While this is not the first time an oscillograph has been assembled for rack mounting, it is one of the first installations to provide packaged components throughout. Although the described assemblies center about a particular application, many of the panels may merely require different labeling or the units may be rearranged to provide a wide variety of applications. All of the equipment described has been developed and fabricated, and is now commercially available. Installations of the described system have been made at the Air Force Missile Test Center, Patrick Air Force Base, Fla. 



**24 HOUR
DELIVERY
FROM STOCK!**

RELAYS

Our stock of more than a million relays — in over a thousand different types — is the world's largest. Don't delay your production for want of large or small quantities of relays of any type.

Telephone, wire or write for quotations.



**NEW AND MORE
COMPREHENSIVE**

**1953
RELAY SALES
CATALOG
NOW READY**

**Be sure to send
for your copy**



Telephone
SEeley 8-4146

**833 W. CHICAGO AVE.
DEPT. 8, CHICAGO 22, ILL.**

FOR SALE OR LEASE



150,000 SQUARE FEET

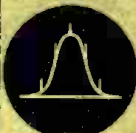
- Partially leased. 83,000 sq. ft. for immediate possession. Balance soon.
- Sprinklered.
- Zoned manufacturing.
- Additional vacant for expansion or parking.
- Excellent labor area on Chicago's Northwest Side.

One of many attractive business and industrial properties offered by

J. J. HARRINGTON & CO.

22 West Monroe Street
CHICAGO 3, ILLINOIS
Financial 6-1322

NEED INSTRUMENTS TO SOLVE ELECTRONIC PROBLEMS?...



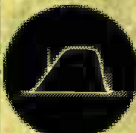
RADA-SWEEP
Radar IF Amplifier
Alignment



MEGA-MATCH
Measurement of
Reflection Coefficient



MEGA-PULSER
Transient Testing
Video Amplifiers



MARKA-SWEEP RF-P
TV Tuner Alignment



RADA-PULSER
Radar IF Transient
Testing



CALIBRATED
MEGA-SWEEP
Wide Range Sweeping
Oscillator
Single Dial Tuned

CONSULT THIS LATEST
64-PAGE
CATALOG

Write



FREE

KAY ELECTRIC CO.

4 MAPLE AVE.

PINE BROOK, N. J.

TECHNICAL BOOKS

"ELECTRON TUBES IN INDUSTRY"

edited by Keith Henney, Editorial Director, and James D. Fahnestock, Associate Editor, of Electronics. Published by McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 353 pages. \$6.00.

The purpose of this book is to provide industrial personnel—engineers and technicians—with enough fundamentals to permit them to talk intelligently about electronics, to know what can be expected of electronic devices and what their limitations are, and to help them visualize new applications. In presenting these fundamentals, practical tried and tested circuits are used as examples. Many of these circuits have already found successful application in industry.

In this third edition, the book has been almost completely rewritten, bringing it up to date, eliminating unnecessary material, and emphasizing all practical aspects. Complicated theoretical aspects of electron tube technology have been held to a minimum.

Digital and Analog Units

(Continued from page 15)

features reminiscent of analog computers: they will have as many separate elements as there are operations to perform, and they will have, not a fixed delay of computation, but an exponential lag characteristic. It might be possible to interleave such digital units with analog ones quite efficiently, because of the continuity of data.

In general, the mixed use of digital and nondigital units in a computer has possibilities which call for constant re-examination as the art progresses. Even the controversy between proponents of digital and analog computers may one day be past history.

Some of the material presented here arose in connection with a doctorate dissertation¹. The guidance and stimulation given to the author by Professor William K. Linvill has been instrumental in formulating many of these ideas.

REFERENCES:

1. Salzer, J. M., "Treatment of Digital Control Systems and Numerical Processes in the Frequency Domain," thesis for Sc.D. degree, Massachusetts Institute of Technology, 1951.
2. Schlesinger, F., "On the Errors in the Sum of a Number of Tabular Quantities," *Astronomical Journal*, Vol. 30, pp. 183-190, 1917.
3. Rajchman, Jan, Snyder, R. L., and Rudnick, P., "Final Report on Computron," RCA Laboratories Report, N.D.R.C. of O.S.R.D., March, 1943.
4. Gordon, M. M., and Nicola, R. N., "Special Purpose Digital Data Processing Computers," paper presented at the meeting of A.C.M., at the Mellon Institute, Pittsburgh, May, 1952.

New Products

(Continued from page 16)

thallium-activated sodium iodide crystal and has a plateau length of approximately 200 volts. With the external directional shield in place, efficiencies of 33% or greater are obtainable using cobalt 60, 40% or greater using iodine 131.

Model DS-1 is equipped with a removable directional shield, and has a built-in preamplifier which provides an output pulse in excess of one-quarter volt, making possible its use at the G-M input of any scaler or count-rate meter. It is available as a separate, complete unit, or with a special lead shield for sample counting.

RADIO CUE SYSTEM

Primarily for directing technical personnel and cue actors in a TV studio, the Model AB radio cue system can also be used in factories where the noise level is too high to permit direct communication. It was developed by the Polarad Electronics Corporation, 100 Metropolitan Avenue, Brooklyn 11, N. Y.

The transmitter operates on a low r.f. frequency into a loop antenna, which restricts the transmitted information to a closely confined area. Several r.f. channels are available if simultaneous transmission for separate activities is desired. Pocket receivers are small and lightweight.

CALENDAR of Coming Events

JANUARY 26-30—IAS-IRE-RTCA-ION Symposium on Electronics in Aviation, New York, N. Y.

JANUARY 26-27—Seventh Regional IRE Conference, University of New Mexico, Albuquerque, N. M.

FEBRUARY 4-6—Western Computer Conference, Hotel Statler, Los Angeles, Calif.

FEBRUARY 5-7—IRE Southwestern Conference and Electronics Show, Plaza Hotel, San Antonio, Texas

MARCH 23-26—IRE National Convention, Waldorf-Astoria Hotel and Grand Central Palace, New York, N. Y.

APRIL 11—New England Radio Engineering Meeting, University of Connecticut, Storrs, Conn.

APRIL 18—Spring Technical Conference of the Cincinnati Section, IRE, Engineering Societies Bldg., Cincinnati, Ohio

APRIL 29-MAY 1—Electronic Components Symposium, sponsored by the AIEE, IRE, RTMA and WCEMA, Shakespeare Club, Pasadena, Calif.

MAY 11-13—National Conference on Airborne Electronics, Hotel Biltmore, Dayton, Ohio

Computer Reliability

(Continued from page 12)

circuits which cannot distinguish between wanted signals and noise. For correct operation of these circuits, there can be no noise which equals the minimum amplitude of the wanted signal; and in practice, the peak noise should be considerably less than the minimum signal to ensure a margin of safe operation.

Two types of noise measurements were made, one in which asynchronous pulses of variable amplitude were inserted into various signal channels to simulate unwanted information pulses, and the other in which small voltage steps were introduced on different plate and screen lines to simulate power supply transients. The first of the tests uncovered a missing ground connection in one circuit and the second suggested a change in power supply filtering. Although it is felt that tests of this nature should supplement other maintenance procedures, no way has been found in which they can be readily mechanized for application to a large scale computer because of the variation in circuit impedance and in signal characteristics that would be encountered.

Experience gained during the conduct of the multiplier reliability test indicates that three significant conclusions may be drawn regarding the problem of obtaining error-free operation of an electronic computer:

First, errors resulting from gradual deterioration of tubes, crystal rectifiers, and other components can be practically eliminated if marginal-checking methods are used to locate weak circuits before they have caused operation failures. Until marginal checking was built into the multiplier, it was almost impossible to go through a day without computational errors and consequent shutdowns. During the life test, no errors could be attributed to deteriorating components—at least within existing ability to determine causes for failures. A total of 154 vacuum tubes and 83 crystal rectifiers were replaced because of low margins.

Second, lack of attention to the details of construction which ensure permanently good electrical connections throughout the system can result in potential sources of error which may

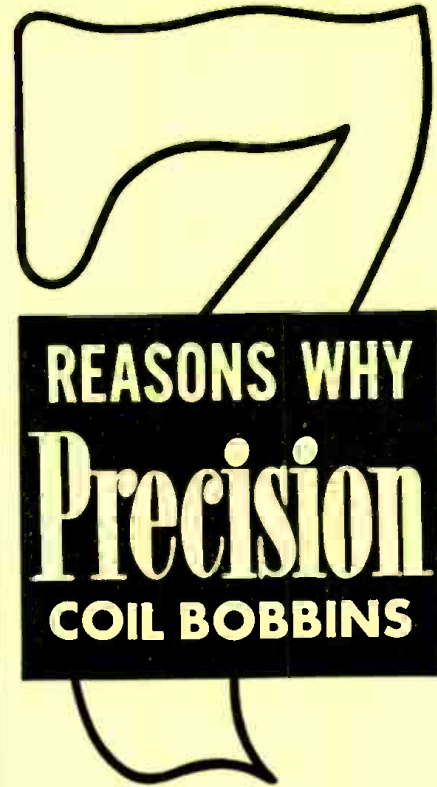
go undetected for a long time. If such conditions exist, long trial runs with satisfactory operation do not establish the fact that the system is a reliable one. An example, taken from the log, will serve to illustrate this point. About halfway through the run, the multiplier started to make errors intermittently. The cause, determined only after tapping each component, was an unsoldered connection which had gone undetected for almost three years.

Third, failures that interfered with the useful operation of the multiplier fell into two general classifications: (1) sudden total failures of components and (2) intermittent circuit failures. At the outset, it was accepted that sudden failures, such as open or short-circuited components or connections, could be expected without warning and would cause errors in operation. Results of the test, however, showed that intermittent failures were far more serious because they were difficult to locate and correct. Of the 142 total error periods, 124 resulted from intermittent failures. Although the sources of some of these were undoubtedly detected and remedied, it was impossible to make direct correlations between errors recorded and defects corrected.

The principal value of the extended reliability test was the proof that circuits of the type used in the Whirlwind I computer could be constructed of presently available components and made to operate in a large system with relatively little time lost in unscheduled trouble-shooting and repair. Test data from the multiplier run could not be used to forecast the reliability of the whole Whirlwind computer since this system contained substantial numbers of components and circuits not present in the multiplier. The performance of the Whirlwind arithmetic element, however, indicates that a linear extrapolation of the multiplier experience to a larger system based on the number of tube cathodes is probably valid if similar circuits are involved. With this criterion, a system of five thousand tubes should average not more than one error period in each 20 hours of operation. For most mathematical, industrial, and scientific applications, this performance would be quite adequate. On the other hand, present-day thinking implies that much larger electronic systems are desirable for controlling actual physical situations where even a low error frequency is objectionable, and one must conclude that continued improvement in components, circuits, and system construction will be needed to obtain satisfactory reliability.

PHOTO CREDITS

PAGE	CREDIT
3, 4, 5...	United States Air Force
6, 7, 20...	University of Illinois
10...	Mass. Inst. of Technology

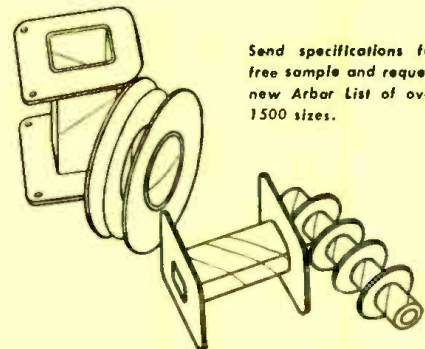


Improve your coils . . .

- Quality Controlled
- Greater Insulation
- Better Heat Dissipation
- Higher Moisture Resistance
- 15 to 20% Stronger
- Lighter Weight
- More Winding Space

PRECISION Coil Bobbins are finished to your exact specifications. Only the finest dielectric materials are used.

Cores furnished in an infinite variety of sizes and shapes—kraft, fish paper, acetate, or combinations. Flanges cut to specifications—plain or fitted with leads, slots or holes; embossed or recessed.



Send specifications for free sample and request new Arbar List of over 1500 sizes.

PRECISION PAPER TUBE CO.

2063 W. Charleston St., Chicago 47, Ill.
Plant No. 2, 79 Chapel St., Hartford, Conn.
Also Mfrs. of Precision Paper Tubes

IRE CONVENTION PROGRAM

*Tentative list of papers to be presented at
the IRE Convention in New York, March 23-26.*

AIRBORNE ELECTRONICS

Some Systems Considerations in Flight Control Servomechanism Design. R. J. Bibbero and R. Grandgent, Republic Aviation Corp.
Paired-In ADF Antennas. L. E. Raburn, Electronics Research Inc.
Magnetic Amplifiers for Airborne Applications. J. K. McKendry, General Precision Labs.
Aircraft Electrical Power. J. C. Dieffenderfer and G. W. Sherman, Wright Air Dev. Ctr.
The Effects of Electronic Equipment Standardization on Aircraft Performance. G. C. Sumner, Consolidated Vultee Co.
The Technique of Monopulse Radar. W. Hausz, G-E.
Reducing Sky Wave Errors in CW Tracking Systems. M. S. Friedland, Patrick AF Base, and N. Marchand, Electronics Lab.
An Application of Integrator Type Signal Enhancer to Direction Finding Equipment. C. A. Strom and J. A. Fantoni, Rome Air Dev. Ctr.
A Theory of Target Glint or Angular Scintillation in Radar Tracking. R. H. Delano, Hughes Aircraft Co.
Automatic Dead Reckoning Navigation Computers for Aircraft. J. L. Dennis, Wright Air Dev. Ctr.

ANTENNAS

The Measurement of Highly Directive Antenna Patterns and Over-All Sensitivity of a Receiving System by Solar and Cosmic Noise. J. Aarons, Air Force Cambridge Research Ctr.
Radiation Patterns for Aperture Antennas with Non-Linear Phase Distributions. C. Allen, G-E.
Factors Affecting Radiation Patterns of Corrugated Surface Antennas. M. Ehrlich and L. Newkirk, Hughes Aircraft Co.
A Microwave Anechoic Chamber for Antenna Pattern Measurements. J. Simmons, Naval Research Lab.
Wide-Frequency-Range Tuned Circuits and Antennas. A. G. Kandoian and W. Sichak, Fed. Telecommunication Labs.
Arrays of Flush Mounted Traveling Wave Antennas. J. N. Hines, V. H. Rumsey and T. E. Tice, Ohio State U.
Transient Build-Up of the Antenna Pattern in End-Fed Linear Arrays. H. Enestein, Hughes Aircraft Co.
A New Microwave Reflector. K. S. Kelleher, Naval Research Lab.
Crosstalk in Radio Relay Systems Caused by Foreground Reflections. H. W. Evans, Bell Telephone Labs.
Low Side Lobes in Pencil-Beam Antennas. E.M.T. Jones, Stanford Research Inst.
Notes on Propagation. L. A. Byam, Jr., Western Union Telegraph Co.
Tropospheric Propagation in Horizontally Stratified Media Over Rough Terrain. H. M. Swarm, R. N. Ghose and G. H. Keitel, Washington U.
Radio Wave Scattering in Tropospheric Propagation. J. W. Herbstreit, K. A. Norton, P. L. Rice and G. E. Schafer, Nat. Bureau of Standards.
Extended-Range Radio Transmission by Oblique Reflection from Meteoric Ionization. O. G. Villard, Jr., A. M. Peterson, L. A. Manning and V. R. Eshleman, Stanford U.
An Interpretation of Vertical Incidence Equivalent Height vs. Time Recordings on 150 KC. R. Lindquist, Pa. State College.

AUDIO AND ACOUSTICS

Sound Reinforcement System. General Assembly, United Nations. L. Beranek, MIT; C. W. Goyder, UN.
A Variable Time Delay. K. Goff, MIT.
A Flux Sensitive Head for Magnetic Recording Play Back. D. E. Wiegand, Armour Research Foundation.
Uniaxial Microphone. H. F. Olson, J. Preston and J. C. Bleazey, RCA Labs.
Sound Pressure Measurement between 50 and 220 DB. J. K. Hilliard, Altec Lansing Corp.
Fundamental Theory. L. Beranek, MIT.
Microphones. H. F. Olson, RCA.
Loudspeakers. H. S. Knowles, Industrial Research Products, Inc.
Phonograph Reproducers. B. B. Bauer, Shure Bros., Inc.
Tape Recording. Marvin Camras, Armour Research Foundation.
Studio Acoustics. H. J. Sabine, Celotex Co.

CIRCUITS

A General RLC Synthesis Procedure. L. Weinberg, Hughes Aircraft Co.
A General Theory of Wide-Band Matching. H. J. Carlin and R. LaRosa, Brooklyn Polytech.
Synthesis of Electric Filters with Arbitrary Phase Characteristics. B. J. Bennett, Stanford U.
Wide-Band Filter Amplifiers at Ultra-High-Frequencies. J. M. Pettit, W. A. Christopherson and D. O. Pederson, Stanford U.
Network Analysis with the Aid of Generating

Polynomials. H. Kurss, Brooklyn Polytech.
Two New Equations for the Design of Filters. M. Dishal, Fed. Telecommunication Labs.
Conventional Amplifiers. W. Bradley, Philco Corp.
Feedback Amplifiers. H. N. Beveridge, Raytheon Mfg. Co.
Transistor Amplifiers. R. L. Wallace, Bell Labs.
Distributed Amplifiers. W. G. Tuller and E. H. Bradley, Melpar Electronics.
Traveling Wave Tube Amplifiers. L. Field, Stanford U.
Continuously Variable Delay Line. C. Berkley, Allen B. Du Mont Labs., Inc.
General Transmission Theory of Distributed Helical Delay Lines with Bridging Capacitance. M. J. DiToro, Allen B. Du Mont Labs., Inc.
Distributed Constant Delay Lines with Characteristic Impedances Higher Than 5000 Ohms. W. S. Carley, U. S. Naval Ordnance Lab.
Helical Winding Exponential-Line Pulse Transformers for Millimicrosecond Service. J. Kukel and E. M. Williams, Carnegie Inst. of Technology.
Time Domain Approximation by Use of Pade Approximants. R. D. Teasdale, RCA.
Frequency Transients in Idealized Linear Systems. B. Gold, Hughes Aircraft Co.
Transient Analysis of Junction Transistor Amplifiers. J. J. Suran and W. F. Chow, G-E.
The Grounded-Collector Transistor Amplifier at Carrier Frequencies. F. R. Stansel, Bell Telephone Labs.
Symmetrical Properties of Transistors and Their Application. G. C. Sziklai, RCA Labs. Div.
A Study of Transistor Circuits for Television. G. C. Sziklai, R. D. Lohman and G. B. Herzog, RCA Labs. Div.
Conductance Curve Design of Relaxation Circuits. K. A. Pullen, Aberdeen Proving Ground.
Transistor Relaxation Oscillators. S. I. Kramer, Fairchild Guided Missiles Div.

ELECTRONIC COMPUTERS

Multichannel Analog Input-Output Conversion System for Digital Computer. P. A. Adamson and M. L. MacKnight, Hughes Aircraft Co.
An Analog to Digital Converter with an Improved Linear Sweep Generator. D. W. Slaughter, Cal. Tech.
Dynamic Binary Counter with Analog Read-Out. L. Packer, Columbia U.
Life and Reliability Experience with Transistors in a High Speed Digital Computer. J. J. Scanning, Bell Telephone Labs.
Engineering Experience in the Design and Operation of a Large Scale Electrostatic Memory. J. Logue, A. Brennemann and A. Koelsch, Int'l. Business Machines Corp.
Analog Computing with Magnetic Amplifiers Using Multi-Phase A-C Voltages. J. E. Richardson, Hughes Aircraft Co.
Some Recent Developments in Logical "Or-And-Or" Pyramids for Digital Computers. C. Leonard, Pennsylvania U.
Magnetic Core Switches as Logical Elements in Computers. E. A. Sands, Magnetics Res. Co.
Magnetic Shift Register Using One Core Per Bit. R. D. Kodis, S. Ruhman and W. D. Woo, Raytheon Mfg. Co.
Simple Computer for Automatically Plotting Correlation Functions. A. H. Schooley, Naval Research Lab.
Symposium: Diagnostic Programs and Marginal Checking for Large Scale Digital Computers.

ELECTRON DEVICES

The Negative Resistance Diode. I. A. Lesk and V. P. Mathis, G-E.
Reliability of Transistors. W. R. Sittner and R. M. Ryder, Bell Telephone Labs.
Characteristics of the M-1768 Transistor. L. B. Valdes, Bell Telephone Labs.
Developmental High Frequency Alloy Transistors. C. W. Mueller and J. I. Pankove, RCA Labs.
Behavior of Germanium Junction Transistors at Elevated Temperatures and Power Transistor Design. L. D. Armstrong, RCA Labs. Div.
Gas Pressure Effects on Ionization Phenomena in High-Speed Hydrogen Thyratrons. W. C. Dean, Odessa, Texas; G. W. Penney and J. B. Woodford, Jr., Carnegie Tech.
Low Noise, Hot Cathode, Gas Tubes. E. O. Johnson, W. M. Webster and J. B. Zirker, RCA Labs. Div.
New Dispenser Type Thermionic Cathode. R. Levi.
Multi Output Beam Switching Tubes for Computers and General Purpose Use. S. Kuchinsky, Burroughs Adding Machine Co.
An Equivalence Principle in High Frequency Tubes. Robert Adler, Zenith Radio Corp.
High Power Traveling Wave Tube Amplifiers. M. Ettenberg, Sperry Gyroscope Co.

Operation of the Traveling-Wave Tube in the Dispersive Region. L. A. Roberts and S. F. Kaisal, Electronics Research Lab.
A Traveling Wave Electron Buncher. R. B. Neal, Stanford U.
Some Properties of Periodically Loaded Structures Suitable for Pulsed Traveling Wave Tube Operation. M. Chodorow and E. J. Nalos, Stanford U.
Experiments on Millimeter Wave and Light Generation. H. Motz, W. Thon and R. N. Whitehurst, Stanford U.

ENGINEERING MANAGEMENT

Report of Year's Activities by the Chairman of the Professional Group on Engineering Management. R. I. Cole, Rome Air Dev. Ctr.
General Problems of Engineering Management Facing the Electronics Industry. H. Pratt, Telecommunications Advisor to the President.
Research and Development Problems of Engineering Management in the Electronics Industry. M. J. Kelly, Bell Telephone Labs.
Production Aspects of Engineering Management in the Electronics Industry. W. A. McDonald, Hazeltine Electronics Corp.
What the Military Services Expect from Engineering Management of the Electronics Industry. Major General D. L. Putt, Air Research and Dev. Command.

INFORMATION THEORY

Recent Advances in Information Theory. L. De-Rosa, Fed. Telecommunication Labs.
Radar Problems & Information Theory. H. Davis, Watson Labs.
Analysis of Multiplexing and Signal Detection by Function Theory. N. Marchand, Marchand Electronic Labs.
Optimum Nonlinear Filters for the Extraction and Detection of Signals. L. A. Zadeh, Columbia U.
Detection of Information by Moments. J. J. Slade, Jr., S. Fich, D. A. Molony, Rutgers U.
Error Probabilities of Binary Data Transmission Systems in the Presence of Random Noise. S. Reiger, Air Force Cambridge Research Ctr.
Statistical Properties of the Output of Certain Frequency Sensitive Devices. G. R. Arthur, Sperry Gyroscope Co.
Cross-Correlation Applied to Automatic Frequency Control. M. J. Steteman, Sylvania Elec. Prods. Inc.
Approximate Probability Density Function of First Level Crossing for Linearly Increasing Signal Plus Noise. G. Preston and R. Gardner, Philco Corp.
A Design Criteria for the Optimum Demodulation of Generalized Modulated Signals. F. W. Lehan, Cal. Tech.
A Necessary and Sufficient Condition for Unique Decomposition of Coded Messages. A. A. Sardinias and G. W. Patterson, Burroughs Adding Machine Co.
A Systematic Survey of Coders and Decoders. R. Lippel, Signal Corps. Engrg. Labs.
Method for Time or Frequency Compression-Expansion of Speech. G. Fairbanks, W. L. Everett and R. P. Jaeger, Illinois U.
A New Coding System for Pulse Code Modulation. A. G. Fitzpatrick, Burroughs Adding Machine Co.
Coincidence Detectors for Binary Pulses. C. Gates, Cal. Tech.

INSTRUMENTATION

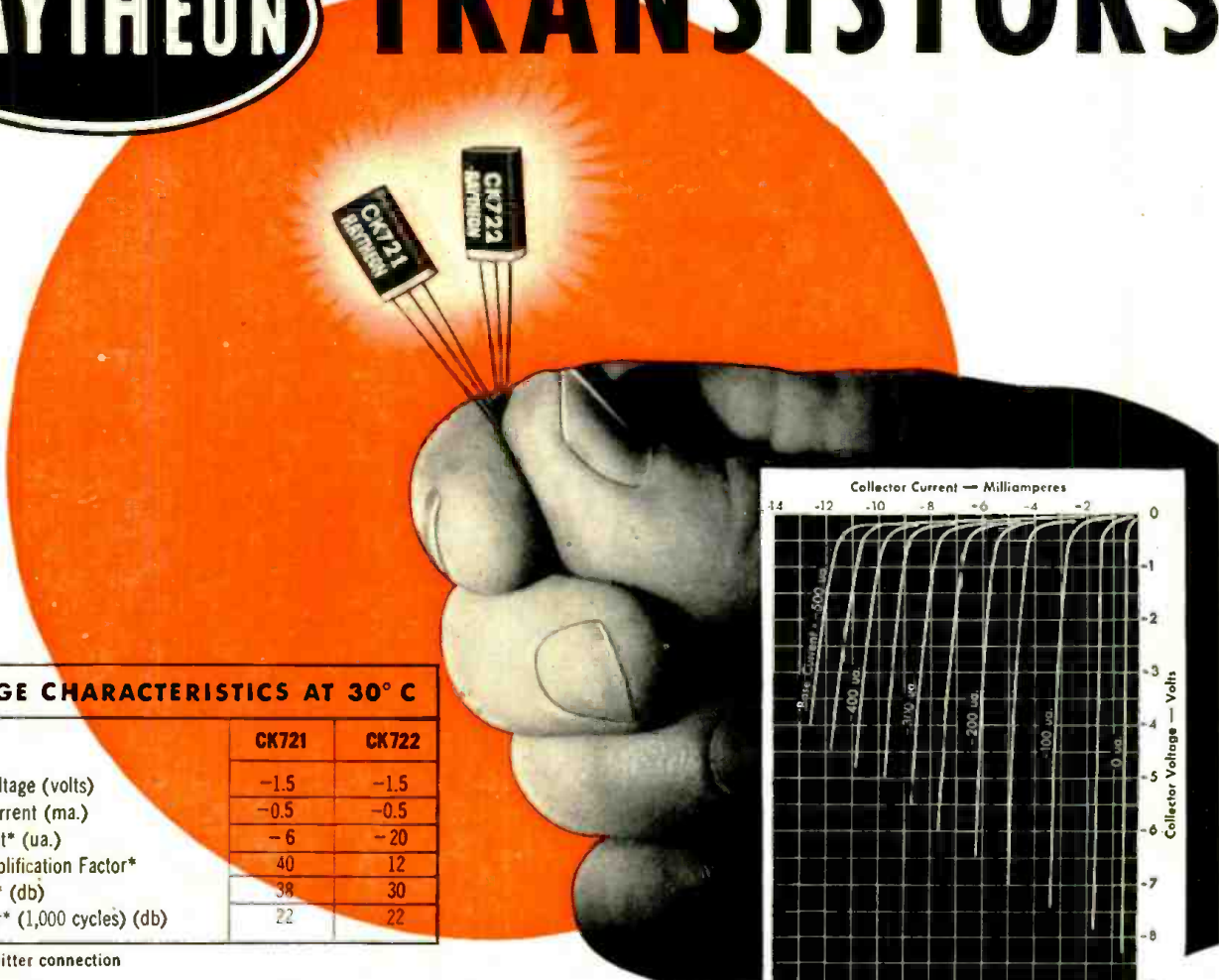
A New Method for Measuring Noise Figure and Gain of a Radar Receiver. R. J. Parent and V. C. Rideout, Wisconsin U.
Automatic Instrumentation for Continuous Monitoring of Systems Performance. M. V. Ratynski, M. Kant and H. Webb, Rome Air Dev. Ctr.
Automatic One-Shot Methods for Bandwidth Measurement. J. B. Woodford, Jr., and E. M. Williams, Carnegie Tech.
Microwave Power Meter with Automatic Zero Setting and Telemetering. L. A. Rosenthal and G. M. Badoyannis, Rutgers U.
Monitoring of Errors in Synchro Servo Systems. G. Quazza, Brooklyn Polytech.
Transistor Metrology. D. A. Alsberg, Bell Labs.
Measurement of Transistor Parameters by CRO and Other Methods. W. E. Morrow, Jr., MIT.
Transistor Static Characteristics Obtained by Pulse Techniques. D. R. Fewer, Bell Labs.
Bridges for Measuring Junction Transistor Admittance Parameters. L. J. Giacoletto, RCA.
A Transistor Alpha Sweeper. H. G. Follingstad, Bell Telephone Labs.
Rapid Tracing of Transistor Characteristics by Oscillographic Methods. V. Mathis, G-E.
The Response of a Panoramic Receiver to CW and Pulse Signals. H. W. Batten, R. A. Jorgensen, A. B. Macnee and W. W. Peterson, Michigan U.
A VHF Impedance Meter. J. H. Mennie, Boonton Radio Corp.
Simplified Measurement of Incremental Pulse Time Jitter. W. T. Pope, Griffith Air Force Base.
Wide-Band Wave Analyzer. O. Kummer, Bell Telephone Labs.
Ultra-Low Frequency, Three-Phase Oscillator. G. Smiley, General Radio Co.
(To be continued in March issue)

NOW AVAILABLE!

PNP GERMANIUM JUNCTION



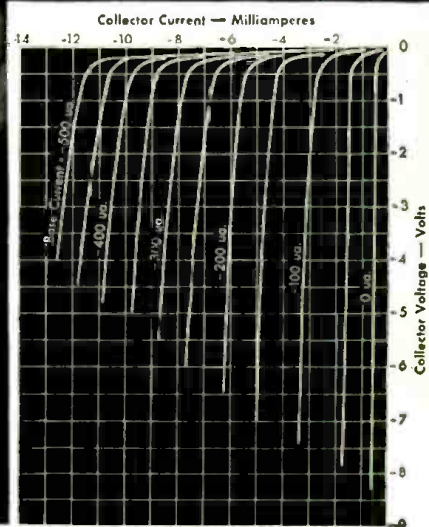
TRANSISTORS



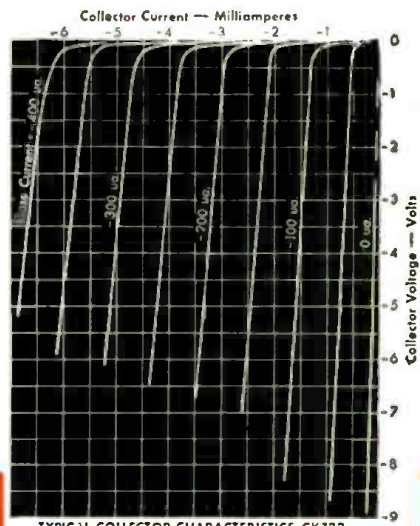
AVERAGE CHARACTERISTICS AT 30° C

	CK721	CK722
Collector Voltage (volts)	-1.5	-1.5
Collector Current (ma.)	-0.5	-0.5
Base Current* (ua.)	-6	-20
Current Amplification Factor*	40	12
Power Gain* (db)	38	30
Noise Factor* (1,000 cycles) (db)	22	22

*Grounded Emitter connection



TYPICAL COLLECTOR CHARACTERISTICS CK721



TYPICAL COLLECTOR CHARACTERISTICS CK722

For the first time in history, Germanium Junction Transistors are commercially available. Raytheon Junction Transistors, types CK721 and CK722 can now be obtained for your experimental and developmental use.

Here's another first for Raytheon! Leaders in the development and production of Electron Tubes and Germanium Products, Raytheon now leads the way in production of this important new electronic development.

For price and delivery information of Raytheon Germanium Junction Transistors, write, phone or wire your Raytheon Tube distributor.



RAYTHEON MANUFACTURING CO.
Receiving Tube Division

Excellence in Electronics

Newton, Massachusetts • Chicago, Illinois • Atlanta, Georgia • Los Angeles, California

RAYTHEON MAKES ALL THESE:

RECEIVING AND PICTURE TUBES • RELIABLE SUBMINIATURE AND MINIATURE TUBES • GERMANIUM DIODES AND TRANSISTORS • NUCLEONIC TUBES • MICROWAVE TUBES



did you know . . .

that Rauland made the first rectangular tube in 1945?
everybody knows . . . that engineering leadership means
sales leadership . . . and that means RAULAND

THE RAULAND CORPORATION, 4245 N. KNOX AVENUE, CHICAGO 41, ILLINOIS • MULBERRY 5-5000

RAULAND

did you know...



that Rauland was the first company to produce the
electrostatic low focus voltage tube?
everybody knows . . . that engineering leadership means
sales leadership . . . and that means RAULAND



THE RAULAND CORPORATION, 4245 N. KNOX AVENUE, CHICAGO 41, ILLINOIS • MULBERRY 5-5000



DID YOU KNOW

that Rauland was the first company to manufacture
aluminized tubes on a production basis?
everybody knows . . . that engineering leadership
means sales leadership . . . and that means RAULAND.

THE RAULAND CORPORATION, 4245 N. KNOX AVENUE, CHICAGO 41, ILLINOIS • MULBERRY 5-5000

Burton Browne advertising

GET DEPENDABLE PERFORMANCE IN TV TEST EQUIPMENT!



... Accurate Measurements and Increased Profits, Too!

COMBINED use of these G-E units takes guesswork out of test measurements. With good linearity and amplitude characteristics G-E equipment eliminates misleading results from distorted patterns. Your technicians will handle more work...handle it more efficiently...add to your profits and your reputation!

Oscilloscope ST-2A. Reports from thousands indicate this scope does the job they need in TV circuit work. Used in conjunction with the G-E Sweep and Marker you have an unbeatable combination. Special features include wide frequency response plus DC amplifier to adapt the equipment to other applications.

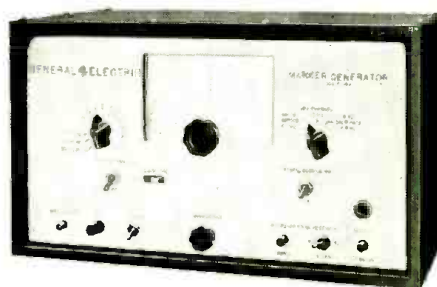
Marker Generator ST-5A. Marks all the critical frequencies on a pass band as well as having continuous coverage. Designed to give fast manipulation with crystal controlled accuracy for outstanding performance. Features separate crystal on each TV channel with simultaneous picture, audio and trap markers on both channel and intermediate frequencies.

Sweep Generator ST-4A. Outstanding in performance and varied in application. Adjustable linear sweep that is all-electronic...no moving mechanical parts. Covers all broadcast TV channels. Good attenuation and extremely low leakage plus continuously variable center frequency.

Balanced Output Adaptor ST-8A. Converts single-ended Sweep Generator output to balanced output for 300 ohm television receiver work.



Model ST-2A



Model ST-5A



Model ST-4A



GENERAL  ELECTRIC

General Electric Company, Section 923
Electronics Park, Syracuse, N. Y.
Please send me complete specifications on G-E
TV Test Equipment.

NAME.....
COMPANY.....
ADDRESS.....
CITY.....STATE.....

teamed together for Better TV Picture Quality

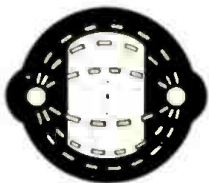
AMPHENOL
INLINE*
 ANTENNA

AMPHENOL
 TUBULAR
 TWIN-LEAD

The combination of the famous Amphenol Inline Antenna with the extremely low-loss Amphenol Tubular Twin-Lead permits any TV set to present the best picture it possibly can.

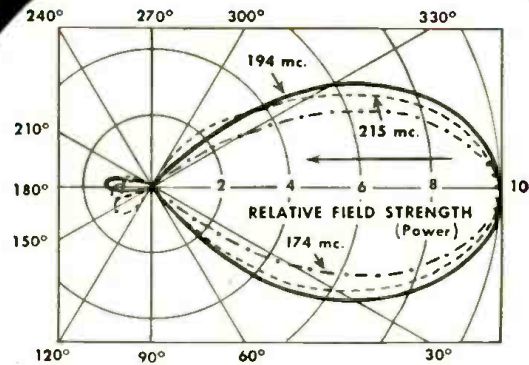
In addition to a strong forward reception lobe, the Inline has uniform gain over the entire range of VHF channels—less variation than the 3 decibel change which causes “fuzziness.” The Inline is also available in stacked array for those fringe or trouble areas which require additional signal strength.

The Amphenol Tubular Twin-Lead provides very low-loss and constant impedance. The tubular construction minimizes the effect of moisture and dirt deposits on the concentrated field of energy and ends weather interference. Because of these characteristics, Amphenol Tubular Twin-Lead has been recommended by leading TV manufacturers and authorities for any installation where UHF is, or will be available.

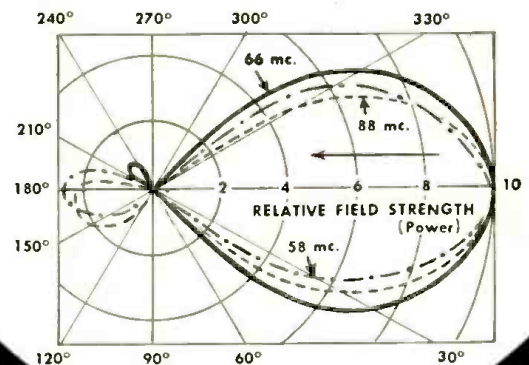


This illustration clearly shows that the concentrated field of energy between the two conductors, which are 7 strands of #28 copper weld wire, is contained by the tubular construction. This important field of energy is unaffected by any exterior conditions.

Your free copy of this book is available from your Authorized Amphenol Distributor. It contains complete factual and test data on the factors which determine Better TV Picture Quality.



consider the evidence...



The test patterns on both high and low bands reveal the Amphenol Inline Antenna's superior uni-directional reception lobe. This single forward lobe intercepts the TV signal at its maximum available strength. It also rejects unwanted reflected signals or side interference that cause “ghosts” and unsteady pictures.

No other broadbanded antenna can present as favorable a reception pattern on all the VHF channels as does the Amphenol Inline Antenna.

Let's forget the "glittering generalities" about quality.

Let's Check 4 specific ways CBS-HYTRON cuts your call-backs



1. BY MAKING CBS-HYTRON TV ORIGINALS BEST.

Longest experience with production . . . with applications . . . with improvements . . . all count. CBS-Hytron-built 1AX2, 1X2A, 6BQ6GT, 12A4, 12B4, 12BH7, 12BY7, 12BZ7, 25BQ6GT, 16RP4, etc. are more trouble-free. Prove it to yourself.



2. BY ENDLESSLY IMPROVING STANDARD TV TYPES.

Close co-operation with leading set makers alerts CBS-Hytron daily to needed betterments. Take one of endless examples: the CBS-Hytron 6CB6. You will find its clear, non-carbonized bulb eliminates undesirable loading effects at vhf.



3. BY APPLYING "RELIABLE" TUBE TECHNIQUES.

CBS-Hytron 6AL5 is typical. Experience with the military 6AL5 family (JAN 6AL5, 6097/CT, 5726) is passed on to you. You profit by a commercial CBS-Hytron 6AL5 made truly reliable.



4. BY MATCHING EACH TUBE TO THE SET.

Daily, CBS-Hytron analyzes leading TV chassis. Dynamic socket-by-socket checks, plus continuous field experience, pay off. Give you

CBS-Hytron matched-to-the-set performance . . . with the accent on trustworthy replacements.

Take advantage of CBS-Hytron extras like these. Keep your customers happy. Guarantee yourself against profit-slicing call-backs. Demand dependable CBS-Hytron tubes.



\$1.45 net

NOW...TEST THE EASY TOPSIDE WAY!

Wish you could test a chassis topside? Without first pulling and wrestling with the heavy chassis? Without disturbing wiring and parts by digging underneath for buried sockets? How much faster, easier, safer you could work! New CBS-Hytron Test Adapter does the trick. Just replace a 7-pin miniature tube with the Test Adapter. Plug tube into Test Adapter. Presto, all socket connections are topside . . . within instant reach of your test prod or clip. Just one job pays for this new CBS-Hytron Test Adapter. Get yours today!

HERE'S HOW! With the CBS-Hytron Test Adapter, you quickly measure voltage, resistance, gain. You inject and trace signals . . . monitor intermittents. You check oscillating stages. Or the effect of adding a bypass condenser or shunt resistor.

With several CBS-Hytron Test Adapters you make stage-by-stage circuit checks . . . fast. You do all this dynamic testing the e-a-s-y way . . . topside. With no ill effects at a-f frequencies. And only slight capacitance and inductance effects at much higher frequencies.

You will like: The positive contact of the low-resistance, silver-plated base pins and test points. The plainly marked pin connections. The easy insertion and tight grip. CBS-Hytron Test Adapter is another designed-by-and-for-you "must" you must have. See your CBS-Hytron jobber today.



DANVERS, MASSACHUSETTS

THE Original

WRENCH WITH THE SCREWDRIVER ACTION!



SPINTITE
REG. U. S. PAT. OFFICE

120 STYLES and SIZES

for

- ASSEMBLY WORK
- REPAIR WORK
- RADIO
- TELEVISION
- INDUSTRIAL
- AIRCRAFT



STEVENS WALDEN, Inc.
WORCESTER 4, MASS.

Within the INDUSTRY

JACK A. BERMAN, in charge of sales for *Shure Brothers, Inc.* for the past thirteen years, will head his own manufacturers' sales representative firm in Southern California.



Mr. Berman, who is resigning as *Shure Brothers'* vice-president in charge of sales and as treasurer of the Radio Parts & Electronic Equipment Shows to establish his own firm in Los Angeles, will represent *Shure Brothers* and other manufacturers' lines in the Southern California territory.

* * *

THE HAMMARLUND MANUFACTURING COMPANY has leased an additional 12,000 square feet of factory space at 541 West 34th Street in New York for use in sub-assembly manufacturing, spare parts packing and shipping, and for stocking standard condensers . . .

PYROFERIC COMPANY has acquired new space at Bronx Boulevard and 216th Street in New York in order to increase production facilities for iron cores and other powdered metal components . . .

COMMUNICATION MEASUREMENTS LABORATORY, INC. has moved into its own modern one-story plant at 350 Leland Avenue, Plainfield, New Jersey. The company had had its headquarters at 120 Greenwich Street in New York City for fourteen years . . .

HYTRON RADIO AND ELECTRONICS CO. has begun construction on a new 150,000 square feet of additional space for manufacturing and warehousing at Newburyport, Massachusetts . . . **PREMIER T.V. RADIO SUPPLY** has moved to new quarters at 3239 West North Avenue, Chicago 47, Illinois. The new location provides four times as much space as the company formerly occupied . . .

SYLVANIA ELECTRIC PRODUCTS INC. has dedicated its new radio receiving tube plant at Burlington, Iowa. The multi-million dollar, 150,000 square foot plant will be an important supplier of radio tubes to the armed forces . . .

HYTRON RADIO AND ELECTRONICS COMPANY has moved its eastern sales office to 32 Green Street in Newark, New Jersey . . . **TRIAD TRANSFORMER MANUFACTURING CO.** has opened its new plant at 4055 Redwood Avenue in Venice, California. The company recently celebrated its 6th anniversary . . .

WESTINGHOUSE ELECTRONIC TUBE DIVISION is now in production at two new tube plants in Elmira and Bath, New York. Virtually all types of tubes will be produced in the two new facilities . . . **INTERNATIONAL RESISTANCE COMPANY** of Philadelphia has purchased 66.4 acres

in Asheville, N. C. and will construct a \$200,000 plant for the purpose of expanding the company's manufacturing facilities . . . **RADIO CITY PRODUCTS CO., INC.** has moved all of its test equipment production to its Easton, Pa. plant. The engineering, sales, purchasing departments, and the general offices will remain in New York . . . **STRONGHOLD SCREW PRODUCTS, INC.** has purchased a one-story, 80,000 square foot factory building at 1801 W. Winnemac Avenue, Chicago. The company plans to take possession by April 1, 1953.

* * *

THE CINCINNATI SECTION of the Institute of Radio Engineers is sponsoring the Seventh Annual Spring Technical Conference which will be held in Cincinnati on April 18th.

R. W. Lehman, *Baldwin Piano Company*, 1801 Gilbert Avenue, Cincinnati, Ohio is in charge of exhibits and advertising in connection with the conference. Reuben Nathan, *Crosley Division, Arco Manufacturing Corporation*, 1329 Arlington Street, Cincinnati 25, Ohio is in charge of publicity.

A diversified program of papers is being planned by the committee in charge.

* * *

BERNARD L. CAHN, since 1949 general sales manager of the *Insuline Corporation of America*,



has been elected vice-president of the company. He assumed his new duties on December 1st of last year.

A graduate of New York University where he majored in business administration and management, Mr. Cahn joined *Insuline* in 1946 after four years of Army service. Entering as a private and emerging as a major, he spent twenty-seven months in the European Theater of Operations.

As assistant to the president and then as sales manager, he has traveled widely throughout the U.S. and is well known in the electronic parts business. He is a member of the Show Corporation Board, the organization responsible for the annual Parts Show.

* * *

B & L RADIO AND TV SUPPLY has recently been opened in Lubbock, Texas to wholesale electronic parts. E. W. Bland and Ogle T. Lemon are partners in this new venture . . . Announcement of the formation of the **HIGH VACUUM EQUIPMENT CORPORATION** has been made by Joseph B. Merrill, president and general manager of the firm. The general offices and factory of the com-

RADIO & TELEVISION NEWS

AMAZING NEW TRAINING PLAN

THOUSANDS OF BETTER PAY JOBS IN TELEVISION

I PREPARE YOU AT HOME WITHIN MONTHS!



Leonard C. Lane,
B.S., M.A.
President of Radio-Television
Training Association,
Exec. Dir. of Pierce School
of Radio and Television

**AT NO EXTRA COST!
YOU GET A ROUND TRIP TO
NEW YORK CITY**

FROM ANYWHERE IN THE U.S. OR CANADA—I pay your way to New York and return, PLUS 2 FREE weeks, 50 hours of advanced instruction and shop training at the **PIERCE SCHOOL OF RADIO & TELEVISION**. You use modern electronics equipment, including student-operated TV and Radio stations. You go behind the scenes of New York's big Radio-TV centers, to study first hand. And I give you all this AT NO EXTRA COST! (Applies to complete Radio-TV course only.)

Only RTTA makes this amazing offer.

EXTRA FEATURES THAT MEAN MORE MONEY FOR YOU!
Thousands of new job opportunities will be available for you right in your own state, now that the government has lifted restrictions on new TV stations. My simple, successful methods can PREPARE YOU NOW to take your place in America's booming TELEVISION and Electronics industries... help you get the success and happiness that you always wanted out of life. You learn the practical, easy way by using actual parts and equipment in the 15 big Radio-TV kits I send you, including a COMPLETE TV RECEIVER... yours to build and keep.

My Advanced Training Prepares You For Better Jobs
Then, after you finish your training for a position as a full-fledged TV Technician—where you can write your own ticket and choose from dozens of fascinating careers—I don't stop there! I continue to train you—AT NO EXTRA COST—to qualify for even better pay in the BETTER JOBS that demand FCC licenses, with my...

FREE FCC COACHING COURSE
PREPARES YOU AT HOME FOR YOUR FCC LICENSE
THE BEST JOBS IN TV AND RADIO REQUIRE AN FCC LICENSE
Given to every student at NO EXTRA COST after TV Theory and Practice is completed.

SET-UP YOUR OWN HOME LABORATORY WITH THE 15 BIG TELEVISION-RADIO KITS WE SEND YOU (At No Extra Cost)

YOU BUILD AND KEEP ALL THESE UNITS

- INCLUDING BIG SCREEN TV RECEIVER,
- plus Super-Hot Radio Receiver,
- R.F. Signal Generator, Combination
- Voltmeter-Ammeter-Ohmmeter,
- C-W Telephone Receiver, AC-DC
- Power Supply.
- Everything
- Furnished
- Including
- All Tubes, and
- Big TV Tube



NOW! Advanced FM-TV Training For Men Who Know Radio
Prepares You For Higher Pay Jobs In A Few Months
COMPLETE theory and practical training course... complete with kits including large screen TV receiver.
FCC License Coaching Course Included FREE.

VETERANS!



MY SCHOOLS FULLY APPROVED TO TRAIN VETERANS UNDER NEW G.I. BILL! If discharged after June 27, 1950—CHECK COUPON BELOW! Also approved for RESIDENT TRAINING in New York City... qualifies you for full subsistence allowance up to \$160 per month.

I GET MY GRADUATES GOOD PAYING JOBS

"As Merchant Ship Radio Officer, I receive \$867. for 40-day trip. Your training helped me get this fine position."
—Stanley Nawrocki

I now hold a fine airlines position at LaGuardia Field, New York City, thanks to your excellent training."
—Joseph Rosenberg

"Your excellent instruction helped me get my present job as an airport radio mechanic for American Airlines."
—Eugene E. Basko

"Thanks to your training, I qualified for a good job as a Receiver Tester at Federal Telephone and Radio."
—Paul Frank Seier

Many others working at NBC, RCA, CBS, Dumont, Philco, Emerson, Admiral and other leading firms.



BOTH FREE
New Illustrated Book plus Sample Lesson

NO SALESMAN WILL CALL!

Mr. Leonard C. Lane, President
RADIO-TELEVISION TRAINING ASSN.
1629 Broadway, Radio City Station
New York 19, N. Y.

Dept. T-2

Dear Mr. Lane:

Mail me your NEW FREE BOOK and SAMPLE LESSON that will show me how I can make BIG MONEY in TELEVISION. I understand I am under no obligation and no salesman will call.

Name _____ Age _____

Address _____

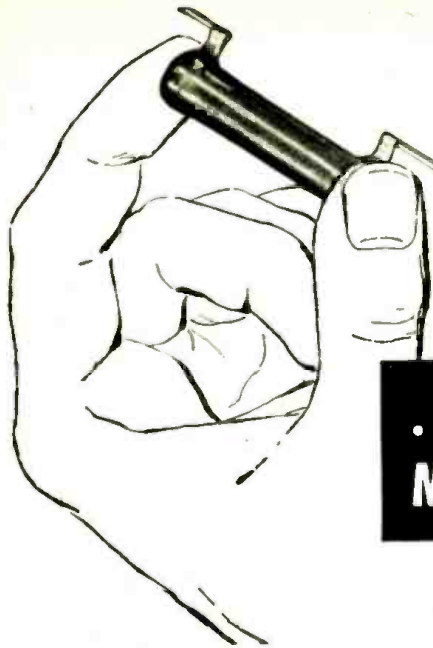
City _____ Zone _____ State _____

I am interested in: Radio-TV Advanced FM-TV
VETERANS: If qualified under new G.I. bill, check here Resident Study

RADIO-TELEVISION TRAINING ASSOCIATION

1629 Broadway, Radio City Station, New York City 19, N. Y.

Approved as a Correspondence School under the laws of the State of New York



OHMITE *resistors*

**... for that EXTRA
MARGIN OF SAFETY!**

Customers judge your service by the results they get. If a radio or TV repair job fails to stand up, they blame *you*, not the parts you used.

Don't jeopardize your business reputation with "just-as-good" replacement parts. OHMITE resistors provide an extra margin of safety. You can depend on these quality resistors—wire-wound or composition—to give years of trouble-free service.



OHMITE MANUFACTURING COMPANY

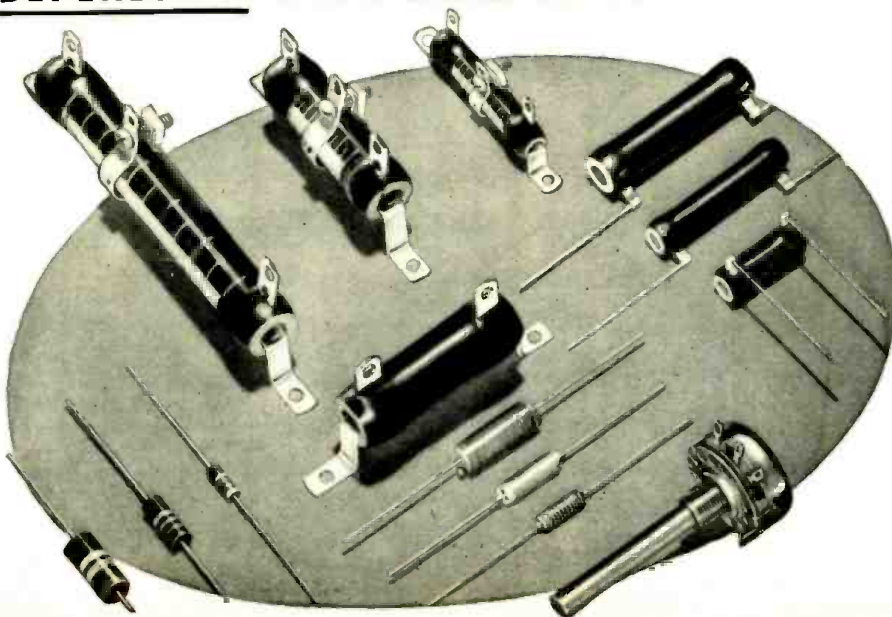
4883 Flournoy Street, Chicago 44, Illinois

Send for stock catalog

*Be Right
with...*

OHMITE®

DEPENDABLE RESISTANCE UNITS



pany are located at 349 Lincoln Street, Hingham, Mass. The company will specialize in the development, design, and manufacture of high vacuum equipment used in the fields of electronics, metallurgy, plastics, and metals . . . **ELECTRO-VOICE, INC.** of Buchanan, Michigan has purchased **RADIO MFG. ENGINEERS, INC. (RME)**, nineteen-year-old amateur communications equipment firm. The subsidiary company will remain under the present management of E. G. Shalkhauser and Russ Planck and all RME business will be conducted from the company's Peoria, plant . . . **LEWIS AND KAUFMAN, INC.** has changed its name to **LEWIS AND KAUFMAN, LTD.** The change is concurrent with the absorption of personnel and facilities of the 20,000 square foot Satiocy, California plant of **PACIFIC ELECTRONICS** . . . **LOUIS BROS.,** West Coast television antenna manufacturer, has formed a new division called **CONCERT HALL.** This division will manufacture bass reflex cabinets, speaker baffles, and television cabinets. The company is located at 3543 E. Sixteenth Street, Los Angeles 23, California . . . **CROSLEY DIVISION** has contracted to purchase the manufacturing facilities of the tube divisions of **SARKES TARZIAN, INC.** at Batavia, Illinois. The plants produce television picture tubes and miniature receiving tubes . . . **ACME ELECTRONICS, INC.** is the new name of **PEERLESS ELECTRONICS DISTRIBUTORS, INC.** The firm will continue to do business at 74 Willoughby Street in Brooklyn where it has been located for the past 5 years.

FRED J. LEMKE has been appointed operating manager at the Akron, Ohio headquarters of *Olson Radio Warehouse.*



Mr. Lemke was formerly Merchandise Division Superintendent for mail order at *Montgomery Ward and Company,* an association

which lasted for more than eighteen years.

In his new post he will be responsible for expediting the handling of all mail orders received by the Ohio parts firm.

JULIUS HABER has been appointed director of public relations for the *RCA Victor Division of Radio Corporation of America,* succeeding **JAMES M. TONEY** who has been appointed director of consumer products distribution . . . *Sangamo Electric Company* has made three new appointments in its Capacitor Division which are of interest to the industry. **WILLIAM W. TAYLOR** has been named assistant sales manager, **BRUCE E. VINKEMULDER** is the new sales promotion manager, while **A. E. McCLUSKEY** is now serving as distributor sales manager. All of these men will make their headquarters at the company's Marion, Illinois plant . . .

(Continued on page 90)

RADIO & TELEVISION NEWS



*How far ahead can you be
next year...*

IN TV AND ELECTRONICS?

◀ **Send for this free CREI booklet today . . .
and find out!**

THIS BOOKLET can mean the difference between small, w-i-d-e-l-y s-p-a-c-e-d salary increases—and rapid advancement. Between routine work—and challenging opportunity. Between constantly defending your job against better-trained men—and dynamic confidence. Between short-circuited hopes—and high-powered ambition.

An exciting new world has opened up with such super-speed that even the most optimistic electronic experts fall short in their predictions of expansion.

Think of the 1,110 TV stations now on the air and the 2,500 stations made possible by the FCC unfreeze. Think of the over 18,000,000 TV sets now in use. That's 5,000,000 more than we were supposed to have by 1954. Think of the 100,000,000 radios in current operation. (95% of the nation's homes have one or more sets.) Think of the tremendous defense orders now being placed for electronic equipment and installations.

Think of the thousands of radio-equipped fire and police departments throughout the U.S. Of the many radio-equipped railroads, of the hundreds of cities with 2-way radio service for cars and cabs. Think of the wide-ranging field of aviation communications—radio-controlled aircraft, navigation-and-traffic control, airport stations.

Think of the maritime world with its navigational aids, fathometers, ship-to-shore and ship-to-ship communications and radar. Think of electronic heating, fax and ultra-fax, of electronic medicine, and all the other applications of electronic know-how.

Countless positions must be filled—in development, research, design, production, testing and inspection, manufacture, broadcasting, telecasting and servicing. Who will get those positions? You—if you prepare today—if you are alert and have the ambition to advance your knowledge. You—if you take 2 minutes to send for a free copy of "Your Future in the New World of Electronics."

This helpful book shows you how CREI Home Study leads the way to greater earnings through the inviting opportunities described above.

However, being an accredited technical school, CREI does not promise you a "bed-of-roses." You have to translate your willingness to learn into saleable technical knowledge

—via study. Since its founding in 1927, CREI has provided thousands of professional radiomen with technical educations. During World War II, CREI trained thousands for the Armed Services. Leading firms choose CREI courses for group training in electronics at company expense, among them United Air Lines, Canadian Broadcasting Corporation, Trans Canada Airlines, Bendix Products Division, All-American Cables and Radio, Inc., RCA-Victor Division, and the Machlett Laboratories.

CREI courses are prepared by recognized experts, in a practical, easily-understood manner. You get the benefit of time-tested materials, under the personal supervision of a CREI Staff Instructor. This complete training is the reason why CREI graduates find their diplomas keys-to-success in Radio, TV and Electronics. CREI alumni hold top positions in America's leading firms.

At your service is the CREI Placement Bureau, which finds positions for students and graduates. Although CREI does not guarantee jobs, requests for personnel currently exceed supply by far.

Talk to men in the field and check up on CREI's high standing in electronics instruction. Determine for yourself right now that your earnings are going to rise with your knowledge—and that you get your rightful place in the Age of Electronics. All this CREI can promise you, provided you sincerely want to learn. Fill out the coupon and mail it today. We'll promptly send you your free copy of "Your Future in the New World of Electronics." The rest—the future—is up to you.

MAIL COUPON FOR FREE BOOKLET

CAPITOL RADIO ENGINEERING INSTITUTE

Dept. 112, 16th & Park Rd., N.W., Washington 10, D. C.

Send booklet "Your Future in the New World of Electronics" and course outline.

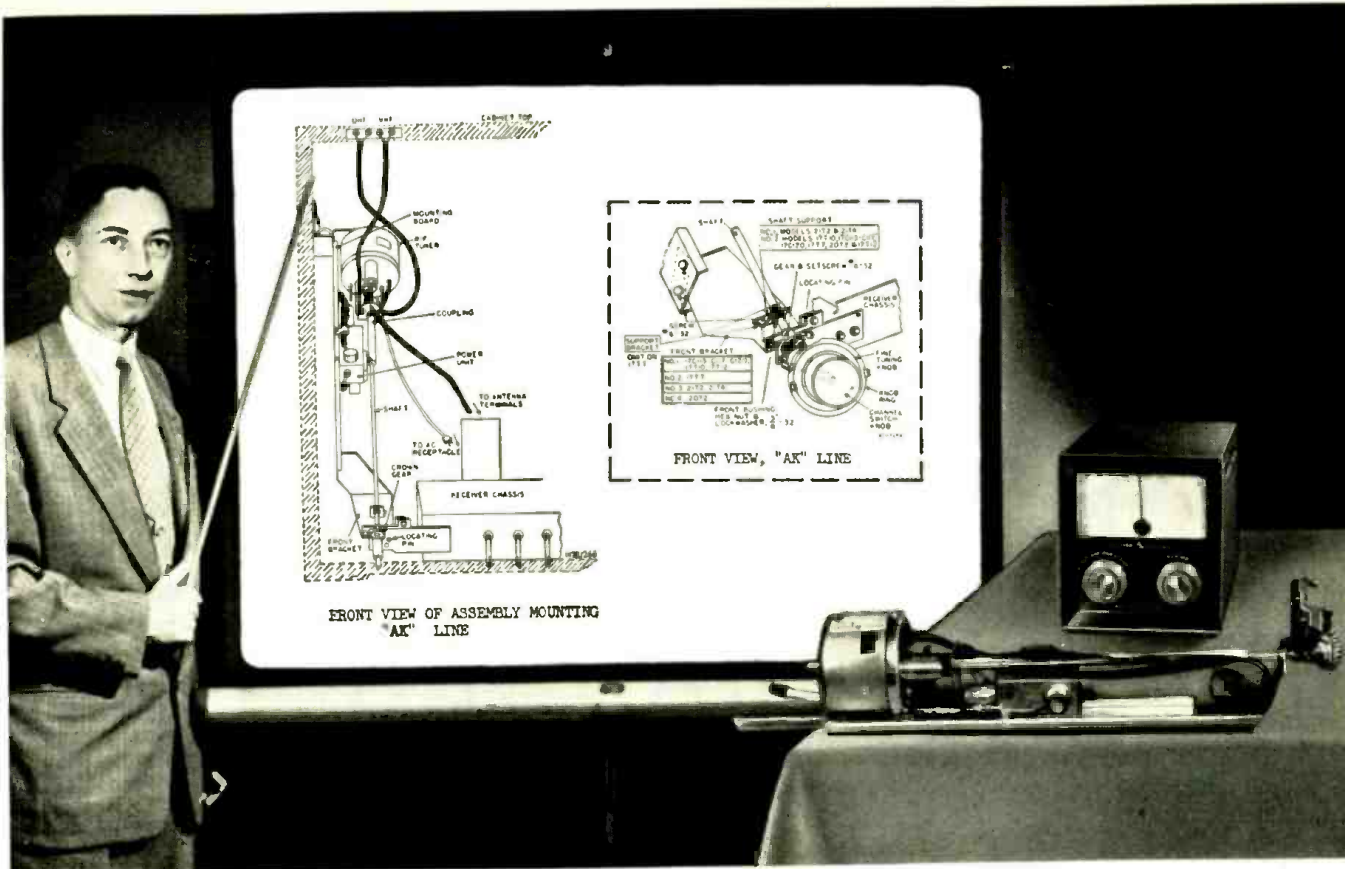
CHECK TV, FM & Advanced AM Servicing Aeronautical Radio
FIELD OF Practical Television Engineering Engineering
GREATEST Broadcast Radio Engineering (AM, FM, TV)
INTEREST Practical Radio Engineering

Name.....

Street.....

City..... Zone..... State.....

If residence school in Wash., D. C. preferred, check here



GENERAL ELECTRIC ANSWERS YOUR QUESTIONS ON *UHF* SERVICE

G-E Field Engineers are holding UHF clinics throughout the country—open to all TV servicemen—without charge.

TV servicemen in practically every area will soon face problems connected with UHF. General Electric technicians from Electronics Park are now holding UHF field clinics all over the country.

The G-E field men will explain continuous tuner converters, switch channel converters, turret head-end conversions—the various kinds of UHF antennas, where they should be used, their installation.

You will see how to install and adjust various kinds of UHF tuners—for new and older sets. With the knowledge you gain from these G-E UHF Field Clinics—you'll be prepared to handle all kinds of UHF service.

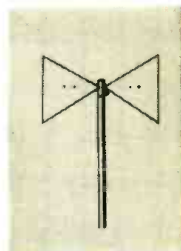
Get in touch with the TV service manager at your General Electric TV distributor's right away. Tell him to sign you up for the first clinic that hits your area.

General Electric Company, Receiver Department, Syracuse, New York

You can put your confidence in—

GENERAL  ELECTRIC

UHF Broad Band
Triangular Dipole
("Bow Tie") Antenna



UHF Broad Band
Stacked "V" Antenna



UHF Six Element
Yagi Antenna



Sylvania's New 1954 Calendar

for Service Dealers sells all through the Year!

They'll read your super-service story every month!

Filled with ideas and recipes your prospects will want to keep



Only 1½¢
PER MONTH PER PROSPECT . . .
YOUR GREATEST
ADVERTISING BUY!

Don't miss this Dramatically Different
Business Builder!

It's your personal
Christmas
greeting, too

Here's the hardest-selling, custom-made Home Calendar ever offered to Radio-TV Service Dealers! It's tailor-made just for you! Features an appealing illustration painted exclusively for Sylvania by a famous cover artist. Reproduced in full color and imprinted with your name and address.

Your prospects simply can't overlook this calendar. It's filled with timely hints and valuable household suggestions they'll want to keep handy. And, every time they turn the page they'll be reminded of your dependable service, skill, and experience.

Order now . . . supply limited! At only 1½¢ per customer per month (in lots of one hundred or more), this calendar

is truly the smartest advertising buy ever offered. But don't delay, the supply is limited! Order a couple of hundred from your regular Sylvania distributor . . . TODAY! If he is out of stock, write to: Sylvania Electric Products Inc., Dept. 3R-2102 1740 Broadway, N. Y. 19, N. Y.

SYLVANIA



FAR BETTER RECEPTION

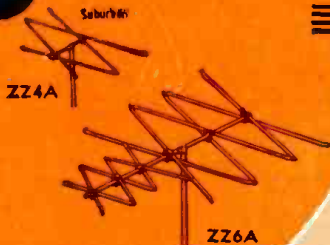
IN EVERY LOCATION

with Sensational New

TRIO ZIG-ZAG

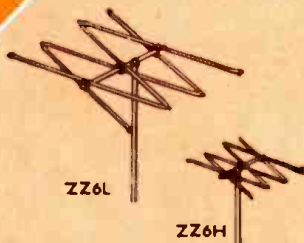
Patent Pending

TV ANTENNAS



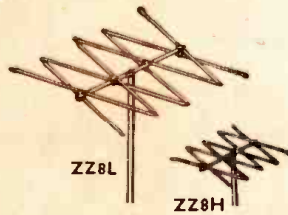
SUBURBAN MODELS

Models ZZ4A and ZZ6A give you all-channel (2 thru 13) reception in ONE SINGLE BAY ANTENNA. The Model ZZ4A has excellent gain and is designed for suburban areas. Model ZZ6A has even greater gain and provides excellent all-channel reception in near fringe areas.



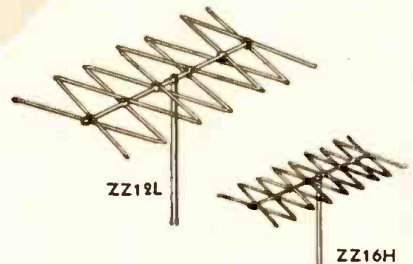
NEAR FRINGE MODELS

For near fringe area reception, the Models ZZ6L and ZZ6H are recommended. Model ZZ6L covers Channels 2 thru 6, Model ZZ6H is for Channels 7 thru 13. Both antennas offer high gain with patterns and front-to-back ratios similar to cut-to-channel yagis.



FRINGE MODELS

Models ZZ8L and ZZ8H were designed for normal fringe area reception and provide clear, snow-free pictures. Forward lobe patterns and front-to-back ratios are similar to a good single channel, multi-element yagi.

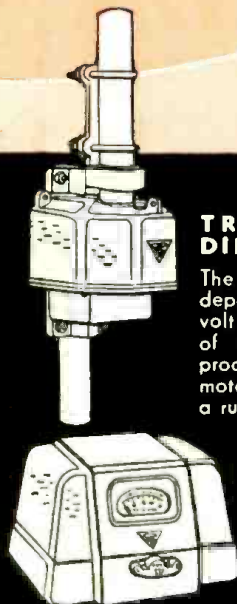


ULTRA FRINGE MODELS

The extremely high gains of the ZZ12L and the ZZ16H models provide unequalled reception in ultra-fringe areas. Model ZZ12L covers Channels 2 thru 6 and Model ZZ16H, Channels 7 thru 13. These two models when stacked, are fed with only one 300 ohm line and provide ALL VHF CHANNEL RECEPTION. Line match is excellent and front-to-back ratios are unusually high.

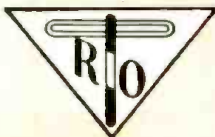
ZZ12L and ZZ16H are stacked for all VHF Channel Reception

* To provide even greater strength, TRIO Antennas now have stamped steel element clamps.



TRIO ROTATOR AND DIRECTION INDICATOR

The TRIO Rotator is America's most dependable — has two powerful 24 volt motors — one for each direction of rotation. Absolutely weather-proof, permanently lubricated. All motors, shafts and gears mounted on a rugged, one-piece casting for true alignment, strength and longer life. Every TRIO Rotator fully guaranteed for two years! Beautiful Direction Indicator has "finger tip" control — no need to hold knob for rotation. A touch of the finger starts it — a touch stops it!



TRIO

TRIO MANUFACTURING COMPANY

GRIGGSVILLE, ILLINOIS

RADIO & TELEVISION NEWS

**BUY DIRECT
AND SAVE**

Sweeping the Country!

'PRE-FAB' COLLINS TUNERS and RECEIVERS AUDIO PRODUCTS CO.

Collins Audio Products Co. is in no way affiliated with Collins Radio Co.

Two ALL NEW Complete Kits for Every High-Fidelity Need



FM Tuner Kit

\$55

The FM 11 tuner is available in kit form with the IF Amplifier mounted in the chassis, wired and tested by us. You mount the completed RF Tuning Unit and power supply, then after some simple wiring, it's all set to operate. 11 tubes: 6J6 RF amp, 6AG5 converter, 6C4 oscillator, 6BA6 1st IF, (2) 6AU6 2nd and 3rd IF, (2) 6AU6 limiters, 6AL5 discriminator, 6AL7-GT double tuning eye, 5Y3-GT rectifier. Sensitivity 6 to 10 microvolts, less than 1/2 of 1% distortion, 20 to 20,000 cycle response with 20dB variation. Chassis dimensions: 12 1/2" wide, 8" deep, 7" high. Illustrated manual supplied. Shipping weight 14 lbs.

Each Collins Tuner Kit is complete with punched chassis, tubes, power transformer, power supply components, hardware, dial assembly, tuning eye, knobs, wire, etc., as well as the completed sub-assemblies: FM tuning units, AM tuning units, IF amplifiers, etc., where applicable. Since all these sub-assemblies are wired, tested and aligned at the factory, Collins Pre-Fab Kits are easily assembled even without technical knowledge. The end result is a fine, high quality, high fidelity instrument at often less than half the cost—because you helped make it and bought it direct from the factory. Bring your present reproducing system up to date with a new Collins Tuner.

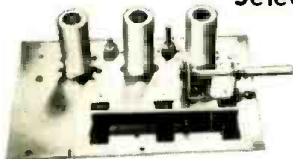


FM/AM Tuner Kit

\$7750

The original 15 tube deluxe FM/AM pre-fab kit redesigned on a smaller chassis. The tuner now measures 14" wide by 12" deep by 7 1/2" high. This attractive new front and dial assembly opens up new applications where space is at a premium. Kit includes everything necessary to put it into operation—punched chassis, tubes, wired and aligned components, power supply, hardware, etc. Kit comprises FMF-3 tuning unit, IF-6 amplifier, AM-4 AM tuning unit, magic eye assembly and complete instructions. All tubes included. Shipping weight 19 lbs.

Selected Basic Components For Special Applications



FMF-3 Tuning Unit

\$1525

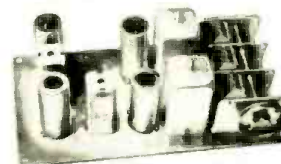
The best for FM. The most sensitive and most selective type of "front end" on the market. 6 to 10 microvolts sensitivity. Image ratio 500 to 1. 6J6 tuned RF stage, 6AG5 converter, 6C4 oscillator. Permeability tuned, stable and drift-free. Chassis plate measures 6 1/2" x 4 1/2". In combination with the IF-6 amplifier, the highest order of sensitivity on FM can be obtained. Tubes included as well as schematic and instructions. Draws 30 ma. Shipping weight FMF-3: 2 1/2 lbs. Dial available @ \$3.85



IF-6 Amplifier

\$1975

A remarkable value! 6 tubes are used in the IF amplifier: 6BA6 1st IF, (2) 6AU6 2nd and 3rd IF's, (2) 6AU6 limiters and 6AL5 discriminator. High gain, wide-band response (200 KC) for highest fidelity. 20 to 20,000 cycles. Distortion less than 1/2 of 1%. Draws 40 ma @ 220 volts. Chassis plate dimensions: 11-5/16" x 2 1/2" Shipping weight: 3 lbs.



AM-4 Tuning Unit

\$2450

Taps in AM superhet performance! A 3-gang tuning condenser gives 3 tuned stages with high sensitivity and selectivity. Assembly is completely wired, tested and aligned ready for immediate use. Frequency coverage 540 KC to 1650 KC at a sensitivity of 5 microvolts. Tubes 6BA6 RF amplifier; 6BE6 converter; 6BA6 IF amplifier and 6AT6 detector. Draws 30 ma @ 220 volts. Mounts on a chassis plate measuring 4" x 7 3/8". Shipping weight 2 1/2 lbs. Dial available at \$3.85.



RD-1C Tuner & Dial

\$2850

The COLLINS RD-1C FM tuner chassis is unique in the field. A whole, compact FM tuner and dial that fits in the palm of your hand. Convert AM sets to FM/AM receivers for only a few dollars! Unlimited applications where space is at a premium. Use in conjunction with your phonograph amplifier. Full frequency response to 20,000 cycles. Sensitivity 20 microvolts, permeability tuned. Tuning unit and IF amplifier on the same chassis plate. Draws 40 ma @ 100 volts. Tubes: 6AG5 converter, 6C4 oscillator, (2) 6AU6 IF amplifiers, 6AL5 in new ratio detector circuit. Shipping weight tuner and dial 5 lbs.

**MAIL
COUPON
TODAY**

To: Collins Audio Products Co. Inc.
P.O. Box 368, Westfield, N. J.
Tel. WEstfield 2-4390

- FM Tuner Kit FM/AM Tuner Kit Slide Rule Dial Assembly
- FMF-3 Tuning Unit IF-6 Amplifier RD-1C Tuner and Dial
- AM-4 Tuning Unit

NAME.....

ADDRESS.....

CITY..... STATE.....

Amount for Kit \$..... See weights, add shipping cost \$.....

Total amount enclosed \$..... Check Money Order

WHEN YOU THINK OF TUNERS, THINK OF COLLINS AUDIO PRODUCTS



New "500" telephone. It has already been introduced on a limited scale and will be put in use as opportunity permits, in places where it can serve best. Note new dial and 25 per cent lighter handset.

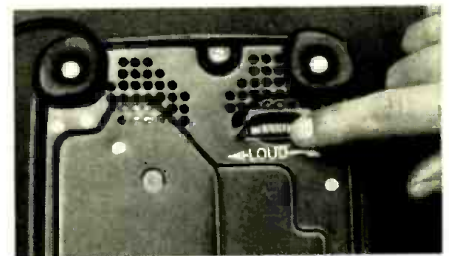
It adds miles to your voice

For years the telephone you know and use has done its job well—and still does. But as America grows, more people are settling in suburban areas. Telephone lines must be longer; more voice energy is needed to span the extra miles.

Engineers at Bell Telephone Laboratories have developed a new telephone which can deliver a voice ten times more powerfully than before. Outlying points may

now be served without the installation of extra-heavy wires or special batteries on subscribers' premises. For shorter distances, the job can be done with thinner wires than before. Thus thousands of tons of copper and other strategic materials are being conserved.

The new telephone shows once again how Bell Telephone Laboratories keeps making telephony better while the cost stays low.



Adjustable volume control on bottom of new telephone permits subscriber to set it to ring as loudly or softly as he pleases. Ring is pleasant and harmonious, yet stands out clearer.

QUICK FACTS ON NEW TELEPHONE

Transmitter is much more powerful, due largely to increased sound pressure at the diaphragm and more efficient use of the carbon granules that turn sound waves into electrical impulses.

Light ring armature diaphragm receiver produces three times as much acoustic energy for the same input power. It transmits more of the high frequencies.

Improved dial mechanism can send pulses over greater distances to operate switches in dial exchange.

Built-in varistors equalize current, so voices don't get too loud close to telephone offices.

Despite increased sensitivity of receiver, "clicks" are subdued by copper oxide varistor which chops off peaks of current surges.

BELL TELEPHONE LABORATORIES

Improving telephone service for America provides careers for creative men in scientific and technical fields.



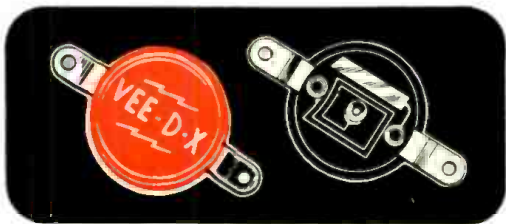
ENGINEERED FOR BRILLIANT PERFORMANCE



REVOLUTIONARY
VEE-D-X
Q-TEE

BY ANY STANDARD OF COMPARISON

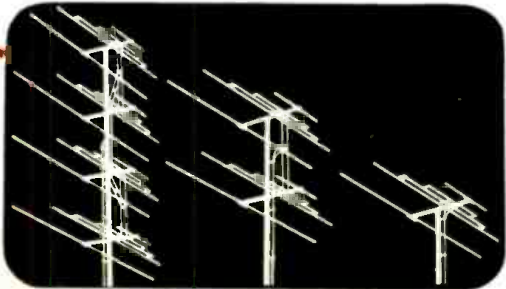
The Finest All-Channel Antenna



Secret of the Q-Tee all-channel operation is the patented printed circuit electronic channel separator in this colorful red plastic housing. Lic. A.A. K. Pats. 2,422,458; 2,282,292; 2,611,086, others pending.

Easy stacking makes the Q-Tee a pleasure to install especially when in combination with new UHF antennas. Three series: Q-Tee single bay for primary areas; Q-Tee double (two-bay) for near-fringe areas; Q-Tee quad (four-bay) for fringe areas.

There is only one Q-Tee! It's powerful — it's revolutionary — it's patented — it's made only by Vee-D-X. Embodying an entirely new engineering approach to all-channel reception, the Q-Tee has met with sensational success. Its brilliant performance, ease of installation, ease of stacking and clean-cut appearance have won for it the reputation of "Antenna of the Year". Ideal for all multi-channel areas (primary, near-fringe and fringe), the Q-Tee provides the high front-to-back ratio found in no other broadband antenna. In areas of co-channel interference this often means the difference between a good picture and none at all. The Q-Tee is an excellent basic VHF antenna for use in combination with UHF antennas.



THE LaPOINTE-PLASCOMOLD CORPORATION
 ROCKVILLE, CONNECTICUT N-2

Send full information on Q-Tee

NAME

STREET

CITY ZONE STATE



IMPS are TOPS!

IMPS ARE REALLY RUGGED!

The tough thermo-setting plastic will take an astounding amount of abuse —yet IMPS will still look and perform like new!



IMPS WON'T FREEZE OR MELT!

They'll operate faithfully in temperatures ranging from -40°C . to $+100^{\circ}\text{C}$. (212°F .)—and that's the boiling point of water!



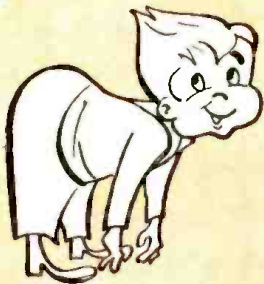
IMPS ARE MOISTURE-PROOF!

No moisture can get through the varnished plastic case, or even through the lead anchor points.



IMP LEADS CAN BEND AND BEND!

Tinned leads that are really securely anchored—you'll be amazed at how much punishment they'll take without breaking!



All over the country service-engineers are praising the newest and finest molded tubular paper capacitor—the Pyramid IMP!

IMPS are available in all popular ratings in 200, 400 and 600 volt ranges. See your local distributor.

For free, attractive catalog on IMPS, write Dept. R1

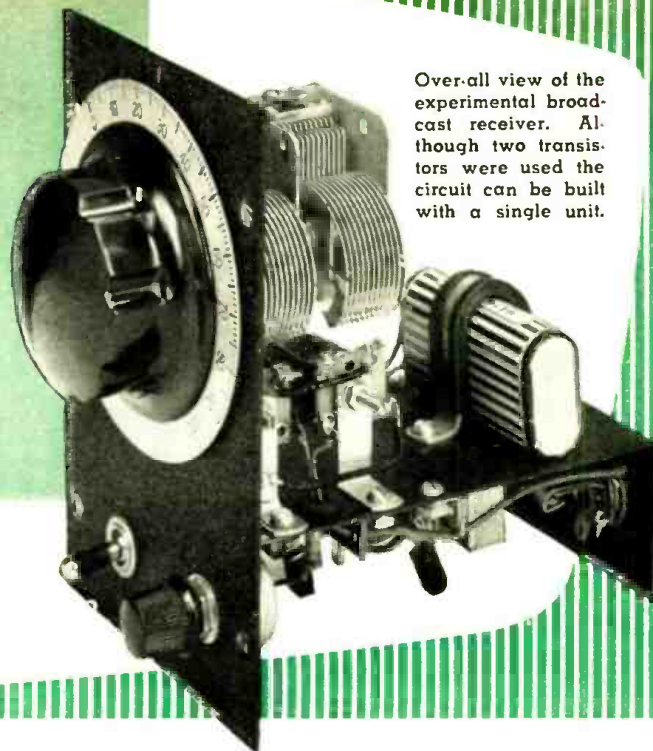
PYRAMID ELECTRIC COMPANY

1445 HUDSON BOULEVARD • NORTH BERGEN, NEW JERSEY

BUILD THIS TRANSISTOR RECEIVER

By
ROBERT K. DIXON

Receiving Tube Division
Raytheon Manufacturing Company



Over-all view of the experimental broadcast receiver. Although two transistors were used the circuit can be built with a single unit.

Transistors are now within the reach of all. Here is a simple receiver you can build—other types of equipment using transistors will be covered in subsequent issues.

ABOUT four years ago, the transistor was first announced. Since that time, a considerable amount of effort has gone into the design and production of transistors and much has been written about them.

Transistors are semiconductor devices capable of acting as amplifiers, oscillators, and performing other functions now performed by vacuum tubes and with greater efficiency. The basic material in most transistors today is germanium and the devices are made in two different types: the point contact, which was the original, and the junction.

A semiconductor is any material which is neither a good conductor nor a good insulator, thus its name. Germanium has a simple atomic structure with the inter-atomic spacings in the crystals forming relatively straight corridors or paths. The basic lattice of the crystal has eight atoms per cell, four of which form the corners of a small cube while the other four are wholly within the cube. There are relatively large spaces between the atoms. In this pure form germanium is basically a stable material and does not exhibit a surplus or deficiency of electrons.

By the introduction of certain selected elements, the germanium can be made to exhibit an excess of electrons and thus become a negative or "n" type material, or by the introduction of other impurities or chemical elements there may be a deficiency of electrons and the material will be considered a positive or "p" type material.

If electrical pressure is applied to a piece of "n" type germanium material, current flow will exist by virtue of the free electrons existing therein. Similarly, if electrical force is applied to the positive type material, conduction appears by virtue of the phenomenon

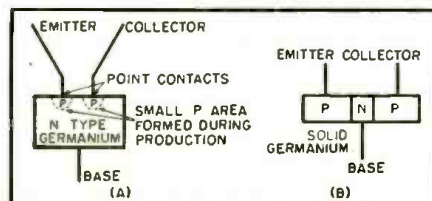
called hole conduction. The application of electrical potential causes electrons to move from the negative and toward the positive end, the presence of holes facilitating the electron flow.

The point-contact transistor consists

EDITOR'S NOTE: Obviously no attempt has been made to "miniaturize" this unit. It is more important to familiarize oneself with the design and limitations of transistors. Miniaturization is then not too difficult a task. These transistors are new items; however, they are available at a suggested retail price of \$7.60.

of a block or crystal of material such as germanium with two properly spaced pointed electrodes making contact with the surface of the germanium. In many respects, it resembles the well-known crystal diode with the exception of the additional electrode. During manufacturing, the position of the two point contact electrodes (including the relative spacing of these elements) is adjusted for proper operation of the transistor as an amplifying device.

Fig. 1. Internal construction of the (A) point contact and (B) junction transistor.



The basic block of germanium is normally "n" type in the point-contact device. Small areas of the germanium adjacent to the pointed electrodes are converted to "p" type material during production. (See Fig. 1A.)

Junction transistors consist of a block of material in which "n" and "p" type materials are arranged in alternate layers. The end sections can be either "n" or "p" material with the center zone being the opposite type. (See Fig. 1B.)

The point-contact transistor finds wide application in switching circuits and oscillator circuits at frequencies normally not possible with the junction type units. The point-contact transistor has inherently higher noise output than the junction units.

The junction transistor, on the other hand, is a more efficient amplifier while operating at low voltages. They are extremely rugged and have exceptionally long life. The normal noise voltage generated in a junction type is lower than that of the point-contact type transistor. Since the electrons travel somewhat slower through the germanium material in transistors than in a vacuum and due to the high internal capacities of junction transistors as we know them today, operation is normally limited to the lower frequencies.

This article deals with a "p-n-p" junction transistor recently announced by the Raytheon Manufacturing Com-

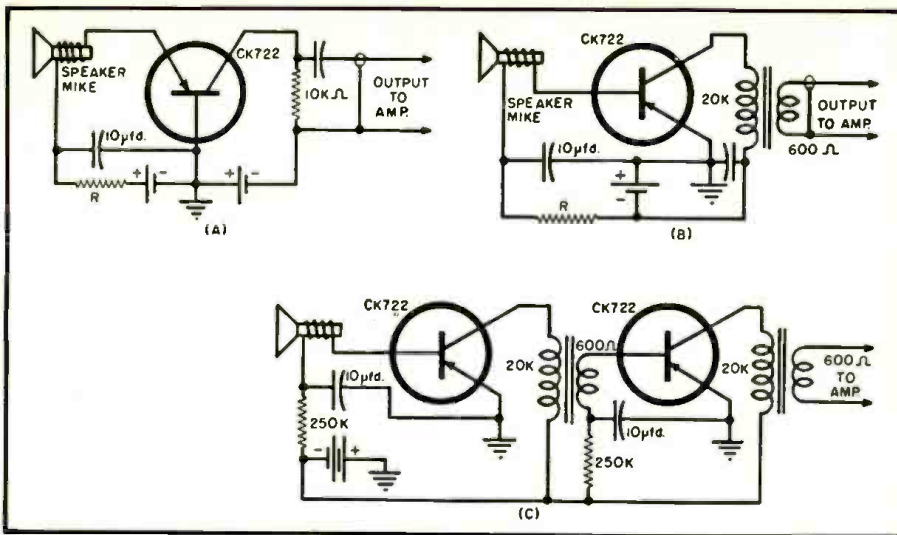


Fig. 2. Microphone preamplifiers using transistors. (A) grounded base, (B) grounded emitter, and (C) a two-stage, transformer-coupled amplifier. See text for details.

MECHANICAL DATA

CASE: Plastic and Glass
 BASE: None (0.016" tinned flexible leads. Length: 1.5" min. Spacing: 0.08" center-to-center)

TERMINAL CONNECTIONS: (Red dot is adjacent to lead 1)
 Lead 1 Collector
 Lead 2 Base
 Lead 3 Emitter

WEIGHT: 0.025 ounce
MOUNTING POSITION: Any

ELECTRICAL DATA

RATINGS—ABSOLUTE MAXIMUM VALUES:

Collector Voltage	-20 volts
Collector Current	-5 ma.
Collector Dissipation (at 30°C)	30 mw.
Emitter Current	5 ma.
Ambient Temperature	50 °C

AVERAGE GAIN CHARACTERISTICS—GROUNDED EMITTER: (at 30°C)

Collector Voltage	-1.5 volts
Collector Current	-0.5 ma.
Base Current	-20 μa.
Current Amplification Factor	12
Power Gain*	30 db
Noise Factor † (1000 cycles)	22 db

* Source: 1000 ohms; Load: 20,000 ohms
 † At -1.5 volts (-1.0 ma.) to the collector.
 ** Socket types: Cinch Nos. 14148 & 14273 or equivalent.

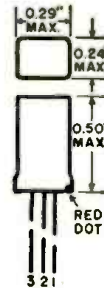


Table 1. Tentative data on the Raytheon CK722 germanium junction transistor.

pany, identified as the CK722. The characteristics and ratings of the CK722 are shown in Table 1. It is extremely rugged and when operated at normal ratings has exceptionally long life.

Basically, the "p-n-p" junction transistor may be compared to the vacuum tube with the emitter resembling the cathode, the base resembling the grid, and the collector resembling the plate. There are several basic differences, however, which are outstanding.

In the "p-n-p" junction transistor,

conduction is accomplished in a solid instead of in a vacuum. The collector is operated with a negative bias instead of the customary positive voltage applied to the plate. Another outstanding difference lies in the input impedance. The vacuum tube has almost infinite input impedance over a considerable range of frequencies. The transistor, on the other hand, is a current-operated device and has a rather low input impedance in the grounded base or grounded emitter connection which is analogous to the

grounded grid and grounded cathode type amplifiers.

The graphic symbol for the "p-n-p" junction transistor is shown in Fig. 3. Since the transistor is a three-terminal device, several combinations of connections may be used, namely, the grounded emitter, the grounded base, and the grounded collector.

Fig. 5 is a typical set of characteristic collector curves for the CK722. These curves may be compared to the plate characteristics of a pentode amplifier except that instead of grid voltage we use various values of base current. A load line of 1000 ohms has been drawn in and examination of the curve will show that operation is linear over almost the full range from zero to maximum collector current. The slow increase in collector current with increasing collector voltage at any fixed value of base current is typical of junction transistors and is indicative of the high collector resistance.

An additional characteristic which is little known but of considerable importance is the "Zener" effect. If the transistor is operated with positive base current so that normally there is no collector current, the collector voltage can be increased to a point where conduction will occur. This is the "Zener" point and may be an important consideration in operation of transistors. "Zener" current flowing during the peak a.c. voltage cycle could cause excessive limiting and consequent high distortion in an amplifier.

Many applications for the CK722 junction transistor will become apparent to the experimenter. Since junction transistors had up to now been available on only a limited basis, very little application and circuit work has been done.

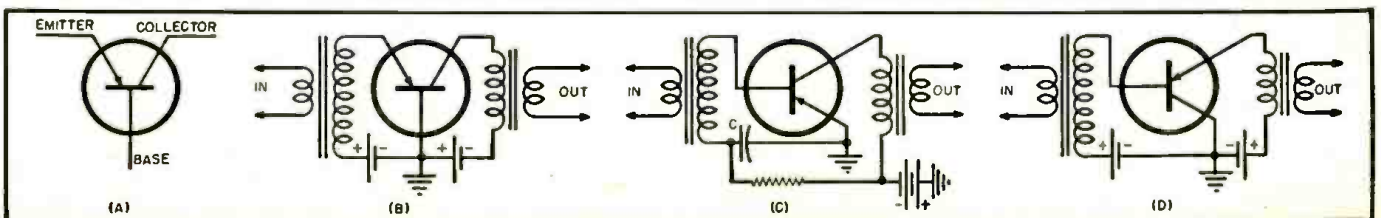
Three basic type circuits immediately suggest themselves. These are: switching circuits, oscillator circuits, and amplifier circuits.

We shall discuss in some detail, the CK722 as a small-signal, low-voltage amplifier.

The small size and relatively high efficiency at low operating voltage coupled with the absence of any heater voltage make the transistor ideally suited for preamplifier use. A further advantage is the fact that transistors are not microphonic, thus no special precautions in mounting need be taken.

Fig. 2 includes several suggested circuits for transistors used as microphone preamplifiers. The microphone

Fig. 3. Equivalent graphic circuits. (A) Graphic symbol of CK722 "p-n-p" junction transistor. (B) Common base amplifier, with low input impedance and high output impedance. Requires two batteries. (C) Common emitter circuit having medium input impedance and high output impedance. Permits single battery operation. (D) Common collector with high input impedance and low output impedance.



may be a small 2 or 3 inch dynamic speaker. Notice that it is directly connected to the transistor without use of an impedance matching transformer. With a voice coil impedance of 6 ohms and with R adjusted for a collector current of 100 microamperes, the sensitivity will be approximately equal to a good carbon mike with much better fidelity and less noise. The circuit of Fig. 2B may be used to eliminate the need of a tapped battery, however, the gain will be slightly less. If a long shielded cable is required, a transformer should be used instead of a resistor load in the collector of the transistor as in Fig. 2B. This can be a small plate-to-line transformer of 20,000/600 ohms impedance.

Because the operating current is low, battery life is good. The supply for the transistor can be obtained from the standard high voltage plate supply of the amplifier and, in fact, this circuit has the advantage of supplying a more constant current to the transistor. The important factors in these circuits are the low input impedance of the emitter, on the order of 100 ohms with the grounded base connection, and the high output impedance of the collector, on the order of 500,000 ohms. With grounded emitter connection, the input impedance of the base is a function of other operating parameters so no value can be given for it.

Several stages of transistor amplifiers can be cascaded and the use of coupling transformers will assure maximum gain. Plate-to-line transformers may be used as shown in Fig. 2C. Resistance coupling can be used but with some loss in gain (approximately 6 db). Large coupling condensers must be used to obtain good low frequency response because of the low impedance levels.

Push-pull operation of transistors is entirely feasible, permitting greater power dissipation with consequent greater power output. Class A operating efficiencies on the order of 50 percent are obtainable while class B operating efficiencies to nearly 80 percent are possible. Matched units should be used in this application and degeneration can be applied to improve performance.

The audio amplifier type operation lends itself admirably to a simple broadcast receiver. To investigate this application more thoroughly, such a receiver has been built. For those interested in duplicating it, a description follows:

Transistor Receiver

One or two transistors may be used in this receiver (Fig. 4). The first unit is utilized as a detector/amplifier. The second transistor is connected as a grounded emitter amplifier.

The first unit is capable of delivering adequate earphone volume so that the second stage can be eliminated if it is desired to reduce the cost of the receiver. Although the experimental receiver shown has been built on

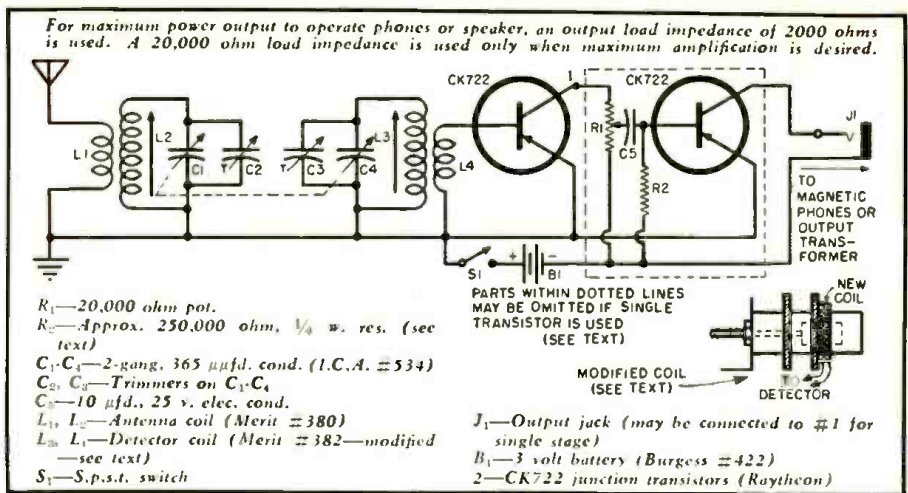


Fig. 4. Diagram of transistor receiver. A single unit may be used if desired. See text.

metal, obviously it could be built using a wooden case without affecting its performance.

In the Boston area where this receiver has been operated, the two tuned circuits have given more than adequate selectivity to separate the local stations. An antenna of 50 feet and a good ground made possible reception of stations over approximately a 15 mile radius. The importance of a good antenna and ground, particularly in an area somewhat remote from high power broadcast stations, cannot be overemphasized.

The two circuits are coupled through mutual coupling existing by physically placing the coils close together, one inch separation center-to-center is recommended. The detector coil must be modified to connect to the transistor detector/amplifier. The antenna coil portion of the Merit type 382 should be carefully removed. It can be slid off the end of the form without damage to the coils after unsoldering the leads. The wire from this antenna coil may be used to scramble wind 50

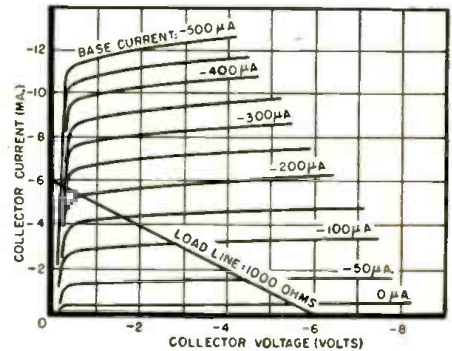
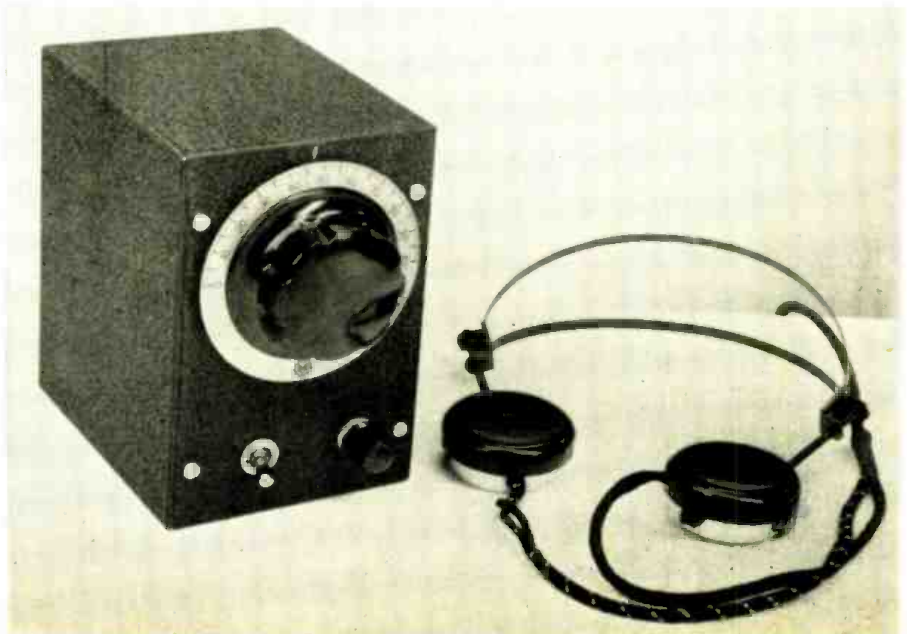


Fig. 5. $I_c/E_b/I_b$ curves for the CK722.

turns on the 382 form, tight against the first pi of the tuning coil. (See Fig. 4). This detector coil can be cemented in place with a good coil dope, such as Amphenol 912.

The amplifier is connected in the grounded emitter type circuit. The advantages of this circuit are that only one battery is required and that it has a higher input impedance than the
 (Continued on page 132)

Over-all view of the experimental transistor receiver showing accessory headphones.



OIL-COOLED LOAD WATTMETER

By

ROBERT M. SEE, W9OCL/5

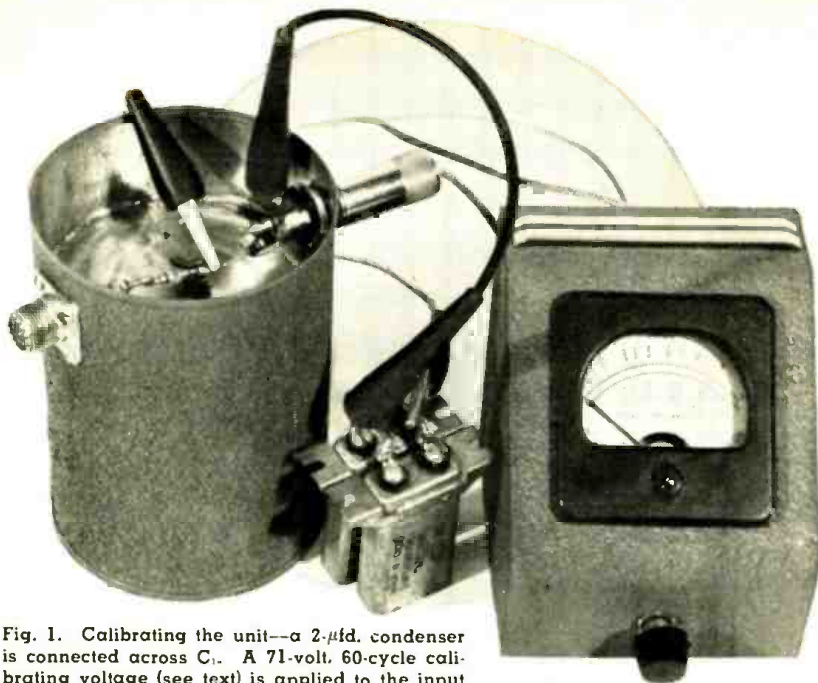


Fig. 1. Calibrating the unit—a 2- μ fd. condenser is connected across C₁. A 71-volt, 60-cycle calibrating voltage (see text) is applied to the input and R₃ set for full-scale deflection of the meter.

Your rig's r.f. output, not the rated d.c. input, is the important factor. Old Timer and Novice can make good use of this simple direct-reading output meter.

IN ALMOST any ham shack, Novice or otherwise, there comes a time when the operator wishes for a simple means of checking the output of his rig to determine whether it is op-

erating as efficiently as it should. The wattmeter described here is the result of such a desire at W9OCL. It will be particularly useful to the Novice in helping him to get acquainted with the factors involved in amplifier efficiency.

Aside from simplicity of calibration, two other requirements were considered to be desirable. These were a 100-watt dissipation rating and a comparatively flat load up to 30 mc.

Although the metering circuit is good up to approximately 40 mc., the voltage standing wave ratio of the load has been measured up to 400 mc. and found to be less than 1.5. If a wattmeter is needed for higher frequencies it would be simple to substitute another metering circuit for the one shown in the circuit diagram. The metering circuit here was chosen because of the fewer parts required and its ability to read power at 60 cycles as well as at 30 mc.

The 100-watt dissipation requirement was satisfied by using twelve 150-ohm, 2-watt Allen Bradley resist-

ors in series-parallel, cooled by being immersed in ordinary #10W motor oil.

Mechanical Construction

A general idea of the construction of the wattmeter can be seen by studying the photographs. The "chassis" is simply a one-quart motor oil can. Save the oil so it may be used later. When opening the can of oil use an opener which will cut smoothly so that the lid will fit comfortably inside the can. Later this lid will be soldered into place to form a completely sealed oil-cooled load, so clean the can well.

The twelve 150-ohm resistors are mounted between three thin brass plates in a sandwich-like manner, six in each "deck." Each deck will then have a resistance of 25 ohms, and the two decks in series a resistance of 50 ohms. The three 2 $\frac{1}{2}$ x 1 $\frac{1}{8}$ inch plates are used for mechanical support and electrical bond. To keep the lead inductance to a minimum, holes are drilled into the plates just large enough to slip in the resistor leads. In this way only a one-eighth inch lead is used. The resistors are fitted flush with the plates and soldered into place. Fig. 2 shows the resistor load in its finished form.

Now the total resistance between outside plates will be approximately 50 ohms. One of the outside plates may be electrically joined to the oil-can lid by soldering a strong L-shaped piece of metal to the plate and lid. This junction should be made so that the lid is suspended above the 50-ohm load about one-half inch. The other outside plate of the load may be connected to a feedthrough insulator which is mounted on the lid.

Fill the oil can about two thirds full of the #10W motor oil and slip the 50-ohm load down inside until it is about half an inch from the bottom of the can. Make certain that the oil completely covers the resistors of the load but leaves some air space below the lid. The lid should now be soldered to the inside of the can to form a good electrical contact as well as a leak-proof seal.

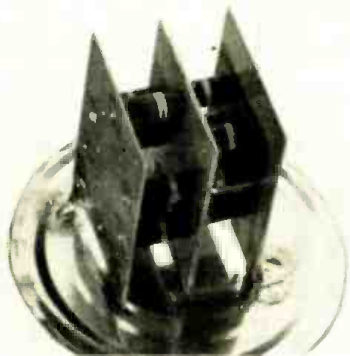
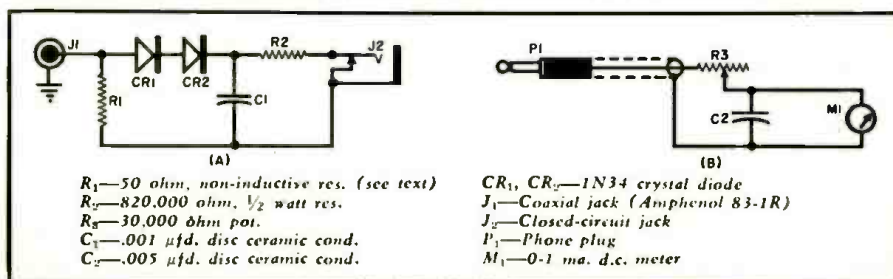


Fig. 2. The 50-ohm load, showing the twelve 150-ohm resistors connected in series-parallel. The plate on the left is soldered to a feedthrough on the can lid. The right-hand plate is grounded to the lid by an L-shaped piece of metal.

Fig. 3. (A) Wiring diagram of oil-cooled load assembly. (B) Meter-case assembly.



The foregoing will take a little care. To find that half-an-inch of clearance it is best not to try to use a half-inch piece of wood or other material, even as a temporary spacer, because once you have placed the 50-ohm load in the can it may be very difficult to get it out again. Of course, no spacer is used in the finished unit. Sliding the can lid in and out also produces wear and the lid may refuse to stay in place when you finally try to solder it.

Do your measuring and marking with a ruler and avoid any temptation to measure by "eye 'n' try" although it may seem quicker.

When you pour the oil, pour it gently into the center, because if the sides are oily, they will not take solder. Use as large a soldering iron as possible for this job.

These points may seem elementary but many hams learn their construction techniques through unhappy experience and these suggestions are intended as tips for the novice who may not have had too much shop work.

None of this is to imply that the work is ticklish, but it should be carefully done and well organized.

The r.f. input is brought into the load by means of a coaxial connector. It should be placed so that the lead to the feedthrough insulator will be as short as possible. A hole is cut on the other side of the can for a closed-circuit type of phone jack. Between the coax connector and the jack are connected the two 1N34 crystals and R_2 in series. These should be placed so that the leads will be as short as possible. C_1 should be a disc type ceramic condenser which is wired into the circuit with a minimum lead length.

The 0-1 milliammeter with C_2 and R_1 are mounted separately in a meter case. Connection from the meter to the load is made by shielded wire which plugs into the jack on the load.

Circuit Considerations

It has been found that by immersing Allen-Bradley 2-watt composition resistors in oil, the power dissipating capabilities can be increased approximately four times with negligible change in the resistance. This fact makes it possible to build the 50-ohm load with only twelve 2-watt resistors. To prove this point to yourself, take two 1500-ohm, 2-watt resistors and measure their resistance on a bridge or by some other accurate method. Now apply 117 volts, 60 cycles to both. Lay one of the resistors in a small dish filled with oil while leaving the other resistor in the open air. After about fifteen minutes disconnect the voltage and measure the resistances again. You will find that the resistor immersed in oil will have changed less than 3% while the other resistor has increased in value at least 20% and is showing visible signs of breaking down. The power being dissipated was eight watts, or four times the rated dissipation of the resistors!

To insure against your load changing value it would be wise not to run

your transmitter into the wattmeter for periods exceeding ten or fifteen minutes at a time without allowing it to cool.

The metering circuit is simply a diode voltmeter of the peak-reading type. C_1 determines the lowest frequency which the meter will read accurately. By using a .001 μ fd. disc-type condenser for C_1 a signal with a frequency as low as 500 kc. may be read with accuracy. However, to calibrate the meter with a 60-cycle voltage a condenser of higher capacitance is needed. This will be discussed later.

Two crystals of the 1N34 class are required in the circuit in order to keep the voltage applied to the crystal within the manufacturer's rating; the peak voltage is equally divided between the two crystals. Another circuit was tried using resistor voltage dividers so that only one crystal would be needed. This was found impractical since the resistor's lead length introduced a resonant circuit which made the higher frequency readings low.

Calibration

Since the voltage across the load will vary directly with the power being dissipated, the meter can be calibrated to read directly in watts (See Fig. 4). However, since this meter is used in other test equipment it was easier to read the power from a curve than to make a new scale for the meter. The curve in Fig. 4 was calculated from the constants of the circuit. A full-scale deflection of 1 ma. on the meter would indicate on the curve that 100 watts was being delivered to the load.

To calibrate the meter, connect a 2- μ fd. condenser across C_1 and apply a 60-cycle, 71-volt source to the input connector of the load. Plug the meter into the jack and set R_1 so that the meter reads full scale. The calibrating voltage may be obtained from your 117-volt line and dropped by means of

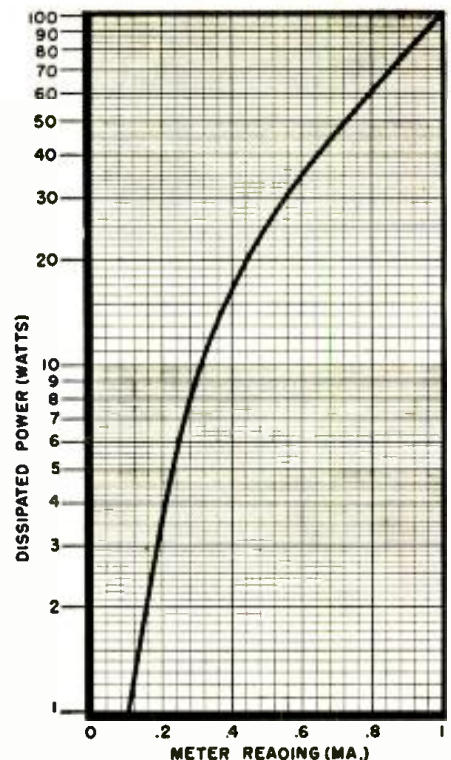


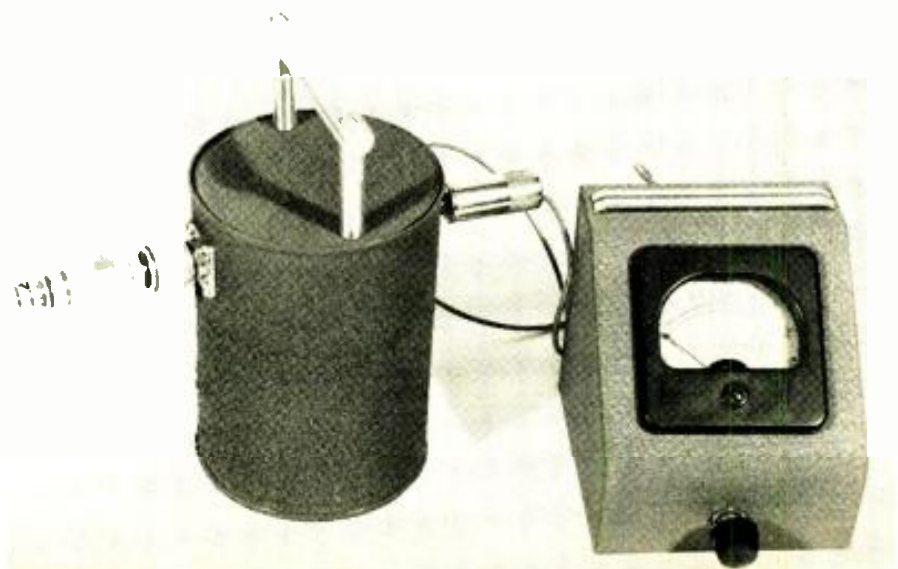
Fig. 4. Calibration curve for the 50-ohm load, calculated from circuit constants. It can be used as a conversion chart or for calibrating the meter face directly.

a Variac or some other method. A v.t.v.m. should be used to determine that the voltage is exactly 71 volts. Now the 2- μ fd. condenser may be disconnected and a cover put on the load can. Your wattmeter is now ready for use.

Extensive tests have shown that the wattmeter will give approximately 5% accuracy up to 30 mc. The accuracy will depend largely on the accuracy of the calibrating voltage and the lead lengths of the components.

-50-

Fig. 5. The r.f. input jack is located on the left and the phone jack for the shielded cable to the meter is on the right. The knob on meter case is R_1 .



CARE OF TRANSISTORS

By

RUFUS P. TURNER, K6AI



Fig. 1. The CK721 and CK722 junction-type transistors. To the right is shown the CK716 in its specially-designed molded socket housing.

Transistors are still expensive and may be easily damaged. Here are some practical pointers on caring for these units.

TODAY'S prices place transistors definitely into the category of expensive components. Every experienced radio technician knows that a natural law seems to be that the most costly parts are the most easily damaged. The danger signal is up. Persons setting out to do transistor circuit work are giving serious forethought to protective measures. This writer knows first-hand the horror of burning out an expensive transistor even before securing the required test data.

For future guidance, a careful study has been made of the ways in which these crystal devices can be damaged, and the findings are presented in this article in hope that they will be of service to other technicians. If you know how you can get into trouble with these units, avoiding the pitfalls will be easier.

Supply Potential Polarity

Correct polarity of applied voltages is very important in transistor circuits. Reversing the high-voltage supply in a tube circuit means nothing more than making the plate negative and stopping circuit operation. But reversing the comparable collector voltage in a transistor circuit means a quick burn-out.

It is worthwhile noting that use of the wrong polarity is an easy matter for the newcomer to transistor circuitry, although he may have had years of experience in tube applications. In fact, the more experience he has had with tubes, the more apt he will be to make the mistake with point-contact transistors because it has become his habit to make the grid negative and plate positive. The reverse is correct in *point-contact* transistor circuitry (See Fig. 2A). The emitter, which is comparable to the tube grid, is biased positive, while the collector, which is

comparable to the tube plate, is made *negative*. Both emitter and collector voltages are viewed with respect to the base (germanium wafer) which is comparable to the tube cathode.

In the point-contact transistor, maximum current flow (crystal forward current) occurs when either the emitter or collector whisker is made posi-

EDITOR'S NOTE: An announcement has just come through from Raytheon that they are in production on the CK722 junction-type transistor. The CK721 junction type is available only in limited quantities at the present time. Their suggested price on the CK722 has been dropped to \$7.50 each. For additional information on the design and application of transistors, see the article "Build This Transistor Receiver" on page 35 of this issue.

tive with respect to the base, just as in crystal diodes. The emitter supply voltage, being normally "whisker-positive," is low (on the order of $\frac{1}{2}$ volt) so that emitter current, while higher than collector current, is held to a safe value. Reversing the emitter voltage polarity will impair circuit operation but will not damage the transistor. When the collector voltage polarity is reversed, a large forward current flows, due to the much higher collector voltage, and burnout occurs quickly.

In the junction-type transistor, shown in a basic amplifier circuit in Fig. 2B, the supply potential polarities are the *same* as in a tube circuit—emitter negative and collector positive. While this reduces the chance of a mistake when transferring the attention from tubes to *junction* transistors, a very good likelihood of error is present when working back and forth between point-contact and junction transistors. Reversing the polarity of the junction transistor collector supply voltage is just as disastrous as in the case of the point-contact unit.

While on the subject of polarity, at-

tention should be called to the fact that a polarized circuit component such as an electrolytic condenser or d.c. meter normally is connected "backward" in some transistor circuits, especially those using point-contact transistors. To tube circuit technicians, long accustomed as they are to grounding the negative terminal of an electrolytic condenser, the necessity for grounding the positive in point-contact transistor circuits may be overlooked.

Mounting and Soldering

When the *Raytheon* CK703 point-contact transistor first appeared on the market in 1949, the ingenuity of technicians was taxed regarding a satisfactory way to make contact with the tiny base pins of that unit. Soldering to the pins was strongly discouraged. The size and construction of the CK703 was the same as the CK716 shown in Fig. 1. This writer devised a socket (See "A Crystal Receiver with Transistor Amplifier" by Rufus P. Turner, *RADIO & TELEVISION NEWS*, January 1950) which, though small in size, turned out to be bulky by comparison with the transistor.

At present, a tiny molded phenolic socket (*Cinch* Exp. 8749) is available for the CK716. The *Cinch* 8672 subminiature socket accommodates *Western Electric* Type A1698 and *Bell Laboratories* Types M1725 and M1729. The 3-pinned *General Electric* Types G11 and G11A may be plugged into a 5- or 7-pin subminiature tube socket. Each of the junction types examined thus far by the writer (typical example: *Germanium Products Corp.-Fedevated Semi-Conductor, Inc.* No. RD2517) have pigtail leads.

If the transistor is not provided with pigtail leads, no attempt should be made to solder or weld connections to its terminals unless the transistor manufacturer specifically sanctions this method of connection. It is fairly easy to damage germanium devices with heat such as that from a soldering iron or welding device. When soldering to the pigtail leads of transistors provided with such leads, hold the pigtail tightly with long nose pliers as close as possible to the body of the transistor and continue to grip the lead for a short time after the joint appears to have cooled. The pliers will conduct the heat away, preventing its entry into the interior of the transistor. Two good rules are to complete the soldering job as quickly as possible and to use as long a pigtail in the construction as possible.

Transistors may be mounted in any position. This is a convenience, since full exploitation of their small size often favors mounting transistors in whichever is the most convenient position.

Protection from Transients

Transistors must be protected from large voltage surges. A very sensible precaution before inserting the transistor is to examine a circuit thoroughly for possibility of surges. Damaging transients may be set up by steep signal waveforms, circuit switching, kickback from inductive components, sudden application of steady operating potentials, and similar causes.

Each circuit should be analyzed as an individual case and necessary remedial steps taken to reduce transients to, or lower than, the maximum potentials specified for the transistor to be used.

When theoretical investigation of transients must be supplemented with experimental data, the tests often can be made satisfactorily with an equivalent 3-terminal resistor network substituted in the circuit for the transistor.

Sudden switching of steady operating potentials on or off is to be avoided in new test circuits which have not been investigated fully. In a strange transistor circuit, it is advisable to increase the various operating potentials, in a stepless manner, slowly and simultaneously from zero to the design level. Only in this way can certain transistor damage be averted.

Current Limiting

Care must be taken to keep transistors in some circuits from becoming d.c. unstable and running to destruction. One such circuit is the oscillator (Fig. 3) in which a parallel resonant circuit is inserted between base and ground. Sufficient resistance must be present at R_1 and R_2 to limit emitter and collector currents to safe values.

A good precaution is to install a current limiting resistor, selected to conform to the type of transistor and circuit operating conditions, in series with the emitter of any transistor oscillator. If a collector load resistor is not employed normally in the circuit, another resistor should also be connected in series with the collector. Current limiting resistors are desirable also in many transistor amplifier and control circuits, especially in those circuits employing external base resistors or in which a coil or transformer is used instead of a load resistor in the output. In Fig. 2, points A and B are the proper locations for current limiting resistors.

External resistance connected between the transistor base and ground tends to make the transistor unstable. Hence, any attempt to "cathode bias" a transistor must be approached with caution. When it is imperative to employ such external resistance in a circuit, its value must be kept as low as

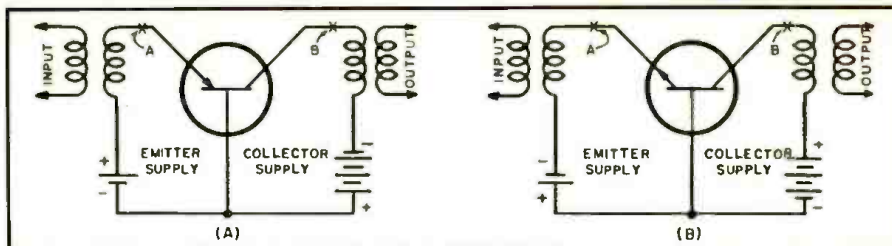


Fig. 2. Single-stage amplifiers (A) point-contact, and (B) junction types.

possible to prevent instability. "Cathode-biased" transistor amplifiers frequently oscillate or "sing" unless the base resistors are bypassed adequately.

In all transistor circuits, care must be taken to avoid excessive peak currents. Such current peaks can occur easily when high capacitances effectively are in series with either electrode of the transistor. The situation is very much the same as that in which a large filter condenser follows a metallic rectifier. Current limiting resistors must be provided for reduction of the peak currents.

Temperature Environment

While germanium transistors show negligible self-generation of heat, they are sensitive to ambient temperature, the junction type to a greater extent than the point-contact type. In fact, temperature dependence is one of the unsolved shortcomings of the transistor.

It is inadvisable, for that reason, to operate transistors at full ratings at high temperature. While +80 degrees centigrade has been stated as the top operating temperature for some transistors, it is best to consult the ratings of the individual type to be used. A warm chassis is not a good place to install transistors. The junction type particularly must be kept well away from hot tubes, resistors, and similar components.

It is correct to regard transistors as rugged, since they have given good account of themselves in vibration and shock tests, appearing better than vacuum tubes in some instances. But

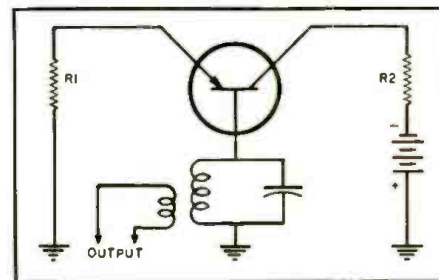


Fig. 3. Circuit of a "base" oscillator.

this is no reason to be unduly careless in handling them. Possible damage should not be risked by tapping or hammering on transistors or by dropping them from considerable heights. To prevent possible internal deformations, the transistor should not be pinched excessively by its mechanical mounting.

With transistors, we are in very much the same position as with vacuum tubes during the 20's. In those days, tubes were expensive and fragile and we just did not throw them around. Every circuit was checked and its "bad acting" possibilities thoroughly considered before tubes were plugged into their sockets.

If for no other reason, the present cost of transistors should put us on guard. The best procedure is to become fully aware of the possibilities for damage to the units, and then to check and double check all circuitry. Finally, care must be exercised in the initial operation of an experimental transistor circuit.

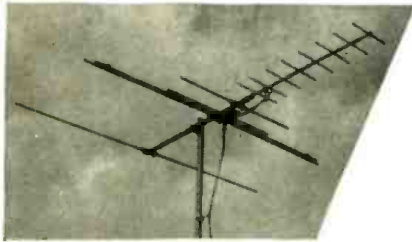
-30-

This portable, battery-operated television receiver uses transistors and no tubes except the 5" picture tube (at the right). This unit was one of the series of transistor equipment demonstrated recently by RCA at its Princeton, N. J., Laboratories.



V.H.F.-U.H.F.

Evaluating antenna performance—a "Megamatch," scope, and GDO are used.



"Suburban Ultra Q-Tee"



"Ultra Q-Tee"

ANTENNA DESIGN

By

L. F. B. CARINI

Assistant Chief Engineer
The LaPointe-Plascomold Corp.



"Q-Tee" model.

Engineering criteria in developing an all-channel antenna for both u.h.f. and v.h.f. video bands.

TELEVISION at u.h.f. has presented the engineering laboratories with a host of new and unusual problems. Among these, one of the most interesting has been the design and development of effective u.h.f. antennas.

The majority of v.h.f. antennas of past design and in current use are unsuited inherently for the reception of u.h.f. Directivity patterns are poor and, more important, these antennas fail to produce the gain required to pick up elusive u.h.f. signals.

Designing an antenna capable of providing a uniform gain over the entire u.h.f. spectrum is, in itself, an inordinate technical challenge. With v.h.f. the dozen channels ranging from 54 mc. to 216 mc. presented no serious problem, and indeed, many of the so-called all-channel antennas gave satisfactory response for average service. The problem of designing an antenna that has a reasonably linear response for all the u.h.f. channels and for v.h.f. as well, becomes complicated by the inability to decide upon compatible values in compromising between theoretical and physical ideals. The new

band of ultra-high frequencies is so broad, comparatively speaking, that many antenna types which were entirely satisfactory at v.h.f. cannot be adapted for u.h.f.

The accompanying chart (Table 1) shows the relative gain of various types of u.h.f. antennas as compared to a simple dipole used as reference. Note that, as in v.h.f., the highest gains are furnished by the more directional arrays.

Theoretical considerations have dictated and practical tests have proven that the best policy is to combine a u.h.f.-designed element or antenna with a v.h.f. antenna for optimum all-channel reception. Such an antenna is shown on the cover. Resonant filters, or channel separators, in the form of printed circuitry may be employed to effectively separate the v.h.f. portion of the antenna from the u.h.f. elements. The use of printed circuits permits filters to be applied directly to the antenna where the division of elements actually defines the limits of channel segregation. Printed circuitry makes possible small, compact LC units

of light weight, which when properly encapsulated, are electrically stable and weatherproof as substitutes for the usual large inductances and condensers.

For metropolitan service, it was found that the average 2 to 3 db gain supplied by a simple broadband "V" cut for u.h.f. when added to a v.h.f. antenna would provide adequate gain within city limits. In fringe areas where maximum signal gain must be obtained, the v.h.f. antenna is used in conjunction with a u.h.f. multi-element yagi. Gain as high as 14 db is obtained to satisfactorily pick up a signal in the most difficult locations. This type of antenna was extensively employed in the Portland area.

Other considerations of what constitutes good u.h.f. antenna design reflect the importance of physical construction. At u.h.f., any slight physical displacement of the antenna, or its constituent components, is sufficient to introduce noise, picture fluctuation, or ghosts. Therefore, one of the primary precautions to observe in engineering development is rigidity in design and permanence of construction. Vibration proofing and a freedom from any movement of the antenna elements become particularly important because they contribute to maintaining a steady signal input to the receiver. For this reason, large metal surfaces which offer considerable high wind resistance are objectionable and should be made of screen or perforated sheet metal. Use of a *Fiberglass* boom for the yagi antenna increases the strength and rigidity of the array. Noise generation at u.h.f. is serious enough as a result of tube noises and it should not be augmented by defective and loose mechanical connections as contributed by corrosion and rubbing of parts during high winds.

Table 1. Comparative gain for several types of antennas suitable for u.h.f. reception.

TYPE	FREQUENCY RANGE	GAIN (in db)
Dipole (1/4 wave center fed)	Broadband	0
V (single)	Broadband	2.3
V (2-bay)	Broadband	5-6
Double Dipole	Broadband	3-4
Bow Tie	Broadband	3
Folded Dipole*	Broadband	5
Helical	Broadband	8
Rhombic	Broadband	9
Corner Reflector	Broadband	10
Yagi (single 12-element)	Single Channel	14
Yagi (2-stack 12-element)	Single Channel	17
Colinear	Multiple Channels	9
Colinear (4-bay array)	Multiple Channels	14
Colinear (8-bay side-by-side)	Multiple Channels	17

* With reflector

IMPROVING THE WILLIAMSON AMPLIFIER

By

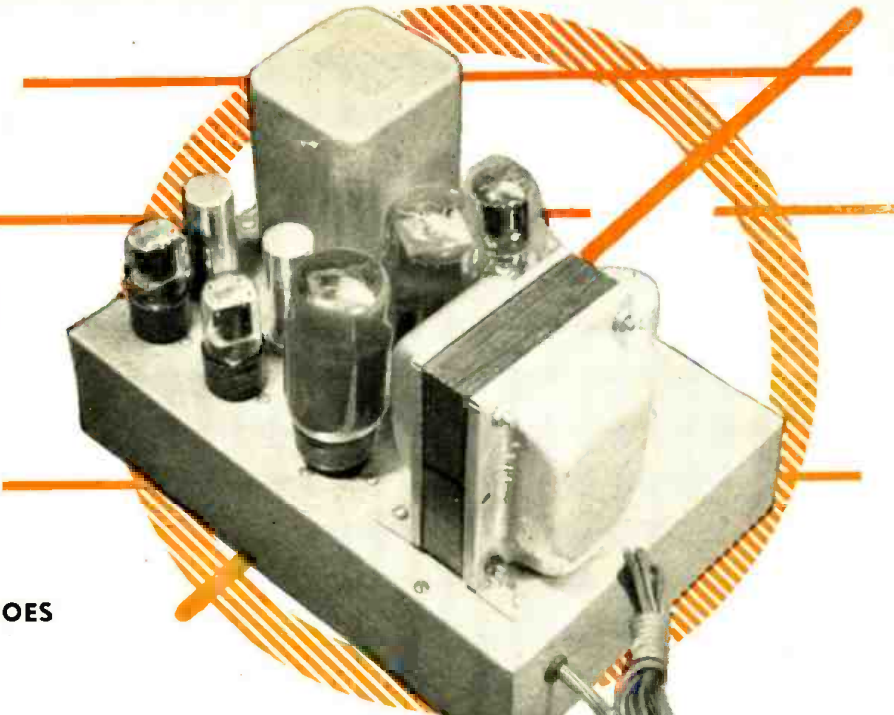
DAVID HAFLER and HERBERT I. KEROES

Acro Products Company

THE Williamson amplifier circuit is undoubtedly the most popular amplifier circuit ever developed for high quality audio reproduction.¹ It has become famous throughout the world, and its popularity is certainly justified. It provides amazingly clean, clear reproduction of a quality which sets a new standard of performance against which all newer circuits have been judged. The circuit permitted the home constructor or experimenter to achieve audio quality surpassing that which was commercially available at the time.

The high quality of the amplifier is due to several design principles. All stages are designed for minimum distortion and maximum bandpass. Class A triodes are used throughout. A push-pull, resistance-coupled driver stage is used to provide adequate signal at low distortion to the push-pull output stage. This stage consists of triode connected tetrodes which furnish a very important advantage over conventional low mu triodes. They require grid signal voltages of approximately 40 volts for full output as contrasted with 60 or 70 volts for triodes of the 2A3 and 6B4 type and 80 to 90 volts for a tube like the 6AS7G. In many triode amplifiers, there is more distortion generated in the attempt to drive the output stage than there is in the output stage. In the Williamson circuit there is sufficient drive available, and the limiting factor is the distortion inherent in the output stage. This is kept to low levels through the use of a feedback loop encompassing the entire four-stage circuit, including the output transformer.

These distinctive features of the amplifier make for a truly high grade circuit. The basic principle of the design is that there is no skimping. For example, Mr. Williamson stipulated design specifications and operating



Top chassis view of the "ultra-linear" Williamson amplifier. A specially-designed output transformer is required in this circuit.

A variation on the Williamson circuit which provides "ultra-linear" operation and a minimum of distortion.

parameters for the output transformer to be used to insure that this critical component had frequency response far in excess of the audio band and could handle 20 watts of undistorted power even though the power rating of the complete circuit was less than 15 watts.

This combination of attributes makes an outstanding amplifier with frequency response from 10 cps to 100 kc. (a wide bandpass provides good transient response) and intermodulation distortion of less than 1% at 10 watts of output. It has the elusive quality of "presence" which cannot be reflected in measurements but only in listening tests.

Improving the Williamson circuit is obviously a difficult task. It seems that conventional designs using conventional components are unlikely to excel the Williamson either in listening quality or in laboratory tests.

However, a recent *unconventional* circuit development has made possible a simultaneous reduction in distortion and increase in efficiency in the output stage of the Williamson (and many other circuits). This new circuit arrangement, on which patents are pending, is termed "ultra-linear"² operation—a name chosen because the circuit represents the most linear possible mode of operation of a pair of output tubes. It is neither triode nor tetrode tube operation but borrows the advantages of both without the disadvantages of either.

"Ultra-Linear" Operation

Arguments concerning triodes *versus* tetrodes have been carried on for many years without any definitive conclusions. Each tube type has its advantages and its disadvantages, and those who favor either will find many reasons to justify their choice while disparaging the other type. The present status of the battle seems to be that the tetrode advocate is in the minority. The triode with feedback, such as is used in the Williamson circuit, has surpassed it in popularity among home constructors and custom builders of audio equipment although not among commercial manufacturers. The commercial interests are motivated by the fact that the efficiency of tetrodes is higher than triodes, and the distortion of a tetrode amplifier can be made lower over a greater operating range than can be done with triodes.

Since there are arguments on each side, the choice between the two must be based on the relative weights of the various factors by which they differ. One person prefers triode low impedance; another likes tetrode power sensitivity. Similarly, the triode proponent likes the sound of triodes; the tetrode man likes tetrode sound. Each rejects the elusive and minute distortions which characterize the other tube type.

The basic cause of the whole argument seems to be that neither tube type is close enough to perfection.

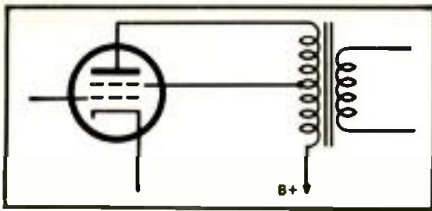


Fig. 1. "Ultra-linear" connection of a tetrode.

Each has its faults. Conventional tubes are essentially nonlinear circuit elements. As such, they generate audible distortion. Acceptance of one type is not necessarily because of its quality—often it stems from rejection of the other type. Choice resolves to the lesser of two evils. The remedy for this basic situation can only come from either a new tube type or from a new method of operating existing tube types.

The tetrode output tube can be operated as a triode by connecting screen to plate as is done in the Williamson circuit. If the screen is *partially* connected to the plate, we have what is effectively a new type of tube. This can be accomplished by connecting the screen grid to a point on the primary winding of the output transformer as is illustrated in Fig. 1. If the primary tap is at the top of the winding, we have a triode tube with plate characteristic curves concave upward. If the tap is at the low end, the "B plus" point, we have a tetrode with plate characteristic curves concave downward. At a critical intermediate point, we obtain a plate characteristic which is essentially a straight line. This is the point of "ultra-linear" operation and the point of minimum distortion.

Fortuitously, the "ultra-linear" point also has several additional operating advantages. It maintains the full efficiency and power sensitivity of the tetrode along with its high power capabilities. Simultaneously, it has low internal impedance like the triode. It combines the most advantageous features of each and has lower harmonic and intermodulation distortion than either of the two basic tube types.

Fig. 2, for example, shows a comparison of the intermodulation distortion of a push-pull stage without feedback for triode connection, "ultra-linear" connection, and tetrode connection. These curves show that the triode cannot handle high powers while the tetrode has relatively high distortion at lower operating levels. The "ultra-linear" stage obviously is an improvement over either of the others over most of the useful power range. Evidently, with other things held equal, an "ultra-linear" output stage must make a better amplifier than can be realized with any triode or tetrode circuit.

One of the more subtle advantages of "ultra-linear" operation lies in the inherent regulation of this type of output stage. There is practically no change in tube current drain from

quiescent operation up to full output. This permits the use of a minimum power supply. With other operating arrangements there is a loss of low frequency power handling capacity if the power supply regulation is inadequate.

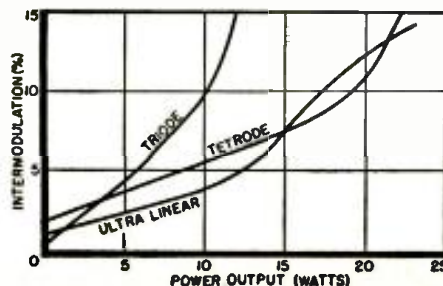
"Ultra-linear" tube operation cannot be utilized with standard output transformers. It is necessary to have a tapped primary winding, and the conventional units of multiple impedance have taps at positions which do not give optimum results. The primary tap for tube types such as are commonly used in the Williamson circuit must be at a point so that the load impedance in the screen circuit is 18.5% of the load impedance in the plate circuit. In order to carry through the optimum conditions, a special transformer, the *Acrosound* TO-300, has been developed to be used for "ultra-linear" operation of beam power tubes of the 6L6, 807, 5881, and KT-66 type. It is a unit which has a tapped primary of 6600 ohms total impedance with the screen-to-screen load impedance 1220 ohms—the ratio of plate-to-screen load which provides most linear tube characteristics. The transformer also has a frequency characteristic of plus or minus 1db from 10 cps to 100 kc. and the ability to handle 40 watts of audio power over a very wide frequency range.

The specifications of this transformer exceed those stipulated by Mr. Williamson. The operating conditions of the output stage exceed those of his triode-connected tubes. Therefore, since the Williamson circuit using the "ultra-linear" output stage will have a more linear characteristic in that portion of the amplifier which is its weakest link and the prime source of distortion, the combination of "ultra-linear" stage and the Williamson circuit can be expected to be an improvement over the original. Actually, the power output of the "ultra-linear" Williamson is about doubled for the same distortion as compared to the triode Williamson and auditory quality is also improved.

Combining the Two Circuits

Fig. 3 shows the complete circuit of the Williamson amplifier with the "ultra-linear" output stage. Several minor changes have been made from the original circuit for optimum integration of the two circuits. All of the changes from the original circuit are

Fig. 2. Comparison of distortion characteristics of triode, "ultra-linear," and tetrode stages. See text for full details.



shown within dotted lines on the schematic. The change in the output transformer is the major change. The other deviations from the original involve only a few condensers and resistors. These changes readjust the feedback to maintain it at the desired 20 decibels, and they also improve on the stability margin of the original circuit.^{3, 4}

The circuit requires a power supply furnishing between 425 and 450 volts at 130 to 140 ma. This is obtained most simply by using a standard 400 volt, 200 ma. power transformer with 5V4G rectifier and condenser input. Operation of the power transformer at the lower drain provides higher-than-rated output voltage along with cool operation. The input filter condenser should have at least a 500 working volt rating while the later condensers can be 450 or 475 volt types. The use of a cathode-type rectifier limits the initial voltage surge so that higher rated condensers are not required.

In order to get equal output signals from each half of the phase inverter, the plate and cathode resistors should be matched to within 1%. If equipment for measuring this closely is not available, the use of 1% deposited carbon resistors (made by *Continental Carbon, IRC, or Wilcor*) is suggested. This also applies to the plate load resistors of the push-pull driver stage which should be matched so that the drive to the output stage is equal on both sides.

The output tubes can be 807's, 5881's, WE350A's, or the British KT-66's. All of these can take the recommended voltage without exceeding tube dissipation. Though the difference in performance is not substantial, the authors have found that the KT-66 provides the lowest distortion at low power levels (around one or two watts), and its power capabilities are somewhat better than the others.

It is highly recommended that, as shown, the output cathode resistors be bypassed with a condenser in excess of 100 μ f. This avoids third harmonic distortion and consequent intermodulation distortion particularly under conditions of high level dynamic operation.¹

Negative feedback is carried around the output transformer and all four stages. This negative feedback reduces distortion, hum, noise, and output impedance by a factor of 10. In connecting the feedback loop, the color coding of the plate and screen leads of the output transformer should be observed. As indicated on the schematic, the plate and screen leads marked with a white tracer should be paired and connected to the *lower* output tube; this tube is on the side of the circuit which is energized from the cathode of the phase inverter. The other plate and screen leads go to the side of the circuit which comes off the plate side of the phase inverter. In this way, feedback phasing is correct, and there will be no oscillation of the amplifier at either high or low fre-

quencies if the remainder of the circuit has been wired correctly.

The feedback connection is made from the 16-ohm tap irrespective of the tap used to connect the speaker. This arrangement saves having to reconnect the output winding and change the feedback resistor should a speaker of different impedance be connected to the amplifier.

A bias balancing network is shown in the cathode circuit of the output stage. This cannot compensate for badly mismatched tubes, but it does permit adjusting for normal variations from tube to tube. A milliammeter should be inserted in each cathode circuit at the points marked "X", and the cathode currents should be balanced by adjusting the potentiometer. Each tube should draw in the neighborhood of 60 ma. if the plate supply voltage is 450 volts. If the plate voltage is 400 volts, the current drain will be approximately 50 ma.

Amplifier Performance

Maximum undistorted output of the "ultra-linear" Williamson amplifier is about 30 watts. This output is achieved with an input signal of one volt. In the triode Williamson, close to two volts of drive are required, and maximum output is not over 15 watts.

The comparative intermodulation data for the triode and "ultra-linear" Williamsons is shown in Fig. 4. It can be seen that the "ultra-linear" circuit provides about double the power before the distortion becomes serious. At levels of one or two watts, the intermodulation is in the vicinity of .06%. At 13 watts of output, it is only .3%, and it reaches the 1% point at about 20 watts.

The high power handling capacity of the amplifier is well demonstrated by the power curve of Fig. 5. It represents the maximum *undistorted* power available at various frequencies. The amplifier puts out 25 watts at 20 cps and nearly 30 watts past 20 kc. This power curve is *not* a response curve. It would be possible for response to be flat and for power to be down considerably at the ends of the frequency spectrum. The *undistorted*

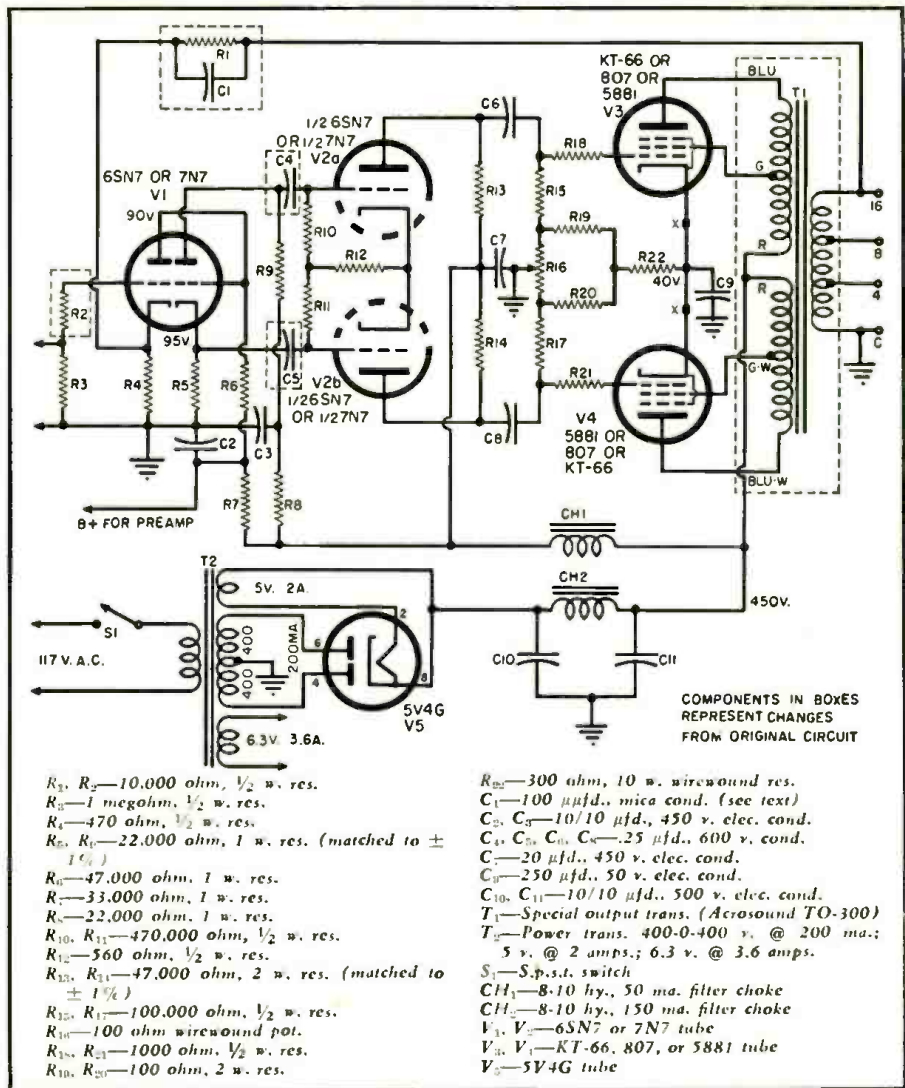


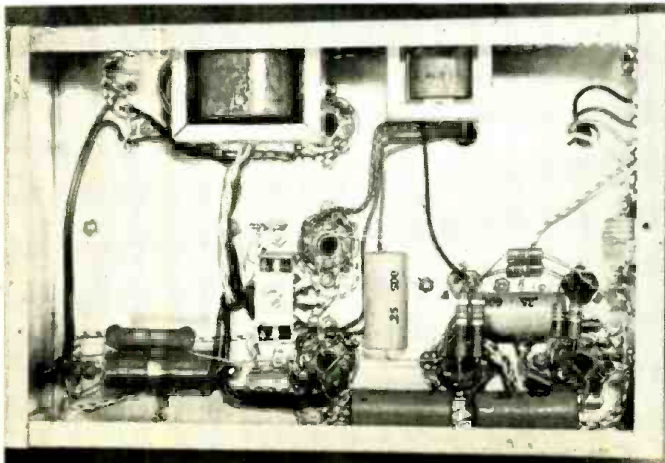
Fig. 3. "Ultra-linear" Williamson circuit. Dotted sections are changes from original.

power measurement is a much more rigid test of amplifier performance than a response curve run at a 25 watt level where the distortion is ignored. Little publicized data makes the distinction between a true power curve of undistorted power and a high level response curve.

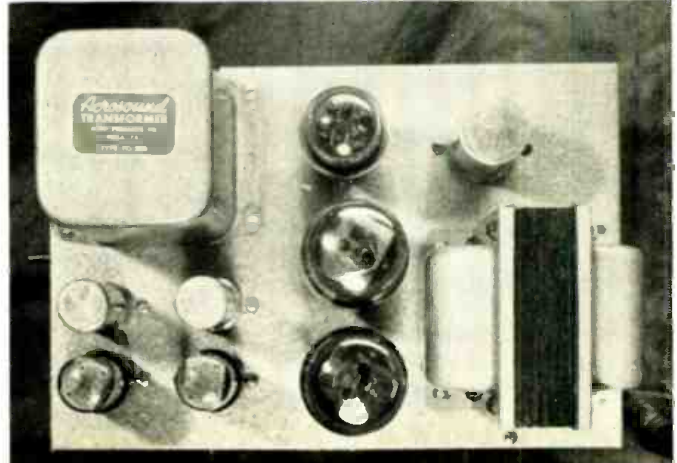
Fig. 6 shows the response curve which is broad beyond normal re-

quirements. The response of plus or minus 1 db from 2 cps to 200 kc. is required to minimize phase shift in the audio band since very small variations in gain are correlated with comparatively large variations in phase even at points far removed from where the response is first observed to vary. In this circuit, the response is flat from
(Continued on page 98)

Underchassis view of the "ultra-linear" Williamson amplifier.



Top chassis view showing specially-designed output transformer.



TV SIGNAL DISTRIBUTION METHODS

By EDWARD M. NOLL

MULTI-RECEIVER systems can be simple or very elaborate depending on the number of outlets, signal levels, and distribution requirements. Outlet arrangement can vary from a simple outlet box for supplying two receivers to an apartment house installation serving hundreds of receivers. The objective of an outlet system is to supply as good or better signals to each receiver than could be obtained from a separate antenna for each receiver. This objective is obtained with ease for some installations but only with difficulty for others. Outlet system criteria are as follows:

1. *Signal Level.* Sufficient signal level should be delivered to each receiver input for each desired station. Levels should correspond to what could be obtained from a conventional antenna system for each receiver at the same location. Some tolerance can be extended in a strong signal area in regards to signal level because of the receiver a.g.c. facility. Amplitude must not be allowed to decline to a level where noise and interference become more apparent on the picture. In weak signal areas it is

advisable that the multi-outlet system give a boost to the signals so stronger signals are available at each receiver.

2. *Signal-to-Noise Ratio.* A distribution system should have a high signal-to-noise ratio. Although amplification is advisable, amplifiers need to establish a signal-to-noise ratio comparable to or better than a high quality tuner. Terminations are exacting in feeding receiver groups since mismatches open such lines to high noise levels and interference.

3. *Interaction.* A difficult multi-outlet problem is the elimination of such interference between receivers as local oscillator radiation, other spurious beats, and loading. Thus a distribution system must have definite one-way characteristics—transfer of signals to receivers but maximum rejection of signals attempting to leave the receivers. Again, terminations must be exacting as any standing waves on

lines can be shifted by receiver channel switching, changing ratios and loading at other receivers on the line.

4. *Signal Level Range.* Still another difficult multi-outlet problem is the ability to handle wide signal level ranges (both fringe and local) on the same distribution system. Both weak and strong signals on the line can be trying, presenting such problems as overload, picture superimposition, oscillations, and beat interference. It is difficult to hold down the strong signals (without sacrificing their quality) and, at same time, permit maximum amplification of weak signals.

Basic Methods

A simple multi-outlet box is satisfactory when sufficient signal is available. There is a substantial signal loss in almost all outlet boxes and—if any one of the desired channels is low in level, picture quality declines. Often on the high-band channels a particular channel can be peaked by experimenting with the lengths of line between the outlet device and each receiver. A sliding, two-foot length of tinfoil on each lead is helpful in peaking line length for optimum performance on a given weak channel.

If signal levels are weak a wide-band booster should be used ahead of the outlet device (Fig. 2A). Here, on occasion, we must cope with the difficult problem of handling both weak and strong signals. Some possible solutions to this simple outlet method are:

a. Use the attenuator included with wide-band amplifier or employ an external attenuator. Adjust control

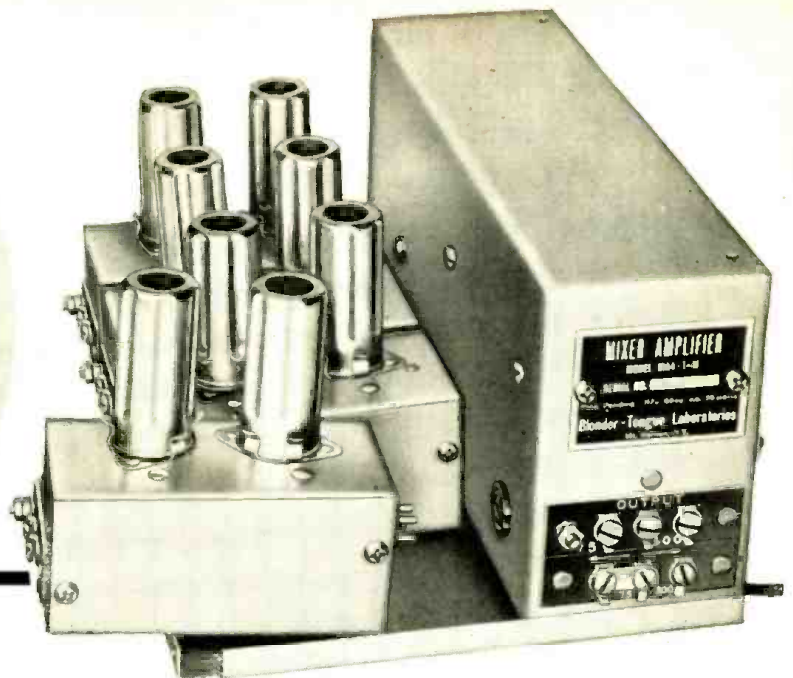
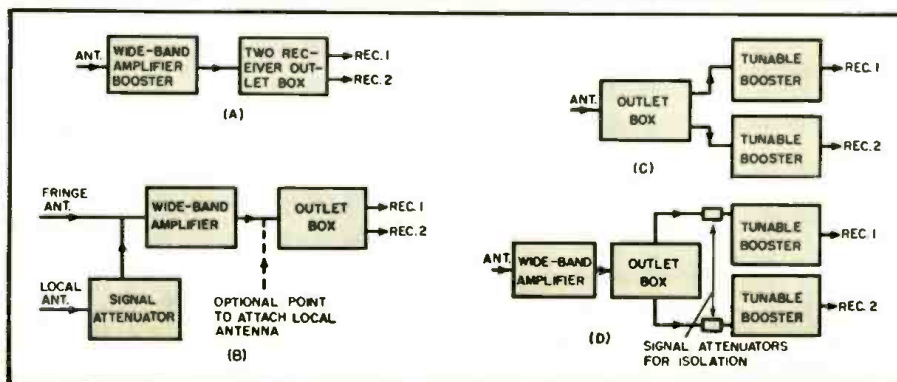


Fig. 1. Blonder-Tongue MA4-1-M mixer-amplifier. Unit has four channel amplifiers and supplies two sets or one set and a distribution line.

Several ways of handling multi-receiver TV installations including strong-fringe, all-strong, or all-fringe signals.

Fig. 2. (A) Wide-band booster and outlet box arrangement. (B) Method for combining local and fringe area signal distribution. (C and D) Reducing receiver interaction.



until strong signal does not overload amplifier—no oscillation or superimposition of strong signal on some other weak channel.

b. If there is a great level differential between strong and weak stations (local and fringe reception from a distance greater than 35-40 miles) the control setting method is not adequate because fringe level is sacrificed. Careful antenna orientation can often reduce the problem. Set the antenna for peak or near-peak fringe reception in combination with minimum pick-up of local channels. This is often a tedious adjustment as improper orientation on local channels can also cause loss of picture resolution or reflections. This task must be performed carefully and critically.

c. A more elaborate and sometimes the only solution to the difficulty is to use separate antennas. Choose a high-gain and sharp-pattern antenna for fringe reception and a simple antenna for local reception. Apply separate transmission lines to the antennas. Connect line from local antenna, Fig. 2B, to output of wide-band booster or through attenuator to input of wide-band amplifier. The length of the line from the local antenna must be adjusted critically so as not to act as a suppression stub for one of the fringe channels. This can be done by cutting off three-inch lengths and observing its influence on fringe station level. Pieces of tinfoil on each line can help in obtaining optimum adjustment.

The outlet box has as a second major function, the minimization of interaction between receivers. This can be in the form of loading (change of signal levels at one receiver when a second receiver is switched from channel to channel) or local oscillator feedthrough (interference pattern formed on one receiver as a result of the admission of local oscillator signal from the second receiver). Consequently, the outlet device should act as a one-way device as much as possible—least attenuation of the signal passing through to the receiver but maximum rejection of signals attempting to leave the receiver.

This can be a severe problem in trying to connect a multi-outlet receiver with strong local oscillator feedthrough to the antenna terminals. A few possible solutions are:

a. Insert tunable boosters between outlet device and individual receivers (Figs. 2C & 2D). A booster of adequate design is an excellent one-way device, providing amplification of the signal in one direction and good rejection of any signal attempting to move in the other direction.

b. The first solution can result in a somewhat poorer signal-to-noise ratio as signals are divided before amplification. A better plan is to include a wide-band booster ahead of the outlet device and separate tunable boosters for individual receivers. This is a practical means of multi-outlet installations for fringe areas.

c. If strong signals are available,

signal attenuators can be inserted in the receiver lines and adjusted for maximum attenuation of the local oscillator signal without a degrading loss of the station signal level.

Distribution Amplifiers

The plan of amplification-before-division is employed in most of the commercial types of multi-receiver systems. This expedient retains a better signal-to-noise ratio than is possible if the signal is first divided (reduced in level) and then amplified. Commercial systems can supply from two to hundreds of outlets depending on the design and number of units used. A small four-position arrangement consisting of a wide-band amplifier and two multi-outlet boxes (or a single four-receiver box) is effective in serving four receivers for duplex and semi-detached housing (either four apartments or two families with receivers on each floor).

With a good high-gain antenna and proper installation, good fringe area reception is possible with this arrangement. Critical performance checks must be made and all problems reduced as much as possible, using techniques mentioned previously. The use of a separate tunable booster at each receiver can improve fringe results.

Commercial systems generally consist of four basic units which can be arranged in numerous combinations to supply from 2 to 2000 TV sets. These units are:

a. Small distribution outlet amplifier to supply two individual receivers. The function of this unit is the same as the ordinary outlet box. However, this type of vacuum tube outlet box has a circuit that has little or no loss (some few with gain) and provides thorough isolation between receivers.

b. Larger distribution amplifiers with a number of individual receiver outlets (four to ten) with thorough isolation between outlets and very little signal loss. On most distribution amplifiers there are separate line outlets available to permit continuance of the coaxial line path to succeeding distribution amplifiers. Some slight loss

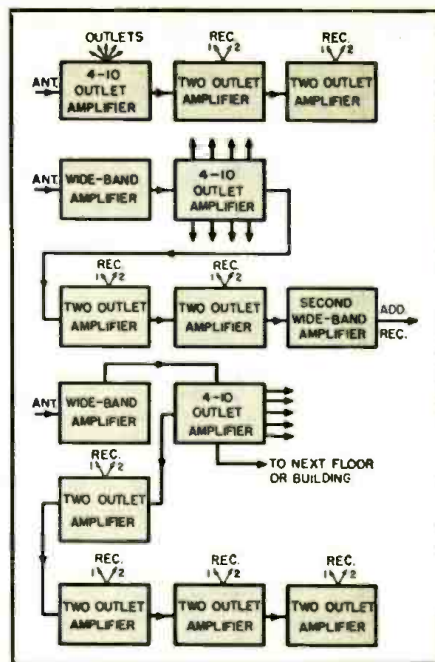


Fig. 3. Three ways in which the distribution amplifiers can be connected. See text for complete application information.

is encountered at these low impedance line outlets. Regular receiver outlets have a 300-ohm impedance.

c. Wide-band amplifier with a high gain is used to bring up signal level for a fringe-area or weak-signal distribution installation. For least difficulty in a distribution system, the signal level for each channel should reach a 10,000 microvolt level. When signal levels are lower, the line runs must be planned carefully to avoid noise pick up. Signal is attenuated rapidly as line lengths are increased and it is possible to have the signal fall off so seriously that poor signal-to-noise ratios are established at the input of the next distribution unit. This poor ratio will continue through the succeeding units of the distribution system.

d. High-gain amplifiers in the form of individual channel amplifiers associated with a central distribution am-

(Continued on page 121)

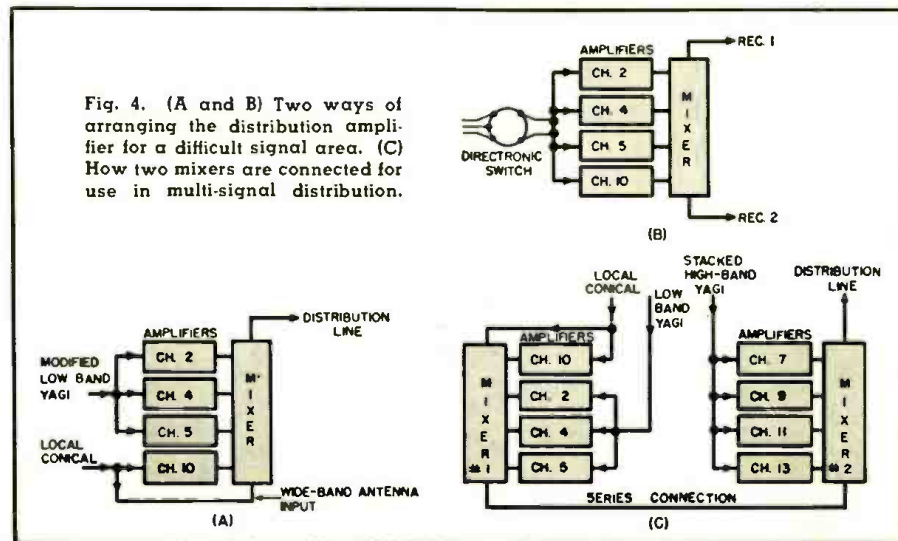


Fig. 4. (A and B) Two ways of arranging the distribution amplifier for a difficult signal area. (C) How two mixers are connected for use in multi-signal distribution.

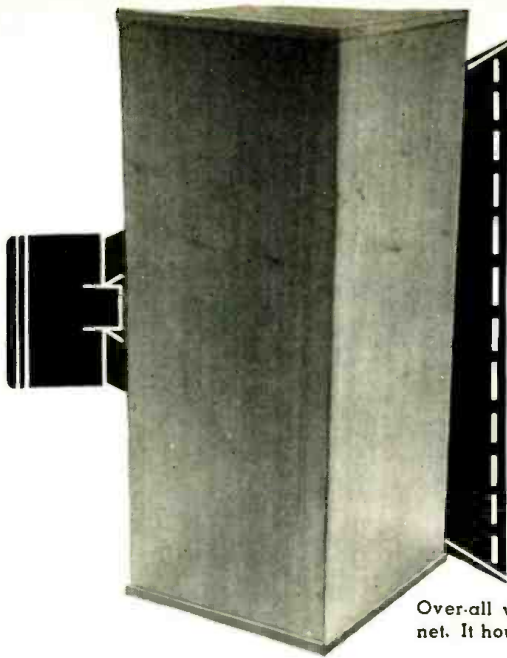
AN IMPROVED CORNER HORN SPEAKER SYSTEM

By

GEORGE L. AUGSPURGER

Audio Research Laboratories

A new version of the integral space transducer originally described in the November 1949 issue.



Over-all view of IS-800 corner horn cabinet. It houses an ordinary 8" p.a. speaker.

"SOMETHING for nothing" is a slogan that usually leads to disappointment in audio work. However, recent developments such as the reluctance pickup and the Williamson amplifier circuit have served to give us something really worth listening to at a cost that does not preclude the purchase of food and clothing. It is only the speaker system, the most uncooperative and contrary link in the whole audio chain, that has so far refused to satisfy the most critical listener for anything less than several hundred dollars.

In the November 1949 issue of *RADIO & TELEVISION NEWS* Ray Doby and the writer described a corner horn speaker system which attempted to coax full-range response from smaller, less expensive speakers. The "integral space transducer," as it was called, was a step in the right direction, but it suffered from several unfortunate deficiencies. It presented a rather startling appearance (most people thought it was a portable bar), and was devilishly tricky to build. It also developed that the "I.S.T." was almost entirely at the mercy of its bass driver. Speaker selection was so critical that the total system "... when she was good, was very, very good; but when she was bad, she was horrid!"

The unit to be described here retains the basic features of the previous design while gaining the advantages of greatly-increased bass efficiency, simplified construction, non-critical driver selection, and lower cost. This new design, using an ordinary p.a. speaker (*Stromberg-Carlson RC-24*) as a driver, can easily outperform a good twelve-inch bass-reflex system. With higher quality eight-inch speakers such as the *Altec 400B*, the IS-800 will satisfy the most critical musical ear. The secret of its remarkable quality lies in the fact that, whereas its predecessor had merely helped the speaker achieve its best

performance, the IS-800 gives its driver no choice. In other words, the horn loading, coupling chamber, back-wave enclosure, and reflex ports are all worked out to give such a degree of control over the speaker cone that, regardless of its own attitude, improved transient characteristics, extended bass response, and more linear transfer qualities cannot help but result.

The IS-800 is basically a vertical corner horn of square cross-section. The driver is mounted at the base of the cabinet and is coupled to the horn by a small compression chamber and a concrete reflector block of the type used so successfully by P. G. A. H. Voigt. The horn expands along two adjacent sides of the square from a 36 square-inch throat to a mouth area of 288 square inches.

The completed cabinet looks somewhat like a glorified office wastebasket. All four sides are alike and all taper toward the base of the unit. The slanting sides not only offer a pleasing appearance, but clearance space is provided for baseboards and moldings. Moreover, the driver back-wave is vented through the space between the room walls and the sloping sides of the cabinet.

The finished system is capped with a mahogany frame, and the horn mouth is protected by a perforated metal grille. The eye appeal of this simple design is quite favorable when compared with the usual visible louvers, ports, and ornate grille treatments. Of course, there is no reason why the front panels of the IS-800 cannot be decorated in any manner that the builder happens to like. We personally prefer the cabinet shown because it is harmonious and unobtrusive in any furnishing scheme.

The actual construction of the horn and cabinet may seem tricky and unfamiliar. Actually, there is nothing really difficult to worry about, but a

good job will take time... a good deal more time than a bass-reflex cabinet for example. The proper sequence of assembly is as follows:

The two back panels (B_1 , B_2) should first be cut out and fastened together. The panels are glued and screwed to the quarter-round joining strip and the triangular plywood base (F). The two curved horn sides (C_1 , C_2) are then cut and fastened to their struts (D_1 , D_2). The struts, in turn, are fastened to the rear panels and the flared pieces joined with a section of quarter-round as was originally done for B_1 and B_2 . The front length of quarter-round, however, should be planed in such a way that the straight edges make an angle greater than ninety degrees toward the upper end.

This bit of doctoring is necessary since the joint is not vertical. If the joining strip is used without modification, the front walls of the horn will be pulled out of square and trouble will result.

The speaker mounting board (G) can now be installed and the coupling chamber completed by the addition of (H), which must be cut and fitted carefully to make a tight seal between the compression chamber and the horn throat.

The horn proper needs the addition of a concrete reflector block for its completion. This task is perhaps the most satisfying and creative part of the whole proceeding. The builder, suddenly supplied with a fascinating batch of wet concrete, will probably spend a happy afternoon finding other uses for the messy stuff. The I.S.T., however, need only be tilted back at an angle of 45 degrees, and a small quantity of the mixture poured into its gullet. Pre-mixed dry concrete, available from almost any lumber company, is inexpensive and easy to use for this operation.

The front panels (A_1 , A_2) are mitred and fitted together, tacked and glued to another joining strip. Two $\frac{1}{2} \times 1$ inch strips are glued one-quarter inch from the outside edges of the front panels, and a thin mahogany strip is

glued to the lower front edges of the sheets. *Kimsul* bats are tacked to the inside surfaces, and the exposed sides are finished in any manner desired. Usually an application of wood filler, then one of stain, and two coats of satin-finish varnish will do a satisfactory finishing job.

Before assembling the two halves of the cabinet, the concave surfaces of the horn should be covered with some sort of acoustic material. Acoustic tile cement is a good gooey compound to use when applying these deadening bats to the *Masonite* surfaces.

Six one-inch holes are bored in each rear side of the backwave chamber, and the two sections are assembled into the complete IS-800 cabinet. If a separate tweeter is to be used, the tweeter mounting strut and the necessary wiring should be installed before this final combination is effected.

The metal grille, the mahogany cap, and the driver can be fitted into place, and the "I.S.T." is ready for use. The cabinet should be placed in a corner of the listening room whose wall surfaces extend at least three feet beyond the speaker system. Since the vertical axis of the horn eliminates directional blasting, the usual precautions of speaker positioning do not apply to the "integral space transducer."

Experience with the previous article has shown that a brief warning is necessary at this point. The dimensions given on these pages are worked out on the basis of an eight-inch driver. Larger speaker sizes will not improve reproduction. Instead, the acoustic relationships of the cabinet will be upset, and ragged response will result. The IS-800 is specifically designed to be used with fairly compliant eight-inch cone speakers such as the *Altec 400B*, *Jim Lansing No. 208*, *Stromberg-Carlson RC-24*, or *Jensen P 8-RX*.

When listening to the reproduction offered by the IS-800, the builder will find that new settings of the equalizer controls are necessary to achieve correct tonal balance. The genuine bass response of the horn will extend the low frequency limit of the system considerably below that of conventional bass-reflex cabinets. The treble response, on the other hand, is non-directional and will have to be boosted unless a separate tweeter and high-pass network are incorporated into the speaker system.

Although the IS-800 is designed primarily for home sound installations, its compact size, non-directional propagation, and live quality sound reproduction make it an excellent unit for

various other situations. Broadcast stations, school music departments, wired-music installations, and even small auditoriums offer opportunities in which the advantages of the "I.S.T." may prompt its use.

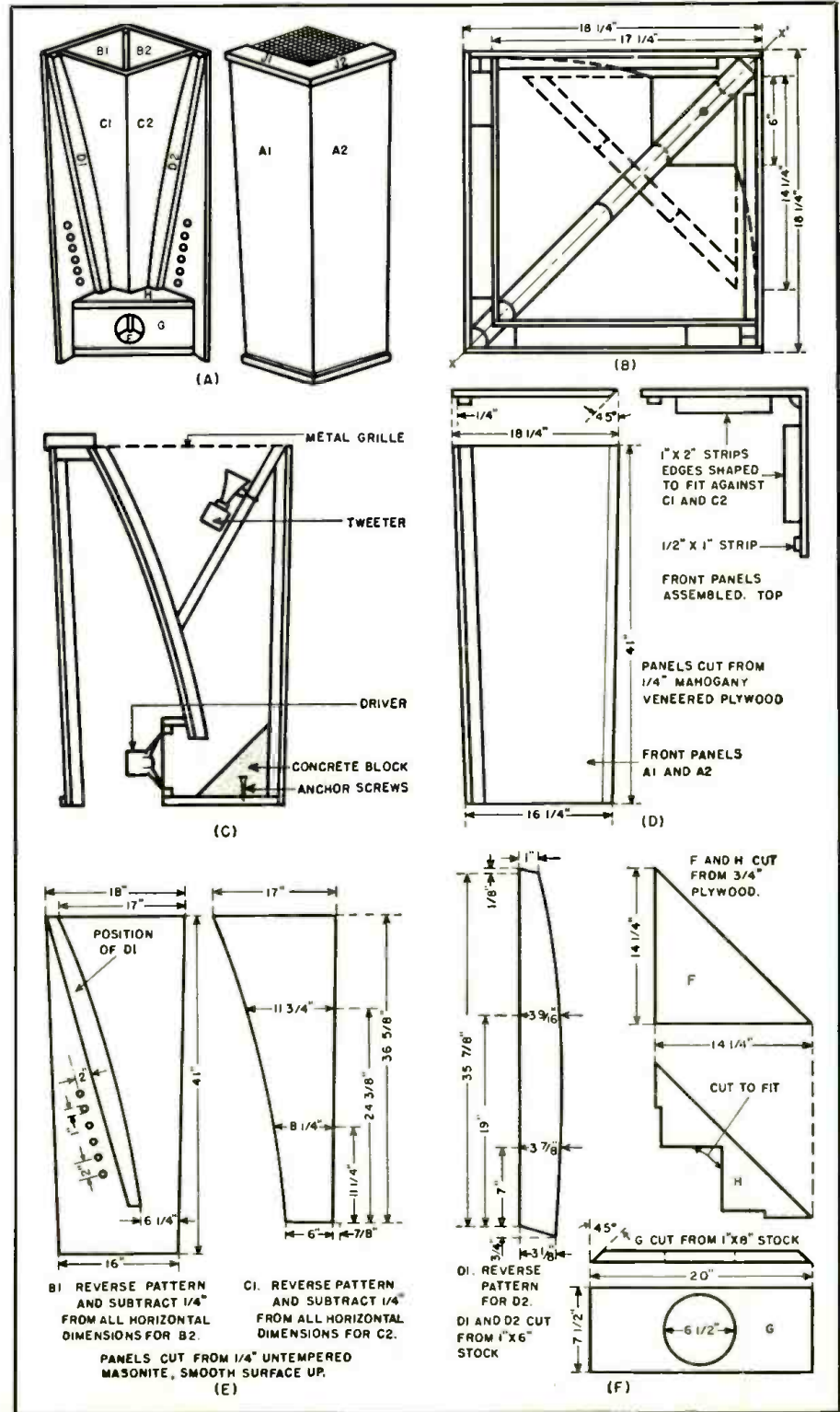
Many of the excellent speaker enclosures available are of such large physical size that their use in the average living room means the rearrangement or elimination of some of the furniture.

The music lover already has enough difficulties to overcome, without adding the possibility of domestic friction

to his or her rapidly growing list of problems.

While the new "integral space transducer" is considerably more elaborate than box type baffles, the use of a less expensive speaker plus the more realistic listening quality achieved more than offset complications in construction. Whether the reader has the unit built, builds it himself, or purchases it ready-made, he will appreciate the IS-800's improvements over conventional moderate-priced speaker systems.

-50-



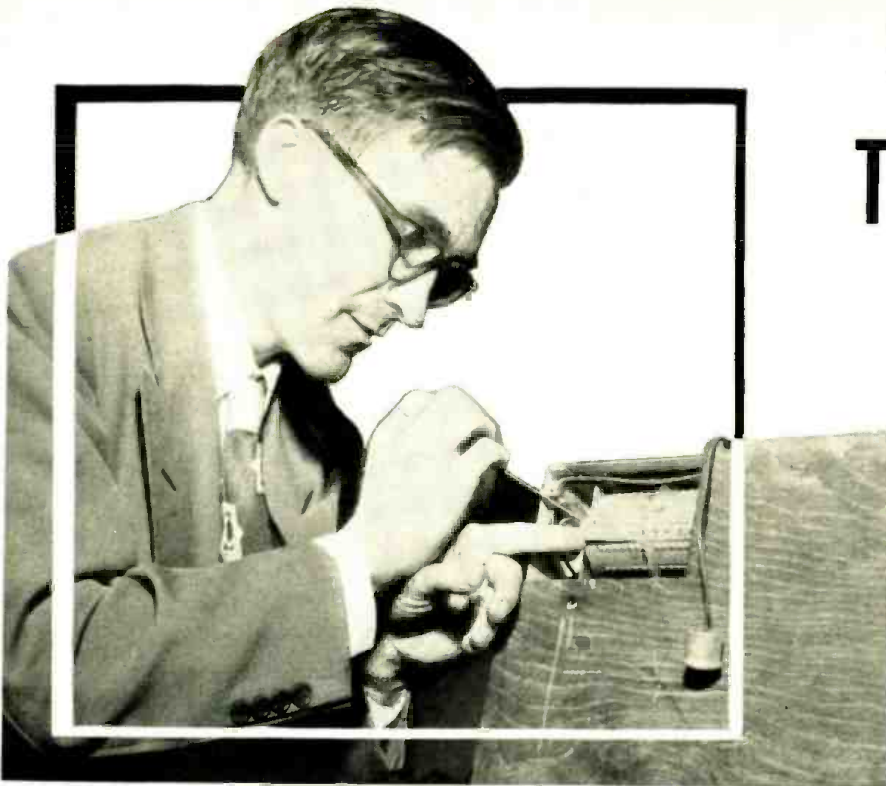
Mechanical details for constructing the improved "integral space transducer." (A) Interior view (left) and completed unit. (B) Top view. (C) Section through x-x' (refer to B). (D) Front panels A₁ and A₂ (left) and top view of front panel assembly. (E) Back panels (left) and curved horn sides. (F) Struts (left), plywood mounting base (top right), speaker mounting board (bottom right), and fitting piece (center right). See text.

CURRENT TV TOPICS

By

WALTER H. BUCHSBAUM

Television Consultant
RADIO & TELEVISION NEWS



Inserting u.h.f. strips into a turret type tuner in a TV receiver.

Data on four TV service problems: spot blanking, foldover, vertical retrace lines, and installation of u.h.f. strips.

MANY of our readers have presented common service problems and since quite a few are similar, we are going to cover four of these topics here. One of the most frequently asked questions is about a bright spot on the screen after the set has been turned off. This phenomenon contributes to shorter tube life and therefore concerns both the service technician and the set owner. The appearance of retrace lines, on weak stations especially, is also a cause of frequent inquiries. Foldover at either side of the picture is another recurring problem. As a sign of TV's rapid progress we have also been asked about the installation of u.h.f. strips into some v.h.f. turret tuners and the difficulties encountered there. In this article all four topics will be discussed individually and circuits shown which can be applied to almost all sets to remedy the various defects.

Spot Blanking

In some receivers, especially recent models using higher anode voltage and electrostatic focus, a circular spot appears on the screen after the set is turned off. This spot fades away gradually, becoming larger as it gets dimmer. When analyzed carefully the reason for it is found in the fact that the HV condenser or the external and internal conducting surfaces on the picture tube retain the HV charge even after the deflection circuit is shut

down. With HV still on the second anode and no deflection power applied, a circular spot appears. Electrons flow from the cathode to the second anode, lighting up the screen and at the same time discharging the condenser. When finally the charge drops below the voltage required to light up the screen, the spot disappears. Because each time the set is turned off only the center of the screen is hit by the electron beam, the screen wears out faster at that point and eventually a yellow or brownish spot may appear.

An ideal solution to this problem is to connect a resistance across the condenser at the moment the set is turned off. This would mean HV present at a switch contact and a chance of arcing as the switch is closed. The difficulty of such a scheme prevents its use in commercially available receivers.

Next to switching in a discharge resistance we could attempt to connect a very high resistance across the HV condenser permanently. In order not to load down the HV supply only about 10 microamperes could be drawn by this bleeder. This would mean a 1000 megohm resistor, able to stand a voltage of at least 10 kv. The only type of resistor applicable is the spiral, carbon-coated HV type used as a bleeder for HV meter multiplier probes. The size and expense of such a resistor obviously limits its usefulness.

There are, however, two different usable methods for removing this undesirable spot. One is to utilize the picture tube as a discharge resistor, the other is to move the electron beam to the side so that it hits the anode directly without reaching the screen. The first system is fairly simple to install and operates reliably and smoothly. When the picture tube is adjusted to give maximum brightness, maximum current flows through it. In the case of a shut-off spot simply adjusting the brightness control to maximum will remove the spot, because the large current passing through the picture tube discharges the HV condenser quickly. Many customers are willing to make this adjustment manually every time the set is turned off. For those who do not want to be bothered with this additional adjustment, an automatic circuit can be added. Fig. 1 shows four such circuits—all based on the principle of maximum brightness on the CRT when the set is turned off.

The brightness is mainly a function of the d.c. voltage between cathode and grid of the picture tube. In some receivers the cathode gets the picture signal and then the grid is at a d.c. potential, adjustable by the brightness control. Other models use grid drive with the cathode as the d.c. brightness-controlling element. Maximum brightness occurs when the grid is either at the same potential as the cathode or slightly more positive than the cathode. The purpose of each of the four switches *S* is to effect this condition at "Off" without interfering with the video signal. In order to function correctly, switch *S* must be part of the "Off-On" a.c. switch. Some receivers use a double-pole, single-throw switch mounted at the end of some other control, but the majority use only a single-pole switch. Fortunately most of the potentiometer manufacturers also market double-pole, single-throw switches which will fit in the same spot as the single-pole switch. It is necessary to ascertain the exact make and type of potentiometer and then buy a suitable switch.

Fig. 1A illustrates a case where the cathode is directly connected to the video amplifier and the grid receives its d.c. voltage through the divider network *R₁*, *R₂*. As the set is turned

off, switch *S* connects the grid to "B plus", making the grid momentarily more positive than the cathode. In the next instant the "B plus" voltage is shut off, the HV source is also removed, and the charge on the HV condenser has passed through the picture tube during the brief moment when the grid was more positive than the cathode. The same principle is used in case Fig. 1B where the grid is essentially at "B plus" and the cathode is connected to ground through switch *S*. Figs. 1C and 1D show arrangements where the grid is at ground potential or the cathode is at about one-half the "B plus" voltage. In either case the spot blanking is accomplished by switching the d.c. element to give maximum brightness. Although actual circuits will vary, most TV receivers will use some scheme similar to one of these four circuits for driving the picture tube. If one remembers to make connection only to the d.c. element, the one having condenser *C*, going to ground, no difficulties should be encountered.

The second method for removing the spot is to cause the electron beam to move either sideways or up or down right after the set is turned off. In the electromagnetic-focus type sets the d.c. flowing through the focus coil as the "B plus" was shut off often accomplished this deflection. In addition, the loss of focus current prevented a focused spot from appearing, resulting in such a dispersed electron beam that it was hardly noticeable. New, automatic-focus picture tubes retain focus much longer, therefore the spot is more visible. One of the simplest methods of deflecting the spot consists of mounting a small permanent magnet either on the flared portion of the tube or at some convenient point on the cabinet or tube mounting. Locate the magnet at either top or side so that it deflects the picture slightly. When the set is turned off, the deflection-yoke power is gone, less HV is applied, and only the magnet affects the electron beam. In this condition the effect of the magnet is usually enough to move the spot completely off the screen. When operating normally the deflection yoke has much more control than the magnet and keeps the picture properly centered. Where a PM centering magnet is used this should not be disturbed or used to recenter the picture because it will counteract the additional small magnet. Twisting the deflection yoke slightly will be sufficient to overcome the small decentering due to the new magnet. Taping the magnet in place after its best location is determined, cures the spot appearances once and for all.

Vertical Retrace Lines

The photograph, Fig. 2, shows the appearance of vertical retrace lines when either insufficient blanking, a weak picture, or a slightly weak picture tube prevent perfect reception. In the last instance a picture tube rejuvenator may help for a while, but

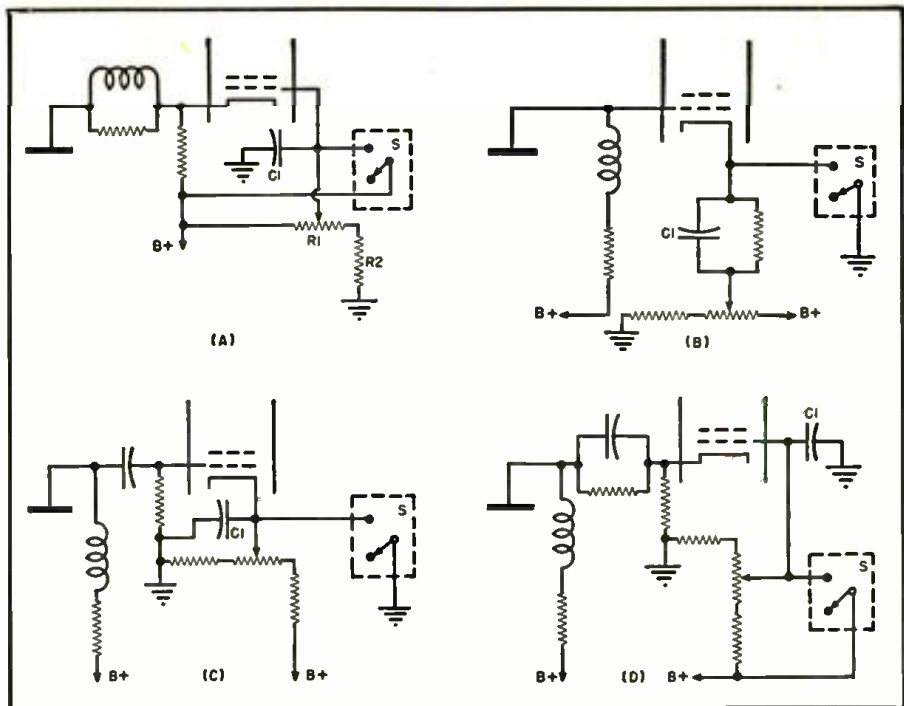


Fig. 1. Four switching methods to remove the spot on the cathode-ray tube. All switches are to be ganged with the "Off-On" switch. (A) Circuit where cathode is directly connected to video amplifier. (B) Circuit where grid is at "B plus" and cathode is grounded through *S*. (C and D) Circuit where grid is at ground potential or the cathode is at about one-half the "B plus" voltage.

the best permanent solution is, of course, a new picture tube. There are, however, various other reasons for the appearance of these retrace lines. Usually it is due to either insufficient video signal or excessive brightness. Normally the blanking pulses extend into the "blacker than black" region of the video signal and cut the picture tube off during the retrace period. If the video signal is so weak that it does not go sufficiently negative to cut the tube off at the retrace period, the lines will appear. Even with a fairly strong picture the brightness control may be set so far that the blanking pulses cannot reach the cut-off voltage of the picture tube. It may even be necessary for the brightness control to be advanced that far in order to overcome the ambient light. In those instances where the picture is satisfactory with the exception of vertical retrace lines, a simple auxiliary blanking circuit can be added. Several major manufacturers include these circuits in their designs.

The principle used here requires that in addition to the blanking pulse contained in the video signal, a strong

pulse be applied to the picture tube during the vertical retrace time. This additional pulse is obtained from the vertical output section and, in order to cut the picture tube off, must be positive when applied to the cathode and negative when applied to the grid. For simplest circuitry the additional pulse should always be applied to the element not driven by the video signal. Three basic circuits are shown in Fig. 4. In Fig. 4A the grid of the picture (Continued on page 148)

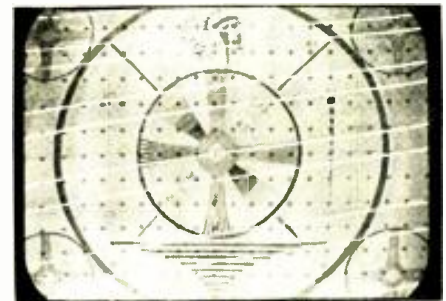
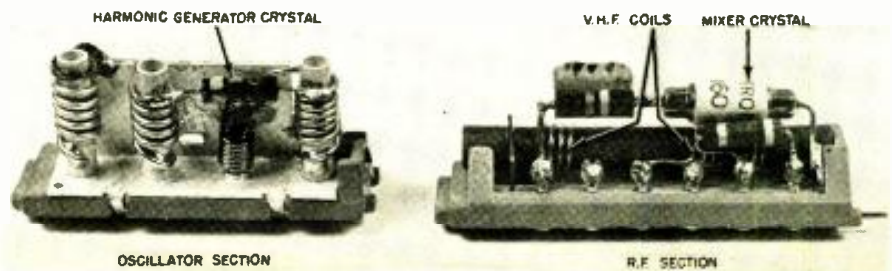


Fig. 2. The appearance of vertical retrace lines when there is insufficient blanking, a weak picture, or a weak picture tube.

Fig. 3. Close-up view of the u.h.f. strips used in the Standard Coil tuner.





A COMPACT BANDSWITCHING V.F.O. MULTIPLIER

Front chassis view of the home-built v.f.o.-multiplier. Three type 6AG7 tubes are used in this compact unit.

By **EARL SNADER**, WØZFO

Construction details on a low-power driver for 80-75, 40, and 20 meters. Power output is about .2 of a watt.

IF YOU are looking for a compact v.f.o.-controlled bandswitching multiplier for that new pint-sized medium power rig you are building, here is something that may fill the bill. This unit delivers two-tenths of a watt output on 80-75, 40, and 20 meters, enough to drive a 2E26. Frequency control is by means of a built-in v.f.o. operating in the 3.5 to 4.0 megacycle range. A Clapp oscillator circuit is used in the v.f.o. Interstage coupling is by means of broadband couplers, eliminating the need for any separate multiplier tuning controls. The tuning condenser for the v.f.o. is mounted with a *National* type SCN dial drive mechanism. One gang of a three-gang, five-position, two-circuit-per-gang bandswitch projects out the rear of the chassis, to be used for bandswitching in circuits independent of the multiplier. The entire v.f.o.-multiplier assembly is mounted on a chassis $7\frac{3}{4}$ " wide by 4" deep by 3" high. Power requirements include 6.3 volts a.c. at 2 amperes for heaters, 75, 105, and 180 volts regulated for the v.f.o. screen, plate, and multiplier screens respectively, and 300 volts for the multiplier plates. Three type 6AG7 tubes are used.

Since no commercially-built chassis could be found with the right dimensions, one was constructed out of heavy gauge aluminum. It was made in three parts: the top plate measuring $7\frac{3}{4}$ " by 4"; the base measuring $7\frac{3}{4}$ " wide, 3" high, and 4" deep; and a small partition 3" high by 4" wide. In the finished assembly this partition divides the v.f.o. and multiplier com-

partments and provides a mounting surface for the v.f.o. tuning condenser and the broadband coupler trimmers. The chassis base and the partition were both made with $\frac{1}{2}$ " flanges on the bottom and the top. Since the partition is fastened to the top plate before the top plate and chassis base are assembled, notches must be cut in the top flanges of the chassis base to pass the partition for assembly. It will be necessary also to cut small pieces out of the front edge of the partition to clear parts of the *National* SCN dial drive mechanism. Otherwise the partition should fit fairly snug inside the chassis base.

All the coils and the tube sockets are mounted on the top plate, and the location of each can be seen from the photograph. Since the v.f.o. tuning condenser is mounted on the partition, the condenser shaft should be aligned with the dial drive mechanism in the front of the chassis before the partition is permanently fastened in place. A *Hammarlund* type MC-50 variable condenser was used because it is ruggedly built and well suited for v.f.o. applications. Any good 50 μ fd. variable condenser could be used, provided it is equipped with double bearings and brass plates. This condenser is mounted with enough clearance between it and the top plates to allow room for the wiring associated with the v.f.o. tube socket. The v.f.o. tube socket is mounted directly above the v.f.o. tuning condenser. The trimmers for the broadband couplers are mounted on the opposite side of the partition from the v.f.o. tuning con-

denser. They can be mounted on a small bracket first and then fastened to the partition as a unit. Care must be taken to provide a good path for r.f. from the one lug of each trimmer to the chassis because they are grounded in that way.

The bandswitch must be partially disassembled for mounting to the chassis base. The sleeves separating the second from the third gang on this switch must be shortened. A hole is drilled for the shaft to pass through the front of the chassis, and the shaft is mounted securely in this hole with a panel bearing. Three holes, carefully aligned with the shaft hole in the front, are drilled in the rear of the chassis. One of these is for the shaft. The other two are for the switch assembly screws. The rear gang of the switch is then mounted on the back of the chassis, separated from the chassis by $\frac{1}{8}$ " fiber washers. Since the front mounting of the bandswitch will be some distance inside the front of the chassis base, a small aluminum bracket is provided to anchor the front of the switch to the chassis base.

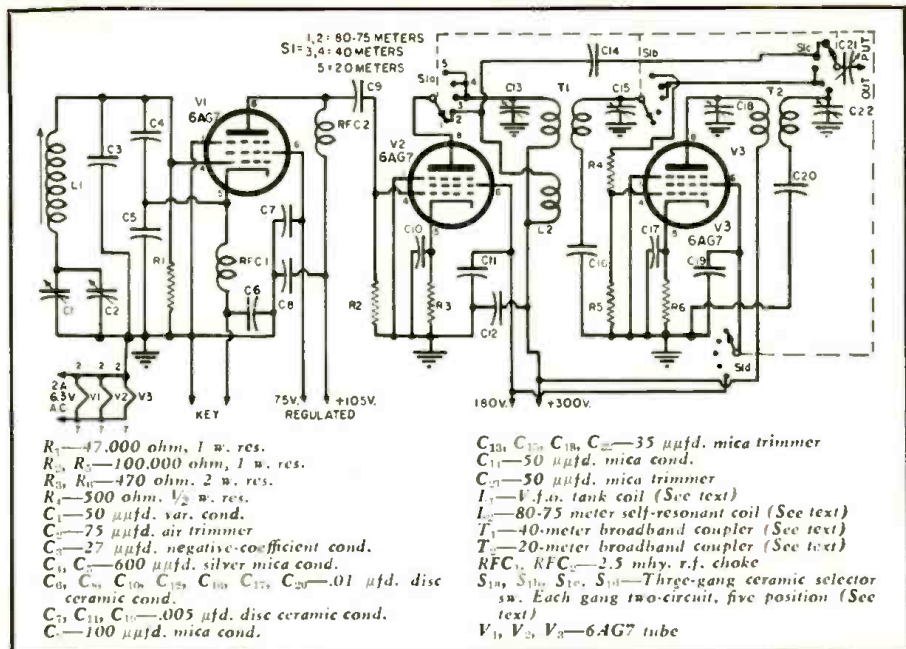
The v.f.o. trimmer is mounted on the rear of the chassis base, directly behind the v.f.o. tuning condenser. There is nothing particularly critical about the location of this trimmer. There should be just enough room to mount it without crowding.

The v.f.o. tank coil consists of 60 turns of No. 28 plain enameled wire, closewound on a slug-tuned ceramic coil form $\frac{1}{2}$ " in diameter. A *Millen* type 69045 form was used in the original model. This is mounted in one corner of the v.f.o. compartment, behind the v.f.o. tube socket and about $\frac{7}{8}$ " from the edge of the chassis. The cathode choke in the v.f.o. circuit, a *National* 2.5 mhy., type No. R-100S, is mounted in the front corner. The v.f.o. plate choke, a pigtail r.f. choke with an inductance of 2.5 mhy., is mounted between the plate lug of the v.f.o. tube socket and a terminal tie strip which also serves to terminate the plate power lead to the v.f.o. and provide a ground connection to the chassis.

The broadly resonant coil in the plate of the first buffer-multiplier tube is closewound on an *Amphenol* type No. 24 polystyrene form $\frac{3}{4}$ " in diameter and $2\frac{1}{4}$ " long. The winding consists of 85 turns of No. 30 plain enameled wire. Single hole mounting is used, and the coil is located about $\frac{5}{8}$ " behind the first multiplier-buffer tube socket.

The two broadband couplers are also wound on *Amphenol* type No. 24 polystyrene forms $\frac{3}{4}$ " in diameter. The 40-meter coupler consists of two coils of 27 turns of No. 28 plain enameled wire. These coils are closewound, and spaced $\frac{7}{16}$ " from each other. The center leads go to the "cold" connections of the coil (the bypass to ground and the 300 volt plate supply lead). The 40-meter coupler can be seen in the photograph showing a bottom view of the v.f.o.-multiplier unit. It is located just behind the bandswitch shaft. The 20-meter broadband coupler is not visible in the photograph, being hidden from view by the bandswitch. It is wound exactly like the 40-meter coupler with the exception that the coils each consist of 16 turns of No. 24 plain enameled wire. Both couplers are mounted with their axes parallel to the top plate but at right angles to each other. The 40-meter coupler is located along the rear edge of the top plate, far enough in from the edge to clear the flange on the chassis base. The 20-meter coupler is mounted along the side of the top plate and near the front. Small brackets were made from heavy gauge aluminum to mount the coupler coils to the top plate in the proper position. When mounted, the couplers should be spaced at least $\frac{3}{8}$ " from the nearest metal, whether it be the bracket or the top plate. This is extremely important and should be carefully noted.

Most of the wiring can be completed before the top plate is put in place. The wiring to the v.f.o. tuning condenser and trimmer, the broadband coupler trimmers, and the bandswitch is done last, after the top plate and



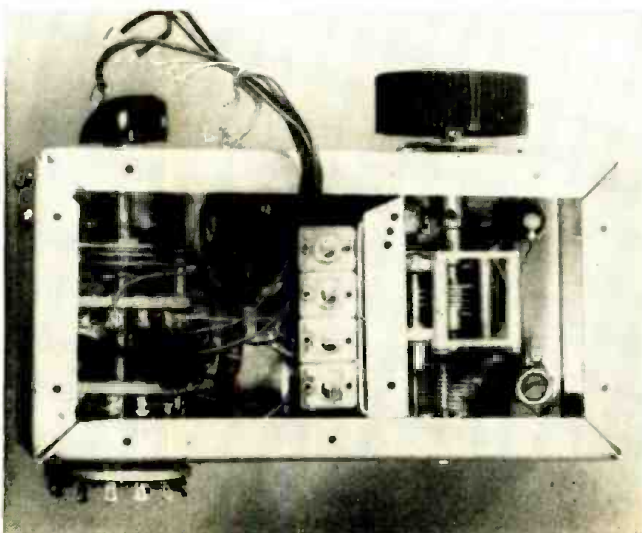
Complete circuit diagram of the bandswitching v.f.o.-multiplier. Two switch positions are provided for the 80-75 meter band and the 40-meter band to allow for switching external circuits to cover the different portions of each of the bands.

chassis base have been assembled together. Wire the filaments first, followed by the cathode and grid resistors and bypass condensers, and then finally the power leads. Condenser C_9 is mounted between a feedthrough insulator in the partition and the grid connection on the first multiplier-buffer tube socket (lug No. 4). Disc bypass condensers are used throughout, to save space and to reduce stray capacitances in the wiring. All bypass condensers and ground leads should come together at one place, to be grounded to the chassis at one place in the multiplier compartment and at one place in the v.f.o. compartment. A single bypass condenser serves to provide a path for r.f. to ground at the "cold" end of each of the three plate coils in the multiplier section. C_{12} performs this function, and coil leads to this condenser should be made

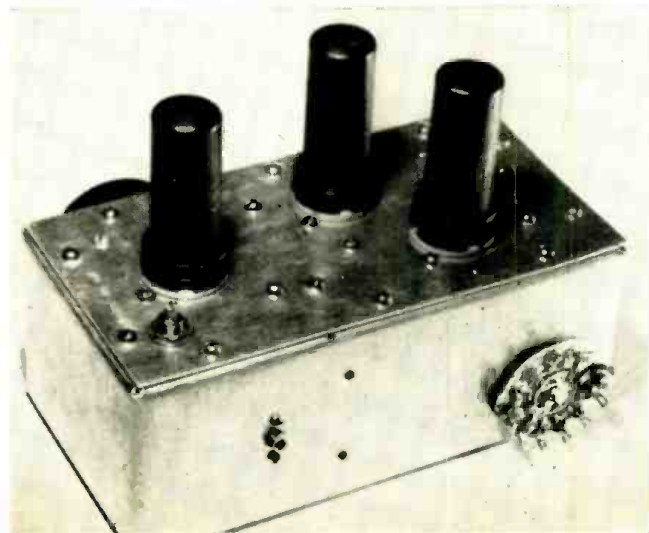
as short and direct as possible. Grid and plate leads in the v.f.o. should be No. 14 bus wire. It is particularly important that all connections in the oscillator circuit be sweated together, because even a slight resistance in any of them may render the oscillator inoperative. This is particularly true of the connections between the rotor of the v.f.o. tuning condenser and the v.f.o. tube itself.

In wiring the bandswitch and the broadband coupler trimmers, connect the lead from each coil to the bandswitch first. Then run the trimmer lead from the bandswitch connections rather than from the coils themselves. The screen lead to the second multiplier tube can be connected to the least accessible section of the bandswitch. This is the underside of the second gang. The other half of that
(Continued on page 152)

Under chassis view of unit. The compact aluminum chassis was constructed in three parts and measures $7\frac{3}{4}$ " by 4" by 3".



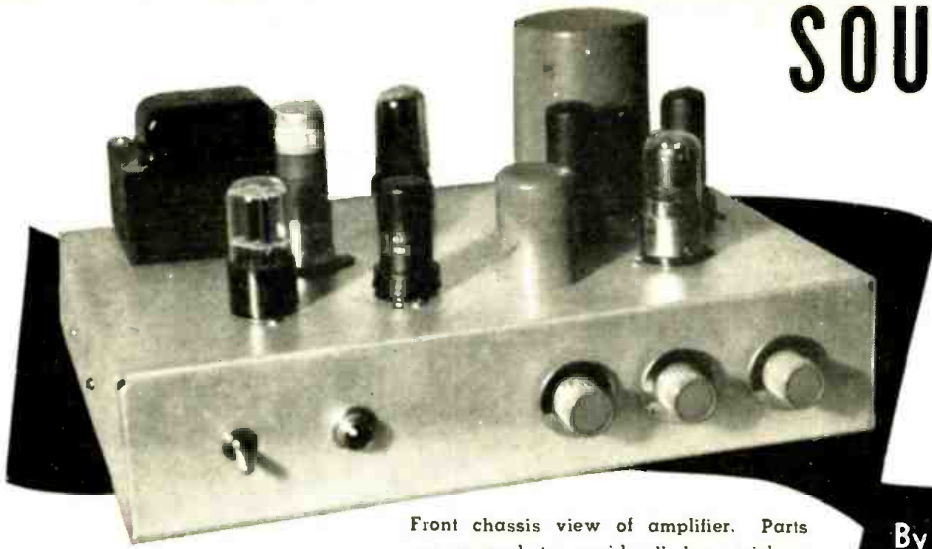
Rear view of v.f.o.-multiplier. The rear gang of the switch is mounted on the back and separated from the chassis by washers.



SOUND SYSTEM

FOR YOUR TV SET

By JOHN POTTER SHIELDS



Front chassis view of amplifier. Parts are spaced to avoid all hum pickup.

Design and construction data on a compact unit and its speaker enclosure. Quality parts are used throughout.

MODERN television receivers, with their large picture tubes and improved circuitry, are capable of producing pictures of excellent size and quality. However, the sound sections of all too many of the television receivers currently in use have been sadly neglected. The audio stages in many of the receivers are no better than those found in the cheap "garden variety" a.c.-d.c. sets, and their speakers are often placed where they receive insufficient baffling. In an effort to overcome these shortcomings, the writer designed the amplifier and speaker combination described in this article. While this combination is capable of producing excellent results,

Over-all view of the author's unit showing amplifier and associated speaker cabinet.



its price is not excessive and it can be easily constructed without resorting to trick circuits. The amplifier can be connected to an existing television receiver without "major surgery," and the speaker enclosure can be used as a convenient stand for a table model receiver or placed alongside a console.

Fig. 2 is the schematic diagram of the amplifier. The power supply section is conventional, consisting of a 5Y3 full-wave rectifier followed by a single-section LC filter. The bleeder resistor (R_{22}) is used to absorb power from the rectifier while the other tube heaters are reaching operating temperature, thus preventing excessive voltage from appearing across the filter condensers. If a slow-heating rectifier, such as a 5V4, is used the resistor can be eliminated.

Much consideration was given as to the type of output tubes to use in

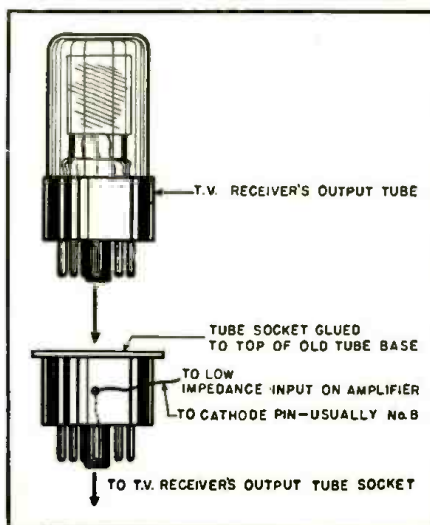
this amplifier. Although triodes are usually preferred because of their excellent speaker-damping qualities and stability, they are relatively expensive and, more important, they are hard to drive, usually requiring a push-pull driver stage. After consulting the tube manuals, it was decided to use a pair of 6F6's pentode connected, operating strictly class A. When operated in this manner, 6F6's require a grid-to-grid driving voltage of 58 volts for a power output of 10.5 watts. Although 6F6's can be operated as triodes, they then require a grid-to-grid driving voltage of 123 volts for a power output of 13 watts.

The split-load type of phase inverter was chosen to drive the output stage as it will easily provide the 58 volts grid-to-grid required by the pentode-connected 6F6's, with low distortion and good balance throughout the audio range. The cathode and plate load resistors in this stage should be a matched pair in order to have equal output voltages. The cathode and plate-load resistors were made rather low in value in order to assure good high frequency response and also to keep the cathode-to-heater voltage as low as possible, thus reducing hum difficulties.

A 6J5 is used as a voltage amplifier and is direct-coupled to the split-load phase inverter. This is possible due to the high positive voltage on the phase-inverter cathode. This direct coupling extends the response of this stage down to d.c. and since there is no coupling condenser, one source of phase shift is eliminated. It should be noted that there are only two coupling condensers in the circuit between the grid of the 6J5 voltage amplifier and the output transformer.

Negative feedback is applied to the unbypassed cathode of the 6J5 from the secondary of the output transformer. The amount of feedback that can be applied depends, to a large extent, upon the characteristics of the output transformer used. Therefore, a

Fig. 1. Method for connecting amplifier into television set without major rewiring.



good quality transformer should be used. The UTC CG-19 output transformer is recommended. Although not as expensive as many of the larger units, it is capable of excellent performance. With feedback, the amplifier is flat from 20 cps to over 20 kc. with no sign of instability. When installing the feedback resistor (R_{11}) a scope should be connected to the amplifier to make sure that no ultrasonic oscillations exist when the desired amount of feedback is obtained. If a loud squeal or motorboating is heard with the feedback loop connected, reverse either the primary or secondary connections (not both) to the output transformer. The value of the feedback resistor shown in the schematic is correct when using the CG-19 output transformer. If a different transformer is used, it is recommended that a pot. be installed temporarily in place of the feedback resistor, and adjusted for the proper amount of feedback. After setting the pot. for the proper amount of feedback, measure the resistance across the pot. and install a fixed resistor in its place.

The tone control stage uses the Thordarson degenerative tone control circuit employing one half of a 6SN7. The operation of this circuit is as follows: The cathode resistor in this stage is higher in value than the plate resistor, hence most of the signal appears across the cathode resistor. The circuit being resistive, the stage gain is equal for all frequencies. For bass boost, the cathode resistor is shunted with a suitable inductance. Degeneration of the lower frequencies is greatly reduced due to the low impedance of the inductance at low frequencies, consequently the gain of the stage is greatly increased at the lower frequencies. To attenuate the bass, the same inductance is introduced into the grid circuit of the following stage. In this case, the low impedance of the inductance at low frequencies bypasses the low frequencies to ground. For treble boost, a condenser is shunted across the cathode resistor of the tone control stage. The lowered impedance of the condenser at high frequencies causes a decrease in degeneration at the higher frequencies, consequently the stage has more gain at the higher frequencies. The highs are attenuated by shunting a condenser across the next stage grid resistor, thus bypassing the high frequencies to ground.

The input stage uses the other half of the 6SN7 connected either as a grounded-grid amplifier (for low-impedance inputs) or as a conventional amplifying stage (for high-impedance inputs). For low impedance inputs, the jack of the amplifier is connected across the 1000-ohm cathode resistor R_2 . As long a connecting cable as desired can then be connected to the cathode resistor of the audio output tube in the television receiver. In order to avoid elaborate surgery on the receiver, an adapter such as is shown in Fig. 1 can be made. Then it

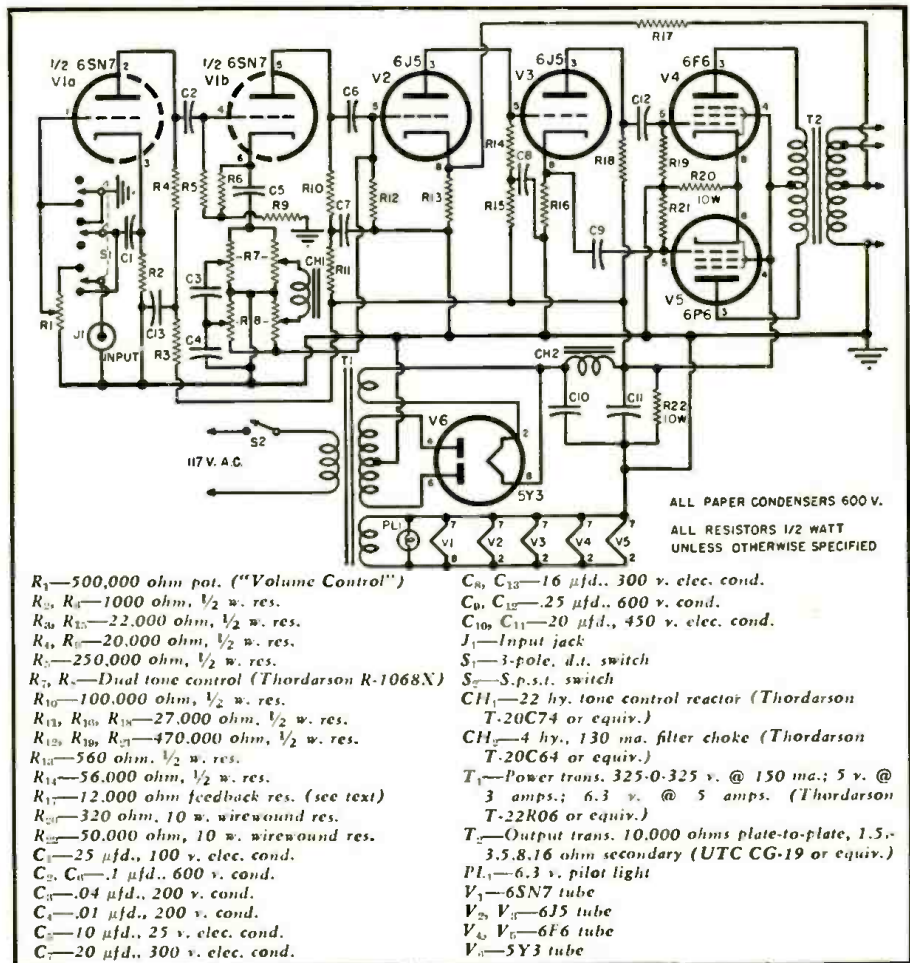
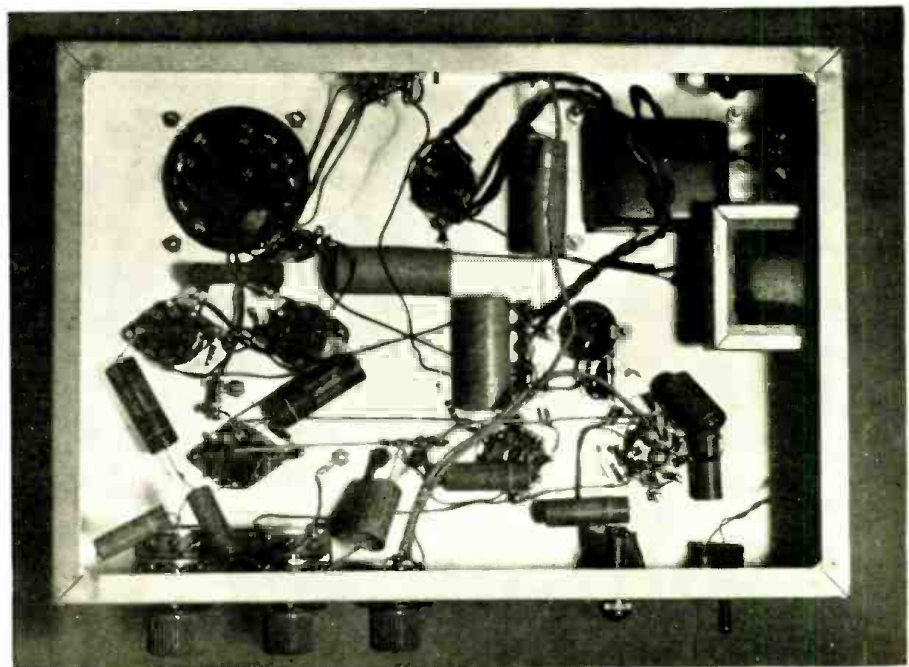


Fig. 2. Complete circuit diagram of amplifier. Quality parts are used throughout.

is only necessary to remove the audio output tube in the receiver, insert the adapter in the socket, and then insert the output tube into the adapter. It is necessary that any cathode bypass condenser connected across the output tube's cathode resistor be removed.

This may mean a slight decrease in output due to degeneration, however the response of the stage will be improved. If it is desired to silence the receiver's speaker when using the amplifier, it can be disconnected from the (Continued on page 94)

Under chassis view of amplifier. Careful placement of parts avoids interaction.



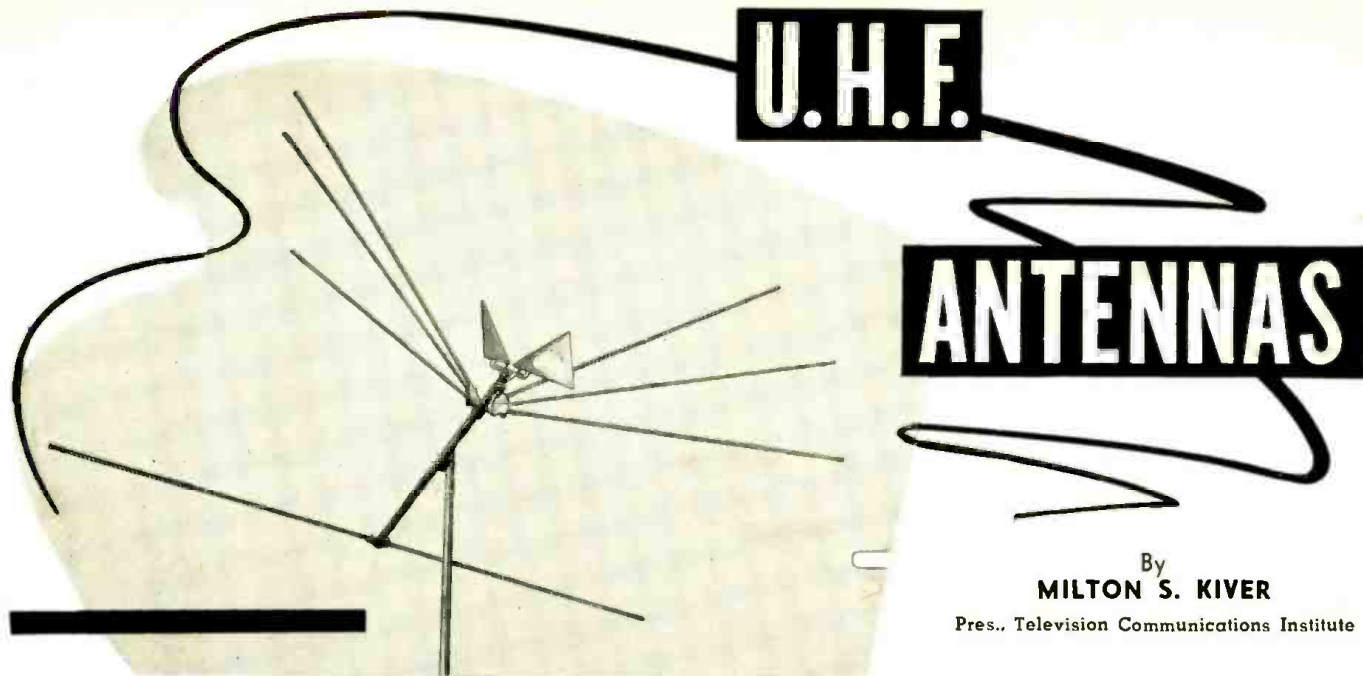


Fig. 1. A combination v.h.f.-u.h.f. antenna. This is the "Jetenna 283" made by JFD Manufacturing Co.

Part 3. Details on some of the combination v.h.f.-u.h.f. arrays which are now being marketed by antenna companies.

A PROBLEM that will soon be facing many TV set owners and technicians is that of choosing the u.h.f. antenna best suited to their location and station frequency. In areas where only u.h.f. stations are assigned, the choice will be between the various u.h.f. antennas available. But in many parts of the country there will be both u.h.f. and v.h.f. signals and for these locations the following choice will exist.

1. To use one all-v.h.f. antenna and one u.h.f. antenna, each with its own lead-in line.

2. Or, to use a combination v.h.f.-u.h.f. array with a single lead-in.

Choice No. 1 is the more flexible of the two and generally will provide the set with stronger signals. Whenever you combine two arrays possessing widely differing responses, a certain

amount of loss will be incurred by both sections. If the combination antenna stems from the basic "V" array, then the angle of the antenna rods which is best for v.h.f. reception will not be best for u.h.f. reception. By the same token, the best adjustment for u.h.f. reception is not the most desirable for v.h.f. signals. And, as is most common, when you choose a compromise position, then reception suffers in both regions.

If the combination array is of the type shown in Fig. 1, some sort of decoupling network must be inserted between the u.h.f. and v.h.f. elements. In essence, what we are principally trying to do with this decoupling or filter network is to prevent the v.h.f. assembly from affecting u.h.f. response. (The u.h.f. antenna will usually have little effect on the v.h.f. response and for

most practical purposes may be disregarded.) Signals passing through the decoupling network will suffer some attenuation and, in this respect, less than optimum operation will be obtained.

On the other hand, whatever loss is occasioned by combining v.h.f. and u.h.f. elements in strong and medium signal areas will have little noticeable effect on the picture. Furthermore, combination arrays will be more economical, both from the standpoint of initial cost and of subsequent installation, and cost is a very potent factor in sales.

The consensus among antenna engineers is that while better results are generally obtainable from separate v.h.f. and u.h.f. arrays, a substantial market will exist for combination arrays and these will be manufactured in quantity.

The opening of the u.h.f. band has only just begun and the number of combination arrays is still quite limited. Many manufacturers, when asked about their plans, indicated a "wait-and-see" attitude. However, several combination arrays have already been marketed and it may be of interest to

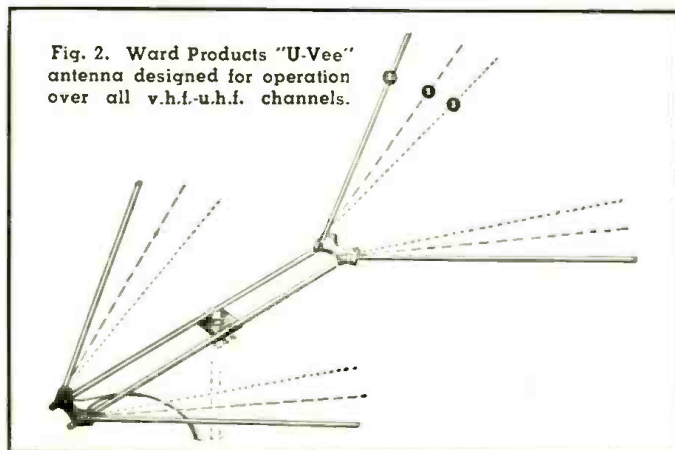


Fig. 2. Ward Products "U-Vee" antenna designed for operation over all v.h.f.-u.h.f. channels.

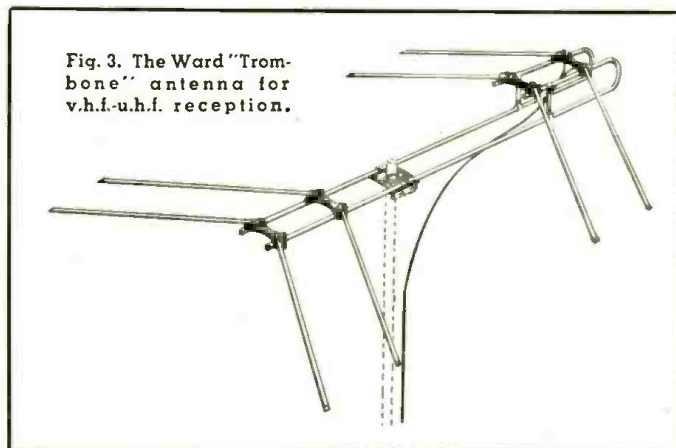


Fig. 3. The Ward "Trombone" antenna for v.h.f.-u.h.f. reception.

examine these to see what form they take and how they operate.

JFD's "Jetenna 283". JFD has recently announced an array to operate over all v.h.f. and u.h.f. channels. Shown in Fig. 1, it is seen to consist of a low band conical for v.h.f. signals and a broadband triangular (or fan) dipole for u.h.f. signals. A single lead-in line delivers signals to the receiver through the use of a special coupling device mounted directly at the antenna itself.

By virtue of the positioning of the various elements, the active rods of the v.h.f. array serve as reflectors for the u.h.f. dipole. The v.h.f. elements, in turn, have their own reflector. A gain close to 9 db is available from the v.h.f. section while the u.h.f. section gain will be on the order of 4 db. The u.h.f. plates are stamped of aluminum, with a tip-to-tip length of 16 inches. The array will match a 300-ohm line. Finally, the two triangular plates of the u.h.f. array will have a forward angle of 35 degrees to match the forward inclination of the v.h.f. elements.

Vertical directivity of this u.h.f. array is quite broad but the horizontal directivity, with the reflector elements, is good. For local areas surrounding a u.h.f. station where ground reflected signals are low, good results may be obtained with this array.

"V" Type Combination Antennas. The ability of a "V" type of antenna to receive v.h.f. and u.h.f. signals was briefly mentioned in the first article of this series. Several antenna companies have taken advantage of this property to devise modified "V" antennas which will operate over all channels with good gain.

The modified array which all manufacture in one form or another is shown in Fig. 2. Basically, the array consists of four rods; two at the front and two at the rear. The lead-in line to the receiver (300-ohm twin-lead) connects to the two rear rods. Comparing this arrangement with arrays with which we are familiar, the only conclusion we can draw regarding the front two rods is that they serve here as directors. This they do. However, closer examination of the array indicates that unlike more conventional arrays, the two front rods are electrically

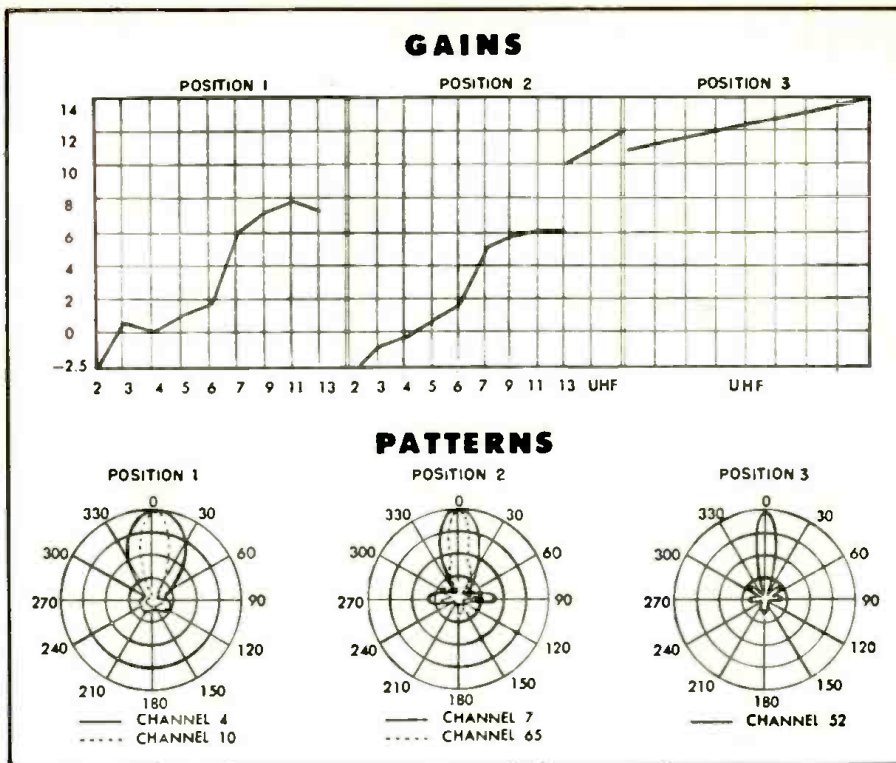


Fig. 4. A comparison of the response curves and the antenna gain for each of the three positions of the Ward Products' "U-Vee" antenna. See Fig. 2.

ally connected to the two rear units through the two rods comprising the "boom". The purpose of these connecting rods is two-fold.

First, the two connecting rods serve as a transmission line to conduct whatever signal is picked up by the two front rods to the two rear rods. In addition, the two rear rods also pick up that portion of the signal which passed over the front rods and combine this with the energy received from the front rods via the connecting rods. Obviously, to obtain maximum results from this combination, the length of the connecting rods must be carefully chosen. Signal pick-up from the rear of the array is low because the energy which approaches the array from the rear is captured by the front and rear rods and combines out-of-phase and is therefore cancelled out.

The second purpose of the connecting rods is to support both front and

rear dipoles and produce a mechanically sturdy array.

It is characteristic of "V" type antennas that the longer each side of the "V" becomes as compared to the operating frequency of the signal, the narrower the angle between the sides must be for an optimum high-gain, single-lobe pattern. Thus, if we use the same "V" for operation on low- and high-band v.h.f. and for the u.h.f. region, then the angle to which the bars must be set depends upon the conditions in your locality.

In position No. 1, Fig. 2, reception is best on the v.h.f. band. The included angle between the rods is 90°. The manufacturer also suggests application of this antenna with the 90° angle for scattered u.h.f. stations in a metropolitan area. In such strong-signal u.h.f. service areas a careful check at the time of antenna installation can determine a fixed position for the 90° array that will allow good re-

Fig. 5. The JFD "Ultra V-Beam" antenna for v.h.f.-u.h.f. use.

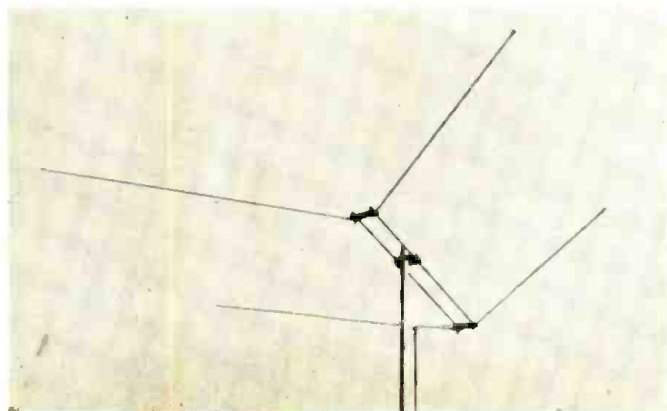
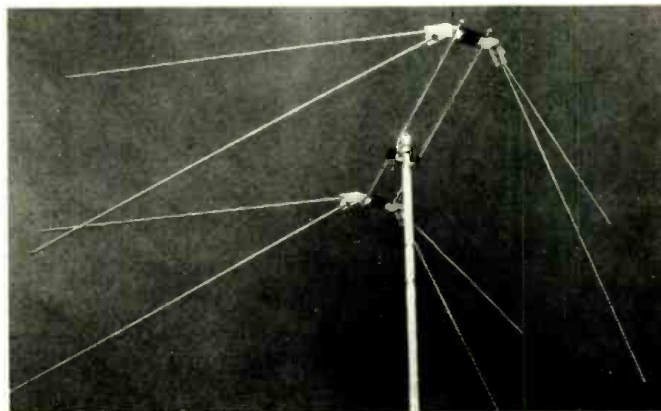


Fig. 6. Another combination v.h.f.-u.h.f. array, made by RMS.



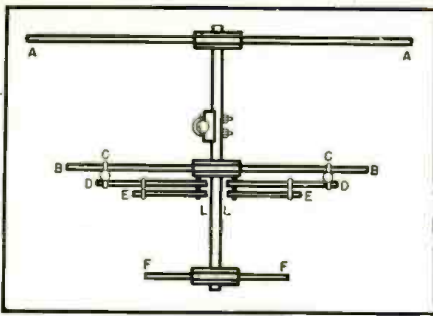


Fig. 7. The v.h.f. portion of the "Ultra Q-Tee" antenna shown below in Fig. 9.

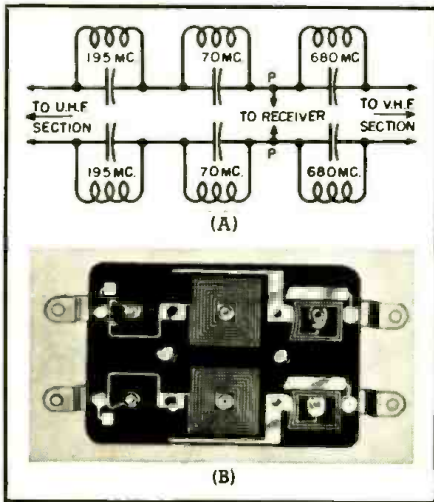


Fig. 8. (A) Low-frequency equivalent circuit filter which prevents interaction between v.h.f.-u.h.f. sections of "Ultra Q-Tee". (B) Actual appearance of filter.

ception on all nearby u.h.f. channels together with both near and distant v.h.f. channels.

In position No. 2, Fig. 2, the included angle is now 60°. Reception is divided between v.h.f. and u.h.f. channels, with the highest u.h.f. channels suffering the most due to lobe break up.

In the final position, No. 3, Fig. 2, the included angle between the dipole rods is 45° and now best reception is obtained on the u.h.f. channels, especially those located above 750 mc. The v.h.f. reception in this position is below normal and likely to be unsatisfactory except in strong v.h.f. signal areas.

A comparison of the response curves and the antenna gain for each of the

three positions is given in Fig. 4. Note in all instances how much better this array performs as the frequency rises. This is an especially desirable characteristic for u.h.f. reception.

The "U-Vee" antenna, as this array is called by its manufacturer (*The Ward Products Company*), can be obtained stacked for improved reception. (*JFD* produces a similar antenna but calls it the "Ultra V-Beam." See Fig. 5. Its rods also have provision for altering the included angle to suit the frequency or frequencies of the stations to be received.)

Ward Products has a variation of the "V" antenna which it calls the "Trombone." See Fig. 3. Use of this antenna on the u.h.f. channels is similar but not identical in principle to the "U-Vee" array. The 90° angle for all four "V's" that gives best fringe-area performance on both v.h.f. bands will produce multiple lobes over the u.h.f. range. This can still be useful in the primary service area of u.h.f. stations but it will prove unsatisfactory in weak signal areas or where there are multiple reflections.

According to the manufacturer, the "Trombone" is not peaked for a single lobe over the u.h.f. band by using the 60° angle (mid-position) for all four "V's". This arrangement gives highest gain on only the lowest u.h.f. channels (near 500 megacycles) and reduces the gain in the v.h.f. band. A better choice for good low-channel "Trombone" performance is to set only the forward pair of "V's" to 60°, leaving the back pair (on the "Trombone" loop) at 90°. When the high end of the u.h.f. band comes into use, above Channel 62, the forward pair of "V's" can be set at 45° included angle for top performance with minimum reduction in v.h.f. gain.

The best choice for the majority of the u.h.f. channels is to set the three forward "V's" to 60° and the back "V" at 90° (widest angle). This gives optimum gain at u.h.f., with a partially-split forward lobe that is said to allow considerable latitude in lining up different u.h.f. stations, but still giving a good front-to-back ratio and minimum side lobes for ghost rejection. Performance on the v.h.f. channels is still good, with a fairly narrow main lobe and good front-to-back rejection.

Variations on the basic "V" are end-

less and it may be expected that different manufacturers will put other twists in it. The *RMS* array is shown in Fig. 6 and it is seen to possess two rods at each point where the "V" of Fig. 2 uses one. Stacking of the "V's" is shown in Fig. 10. "Q" bars are used to connect the upper and lower stacks and are so designed to raise the apparent impedance of each section so that the antenna will work effectively into a 300-ohm load.

The "Q-Tee and "Ultra Q-Tee". The "Ultra Q-Tee" antenna, Fig. 9, is another combination v.h.f.-u.h.f. array that possesses a number of features which differ from the other combination antennas we have just discussed. The u.h.f. portion of this array consists of the two foremost rods that are tilted forward. The straight rod just behind them serves as the reflector. The same straight rod also serves as a director on the upper v.h.f. band for the array of rods that are positioned behind it. These other rods form the v.h.f. section of this array.

In order to understand the reason for using this particular form of antenna, let us first consider the v.h.f. section. This is shown in Fig. 7. Dipole B-B is cut for a half-wavelength at 63 mc. (Channel 3) and this rod is designed to receive all of the low-band Channels (2-6). Rod A-A is the reflector for dipole B-B and its length is somewhat greater than B-B's.

Dipole D-D is cut for a full wave at the center of the high v.h.f. band C,C are printed circuit isolation filters, resonant at 195 mc. and designed to isolate the low-channel dipole (B-B) from the high channel dipole (D-D). Rod E-E, a matching and phasing section, performs a dual function and accounts for the operational characteristic of this antenna. On the high v.h.f. channels elements E-E are "T" match sections which tap the dipole (D-D) and provide a 300-ohm termination at (L-L). The high channel antenna is, therefore, a full-wave antenna "T"-matched, with a half-wave director (F-F).

On the low channels the isolation filters (C,C) have a low-inductive impedance since they operate below their resonant frequency. The high channel dipole (D-D), combined with element (E-E), forms a double "T" matching section which taps dipole (B-B) to

(Continued on page 120)

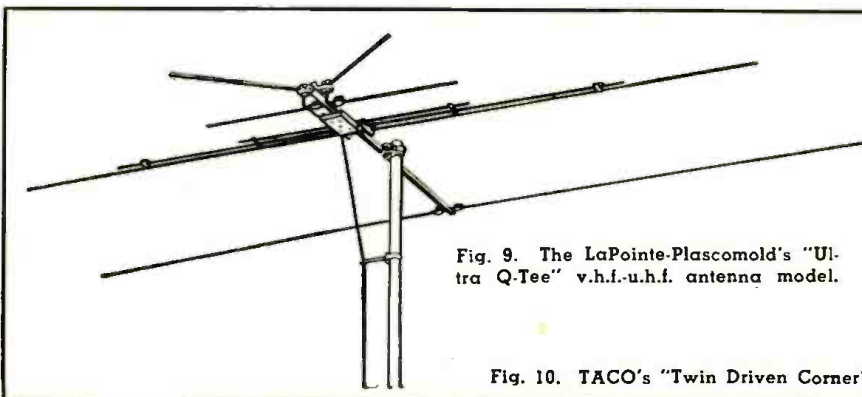


Fig. 9. The LaPointe-Plascomold's "Ultra Q-Tee" v.h.f.-u.h.f. antenna model.

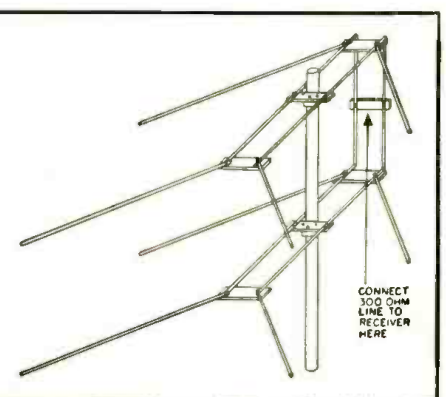


Fig. 10. TACO's "Twin Driven Corner" unit.

WRITING FOR PROFIT AND PRESTIGE

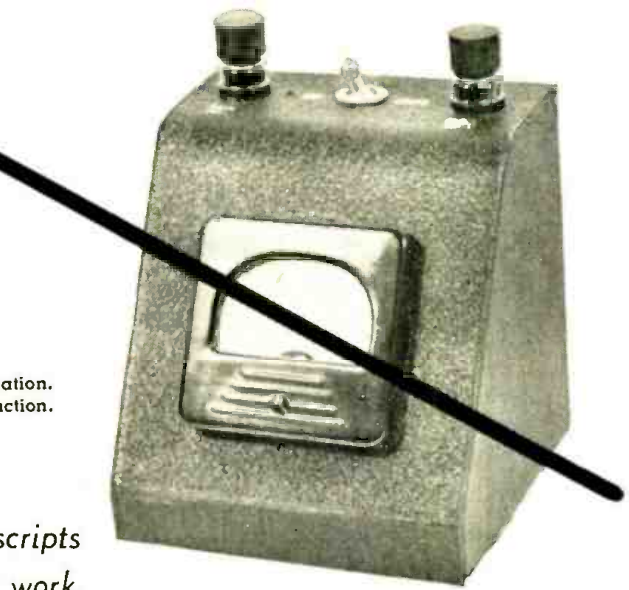
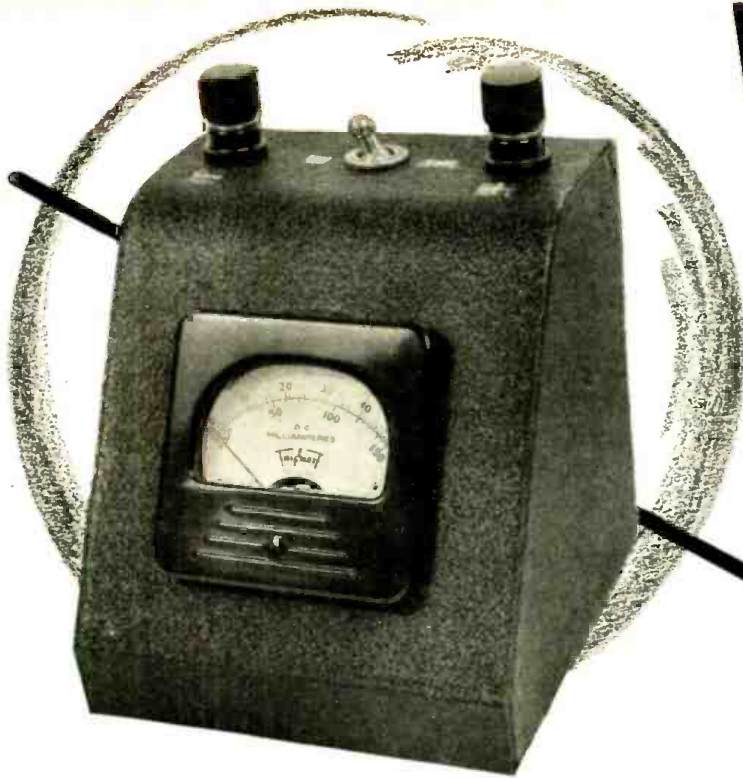


Fig. 1. A sharp, crisp photograph of the type acceptable for publication. (Right) A fuzzy, out-of-focus picture such as this is not suitable for reproduction.

By
LOUIS E. GARNER, JR.

Tips from an "old hand" on how to prepare manuscripts to insure acceptance and highest rates for your work.

CONSIDERING the number of experimenters, technicians, and radio amateurs in the nation, the variety of available subjects, and the excellent rates paid by technical magazines, it is indeed surprising that more of these men don't turn to writing for prestige and profit. Technical writing offers a way for experimenters to make their hobby self-supporting, for radio-TV technicians to profitably fill in their "no-work" time, and for beginning engineers to gain professional recognition.

Probably every ham or engineer who has worked on or designed a new test instrument, an interesting control device, or a "gadget," and every technician who has developed a new "kink" in his service technique, could write an interesting and salable article—*provided* he took the time to do so and, equally important, went about the job in the right way. For good technical articles don't just "happen"—there is a definite technique to writing articles that will sell; a technique that may be applied equally well by the beginner or the experienced man, and a technique that will go a long way towards insuring success irrespective of the comparative writing skill of the individual.

Before starting an article, or even an outline, for that matter, the prospective writer should make an import-

ant decision—whether the article is to be written primarily as a means of securing additional income, or primarily for professional recognition (although both types of compensation may result). This decision will determine to a large extent the available market, the possible subjects, and the type of presentation.

Articles published by the official organs of professional groups and societies carry the greatest prestige value, although the monetary compensation may be very low. In fact, many professional journals accept the articles as "contributions" without any cash payment whatsoever. This does not

imply that their standards are low. Often, it will prove quite difficult to prepare an article measuring up to the high standards enforced. However, junior engineers find that preparing papers for professional journals offers an excellent means of gaining recognition and prestige.

Professional journals often have stringent rules for submitting manuscripts and prospective authors should obtain all the necessary information from the editors before starting an article or paper. In many cases, manuscripts must be typed in a certain manner, must be submitted in duplicate or triplicate, and all drawings must be finished ink drawings suitable for reproduction.

The more popular technical magazines, on the other hand, are not as strict concerning the mechanical preparation of the article, but may be many times more critical on the style of presentation—they all insist on an informative, easy-to-read, easy-to-understand, and, above all, interesting article. Since writing an interesting article is often more difficult than writing a "letter-perfect" but dull article, the compensation is greater. A technical writer, preparing an article for the more popular technical magazines, may be able to average as much as \$15 to \$30 an hour for actual writ-

(Continued on page 133)

Fig. 2. Neatly and clearly drawn diagrams, with all of the components properly identified, add value to your manuscript.

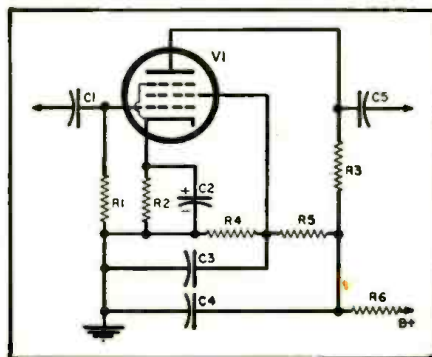




Fig. 1. The "Vest-Pocket Receiver" housed in a small plastic box.

A VEST-POCKET RECEIVER

By

E. G. LOUIS

Complete construction details on a compact unit which incorporates a commercially-available printed circuit.

THERE are two basic approaches that may be used in designing a radio receiver. The more popular approach is to provide considerable r.f. (or i.f.) gain, together with comparatively little audio gain after the detector. This approach is mandatory in the case of sensitive receivers, where weak r.f. signals must be picked up, and where the signal-to-noise ratio is important.

In the case of receivers to be used only on local broadcast stations, where high signal levels are usually encountered, a different design technique may be employed. Little or no r.f. gain may be provided, together with considerable audio gain. A receiver may consist of no more than an antenna, a tuned circuit, a detector, and a high-gain audio amplifier. This approach was used successfully in designing and building the small receiver shown in Fig. 1.

Although a very short antenna is used, the receiver is sufficiently sensitive to give ample earphone volume with local AM broadcast stations (5-15 mile radius).

As can be seen in the "close-up" view (Fig. 3) the receiver is completely self-contained, with both "A" and "B" batteries within the plastic case. The extremely small size of the receiver is evident in both Figs. 1 and 3. Compare the complete receiver with the size of the standard penlight battery used as the "A" supply!

Because of its small size and light weight, this receiver is handy for use when working in the garden, mowing

the grass, hiking, cycling, or when attending sports events.

The layout and construction is such that the average skilled technician should have no difficulty assembling and wiring the complete receiver in an afternoon and evening.

Circuit Description

The complete schematic diagram for the receiver is given in Fig. 2. The circuit enclosed by the dashed line is a complete *Centralab* printed circuit amplifier and is mounted and wired as a single component. Hence, the individual resistors and condensers in this circuit are identified only by parts values.

The r.f. signals picked up by the antenna are coupled through C_1 to a tuned circuit consisting of L_1 and C_2 , where the desired station is selected. The r.f. signal appearing across the tuned circuit is coupled, in turn, to the grid of the first CK512A amplifier tube through C_3 , appearing across R_1 . Grid-leak detection takes place at this point (due to the high value of R_1), and hence there is only an audio signal to consider in the remainder of the circuit.

The amplified audio signal appearing across the 1-megohm plate load resistor of the first CK512A amplifier is coupled through a .001 μ fd. condenser to the volume control, R_2 . From here the signal is applied to the grid of the second amplifier, another CK512A tube.

Only two stages of voltage amplification are provided, so the signal appearing across the 1-megohm plate

load resistor of the second CK512A tube is applied directly to the grid of the CK525A power amplifier stage through another .001 μ fd. coupling condenser.

The output signal appears across a subminiature choke, L_2 , and is coupled through C_4 to the output jack.

Operating voltages are obtained from a 1.5 volt standard penlight cell, which acts as the "A" battery, and a 30-volt hearing aid "B" battery. If desired, one of the new mercury cells may be substituted for the "A" battery to provide longer life—a *Mallory* type RM-1200 mercury cell is suggested.

Construction Hints

The layout used by the author is readily apparent from the photo (Fig. 3). However, this layout need not be followed exactly—in fact, some modification will be mandatory unless the case used by the builder is exactly the same shape and size as that used by the author. When modifying the layout, take care to keep the output and input connections to the printed circuit amplifier well separated to prevent oscillation.

A suitable case for the receiver can generally be found at a dime store or at a plastic "hobby" shop. The one used by the author was obtained in an assortment purchased from the *Olson Radio Warehouse* (Akron, Ohio). Dimensions are approximately $2\frac{1}{2}$ " x $3\frac{1}{2}$ " x $\frac{7}{8}$ ".

Most of the major parts are mounted simply by cementing them in place using *Duco* cement. However, a pair of small cable clamps is used to hold the antenna in place along the side of the receiver case. The batteries are held in place by the spring tension exerted by U-shaped pieces of phosphor bronze cemented to the case. These "clips" also serve to make contact with the battery terminals.

The "antenna" was salvaged from the upper section of a damaged auto antenna. The length is not too critical but at least a 12" length should be used and a 14" or 16" length will give somewhat better results.

RADIO & TELEVISION NEWS

A standard "Ferri-Loop" antenna which has been modified to fit into the small space available serves as the tuning coil (L_1). This coil, as supplied by the manufacturer, is fairly long, with most of the length represented by a cardboard tube and the mounting bracket. The excess tube length was cut off using a sharp pocket knife and the remaining coil (with its core) cemented in place. In Fig. 3, this coil is located below the trimmer condenser and at the end of the "A" battery.

Station tuning is provided by a mica compression trimmer (C_2) which may be adjusted by means of a small screwdriver. Only a portion of the band is covered by the trimmer and it becomes necessary to choose a value that will permit tuning the desired station(s). The value given in the parts list covers the upper portion of the broadcast band (1000 to 1500 kc.). To cover lower portions of the band, use a trimmer having a greater maximum capacity—values of 270 $\mu\text{fd.}$, 360 $\mu\text{fd.}$, 480 $\mu\text{fd.}$, etc. are satisfactory. The exact portion of the band covered will depend not only on the trimmer size but also on the exact positioning of the iron core in the coil.

A miniature output jack was obtained by cutting a Walsco type 791 jack to almost half its normal length and cementing it in place in the plastic case. This component is visible in Fig. 3 and is located just above the output choke. The phone plug supplied with the Telex midget earset was removed and a Walsco type 790 plug used instead (to match the miniature jack).

The output choke, L_2 , may be replaced by a 50,000 ohm, $\frac{1}{4}$ watt resistor if desired, giving somewhat less gain, but saving considerable space as well as reducing the cost of the completed receiver. In fact, in the model shown, the choke was accidentally damaged and later developed an "open." Rather than attempt to remove the choke, a 50,000 ohm resistor was simply soldered in parallel with the choke connections, giving satisfactory results.

Somewhat higher over-all gain may be realized by using a crystal headphone in place of the 2000-ohm magnetic earset shown. However, when this is done it may become necessary to shield the case to prevent feedback and oscillation.

Adjustment and Tuning

Since the wiring and assembly of the small receiver are straight-forward, little or no difficulty should be encountered. There are two points on which some builders may run into a little trouble, however.

First, if care is not taken in layout and wiring, it may be found that over-all oscillation takes place. In such a case, better separation between the output and input is advisable. In a few instances it may become necessary to shield the entire receiver, either by assembling it in a small metal case (such as a cigarette case)

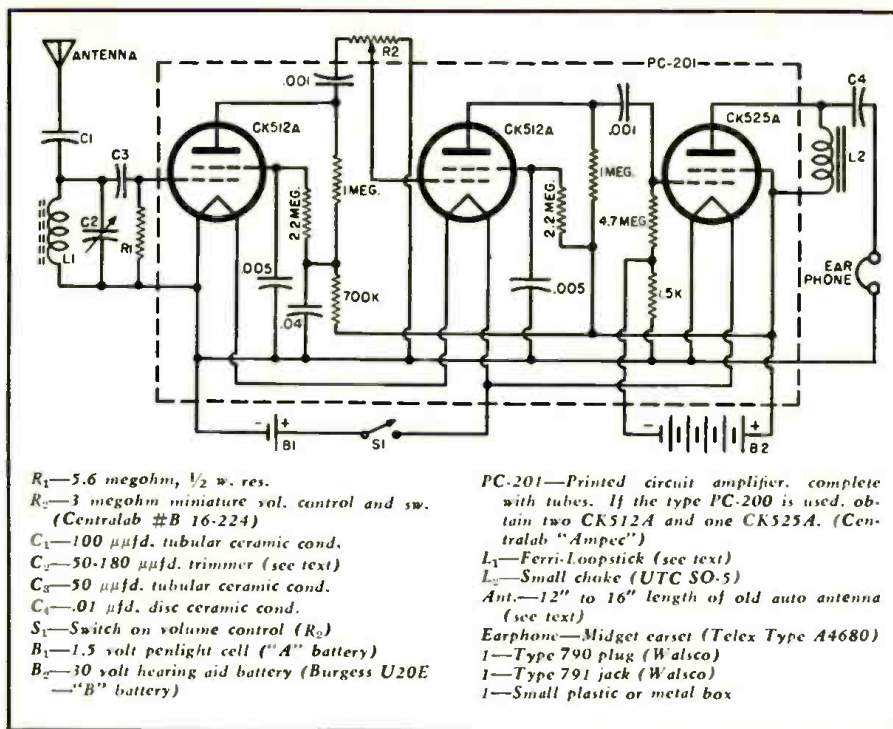


Fig. 2. Circuit diagram. The printed circuit is shown within the dotted lines.

or by cementing aluminum foil to the outside of the plastic case, connecting it to circuit "ground."

If over-all shielding proves necessary, care should be taken that no wiring connections are shorted, that the antenna is not shorted, and that the mounting screws of the "switch-volume control" are not shorted.

If the receiver is assembled in a metal case, slightly different construction techniques will be necessary in order to avoid shorts. One technique is to wire the entire receiver on a plastic "sub-chassis" which, in turn, is mounted in the metal case. A feed-through insulator should be used for mounting the antenna.

Another minor difficulty that may be encountered is an apparent lack of gain, in other words, insufficient "pick-

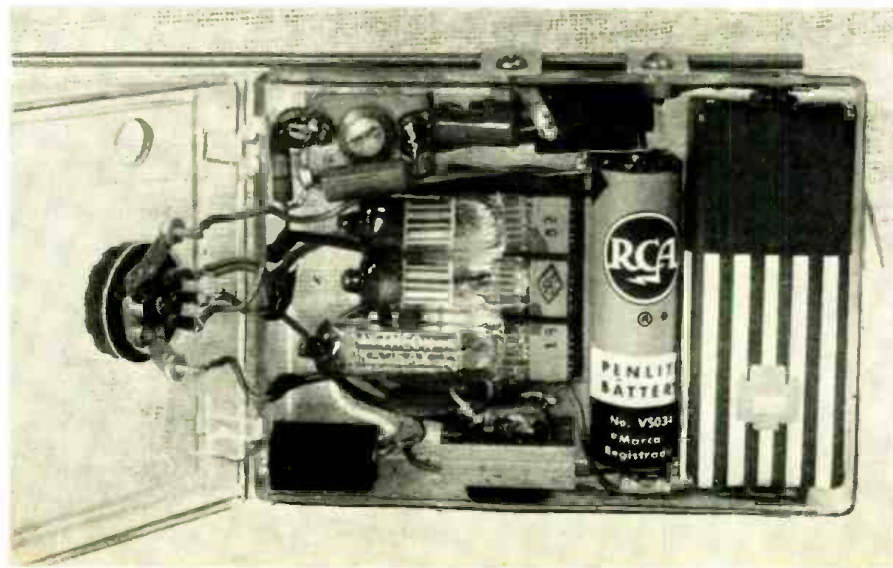
up." This will be noticed if the signal level of the local stations is low in the locality where the receiver is to be used—in another location, ample volume might be obtained.

While the over-all gain of this receiver is many times that of a simple detector, it must be remembered that the antenna length has been kept extremely short to increase portability. Because of this, the ability of the receiver to "pull-in" stations is not appreciably greater than a crystal receiver with a good outside antenna and earth ground.

If desired, a longer antenna may be used to increase signal pickup.

Touching the antenna with the hand or body will reduce signal pickup by "loading" the tuned circuit and reducing (Continued on page 157)

Fig. 3. Close-up view—layout may be varied to conform to builder's requirements.



SINGLE-CHANNEL REMOTE BROADCAST AMPLIFIER

By LEON A. WORTMAN

IN THE operation of a 250-watt standard broadcast station there are the usual problems of equipment costs, maintenance, and operation. The cost of equipment for a 250 watt is the same as for a 50 kilowatt, per unit. However, because of lower rate cards and comparatively smaller, though not inadequate staffs, the methods of attacking these problems differ from those of higher powered stations serving larger areas and commercial listening audiences. One such station is KRUX in Phoenix, Arizona. KRUX operates as the "News, Music, and Sports Station" of this southwestern area, and as such finds itself with a heavy schedule of remote broadcasts. These range from church services, public service features, to the entire gamut of sports events, local and national.

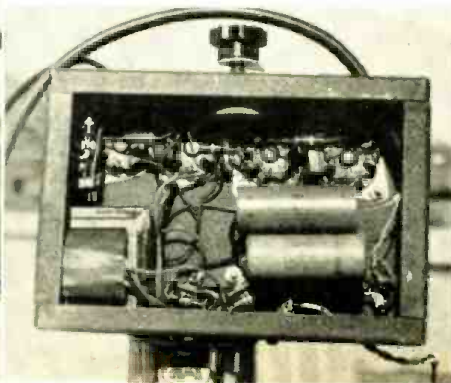
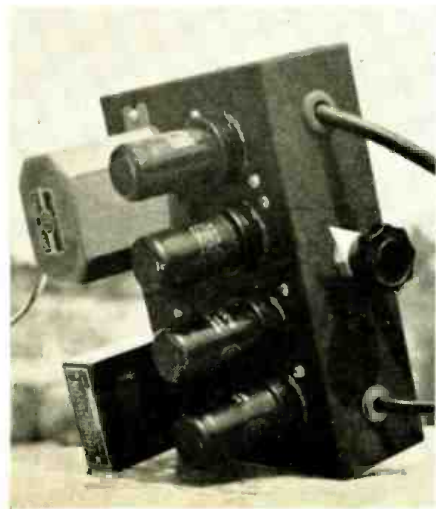
Commercially-manufactured remote amplifier "boxes" are expensive; understandably so because of the design and development costs and the comparatively limited demand. An operation such as that at KRUX requires more than the usual number of remote amplifiers. Public service remotes tie up equipment and the engineer's time, and because of sequential remotes

some economical solution had to be found. So, it was decided to "roll our own." Since there are undoubtedly other stations and engineers with the same problem, the following design, description, photographs, and general information are offered as an "assist."

The unit shown in the photographs was constructed to solve the problem of maintaining standard broadcast quality, when carrying the full schedule of the Phoenix Senator's baseball games. This schedule includes approximately 125 broadcasts, exclusive of numerous commercial and public service remotes, during the months from March to September. That meant that about 500 engineer-hours would be required for setting up, riding gain, and tearing down the equipment during the season.

If it could be arranged so that the

Top and underchassis views of the amplifier. It is constructed on a standard 7" x 5" x 2" chassis. Spare parts were used throughout. The power supply is built on a separate chassis of the same dimensions.



Single-channel remote b.c. amplifier shown mounted under table at ball park. Power supply and amplifier are spaced at least 1½ feet apart to reduce hum pickup.

An inexpensive unit for the small station which can be built from spare parts and needs no tricky adjustments.

equipment remained permanently installed at the ball park, the engineer's time could be cut and his services utilized for other duties. Since it was decided that one microphone was to be used for the broadcast, requiring no mixing, the engineer on duty at the main studio console could do all of the "gain riding" and "zero peaking" necessary for the full modulation of the transmitter. Thus engineering time could again be saved and utilized elsewhere. The final problem of equipment costs was eliminated by constructing a single-channel remote amplifier using existing station facilities.

The equipment had to be small enough to be mounted unobtrusively and without causing any additional crowding in the radio-press box. The amplifier and power supply, as seen in the photographs, are mounted on separate 7" x 5" x 2" chassis. Not one of the components is custom or specially built. All were and can be bought from the local supply houses or ham parts distributors. Many of the components are to be found in the spare parts cabinet, as were most of the ones used in this unit, of any standard broadcast station. Only two different types of tubes are used in order to keep the spare requirements at a minimum.

In the design and construction of any high-gain audio frequency amplifier several precautions must be taken. This type of amplifier is subject to the bugaboos of hum, distortion, and high-frequency thermal noises. A unique method for eliminating such high-frequency thermal agitation noises was the use of standard p.a. transformers instead of flat-response,

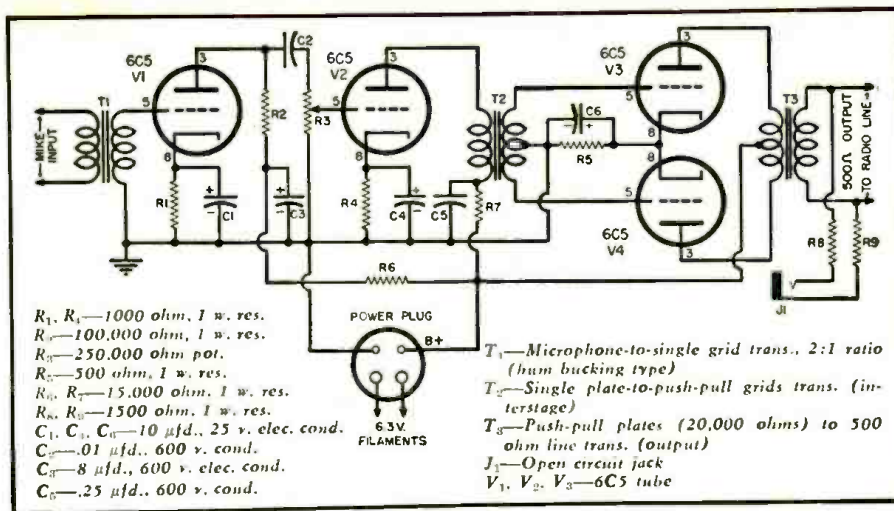
high-fidelity units. In view of the fact that the remote amplifier is primarily intended for use by a sports announcer and not for the broadcast of music, the 5 kilocycle top of the output transformer used is more than adequate and in no way lends a false or unnatural quality to the voice. This is an economical and practical method of eliminating the noise "bug."

Power supply ripple is eliminated through the use of heavy plate filtering. The power supply chassis uses an 8 μ fd. and a 16 μ fd. condenser in addition to a filter choke for a.c. ripple minimization. The 6C5 input stage has an extra ripple filter and decoupling section provided by a 15,000 ohm, 1 watt resistor bypassed by an 8 μ fd. electrolytic. The second single-ended 6C5 has a 15,000 ohm, 1 watt resistor in series with the plate supply and bypassed by a .25 μ fd. paper condenser to provide audio decoupling for this stage. A single plate to push-pull grids transformer is used here to provide the advantages of transformer coupling amplification. Again a standard p.a. transformer is used in preference to a flat-response, high-fidelity transformer in the interest of economy and lower high frequency cut-off.

The input transformer can be any grade of microphone-to-single-grid transformer of the proper impedance to match the impedance of the mike to be used. Most broadcast stations use microphone impedances of 30, 50, 250, or 500 ohms. At KRUX, 250 ohm impedances are used throughout the installations. One precaution which must be taken is that the input transformer must be thoroughly shielded against hum pickup.

To return to the hum problem: it was found impossible to mount the power transformer on the same chassis with the audio transformers without introducing a highly audible hum. In fact a minimum physical separation of 1½ feet was found necessary between the power supply unit and the audio transformers. The power supply output of 6.3 volts a.c. and 250 volts filtered d.c. terminates at the back of the chassis with an *Amphenol* 4-prong tube socket. The power supply connections for the audio unit come out to a male chassis mount plug made by *Amphenol* to fit a 1½" punched hole. A four-wire cable, with one male and one female *Amphenol* plug at either end and covered with heavy cambric "spaghetti" to provide protection, is used to interconnect the two chassis.

The gain control, normally an expensive component in broadcast audio equipment, is the well-known carbon type potentiometer used to control the volume in public address equipment and radio receivers. It costs only about 79 cents as opposed to attenuator pads costing about \$17. In view of the fact that it is not varied during the broadcast time and is in a high-impedance circuit, it is thoroughly adequate in this remote amplifier.



Circuit diagram of amplifier. A single tube type eliminates replacement problems.

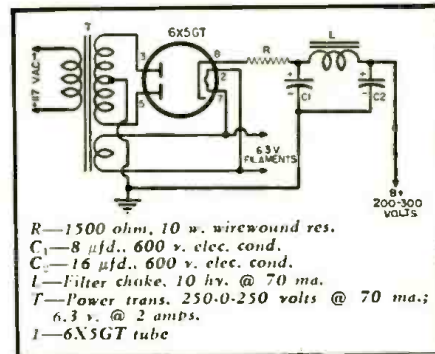
As in all broadcast equipment, precautions must be taken to eliminate the hazard of component breakdown. Loss of air time is inordinately expensive as it is the one commodity radio stations have to sell. Thus all condensers are oversized for working voltages and resistors are oversized for working wattages. The 1500 ohm, 10 watt resistor in series with the power supply high voltage acts as an additional voltage limiter and protector of the power supply filter condensers.

A single ground tie point is used in the wiring of both chassis. One exception was found necessary: some a.c. hum was being amplified and was traced to the filament wiring. It was found further that grounding one side of the filament terminals of the second audio stage at the chassis gave the greatest degree of hum elimination. Of course, shielding the filament wiring should eliminate this difficulty if included in the original wiring.

The grid connection from the microphone input transformer is only a few inches long and runs close to the chassis. Some hum pickup was experienced through this short lead. However, shielding it immediately eliminated all trace of hum from this source.

The earphone monitor is connected directly across the radio line in series with two 1500-ohm resistors. The resistors effectively isolate the monitor circuit from the radio line to the studio in case of a short circuit in the earphone plug and cord. The audio output is brought directly out from the rear of the chassis and is connected to the terminal block of the radio line supplied by the local telephone company. This connection need never be disturbed.

The amplifier has more than sufficient gain to cover the radio line from the Phoenix Municipal Stadium to the main studios, some 12 miles distant, without the use of telephone repeater amplifiers, and without any audible line noise under the program level. The cambric-covered power cord is rigidly mounted under the table with cable

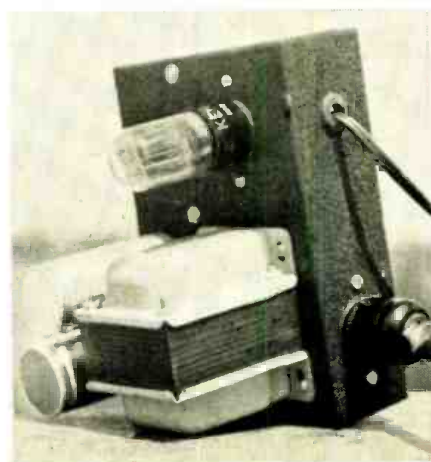


Power supply for the remote amplifier.

clamps. The microphone cord and earphone monitor cords and plugs are also secured to the bottom of the table and in such a position that the announcer-operator can easily make his own connections. Of course, the units are bolted to the bottom side of the table directly in front of the announcer.

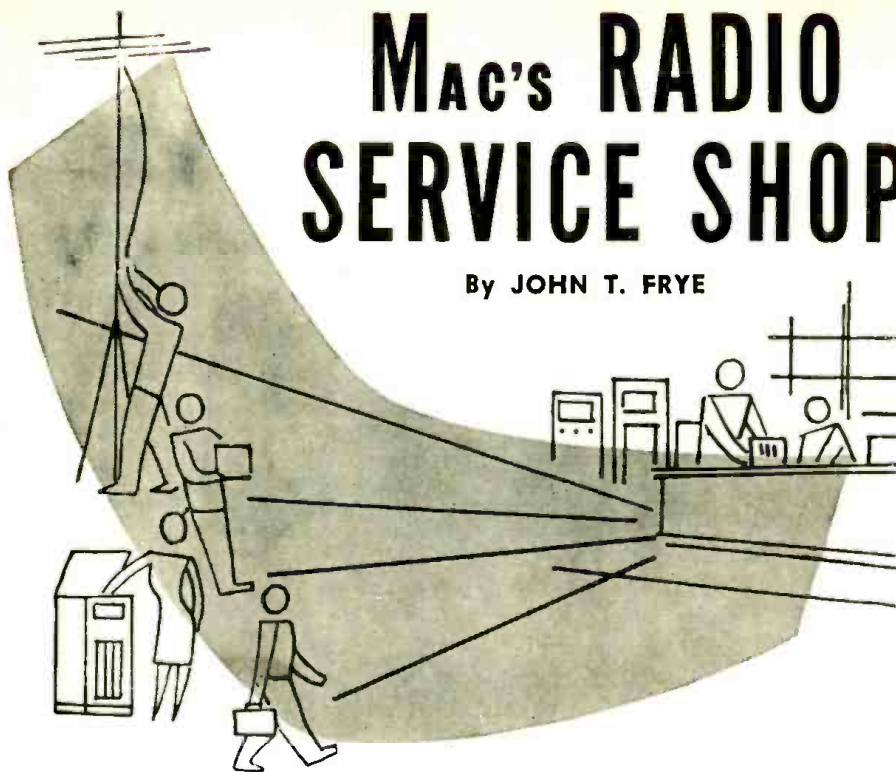
The sportscaster takes a microphone and a pair of earphones with him when he goes to the ball park. All he has to do on arrival is plug in his mike and phones, then insert the a.c. plug in the outlet mounted next to the
 (Continued on page 154)

Over-all view of the power supply chassis. It is connected to the amplifier chassis by means of a shielded four-wire cable.



MAC'S RADIO SERVICE SHOP

By JOHN T. FRYE



SERVICING WITH THE GDO

ORDINARILY Barney was not eager to get to work, but on this particular morning he was glad to step out of the howling February snowstorm into the warm sanctuary of the service shop.

"Whew!" he exclaimed as he beat the snow from his sock cap and wiped the water from his freckled face. "Tain't fit for man nor beast out there today; and I keep remembering that last fall, when old Indian Summer hung on and on, I was the one who told everyone we weren't going to have any winter weather this year. Hey, Mac, what's the gadget you've got there? Something new?"

"Yes," his boss answered as he fondly cradled the little gray, crackle-finished instrument in the palm of his hand. "Let me introduce you: Barney, this is Mister Grid Dip Oscillator, familiarly known as GDO; Mister GDO, this is Barney, familiarly known as Red, Sorrel Top, or Scarlet O'Gal-

lager. I want the two of you to become better acquainted."

"How do you do?" Barney inquired politely of the instrument. "I've heard a lot about you on the ham bands."

"And from here on in, unless I miss my guess, you're going to hear a lot about him from technicians," Mac stated. "I'm confident the GDO is about to join the parade of instruments from the laboratory to the service bench that began with the cathode-ray oscilloscope and the vacuum tube voltmeter. Engineers and amateurs have long known how useful this rather simple little instrument is; but it was not until the last few months, when several manufacturers brought out grid dip oscillators in both kit and assembled forms at down-to-earth prices, that technicians felt they could afford to buy one of the units just to see what could be done with it in service work. Now that they have found out, the things are selling like

bottle-openers at a bartenders' picnic."

"How does it work?"

"Here's a diagram (Fig. 1) of this particular instrument, the *Heathkit* Model GD-1." Mac said as he slid a paper across the bench. "You can see that it is essentially a high-frequency triode connected as a Colpitts oscillator with plug-in inductances. A 500 microampere meter is connected in the grid return circuit and reads rectified grid current. There is also provision for plugging earphones into this grid-return lead.

"Now watch what happens when I bring the inductance of the GDO close to this coil-and-condenser circuit and tune the grid dip oscillator through the resonant frequency of the combination. See that meter pointer dip downward as I pass through resonance?"

"How come?" Barney demanded.

"The tuned circuit at its resonant frequency absorbs energy from the oscillator and lowers the amplitude of the oscillation, which, in turn, makes the rectified grid current go down. All I have to do is note on this calibrated dial of the tuning condenser of the GDO the frequency at which this dip occurs, and I know the resonant frequency of that tuned circuit."

"What does the variable resistor, R_1 , do in the circuit?"

"That's a sensitivity control. You can see that the negative rectified grid voltage appears at the bottom of this resistor and a positive potential fed through R_2 appears at the top. The resultant of these two opposing voltages causes a current to flow through the meter to ground. If the slider is clear to the top, the positive voltage is grounded and only the grid current registers on the meter. As the slider is moved down, more and more positive voltage is allowed to buck this developed grid voltage."

"But why?"

"The object is to keep the 500 microampere meter on scale for various values of grid current. Different coils and different settings of the tuning condenser will produce different values of grid current. A meter to read this wide range of current without going off scale would have to be one with a relatively high current range; and that would mean a small, hard-to-detect dip with the loose coupling to a tuned circuit required for best accuracy. By using a variable positive bucking voltage, the pointer can be kept on scale for all values of grid current, yet the greater dip-indicating sensitivity of the 500 microampere movement can be retained."

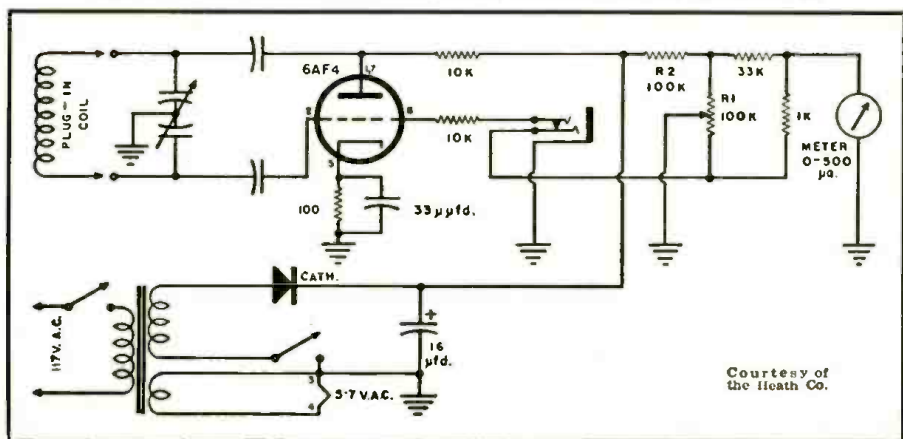
"Is that all it will do: indicate the resonant frequency of tuned circuits?"

"By no means. Watch the screen of the TV set over there on the other bench."

As he said this, Mac plugged another inductance that looked like a fat, king-sized hairpin into the GDO and moved the tuning dial with his thumb. Suddenly the picture was re-

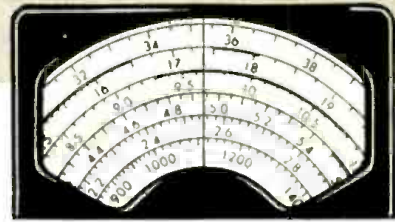
(Continued on page 111)

Fig. 1. Circuit diagram of a commercially-available grid dip oscillator kit.





International SHORT-WAVE



Compiled by KENNETH R. BOORD

IT IS A privilege this month to dedicate the *ISW DEPARTMENT* to radio broadcasting in the Republic of Korea. Thanks goes to Hahn Ki Syun, chief of the engineering section, Radio Korea, Office of Public Information, Pusan, Republic of Korea, for this data:

"Due to the war, we have lost almost all of our broadcasting equipment, but our engineers have been trying to rebuild our facilities one by one. We have constructed a 10 kw. broadcasting (medium-wave) at Taegu, a part of our *Radio Korea Network*, and a similar station was completed at Taejon in November. We expect to build up the 1 kw. short-wave station at Seoul and the 400 w. short-wave station at Taejon within a few weeks. And within a few weeks more, short-wave listeners should be able to listen to our 'Voice of Freedom' on a 10 kw. short-wave outlet from Seoul; a further 10 kw. medium-wave station will follow at Seoul. We have had much difficulty through shortages of equipment, materials, and even engineering books."

Mr. Hahn gives this picture of current broadcasting in Korea:

Seoul, HLKA, 970 kc., 5 kw., and 9.555, 300 w. Pusan, HLKA, 800 kc., 5 kw.; 2.510, 1 kw., and 7.935, 1 kw.; former HLKB, 650 kc., 500 w., is now a 1 kw. "spare" medium-wave outlet. Iri, HLKF, 570 kc., 500 w.; Taegu, HLKG, 710 kc., 10 kw.; Kwangju, HLKH, 780 kc., 500 w.; Taejon, HLKI, 880 kc., 10 kw.; Namwon, HLKL, 1030 kc., 500 w.; Chunchon, HLKM, 1230 kc., 300 w.; Mokpo, HLKN, 650 kc., 500 w.; Masan, HLKO, 600 kc., 50 w.; Chungju, HLKQ, 600 kc., 500 w.; Kangneung, HLKR, 1080 kc., 500 w., and Cheju, HLKS, 1080 kc., 500 w. These stations make up the *Radio Korea Network* which is currently scheduled 1600-1830, 2130-0030, 0500-0900. Various Asiatic languages are used, and at least the short-wave outlets occasionally identify in *English*. By the time you read this, the new short-wave outlet at Taejon and the further short-wave outlet at Seoul (10 kw.) may be on the air.

Best wishes go to the *Radio Korea Network* and its personnel in the further resumption of radio broadcasting in the Republic of Korea.

Club Notes

England—The World Friendship Society of Radio Amateurs, 35, Bell-

wood Road, Waverley Park, Peckham Rye, London, S.E. 15, England, now has a *new* bulletin especially for its Junior Section members; it is called "Wave-Guide" and is edited by D. F. Shaw and J. I. Meardon.

New Zealand—The New Zealand Radio DX League has named Frank W. Wilson as president to succeed Arthur T. Cushen who had headed the group for the past two years.

USA—The Newark News Radio Club, Newark, New Jersey, recently passed its 25th milestone. And the Universal Radio DX Club, located at Hayward, California, recently observed its 19th anniversary. Congratulations to both!

This Month's Schedules

Albania—*Radio Tirana* is reported now using 6.560, 7.850A at 2300-0100, 1000-1130, 1215-1700. Chatfield, N. Y. notes the 7.850A channel at fair level 1500-1600. Levy, N. Y., notes it with news 2345.

Algeria—*Radio Algeria*, 6.160, noted signing off Arabic session with "La Marseillaise" 1745; had news headlines in Arabic just before closing; the 9.570 outlet, used for French sessions,

(Note: Unless otherwise indicated, all time is expressed in American EST; add 5 hours for GCT. "News" refers to newscasts in the English language. In order to avoid confusion, the 24 hour clock has been used in designating the times of broadcasts. The hours from midnight until noon are shown as 0000 to 1200 while from 1 p.m. to midnight are shown as 1300 to 2400.) The symbol "V" following a listed frequency indicates "varying." The station may operate either above or below the frequency given. "A" means frequency is approximate.

The antenna for the 10 kw. transmitter at Taegu, a "Radio Korea" network affiliate.



noted closing 1800 with "La Marseillaise," after news in French 1751. (Pearce, England)

Anglo-Egyptian Sudan—*Radio Omdurman*, 9.737A, is occasionally audible to fair in its 2315-2345 all-Arabic session. (Niblack, Ind., others)

Angola—*Radio Clube de Angola*, 11.862A, Luanda, has been fading in lately as early as 1340. (Niblack, Ind.) *Radio Clube de Huila*, 10.048A, Sa da Bandeira, more recently has been running to 1600 closedown (formerly closed 1500). (Pearce, England; Ridgeway, South Africa) *Radio Diamang*, CR6RG, Dundo, recently moved from 6.870, is now using 7.065 parallel with 9.344 at 1300-1430 daily; CR6RD, Nova Lisboa, has been heard on Saturday opening 0930, Sundays and weekdays 1230, using 9.705, 9.7096 to 1530 closedown. (Ridgeway, South Africa)

Argentina—LRX, 9.66, Buenos Aires, *Radio El Mundo*, noted at strong level around 2045. (Stein, Calif.) SIRA announces *English* for 17.720 at 1700-1930; 11.880 at 1300-1400; 15.290 at 2300-0100. (Villela, Md.) *Radio Belgrano*, 9.755A, has hourly national and world news in Spanish at 55 minutes past the hour, according to Villela; at 1825 ("las 20:25, hora que Eva Peron entro en la eternidad"—"at 2025, the hour that Eva Peron entered Eternity") has a 5-minute official news bulletin in Spanish.

Belgium—ORU, 17.865A, Brussels, noted in French and Dutch 0500. (Pearce, England) The 6.065 outlet noted with dance music 2240, signing off North American transmission 2400. (Lieberman, N. Y.) *English* for North America is currently carried over ORU, 6.065, beamed to North America, and 9.745 beamed to Belgian Congo, and relayed by OTC, 9.655, Leopoldville, at 2100-2400. Kelting, N.Y., notes ORU, 9.745, with French program 2045-2130, then *English*.

Belgian Congo—OTM1, 6.295, appears to have replaced 11.720A, audible around 1500 parallel with OTM2, 9.380, in the *Radio Congo Belge* transmission to 1600 closedown. (Kary, Pa.) OTH, 9.210, is heard in Sweden 1245-1330. (*Nattugglan*, Sweden) *Radio Elizabethville*, OQ2AB, 11.90, has been noted recently on Tue. as well as Sun. with the 0930-1100 session. *Radio Leo*, OQ2AA, 11.717, on Sun. only has a session 0300-0430 which is all-French; OTM4, 11.72A, now opens 0300 with French and Flemish programs to 0730 (Continued on page 127)

3-ELEMENT 14_{MC}. ROTARY BEAM ANTENNA

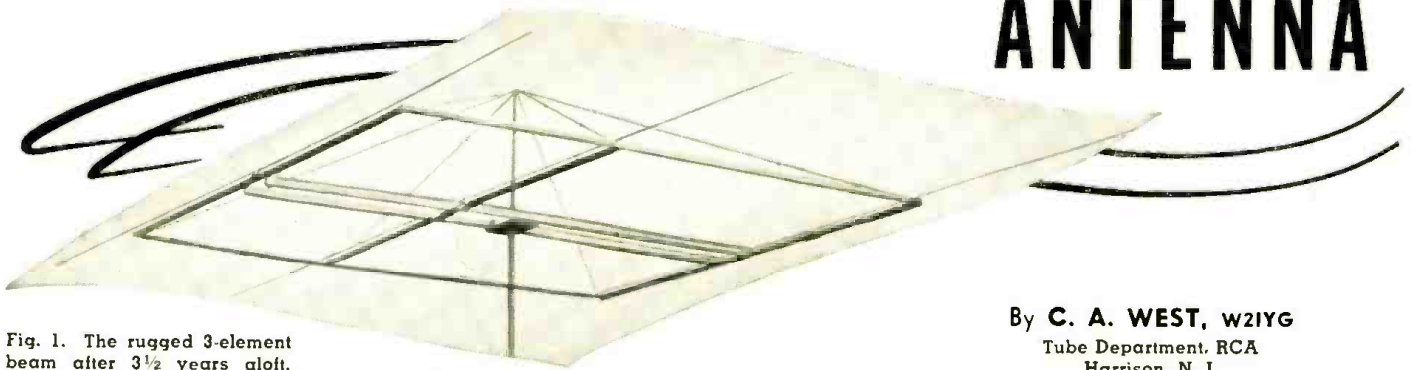


Fig. 1. The rugged 3-element beam after 3½ years aloft.

By **C. A. WEST, W2IYG**
Tube Department, RCA
Harrison, N. J.

High front-to-back ratio, good forward gain, and a beam that stays up in the wind are the result of careful design. Simplified construction and adjustment are also featured.

ONE sure aid in working DX is the use of a rotary-beam antenna. This article describes the construction of a 3-element, 14-megacycle rotary beam which was built by the author. The antenna, which has been in use for more than three and a half years, remains in excellent condition in spite of several of the worst wind and ice storms ever experienced in New Jersey.

There can be very little doubt that sound mechanical planning is of the utmost importance when the construction of an array of this sort is contemplated. Some of the questions which should be answered before actual planning gets under way are:

Is the cost within reason?
Is the array simple to construct?
Can it be assembled easily at its final location?

Is maintenance relatively light?
Will it stay up?

For the beam antenna described in this article, the answer to all of these questions is "yes." The entire cost of the array was about \$75.00. No special tools were required for the construction; anyone familiar with saw, hammer, screwdrivers, and pliers could do the job. The final assembly of the beam on a rooftop was completed by three people in about one and a half hours. The only maintenance required so far was the replacement of the guy wires, a two-hour, one-man job which would have been unnecessary if rust-proof cable had been used initially. Fig. 1 is a photograph of the antenna taken more than three and a half years after its construction.

Preliminary Considerations

It was decided to mount the beam on the roof of the house to avoid the added work and expense of constructing a tower. Mounting the antenna on

the roof also provides for the housing of the motor, gear box, direction-indicating equipment, slip rings, transformer and relay, and associated wiring in the attic, thus providing for their protection against the elements and making maintenance work much easier.

Roof mounting also solves the problem of mounting the parasitic array itself. When a tower or pole is used to support the array, it is usually necessary to assemble the array before it is finally placed atop the tower or the pole. Needless to say, a 3-element, 14-megacycle array, 34 feet long and 17 feet wide, is a rather cumbersome assembly to raise to the top of any tower or pole. Roof mounting, however, provides for assembly at the final location.

Another advantage of mounting the

Fig. 2. A pipe shaft runs up through the roof inside a larger pipe bushing, steadied by pipe straps. At the top are two 2 x 6 roof supports. Note the BX cables.



beam on the roof is that provision is made for short feedlines and other wires and cables for carrying power to the rotator, and to the electric-indicating system, if one is used.

Whether the antenna is to be supported by a roof, a tower, or a pole, many of the ideas presented in this article should prove quite useful. It is recommended that a lot of thought be put into the planning of the beam. Many arrays have been completely destroyed by wind and sleet storms due to poor mechanical construction.

Main Supports

It was estimated that the entire array plus the rotator (propeller-pitch type) would weigh about 150 to 200 pounds. The supports in the attic would have to hold this weight safely and would also have to have enough strength to provide for bending and twisting torque created by the wind striking the array. For this reason, two pieces of 2" x 8" lumber were used to support the platform on which the shaft of the array and the rotator were mounted, as shown in Fig. 2. These 2" x 8" pieces were bolted securely to two of the 2" x 8" rafters in such position that about two-thirds of the shaft supporting the array was below the roof top. It is important that this length of the array be below the roof to provide for bending torque on the shaft, and to reduce the hazard of damage to the roof if strong winds strike the array broadside. Two 2" x 4" pieces of lumber were also bolted to the main supports as shown in Fig. 2 to provide for torque at right angles to the main supports and to give added strength.

After the main supports had been bolted into place, the rotator platform was prepared. Two pieces of 2" x 12" lumber were cut to the width of the main supports, allowing a little overhang for later centering of the shaft of the array on the rotator flange. A hole large enough to pass the array shaft was cut in the center of the joined 2" x 12" pieces and, with the rotator mounting plate used as a template, holes were drilled for fixing

the rotator in place. The mounting plate is used on top of the wood rotator platform for added strength.

At this point, consideration was given to the shaft and its bushing. A 2-inch pipe was used for the bushing and a 1½-inch pipe for the shaft. The two slipped together very easily with a fraction of an inch play, but there was no problem with rattling. When the 2-inch pipe used for the bushing was cut with a pipe cutter, a small edge protruded at the inner circumference; this edge was filed until the 1½-inch pipe shaft fit snugly into the bushing.

It is preferable to install the shaft bushing before the initial assembly of the array. When the proper point was located on the roof, a hole was made in the roof to hold the bushing, as shown in Fig. 4. The roof peak was re-inforced by means of two pieces of 2" x 6" lumber, and a plumb line was dropped through the bushing so that the bushing could be brought into a vertical position. The steel straps were then fastened in place, as shown in Figs. 2 and 4. The bushing must be sealed at the point where it comes through the roof to prevent rain coming into the attic.

Rotator Preparation

There are several difficulties involved if the rotator (propeller-pitch type) is used "as is," chief of which is slow rotation speed. Another difficulty is the burning of brushes and commutator when a.c. is used to energize the d.c. motor. In addition, a considerable amount of electrical noise is generated, which wreaks havoc in the receiver when the array is rotated to peak a signal.

All these difficulties can be avoided by making the last set of planetary gears inoperative. These gears may be disabled quite simply by removing the upper spline from the gear box assembly and fastening the shaft pipe flange right on top of the planetary gear housing, as shown in Fig. 4. This operation makes possible a much greater shaft rotation speed for a given voltage applied to the rotator motor. Before the spline was removed, about 25 volts a.c. was required to obtain a shaft rotation of 1 rpm. With the spline removed, only about 15 volts a.c. was required for one rpm. Two other improvements are also obtained: (1) electrical noise is cut to a much lower value; (2) burning of the brushes and commutator is prevented and heating of the motor is reduced.

While the rotator is being modified, it is a good idea to remove the motor from the gear box and disassemble it for inspection. If the commutator has a ridge burned in it, the armature should be removed and the commutator turned down. The insulating surfaces between the commutator faces should be cleaned with a sharp pointed tool to remove any small metal particles which accumulate during the commutator turn-down. The entire motor may be cleaned in kerosene with the

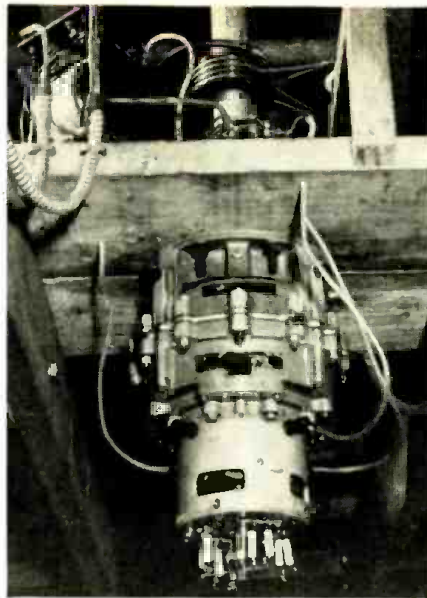


Fig. 3. The motor and gear box are mounted below the platform. The motor housing is removed to show the bypass condensers for the brushes. At top, brass rod brushes bear against slip rings on the shaft.

aid of a brush, then wiped dry and re-assembled.

Electrical noise generated by brush sparking may be reduced by connecting a 0.01 µfd. condenser between each brush lead and the case of the motor, as shown in Fig. 3. The reduction in noise on 20 meters is sufficient to allow rotation of the array without drowning out weak signals, even when there is no noise limiter on the receiver.

Array Design

There are two general classifications of array construction, self-supporting and frame with guy-wire supports. The author discarded the self-supporting type almost immediately because of the lack of strength exhibited by several of these beams in his neighborhood. The design shown in Fig. 5 was chosen for several reasons: 1. economy and availability of

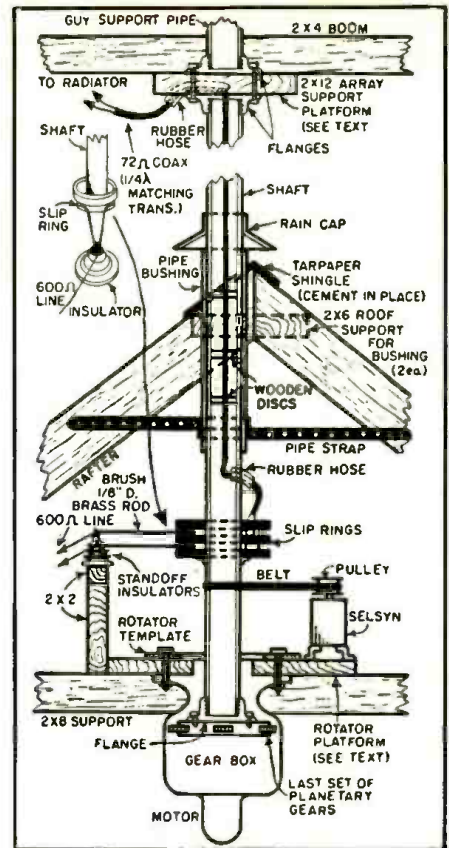


Fig. 4. Detail drawings of the rotator and beam support. One of the two slip ring and brush assemblies is shown at upper left.

materials, 2. strength, 3. ease of construction and assembly, 4. ease of tuning.

Basically, a parasitic array requires at least two elements, a radiator and either a reflector or a director. If greater gain or front-to-back ratio is desired, additional directors and reflectors may be added. The 3-element array was chosen to provide maximum front-to-back ratio. Although a 3-element array may be tuned for either maximum forward gain or maximum front-to-back ratio, the latter was chosen for two reasons: (1) it was

Fig. 5. Construction details of the beam and tuning stubs. The guy wires are broken into non-resonant lengths by the insulators. Aluminum should be used for the tuning stubs, if possible, as copper-to-aluminum contacts may corrode. The wooden braces keep elements from whipping in the wind, changing beam characteristics.

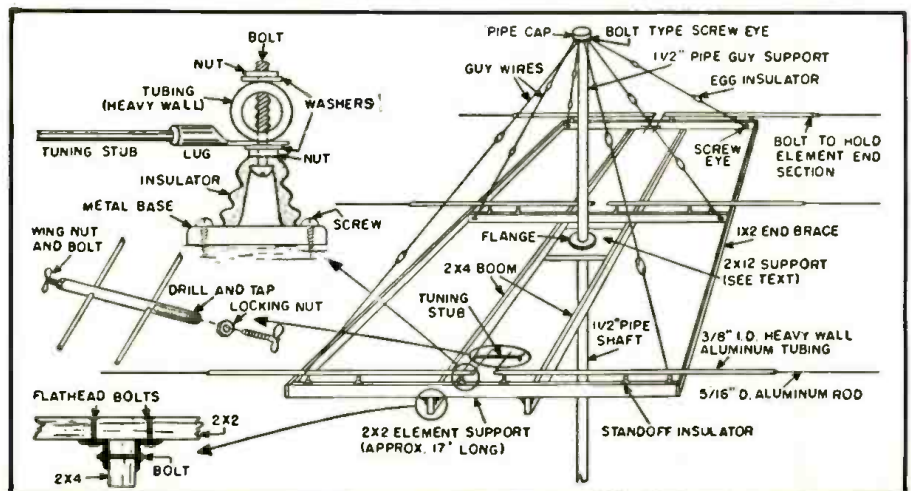




Fig. 6. The "on-off" switch, fuse, and pilot lamp are mounted at the beam-indicator map. The control switch is at the operator's desk. A selsyn drives the arrow.

highly desirable to be able to reduce to a minimum the strength of all signals not coming from the direction of the desired signal; (2) the comparative difference in forward gain between the two systems of tuning is negligible.

When maximum front-to-back ratio is desired, the satisfaction gained by tuning a parasitic array is well worth the small amount of additional effort involved. There are two popular methods of tuning the director and reflector. One is to lengthen or shorten the outer ends of the elements, and the other is to lengthen or shorten the center section of the elements by means of adjustable stubs.

The latter method was chosen for two reasons: (1) the r.f. potential at the center of each element is close to zero, thus preventing r.f. burns when the energized array is being adjusted; (2) correct adjustment is assured because element symmetry is maintained by one adjustment which can be made from a single position on the roof. If the first method of adjustment were used, it would be necessary to move back and forth from the end of each element continually, making an adjustment, testing, and repeating the procedure until the correct element length was obtained. With the second method, it is necessary only to slide the shorting bar back and forth until tuning is correct and then lock the bar in place. The method of making this adjustment will be described later.

Copper-to-aluminum contacts should be avoided in the stubs because they may cause galvanic action, with resultant deterioration of the aluminum. Small copper parts such as lugs, washers, etc., should be carefully tinned, and the final joints covered with a good varnish. It would be a good idea to varnish all the elements when the beam is completed.

Because the author was interested

primarily in best performance in the phone section of the 20-meter band, the design frequency chosen was 14.25 megacycles, the center of the American phone band. The length in feet of the radiator, director, and reflector were determined from the following relations, in which the decrease of 4 per-cent in director length and the increase of 5 per-cent in reflector length, as compared with the length of the radiator, were taken into consideration:

$$\begin{aligned} \text{Length (radiator)} &= \frac{468}{f(\text{mc.})} = \frac{468}{14.25} = 32' 11'' \\ \text{Length (director)} &= \frac{450}{f(\text{mc.})} = \frac{450}{14.25} = 31' 7'' \\ \text{Length (reflector)} &= \frac{492}{f(\text{mc.})} = \frac{492}{14.25} = 34' 6'' \end{aligned}$$

The length of the two tuning stubs and the shorting bar must be taken into consideration, as shown in Fig. 7. For example, the length of each half of the director is 15 feet, 2 inches; thus, the length of the whole director is 30 feet, 4 inches. The length of each tuning stub is 12 inches, but the shorting bar is set initially at 6 inches; thus, the total effective length of the stubs is 1 foot. The shorting bar itself is 3 inches. Therefore, the total length of the director is 31 feet, 7 inches, the desired calculated length. Because the director should be about 4 per-cent shorter in length than the radiator, as mentioned previously, the 12-inch stubs allow for a variation of from 1 per-cent to 7 per-cent, with the mean at about 4 per-cent.

Tests have shown that maximum gain is obtained with a director-radiator spacing of 0.1 wavelength and a reflector-radiator spacing of 0.15 wavelength. The following equations may be used to determine the length in feet between the director and the ra-

diator, L_d , and the length between the reflector and the radiator, L_r .

$$\begin{aligned} L_d &= \frac{0.1K}{f} = \frac{98.4}{14.25} = 6' 11'' \\ L_r &= \frac{0.15K}{f} = \frac{147.5}{14.25} = 10' 4'' \end{aligned}$$

where: K = one wavelength = 984 feet.
 f = frequency in megacycles.

The construction of the array, as shown in Fig. 5, is relatively simple. Because the entire array is supported by six guy wires, pieces of 2" x 4" lumber were used for the boom. The length of the boom is determined by the distance between the director and the reflector. Three pieces of 2" x 2" lumber used to support the elements were bolted to the boom by means of 90-degree angles. After the entire array had been assembled on the ground to determine the "center-of-gravity" point, a piece of 2" x 12" lumber the width of the boom was fastened to the boom at this point. The use of these pieces prevents bending torque on the shaft and balances the entire array on the shaft.

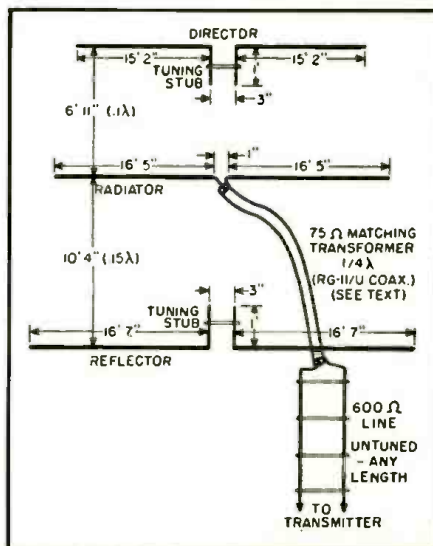
One advantage of the frame construction is that elements of small diameter may be used. About half of the length of each element is supported by the 2" x 2" pieces of lumber, which are approximately 17 feet long. The array shown in Fig. 5 used two 12-foot lengths of heavy-wall aluminum tubing having an inside diameter of $\frac{3}{8}$ -inch, with a length of solid aluminum rod having a $\frac{5}{16}$ -inch diameter inserted into the tubing at the outer end to provide the proper length. Two pieces of 1" x 2" lumber were screwed to the ends of the element supports, as shown in Fig. 5, to prevent the element supports from whipping in the wind and thus changing the spacing between elements.

The main strength of the entire array lies in the six guy wires and their arrangement. A molded steel pipe flange was used to support a five-foot length of 1½ inch pipe, the top of which is used as the focal point for the six guy wires. Two egg insulators break each guy wire into three equal sections and prevent any resonant effect from the guy wires. Rustproof wire or cable should be used for the guy wires to prevent rusting and snapping. If steel wires are used, they should be coated with some rust-inhibiting material, such as aluminum paint. The use of rustproof and rust-inhibiting materials throughout the array will save considerable maintenance time and effort later on. Wooden members should be undercoated and painted with good enamel, with a top coat of spar varnish.

Feeding the Array

There are several methods for feeding a parasitic array, such as the "T" match, delta match, and quarter-wave transformer match. The quarter-wave transformer match was chosen for reasons of cost, simplicity, and ease of adjustment. (Continued on page 142)

Fig. 7. Dimensions of the beam proper. The elements are aluminum tubing. The radiator is fed through a ¼-wave coaxial matching transformer via slip rings.



For opportunities within your reach

See what the RCA TV Servicing Course offers you



Good-pay jobs. A business of your own.

OPPORTUNITIES FOR GOOD-PAY JOBS in Television are within your reach when you study TV Servicing by the RCA Institutes Home Study Method. Or perhaps you would like to start a TV Service business of your own.

If you are not satisfied with the way your future now stacks up, see how easily

you can change the course of your career. RCA Institutes Home Study Course in TV Servicing is helping thousands of other people to better jobs. It can help you. Right now thousands of opportunities are going begging. There is a critical shortage of trained TV servicemen. This is *your* big opportunity.

Easy-to-understand, illustrated lessons



The entire course is divided into ten units of several individual lessons. You study them at home in your spare time.

Lesson-by-lesson you learn the theory and step-by-step procedures of installing TV antennas, of servicing and trouble-shooting TV receivers. Hundreds of pictures and diagrams help you understand the how-it-works information and the how-to-do-it techniques. You will be amazed how easily you absorb the knowledge of each lesson, how quickly you train yourself to become an experienced technician.

Experienced engineers and faculty prepared the course, grade your lessons



The RCA Institutes course was written and planned by instructors with years of specialized experience in training men by home-study and resident-school methods. The course embodies RCA's background of television experience plus knowledge gained in training several thousand technicians. A study of the course parallels an apprentice's training. Your lessons are carefully examined and accurately graded by friendly teachers who are interested in helping you to succeed.

One of the leading and oldest Radio-Television training schools



Founded in 1909, RCA Institutes, Inc. has been in continuous operation for the past 44 years. Its

wide experience and extensive educational facilities give students, just like you, unsurpassed technical training in the highly specialized field of radio-television-electronics.

RCA Institutes is licensed by the University of the State of New York . . . an affiliate member of the American Society for Engineering Education . . . approved by the Veterans Administration . . . approved by leading Radio-Television Service Organizations.

It costs so little to gain so much

RCA Institutes makes it easy for you to take advantage of the big opportunities in TV Servicing. The cost of the TV Servicing Home Study Course has been cut to a minimum. You pay for the course on a pay-as-you-learn unit lesson basis. No other home study course in TV Servicing offers so much for so little cost to you.

RCA Institutes conducts a resident school in New York City offering day and evening courses in Radio and TV Servicing, Radio Code and Radio Operating, Radio Broadcasting, Advanced Technology. Write for free catalog on resident courses.

SEND FOR FREE BOOKLET—Mail the coupon—today. Get complete information on the RCA INSTITUTES Home Study Course in Television Servicing. Booklet gives you a general outline of the course by units. See how this practical home study course trains you quickly, easily. Mail coupon in envelope or paste on postal card.



MAIL COUPON NOW!

RCA INSTITUTES, INC., Home Study Dept. RN253
350 West Fourth Street, New York 14, N.Y.

Without obligation on my part, please send me copy of booklet "RCA INSTITUTES Home Study Course in TELEVISION SERVICING." (No salesman will call.)

Name _____ (please print)

Address _____

City _____ Zone _____ State _____



RCA INSTITUTES, INC.
A SERVICE OF RADIO CORPORATION of AMERICA
350 WEST FOURTH STREET, NEW YORK 14, N.Y.

Thousands depend on PHOTOFACT! THEY TELL YOU WHY

Unsolicited letters tell what the world's finest TV and Radio Data means to Service Technicians



Alexander Cuomo
193 Columbia St.
Brooklyn, N. Y.

"Just to let you know that your PHOTOFACT diagrams are a lifesaver to me and many other Radio and TV men. I congratulate you and your entire staff that worked hard to make it possible for us to read your diagrams in a simple manner. Thank you."



C. S. Pruett
Pruett's Radio Shop
450 N. 7th St.
Dade City, Fla.

"I have all of your PHOTOFACT Folders, and I think they are the most useful thing in my shop. They really save time and money."



Fred Hale
719 E. 10th St.
Brooklyn, N. Y.

"Let me say that I like the way you put out PHOTOFACT Folders. It is worth \$1.50 for one circuit alone because you do a thorough job."

NOW! GET THE PROOF FOR YOURSELF!

FREE

We'll send you a Free Photofact Folder on any receiver listed in "PF Index & Technical Digest."

Learn for yourself—at our expense—how PHOTOFACT pays for itself by earning bigger repair profits for you! Select any Folder from the PF Index (if you haven't an index, get a copy from your distributor). When you write us for your Free Folder, be sure to state Photofact Set and Folder Number as shown in the Index. Get your Free Folder now. Examine, use, compare—see why you can't afford to be without PHOTOFACT!

HOWARD W. SAMS & CO., INC.
2203 E. 46th St., Indianapolis 5, Ind.

HOWARD W. SAMS & CO., INC.

NEW TV GRANTS SINCE FREEZE LIFT

Partial listing of construction permits granted by the FCC since lifting of freeze. Additional stations will be listed next month.

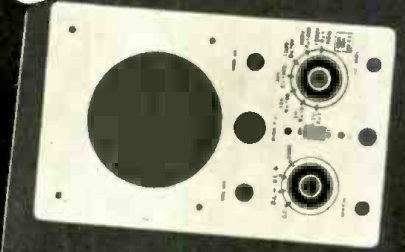
STATE	CITY	CALL**	CHANNEL	FREQUENCY (mc.)	POWER (Video)*
Alabama	Gadsden	WTVS	21	512-518	22
"	Mobile	WALA	10	192-198	316
"	Mobile	WKAB-TV	48	674-680	22.5
"	Montgomery	WCOV-TV	20	506-512	88
Arizona	Tucson	KVOA-TV	4	66-72	11
"	Tucson	KOPO-TV	13	210-216	316
Arkansas	Fort Smith	KFSA-TV	22	518-524	265
"	Little Rock	KETV	23	524-530	17.5
"	Little Rock	KRTV	17	488-494	22
California	Santa Barbara	KEYT	3	60-66	50
"	San Bernardino	KITO-TV	18	494-500	87
"	Fresno	KMJ-TV	24	530-536	105
Colorado	Colorado Springs	KDRO-TV	13	210-216	11.5
"	Denver	KIRV	20	506-512	89
"	Denver	KFEL-TV	2	54-60	56
"	Denver	KBTV	9	186-192	240
"	Denver	KDEN	26	542-548	105
"	Pueblo	KCSJ-TV	5	76-82	12
"	Pueblo	KDZA-TV	3	60-66	10.5
Connecticut	Bridgeport	WSJL	49	680-686	99
"	Bridgeport	WICC-TV	43	644-650	81
"	New Britain	WKNB-TV	30	566-572	180
"	Waterbury	WATR-TV	53	704-710	245
Florida	Ft. Lauderdale	WITV	17	488-494	18.8
"	Ft. Lauderdale	WFTL-TV	23	524-530	100
"	Pensacola		15	476-482	20
"	St. Petersburg	WSUN-TV	38	614-620	83
Illinois	Belleville	WTVI	54	710-716	115
"	Decatur	WTVP	17	488-494	18
"	Peoria	WEEK-TV	43	644-650	175
"	Rockford	WTVO	39	620-626	15.5
Indiana	Muncie	WLBC-TV	49	680-686	16
"	South Bend	WSBT-TV	34	590-596	170
Iowa	Sioux City	KVTV	9	186-192	29
"	Sioux City	KWTV	36	602-608	18.5
Kentucky	Ashland	WPTV	59	740-746	250
"	Henderson	WEHT	50	686-692	26
"	Louisville	WKLO-TV	21	512-518	200
Louisiana	Baton Rouge	WAFB-TV	28	554-560	225
Maryland	Frederick	WFMD-TV	62	758-764	105
Massachusetts	Fall River	WSEE-TV	46	662-668	19.5
"	Holyoke	WHYN-TV	55	716-722	65
"	New Bedford	WNBH-TV	28	554-560	200
"	Springfield	WWLP	61	752-758	115
Michigan	Ann Arbor	WPAG-TV	20	506-512	1.75
"	Battle Creek	WBCK-TV	58	734-740	18.5
"	Battle Creek	WBKZ-TV	64	770-776	24.5
"	Flint	WCTV	28	554-560	17.5
"	Flint	WTAC-TV	16	482-488	59
"	Jackson	WIBM-TV	48	674-680	225
"	Kalamazoo	WKMI-TV	36	602-608	83
"	Saginaw	WKNX-TV	57	728-734	17.5
Minnesota	Duluth	WFTV	38	614-620	17
Mississippi	Jackson	WJTV	25	536-542	180
Missouri	St. Joseph	KFEQ-TV	2	54-60	52
"	Springfield	KTTS-TV	10	192-198	12.5
Nebraska	Lincoln	KOLN-TV	12	204-210	21.5
"	Lincoln	KFOR-TV	10	192-198	56
New Jersey	Asbury Park	WCEE	58	734-740	100
"	Atlantic City	WFPG-TV	46	662-668	18
New York	Elmira	WTVE	24	530-536	58
"	Poughkeepsie	WEOK-TV	21	512-518	105
North Carolina	Asheville	WISE-TV	62	758-764	23
"	Greensboro	WCOG-TV	57	728-734	115
"	Raleigh	WETV	28	554-560	280
Ohio	Akron	WAKR-TV	49	680-686	145
"	Dayton	WONE-TV	22	518-524	210
"	Lima	WLOK-TV	73	824-830	20
"	Massillon	WMAC	23	524-530	99
"	Youngstown	WUTV	21	512-518	170
"	Warren	WHHH-TV	67	788-794	80
"	Youngstown	WFMJ-TV	73	824-830	175
"	Youngstown	WKBN-TV	27	548-554	200
Oregon	Portland	KPTV	27	548-554	91

*ERP = (effective radiated power). **Call letters without TV suffix from application files and subject to change; except where included in calls such as KBTV.

.. = Call letters to be announced.

Check these ADVANTAGES FOUND Only in HEATHKITS

1



2



3



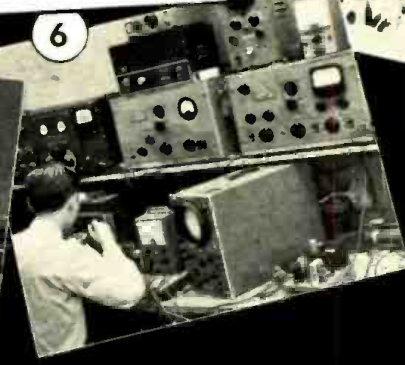
4



5



6



9



8



7



- ✓ **1. Baked Enamel Lifetime Finish Panels** — Oven baked finishes for maximum durability and freedom from mars, scratches and discoloration. Panels that can really take service shop and laboratory abuse.
- ✓ **2. Save Money** — You save all expensive factory wiring costs when you build your own. And, direct factory to customer sales eliminate all middle man profits. You can have a complete Heathkit laboratory or service shop for what one or two pieces of ready built equipment cost.
- ✓ **3. Modern Styling** — New "fitted panels" and formed cabinets with rounded corners present a smart, professional appearance. Dignified appearance for prestige.
- ✓ **4. Quality Components Used Throughout** — Heathkits use well known, time and quality tested components such as Simpson, Chicago Transformer, Wilkor, Allen-Bradley, Altec-Lansing, Centralab, Cinch, Oak, Grigsby-Allison, Mallory and many others.
- ✓ **5. Extensive Factory Facilities** — Shearing, punching, forming, spot welding, etc. is done right in our own plant — controlled production for highest quality and less cost to you.
- ✓ **6. Extensive and careful engineering** — A staff of engineers working in a modern, well equipped laboratory carefully develop Heathkits according to highest engineering practices. Your assurance of accurate, up to the minute instruments.
- ✓ **7. Complete Kits** — All the parts are right in the kit — you get all tubes, controls, transformers, meters — everything — no other components to buy. And no cutting, punching, or painting necessary — it's all done for you. Heathkits go together easily and smoothly.
- ✓ **8. Only Complete Line** — Over 30 kits available — Heathkits form the only complete line of kit-form test equipment on the market. Kits for hams, engineers, service men, schools and audio enthusiasts.
- ✓ **9. Detailed, Complete Instruction Manuals** — Comprehensive manuals tell you exactly how to build your Heathkit. Manuals contain easy-to-follow instructions, clear, large pictorials, schematic, detail drawings, etc. They make construction easy, fun, and educational.

Nine New Heathkits This Year!

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
33 E. 40th ST.
NEW YORK CITY (10)
CABLE: ARRA-NY

The HEATH COMPANY

... BENTON HARBOR 15, MICHIGAN

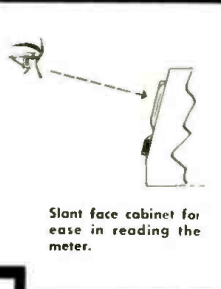
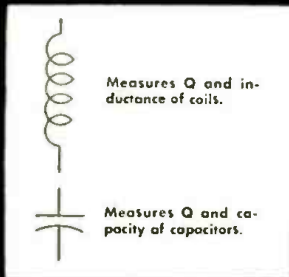
NEW Heathkit "Q" METER KIT

• A HIGH QUALITY Q METER AT LOW COST.

MODEL QM-1

SHIPPING
WT. 12 LBS.

\$39⁵⁰



- First Q METER within the price range of all.
- Read Q's of 0-500 directly on calibrated scale.
- Stable oscillator supplies R.F. frequencies of 150 kc to 18 megacycles.
- Calibrated capacitor with range of 40 mmf to 450 mmf with vernier of ± 3 mmf.
- Simple, easy operation.
- Can be used to measure small inductances or capacitors.
- Measures Q of condensers, RF resistance and distributed capacity of coils.
- Measures capacity by substitution, capacity by resonance, inductance by resonance.
- Slanted panel for convenient operation.

Another outstanding example of progressive HEATHKIT engineering. Now a highly desirable Q METER within the price range of all laboratories, schools and experimenters. No longer is it necessary to deny yourself the many measurement advantages offered by this instrument.

Use the new HEATHKIT Q METER for the following simple basic measurements: capacity by substitution, capacity by resonance, inductance by resonance and Q at the OPERATING frequency all can be read on the calibrated scales. The method used to obtain information regarding the Q of condensers, RF resistance, distributed capacity in coils, etc., is only slightly more involved. In the HEATHKIT Q METER, the generated RF signal is coupled through a cathode follower and injected across a low impedance condenser which is included in the resonant circuit under test. Large $4\frac{1}{2}$ " 50 microampere Simpson meter reads Q directly. The resonating condenser and vernier condenser are calibrated in mmf for substitution method capacity tests. The resonating condenser is also calibrated in effective capacity for resonance tests. The inductance calibration serves for rapid determination of the approximate inductance of a coil. The HEATHKIT Q METER has a generator frequency range of 150 kc to 18 megacycles. Vernier capacity covers ± 3 mmf and the resonating condenser is calibrated from 40 mmf to 450 mmf actual capacity or 40 mmf to 350 mmf effective capacity. Meter reads Q directly up to 250. Higher and lower full scale readings can be obtained by varying the injection voltage levels.

The entire kit consists of 12AT7, 6AL5, 6C4, OD3 and 6X5 tubes, 50 microampere Simpson meter, power transformer, cabinet and all other parts necessary for construction as well as instructions for assembling, testing and operation of the completed instrument.

Heathkit DECADE RESISTANCE KIT

The HEATHKIT DECADE RESISTANCE KIT is widely used by schools, experimenters and laboratories because of the extremely wide resistance range offered and the useful, dependable service provided. The DECADE consists of 5 rotary 2 deck ceramic wafer switches with silver plated contacts and twenty 1% precision resistors in a circuit which provides the resistance range of 1 ohm to 99,999 ohms in 1 ohm steps. The HEATHKIT DECADE RESISTANCE KIT is simple to construct and is housed in a beautiful polished birch cabinet with an attractive panel. The DECADE will furnish years of accurate trouble-free service.

Individual decade sections of above can be purchased separately for special applications.



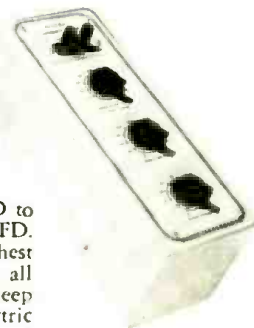
MODEL DR-1
SHIPPING
WT. 4 LBS.

\$19.50

NEW Heathkit DECADE CONDENSER KIT

Extremely useful in all experimental and design work such as determination of condenser values for: compensating networks, filters, bridge impedances, tuned circuits, etc. Uses all precision silver mica condensers within $\pm 1\%$ accuracy. Values run in three decades from 100 MMFD to 0.111 MFD in steps of 100 MMFD. Smooth acting, positive detent, highest quality ceramic wafer switches make all capacitor values easy to set up and keep losses to a minimum. Low loss dielectric terminal board mounts on outside of panel for easy cleaning. Heathkit binding posts accommodate a wide variety of test leads. Comes complete with all parts, including polished birch cabinet.

Individual decade sections of above can be purchased separately.



MODEL DC-1
SHIPPING
WT. 4 LBS.

\$16⁵⁰


EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (10)
CABLE: RRHAK PLT

The HEATH COMPANY


... BENTON HARBOR 15, MICHIGAN

NEW *Heathkit* OSCILLOSCOPE KIT


• NEW WIDE BAND VERTICAL AMPLIFIER ± 2 DB 10 CYCLES TO 1 MC.




Direct plate connections for modulation tests.



Displays TV sync pulses correctly.



Useful to 5 mc.

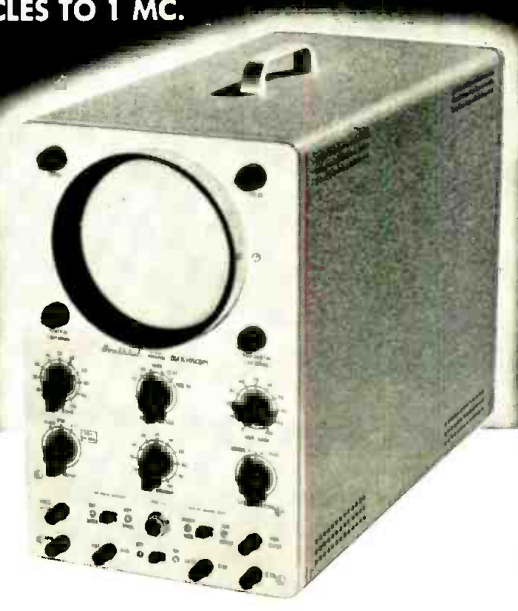


Good square wave response at 100 kc.

MODEL O-8

SHIPPING
WT. 29 LBS.

\$43.50



- New wider band vertical amplifier ± 2 db from 10 cycles to 1 megacycle useful to over 5 megacycles.

- High sensitivity in vertical amplifier. .025 volts RMS per inch deflection.

- New 3 step input attenuator input ranges X1, X10, X100.

- New 5CP1 intensifier type tube for greater brilliance.

- Terminal board and rear cabinet opening provisions for direct connections to deflecting plates.

- Newly styled formed and ventilated aluminum cabinet.

- Wide band sweep generator, 15 cycles to over 100 kc. Will synchronize with 5 megacycle signal.

- 10 tube circuit featuring push pull operation of vertical and horizontal amplifiers.

- Internal synchronization on either positive or negative peaks.


- Reproduces faithfully the front and back porches of TV sync pulses. Excellent square wave reproduction to over 100 kc.

- Optional Intensifier kit available for 2200 volt operation.

Proudly announcing the new 1953 HEATHKIT Model O-8 OSCILLOSCOPE featuring the finest performance ever offered in this extremely popular kit instrument. Improved wider band vertical amplifier featuring a new 3-step input attenuator affording smooth control of the excellent .025 volts per inch vertical sensitivity. Possibility of overloading the vertical input circuit is minimized. Greater band width in the vertical channel is a decided advantage to TV service men. Permits clear observation of all TV sync pulse detail and excellent square wave reproduction over 100 kc. 5CP1 intensifier type CR tube provides a brilliant trace with normal accelerating voltages. A handsome, ventilated cabinet with smooth rounded corners and a snug fitting drawn panel adds to the smartly styled professional appearance. Longer life is assured through cooler instrument operation. Push pull output stages in both vertical and horizontal amplifiers for balanced deflection of the spot. All of the many fine features of the previous model have been retained. Rear cabinet access to terminal board for direct connection to CR plates. The entire kit of all 10 tubes, parts, cabinet and panel as well as detailed construction manual for assembly and operation of the instrument included.

INTENSIFIER KIT: For extreme trace brilliance in special applications such as photography, group demonstrations or operation in brightly lighted areas an optional Intensifier kit providing 2200 volt operation of the CR tube is available. Kit includes high voltage filter condenser, high voltage selenium rectifier, etc. \$7.50.

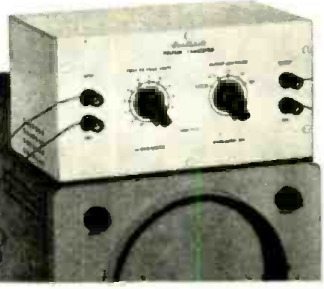
Heathkit SCOPE DEMODULATOR PROBE KIT



Trouble shooting or aligning TV, RF, IF and video stages requires demodulation of high frequency signals before Oscilloscope observation. The HEATHKIT SCOPE DEMODULATOR PROBE KIT was specifically developed for this application. Kit consists of a probe housing, crystal diode detector circuit, shielded cable and spade lugs. Assembly is simple and the probe will quickly prove its usefulness as an Oscilloscope accessory.

No. 337
SHIP. WT. 1 LB.
\$4.50

NEW *Heathkit* VOLTAGE CALIBRATOR KIT



MODEL VC-1
SHIPPING
WT. 5 LBS. **\$9.50**

Use the Heathkit Voltage Calibrator with your oscilloscope to measure peak-to-peak TV complex waveshapes. TV manufacturer's specifications indicate correct peak-to-peak voltages and this kit will permit making these important measurements.

A big help to engineers in circuit work. Makes peak-to-peak voltage measurements of complex waveshapes of all kinds. Flat topped semi-square wave output of calibrator assures fast and easy measurement of any voltage between .01 and 100V peak-to-peak.

The Voltage Calibrator can remain connected to your oscilloscope at all times for instant use. "Signal" position connects signal under study directly through calibrator and into scope input circuit for direct observation. Eliminates transferring leads from calibrator. *A wonderful scope accessory.*

Heathkit ELECTRONIC SWITCH KIT

A few dollars spent for this accessory will increase the usefulness of a scope immeasurably. An electronic switch will open up a whole new field of scope applications for you. The S-2 allows TWO SIGNALS to be observed at the SAME TIME — this important feature allows you to immediately spot phase shift, clipping, distortion, etc. The two signals under observation can be superimposed or separated for individual study. Each signal input has an individual gain control for properly adjusting scope trace patterns. Has both coarse and fine frequency controls for adjusting switching time. Multivibrator switching frequency is from less than 10 cps to over 2000 cps in three overlapping ranges. Kit comes complete including 5 tubes, power transformer, all controls, instruction manual, etc. *Every scope owner should have one!*



MODEL S-2
SHIPPING
WT. 11 LBS.

\$19.50

ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY 16
CABLE ARAPO N.Y.

The HEATH COMPANY

... BENTON HARBOR 15, MICHIGAN

Heathkit
VACUUM TUBE

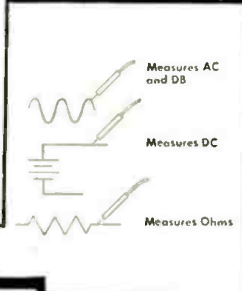
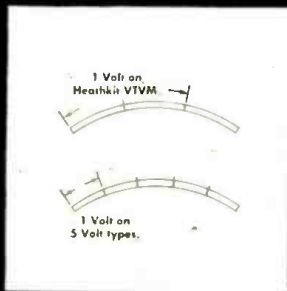
VOLTMETER KIT

• NEW 1½ VOLT RANGE ON 1953 VTVM

MODEL V-6

SHIPPING
WT., 7 LBS.

\$24.50



- New 1½ volt low range gives over 2" of scale per volt instead of less than ¾" found on 5 volt range type.
- Increased accuracy due to expanded scales.
- New 1500 volt DC high range gives 50% greater coverage.
- Seven ranges in all. 1½, 5, 15, 50, 150, 500 and 1500 volts DC (1000 volts maximum AC only).
- Provides proper service ranges 150 volts for AC DC work and 500 volts for AC type service.
- High input impedance, 11 megohms minimizes circuit loading.
- Variety of accessory probe kits available.
- 1% precision resistors in multiplier circuits.
- 200 microampere Simpson meter.
- Center scale zero adjust.
- Transformer operated.
- Test leads included.
- New cabinet styling.
- Large, clearly marked meter scales indicate ohms, AC volts, DC volts and DB.

The 1953 Heathkit V-6 VTVM has improved ranges! The lowest range has been moved way down to 1.5V full scale. This gives 3½" of actual scale length for the 1.5V covered—that's 2½ inches per volt!! Now you can make your low level measurements faster and with greater accuracy.

And the upper range has been moved up. Readings up to 1500V DC can be readily made with new, improved VTVM—plus readings up to 1000V on AC. Higher ranges for extended use.

New vertical chassis mounting gives added chassis space for really easy wiring—no tight corners to worry about. Uses only highest quality components throughout. Simpson 200 microampere meter movement combined with 1% precision resistors in multiplier circuit insure highly accurate and dependable readings.

AC and DC voltage ranges are 0-1.5V-5V-15V-50V-150V-500V-1500V. (1000V max. reading on AC)—a total of seven ranges for convenient, accurate readings. Instrument also measures resistance from .1 ohm to over 1 billion ohms in seven handy ranges of RX1, X10, X100, X1000, X10K, X1 Meg.,—all convenient multiples of 10 with no skips. Has Db scale in red for easy identification.

New panel has tough baked on enamel finish for freedom from scratches and maximum durability. Modern styled, formed, compact cabinet with rounded edges and crackle finish is truly handsome.

Comprehensive, detailed instruction manual with step-by-step instructions, figures, pictorials, etc. makes assembly a cinch.

Be sure and look over the special accessory VTVM probes below—for added usefulness.

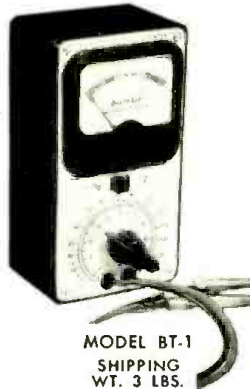
<p><i>Heathkit</i> R. F. PROBE KIT SHIP. WT. 1 LBS. \$5.50 No. 309 Extends RF range of HEATHKIT 11 megohm VTVM to 250 megacycles ± 10%.</p> 	<p><i>Heathkit</i> 30,000 V. D.C. PROBE KIT SHIP. WT. 2 LBS. \$5.50 No. 336 Provides DC multiplication factor of 100 for any 11 megohm VTVM.</p> 	<p><i>Heathkit</i> PEAK TO PEAK VOLTAGE PROBE KIT SHIP. WT. 2 LBS. \$6.50 No. 338 Reads on DC scale of any 11 megohm VTVM 5 kc to 5 megacycle range.</p> 
---	--	--

NEW *Heathkit* BATTERY TESTER KIT

The new Heathkit Battery Tester measures all types of dry batteries between 1½ volts and 150 volts under actual load conditions. Readings are made directly on a three-color GOOD-WEAK-REPLACE scale that your customers can readily understand. Operation is extremely simple and merely requires that the leads be connected to the battery under test. Only one control to adjust in addition to a panel switch for A or B battery types.

The Heathkit Battery Tester features compact assembly. An accurate meter movement and wire wound control mount in the portable, rugged plastic case.

Use the BT-1 to check portable radio batteries, hearing aid batteries, lantern batteries and photo flash gun batteries.

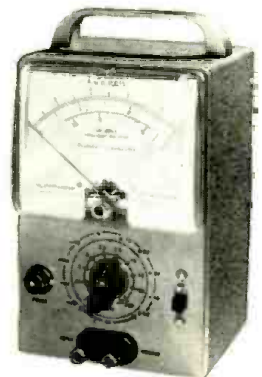


MODEL BT-1
SHIPPING
WT. 3 LBS.

\$7.50

Heathkit AC VACUUM TUBE VOLTMETER KIT

A new AC VTVM that makes possible those sensitive AC measurements required by laboratories, audio enthusiasts and experimenters. Ten full scale ranges of .01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 volts RMS. 10 DB ranges from -52 to +52 DB. Frequency response within 1 DB from 20 cycles to 50 kc. Simpson 200 microampere meter with large plainly marked meter scales. Precision multiplier resistors. Two amplifier stages using miniature tubes. A unique bridge rectifier meter circuit and a clean layout of parts. Order the AV-2 today and become acquainted with the interesting possibilities offered by this instrument.



MODEL AV-2
SHIPPING
WT. 5 LBS.

\$29.50

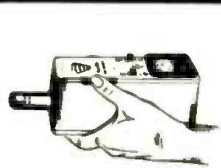
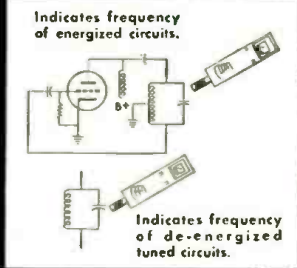
SOLE AGENT
ROCKE INTERNATIONAL CORP.
12 E. 40th ST.
NEW YORK CITY (16)
CABLE: ARELAD NY

The **HEATH COMPANY**

... BENTON HARBOR 15, MICHIGAN

NEW *Heathkit* GRID DIP METER KIT

• CONVENIENT ONE HAND OPERATION.



Complete unit easily held and operated with one hand.

MODEL GD-1

SHIPPING
WT. 4 LBS.

\$19⁵⁰



- New GRID DIP METER with assembled calibrated coils.
- Uses quality Simpson 500 microampere meter.
- One hand operation, extremely compact, Only 2½" wide by 3" high by 7" long.
- Variable meter sensitivity control.
- Uses newest type 6AF4 high frequency triode in a Colpitts oscillator circuit.
- Continuous coverage from 2 megacycles to over 250 megacycles in 6 ranges.
- Head phone monitoring jack.
- AC power transformer operated for maximum safety.

Here is the GRID DIP METER KIT you have been asking for. This new HEATHKIT instrument is compact, highly sensitive and easy to use. Housed in a handsome formed aluminum cabinet—rounded corners—durable oven baked finish on panel and cabinet. The entire instrument can be easily held and operated in one hand, tuning accomplished with the thumb wheel drive. This excellent design feature leaves the other hand entirely free for making circuit adjustments. The instrument with many applications—with oscillator energized, use it for finding the resonant frequency of tuned circuits, locating parasitics, determining characteristics of filter circuits, roughly tuning transmitter stages with power off, and neutralizing transmitters. Useful in TV and radio repair work for alignment of traps, filters, IF stages, peaking and compensation networks within the 2 to 250 megacycle range. With the oscillator not energized, the instrument acts as an absorption wave meter and indicates the frequency of radiating power sources. Locates spurious oscillations, as a relative indication of power in various transmitter stages, etc. (Head phones not included). Complete kit includes plug-in coils, tube, all necessary parts and detailed assembly and instruction manual.

Heathkit IMPEDANCE BRIDGE KIT



MODEL IB-1B
SHIPPING
WT. 15 LBS.

\$69⁵⁰

The HEATHKIT IMPEDANCE BRIDGE is especially useful in educational training programs, industrial laboratories and for experimental work. Use it for measuring AC and DC resistance value of resistors,

determination of condenser capacitance and dissipation factor, finding coil inductance and storage factor, electrical measurements work, etc. Quality components: GR 1000 cycle hummer, GR main control, Mallory ceramic wafer silver plated contact switches, ½% precision resistors, etc. The basic circuit is a self powered, 4 arm bridge. Choice of Wheatstone, Capacitance comparison, Maxwell or Hay bridge circuits. Resistance from 10 milliohm to 10 megohm. Capacitance 10 mmf to 100 mfd. Inductance 10 microhenry to 100 henries. Dissipation factor .002 to 1. Storage factor (Q) 1 to 1000. The IMPEDANCE BRIDGE has provisions for external generator use for measurement at other than the 1000 cycle level. Take the guess work out of electrical measurements. The HEATHKIT IMPEDANCE BRIDGE mounted in a beautiful polished birch cabinet with large easy reading panel calibrations will furnish years of accurate, trouble free measurement service.

Heathkit HANDITESTER KIT



MODEL M-1
SHIPPING
WT. 3 LBS.

\$13⁵⁰

The HEATHKIT Model M-1 HANDITESTER fulfills requirements for a portable volt ohm milliammeter. This kit features precision 1% resistors, 3 deck switch for trouble free mounting of parts, specially designed battery bracket, smooth acting ohms adjust control, beautiful molded bakelite case and a 400 microampere meter movement. 5 convenient AC and DC voltage ranges as follows: 10 - 30 - 300 - 1000 - 5000 volts. Ohms ranges 0 - 3000 and 0 - 300,000. DC milliamperage ranges 0 - 10 milliamperes and 0 - 100 milliamperes. The instrument is easily assembled from complete instructions and pictorial diagrams. Test leads are included. Carry the HEATHKIT M-1 HANDITESTER in your tool box at all times for those simple jobs and eliminate that extra trip for additional testing equipment.

SOLE AGENT
ROCKE INTERNATIONAL CORP.
13 E 40th ST.
NEW YORK CITY (16)
CABLE: 8248 N Y

The **HEATH COMPANY**

... BENTON HARBOR 15, MICHIGAN

NEW
Heathkit

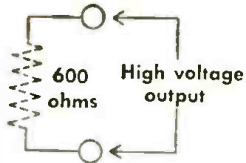
AUDIO GENERATOR KIT

• RANGE EXTENDED TO 1 MEGACYCLE

MODEL AG-8

SHIPPING
WT. 16 LBS.

\$29.50



Low impedance output
High voltage output



Sine wave output
from 20 cycles to 1
megacycle.

- Improved design — new low price.
- Frequency coverage in five ranges from 20 cycles per second to 1 megacycle.
- Response flat 1 DB from 20 cycles to 400 kilocycles. Down 3 DB at 600 kilocycles. Down only 8 DB at 1 megacycle.
- Five calibrated output voltage ranges, continuously variable 1 mv, 10 mv, 100 mv, 1 v, 10 v.
- Low impedance output circuit. 600 ohms.
- Distortion less than .4 of 1% from 100 cycles per second through the audible range.
- New HEATHKIT universal type binding posts.
- Durable infra-red baked enamel panel.
- Transformer operated for safe operation.
- Sturdy, ventilated steel cabinet.

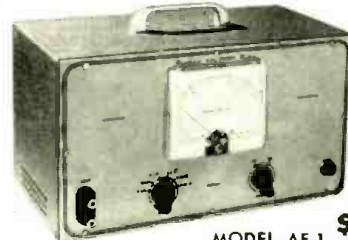
A new Audio Generator with features heretofore found in only the most expensive generators. Such features as complete coverage from 20 cycles to 1 Mc — response flat ± 1 db from 20 cycles to 400 Kc, down 3 db at 600 Kc and down only 8 db at 1 Mc.

And it has calibrated output . . . Calibrated continuously variable and step attenuator output controls allow you to easily set calibrated output voltage. Moreover, distortion is less than .4 of 1% from 100 cps through the audible range.

Oscillator section consists of a two stage resistance coupled amplifier (6SJ7 and 6AK6) utilizing both positive and negative feedback for oscillator operation and reduction of distortion. Oscillator section drives a cathode follower output power amplifier (6AK6) which isolates the oscillator from variations in load and presents a low impedance output (600 Ohms). Power supply is transformer operated and utilizes 6X5 rectifier with 2 sections of RC filtering.

An unbeatable dollar value — for here is an audio generator with wide frequency coverage, excellent frequency response, stepped and continuously variable calibrated output, high signal level, low impedance output, and low inherent distortion.

Heathkit AUDIO FREQUENCY METER KIT

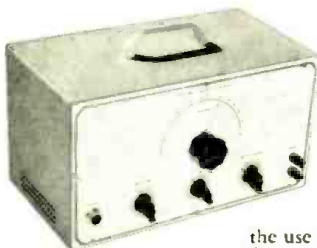


SHIPPING
WT. 15 LBS.

MODEL AF-1 **\$34.50**

The HEATHKIT AUDIO FREQUENCY METER provides a simple and easy way to check unknown audio frequencies from 10 cycles to 100 kc between 3 and 300 volts RMS. The instrument features 7 ranges for accuracy and wide coverage. The meter itself has a quality 200 microampere Simpson movement and large clearly marked scales. The AUDIO FREQUENCY METER is transformer operated and features a voltage regulator tube to maintain constant plate voltage on the second stage. Kit supplied complete with all necessary construction material and a detailed construction manual.

NEW *Heathkit* AUDIO OSCILLATOR KIT



MODEL AO-1
SHIPPING
WT. 14 LBS.

\$24.50

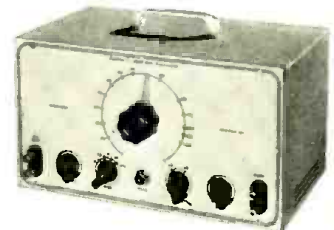
A new Audio Oscillator with both sine and square wave coverage from 20 to 20,000 cycles . . . An instrument designed to completely fulfill the needs of the audio engineer and enthusiast — Has numerous advantages such as high level output (up to 10V obtainable across the entire range), distortion less than .6%, and low impedance output.

Special design features include the use of a thermistor in the second amplifier stage for keeping the output essentially flat across the entire range.

A cathode coupled clipper circuit produces good, clean, square waves with rise time of only 2 microseconds. Oscillator section uses 1% precision resistors in range multiplier circuit for greatest accuracy.

You'll like the operation of this fine new kit.

Heathkit SQUARE WAVE GENERATOR KIT



MODEL SQ-1
SHIPPING
WT. 14 LBS.

\$29.50

The HEATHKIT SQUARE WAVE GENERATOR is an excellent square wave frequency source with wide range coverage from 10 cycles to 100 kc continuously variable. This feature makes it useful for TV and wide band amplifier work as well as audio experimentation. The output voltage is continuously variable between 0 and 20 volts. The circuitry consists of a multivibrator stage, a clipping and squaring stage and a cathode follower low impedance output stage. The power supply is transformer operated and utilizes a full wave rectifier circuit with two sections of filtering. Another excellent HEATHKIT value at this remarkable low price. Kit includes all necessary construction material as well as complete instruction manual for assembly and operation.

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE AREA N.Y.

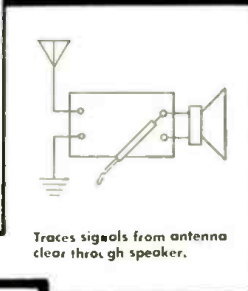
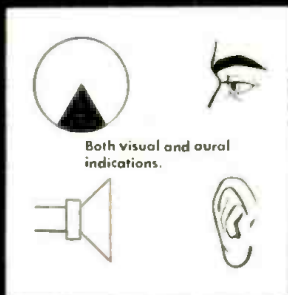
The **HEATH COMPANY**

... BENTON HARBOR 15, MICHIGAN

NEW *Heathkit* VISUAL-AURAL

SIGNAL TRACER KIT

• NEW NOISE LOCATOR AND WATTMETER CIRCUITS.



MODEL T-3

SHIPPING
WT. 8 LBS.

\$22.50

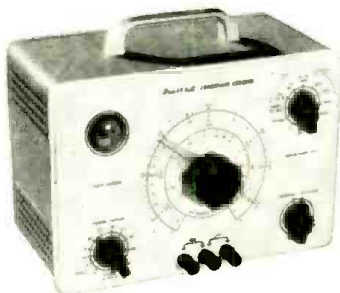


- Permits visual signal observation as well as aural operation.
- Two separate input channels.
- Tremendous RF channel sensitivity. Adequate for actual signal detection at receiver input.
- Separate high gain RF and low gain audio channels.
- A unique and useful noise locator circuit.
- Built-in calibrated wattmeter.
- Two separate shielded probes for RF and audio application.
- Additional test leads supplied.
- Substitution test speaker and output transformer eliminates necessity for speaker removal in service work.
- Utility amplifier. Check record changers, tuners, microphones, instrument pickups, etc.
- VTVM and Scope panel terminals.
- 5 tube transformer operated circuit.

The new HEATHKIT VISUAL AURAL SIGNAL TRACER represents one of the most convenient and useful instruments the service man can use in AM, FM and TV

service work. The electron ray beam indicator constantly monitors both input channels for visual observation of the signal. Now, see and hear the signal level for easier estimation of signal strength and gain per stage in a receiver circuit. Separate high gain channel and special shielded demodulator probe for RF circuit work. Low gain channel for audio circuit investigation and for use as a noise locator. In this feature, approximately 200 volts DC is applied to a suspected circuit component and the action of the voltage in the component can be seen and heard to determine satisfactory operation. This feature alone will prove tremendously helpful in locating the source of objectionable noises in coils, transformers, resistors, condensers, cold solder joints, controls, etc. A convenient wattmeter permits rapid preliminary check for voltage distribution circuit breakdown as well as transformer failures. Use the T-3 as a universal test speaker and substitution transformer and save service time by eliminating the necessity for speaker removal on every service call. Additional service uses are: as a utility amplifier for checking the output of record changers, tuners, microphones, instrument pickups, etc. Separate panel terminals permit utilization of other shop equipment such as your Oscilloscope or VTVM. Entire kit supplied complete with 5 tubes, all necessary construction material along with a detailed step by step instruction manual for the assembly and operation of the instrument.

NEW *Heathkit* CONDENSER CHECKER KIT



MODEL C-3
SHIPPING
WT. 7 LBS.

\$19.50

Announcing the new improved Model C-3 HEATHKIT CONDENSER housed in a new smartly styled professional appearing cabinet featuring rounded corners and snug fitting drawn panel. Adequate provisions for ventilation in-

sure longer instrument life through cooler operation. Use the C-3 to accurately measure those unknown condenser and resistor values. All readings of condensers and resistors are read directly on the calibrated scales. Range of condenser measurements is from .00001 mfd to 1000 mfd. Calibrated resistance measurements can be made from 100 ohms to 5 megohms. A leakage test with a choice of 5 DC polarizing voltages will quickly indicate condenser operating quality under actual voltage load conditions. The spring return leakage test switch automatically discharges the condenser under test and eliminates shock hazard. An electron ray beam indicator tube is used in a new leakage test circuit for added sensitivity. The instrument is transformer operated for safety and will prove an extremely welcome addition to your shop equipment. The kit is furnished complete with all necessary parts, test leads and includes a step by step detailed construction manual for assembly and operation.

Heathkit TV ALIGNMENT GENERATOR KIT

MODEL TS-2
SHIPPING
WT. 20 LBS.

\$39.50



Here is an excellent TV ALIGNMENT GENERATOR designed to do TV service work quickly, easily and properly. The Model TS-2 when used in conjunction with an Oscilloscope provides a means of correctly aligning TV receivers. The instrument furnishes a frequency modulated signal covering in 2 bands the range of 10 to 90 megacycles and 150 to 230 megacycles. An absorption type frequency marker covers from 20 to 75 megacycles in 2 ranges; therefore you have a simple, convenient means of checking IF's independent of oscillator calibration. Sweep width is variable from 0 to 12 megacycles. Other excellent features are horizontal sweep voltage controlled with a phasing control — both step and continuously variable attenuation for setting the output signal to the desired level — a convenient stand by switch — and blanking for establishing a single trace with a base reference level. Make your work easier, save time and repair with confidence. Order your HEATHKIT TV ALIGNMENT GENERATOR now.

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE: ARLAB-N.Y.

The HEATH COMPANY

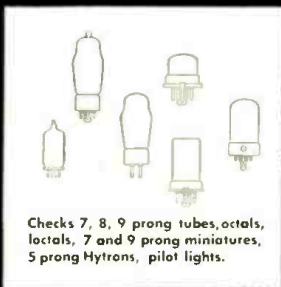
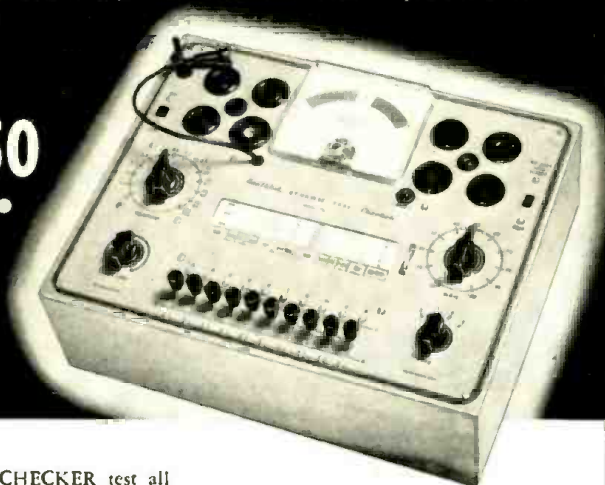
... BENTON HARBOR 15, MICHIGAN

Heathkit TUBE CHECKER KIT

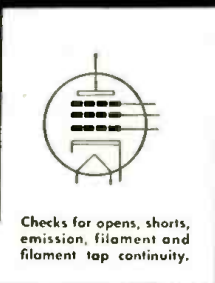
MODEL TC-1

SHIPPING
WT. 12 LBS.

\$29⁵⁰



Checks 7, 8, 9 prong tubes, octals, locals, 7 and 9 prong miniatures, 5 prong Hytrons, pilot lights.



Checks for opens, shorts, emission, filament and filament tap continuity.

- Beautiful counter type birch cabinet.
- 4½" Simpson 3 color meter.
- Simplified setup procedure.
- Built-in gear driven roll chart.
- Checks emission, shorted elements, open elements and continuity.
- Complete protection against obsolescence.
- Sockets for every modern tube.
- Blank for new types.
- Individual element switches.
- Contact type pilot light test socket.
- Line adjust control.

PORTABLE TUBE CHECKER KIT MODEL TC-1P

Same as TC-1 except supplied with polished birch cabinet (with removable lid) instead of counter type cabinet. Shipping weight 14 lbs. **\$34.50**

No. 365 Polished Birch Tube Checker Cabinet only. Shipping Weight 7 lbs. **\$7.50**

With the HEATHKIT TC-1 TUBE CHECKER test all types of tubes commonly encountered in AM-FM and TV receiver circuits. Test setup procedure is simplified, rapid and flexible. Tube quality is read directly on a beautiful 4½" Simpson three color BAD - ? - GOOD scale that your customers can readily understand. Panel sockets accommodate 4, 5, 6 and 7 prong tubes, octals, locals, 7 and 9 prong miniatures, 5 prong Hytrons, a blank socket for new tubes and a contact type socket for quick checking of pilot lights. Built-in gear driven roll chart for instant reference. Neon short indicator, individual three position lever switch for each tube element, spring return test switch, line set control to compensate for supply voltage variations. At this low price, no service man need be without the advantages offered by the HEATHKIT TUBE CHECKER.

Heathkit TV PICTURE TUBE TEST ADAPTER

Use your HEATHKIT TUBE CHECKER with this new TV TEST ADAPTER to determine picture tube quality. Check for emission and shorts, independent of TV power supply. Consists of standard 12 pin TV tube socket, 4 feet of cable, ocal socket connector and data sheet. Quickly prove TV picture tube condition to yourself and your customer.



No. 355
Ship. Wt. **\$4⁵⁰**
1 lb.

Heathkit RESISTANCE SUBSTITUTION BOX KIT



MODEL RS-1
SHIPPING
WT. 3 LBS.

\$5⁵⁰

NEW HEATHKIT RESISTANCE SUBSTITUTION BOX KIT provides switch selection of any single one of 36 RTMA 1 watt 10% standard value resistors, ranging from 15 ohms to 10 megohms. This coverage available in 2 ranges in decades of 15, 22, 33, 47, 68 and 100. Housed in rugged plastic cabinet featuring new HEATHKIT universal type binding posts. The entire kit priced less than the retail value of the resistors alone.

Heathkit BATTERY ELIMINATOR KIT

A clean 6 volt d-c supply source is definitely required for successful automobile radio servicing. Has a continuously variable d-c output from 0 to 8 volts. It can be safely operated at a steady 10 ampere level and will deliver up to 15 amperes for intermittent periods. The voltage output terminals are completely isolated from the chassis to accommodate additional service applications such as supplying bias voltages or d-c substitution voltages for battery operated tube filament circuits.

The output of the Battery Eliminator is constantly monitored by a d-c voltmeter and a d-c ammeter. The circuit features an automatic overload relay of self resetting type. For additional protection, a panel mounting fuse is provided. Build this kit in a few hours and pocket a substantial savings.



MODEL BE-3
SHIPPING
WT. 20 LBS.

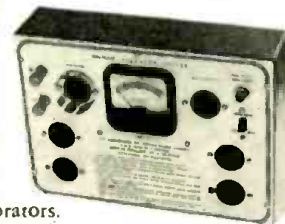
\$24⁵⁰

Heathkit VIBRATOR TESTER KIT

Repair time is valuable, and the Heathkit Vibrator Tester will save you hours of work. Instantly tells the condition of the vibrator under test—and the check is thorough and complete. Checks vibrator for proper starting, and the easy-to-read meter indicates the quality of output on large BAD-GOOD scales. Tests both interrupter and selfrectifier types of vibrators. Five different sockets for checking hundreds of vibrators.

Operates from any battery eliminator capable of delivering continuously variable voltage from 4-6V at 4 amps. The Heathkit BE-3 Battery Eliminator is ideal for operating this kit.

Faulty vibrators can be spotted within seconds and you're free to go on to other service jobs.



MODEL VT-1
SHIPPING
WT. 7 LBS.

\$14⁵⁰

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE ARIANY

The HEATH COMPANY

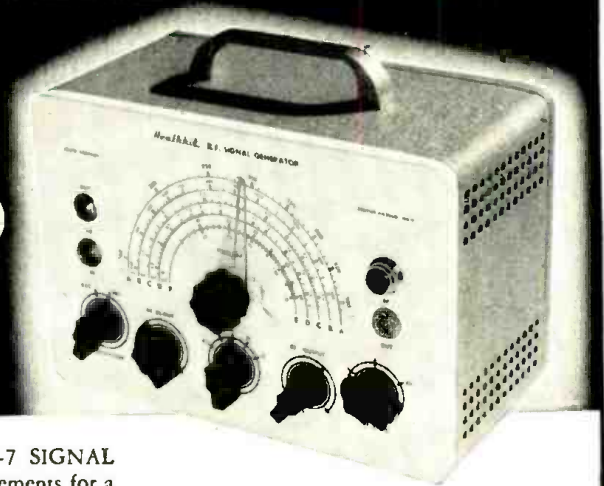
... BENTON HARBOR 15, MICHIGAN

Heathkit SIGNAL GENERATOR KIT

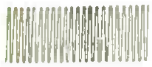
MODEL SG-7

SHIPPING
WT. 7 LBS.

\$19⁵⁰



Modulated or unmodulated RF output.



400 cycle sine wave output.

- Step attenuated RF output.
- 6 to 1 vernier dial ratio.
- Turret mounted coil sub-assembly.
- Pre-calibrated and adjusted coils.
- Hartley RF oscillator circuit.
- Colpitts oscillator 400 cycle sine wave output.
- Modulated or unmodulated RF output.
- Frequency coverage on fundamentals 160 kc to 50 megacycles in five ranges. 51 megacycles to 150 megacycles on calibrated harmonics.
- RF output in excess of 100,000 microvolts.
- Audio output 1/2 to 2 volts.
- AC transformer operated.
- Professionally styled cabinet.
- Infra red baked enamel panel.

The new HEATHKIT Model SG-7 SIGNAL GENERATOR easily fulfills requirements for a controllable, modulated or unmodulated source of variable frequency. A convenient 400 cycle sine wave output is available for audio work. All RF oscillator coils are precision wound and adjusted to calibration before shipment thereby assuring maximum accuracy. The coils, band switch and tuning condenser all mount as a turret assembly so as to offer the advantage of short wiring leads and easy mounting of parts. The RF output circuit is of the low impedance type obtained by the use of cathode coupling to the output jacks. The level of RF output is varied by means of the RF step and RF output control. Use the HEATHKIT SG-7 as an RF signal source modulated or unmodulated for radio repair, laboratory work, experimental testing, 400 cycle sine wave audio testing, checking RF stages, alignment of both AM and FM IF stages, marker generator for TV alignment, etc. The kit is transformer operated and utilizes miniature tubes for ease in handling high frequency. Panel jacks and a convenient switching system permit either external or internal modulation. The entire kit is supplied complete with tubes and all necessary material as well as a detailed step by step instruction manual for the assembly and operation of the instrument.

Heathkit INTERMODULATION ANALYZER KIT



MODEL IM-1
SHIPPING WT.
18 LBS.

\$39⁵⁰

The HEATHKIT MODEL IM-1 is an extremely versatile instrument specifically designed for measuring the degree of interaction between two

signals caused by a specific piece of apparatus, or a chain of equipment. It is primarily intended for tests of audio equipment but may be used in other applications such as making tests of microphones, records, recording equipment, phonograph pickups and loud speakers. Use it for checking tape or disc recordings, as a sensitive AC voltmeter, as a high pass noise meter for adjusting tape bias, cutting needle pitch or other applications. High and low test frequency source, intermodulation section, power supply and AC voltmeter all in one complete unit. Percent intermodulation is directly read on three calibrated ranges, 30%, 10% and 3% full scale. Both 4 to 1 and 1 to 1 ratios of low to high frequencies easily set up. At this low kit price YOU can enjoy the benefits of Intermodulation analysis for accurate audio interpretations.

Heathkit LABORATORY REGULATED POWER SUPPLY KIT



MODEL PS-2
SHIPPING
WT. 20 LBS.

\$29⁵⁰

New HEATHKIT LABORATORY POWER SUPPLY provides continuously variable regulated DC voltage output

from 160 volts to 400 volts depending on load. Panel terminals supply separate 6.3 V. AC supply at 4 amperes for filament circuits. A 3 1/2" plastic cased panel mounted meter provides accurate metered output for either voltage or current measurements. Exceptionally low ripple content of .012% admirably qualifies the HEATHKIT LABORATORY POWER SUPPLY for high gain audio applications. Ideal for laboratory work requiring a reference voltage for meter calibration or for plotting tube characteristics. In service work, it can be used as a separate variable voltage supply to determine the desirable operating voltage in a specific circuit. Use it as a DC substitution voltage in trouble shooting TV circuits exhibiting symptoms of extraneous undesirable components in plate supply circuits. Entire kit, including all 5 tubes now available at this low price.

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
23 E. 40th ST.
NEW YORK CITY (16)
CABLE 68288 N.Y.

The **HEATH COMPANY**

... BENTON HARBOR 15, MICHIGAN

Heathkit WILLIAMSON TYPE AMPLIFIER KIT

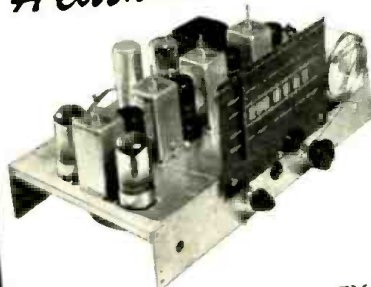
The new HEATHKIT WILLIAMSON TYPE AMPLIFIER incorporates the latest improvements described in Audio Engineering's "Gilding the Lily." 5881 output tubes and a new Peerless output transformer with additional primary taps afford peak power output of well over 20 watts. Frequency response ± 1 db from 10 cycles to 100 kc. allows reproduction of highs and lows with equal crispness and clarity. Harmonic and intermodulation distortion have been reduced to less than $\frac{1}{2}$ of 1% at 5 watts. This eliminates the harsh unpleasant qualities which contribute to listening fatigue. Make this amplifier the heart of your radio system to achieve the fine reproduction that is the goal of all music lovers.

The HEATHKIT PREAMPLIFIER (available separately or in combination with the amplifier kit) features inputs for magnetic or low level cartridges, crystal pickups and tuners, turnover control for LP or 78 type records, individual bass and treble tone controls each providing up to 15 DB of boost or attenuation. Special notched shafts on preamplifier controls and switches adaptable to custom installation. The preamplifier can be mounted in any position and a liberal length of connecting cable is supplied. No radio experience is required to construct this amplifier. All punching, forming, or drilling has already been done. The complete kit includes all necessary parts as well as a detailed step by step construction manual with pictorial diagrams to greatly simplify the construction.

ACROSOUND TRANSFORMER OPTION. If desired, the output transformer with the kit will be the Acrosound output transformer, type TO-300. The use of this transformer permits ultra-linear operation as described in Audio Engineering's "Ultra-Linear Operation of the Williamson Amplifier."



Heathkit FM TUNER KIT



MODEL FM-2
SHIPPING
WT. 9 LBS.

\$22⁵⁰

The HEATHKIT MODEL FM-2 TUNER specifically designed for simplified kit construction features a preassembled and adjusted tuning unit. Three double tuned IF transformers and a discriminator transformer are used in an 8 tube circuit. Smooth tuning is obtained through a 9 to 1 ratio vernier drive using a calibrated six inch slide rule type dial. The usual frequency coverage of 88 to 108 megacycles is provided. Experience the thrill of building your own FM tuner. Operate it through your amplifier or radio and enjoy all the advantages of true FM reception. Transformer operated power supply to simplify connections to all types of audio systems. The kit is supplied complete with all 8 tubes and a necessary material required for construction. A complete instruction manual simplifies assembly and operation.

PRICES OF VARIOUS COMBINATIONS

- W-2 Amplifier Kit** (Incl. Main Amplifier with Peerless Output Transformer, Power Supply and WA-P1 Preamplifier Kit) Shipping Weight 39 lbs. **\$69⁵⁰**
- W-2M Amplifier Kit** (Incl. Main Amplifier with Peerless Output Transformer and Power Supply) Shipping Weight 29 lbs. Shipped express only **\$49⁷⁵**
- W-3 Amplifier Kit** (Incl. Main Amplifier with Acrosound Output Transformer, Power Supply, and WA-P1 Preamplifier Kit) Shipping Weight 39 lbs. Shipped express only **\$69⁵⁰**
- W-3M Amplifier Kit** (Incl. Main Amplifier with Acrosound Output Transformer and Power Supply) Shipping Weight 29 lbs. Shipped express only **\$49⁷⁵**
- WA-P1 Preamplifier Kit only.** Shipping Weight 7 lbs. Shipped express or parcel post. **\$19⁷⁵**

Heathkit ECONOMY 6 WATT AMPLIFIER KIT



MODEL A-7
SHIPPING
WT. 10 LBS.

\$14⁵⁰

The HEATHKIT Model A-7 amplifier features beam power, push pull output with frequency response flat $\pm 1\frac{1}{2}$ DB from 20 to 20,000 cycles. Separate volume, bass and treble controls. Two input circuits, output impedances of 4, 8, and 15 ohms. Peak power output rated at full 6 watts. High quality components, simplified layout, attractive gray finished chassis, break off type adjustable length control shafts and attractive lettered control panel.

THE MODEL A7A amplifier incorporates a preamplifier stage with special compensated network to provide the necessary voltage gain for operation with variable reluctance or low output level phono cartridges. Excellent gain for microphone operation in a moderate powered sound system. **\$16.50**

Heathkit HIGH FIDELITY 20 WATT AMPLIFIER KIT

The HEATHKIT MODEL A-8 amplifier kit was designed to deliver high fidelity performance with adequate power output at moderate cost. The frequency response is within ± 1 DB from 20 to 20,000 cycles. Distortion at 3 DB below maximum power output at 1000 cycles is only .8%. The amplifier features a Chicago power transformer in a drawn steel case and a Peerless output transformer with output impedances of 4, 8, and 16 ohms available. Separate bass and treble tone controls permit wide range of tonal adjustment to meet the requirements of the most discerning listener. The amplifier uses a 6SJ7 voltage amplifier, a 6SN7 amplifier and phase splitter and two 6L6's in push pull output and a 5U4G rectifier. Two input jacks for either crystal or tuner operation. The kit includes all necessary material as well as a detailed step by step construction manual.

MODEL A8-A features an added 6SJ7 stage (preamplifier) for operating from a variable reluctance cartridge or other low output level phono pickups. Can also be used with a microphone. A 3 position panel switch affords the desired input service. **\$35.50**



MODEL A-8
SHIPPING WT. 19 LBS.

\$33⁵⁰

EXPORT AGENT
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE ARLUS N.Y.

The **HEATH COMPANY**

... BENTON HARBOR 15, MICHIGAN

Heathkit SUPERHETERODYNE RECEIVER KITS

- High gain dual iron core tuned type IF transformers
- AC transformer operation for safety
- Continuously variable tone control
- Sturdy punched and plated steel chassis
- Ideal for custom installation
- Full AVC action
- Inverse feedback for improved frequency response
- Kit supplied with all necessary construction material except speaker and cabinet. (Available separately if desired).

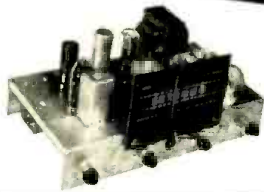
6 tube all wave circuit.
3 ranges, continuous coverage 550 kc to over 20 megacycles, shipping wt. 11 lbs.

Model AR-1
\$23.50



5 tube broadcast band
550 to 1600 kc coverage,
shipping wt. 11 lbs.

Model BR-1
\$19.50



Two excellent radio receiver kits featuring clean design and open layout for simplified construction. Satisfy that urge to build your own radio receiver and select the model which meets your requirements. Both receivers feature continuously variable tone control, a radio phono switch and phono input and an AC receptacle for the phono motor. A six inch calibrated slide rule type dial with a 9 to 1 ratio vernier dial drive insures easy tuning.

SHIPPING INFORMATION

ON PARCEL POST ORDERS include postage for weight shown and insurance. (We insure all shipments.) Don't worry about sending more than the correct amount — if you send us too much, every extra cent will be promptly returned.

ON EXPRESS ORDERS do not include transportation charges. They will be collected by Express Agency on delivery.

ORDERS FROM CANADA must include full remittance for merchandise.

Orders processed on the same day received. Customers notified of unavoidable delay.

U. S. postal or express money orders, bank drafts or checks are acceptable. Do not send loose coins or stamps.

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE

ROCKEFELLER AGENTS
ROCKE INTERNATIONAL CORP.
13 E. 40th ST.
NEW YORK CITY (16)
CABLE: ARKAD-NY

The HEATH COMPANY

... BENTON HARBOR 15, MICHIGAN

ORDER BLANK



From

SHIP VIA

- Parcel Post
 Express
 Freight
 Best Way

(PLEASE PRINT)

QUANTITY	ITEM	PRICE	QUANTITY	ITEM	PRICE
	Heathkit Oscilloscope Kit—Model O-8 (29 lbs.)	\$43.50		Heathkit Square Wave Gen. Kit—Model SQ-1 (14 lbs.)	\$29.50
	Heathkit Intensifier Kit (O-8 only) No. 339 (1 lb.)	7.50		Heathkit AC VTVM Kit—Model AV-2 (5 lbs.)	29.50
	Heathkit Voltage Calibrator Kit—Model VC-1 (5 lbs.)	9.50		Heathkit Intermodulation Analyzer Kit—Model IM-1 (18 lbs.)	39.50
	Heathkit Electronic Switch Kit—Model S-2 (11 lbs.)	19.50		Heathkit Regulated Power Supply Kit—Model PS-2 (20 lbs.)	29.50
	Heathkit Scope Demodulator Probe Kit No. 337 (1 lb.)	4.50		Heathkit Handitester Kit—Model M-1 (3 lbs.)	13.50
	Heathkit T.V. Alignment Generator Kit—Model TS-2 (20 lbs.)	39.50		Heathkit Decade Resistance Kit—Model DR-1 (4 lbs.)	19.50
	Heathkit Q Meter Kit—Model QM-1 (12 lbs.)	39.50		Heathkit Decade Condenser Kit—Model DC-1 (4 lbs.)	16.50
	Heathkit Grid Dip Meter Kit—Model GD-1 (4 lbs.)	19.50		Heathkit Impedance Bridge Kit—Model IB-1B (15 lbs.)	69.50
	Heathkit VTVM Kit—Model V-6 (7 lbs.)	24.50		Heathkit Battery Tester Kit—Model BT-1 (3 lbs.)	7.50
	Heathkit RF Probe Kit No. 309 (1 lb.)	5.50		Heathkit Resistance Substitution Box Kit—Model RS-1 (3 lbs.)	5.50
	Heathkit MV Probe Kit No. 336 (2 lbs.)	5.50		Heathkit F.M. Tuner Kit—Model FM-2 (9 lbs.)	22.50
	Heathkit Peak-to-Peak Volt. Probe Kit No. 338 (2 lbs.)	6.50		Heathkit Broadcast Receiver Kit—Model BR-1 (11 lbs.)	19.50
	Heathkit Visual-Aural Signal Tracer Kit—Model T-3 (8 lbs.)	22.50		Heathkit Three Band Receiver Kit—Model AR-1 (11 lbs.)	23.50
	Heathkit Condenser Checker Kit—Model C-3 (7 lbs.)	19.50		Heathkit Amplifier Kit—Model A-7 (10 lbs.)	14.50
	Heathkit RF Signal Generator Kit—Model SG-7 (7 lbs.)	19.50		Heathkit Amplifier Kit—Model A-7A (10 lbs.)	16.50
	Heathkit Tube Checker Kit—Model TC-1 (12 lbs.)	29.50		Heathkit Amplifier Kit—Model A-8 (19 lbs.)	33.50
	Heathkit T.V. Tube Adapter No. 355 (1 lb.)	4.50		Heathkit Amplifier Kit—Model A-8A (19 lbs.)	35.50
	Heathkit Battery Eliminator Kit—Model BE-3 (20 lbs.)	24.50		Williamson Type Amplifier Kit (Type Shipped express only)	
	Heathkit Vibrator Tester Kit—Model VT-1 (7 lbs.)	14.50		WA-P1 Pre-amplifier Kit (7 lbs.) (Shipped exp. or p.p.)	19.75
	Heathkit Audio Generator Kit—Model AG-8 (16 lbs.)	29.50			
	Heathkit Audio Oscillator Kit—Model AO-1 (14 lbs.)	24.50			
	Heathkit Audio Frequency Meter Kit—Model AF-1 (15 lbs.)	34.50			

*Please ship C.O.D. Postage enclosed for _____ lbs.

Enclosed find Check Money Order for _____

ELIMINATING OSCILLATOR HUM IN FM RECEIVERS

BY HERBERT MICHELS

AN OFTEN troublesome problem, especially in high fidelity systems, is the elimination of 60-cycle hum originating in the local oscillator of an FM receiver. This hum, noticeable only when a station is tuned in, is the result of the a.c. heater voltage applied to the oscillator tube causing frequency variations in the local oscillator's output at a 60-cycle rate.

The discriminator circuit, responding to modulation of the local oscillator as well as the incoming station, will feed this 60-cycle component on to the audio system.

Oscillator hum is most apparent in circuits in which the cathode is not at r.f. ground potential; however, it also can be troublesome in other types of oscillator circuits. Fig. 1A illustrates the most common circuit wherein the 60-cycle potential between the cathode and the heater of the tube will result in frequency modulation of the oscillator.

There are various methods of eliminating the hum—the easiest, but perhaps least practical, is the careful selection of tubes. However, this can be rather expensive if it means buying extra tubes for the purpose. Fig. 1B shows another, and far more practical, method of hum elimination.

In the circuit as shown in Fig. 1B one side of the heater is connected to the cathode which is connected to ground through the coil. This places the heater at an above ground potential as far as r.f. is concerned. Therefore, it is necessary to place an r.f. choke (20 turns of #12 wire on a 1/2 inch form closewound) in series with the other heater lead. This often brings satisfactory results; however, it also changes the resonant frequency of the tuning circuit. A front-end realignment of the receiver is necessary to assure proper tracking.

A third method as shown in Fig. 1C often brings successful results without

the necessity of realignment. This method is to place a high d.c. potential on the heater system. This potential must not be higher than the maximum allowable heater-cathode potential for the tube being used. It may be necessary to use a tapped bleeder across the "B+" supply to secure the proper potential.

Since a heater circuit in which one side of the heater supply (or transformer center tap) is grounded would result in a shorted plate voltage supply, it is necessary to first remove any ground connections from the heater circuit before connecting the "B+" to the heaters.

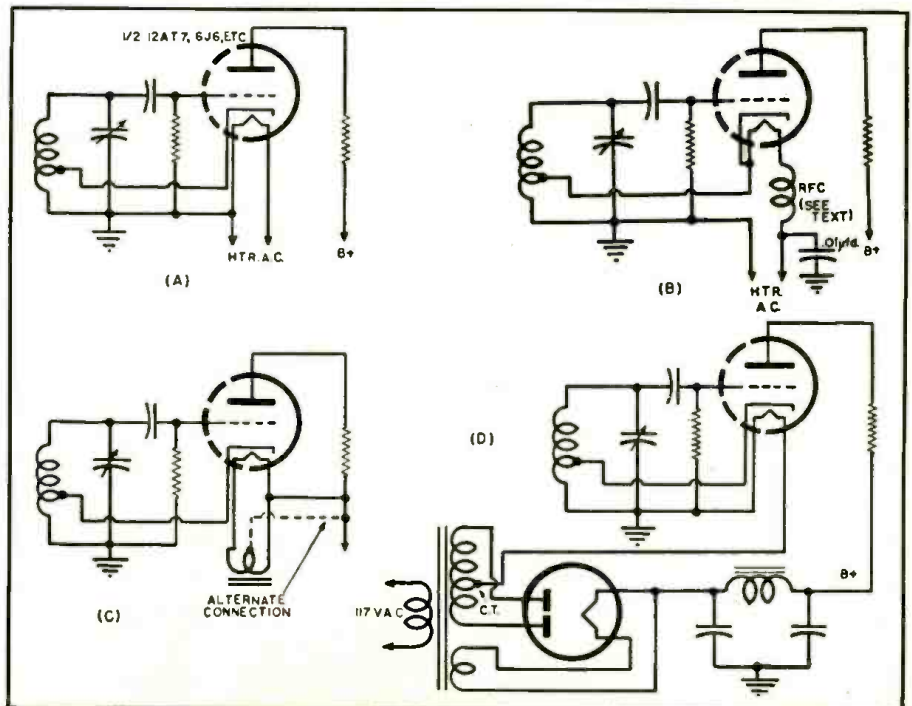
One is fortunate if the total current drawn from the d.c. supply in the receiver closely approximates the required heater current of the oscillator tube. If so, this permits the use of the circuit as illustrated in Fig. 1D; a superior method of hum elimination.

The rated values of plate current as listed in a tube manual, or more accurately an actual meter measurement, will determine the current in the d.c. supply. The heater should be connected in the power transformer center tap ground return circuit—this eliminates the possibility of damaging the filter condensers in the event of a tube failure.

One final note: hum in an FM receiver may originate from many sources. This could be due to improper d.c. supply filtering, poor circuit design, insufficient shielding, etc. Determine if the local oscillator is the cause of the hum before proceeding to take corrective measures. To do this, disconnect the heater supply voltage from the oscillator tube heater pins. Then connect a battery of the required voltage to light the tube. If the hum disappears when the battery is substituted for the a.c. heater supply it is an indication that the oscillator is the cause of the hum.

-30-

Fig. 1. (A) Typical FM receiver oscillator circuit. (B) Heater circuit modified for hum reduction. (C) Heater at high d.c. potential. (D) A d.c. heater supply.



ATR

For
AC CURRENT ANYWHERE



STANDARD AND HEAVY DUTY INVERTERS

For Inverting D. C. to A. C.
Specially Designed for operating A. C. Radios, Television Sets, Amplifiers, Address Systems, and Radio Test Equipment from D. C. Voltages in Vehicles, Ships, Trains, Planes and in D.C. Districts.

ATR ✓ NEW MODELS
✓ NEW DESIGNS
✓ NEW LITERATURE

"A" Battery, Eliminators, DC-AC Inverters, Auto Radio Vibrators

See your jobber or write factory

AMERICAN TELEVISION & RADIO CO.
Quality Products Since 1931
SAINT PAUL 1, MINNESOTA-U. S. A.

J. E. SMITH
President
National Radio
Institute
Washington, D. C.



I Will Train You at Home

For Good Pay Jobs, Success in

RADIO-TELEVISION



YOU LEARN SERVICING

by practicing with equipment I furnish

You build valuable Multitester (at left) as part of my Servicing Course. You use it to make many tests, get practical experience, make EXTRA money fixing neighbors' radios in spare time. Many of my students earn \$5, \$10 a week extra while learning. I send you many other kits too. You build a modern Radio. You build many circuits common to Radio and Television. All equipment is yours to keep. Read about and see other equipment in my free book. Mail card below.



YOU LEARN COMMUNICATIONS

by practicing with equipment I furnish

As part of my Communications Course I send you kits of parts to build the low power broadcasting transmitter shown at right and many other circuits common to Radio and Television. You use this equipment to get practical experience putting a station "on the air," performing procedures demanded of Broadcast Station operators. I train you for FCC Commercial Operator's License. Mail Card for Sample Lesson and 64-Page Book. FREE!



TELEVISION is Today's

Good Job Maker

In 1951 over 15,000,000 homes had Television sets, more are being sold every day. 108 TV stations are already operating, over 1800 are now authorized and many hundreds are expected to be on the air in 1953. This means new jobs, more jobs and better pay for trained men. The time to act is NOW! Start learning Radio-Television servicing or communications. Want to get ahead? America's fast growing industry offers good pay, a bright future and security. Cut out and mail card now. J. E. Smith, President, National Radio Institute, Washington, D.C.

There are Good Jobs, Good Pay, Success in Radio-TV! SEE OTHER SIDE

CUT OUT AND MAIL THIS CARD NOW

Sample Lesson & 64-Page Book

Both FREE

This card entitles you to Actual Lesson on Servicing, shows how you learn Radio-Television at home. You'll also receive my 64-Page Book, "How to Be a Success in Radio-Television." Mail card now!

NO STAMP NEEDED! WE PAY POSTAGE

Mr. J. E. SMITH, President,
National Radio Institute, Washington 9, D.C.

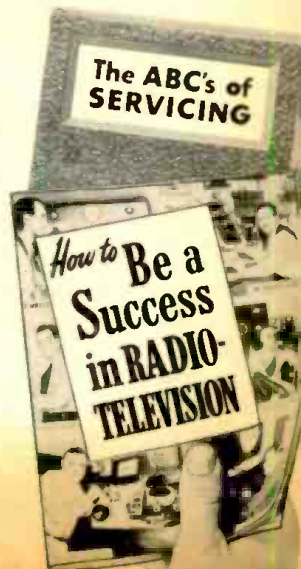
Mail me Lesson and Book, "How to Be a Success in Radio-Television." (No Salesman will call. Please write plainly.)

NAME AGE

ADDRESS

CITY ZONE STATE

A B C D E F G



Train at Home to Jump Your Pay as a RADIO-TV Technician



J. E. Smith, President
National Radio Institute

The men whose letters are published below were not born successful. At one time they were doing exactly as you are doing now... reading my ad! But they acted. They decided they would know more... so they could earn more! They acted! Mail the card now for my 2 books FREE.

There's a Bright Future for You in America's Fast Growing Industry

Do you want good pay, a job with a bright future, security? Would you like to have a profitable business of your own? If so, find out how you can realize your ambition in the fast growing RADIO-TELEVISION industry. Even without Television, the industry is bigger than ever before. 105 million home and auto radios, 2900 Radio Broadcasting Stations, 108 TV Stations with 1800 more now authorized. Expanding use of Aviation and Police Radio, Micro-Wave Relay, Two-Way

Radio for buses, taxis, etc., are making opportunities for Servicing and Communications Technicians and FCC Licensed Operators.

You Learn by Practicing with Kits I Furnish

With both my Servicing Course and my NEW Communications Course I send you many Valuable Kits of Parts. They "bring to life" theory you learn in my illustrated texts. Mail card for my big 64-page book. It shows photos of equipment you build from kits I send.

My Training Includes Television

Both my Servicing and Communications Courses include lessons on TV principles. You get practical experience by working on circuits common to both Radio and Television. My graduates are filling jobs, making good money in both Radio and Television. Remember, the way to a successful career in Television is through experience in Radio.

Send NOW for 2 Books FREE

Mail the Postage-Free Card NOW!

What will YOU be doing one year from today... will you be on your way toward a good job of your own in a Radio and Television service shop or business? Decide now that you are going to know more and earn more! ACT NOW! Take the important first step to a career and security. Send the postage-free card now for my FREE DOUBLE OFFER. You get Actual Servicing Lesson. Also my 64-page book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning; see equipment you practice with at home. Mail card now. J. E. SMITH, President, National Radio Institute, Washington 9, D.C. Our 39th year.

I TRAINED THESE MEN



Handicapped but Successful

"I am now Chief Engineer at WHAW. My left hand is off at the wrist. A man can do... If he wants to." R. J. Bailey, Weston, W. Va.



\$10 a Week In Spare Time

"Before finishing, I earned as much as \$10 a week in Radio servicing in my spare time. I recommend NRI." S. J. Petrucci, Miami, Fla.



Control Operator, Station WEAN

"I received my license and worked on ships. Now with WEAN as control operator, NRI course is complete." R. Arnold, Rumford, R. I.



Trained Men Make Money In TV

"I am now servicing Television. Your course enabled me to repair TV receivers without any trouble." R. Currier, Fair Haven, Vt.



Has Growing Business

"Am becoming expert Technician as well as Radiotelephon. Without your course this would be impossible." P. Brogan, Louisville, Ky.



Got First Job Thru NRI

"My first job was with KDLR. Now Chief Engr. of Radio Equipment for Police and Fire Dept." T. Norton, Hamilton, Ohio.

NRI Training Can Lead to Jobs Like These in RADIO-TELEVISION

BROADCASTING
Chief Technician
Chief Operator
Power Monitor
Recording Operator
Remote Control Operator

GOVERNMENT RADIO
Operator in Army,
Navy, Marine Corps,
Coast Guard
Forestry Service
Dispatcher
Airways Radio Operator

SERVICING
Home and Auto Radios
P.A. Systems
Television Receivers
Electronic Controls
FM Radios

AVIATION RADIO
Plane Radio Operator
Transmitter Technician
Receiver Technician
Airport Transmitter Operator

IN RADIO PLANTS
Design Assistant
Transmitter Design Technician
Service Manager
Tester
Serviceman
Research Assistant

TELEVISION
Pick-up Operator
Voice Transmitter Operator
Television Technician
Remote Control Operator
Service and Maintenance Technician

SHIP AND HARBOR RADIO
Chief Operator
Assistant Operator
Radiotelephone Operator

POLICE RADIO
Transmitter Operator
Receiver Serviceman

Find Out What RADIO-TV Offers You



SAMPLE LESSON and 64-PAGE BOOK Both FREE

Cut out and mail postage-free card today!

FIRST CLASS
Permit No. 20-R
(Sec. 34.9, P.L. & R.)
Washington, D.C.

BUSINESS REPLY CARD

No Postage Stamp Necessary If Mailed In The United States

4c POSTAGE WILL BE PAID BY
NATIONAL RADIO INSTITUTE

16th and U Sts., N.W.

Washington 9, D. C.

Make Extra Money While Learning

Keep your job while training. Many NRI students make \$5, \$10 and more a week extra fixing neighbors' Radios in spare time while learning. I start sending you special booklets that show you how to service sets the day you enroll. Multi-tester you build with parts I furnish helps discover and correct Radio troubles.



Want Your Own Business?

Many N.R.I. trained men start their own business with capital earned in spare time. Let me show you how you can be your own boss... Robert Dohmen, New Prague, Minn., (whose store is shown at right) says, "Am now tied in with two television outfits and do warranty work for dealers. Often fall back to N.R.I. textbooks for information on installing Television sets."



WHAT'S

New in Radio

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page and the issue number, delay will be avoided.

NEW "PILOTUNER"

An FM-AM radio tuner for use as the central control head of a hi-fi music system is now available from Pilot Radio Corporation, Long Island City, N.Y.

The Model AF-821 is a 9-tube unit with a two-stage preamp with adjust-



able equalization for various makes of reluctance cartridges, separate input connections for phono and TV operation, extended range bass and treble controls, temperature compensated oscillator for drift-free FM reception, a.f.c., built-in antennas, and full shielding.

G-E CARTRIDGES

General Electric Company has added three wide-range variable reluctance phonograph cartridges to its line.

The RPX 053 dual and the RPX 061 and RPX 063 single are 15,000 cycle units and all feature diamond styli. The new cartridges feature 6 to 8 grams tracking pressure for all types of records, uniform velocity scratch and needle talk. The stylus is retractable.

"STEREOPHONIC RECORDER"

Ampex Electric Corp., Redwood City, Calif. is marketing a stereophonic recorder which employs a dual-track head assembly that records or plays back two separate channels simultaneously.

Material recorded by two properly placed microphones may be played back through two similarly spaced speakers to give a directional effect. The Model 403-2 incorporates separate



electronic assemblies for each track. These assemblies are identical except that the second sound track has a bias

buffer amplifier rather than the bias oscillator of the first assembly. This is done to provide the same bias frequency to each record head.

The new model will operate at either 7 1/2 or 15 inches-per-sec. tape speeds. Frequency response is to 15,000 cycles at the 7 1/2" tape speed and signal-to-noise ratio is over 55 db.

CABINET SPEAKER

White Sound, Inc., 105 W. Madison St., Chicago, Ill. is marketing a new line of cabinet speakers based upon development of an exponential horn, folded within an enclosure.

There are four of these horn-loaded units available at the present time. The company will provide complete specifications on request.

PLUG-IN AMPLIFIERS

Four basic plug-in audio amplifiers are now available from Gates Radio Co., Quincy, Ill.

The Model PRE-1 preamp, Model PGM-1 program amplifier, Model MON-1 monitoring amplifier, and Model PWR-3 regulated power supply can be combined in any assembly. All units are identical in size except the



PRE-1 which is half-size. Four program amplifiers can be used in the space formerly occupied by a single unit.

RADIO CONTROL UNITS

Vernon C. MacNabb Co., 909 Westfield Blvd., Indianapolis 20, Ind. is offering a 27,255 kc. Citizens band receiver and transmitter for radio control operations.

The receiver, which weighs 4 ounces and measures 2 1/2" x 1 3/4" x 2 1/4", gives a 5:1 plate current change to operate the Sigma 4F adjustable relay.

The hand-held transmitter, weighing 4 pounds and measuring 3" x 4" x 9", uses two 3V4 tubes. A three-section plug-in antenna is employed.

BASIC AMPLIFIER

A basic amplifier for the average home system is being marketed by Precision Electronics, 9101 King Ave., Franklin Park, Ill. as its Model 100 BA.

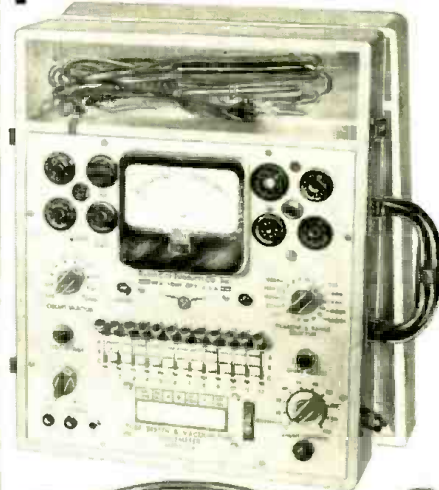
Power output is 10 watts with 20

RCP is FIRST again with this . . .

"DO-ALL"

TV Set and Tube Tester

(Includes VT Voltmeter and Reactivator)



Model 808

ALL IN ONE UNIT!

● **A TUBE TESTER:** All the features of the famous 323 Dynoptimum free point tube tester—protected against obsolescence—tests all modern standard, miniature, novel base and subminiature tubes. Easily read on 4 1/2" meter.

● **A CATHODE RAY TUBE TESTER:** Will check all magnetic deflection type Television picture tubes. Locates and isolates all shorts or leaks.

● **A REACTIVATOR:** Revives and Reactivates many otherwise Dim or Bad Television Picture tubes. Can also be used on other tubes.

● **A VT VOLTMETER (AC-DC):** This really outstanding 17 Range instrument is a VT Voltmeter for AC as well as DC. Balanced bridge type push-pull circuit. Draws negligible current due to high impedance of 25 megohms. Accuracy ± 3% DC, ± 5% AC. Discriminator alignment scale with zero center. AC & DC volts 0 to 5-25-100-250-1000; db-20 to 16.-6 to 30, 6 to 42, 14 to 50, 26 to 62.

● **AN OHMMETER:** Reads all Resistances 0.2 ohms to 1000 megohms on 5 ranges. Use this instrument also to check condensers for leakage and shorts.

Housed in handsome hand-rubbed oak carrying case with test leads, isolation probe, batteries, etc. Size 12 1/2" x 12 3/4" x 4 3/4"; weight 12 1/2 lbs.

MODEL 808—complete, \$99.95 NET

ready to operate. High Voltage Multiplier Probe for Model 808. Extends Range of VTVM to 30,000 volts.

MODEL No. HVMP-1 \$8.95 NET

For the "GREATEST VALUE PER DOLLAR IN TV-RADIO TEST EQUIPMENT" send for the new, colorful, fully illustrated 1953 RCP catalog. Complete details on Model 808 and other instruments in this top-quality line are shown.

MAIL COUPON NOW FOR

FREE CATALOG

RADIO CITY PRODUCTS CO., Inc.
Dept. RN-2, 152 West 25th St., N. Y. 1, N. Y.

Please send me a copy of your new 1953 colorful, fully illustrated catalog featuring the top-quality RCP instrument line.

NAME.....

ADDRESS.....

CITY.....STATE.....

STOP COSTLY SHUT-DOWNS!

Write for Catalog

WELLS SALES INC. 833 W. Chicago Ave., Chicago 22, Ill.

PHONE WELLS FOR ANY ELECTRONIC COMPONENTS
IMMEDIATE DELIVERY
FROM WORLD'S LARGEST STOCK... Seeley 8-4143

watts peak. Distortion at 10 watts is 1% harmonic and 2% intermodulation. Frequency response at 3 watts is $\pm .5$ db, 20 to 50,000 cps. Frequency response at 10 watts ± 1 db, 30 to 20,000 cps.

POWER AMPLIFIER

Brociner Electronics Lab., 1546 Second Ave., N.Y. 28, N.Y. has developed the Model UL-1 power amplifier which is an "ultra-linear" modification of the Williamson circuit.

Frequency response is from 10 to 200,000 cycles within 1 db. Power output is 20 watts from 30 to 20,000 cycles and 12 watts from 15 to 50,000 cycles. A power take-off socket sup-



plies filtered plate voltage and heater power for use with preamps. The distortion is 2% intermodulation at 20 watts and less than .1% at 1 watt. Hum and noise level is 80 db below 20 watts. The amplifier uses two 12AU7's, two 6BG6G's, and one 5V4G tube.

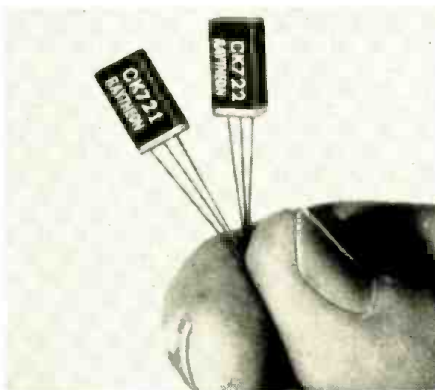
FOUR-WATT RESISTOR

International Resistance Co., 401 N. Broad St., Philadelphia 8, has added a new power resistor, type PW4, rated at four watts, to its line.

The new type is available in resistances from 1 to 8200 ohms in $\pm 5\%$ and $\pm 10\%$ tolerances. It is $1\frac{3}{4}$ " long by $21/64$ " dia. It can be used in television circuits requiring 2 to 3 watts actual dissipation at high ambient temperature since the unit is completely insulated with an inorganic core material molded in a high temperature plastic which will not support combustion.

TRANSISTORS AVAILABLE

Raytheon Mfg. Co., 55 Chapel, Newton 58, Mass. now has two *p-n-p* ger-



manium junction transistors available—the types CK721 and CK722.

The CK722 is available in production quantities but the CK721 will be

limited in quantity until April. Both units have a 22 db noise factor at 1000 cycles. Power gain of the CK721 is 38 and the CK722 is 30 db. Leads may be soldered or welded or cut for insertion in subminiature sockets.

Technical specifications are available from the Technical Information Service of the company or the company's sales offices in N.Y., Chicago, and Los Angeles.

ALKALINE DRY BATTERY

A new alkaline "B" radio battery has been developed by *RCA* which is 25 per-cent smaller than present comparable types yet offers double the playing capacity.

Designed specifically for use in "personal portables" the 67½ volt battery (VS216) utilizes the alkaline-cell principle formerly incorporated only in wet-type batteries.

The company has redesigned its "A" battery to provide balanced life operation with the new "B" battery. The new "A" unit (VS236) is twice the length of the standard cells but has a life capacity nearly four times greater. Two of these batteries will balance the life of the new alkaline "B" battery in "personal portable" applications.

UNIQUE BATTERY CAP

Industrial Research Inc., 4016 N.W. 29th St., Miami 42, Fla. is producing a new storage battery cap which preserves the water in batteries, prevents corrosion, and warns of overcharge or impending battery failure.

The "Hydrocap" contains a catalyst



which converts the battery's escaping hydrogen and oxygen gases back into water. Full details on these new units are available on request.

BINAURAL ARM

Livingston Electronic Corp. of Livingston, N.J. has developed a binaural transcription arm which plays either conventional or binaural recordings, uses conventional cartridges, costs less than two separate arms, and is especially designed for easy adjustment.

The unit provides independent action for each cartridge and has negligible tracking error.

CITIZENS RADIO GEAR

Motorola, Inc. of Chicago has received FCC approval on its Model T44A mobile receiver and L44A base station equipment for operation in the 460-470 mc. Citizens band.

The receiver circuit includes the
(Continued on page 124)

BUY TEST EQUIPMENT ON THIS RADICALLY NEW TIME PAYMENT PLAN

NO INTEREST!! - NO CARRYING CHARGES!!

USE CONVENIENT TIME PAYMENT ORDER BLANK BELOW

Superior's New

JUNIOR SUPER-METER

MOST COMPLETE AND COMPACT MULTI-SERVICE INSTRUMENT EVER DESIGNED



Handsome round cornered molded bakelite case 3 1/4" x 5 7/8" x 2 1/4" complete with all test leads and instructions

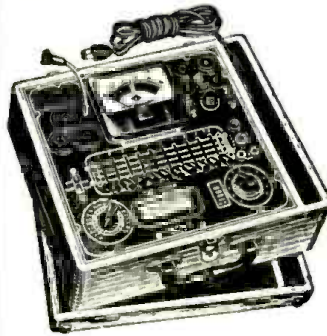
\$2140
NET

Measures: * Voltage * Decibels
* Capacity * Resistance
* Current * Inductance
* Reactance

Specifications: D.C. Volts: 0-7.5/75/150/750/1500 Volts. A.C. Volts: 0.15/150/300/1500/3000 Volts. Resistance: 0-10-100/100,000 ohms. 0-10 Megohms. D.C. Current: 0-7.5/75 Ma. 0-7.5 amps. Capacity: .001 Mfd.—.2 Mfd. .1 Mfd.—20 Mfd. Electrolytic Leakage: Reads quality of electrolytics at 150 Volt test potential. Decibels: —10 Db to +18 Db. + 10 Db. to + 38 Db. + 38 Db. to + 58 Db. Reactance: 15 ohms—25 K ohms 15 K ohms—2.5 Megohms. Inductance: .5 Henry—50 Henries 30 Henries—10 K Henries. Plus Good-Bad scale for checking the quality of electrolytic condensers.

Superior's New
Model TV-11

TUBE TESTER



Operates on 105-130 Volt 60 Cycles A.C. Hand-rubbed oak cabinet complete with portable cover

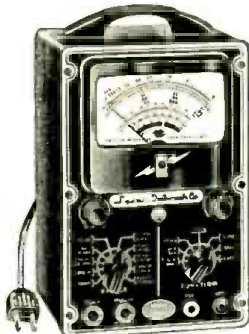
\$4750
NET

• Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary. • Uses no combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket. • Free-moving built-in roll chart provides complete data for all tubes. • Phono jack on front panel for plugging in either phono or external amplifier detects microphonic tubes or noise due to faulty elements and loose external connections.

Superior's New
Model 670-A

SUPER-METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS



The Model 670-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 6 1/4" x 9 1/2" x 4 1/2"

\$2840

SPECIFICATIONS:
D.C. VOLTS: 0 to 7.5/15 75/150/750/1500/7500 Volts
A.C. VOLTS: 0 to 15/30 150/300/1500/3000 Volts
OUTPUT VOLTS: 0 to 15/30 150/300/1500/3000 Volts
D.C. CURRENT: 0 to 1.5/15/150/ Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Quality test for electrolytics)
REACTANCE: 50 to 2,500 Ohms. 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: —6 to +18 +14 +38+34 to +58

ADDED FEATURE:
The Model 670-A includes a special GOOD-BAD scale for checking the quality of electrolytic condensers of a test potential of 150 Volts.

Superior's New

TV BAR GENERATOR

THROWS AN ACTUAL BAR PATTERN ON ANY TV RECEIVER SCREEN!!



TV Bar Generator comes complete with shielded leads and detailed operating instructions. Only NET

\$3995
NET

Connects direct to antenna post. No connection inside receiver.

Features.—Can be used when no stations are on the air. • Provides linear patterns to adjust vertical and horizontal linearity • Provides vertical and horizontal sweep signals • Provides signal for testing video amplifiers.

Superior's Model 660-A—A NEW A.C. OPERATED

SIGNAL GENERATOR



• Tubes used: 1-6BE6 as R. F. Oscillator, mixer and amplifier. 1-6BE6 as Power Rectifier.
The Model 660-A comes complete with coaxial cable test lead and instructions. NET

\$4295

Provides Complete Coverage for A.M.—F.M. and TV Alignment

• Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 220 Megacycles on powerful harmonics. • Accuracy and stability are assured by the use of permeability trimmed III-Q coils. • R. F. available separately or modulated by the internal audio oscillator. • Built in 400 cycle sine wave audio oscillator used to modulate the R. F. signal also available separately for audio testing of receivers, amplifiers, hard of hearing aids, etc. • R. F. Oscillator Circuit: A high transconductance heptode is used as an R. F. oscillator, mixer and amplifier. Modulation is effected by electron coupling in the mixer section thus isolating the oscillator from load changes and affording high stability. • A. F. Oscillator Circuit: A high transconductance heptode connected as a high- μ triode is used as an audio oscillator in a high-C Colpitts Circuit. The output (over 1 Volt) is nearly pure sine wave. • Attenuator: A 5 step ladder type of attenuator is used.

NEW TIME PAYMENT PLAN ORDER BLANK

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. B-49, 38 Murray Street, New York 7, N. Y.

Please send me the units checked below. I am enclosing the down payment with order and agree to pay the monthly balance as shown. It is understood there will be no carrying, interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

- JUNIOR SUPER METER Total Price \$21.40
\$5.40 down payment. Balance \$4.00 monthly for 4 months.
- MODEL TV-11 Total Price \$17.50
\$11.50 down payment. Balance \$6.00 monthly for 6 months.
- MODEL 670-A Total Price \$28.40
\$7.40 down payment. Balance \$3.50 monthly for 6 months.
- TELEVISION BAR GENERATOR Total Price \$39.95
\$9.95 down payment. Balance \$5.00 monthly for 6 months.
- MODEL 660-A Total Price \$42.95
\$12.95 down payment. Balance \$5.00 monthly for 6 months.
- I enclose \$..... as down payment.
- Ship C.O.D. for the down payment.

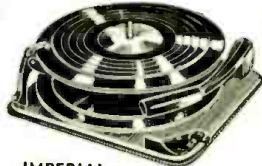
Signature.....

Name.....

Address.....

City..... Zone..... State.....

OLSON'S PENNY PROFIT POLICY MEANS GREATER BARGAINS



**IMPERIAL
DELUXE MODEL
STOCK NO. RA-69**

Equipped with single needle, with precision metal long-lasting tip. Plays all speed records. 33 1/3, 45 and 78 RPM. Regular retail price \$47.50. Shpg. wt. 5 lbs.

Single, each \$19.99
In lots of 3, each, only \$18.99

**HI-FI DELUXE MODEL
STOCK NO. RA-113**

Equipped with "Turnover" cartridge and dual needle. One side for 33 1/3 and 45 RPM discs and other side for 78 RPM discs. Both sides equipped with precision metal long-lasting tip. Regular retail price \$52.50. Shpg. wt. 15 lbs.

Single, each \$29.99
In lots of 3, each, only \$21.99

GIANT 3-SPEED RECORD CHANGER SALE!

3-SPEED GENERAL INSTRUMENT AUTOMATIC RECORD CHANGER

Automatically Changes All Sizes—
7", 10" and 12"

All Speeds—33 1/3, 45 and 78 RPM

All the finest features are incorporated in these General Instrument Record Changers. Records Slide Gently down the center spindle. There is no wobble, no scrape, no slip. No chance of damaging your records. The newly-designed controls are so simple, they explain themselves. No instructions needed. All moving parts in every General Instrument Changer are factory adjusted thus insuring years of trouble-free performance.

These Changers are precision-built by craftsmen who have had years of experience. Every Changer is brand new—in original factory-sealed cartons—and guaranteed 100% by Olson and the manufacturer. Here is one of Olson's most sensational bargains. Believe us—you can't go wrong.

Changer can be connected to any radio or amplifier. Equipped with clever "touch-plate"—a slight press and you can reject or skip a disc and go on to the next one. Has perfect cast parts. Here's a Changer you'll be proud to demonstrate to your friends. You can sell plenty of them too. Operates on 115 Volts AC, 60 cycle. Base size 12"x12 1/2"x3 1/2". Above plate and 3 1/2" below. Take your choice of either model.

COMPLETE 3-SPEED RECORD CHANGER AMPLIFIER KIT

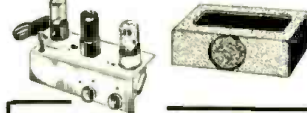
Easily Assemble Your Own
Automatic Record Player

Stock No. AS-71
FOR ONLY \$29.99

SEE WHAT YOU SAVE
Complete Kit Regular List Price

3-Speed Changer	\$47.50
Amplifier (Wired)	7.50
Set of 3 Tubes	4.55
7" Heavy Duty Speaker	4.00
Output transformer	8.50
Mounting Base (Pre-Drilled)	8.50
Mounting Hardware	.55
Total List Price	\$74.35

Here's an outfit that normally retails at \$74.35. Save yourself a pile of money and have fun assembling your own 3-Speed Automatic Record Player. It's easy—can be assembled by anyone in just 30 minutes. All notes are drilled and all mounting hardware is provided. The Amplifier is completely wired. All you have to do is attach the Changer and Speaker wires. Shpg. wt. 20 lbs.



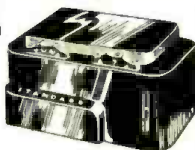
You Get Everything You Need to Easily Assemble Your Own 3-Speed Automatic Record Player. Kit Includes:

- GENERAL INSTRUMENT IMPERIAL DELUXE CHANGER (Model RA-69—as described to left).
- 5" PM HEAVY-DUTY SPEAKER AND OUTPUT TRANSFORMER.
- 3-TUBE AMPLIFIER COMPLETE WITH TUBES
- MOUNTING BASE—WITH HARDWARE & INSTRUCTIONS

HIGH GAIN STANDARD COIL TV BOOSTER

- ★ Latest Model ★ Brand New
- ★ Reg. List Price \$30.00
- ★ While they last. Model No. B-51.

\$10.95
Ea.



Just connect one of these Standard TV Boosters to your receiver and get brighter, snappier pictures and less "snow" and interference. Easy to install. Works on all TV sets. An amazing deal—you can cash in—save money—Order Today. Tunes all 12 channels. Uses a 6AK5 tube and a vacuum rectifier. Complete. Operates on 115 V. AC. Shpg. wt. 6 lbs.

12" Magnavox Speaker and Baffle Close-Out



Stock No. AS-66
Get both for only \$7.95

You get Magnavox's fine 12" PM speaker with Alnico 5 magnet. (Same as you'll find in those expensive Magnavox Super-Radio-Phono Combinations.) Power output 8 watts. Voice coil fully dustproofed. Impedance 6-8 ohms. In addition you get a walnut Speaker Baffle to bring out the full rich, rounded tones of the Magnavox Speaker. Baffle may be mounted on a wall or it will stand on a table. Here's the ideal combination for extension speakers for porches or other rooms. Can be connected to any radio or amplifier. Order 4 or more sets and install them in restaurants, auditoriums, halls.

In lots of 4 sets.
One set for \$8.95.
Shpg. wt. 12 lbs.



DELUXE COUNTER

\$1.69

Stock No. X-298
Shpg. wt. 1 lb.

We're letting these go at a fifth of Actual Cost—\$8.50. Keep an accurate count up to 100,000 on transactions, traffic, production, etc. Just touch a lever and it counts.

BIG INSULATED RESISTOR KIT

OLSON SPECIAL PRICE
Contains a carefully selected assortment of 100 insulated resistors. Standard RMA color code. Included are 70—1/2 watt, 20—1 watt and 10—2 watt resistors. Insulation packed in a durable pilothim bag. Regular List Price \$2.99
Stock No. AS-32



SLOTTED SUPER SPACE LINE



LOWER LOSS 300 OHM

STOCK NO. W-115
500 Ft. Spool
Single \$7.95
Lots of 2 Spools

\$7.75
EACH

This slotted 300 ohm TV line is made to standard specifications in such a manner as to provide maximum air spacing while maintaining the dielectric strength and durability of the usual 300 ohm twin line. Color: Brown, with 22 stranded copper, pure polyethylene 55 mil. wall. Never offered before at such a low price. ORDER EARLY—while supply lasts. Shpg. wt. 7 lbs.

DON'T THROW AWAY OLD PICTURE TUBES



BOOST BRILLIANCE
WITH THIS TV
TUBE BOOSTER

\$2.95
Stock No. T-100

Completely automatic. Easy to install—no tools needed. Just plug into old picture tube that is starting to dim and watch the big change. Works on any Tube—10" to 30"—in all AC parallel circuits. Adds months and months of service to those old tubes. Reg. \$5.95. Shpg. wt. 1 lb.

OLSON ELECTRIFYING BARGAIN!

THE NEW WONDER OF ELECTRONIC CONTROL CAN BE YOURS FOR PRACTICALLY NOTHING THYRATRON REMOTE CONTROL



SERVICEMEN—HOBBYISTS—HAMS
EXPERIMENTERS—RADIO SCHOOLS

Here's the chance of a lifetime to own a genuine Thyratron Electronic Remote Control of your own at a fraction of its regular price! This mighty handy only 5 1/2" x 3 1/2" x 2 1/2" of miracle control can be made to perform hundreds of practical, fascinating feats of remote control. A complete schematic showing the circuit is included with each unit, what you get: Valuable parts and tubes galore that you can so easily use in any other radio, amplifier, etc.—or for experimenting.

- LOOK AT ALL THE PARTS YOU GET**
- 6SL7 and 6SN7
 - GL-5662 Tube
 - 16 Mfd. @ 150 Volts
 - 1 Mfd. @ 200 Volts
 - .02 Mfd. @ 200 Volts
 - .1 Mfd. @ 200 Volts
 - 1 Mfd. @ 200 Volts
 - Control Relay
 - Switch-SPST
 - Pilot Lamp, Type 44
 - 100 Ohm—1/2 Watt Wirewound
 - 8000 Ohm—10 Watt Wirewound
 - 3000 Ohm—1/2 Watt Wirewound
 - 1 Megohm—1/2 Watt Carbon
 - 240,000 Ohm—1/2 Watt Carbon
 - 2 Ohm—1/2 Watt Wirewound
 - 1 Megohm—1/2 Watt Wirewound
 - 24 Ohm—2 Watt Wirewound
 - 33 Ohm—1/2 Watt Wirewound
 - 15,000 Ohm—1/2 Watt Carbon
 - 500 Ohm—1/2 Watt Carbon

How can you lose? These parts are certainly worth THREE TIMES this amazing low cost. The General Electric Thyratron Type GL-5662 tube alone costs \$3.30 wholesale. Consider the ultra sensitive relay, filament transformer, tubes, condensers, resistors (many of them 1% precision). No matter how you cut it, here's a great, great Olson Bargain. Operates on 115 V. AC. Shpg. wt. 5 lbs.



COMBINATION DEAL!

10 WATT HI-FI PUSH-PULL AMPLIFIER

COMPLETE WITH

12" CO-AXIAL SPEAKER

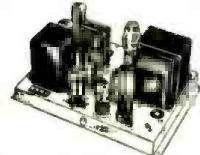
BOTH FOR ONLY \$39.95
WITH TUBES COMPLETELY WIRED NOT A KIT

STOCK NO. AS-67

Order this matched outfit today. You get the 10-Watt Hi-Fi Amplifier PLUS the 12" Co-Axial Speaker both as described below. Can be built into any cabinet or hood—giving you a complete Amplifier System of which you can be proud. Shpg. wt. 25 lbs.

Amplifier is completely assembled and ready to play. Built-in PRE-AMP for G.E. and similar types of magnetic pickups. 4 Input selector switch. 4 Input selector switch. 1 radio, 1 mike, 4 Controls, 1 Bass, 1 Treble, 1 Volume, 1 Phono-radio Switch. Output Impedances: 4, 8, 16 ohms. Peak power output 17 watts. Order this amplifier today and see what brilliant, realistic tone it will deliver. Supply is limited. Every one in factory-sealed cartons. You couldn't buy the parts alone for this price. Remember this is a full size amplifier, transformer operated, not an AC-DC job. Frequency response 20 to 20,000 cps. at less than 1% of 1% distortion. 3 Tubes, 1-6X4, 1-6C7, 2-6V6, 1-6Y3. Complete with tubes. Size 12" x 6 1/2" x 3 1/2".

Speaker is our new 1953 Co-Axial Model. Guaranteed to outperform any speaker in its price class. Features two "high concentration" Alnico 3 magnets and a high frequency diffuser. The 12" section delivers the bass while the inner, 6" tweeter speaker section delivers the treble tones. Together they give you living tone. This speaker is unconditionally guaranteed to satisfy even the most critical user or Olson promises to refund your money. Only two wires to connect to amplifier. Voice coil impedance 8 ohms. Frequency response 30 to 17,000 cps. Shpg. wt. 25 lbs.



TECH-MASTER

New Williamson-Type Amplifier Kit

Stock No. AMP-12
COMPLETE WITH TUBES \$48.95

Full 15 Watts—Ultra Linear • Includes Altec Lansing Peerless Audio Transformer
Complete Kit of exact transformers, condensers, resistors, sockets, tubes, hardware, punched chassis—every part you need—as well as a full detailed wiring diagram. Utilizes the famous WILLIAMSON circuit for high fidelity reproduction. Only top quality parts are included—specially wound ALTEC LANSING Peerless Transformers, for instance, are employed. Easy to assemble.

SPECIFICATIONS: Output Impedance—4-8-16 ohms; Input Impedance—High for crystal pickups, turners, pre-amps, etc.; Response—8 cps to 80,000 cps; 1 Mfd. @ 2 Tubes, 2-12SN7-28A, 1-6X4, 10X-125V, 50-60 cycles 120 W. Size—9"x12"x 6 1/2". Shpg. wt. 27 lbs.

TECH-MASTER

4 CHANNEL PRE-AMPLIFIER KIT

For Use with Williamson Amplifier



Stock No. AMP-13

3 input channels and selector switch for: PL-AM or TV, Tuner, crystal and reluctance pick-ups, tape or wire recorder, etc. 3 position equalizer switch permits selection of turnover and roll-off. 2 continuous controls for full bass and treble boost and attenuation. Powered from main amplifier. AC outlet permits main amplifier, etc. to be controlled by master switch. Complete with pre-printed punched chassis, all components, tubes, cabinet and detailed instructions. Easy to assemble.

SPECIFICATIONS: 4 Input channels—1 Low frequency gain, 3 Hi-Impedance. Tube Complement (1-12AX7, 1-12AU7). Size—10 1/2"x4"x4". Shpg. wt. 4 lbs.

\$19.55
with Tubes

USE HANDY ORDER BLANK ON NEXT PAGE



OLSON RADIO WAREHOUSE

275 E. Market St., Akron 8, Ohio

SELENIUM RECTIFIERS

Full-Wave Bridge Types

Current (Con- tinuous)	18/14 Volts	36/28 Volts	54/42 Volts	130/100 Volts
1 Amp.	51.25	52.10	53.60	57.50
2 Amps.	2.20	3.60	6.50	10.50
2 1/2 Amps.			7.50	13.00
4 Amps.	3.75	6.75	8.75	
5 Amps.	4.95	7.95	12.95	27.00
6 Amps.	6.50	9.00	14.00	33.00
10 Amps.	6.75	12.00	20.00	40.00
12 Amps.	8.50	16.00	25.50	50.00
20 Amps.	13.25	24.00	36.00	90.00
24 Amps.	16.00	31.00	39.50	98.00
30 Amps.	18.50	36.00		
36 Amps.	25.50	45.00		

FLEXIBLE SHAFTS

MC 215

(ALL LENGTHS IN INCHES)

34	163	260
135	186	

MC 124

(ALL LENGTHS SHOWN IN INCHES)

23	61	120	175
29	65	140	205
39	103	161	241
52	114	166	348

PRICE MC 124 or MC 215 **2c Per In.**

CIRCUIT BREAKERS

AM 1614-80—28VDC, 80Amp. \$1.59
 AM 1614-100—28VDC, 100 Amp \$1.69
 KJ-600V, 15 Amps, up to 300%
 overload ratings. Trip adj. 10
 min.—inst. **\$21.95**

FILTER CHOKES

Stock	Description	Price
CH-533	13.5H, 1A, 13.5KV Test	539.95
CH-366	20H/3A	6.95
CH-322	35H/50 MA—10 Ohms DCR	2.75
CH-141	Dual 7H/75 MA, 11H/60 MA 5KV DC Test	4.69
CH-119	8.5H/125 MA	2.79
CH-69-1	Dual; 120H/17 MA	2.35
CH-8-28	2 x .5H/380 MA, 75 Ohms	1.79
CH-776	1.28H/130 MA, 75 Ohms	2.25
CH-344	1.5H/145 MA/1200V Test	2.35
CH-43A	10H/15 MA—800 ohms DCR	1.75
CH-366	20H/300 MA	6.95
CH-999	15H/15 MA—400 ohms DCR	1.95
CH-511	6H/30 MA—310 ohms DCR	2.45
CH-501	2.5H/400 MA	2.79
CH-188M	5H/200 MA	1.79
CH-303	300H/.02A, 2500V Test	1.69
CH-982	SWING 9-60H/.4-.05A 10KV	7.95

POWER TRANSFORMERS

Comb. Transformers—115V50-60 cps	Input	
CTJ5-2-600VCT/.2A, 5V/6A	5.95	
CT-15A 580VCT .085A 6.3V/.6A, 6.3V/1.8A	2.85	
CT-164 4200V.002V/.12KV Test, 5VCT/ 3A/12KV Test, 6.3V/0.6A/ 5400V Test	12.95	
CT-341 1050 10 MA—625V @ 5 MA, 26V @ 4.5A 2x2.5V/3A, 6.3V @ 3A	16.95	
CR 825 360VCT .340A 6.3VCT/3.6	3.95	
CT-626 1500V .160A 2.5/12.30/100	9.95	
CT-071 110V .200A 33/.200. 5V/10. 2.5/10	4.95	
CT-367 580VCT .050A 5VCT/3A	2.25	
CT-99A 2x110VCT.010 A 6.3/1A, 2.5VCT/ 7A	3.25	
CT-403 350VCT .026 A 5V/3A	2.75	
CT-931 585VCT .086A 5V/3A, 6.3V/6A	4.25	
CT-456 390VCT .30MA 6.3V/1.3A, 5V/ 3A	3.45	
CT-931 585VCT 86 MA 5V/3A, 6.3V/	4.95	
CT-442 525VCT 75 MA 5V/2A, 10VCT/ 2A, 50V/200	3.85	
CT-720 550-0-550/250 MA, 6.3V/1.8A	8.95	
CT-43A 600-0-600V/.12KV Test, 5VCT/6A,	6.49	
CT-501 650VCT/200 MA, 6.3V/8A, 6.3V/ 5A	6.49	
CT-444 230-0-230V/.085A, 5V/3A, 6V/2.5A	3.49	
Filament Transformers—115V50-60 cps	Input	
Item	Rating	Each
FT-674	8.1V 1.5A	5 1.10
FT-157	4V-16A, 2.5V 1.75A	2.95
FT-101	6V/2.5A	7.75
FT-924	5.25V/21A, 2x7.75V 6.5A	14.95
FT-824	2x26V 2.5A, 16V 1A, 7.2V 7A,	8.95
	6.4V 10A, 6.4V 2A	8.95
FT-463	6.3VCT 1A, 5VCT 3A, 5VCT 3A	5.49
FT-55-2	7.2V/21.5A, 6.5V/6.85A, 5V/6A,	8.95
	5V/3A	3.75
FT-986	16V @ 4.5A or 12V @ 4.5A	3.75
FT-38A	6.3 2.5A, 2x2.5V 7A	4.19
FT-A27	2.5V 2.5A, 7V 7A, TAP 2.5V/ 2.5A, 16KV TEST	18.95
FT-608	6.3V 3A 750V Test	1.75
FT-873	4.5V 5A, 7V 7A	2.15
FT-899	2x5V A 5A, 2x9KV Test	24.50
Plate Trans.—115V, 60 cps	Rating	Price
PT-699	300/150V .05A, 300/150V.05A	5 2.79
PT-362	120-0-120V 350 MA	4.69
PT-108	17.600V/144 MA	120.00
PT-671	62V/3.5A	7.95

Send M.O. or Check, Shipping Chgs. C. O. D.

COMMUNICATIONS EQUIPMENT CO.

131 Liberty St. Dept. H-2, New York City 7, N. Y.

Within the Industry

(Continued from page 26)

ALLEN H. CENTER, formerly public relations director for the *Parker Pen Company*, has joined the staff of *Motrola, Inc.* as public relations director . . . **EUGENE M. KEYS** has been elected to the post of executive vice-president, director of sales, and to the board of directors of the *Edwin I. Gutham & Co., Inc.* . . . **EDWARD M. SHERIDAN** has joined *I.D.E.A., Inc.* as industrial sales manager. He was formerly associated with *RCA Victor Engineering Products Division* for 10 years and was manager of the Product Analysis Section of the New Products Division prior to taking his new post . . . **CLARK KELLEY** is the new assistant service manager of *Sparton Radio-Television* of Jackson, Michigan . . . **R. J. McCLUSKER** has been named assistant sales manager of the *Westinghouse Television-Radio Division*. He succeeds **J. W. HITCHCOCK** who resigned recently . . . *Hycon Mfg. Company* has appointed **RAYMOND F. CRISP** to the post of manager of technical services. He was formerly chief electronics engineer for the firm . . . **ROLAND J. SHERWOOD**, vice-president in charge of sales for the *Hullcrafters Company*, has resigned his post to organize his own business in an unrelated field . . . **LEONARD F. CRAMER**, assistant general manager of the *Crosley Division*, has been elected a vice-president of *Arco*. In his new post he will be in complete charge of *Crosley's* TV and radio activities . . . *Raytheon Television and Radio Corporation* has promoted **JAMES R. BUTLER** to the post of merchandising manager for the firm. He was formerly sales promotion manager . . . **WILLIS E. CLEAVES** has been named general sales manager of the *Bendix Radio Communications Division* of *Bendix Aviation Corporation*. He succeeds **ARNOLD ROSENBERG** who has resigned . . . **GAIUS WIKI** is the new general sales manager of *Utah Radio Products Co., Inc.* of Huntington, Indiana. He succeeds **FRED TOWER** who has been promoted to division manager and vice-president of the *Caswell-Rumyan Division* of the firm . . . **T. J. NEWCOMB**, who has been with *Westinghouse* for more than 20 years, has been appointed manager of the company's Television-Radio Division with headquarters at Sunbury, Pa. . . The promotion of **HARRISON JOHNSTON** to the position of general sales manager has been announced by the *Ampex Electric Corporation* of Redwood City, California . . . **EDWARD P. ROBINSON** has been named plant manager for the *Espey Manufacturing Co., Inc.* of New York. He has been with the firm since 1947 . . . **R. K. GILBERT** has been appointed operation manager of the Chicago plants of *Standard Coil Products Co., Inc.* He was formerly associated with *Philco Corporation* for 16 years, serving in several important production capacities . . . **MORT LESLIE**, a veteran in the

radio and television broadcasting sales fields, has been appointed assistant sales manager for *JFD Manufacturing Company, Inc.* . . . **MIKE MEYERS** is the new chief field engineer for *Radio Merchandise Sales, Inc.*

JOHN B. OTTMAN, former advertising manager of *Stewart-Warner's Electric Division*, has been appointed television-radio sales promotion manager for *Admiral Corporation*.



A native of New York City, Mr. Ottman is a graduate of Yale and the Harvard Graduate School of Business Administration. He served in the U.S. Air Force for three and a half years and joined *Stewart-Warner* in 1947.

NEDA will hold its 1953 convention and conference September 14, 15, and 16 at the Chase Hotel in St. Louis, Missouri, according to word received from the association's headquarters.

A departure from past meetings, this year's convention will eliminate booths for conference purposes and provide instead three large rooms on the first floor of the hotel for conferences. Each manufacturer will be allotted a table and several chairs for use in greeting and talking to distributors.

There will be no business or social functions of any kind during conference hours. Entertainment for each of the three evenings will be provided by each of the three groups attending; "The Reps," participating manufacturers, and NEDA.

Educational programs are scheduled for 10:00 to 11:30 a.m. each morning of the convention. Conference hours will be 1 p. m. to 6 p. m.

A.T. & T.'s Long Lines Department has announced the recent completion of two new links in its expanding telephone-television network.

The company has now connected Roanoke, Virginia into the nationwide television network.

The company also opened a new radio-relay link between Kansas City and Dallas. The new facility will provide 96 television circuits as well as one Kansas City-Dallas TV channel.

Network service is now available to 112 television stations in 69 cities in the U.S., as of December 15, 1952.

CAPT. HENRY J. ROUND, 1952 Armstrong Medal winner, recently received his award from the hands of John Bose, president of the Radio Club of America at the club's 43rd annual banquet.

The award was made in recognition of Capt. Round's pioneering work in radio, especially in the fields of radio direction and position finding and the high amplification of short-wave signals. Capt. Round is a native of England,

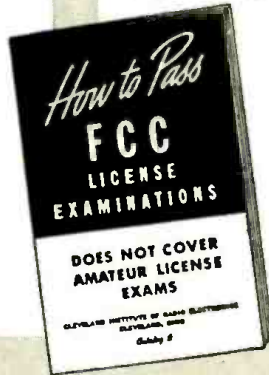
Let me send you FREE
the entire story

Just fill out the coupon and mail it. I will send you, free of charge, a copy of "How to Pass FCC License Exams," plus a sample FCC-type Exam, and the amazing new booklet, "Money-Making FCC License Information."



EDW. H. GUILFORD
Vice President

I can train you to pass your FCC License Exams in a minimum of time if you've had any practical radio experience — amateur, Army, Navy, radio servicing, or other. My time-proved plan can help put you, too, on the road to success.



How to Pass FCC COMMERCIAL Radio Operator License Exams

FREE

Tells where to apply and take FCC examinations, location of examining office, scope of knowledge required, approved way to prepare for FCC examinations, positive method of checking your knowledge before taking the examination.

GET YOUR FCC TICKET IN A MINIMUM OF TIME

Get this Amazing Booklet FREE



TELLS HOW

HERE IS YOUR GUARANTEE

If you fail to pass your Commercial License exam after completing our course, we guarantee to continue your training without additional cost of any kind, until you successfully obtain your Commercial license, provided you first sit for this examination within 90 days after completing our course.

WE GUARANTEE TO TRAIN AND COACH YOU AT HOME IN SPARE TIME UNTIL YOU GET

YOUR FCC LICENSE

If you have had any practical experience—Amateur, Army, Navy, radio repair, or experimenting

Employers make

TELLS HOW

JOB OFFERS Like These to Our Graduates Every Month

Letter from Chief Engineer, Broadcast Station, North Carolina. "Need men with radio-telephone 1st class licenses, no experience necessary. Will learn more than at average station for we are equipped with Diesel Electric power, transmitting and studio equipment."

Telegram from Chief Engineer, Broadcast Station, Wyoming. "Please send latest list available first class operators. Have November 10th opening for two combo men."

These are just a few examples of the job offers that come to our office periodically. Some licensed radiomen filled each of these jobs . . . it might have been you!

HERE'S PROOF FCC LICENSES Are OFTEN SECURED IN A FEW HOURS OF STUDY WITH OUR COACHING at HOME in SPARE TIME

Name and Address	License	Lessons
Lee Worthy 2210 1/2 Wishire St., Bakersfield, Calif.	2nd Phone	16
Clifford E. Voot Box 1016, Dania, Fla.	1st Phone	20
Francis X. Foersch 38 Beucler Pl., Bergenfield, N. J.	1st Phone	38
S/Sgt. Ben H. Davis 317 North Roosevelt, Lebanon, Ill.	1st Phone	28
Albert Schoell 110 West 11th St., Escondido, Calif.	2nd Phone	23

TELLS HOW

TV ENGINEERING INCLUDED IN OUR TRAINING & COACHING

Our Amazingly Effective JOB-FINDING SERVICE

Helps GIRE Students Get Better Jobs

Here are a few recent examples of Job-Finding results

GETS FIVE JOB-OFFERS FROM BROADCAST STATIONS
"Your 'Chief Engineer's Bulletin' is a grand way of obtaining employment for our graduates who have obtained their 1st class license. Since my name has been on the list I have received calls or letters from five stations in the southern states, and am now employed as Transmitting Engineer at WMMT."
Elmer Powell, Box 274, Sparta, Tenn.

GETS CIVIL SERVICE JOB
"I have obtained a position at Wright-Patterson Air Force Base, Dayton, Ohio, as Junior Electronic Equipment Repairman. The Employment Application you prepared for me had a lot to do with my landing this desirable position."
Charles E. Loomis, 4516 Genessee Ave., Dayton 6, Ohio.

OURS IS THE ONLY HOME STUDY COURSE WHICH SUPPLIES FCC-TYPE EXAMINATIONS WITH ALL LESSONS AND FINAL TESTS.

GETS JOB WITH CAA
"I have had half a dozen or so offers since I mailed some fifty of the two hundred employment applications your school forwarded me. I accepted a position with the Civil Aeronautics Administration as Maintenance Technician. Thank you very much for the fine cooperation and help your organization has given me in finding a job in the radio field."
Dale E. Young, 122 Robbins St., Dwosso, Mich.

Your FCC Ticket is recognized in all radio fields as proof of your technical ability.



Get All 3 FREE

MAIL COUPON NOW

CLEVELAND INSTITUTE OF RADIO ELECTRONICS

Desk RN-49
4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay)

I want to know how I can get my FCC ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examinations" (does not cover exams for Amateur license), as well as a Sample FCC-type exam and the amazing new booklet, "Money-Making FCC License Information."

Tell me how I can get a TV Engineering Course without additional charge.

NAME

ADDRESS

CITY..... ZONE..... STATE.....

Paste on 2-cent post card or send air mail

CLEVELAND INSTITUTE OF RADIO ELECTRONICS

CARL E. SMITH, E. E., Consulting Engineer, President
Desk RN-49 — 4900 Euclid Bldg., Cleveland 3, Ohio

New master of the



THE **NEPCO** LINE

National Electric Products

Radio and Television Department

Pittsburgh, Pa.

RADIO & TELEVISION NEWS

elements



The NEPCO Line—television's new "Master of the Elements"—now meets the pressing demand for *better* electronic equipment. This complete line of *quality* TV Antennas, Mounting Accessories and Wire represents more built-in ruggedness than any now known—proves that *only the best meets the test of time!*

See the Nepeco Line today. Examine its radically *new* design and construction. Prove to yourself that there's nothing finer on the market today—that it's the best by far at any price. Backed by the world's largest producer of electrical "rough-in" materials, the Nepeco Line carries National Electric's guarantee of quality, engineering and research. You can specify and install it with *complete* confidence of *long-life* installations and customer satisfaction. Write for details now.

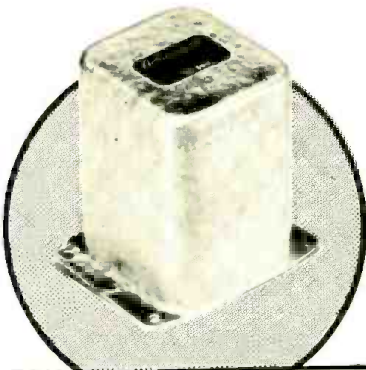
THE **NEPCO** LINE

HARRISON HAS IT!

Famous

Aerosound ★

**ULTRA LINEAR
OUTPUT TRANSFORMERS**



Using a Williamson?

**Double Your Power Output
...Reduce Distortion by 50%!**

ACRO TO-300

One of the world's finest transformers! Specifically designed to obtain maximum performance from ultra linear circuits.

- Undistorted Power: 40 watts, 30 to 20,000 cps
- Frequency Response: ±1 db, 10 to 100,000 cps
- Unequaled Square Wave Performance
- Resonance-Free Response
- Low Phase Shift
- Output Impedances: 4, 8, 16 ohms
- Fully potted steel case: 3 5/8 x 3 1/4 x 1 1/4" H.

\$24⁷⁵

TO-305. Same as TO-300, PLUS 125 and 500 ohm output impedances\$30.75

TO-310. Same as TO-300 except 20 watts. For converting popular 10-watt 6v6 amplifiers to Ultra Linear operation \$18.75
TO-290. 20 watts. For original Williamson using 807, 5881 or KT66 as triodes \$15.75

FREE! 12-page brochure on ultra linear output transformers, amplifier circuits and specs.

If COD, send 25% Deposit.

**Mail Your Order
TODAY!
Immediate Shipment**

HARRISON
RADIO CORPORATION

225 Greenwich St. • N. Y. 7, N. Y.
Please send me the following transformers as checked below (include postage; weight approximately 25 lbs. each):

- TO-300 TO-305 TO-310
 TO-290 Free Data Sheets

Amount Enclosed \$ _____

NAME _____

ADDRESS _____

TV Sound System
(Continued from page 55)

output transformer secondary. The volume control on the receiver can be used to vary the output of the amplifier. This method of connecting the receiver to the amplifier has many advantages over simply running a line to the high impedance input of an amplifier from, say, the hot side of the receiver's volume control. For one thing, there is little chance of hum pickup due to long high impedance lines, also there is no attenuation of the higher frequencies due to long runs of shielded wire which bypass the higher frequencies to ground.

For high impedance inputs, the grid of the 6SN7 is connected to an internal volume control and the cathode resistor R_2 is bypassed with a 25 μ f. condenser, C_1 . The high impedance input is useful when it is desired to connect a record player attachment with a crystal pickup.

The speaker system used with this amplifier is shown in Fig. 3. It consists of an 8-inch, wide-range speaker mounted in a bass reflex enclosure. An 8-inch speaker was found to be a good compromise between the larger speakers, which require large enclosures, and smaller speakers which are not capable of adequate bass reproduction. A wide range 8-inch speaker, when properly baffled, is cap-

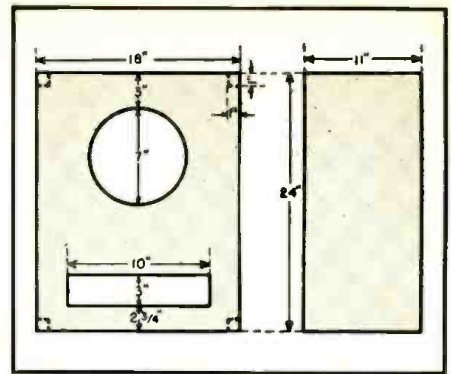


Fig. 3. Construction details for building the associated speaker enclosure. Cabinet should be constructed of 5/8" plywood with corners braced with 1" x 1" blocks of wood.

able of excellent bass response, and the cone is small and rigid enough to reproduce the higher frequencies. The speaker system used by the writer showed remarkably smooth response throughout the audio range. Fig. 3 shows the dimensions of the bass reflex enclosure. The back, one side, and the top of the enclosure should be lined with suitable insulating material such as Celotex or rock wool. It should be rigidly constructed, the joints should be screwed and glued, and the back cover should be very tightly secured to the enclosure.

It is the writer's belief that anyone who constructs this amplifier-speaker combination will find it as useful and enjoyable as he did.

ELIMINATING BARKHAUSEN EFFECT

FROM the Service Department of Scott Radio Labs, Inc. of Chicago comes some useful tips on the causes and remedies of Barkhausen lines in the picture.

"Barkhausen lines are vertical black lines which run the full length of the screen. The lines usually are most prominent and occur more often in the left half of the CR tube screen when facing the front of the receiver. The lines shift and differ in intensity with each channel.

"Barkhausen can occur in any receiver using a 6BQ6, 6CD6, 6BC6, or other similar horizontal output tubes used in modern television receivers. In such tubes an r.f. oscillation is set up between the screen and the plate due to rapid plate potential changes and emanates from the horizontal output tube as an r.f. signal. Physical characteristics of the tube determine the frequency of this oscillation to some degree. Some of the frequencies generated in the horizontal output tube fall within the TV spectrum and if allowed to enter the r.f. section of the receiver, they will appear visually as outlined above.

"The built-in antenna will pick up this radiated signal, and whether or not the built-in antenna is used, it can feed or radiate the signal to the r.f. unit. In receivers where the built-in antenna is not used, it would be best to remove the antenna from the cabinet. The aquadag coating on the outside of the picture tube will also act as a radiator of this r.f. signal if not properly grounded.

"In many receivers, the power cord terminates near the high voltage power box, and the power cord can pick up this signal and transmit it to the antenna leads, particularly where the antenna leads come from an outside antenna and then are allowed to be coiled on the floor in close association with the power lead. Often rearranging of the receiver line cord with reference to the incoming antenna leads will eliminate Barkhausen oscillation.

"Within the receiver, moving of the piece of twin-lead from the tuner to the termination point at the rear of the chassis will often eliminate Barkhausen lines. Since horizontal output tubes radiate at different frequencies, the change of the horizontal output tube may either remove Barkhausen lines entirely or transfer them to a channel which is not in use. Also it would be advisable to try different damper tubes. In extremely difficult cases it may be necessary to attach a magnet to the horizontal output tube. Quite often an ion trap is slipped over the top of the horizontal output tube to eliminate Barkhausen radiation. Another possibility for the elimination of Barkhausen is slight readjustment of the horizontal drive control. Check all tube shields on the tuner to make certain that they are properly grounded.

"Problems of Barkhausen elimination are normally problems of installation and each set will show different characteristics and on each receiver lines will appear on different channels and in a different position on the CR screen."



TUBES

ALL TUBES are guaranteed for one year... individually boxed. Very BEST BRANDS available for immediate delivery!

FREE OFFER!

5 lbs. of good usable radio service parts with every 100 tubes ordered; a kit of assorted radio repair hardware free with every 50 tubes ordered!

0Z4	59c	2B7	.89	6AT6	.59	6CD6G	1.49	6SG7	69c	7B7	79c	12AV7	.89	1B3GT	ea. \$.95	6BK7	ea. \$.98	7H7	ea. \$.69
0Z4G	.65	2C34	.60	6AS5	.90	6D6 7B	1.10	6SH7	.69	7B8	1.30	12A6W	.95	1X2A	.89	6BL7	.79	12AT7	.89
1A5GT	.65	2E5	.89	6AU6T	.89	6D8C	1.15	6SH7GT	.69	7C4	.69	12A4	.69	5U4G	.59	6B06GT	.85	12AU7	.65
1A7	.69	2X2 879	.74	6AUE	.59	6E5	.69	6S17	.69	7C5	.59	12A7	.69	6A84	.69	6B07	1.19	12A74	.69
1B3GT	.95	3L4	1.19	6AV5GT	.89	6F5GT	.59c	6S17GT	59c	7C6	.59	12B6	.59	6AU6	.59	6B27	1.29	70L7GT	.89
1B5	.59	3Q4	.69	6AV6	.59	6F6GT	.59	6S17GT	.69	7C7	.69	12B6G	.69	6AV5GT	.69	6C6DG	1.49	715B	7.75
1C7G	29c	3Q5GT	.89	6AX4	.69	6F8C	1.15	6S17GT	.69	7E6	.69	12B6F	59c	6AX4	.69	6U8	.89	807	1.55
1E7	.59	3S4	.59	6AX6	.69	6G6G	.95	6SN7GT	.69	7E7	.89	12B7	.69	6B6CG	1.49	6V3	1.29	866A 1616	1.49
1H5GT	.59	3V4	1.40	6B4C	1.44	6H6GT	.59	6S07	.59c	7F7	1.47	12B8	.69	14C5	1.07	3525	.55	75	69c
1J6GT	.69	5T4	.69	6B5	.79	6J5GT	.59	6S07GT	.59	7F8	.79	12C8	.69	14C7	.98	3526G	.95	78	75
1L4	.69	5U4G	.59	6B6G	.79	6J6GT	.59	6S07GT	.59	7G7	.79	12F5GT	.69	14F7	.89	35 51	.79	78 606	1.10
1LA4	1.19	5V4G	.87	6B8GT	1.15	6J7G	.69	6S57	.72	7H7	1.15	12H6	.69	14F8	1.30	36	1.06	80	.69
1LA6	.59	5W4	.59	6B8A	.59	6J8G	1.15	6T7G	1.15	7I7	.79	12J5GT	.69	19B6CG	1.49	37	.72	83	1.45
1LC5	.69	5W4GT	.59c	6B7	.69	6K5GT	.69	6T8	.89	7K7	.79	12K7GT	.69	19T8	.89	38	.85	84 624	.72
1LC6	1.19	5Y3GT	.45	6B5C	.69c	6K6GT	.59	6U5	.69	7L7	.79	12Q7GT	.69	20	1.40	39 44	.88c	85	.79
1LD5	.99	5Y4G	.54	6B7C	.79	6K7GT	.69	6UGGT	.69	7M7	.79	12S7GT	.69	24A	.69	41	.72	117A7	1.40
1LE5	1.19	5X4G	.81c	6B8D5GT	.89	6K8GT	.69	6U7G	.69	7Q7	.89	12S7GT	.69	24ACSGT	1.04	42	.66	117B7	.89
1LH4	1.19	5Z3	.69	6B8E	.59	6L5G	.95	6V3	1.29	7R7	.89	12S7GT	.69	25BQ6GT	1.15	43	.72c	117C7	1.40
1LN5	1.19	6A3	1.15	6B8F5	.69	6L6G	.95c	6V8	.89	7V7	.79	12S7GT	.69	25L6GT	.59	45	.59	117D3	.59
1N5GT	.69	6A7	1.21	6B8G	.69	6L6GA	.69	6V8GT	.59	7W7	1.07	12S7GT	.69	25W4GT	.69	45Z5	.69	117E6	.69
1P5GT	69c	6A8GT	.69	6B8GG	1.49	6L7	.69	6W4GT	.59	7X6	.89	12S7GT	.69	25Z5	1.04	46	.89c	715B	7.75
1Q5GT	69c	6A84	.69	6B8H	.69c	6M6G	1.40	6W6	.69	7X7	.89	12S7GT	.69	25Z6GT	.69	47	.807	1095	1.55
1R5	.59	6A87	1.15	6B8J	.69c	6N7GT	.69	6X4	.59c	7Y4	.79	12S7GT	.69	32L7GT	.69	50A5	.89	813	10.95
1S5	.59	6AC5GT	.89	6B8K7	.38	6P5GT	.69c	6X5GT	.69	7Z4	.79	12S7GT	.69	32L7GT	.69	50B5	.69c	866A 1616	1.49
1T4	.59	6AC7	.99	6B8L7	.79	6Q7GT	.59	6Y8	.69	7Z4 84	.72	12A7	1.15	32L7GT	.69	50C5	.69c	1294	.29c
1U4	.59	6AC5	.69	6B8M	.89	6R7GT	.69	6Z4 84	.69	7A4	.79	12A8	.69	35A5	.99	50C6G	1.04	1295	.45
1U5	.59	6AG7	.59	6B8Q6GT	.85	6S4	.59	7A5	.89	7A5	.89	12A8	.69	35B5	.69c	50L6	.69	1619	.45
1V	.88	6AH6	1.49	6B8Q7	1.19	6S7GT	1.15	7A6	.69	7A6	.69	12A8	.69	35C5	.69	50X6	.79	1629	.29
1X2A	.89	6AK5	.89	6B8T	1.29	6S8GT	.69	7A7	.69	7A7	.69	12A15	.54	35D5	.69	50Y6	.69	2050	2.00
2A3	1.15	6AK6	1.08	6C4	.59	6S8A7GT	.69	7A8	.69	7A8	.69	12A16	.59	35E4	.45	50Y6	.69	2051	1.15
2A5	.79	6AL5	.69	6C5GT	.69c	6S8C7	.69	7B4	.69	7B4	.69	12A17	.89	35F4	.45	70L7	.89c	7153	.87
2A6	.89	6AQ5	.69	6C6	.69	6S8D7GT	.99	7B5	.69	7B5	.69	12A16	.65	35Z3	.99c	70L7GT	.89c	VT51	.29c
2A7	.89	6AQ6	.51	6C8G	1.15	6S8F5	.59	7B6	.69	7B6	.69	12A16	.59	35Z4	.59	71A	.87	VT52	.87
2B3	.89	6AR5	.74	6C8B	.69	6S8F5GT	.59												

TUBES and PARTS

TUBE SPECIALS!

1B3GT	ea. \$.95	6BK7	ea. \$.98	7H7	ea. \$.69
1X2A	.89	6BL7	.79	12AT7	.89
5U4G	.59	6B06GT	.85	12AU7	.65
6A84	.69	6B07	1.19	12A74	.69
6AU6	.59	6B27	1.29	70L7GT	.89
6AV5GT	.69	6C6DG	1.49	715B	7.75
6AX4	.69	6U8	.89	807	1.55
6B6CG	1.49	6V3	1.29	866A 1616	1.49

TUBE KITS

BEST BRANDS AT BEST PRICES



3Q4, 1T4, 1R5, 1S5.	List Value \$8.00. Tube Kit only.	\$1.98
3S4, 1T4, 1S5, 1R5.	List Value \$7.80. 4 Tube Kit.	\$1.98
1U4, 3S4, 1S5, 1R5.	List Value \$7.80. All for.	\$1.98
3V4, 1R5, 1S5, 1T4.	List Value \$7.80. All for.	\$2.49
117Z3, 1U5, 3V4, 1R5, 1T4.	AC-DC Portable Kit. All for.	\$2.59
12A76, 12BA6, 12BE6, 35W4, 50B5.	5 Tubes for.	\$3.22
50L6GT, 35Z5GT, 12SQ7GT, 12SK7G, 12SA7G.	3 Tubes for.	

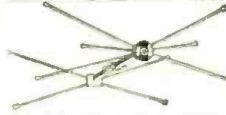
PICTURE TUBES

PICTURE TUBES

Send us your duds COLLECT — up to 70 lbs. via Railway Express. Send dud shipments over 70 lbs. by truck. ONE FULL YEAR GUARANTEE—All Types

SIZE	PRICE	PLUS YOUR DUD	SIZE	PRICE	PLUS YOUR DUD
10-Inch	\$10.95		17-Inch	\$17.95	
12-Inch	13.95		19-Inch	19.95	
14-Inch	14.95		20-Inch	20.95	
7-Inch		16.95	21-Inch	21.95	
15-Inch			24-Inch	39.95	
16-Inch					

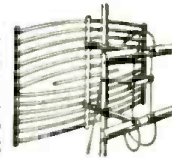
TV ANTENNAS



8 Element Conical only \$2.95
10 Element conical... rugged throughout. only \$3.95
Double bay array, with stacking bars \$7.75
4 Bay array, with harness and stacking bars \$14.95

NEW DAVIS SUPER-VISION TV ANTENNA

Unbeatable for fringe area and DX—The only television antenna with a money-back guarantee. With the new Electronic Dipole Separators. \$20.55 less mast
5" aluminum mast heavy gauge 1/4" diam. with interlocking end. Slip two sections together for a ten footer each 90c



Outdoor TV Antenna Special!

Famous Make Folded Dipole Inline Antenna — no assembly necessary—elements snap in place with guaranteed positive lock. At this low price, we cannot mention manufacturer's name ONLY \$4.95

FRINGE AREA DOUBLE "V" TV ANTENNA KIT

High Gain, Best Pictures Possible... \$6.95 Complete
complete with 300 ohm line, insulators, guy wire, hardware, full size antenna with double length 9 ft. mast.

P. M. SPEAKERS

12" COAXIAL PM SPEAKERS \$12.95
High Fidelity with high pass filter attached. 20 watt; 40-17500 cps. response; 8 ohm VC.
Very best quality—NATIONAL BRANDS. Individually Packed.
3" ea. \$1.39 8" ea. \$3.23
4" ea. 1.59 10" ea. 5.10
5" ea. 1.59 12" ea. 5.95
6" SPECIAL PRICE ea. \$1.79

MISCELLANEOUS BUYS

I. F. TRANSFORMER—456 Kc 19c
PILOT LIGHTS. Type No. 47
10 for 39c
VOLUME CONTROLS with switch. 2" shaft 1 meg. 1/2 meg. 1/4 meg. 34c
SINGLE ION TRAPS ea. 15c
OUTPUT TRANSFORMER—for 50L6 29c for 6V6 39c
UNIVERSAL OUTPUT TRANSFORMER, 12 watt 79c
CHIMNEY MOUNT for TV ant. 98c
3 SPEED G. I. CHANGER 524.95
6 foot LINE CORD UL 10 for \$1.95
TV INTERLOCK CORDS ea. 49c

21" TV CONVERSION KIT

Consisting of rectangular tube, 70 DEGREE YOKE, Beautiful Mask and FLYBACK TRANSFORMER \$31.95 complete
20" TV CONVERSION KIT, as above, \$28.95 complete
17" TV Conversion Kit, as \$23.95 above, complete



300 OHM TWIN LEAD

55 Mil 1,000 ft. \$10.95
100 ft. \$1.49
20 GAUGE, 1000 ft. \$16.95
80 MIL WEB 100 ft. 1.89

TV SET SPECIALS!

"FAMOUS NAME TELEVISION SETS!"

- Automatic Gain Control
- Saw Tooth AFC
- Standard Coil Tuner—adaptable to UHF
- All the exclusive features of most expensive sets
- Meet all Standard RTMA requirements
- Finished in luxurious mahogany
- Manufacturer Licensed under RCA Patents.
- 17" Table Model now only \$149.00
- 21" Table Model now only 179.00
- Console Sets \$20.00 additional.
- Limed Oak Finish \$12.50 extra



RESISTOR KITS

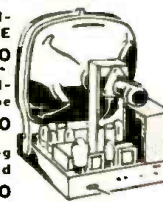
Insulated 1/2, 1 and 2 watt assortment of most used values, I.R.C. Ohmite, \$2.95
Stackpole, Speer, etc. 100 for

WELLER SOLDERING GUN

For All Types of Soldering
Model Watts
WS-100 150 \$8.77
Single heat
WS-200 275 \$9.75
Single heat
WD-135 150-200 \$10.73
Dual Heat
WD-250 275-350 \$11.71
Dual heat

Finest TV CHASSIS

Complete with all tubes, including 17" RECTANGULAR PICTURE TUBE and SPEAKER. \$129.50
Complete with all tubes, including 20" rectangular picture tube and speaker. \$149.50
Complete with all tubes including 21" rectangular picture tube and speaker. \$159.50
INCLUDES: Nationally Known
• manufacturer licensed under RCA patents
• permanent magnet speaker
• all tubes aligned perfectly
• ideal for fringe areas... works better than other receivers and where others can't
• ultra-sensitive fringe area tuner
• standard 90-day guarantee on all tubes and parts
• full band reception and output
• gated AGC—finest automatic gain control
• COMPLETE... READY TO OPERATE



PREMIER T.V. RADIO SUPPLY

Division of Continental Corp.
3237 W. North Ave. • Chicago 47, Ill.
Armitage 6-5550

NEW ADDRESS!

CUSTOMERS! We have moved to much larger quarters. FREE ball point pen imprinted with our new address is available... write for yours today!

TERMS 20% DEPOSIT with order, balance C. O. D. All shipments F.O.B. Chicago. Orders Less Than \$5.00—\$1.00 Service Charge.



ANCHOR BOOSTERS

Model ARC-101-100 \$29.10
Model ARC-101-75 22.05
Model ARC-101-100 is a two stage super high gain booster for the most difficult reception areas.
Model ARC-101-75 a single stage booster designed to give uniform response on all channels. One knob control.

DEALERS-SERVICEMEN-MAKE MORE MONEY-GET ACQUAINTED with McGEE

28 WATT \$150.00 LIST PORTABLE P. A. ON SALE \$69.95



**3-SPEED PHONO TOP—TWO 12-INCH SPEAKERS
7-TUBES PUSH PULL 6L6'S HEAVY LEATHERETTE
COVERED PLYWOOD PORTABLE CASES
CRYSTAL MIKE \$8.95 EXTRA**

STOCK No. AP-28X. Portable 28 watt public address system. You get a 7-tube heavy duty push-pull 6L6 amplifier with inputs for 2 mikes either crystal or dynamic with separate mixing volume controls. One phono input. Fully variable tone control high fidelity, wide range frequency response. The heavy duty output transformer has taps for 8, 16, 25, 50 and 500 ohm speaker connections. Two heavy duty 12 inch Alnico V P.M. speakers, each with 25 feet of speaker cable. Each speaker is mounted in separate carrying cases. Each case has a snap lock and is large enough to give good speaker baffling. Each case is 21 x 10 x 13 inches. One is used to carry the amplifier. A 3-speed phono motor and pick-up is mounted in the top of the amplifier to play 33, 45 and 78 RPM records. This portable P.A. system will play out 20 watts all day long and 28 to 30 watts peak audio. McGEE offers you this \$150.00 list portable P.A. system at a terrific saving.

STOCK No. AP-28X complete portable P.A. system with 3-speed phono and speakers as pictured (loss mike) ship. wt. 71 lbs. \$69.95.

Electro Voice Mike \$10.00 or **Crystal Mike with 20 feet of cable and desk stand \$8.95 extra.**

Floor type mike stand instead of desk stand \$4.95 extra.

OFFERING TO THE RIGHT FOR WALL SPEAKERS INSTEAD OF THE PORTABLE SPEAKERS.)

The AP-28X P.A. system is offered with two of the 25 watt weatherproof trumpet and drivers No. MA-33 shown below. In place of the two portable speakers with baffles. Specify that you want MA-33 trumpets with your amplifier and add \$35.00 to the cost. Stock No. MA-28XX. Net price \$104.95.

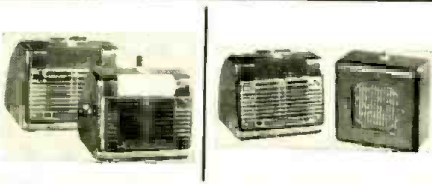
28-WATT AMPLIFIER WITH 12-INCH WALL SPEAKERS

The 28 watt amplifier shown to the left is also offered with two 12 inch wall speakers. In their place we will ship two Sealing Walnut wall baffles with two heavy duty 12 inch Alnico V magnet PM Speakers and 500 ohm line matching transformer. Stock No. SS-28X. 28 watt amplifier with 3 speed phono top with two 12 inch wall speakers. \$69.95. Extra 12 inch wall speakers \$11.95. Model 914 Electro Voice mike \$8.95 extra. Floor stand \$4.95 extra.



3 STATION INTERCOM MASTER \$16.95 SUB STATION \$3.95

3-station intercom master housed in chrome plated metal cabinet 7 1/2" x 8 1/2" x 3" deep. Full 3-tube amplifier for 110 volt AC-DC operation. Press-to-talk switch in on top of cabinet and volume control with off-on switch and station selector switch are on either side. May be used with from one to 3 sub-stations. (See matching cabinet chrome plated sub-station No. PM-A5). Master is quiet at all times except when press-to-talk switch is pressed at the master or call-back switch is pressed at the sub. Uses 3-wire intercom cable. 3-station intercom master MM-A4, shipping weight 10 lbs. Sale price \$16.95 each. Sub-stations extra. 3-wire plastic intercom cable, 100 ft. for \$1.95, 500 ft. for \$8.95.



INTERCOM SUB STATIONS \$3.95

Chrome plated, with call back switch for a 3-wire intercom master. Size 7 1/2" x 8 1/2" x 3" deep. 5" Alnico V PM speaker. Intercom dealers buy at less than present production cost. Limited quantity. Stock No. PM-A5, ship. weight 8 lbs. Sale price \$3.95 each or 3 for \$10.00. Special 3-wire plastic intercom cable, 100 ft. for \$1.95, 500 ft. for \$8.95.

Brown leatherette covered intercom sub-station with call back switch for use with 3-wire intercom masters. 5" speaker and 3 1/2" deep. Has new plastic grill cloth. Alnico V PM speaker. A true Morse code. Stock No. NE-5, ship. weight, 1 1/2 lbs. Sale price \$3.95 each or 3 for \$10.00. Special 3-wire plastic intercom cable, 100 ft. for \$1.95, 500 ft. for \$8.95.

BRUSH CRYSTAL EAR PHONE With Control \$5.49

Simply clip on to the speaker voice coil of any radio or TV set or to an amplifier. No soldering necessary. Listen in privacy to your favorite programs. The tiny Brush crystal ear phone fits your ear just like a regular hearing aid ear piece. A small remote control box enables using 20 ft. from the radio or TV set. Has its own separate volume control and small matching transformer built-in to operate the crystal from any speaker voice coil. Ideal for hospitals, homes, hundreds of other uses. 3 1/2" x 1 1/2" x 1 1/2" deep. Includes conventional earphones. Stock No. BR-50 includes Brush crystal ear piece, remote control box, 20 ft. of cable and instructions. Sale price, \$5.49.

Crystal ear phone with 36" cord. Stock No. BR-51. \$2.95. (You connect it like any crystal earphone, diagram furnished.) Accessory kit includes volume control with switch plus coupling circuitry and instructions. 99c extra.

5-TUBE RADIO \$21.95 WITH BRUSH EARPHONE PLUS REGULAR SPEAKER

Top quality 5-tube model radio with Brush Crystal earphone for private listening as well as the regular heavy duty 5" speaker. Beautiful cabinet available in ivory or walnut is constructed so that it has no open back. Using the same finished appearance from either the front or back. Complete with 12SA7, 12SK7, 50L6 and 3Z5Z rectifier tube. Illuminated slide rule dial. Brush crystal earphone has 20 feet of cable and separate control box so that the volume can be regulated to suit the individual. Tiny earphone fits in your ear just like a hearing aid. Makes music programs even more enjoyable. Ideal for hospital and home use and hundreds of other places where you want to listen in privacy with no chance of disturbing others. Complete 5-tube superhet radio with Brush crystal earphone. Stock No. 14-B1A, shipping weight 8 lbs. Sale price \$21.95. Limited finish. See extra for ivory cabinet.

CROSLEY RADIO WITH 45 OHM CHANGER \$29.95

5 tube superhet radio (450 to 1500 kc Broadcast) using 12SA7, 12SK7, 50L6 and 3Z5Z tubes! Automatic changer for up to 8 45 RPM records (6 7/8" only). Brand new in original factory cartons. Only 100 to sell at the terrific low price of \$29.95. Shipped Express only. Shipping weight 23 lbs. Mahogany cabinet 17" x 16" x 8 1/2" high. Lid covers 45 RPM changer (will not play 78 or 33 1/2 RPM records). Ideal for children and grandparents alike. Model No. 10-145A. \$29.95.

OUTDOOR SPEAKERS — WALL BAFFLES — 50-WATT BOOSTER AMPLIFIER

25-Watt Weather-Proof Out-Door Speaker \$28.95

25-Watt Horn \$28.95

8" PM AND LEATHERETTE BAFFLE, \$4.95 LOTS OF 10, \$4.75

The finest Leatherette Baffle we have ever offered. New, self-supporting, plastic grill material, baffle is covered tan with matching grill. Offered with a good heavy duty 8" Alnico V PM speaker with 500 ohm voice coil. Stock No. 818. Speaker and Baffle, \$4.95 ea.; lots of 10, \$4.75. 8" Baffle only. Stock No. NV-8. \$2.29 ea.; 10 for \$19.95.

50-WATT BOOSTER AMP. \$39.95

2-Mike Pre-Amp \$12.95 Extra. Not a Kit, but a Manufactured Amp.

50-WATT BOOSTER A sensation. 50 watt booster amplifier with push-pull parallel 6L6 output tubes, with the PR-2X Pre-amp to add the use of 2 mikes and one low level input. The booster amplifier has one input jack and with 1 volt input gives 50 watts of audio. Booster has a 6L6, 6B6, 6BA6, 6BM6, 6BE6, 6BE7 and 5Y3. The 50 watt variable controls are for master volume control and bass boost tone control. Size 8 x 6 1/2 x 4 1/2. Stock No. PA-50N. Shipping weight 26 lbs. Sale price \$39.95 ea.

2-MIKE PRE-AMP. Pre-amplifier plugs in directly to the PA-55N booster amplifier. It enables use of 2, Crystal or Dynamic Mikes plus one low level input. Furnished with 4 remote control buttons for use with 50 Watt Booster Amplifier. Small chassis size 5 x 3 1/4 x 4". Stock No. PR-2X, with tubes 787 and 7N7. Net price \$12.95 ea.

ORDER FOR USE WITH ANY P.A. SYSTEM OFFERED ON MCGEE'S 2 PAGES OF ADVERTISING

25-WATT HORN 25-Watt driver and driver column re-entrant Trumpet. The standard type trumpet and driver you see the most. Drivers are 100% weatherproof, horn is spun aluminum, offered to you at a considerable savings. Stock No. MA-33. Shipping weight 20 lbs. Net price \$28.95.

IT'S MCGEE FOR COAXIAL SPEAKERS—3-SPEED CHANGERS—FM-AM CHASSIS

MCGEE'S \$62.50 LIST 15" COAXIAL SPEAKER, \$21.95

21 OZ. ALNICO V MAGNET—5" TWEETER

This is the finest 15" coaxial PM speaker value that we have ever offered. New 1952 production, of a famous manufacturer of fine speakers. The 15" speaker has a 2 1/2 oz. Alnico V magnet, equal to 68 oz. of the Alnico 3 type magnet. The cone is free floating, of one piece construction. Will reproduce low frequencies down to 20 cps. The 5" tweeter is coaxially suspended and has a ridged cone to reproduce only the high frequencies. It will respond up to 17,500 cps. The high-pass filter is concealed under the pot cover, leaving only two wires to connect both the tweeter and woofer to any 8 ohm output transformer of a radio, or high fidelity music lover's amplifier. Stock No. P15-CU, shipping weight 13 lbs. Net price \$21.95.

12" JENSEN PM, \$15.95

Another McGEE Secon! Jensen Concert 12" 1 1/2 oz. Alnico V magnet 12" speaker. 8 ohm voice coil. Will take 25 watt audio. You save dollars on this speaker. Just 100 to sell. Shipping weight 3 lbs. Stock No. P-12P. Sale price \$15.95; 2 for \$30.00.

12" COAXIAL SPEAKER, \$12.95

McGEE offers the new 1952 model 12" coaxial PM speaker. Quality you would put in your finest sets if you were a manufacturer. 12" woofer has 6.8 oz. Alnico V magnet. Tweeter is coaxially suspended and has a metal diffuser. High pass filter is under the pot cover. Only two wires to connect to your radio or audio amplifier. 8 ohm with 18 watt peak and 10 watt average. Shipping weight 8 lbs. Response from 30 to 17,500 cps. Stock No. CU-14Y. Sale price \$12.95 each; 2 for \$25.00.

ESPEY 12-TUBE FM-AM CHASSIS, \$59.95

★ BUILT-IN PRE-AMP FOR G.E. VARIABLE RELUCTANCE PICK-UP
★ WIDE RANGE AUDIO
★ WHY NOT ORDER WITH A COAXIAL SPEAKER AND A RECORD CHANGER? SEE OUR SPECIAL OFFERING

McGEE's new 1953 model 12-tube FM-AM chassis. Latest design with phono inputs for all types of record players, crystal or G.E. variable reluctance. Receives standard broadcast 550 to 700 kc and FM 88 to 108 mc. Wide range audio response (push-pull 6V6 output) and bass boost tone control. Loop antenna for broadcast and 300 ohm line type FM antenna may be stapled in cabinet. Attractive lighted slide rule dial. Chassis size, 13 1/2" x 9" high and 9" deep. Complete with tubes: 6BE6, 6BA6, 6BM6, 12A7T, 6X4, 6X4T, 6X4T, 12A7T, 2-6V6GT and 3Y3GT rectifier. Shipping weight 20 lbs. Stock No. 7C-X. Espey 12-tube FM-AM chassis. Sale price, \$59.95, less speaker. Output matches voice coil of our 12" or 15" coaxial speakers.

G.I. 3-SPEED CHANGER WITH G.E. \$22.95

Another tremendous McGEE Secon! Brand new General Instrument 3-speed automatic record changers. Complete with RPX-050 G.E. variable reluctance cartridge with turn-about stylus. Plays all 3 speeds automatically. 10" or 12" records. Has reject button. Repeats last record. Base size, 2 1/2" x 1 1/2". Shipping weight 14 lbs. Stock No. 710-GE. Secon price, \$22.95.

ESPEY DEAL (1), \$99.95
Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and V1-950 G.E. 3-speed changer equipped with a G.E. turnabout variable reluctance cartridge. A better home music system than ordinarily available. Espey Deal #1. Sale price \$99.95.

ESPEY DEAL (2), \$118.95
With 15" coaxial PM speaker P15-CU instead of CU-14Y. \$10.00 extra.

ESPEY DEAL (3), \$138.95
Espey 7-C chassis complete with THREE 12" coaxial PM speakers CU-14Y (these three 12" coaxial speakers give a cone area equal to an 18" speaker) and a Garrard 3-speed changer with G.E. variable reluctance turnabout cartridge. Espey Deal #3. Sale price \$138.95.

MCGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order, Balance Sent C.O.D. With Parcel Post Orders, Include Postage. TELEPHONE VICTOR 9045. WRITE FOR FLYER 1422 GRAND AVE., KANSAS CITY, MISSOURI

LOOK TO MCGEE FOR ALL RADIO AND TELEVISION MATERIAL

GENUINE STANDARD COIL T.V. BOOSTER \$11.95

Not Surplus, But Right From The Factory
 Latest Model B-51 Standard Coil Television Booster. McGee makes another lucky purchase and as usual, passes the saving on to you. The famous Model B-51, 12 Channel Standard Coil TV booster, which lists for \$35.00, is offered to you for only \$11.95 each, brand new, factory cartoned and fully guaranteed by McGee. This top quality single stage booster utilizes channels. Uses 6AK5 tube. Average gain, 6 to 7 volts on low channels and 5 or 6 on high channels. No distorting of picture or sound. Has extremely fine channel selector control switch for low noise factor. Continuous one-knob tuning and channel selector control switch for off-on and bypassing 300 ohm lead-in to set. Modern design, dark brown plastic cabinet. 8"x4 1/2"x4 1/2". Made for 110 volt, 60 cycle AC operation. Shipping weight 5 lbs. Model B-51. Sale price, \$11.95 each, or buy 2 for only \$22.00.

MCMURDO SILVER BOOSTER \$10.95

Sensational value. Continuously variable inductance type tuner. from channel 2, including the FM band, through channel 13. This booster is self powered for 110 volts AC operation. It incorporates a 6AG5 tube. Input for 300 ohm TV line and 300 ohm output to the TV set. Single knob tuning. Attractive plastic case. McMurdo Silver Super Radio TV Booster. Stock No. C-14-10. Shipping weight 5 lbs. McGee's terrific sale price, \$10.95 each, two for \$20.00.

CASCO ASTATIC \$19.10

New Astatic "Scanfar" TV booster with improvements to match the newer model TV receivers. Minimum noise with maximum gain. Balanced cascaded circuit with 6J6 and 12AT7. Input and output for both 72 and 300 ohm. Mahogany finished metal cabinet 6 1/2"x7 1/4"x4 1/4" high. Model C-11. Net price \$19.10.

DB-520 REGENCY \$19.10

New Regency DB-520 TV booster with exclusive circuit stabilizer and newly designed cabinet only 4 1/2"x6 1/4"x4 1/4". Improved circuit with push-pull 6J6 is equal to the best cascade circuits and has higher gain. Matches 72 or 300 ohm. Net price \$19.10.

20 INCH CONVERSION KIT \$29.95

YOU GET—
 20HP4—20" PICTURE TUBE
 20-INCH PLASTIC MASK
 14 K.V. FLYBACK AND 70° YOKE

Our 20" conversion kit includes a 6-month guaranteed 20HP4, 20" rectangular blackface picture tube, plus a 14,000 volt G.E. built high voltage flyback transformer, plus a matched 70° cosine yoke, plus a 20" rectangular gold trimmed plexiglas mask and suggested diagram. The picture tube is the latest electro-static focus type that requires no focus coil. Shipped via express or truck only. Slight weight, 40 lbs. Stock No. 20-TP, net price, \$29.95.

14-INCH CONVERSION KIT \$19.95

Our 14" conversion kit includes an RCA 14CP4, 14" rectangular blackface tube, plus a 14,000 volt G.E. built flyback, plus a 70° cosine yoke, plus a 14" plexiglas gold trimmed mask. Offered at the very low price of only \$19.95. Suggested diagram furnished. Ship. weight, 20 lbs. Via express or truck only. Stock No. 14-CP, net price, \$19.95.

17-INCH CONVERSION KIT \$24.95

Our 17" conversion kit includes a 6-month guaranteed 17HP4 blackface rectangular picture tube, plus a G.E. built 14,000 volt flyback, plus a matched 70° cosine yoke, plus a gold trimmed 17" plexiglas mask, and suggested diagram. The 17HP4 is the latest electro-static focus tube that requires no focus coil. Shipped via express or truck only. Stock No. 17-TP4. Net price, \$24.95.

T.V.-RADIO NEWS SPECIAL \$9.95

3 Flybacks and 3 Deflection Yokes for \$9.95. You get 3 deflection yokes, 2-70° yokes, and 1-25° yoke, and 3 horizontal flyback and 2 General Electric 14,000 volt ceramic core 70°, and 1 early model Philco. The G.E. flyback cost regularly more than our price for the complete deal. Stock No. 33YK, ship. weight, 5 lbs. Radio News Special, only \$9.95.

4 General Electric Diodes for \$1.95

Reg. \$7.20 Net
 You receive 2-1N48, 1-1N52, 1-1N63, 1-6V6 vacuum General Electric Germanium crystal diodes. The total dealers net is \$7.20. A special purchase enables a saving of over \$5.00 to you on this kit of 4 diodes. G.E. Germanium crystals are growing in popularity every day. Every radio and TV service department will do well to have a few of these kits on hand. Stock No. 61D-4, kit of 4 diodes, (2-1N48, 1-1N52 and 1-1N63) only \$1.95 or 2 kits for \$3.75.

T.V. COMPONENT DEAL #CGE \$12.95

Here is a terrific TV parts deal for those who repair TV or the builder and experimenter. You get a Meissner 12-channel TV tuner, a horizontal output transformer, plus a standard 4-wire vertical output transformer, plus a 70° cosine deflection yoke (no tubes included). It's worth \$20.00. Our special price only \$12.95.

RCA 201E1 T.V. TUNER \$7.95

Terrific buy on this RCA tuner. We have a limited quantity of the famous original 201E1, 13 channel completely wired and tested TV front end tuners. Ready to connect to your TV video I.F. strip. Offered at a sacrifice. Price was \$41.00. Now only \$7.95 each, with tubes. Each tuner in good condition but has been repaired. Stock No. RCA-13P, TV front end tuner. Converter coil type for separate sound as used in the famous 630 chassis. Complete with 3-6J6 tubes. \$7.95. Specify shaft length desired, either 2" or 4".

RCA 201E1 T.V. TUNER

Same as pictured above only new—with tubes. Stock No. 2201. Sale Price, \$11.95.

3-TUBE SARKES-TARZIAN T.V. TUNER \$9.95

This popular Sarkes-Tarzian Type 3 tuner is widely used, 13 channel rotary type switch with individually tuned coils. Price is complete with diagram and three tubes: 6C4 osc., 6AH6 R.F. and 6AG5 mixer. Regular factory cost is twice our price. Each tuner is wired ready to hook up to video and sound I.F. strip. May be used with either inter-carrier or separate sound I.F. circuits. Has built-in converter coil, built in fine frequency control. Same as Sarkes-Tarzian tuner, with 3 tubes. Net price, \$9.95 each. Specify shaft length, either 2 1/2" or 3 1/2".

RCA PRINTED CIRCUIT T.V. TUNER \$14.95

RCA Printed Circuit T.V. Tuner with 6J6 and 6CH6 tubes. Similar mechanically to the standard coil (same knob kit). Snap-in channel selector transformer. 2 General Electric 14,000 volt ceramic core 70°. Stock No. 1C-A12, 12 Channel Tuner with Tubes. Net, \$14.95. Knobs, 59c.

T.V. TUNER FOR EMERSON \$12.95

STOCK NO. SC-947E
 For Emerson 660D ETC. Has 2 1/4" insulated shaft and tubes 6BC3—filaments in series—shunted to .6 amps. Stock No. SC-947E. Sale Price, \$12.95. Knobs, 59c.

T.V.-RADIO NEWS SPECIAL \$9.95

3 Flybacks and 3 Deflection Yokes for \$9.95. You get 3 deflection yokes, 2-70° yokes, and 1-25° yoke, and 3 horizontal flyback and 2 General Electric 14,000 volt ceramic core 70°, and 1 early model Philco. The G.E. flyback cost regularly more than our price for the complete deal. Stock No. 33YK, ship. weight, 5 lbs. Radio News Special, only \$9.95.

T.V. COMPONENT DEAL #CGE \$12.95

Here is a terrific TV parts deal for those who repair TV or for the builder and experimenter. You get a Meissner 12-channel TV tuner, Crosey 4-tube video I.F. strip, a 14 K.V. G.E. horizontal output transformer, plus a standard 4-wire vertical output transformer, plus a 70° cosine deflection yoke (no tubes included). It's worth \$20.00. Our sale price, only \$12.95.

TERRIFIC COMBINATION CABINET SALE

33.90
 Originally intended for an Admiral 14" TV combination. Made of walnut veneer, 32" wide, 35 1/2" high and 20" deep. Offered at less than the factory price. Upper left door is made to swing down, opening record changer compartment. 14 1/2" x 20" deep. Upper right door swings open for the TV x 20" deep. Note: The TV chassis area is only 14 1/2" wide and 15 1/2" high, 20" deep, limiting the size of TV chassis to a 14" x 12" set. Panel is cut for the 14" Admiral. 12" speaker may be mounted in the lower right section. Lower left section has hinged door and is for record storage. Brass hardware and matching grill cloth. Shipping weight 60 lbs. Stock No. A-130X mahogany TV combination cabinet. Special Price, \$33.90. Blank panel overlay for cut-out TV panel is furnished.

CAPEHART CABINET FOR 1000 SET—ONLY \$99.95

69.95
 EITHER WALNUT OR MAHOGANY
 Beautiful, finest quality walnut combination radio-phonograph cabinet, 32" wide, 35 1/2" high and 20" deep. Made for Capehart's finest combination, selling for \$100 and up. Cabinet cost manufacturer over \$200.00. Has high polished mahogany walnut panels. Made of 3/4" material. Top 1 1/2" solid stock. This cabinet weighs approximately 175 lbs. The changer radio and speaker grill all have hinged doors. Radio compartment on right hand side is 14" high and 11 1/2" wide. Made to mount chassis vertically. Changer compartment is 14" high by 20" wide. Large enough to hold any record changer or recorder mechanism. Front 10" top over the changer compartment is hinged to fold back for easy access to the changer. Both radio and changer compartments come with uncut blank panels. Speaker is cut for a 12" speaker and the speaker compartment is 12" wide. Shipping weight, 275 lbs. Stock No. K-275 Capehart combination cabinet. Net price \$99.95. SPECIFY when ordering, whether you want Walnut or Mahogany.

COMPLETE RADIO, TELEVISION AND AMPLIFIER KITS AT MCGEE

3-WAY PORTABLE KIT \$15.95

A NEW '52 MODEL
 New 1952 Model 3-way personal portable radio kit. Operates on 110 AC-DC or 67 1/2 V. plus 1 1/2 volt self-contained batteries. Leatherette covered case size, 3 1/2"x5 1/2"x8 1/2". Receives broadcast 570 to 1650 KC. A conventional 2-band superhet circuit with 456 KC iron core I.F.s. Incorporates the new super gain loop antenna. All plated chassis. Lab. approved circuit—matched parts. Price includes all parts, tubes, diagram, Alnico V PM speaker. A factory quality kit. Stock No. PN-AT, shipping weight 7 lbs. The complete kit, less batteries, \$15.95. 67 1/2 V. Kit \$1.95. 1 1/2 V. A. 39c extra.

Build Your Own Phono-Mike Broadcaster \$7.95

Kit Model DE-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio within your home, (about 35 feet) from 1000 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Fader control fades from mike to record. Ideal for a home P.A. system, baby's cradle and home entertainment. A complete kit of parts including tubes. Kit Model DE-6R. Net price, \$7.95. DE-6R, RT, wired and tested. Net price, \$9.95. Crystal mike and desk stand, \$4.95 extra. Concealed microphone unit, only 1" in diameter and 1/2" thick. Suggests hidden mike when ordering. Stock No. T-601. Net, \$3.95 extra.

8-Tube Hi-Fi Amplifier Kit \$29.95

A complete kit, including tubes, 2-12AX7, 2-12AX7, 2-triode plus rectifier diagram and photos. Inputs for radio tuner and any kind of phono or picture crystal or G.E. variable reluctance and either crystal or dynamic mike. Output matches 8 ohm voice coil. Twin electronic bass and treble tone controls with range selector switch for either juke box quality with heavy bass response or brilliant symphonic range. Response 18 to 20,000 cps. 8 tube all triode amplifier kit, complete with tubes. Shipping weight 25 lbs. Model 7X3. Net \$29.95.

10-Watt Hi-Fi Amplifier Kit \$14.95

A complete kit of parts including tubes, 2-12AX7, 2-12AX7, 2-12AX7, plus rectifier, diagram and instructions to build a Hi-Fi fidelity 10 W. I.F. tone control audio amplifier with bass and treble boost. Inputs for radio tuner, crystal mike and crystal phono pickup. Output matches 8 ohms. Response from 50 to 15,000 cps. Chassis ready punched. Ventilated cover. Straight forward circuit with twin triode gain stages and 2-50L6 tubes in push-pull. Size, 5 1/4" x 10" x 5 1/2". Net \$14.95. 1P-10R, ship. wt. 8 lbs. Sale price, \$14.95.

10-TUBE RADIO KIT \$29.95

10 tube broadcast radio chassis, 12 1/2" x 10" x 8 1/2" high. Complete with tubes, 2-6X87, 2-6BN7, 1-6A1, 2-6V6 plus 6Y3 rectifier diagram and instructions. 3 gang superhet with 8" slide rule dial. Chassis size, 12 1/2" x 10" x 8 1/2" high. Features push-pull 6V6 high fidelity audio. Output matches 8 to 8 ohm voice coil speakers. Inputs for G.E. variable reluctance or crystal phono pickup and crystal mike. Heavy duty power transformer. Model 1K-R10 kit less speaker, shipping weight 18 lbs. Net \$29.95.

17, 20" T.V. Kit \$59.95 Less Tubes

A complete kit of parts to build an AC transformer operated television chassis for use with a 17" or 20" tube. The 12 channel Sarkes-Tarzian tuner is ready wired, as is the 4 tube video I.F. strip. Circuit is of the conventional design. Do not buy this unless you understand television. It is illustrated with a user friendly schematic. Kit model WH-20. Ship. wt. 40 lbs. less all tubes. Net \$59.95. Kit of 22 tubes, less picture tube \$16.95. 17" 17BP4A, \$19.95. 20HP4, \$25.00.

6-TUBE 2-BAND KIT \$14.95

Popular with schools and colleges for training. 6 tube AC-DC 2 band radio kit with plastic cabinet. Receives broadcast and 6 to 18 mc shortwave. Full 2 gang superhet with 5" speaker and a slide rule dial. A complete kit with tubes: 12SK7, 12SK8, 12SK7, 12SK7, 50L6 and 5Z5Z, diagram and instructions. Factory quality. Cabinet size 17"x8 1/2" x 8 1/2". Shipping weight 12 lbs. Model M60-2. Net \$14.95.

5-TUBE AC-DC KIT \$12.95

Model RS-5. A 5 tube AC-DC straight broadcast kit, housed in the same cabinet as #2 above. Complete with tubes. Shipping weight 10 lbs. Net \$12.95.

AC POWERED BROADCAST TUNER KIT \$12.95

A self-powered, 3-gang superhet tuner kit with R.F. stage. This complete kit is furnished with a diagram, photos and tubes. 6BA6 R.F., 6BE6 oscillator, R.F., 6BA6 I.F. detector, 6AL5 diode, AVC, plus rectifier. Connect to any audio amplifier. Ideal for use with our S-2020 or 7X3 amplifier kits. Chassis size, 9 1/2"x4 1/2" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, \$12.95.

MCGEE RADIO COMPANY Prices F.O.B. K.C. Send 25% Deposit with Order, Balance Sent C.O.D. With Parcel Post Orders, Include Postage **TELEPHONE VICTOR 9045. WRITE FOR FLYER 1422 GRAND AVE., KANSAS CITY, MISSOURI**

PRICES SLASHED! SAVE BIG MONEY ON CRT-TV TUBES

All tubes in Penn Tube Cartons. Code dated of current date.

Standard R.M.A. Guarantee.

1X2	.....	\$ .65
5U4	.....	.49
5V4	.....	.86
5Y3	.....	.40
6AL5	.....	.50
6AG5	.....	.72
6A55	.....	.69
6AU6	.....	.49
6AQ5	.....	.66
6BA6	.....	.63
6BC5	.....	.66
6BG6	.....	1.44
6CB6	.....	.69
6CQ6	.....	1.04
6CD6	.....	2.18
6C4	.....	.50
6J6	.....	.75
6K6	.....	.55
6S4	.....	.55
6SN7	.....	.73
6V6	.....	.60
6W4	.....	.55
6T8	.....	.63
12AU7	.....	.75
12AT7	.....	.95
12SN7	.....	.75
12BH7	.....	.85
19BG6	.....	1.98
25L6	.....	.70
25W4	.....	.66
1B3	.....	.65
50L6GT	.....	.57

ALL OTHER TYPES AVAILABLE

70° DEFLECT. YOKES \$195

U.H.F. CORNER REFLECTOR ANTENNA \$995

CATHODE RAY TUBES

10 INCH (EXCHG. PRICE)	.....	\$ 9.95
12 INCH (EXCHG. PRICE)	.....	10.95
14 INCH (EXCHG. PRICE)	.....	11.95
16 INCH (EXCHG. PRICE)	.....	15.95
17 INCH (EXCHG. PRICE)	.....	16.95
19 INCH (EXCHG. PRICE)	.....	18.95
20 INCH (EXCHG. PRICE)	.....	19.95
21 INCH (EXCHG. PRICE)	.....	20.95

ONE YEAR GUARANTEE

\$ TURN YOUR DUDS INTO CASH. WRITE US. \$

WE WILL BUY YOUR OLD PICTURE TUBES

Mail orders promptly filled. All prices F.O.B. Chicago. Shipping sent C.O.D. Send M. O. or check only. 20% deposit required on all orders. All merchandise subject to prior sale.

PHONE: IN 3-8006

PENN TUBE COMPANY

Radio and Television Tubes
3547 MONTROSE
CHICAGO 18, ILLINOIS

"Ultra-Linear" Amplifier (Continued from page 45)

20 cps to 20 kc. within much less than .1 db. Maximum phase shift over this band is about 3 degrees.

The very wide frequency band and low phase shift permit excellent transient response as attested by the square wave oscillograms of Fig. 7. The slight ringing visible on the high frequency square waves could be removed by introducing roll-off in the circuit above 100 kc. This expedient, however, would lessen the steep rise and round the upper left-hand corner. The designer always has to compromise between damping of the square wave and loss of high frequency response. In this circuit, the Williamson principle of maximum bandpass was preserved, and the resulting square wave is still better damped than that of most other high quality equipment.

Those who have actually tested amplifiers with square waves on scopes capable of showing details of the performance without distortion, will appreciate the extremely short rise time and rectangular corners of these oscillograms.

The transient response of the circuit undoubtedly makes a substantial contribution to its listening quality.

Listening Tests

Many AB listening tests have been made comparing the "ultra-linear" Williamson with the triode Williamson and with other circuits. A variety of speakers and speaker systems have been utilized in these tests, and many different program sources have been included. Results were almost invariably the same—the "ultra-linear" circuit was accepted as the most realistic. On bass passages, drum rolls, and musical climaxes, the ability of the circuit to handle large power without transient instability shows up to advantage.

At the high-frequency end of the spectrum, the low phase shift maintains the correct harmonic structure of complex transients; and the percussive sounds of triangles, cymbals, tambourines, and other instruments come through with a naturalness and crystal clarity which is audibly evident to the untrained ear. String instruments have the natural "gutty" quality; and with a high grade speaker, it is possible to differentiate between the metal "E" string of the violin and the gut "A" string even

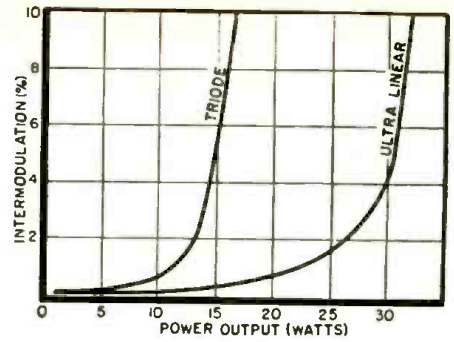


Fig. 4. Intermodulation distortion for triode and "ultra-linear" operation at 40 and 2000 cps mixed in a 4 to 1 ratio.

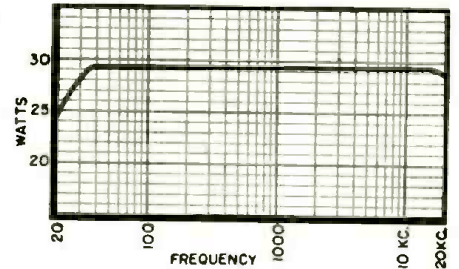


Fig. 5. Undistorted power vs. frequency.

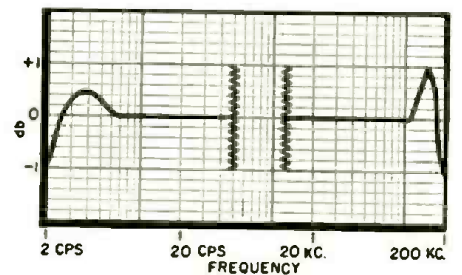


Fig. 6. Frequency response of the amplifier.

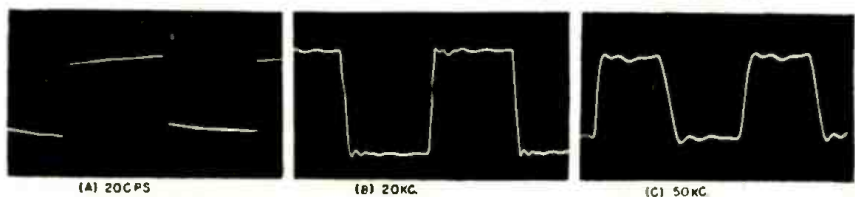
though a tone of the same frequency may be played on either.

The scratch of phonograph records is less noticeable and less irritating on the "ultra-linear" Williamson than on other amplifiers. Scratch and noise have a high transient energy content and tend to intermodulate with high frequency signals if the amplifier cannot handle considerable power at the high-frequency end of the musical spectrum.

The low intermodulation content of the amplifier is evident in the crisp definition of the music. There is no blurring, no shrieking. The slip of the violin bow against the bridge, the breathing of the singer, the cough in the audience; all are audible while the music plays. The various instruments are distinguishable individually rather than as a conglomeration of sound.

The increased power handling ca-

Fig. 7. Square-wave performance at (A) 20 cps, (B) 20 kc., and (C) 50 kc.



Long Life—Low Maintenance
No Comebacks with the

New **300 OHM
TRANSMISSION CABLE**
by **BELDEN**

FOR 50 YEARS
*Wiremaker for
Industry*

To You,
Belden's Golden Anniversary
Means

—product performance that
can come only from a "know-
how" that has grown through
actual service since the
inception of Radio.

—an ability to co-oper-
ate in pioneering new
wires to meet or antici-
pate industry's grow-
ing needs.

In the years that
follow

This Belden
Program Is—

— TO BE
CONTINUED



No. 8230



**COPPER-
SHEATHED
20-GAUGE
STRANDED STEEL WIRE**

Brown Polyethylene—Resists Weather and Oxidation

The new Belden Weldohm, 300-ohm Transmission Cable is the greatest advancement in television installation since television began.

Reducing TV lead-in conductor breakage to a minimum is easy. The new Belden Weldohm Cable has overcome the breakage point by 162%, that's 1½ times the strength of pure copper wire.

In actual test, Belden Weldohm Cable will withstand 254% more whipping or severe flexing than the average installation of 300-ohm copper lead-in wire.

There is no difference in the electrical characteristics between an all-copper conductor and the Belden Weldohm copper-coated steel wire. The web is 72 mils of 100% virgin polyethylene.

NEW
FOR U. H. F. INSTALLATION
BELDEN ULTRA - WELDOHM — 8235

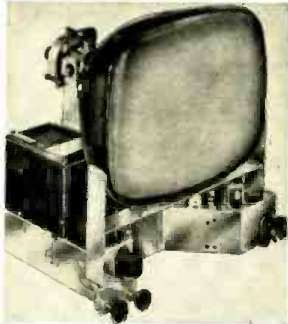
BELDEN MANUFACTURING CO., 4681 W. Van Buren St., Chicago 44, Illinois

Belden
Radio **WIRE**

Great, New 1953 Model 630-DX CHASSIS

terrific savings-immediate delivery

Includes newest developments—Cascode Tuner—30 Tubes—for 16" to 24" Picture Tube—Wonderful Saving! Adaptable for color and UHF!



The great 630 with all the up-to-date improvements! Wonderful reception on long range up to 200 miles without a booster is yours today at this low-low price. Gives 3-times normal reception. Special super high-gain standard coil tuner gives greater sensitivity, top performance on any channel. Aligned and tested for 5 hours, molded condensers, 4 microvolts sensitivity, FM sound system, horizontal and linear lock and is directly adaptable for color and UHF.

Model 630 DX-1; RMA Guaranteed—Factory Wired, ready to play. Complete with 12" speaker, hardware and knobs.

14950
(less CRT)

FREE: New Trouble Shooting book with any chassis!

Giant Savings

TV PICTURE TUBES

Full Year's Guarantee—
Brand New—Black Face—
Standard Brands.

10BP4	\$19.95	20CP4A	\$35.95
12LP4A	22.95	21EP4A	38.50
17BP4A	24.95	27EP4	92.95

All other sizes in stock
—equally low priced!



Save \$50 on this Decorator TV Cabinet

For 17", 20" & 21" Picture Tubes—
630 or other Chassis.

Every beautiful cabinet is richly finished of hand rubbed mahogany and made by our own cabinet makers. They are custom styled, guaranteed new and perfect. Includes mask and mounting brackets. Cabinets are also available with blank control panel to fit any chassis.

Model 200: Original list \$99.95

\$4950

Blonde finish, add \$10 Now
Also Deluxe Cabinets, write for catalog

WRITE FOR NEW, 1953 CATALOG
MIN. ORDER: \$5.00. 25% with order, balance C.O.D. Include postage with order. All merchandise subject to prior sale. Prices subject to change without notice. F.O.B., New York City.

THE ROSE COMPANY

102 Park Place, Dept. R-2, New York 7, N. Y., COrtlandt 7-6195

SCOOP!

AM Radio Tuner made especially for any 630 of 630 DX Chassis. Complete, ready to install. Fits into well of TV chassis.

ROSE Special **\$1495** ea.

SUPER 630 DX-2 TV CHASSIS

Includes the same features as the 630 DX-1 chassis PLUS the following:

- ★ Keyed AGC level control
- ★ Cornell-Dubilier plastic molded condensers
- ★ 4.5 Megacycle wave trap to eliminate interference
- ★ Photo input & switch which cuts out high voltage supply
- ★ RCA matched 70° cosine voke & III-Voltage transformer
- ★ Four (4) 6CR6 tubes in video IF strip
- ★ RCA 12" Speaker

Net price **\$15950** (less Complete CRT)

Universal Mounting Brackets \$5.95

pability of the "ultra-linear" Williamson shows up to audible advantage. The newest LP records, tape, and live FM cover very broad dynamic ranges, and it takes power to do them justice. The ten-watt amplifier cannot reproduce the climaxes of today's program sources, as is evidenced by comparison with a higher power unit such as the "ultra-linear" Williamson. New developments in program sources are forcing new ideas in amplifiers.

For some applications, even higher powers may be required. Just as can be done with the triode Williamson, the "ultra-linear" circuit can be operated in push-pull parallel, and the performance specifications can be maintained within a 60-watt rating. Experimental work is also being carried out with high power transmitting tubes to investigate the feasibility of using the same circuit arrangement in amplifiers of more than 100-watt capacity.

Thus the "ultra-linear" Williamson circuit offers a distinct improvement over the original. It also offers the possibility of still further extension into the higher power ranges.

Many articles have appeared which describe amplifiers in terms of "best we ever heard." Such descriptions do not furnish a basis for the reader to judge the quality of the circuit. In this article the authors have attempted to provide the theoretical justification for an improved amplifier circuit. Theory and specifications cannot substitute for the listening tests which, in the end, are the only ones which count. The dubious reader, therefore, will wait until he hears it before accepting the "ultra-linear" Williamson as the best around. However, when he does hear it, he will find that, to coin a phrase, "hearing is believing."

REFERENCES

1. Keroes, Herbert I.: "Building the Williamson Amplifier." Radio & Television News, December 1950
2. Hafer, David & Keroes, Herbert I.: "An Ultra Linear Amplifier." Audio Engineering, November 1951
3. Cooper, George Fletcher: "Audio Feedback Design." Radio Electronics, December 1950
4. Miller, Edward S.: "A High Quality Audio Amplifier." Radio & Television News, February 1952
5. Keroes, Herbert I.: "Considerations in the Design of Feedback Amplifiers." Audio Engineering, May and June 1950

-30-

AUDIO FAIR

THE Audio Fair-Los Angeles will be held Feb. 5, 6, and 7 at the Alexandria Hotel in Los Angeles with approximately 100 exhibitors demonstrating their products to audio enthusiasts.

Open to the public without charge, the Fair will feature custom high-fidelity equipment, television gear, binational demonstrations, etc.

The Audio Engineering Society, sponsor of the Fair, will conduct technical sessions and present engineering papers on the latest developments in the audio world.

Inquiries regarding this event should be addressed to the Fair Manager, 4245 Normal Avenue, Los Angeles 29. -30-

TRAIN At Home FOR OPPORTUNITIES IN



UHF-TV SERVICING

Set Your Own Pace with This Practical Program!

Get in on the ground floor of this fast-growing field. Train now to cash in on the opportunities that are yours in UHF-TV SERVICING with proven, practical T.C.I. training. Here is non-mathematical training that's complete down-to-cases... up-to-the-minute. Here is training you take in your spare time, without leaving your present job! Think of it—in your own home you learn TV set conversion, master antenna installation, the latest in UHF-TV, money-making short cuts and much more. You learn to trouble-shoot, test and repair TV sets the only practical way—by actually doing this work yourself!

HERE'S HOW YOU LEARN BY DOING!

You get the experience you need by working on a large screen, modern TV receiver that's given to you with the course and is yours to keep. As an optional feature you get two weeks of field experience on service calls and on the repair bench with one of Chicago's largest independent TV servicing organizations. You profit from the experience and know-how of men in the field. Not through books alone but by actually doing the work yourself, you get the knowledge you need to qualify for opportunities in UHF-TV SERVICING! Age is no barrier. Many T.C.I. students are over 40! Mail Coupon for full facts. FREE Catalog and SAMPLE LESSON. Act NOW!

VETERANS discharged since June 27, 1950 are eligible for G.I. benefits. Check coupon.

THESE MEN LIKE YOURSELF SAY T. C. I. TRAINS YOU BEST!

"I've almost completed your course now, but I have been servicing TV sets since almost the beginning of the course." E.R.M., Rhode Island.

"Thanks to your course, jobs that used to take me several hours now take but a few minutes to complete." W.L.K., Wash.

"I like the easy way your lessons are presented. I'm very pleased with your course and have recommended it to a friend." L.R.S., Texas.

TELEVISION COMMUNICATIONS INST. 205 W. Wacker Dr., Dept. 1-AG, Chicago 6, Ill. YES! Rush full facts on UHF-TV training. Include FREE Catalog and Sample Lesson. I am not obligated. Salesman will not call.

Name Veterans Check here

Address

City Zone State

BEGINNERS: Check here for information on Pre-TV Radio Course.

TELEVISION Communications Institute 205 W. Wacker Dr., Dept. 1-AG, Chicago 6, Ill.

MAIL NOW FOR FREE BOOKLET

**Extra profits
for service-
men!**

NOW you can add UHF to the thousands of VHF Super Fans presently installed in your area, with Channel Master's exclusive new Ultra-Dapter, Model No. 414. In 5 minutes you can convert any Super Fan into an all-channel VHF-UHF antenna. See your distributor for details.

VHF *and* UHF

Now! Get all 82 channels
with the
new

CHANNEL MASTER ULTRA FAN

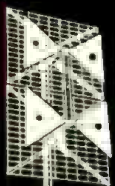
Single Bay
model no. 413

Stacked
model no. 4132

Write for literature on Channel Master's new complete line of UHF antennas including such models as these:



Ultra Bow
Model No. 401



Ultra Bow with
screen reflector
Model No. 403



Ultra Vee
Model No. 404

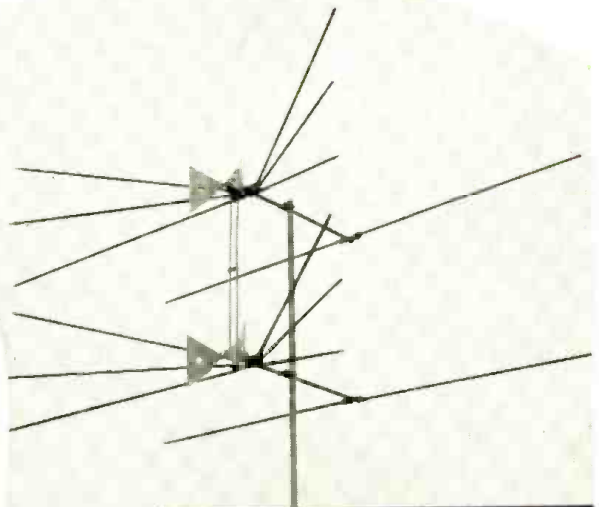


Today's most sensitive
ALL-VU* antennas!

*All VHF, All UHF

Featuring:

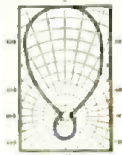
- 1. **2 great antennas in 1** —
A genuine, high gain Super Fan on VHF, and an all-channel Triangular Dipole and reflector for peak UHF reception.
- 2. **Electronic inter-action filter** —
Automatically isolates VHF and UHF bands, eliminates inter-action. Ultra Fan operates with only a *single* transmission line to TV set.
- 3. **"Free space" terminals** —
Channel Master's exclusive UHF "free space" terminals prevent accumulation of dirt and moisture which gradually reduce picture quality in ordinary UHF installations.
- 4. **Famous Channel Master engineering** —
The Ultra Fan is an *integrated* VHF-UHF antenna that give uniformly high gain over all TV channels, from 2 through 83.



HORIZONTAL POLAR PATTERNS
(Relative Voltage)



Channel 2

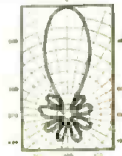


Channel 10

VHF



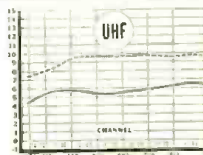
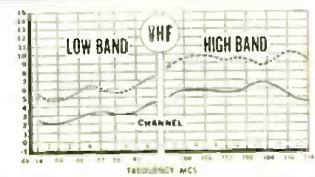
Channel 60



Channel 77

UHF

GAIN CURVES

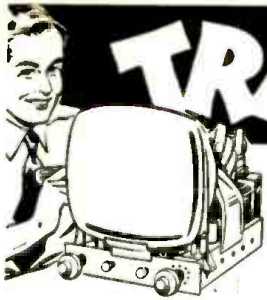


— Single Bay
- - - Stacked

MEMBER



CHANNEL MASTER CORP. ELLENVILLE, N. Y.

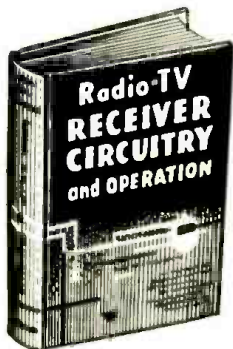


TRAIN AT HOME FOR

REPAIR ANY RADIO OR TELEVISION SET!

The two new Ghirardi service books described below offer you the most complete, up-to-date and easy to understand service training course on the market today—at only a small fraction of the price you might expect to pay!

Takes headaches out of tough jobs! Ghirardi's COMPLETE GUIDE to RADIO-TV CIRCUITS



**Radio & TV Receiver
CIRCUITRY & OPERATION**
by Ghirardi & Johnson
688 pages, 417 illus.
Price \$6.00

Naturally, as a radio man, you recognize the importance of a good book on circuits. And wait until you read this one! It can teach you to work faster and better. You can learn service shortcuts you may never dream existed. And you'll get a training in basic circuitry of the type that can fit you for the big money jobs in many phases of electronics!

Actually, there are only a few basic circuits in modern radio and television receivers—but each of these has dozens of variations. Learn these from A to Z and watch service headaches disappear!

**SAVE TIME ON JOBS—
MAKE MORE MONEY!**

This big RADIO & TV RECEIVER CIRCUITRY AND OPERATION book shows exactly how one circuit differs from another; how the different circuits are related; and the troubleshooting difficulties and peculiarities of each. You learn to locate troubles in a small fraction of the usual time—then repair them faster and lots more efficiently.

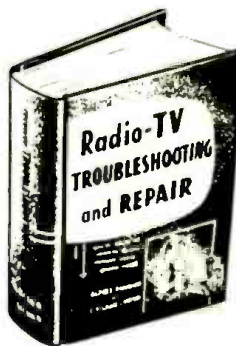
Receiver stages are studied in their logical order. Over 400 diagrams, charts and photos make every step remarkably clear. Review questions with every chapter help you learn fast and right! Answers are given to odd-numbered questions in back of book.

Use coupon on opposite page to order RADIO & TV RECEIVER CIRCUITRY AND OPERATION today! If not more than satisfied that this big new book will be your "Open Sesame!" to better, more profitable servicing, return it in 10 days and every cent of the purchase price will cheerfully be refunded!



A. A. Ghirardi Radio-TV training books are more widely used than any others of their kind.

Work better, faster, more profitably with Ghirardi's COMPLETE GUIDE to MODERN SERVICE METHODS!



**Radio & TV Receiver
TROUBLESHOOTING
& REPAIR**

by Ghirardi & Johnson
820 pages, 419 illus.
Price \$6.75

**It pays to learn to
work by time-sav-
ing professional
methods!**

Completely modern, profusely illustrated, and written so you can easily understand every word, Ghirardi & Johnson's new RADIO & TV RECEIVER TROUBLESHOOTING & REPAIR book is a complete course in servicing by up-to-date professional methods. Backed with this training, you can quickly prepare for fast accurate and profitable service on any radio or television receiver!

First, RADIO & TV RECEIVER TROUBLESHOOTING & REPAIR teaches you all about modern troubleshooting and test methods. You learn how to locate common troubles in the quickest, easiest ways. You learn all about trouble sources in components. You learn to make simple "static" tests—then progress rapidly to dynamic signal tracing and signal injection techniques.

**HOW-TO-DO-IT CHARTS HELP
YOU LEARN FASTER**

Special problems in hard-to-fix sets are clearly explained. Step-by-step charts show every detail of modern service procedure in jig time. Receiver alignment, tuning problems, speaker troubles, intermittents and dozens of other tough jobs are made so clear you cannot fail to understand them.

Most important of all, this big new book brings you the latest television service procedures and methods in addition to complete coverage on radio problems.

To the beginner, it is a complete service training course. To the established serviceman, it is a guide to every detail of profitable modern methods and also serves as on-the-job reference in giving you quick solutions to puzzling service problems.

Read RADIO & TV RECEIVER TROUBLESHOOTING AND REPAIR for 10 days at our risk. Use coupon on opposite page!

MONEY-SAVING OFFER

On Ghirardi's new 2-vol. service training course!

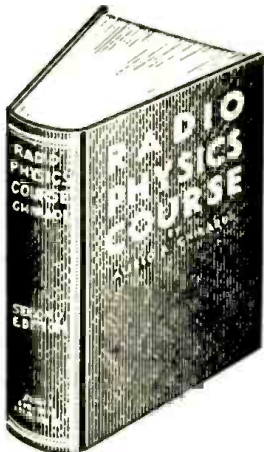
Get both of the above new Ghirardi service training books at a special combination price! Have the service data you need—when you need it! Sold separately, Radio & TV Circuitry and Operation and Radio & TV Receiver Troubleshooting and Repair would cost you \$12.75. Bought as a combination you get both books for only \$12.00—with the same privilege of returning them in 10 days if you don't like them.

Check SPECIAL COMBINATION OFFER in coupon on opposite page. Mail today!

Ghirardi's COMPLETE BASIC TRAINING for beginners



More people now in Radio-TV got their basic training from this famous book than any other book or course of its type!



36 COURSES IN ONE

Ghirardi's
RADIO PHYSICS COURSE

972 pages, 508 illus.
856 self-test review questions.
Price only \$5.00—the biggest
buy in basic training on the
market!

"The most complete training course in radio fundamentals ever offered!"—that's what experts say about Ghirardi's world-famous RADIO PHYSICS COURSE. More widely used by Signal Corps, Navy, etc. in World War II, than any other basic radio training text. Everything is explained so clearly that you can understand every word without previous radio training of any kind.

Ghirardi's RADIO PHYSICS COURSE starts with Basic Electricity. Then it takes you step by step through the entire field of Radio-Electronics from simple circuits showing the basic functions of resistors, condensers, coils,

transformers, etc., to the final applications of these circuits in home, auto, and aircraft radios, public address systems, etc. Subjects covered include Sound, Speech, Music, Electron Theory, Electric Circuits, Current, Resistance, Capacitance, Inductance, Transformers, Filters, Radio Waves, Vacuum Tubes, Radio Circuits, Loudspeakers and dozens of others. You get the kind of training you need—at a price you can afford to pay. If broken into "course" form and sent as monthly lessons, you'd regard it as a bargain at \$5.00 or more. Instead you buy it for only \$5.00—and you progress as fast as spare reading time permits.

Let these great books GIVE YOUR EARNING POWER A BOOST!

HIGHER PAY in 1953!

Send no money!

Read any of the 7 famous books* described on these pages for 10 days FREE. Use coupon below for examination privilege!

*Except PIX-O-FIX TV Troubleshooter's Guide which is sold for cash only.

Only \$1. HANDLE UP TO 90% OF TV TROUBLESHOOTING by easy picture analysis!



**Ghirardi & Middleton's
PIX-O-FIX
TV TROUBLE FINDER
GUIDE**

Price \$1.00
(Outside U. S. A. \$1.25)
Cash only—
no free examination

This short cut way of handling television troubleshooting and repair can save you hundreds of dollars worth of time! You spot TV trouble symptoms at a glance—repair them lots faster!

Just "dial" PIX-O-FIX until the TV screen photo appearing in its "window" matches the screen picture on the set being repaired. PIX-O-FIX then indicates all possible causes of this particular trouble and the receiver section where they may occur. Step-by-step repair instructions follow.

PIX-O-FIX covers 24 common troubles; 190 possible trouble causes and 253 definite, easily-understood remedies. A truly professional service device—not a "fix-it-yourself" gadget for consumers. Priced at only \$1.00.

**It pays to know how to
USE ELECTRONIC TEST
INSTRUMENTS
more effectively!**

BASIC ELECTRONIC TEST INSTRUMENTS teaches you to use familiar instruments more fully; how to choose the right instrument for each job; how to operate and maintain them properly; and how to evaluate their readings and put them to practical use. You learn dozens of short-cuts in using instruments on hundreds of jobs. Best of all, BASIC ELECTRONIC TEST INSTRUMENTS saves money by helping you avoid buying unnecessary instruments—and it helps you handle even the complicated jobs with fewer instruments. In addition to the older instruments, the book covers all the newer types from grid-dip oscillators, to TV sweep and marker generators, distortion meters and many more. Read it for 10 days at our risk!

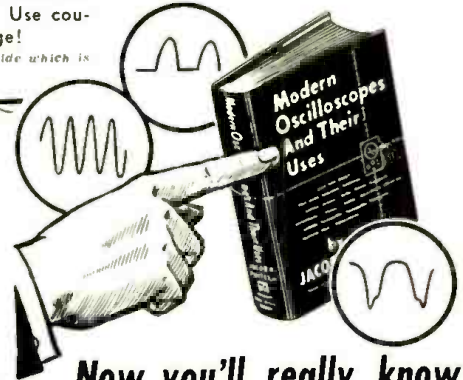


**JUST OUT!
BASIC ELECTRONIC
TEST INSTRUMENTS**

255 pages, 171 illus.
Price \$4.00

**MODERN
OSCILLOSCOPES
AND THEIR USES**

by
Jacob H. Ruiter, Jr.
326 pages.
370 illus.
Price \$6.00



**Now you'll really know
HOW TO USE OSCILLOSCOPES!**

Learn to use the oscilloscope fully on all types of AM, FM and television service work—and watch your efficiency and earnings soar!

MODERN OSCILLOSCOPES AND THEIR USES, a fact-jammed 326-page book by Jacob H. Ruiter, Jr. of the Allen B. DuMont Laboratories contains exactly the help you need—and written in a way that makes these remarkable instruments perfectly understandable. It shows how to use your scope

for faster, more accurate work on all types of jobs from troubleshooting to re-aligning. You learn how to make connections; how to set controls, and, above all, how to analyze patterns. 370 illustrations including dozens of pattern photos make things doubly clear.

No other type of specific service training stands to mean so much to you in terms of being able to do better, faster and more profitable work!

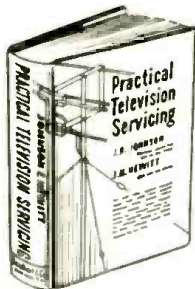
**Let this "Automatic Teacher" show how to
REPAIR OVER 4,800 RADIO MODELS**



Whether you repair radios for a living or work with them occasionally, Ghirardi's manual-size, 744-page RADIO TROUBLESHOOTER'S HANDBOOK can save you time and money on a big percentage of jobs—especially on older sets where data is so often lacking. Eliminates useless testing!

Actually, this giant book contains specific trouble symptoms and their remedies for common troubles found in more than 4800 older sets of leading manufacturers. Just look up the case history notes on the set you want to fix. RADIO TROUBLESHOOTER'S HANDBOOK tells what the trouble is—what causes it—and exactly how to repair it. Hundreds of additional pages contain valuable data on old tubes, parts and equipment, plus graphs, diagrams and money-making service hints. Price only \$5.00, 10-day free examination.

**A QUICK GUIDE TO
TELEVISION SERVICE**



**PRACTICAL
TELEVISION
SERVICING**

by Johnson & Newitt
Price only \$4.00

For those who already know radio, this is the book to help you make the jump to more profitable TV receiver servicing in the least time—at the lowest possible cost!

PRACTICAL TELEVISION SERVICING with its 334 pages and 253 clear illustrations is a complete training course written so you can really understand it. First you learn how TV work differs from radio—how to set up shop—what equipment to get—what mistakes to avoid. Then you learn every detail of TV servicing from quick diagnoses of simple troubles to complicated instrument troubleshooting. Actual TV servicing case histories are worth their weight in gold and make tough jobs easier to understand. Read this big book for 10 days at our risk. Send coupon today!

Mail Order—10 DAY EXAMINATION OFFER

Dept. RN-23, RINEHART BOOKS, INC., Technical Division
232 Madison Ave., New York 16, N. Y.

Send the books checked below for 10-day FREE examination. In 10 days after receiving the books, I will either remit the price indicated or return the books to you postpaid and owe you nothing.

COMBINATION OFFER: Ghirardi's Radio & TV Receiver CIRCUITRY & OPERATION and RADIO & TV RECEIVER TROUBLESHOOTING AND REPAIR (both books) only \$12.00 for the two. (Outside U. S. A. \$13.00.)

Single Books

- Ghirardi's RADIO & TV RECEIVER CIRCUITRY & OPERATION. Price \$6.00.
- Ghirardi's RADIO & TV RECEIVER TROUBLESHOOTING & REPAIR. Price \$6.75.
- Ghirardi's RADIO PHYSICS COURSE. Price \$5.00.
- ELECTRONIC TEST INSTRUMENTS. Price \$4.00.

PRACTICAL TELEVISION SERVICING. Price \$4.00.

- MODERN OSCILLOSCOPES AND THEIR USES.** Price \$6.00.
- RADIO TROUBLESHOOTER'S HANDBOOK.** Price \$5.00.
- PIX-O-FIX TV TROUBLEFINDER'S GUIDE.** Price \$1.00. CASH ONLY. No free examination. (Outside U. S. A. \$1.25.)

TO ORDER BOOKS OUTSIDE U. S. A., add 50c to price of each book for handling through customs, etc. Cash only. Same 10-day return privilege with money refunded.

Name
Address
City, Zone, State
Employer's Address

TUNG-SOL[®]

for
Uniformity
and
Dependability



REPLACEMENT:

Tung-Sol tubes keep service standards up to set manufacturers' specifications.

INITIAL EQUIPMENT:

Tung-Sol tubes meet the highest performance requirements of set manufacturers.

TUNG-SOL

RADIO, TV TUBES, DIAL LAMPS

TUNG-SOL ELECTRIC INC., NEWARK 4, N. J.
Sales Offices: Atlanta • Chicago • Dallas • Denver
Detroit • Los Angeles • Newark

ALSO AUTO LAMPS, ALL-GLASS SEALED
BEAM LAMPS AND SIGNAL FLASHERS

RADIO-TV Service Industry News

AS REPORTED BY THE
TELEVISION TECHNICIANS LECTURE BUREAU

PRODUCTION for the defense program is supposed to reach its plateau, or peak, in the electronics industry during the months just ahead. It is expected, with the slackening of the demand for critical materials for military needs, expanding supplies of raw materials available for normal channels will rapidly stimulate the development and production of products for civilian use. The allocation and procurement of supplies for the defense program has preceded production by many months so it can be assumed that the flow of material into normal channels of trade will be noticeable even while production for defense stays at a high level.

An Expanding Industry

The electronics industry has been straining at the leash for a long time and the slackening of the pressure for war goods will be followed immediately by the rapid expansion of the industry in several directions. The applications of electronic devices to new tasks mean more complex circuitry with the result that maintenance is demanding a higher degree of training and competence on the part of personnel employed in that phase of the work. It is well worth careful study of what lies in the immediate future to appraise what the up-coming developments may mean to independent service as a business activity.

When television first burst upon the scene in 1947 it found the independent service forces of that day poorly prepared to cope with the new problems it presented. Almost every radio service operator in business at that time jumped into the "bonanza" of contract service for installing and servicing TV receivers. Most of the men who had had good radio service business expanded their activities to handle the sale of TV sets. In the intervening years many of these men have built substantial radio and appliance retail businesses with TV installation and service as a profit producing department.

Very few of the former radio service operators survived as TV service contractors. During the summer of 1951 alone the mortality rate in in-

dependent TV service businesses was close to 20%. In other words, about one out of every five independent service businesses ceased to exist during the six-month period in 1951 when the business of TV servicing hit rock bottom. We have heard of only a few TV service businesses that did not operate at a loss during the two summer months of that year.

Facts of Service Business Operation

The TV service business has been experiencing a small scale "boom" that started with the national political conventions last July. However, only a very small percentage of the independent service businesses have been able, during this period, to build up adequate cash reserves to tide them over the slack periods that are sure to come. This factor will bring about another period of high mortality when the cycle dips again to low business levels for a few months.

In traveling about the country on lecture tours your editors talk to many parts distributors about the caliber of service businesses they have in their trade areas. One of the most common remarks we hear is crystallized in this statement:

"Bill Jones (a neutral name we have selected) could have the leading and most profitable business in this area. He is a good technician; he gets along well with his customers and he tries to maintain a good credit standing.

"But the trouble with Bill is his business is under-capitalized. The result is he hasn't been able to expand enough to handle the volume of business necessary during good times to build adequate reserves to tide him over bad times. So when business gets bad Bill goes into debt to keep going. When business improves it takes him months to pull himself out of debt. He isn't building a business. He merely has a job working for himself in which he is not building any future security for himself or his family."

Then they will point to some other service business in which the owner is not an especially good technician but he is a good enough business man to keep a large enough volume of business coming in so that he can

hire competent men to handle the technical end of his business. He is able to give his attention to sales promotions that keep a steady volume of business coming in, to a regular and careful study of costs, and the planning of work routines and all of the other elements that are involved in running the business so it will produce a profit as well as a good income for the owner. That is the kind of business, they say, that will survive the long pull.

Classifications of Service Work

The many millions of AM radios that are either in use or sitting inoperative in closets, constitute a pretty good market for service in themselves. In TV areas, AM radio servicing has been taken over pretty much by TV service companies and the small shops that handle some minor TV service. As a rule, very little service sales attention is being given to the large number of AM radios that are in need of service. The AM radio repair jobs that come into shops are usually "emergency" jobs. The one that gets repaired is probably the last of several AM radios to finally quit working in that home. Chances are if the service operator who got the repair job would make the effort he could get two or three other AM radios to repair out of the home where the "emergency" job came from.

Recently we mentioned this to a parts distributor who immediately cited what a service operator had told him the day before. This service operator delivered a TV set which he had repaired to the customer's home. As the customer paid him she said, "Will you take our four regular radios to your shop and repair them, too?" These "four regular radios" were a console and three table models—all inoperative.

There has been very little aggressive effort on the part of the service industry to get some of the available business on automatic changer replacements and on record player repairs. In many TV areas set owners are taking a new interest in recorded music. Lots of people who still have single-speed changers in their AM console cabinets that they like as furniture pieces, do not know that they can buy 3-speed changers that would fit into their console cabinets. While it would take some "personal selling" to do it, any radio or TV service operator who needs to increase his volume of business could do it with a campaign on replacing single-speed changers with 3-speed units.

The phono crystal cartridge and needle replacements have been sorely neglected, too. Perhaps it is because technically trained people think only in terms of technical proficiency required of an electronic device and not about how to *sell* their services to the people who own those devices.

The average person is prone to procrastinate in having things repaired.

WALSCO

UHF

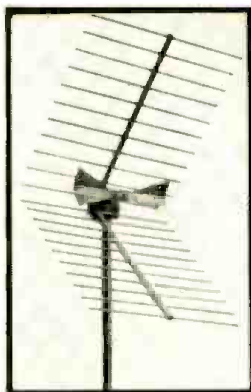


FIRST
antenna to be
tested and
accepted in
Portland

PROVEN
America's Finest
all-channel
UHF
antenna

GUARANTEED
everywhere,
anywhere
for one
full year

AVAILABLE NOW!



Corner Reflector Model 4450



Reflecto-Fan Model 4400

Freq. MC	Gain in db.*		
	Mod. 4400	Mod. 4402	Mod. 4450
500	6.1	8.4	7.8
600	7.6	10.6	8.9
700	8.9	11.9	11.0
800	7.9	11.3	12.9
900	7.0	9.0	11.8

*Measured gain over tuned folded dipole

List Price

Model 4400 (Single Bay)..... \$ 6.75

Model 4402 (Dual Stack)..... 14.25

Model 4450 (Single Bay)..... 14.50

WALSCO

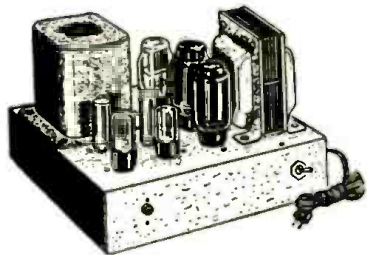
Walter L. Schott Company

3225 Exposition Place

Los Angeles 18, California

Overseas Representative: Ad Aurlima, Inc. 89 Broad St., New York 4, N. Y.

**RESCO ULTRA-LINEAR
Williamson
Amplifier Kit**
featuring the
ACRO TO-300



Build the finest amplifier ever developed. Complete with all components, punched chassis, and easy-to-follow instructions. Get the full benefits of Acrosound TO-300 performance as shown by specifications listed below.

Now Available for Immediate Delivery! **\$74⁵⁰**

**ULTRA-LINEAR
WILLIAMSON ACRO TO-300**



The World's Finest Audio Output Transformer

Only a few resistors and condensers are involved in converting to ultra-linear operation — layout remains the same. Get more out of your Williamson by giving it the specifications listed below.

SPECIFICATIONS

- Response — 1 db. 2 cps. to 200 kc.
- 30 watts of clean power within 1 db. 20 cps. to 30 kc.
- Less than 1% IM at 20 watts.
- Square wave transmission to 50 kc.

ACRO TO-300 net \$24.75

ACRO TO-310 net \$18.75

(TO-310 used to change over 6V6 amplifier to ultra-linear operation)

FREE

Write for ACRO Catalog showing amplifier schematics and conversion information.

- TO-300 TO-300 (Shipping wt.—7 lbs.)
- Amplifier Kit (Shipping wt.—25 lbs.)
- Check or M.O. enclosed. I include postage.

Name

Address

City..... Zone..... State.....

Radio Electric
SERVICE CO. OF PENNA., INC.

7th & Arch Streets, Phila. 6, Pa.

Vacuum cleaners stand idle in closets because the housewife puts off getting a new bag to replace the one worn out. Faucets drip because the old man forgets to get new washers until the old ones finally give way completely and the water pours out in a steady stream. Automatic record players gather cobwebs because the needle is worn out or the tripping mechanism gets out of whack.

One case in particular that recently came to our attention is typical of user indolence in having equipment repaired. This family had four AM radios; one in the kitchen, a console in the living room, and table models in each of two bedrooms. When the kitchen radio went out the housewife set it aside with a firm resolve to have it fixed right away and, in the meantime, she put one of the bedroom radios in the kitchen. The bedroom radio went on the fritz so it was set aside to be repaired, the family depending on the radios in the kitchen and living room for their radio listening. Then the substitute set in the kitchen went out, so they relied on the living room radio. Finally the last of their radios started to "act up" so the husband resurrected the first kitchen radio, took it to a radio shop and had it repaired. At last report they were doing all of their radio listening over the repaired kitchen radio. The radio service operator who repaired this set could have had three others to repair if he had been either curious or alert when he dealt with this customer.

The TV service technicians who have called at this home to service the television set have never inquired about their AM radios, record changers, or battery radios. Yet an itinerant grinder picks up about ten dollars each year on his regular annual calls at this home, for sharpening all of the knives and scissors on the place.

TV Servicing

The tremendous dollar volume of business that will continue to flow from TV service and replacements eventually will result in the development of basic types of business operations to handle it economically and profitably. Most TV service businesses are haphazard operations as businesses that are hopelessly swamped when business is good and desolate when it is bad. The TV service contract was so badly abused by some customers' impossible demands for service and by the misguided, mishandling of funds by many service businesses that its usefulness as a medium to level off service revenue to insure year-round operation was destroyed.

Right now the TV service business generally is very good. Yet many service operators are badly under-pricing their labor. Many service operators who are handling a lot of money from their service activities are confusing the volume of dollars they are handling as "earnings". They are not



ACORN

**CARTER Type B-420
SUPER DYNAMOTOR**

A tremendous value at this price! 12 volt input at 12 amps; 400 volt output at 200 ma, continuous. All brand new.

SPECIAL \$23.95



**C-D PHOTOFLASH
CONDENSERS**

400 mfd @ 450 volts, equivalent to 400 watt seconds. All brand new, but removed from original equipment, never used. Limited quantity at this special price. **SPECIAL... \$5.95**

**4 1/2" SQ. 0-200 MICROAMP
MULTI-METER**

Famous make, with multi tester scale. Made specifically for VTVM use. Scales 0-1000 ohms; volts d.c. 0-3, 0-10; volts a.c. 0-3, 0-10. **SPECIAL... \$9.95**



**POWER
TRANSFORMERS**

WESTINGHOUSE Pri. 115v 50-60 cy. Sec. 65v c.t. @ 250 mls; 12.6v c.t. @ 5 amps; 6.3v @ 5 amps; 6.3v @ 5 amps; 5v @ 3 amps. Electrostatically shielded. Brand new. Shpg. wt. 13 lbs. \$4.49



PHILCO Pri. 115v. 50-60 cy. Sec. 65v c.t. @ 150 mls. 6.3v @ 4.5 amps; 6.3v @ .3 amps; 5v @ 3 amps. Half-shell mg. Shpg. wt. 9 lbs. \$3.69

RCA Pri. 115v. 50-60 cy. Sec. 730v c.t. @ 225 mls; 6.3v @ 8 amps; 6.3v @ 1.2 amps; 5v @ 3 amps. Half-shell mg. Shpg. wt. 13 lbs. \$5.99

SPEAKER SPECIALS

RCA 12" SPEAKER

Ideal for replacement or new set use. 6-8 ohm voice coil. **\$3.85**

SPECIAL..... \$11.00

3 For

ROLA 8" SPEAKER

Genuine Rola electro-dynamic 8" speaker with 750 ohm field coil. Complete with output transformer. **\$1.95**

former. **SPECIAL..... \$18.50**

10 For

ROLA 5" SPEAKER

5" electro-dynamic speaker with 750 ohm field coil. Complete with output transformer. **\$1.19**

SPECIAL..... \$11.00

10 For

10 MFD-600V OIL CONDENSERS

Sprague and C-D. Diam.: 2 3/8", height 3 3/8". Rated at 220V a.c. Each. **99c**

Brackets for above, each. **15c**

Complete with brackets. **\$2.95**

3 For

SLEEPER SPECIALS!

4-Gang AM-FM tuning condensers. Steatite insulation. (\$12 regular.) Each. **\$1.39**

4 For

4-Gang FM tuning condensers. 5-40 mmfd. Steatite insulation. (\$11 regular.) Each. **\$1.10**

5 For

UTC 0-4 Ounce, Plate to Grid Transformer. (\$11 List.) Special. **2.95**

**630 SUPER DE LUXE
31-TUBE TV KIT**

Build yourself the finest television with this complete kit. Every late development, including voltage doubler, keyed AGC, etc. For use with all kines from 16" to 24". Complete with all tubes (less kine), easy-to-follow instructions, etc. **\$119.44**

KIT OF 100 RESISTORS

Consists of popular 1/2 and 1 watt resistor values. Made by leading manufacturers. All Standard Brands, all useful values. **\$2.99**

TERMS: 20% cash with order, balance C.O.D. unless rated. Prices F.O.B. our warehouse in N. Y. C. Minimum order \$3. NOTE: Due to conditions beyond our control, prices are subject to change.

Phone **WOrth 4-3270**

ACORN ELECTRONICS CORP.
76 Vesey St., Dept. N-2, New York 7, N. Y.

amortizing their test equipment, trucks, or any of the capital equipment that is wearing out. Most of them have no system of books whatsoever. Some of them insist they are making a lot of money on service at three dollars per call!

The "TSA News" (Detroit) recently carried an article by C. T. Wycoff which included an interesting breakdown of the cost of a service call:

"Many people think of television service calls at \$5.00 per call for half an hour or less, robbery, not realizing the costs involved.

"Let's break down the cost of a call. In a large city the maximum calls that a technician can complete in one day is seven calls in eight hours; the average mileage required per call is eight miles. 7 calls in 8 hours is one and 1/8 hours per call.

1 and 1/8 hours at \$2.00 per hour (low for professional labor)	\$2.25
8 miles at 9 cents per mile (replacement costs of car) . . . . .	.72
Supervision and management (someone has to run the business) . . . . .	.83
Clerical and bookkeeping . . . . .	.83
Overhead, rent, light, heat, & miscellaneous . . . . .	.41

Total cost \$4.64

"These figures are those of a typical service organization and do not figure in the costs of social security, workman compensation, call backs, or jobs guaranteed, etc."

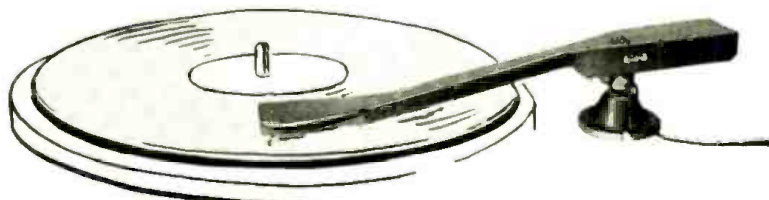
Many service technicians believe that city or state licensing would answer the problems of independent service business operation. Actually, any form of licensing will eventually drive the small operator out of business. Where reports, inspections, and the payment of fees to political elements become a requirement for a man to operate a business, the red tape that develops demands so much time and attention that it becomes impossible to operate in a small way. Larger business units take over and through their volume of business they are able to afford the specialized help necessary to look after the non-productive phases of the business.

In most areas where licensing bills have been proposed the excuse is that "gyp" service technicians are gouging the public and giving inferior service. Yet in those same areas you will find successful TV service businesses that are being operated at a profit and have a high rate of customer satisfaction with the services they are charging and the prices they are charging. These businesses do not sell *cheap* service. They sell *quality* service. They are managed by men who realize that TV owners cannot truly appraise the value of good service. It is the responsibility and obligation of the servicing company to tell them about good service and what it rightfully costs. So they carry on regular *customer relations* programs as a part of every service call.

No "CANNED" Effect!

WEATHERS

FREQUENCY MODULATION PHONOGRAPH PICKUP SYSTEM



REALISM without "NOISE"



W-2 FM Capacitance Pickup Cartridge

- Greatly Reduced Stylus Pressure
- Extended Record and Stylus Life
- Negligible Distortion
- Negligible Needle Talk
- No Undamped Resonances
- No Hum From Motor Field
- Triple Play Single Stylus Model Plays ALL Records

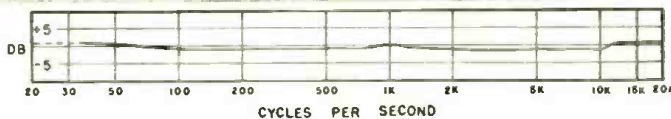
NEW! Weathers Reproducer Arm for the W-2 FM Capacitance Pickup



(For Standard W-2 Cartridge Only)

W-216 Arm and W-202 Cartridge Set for any 16" transcription turntable

Protect your investment in new records with the one gram stylus pressure of the Weathers cartridge and arm. You will be amazed at the reduction in stylus wear. A new standard in record reproduction which must be heard to be fully appreciated. The low mass of the Weathers stylus follows every groove undulation perfectly without distorting the groove wall.



Typical frequency response curve produced with Cook Series 10 Test Record. (Response over 500 cycles compensated to obtain constant velocity characteristic.) Terminals provide compensation based on AES Standard Playback Curve or constant-amplitude response, as preferred.

SIMPLE INSTALLATION COMPONENTS

Each cartridge, or cartridge and arm set, includes a Weathers oscillator with pickup cable receptacle and power cable for one 6AT6 tube. Power cable may be connected to user's amplifier (receptacle supplied) or to Weathers W-22 Power Supply, sold separately. The new W-21A oscillator is factory-adjusted with the cartridge and pickup cable in each set and does not ordinarily require further adjustment, even after tube replacement.



Oscillator

Power Supply

CARTRIDGE FOR STANDARD RECORD PLAYERS

The W-202-C Universal Cartridge Set is available for installation in modern record players, manual and automatic, and in standard makes of transcription arms. Stylus pressure may be adjusted to 3 grams or less when installed in a Webster automatic changer or RCA-45 record player. W-202-C Universal Cartridge Set is electrically identical with the W-202 and W-212 Standard Set (used only with the Weathers arm), but the stylus compliance is slightly reduced.

WEATHERS INDUSTRIES

BOX 531

66 E. GLOUCESTER PIKE, BARRINGTON, NEW JERSEY

See your distributor or write for literature

Gerrold Announces New
MODEL 704
 Direct Reading
FIELD STRENGTH METER

for TV and FM
 it will
 actually
 read
 microvolts!

*Accurate for the Laboratory
 ... Rugged for the Field*



Model 704 offers the answer to field signal measurement!

DIRECT READING . . .
 Microvolts and db meter scales
 5 microvolts to 3.0 volts

ACCURACY . . .
 ±0.8 db

FREQUENCY RANGE . . .
 Continuous Tuning 50-220 M C

INPUT IMPEDANCE . . .
 72 or 300 ohms
 Separates and measures video, audio and adjacent Channel carriers. Locates RF interference.

6 Volt Vibrator Pack available for battery operation.

MODEL 704-6V
Price \$24.75
 (includes cable)

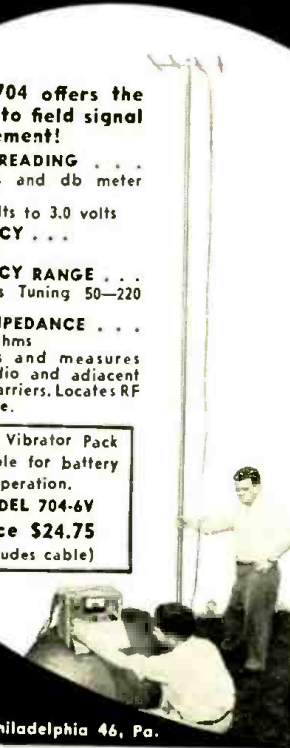
\$275.

MODEL 704
 with AC power supply

JERROLD

ELECTRONICS CORP.

1451 South 26th St. • Philadelphia 46, Pa.



Any service technician who feels that licensing would answer any of his problems would do well to talk to any one-store drug store owner. Just ask him to tell you how many licenses he must carry and what they entail in record keeping alone. It will provide part of the answer why large drug chains are gradually pushing the small, one-man drug store out of business.

Cheap Service or Good Service?

Recently in looking over a community newspaper we noticed the classified section carried three ads offering TV service. One ad listed TV service calls at \$3.00 and gave only the phone number; the second ad listed TV service calls at \$4.00 and gave only the phone number; the third ad offered TV service calls at \$4.50, included the name and address of the advertiser and a brief, professionally-phrased statement about the technical qualifications of the business.

After considerable checking we found the \$3.00 service calls were offered by a man who worked in a factory and handled TV service calls nights and on week-ends; the second was a radio technician who was trying to get some TV service business; and the third was a highly competent TV service company with an almost perfect record of customer satisfaction. The first two were equipped to handle only the simplest forms of TV service work, such as the replacement of receiving type tubes. The TV service company was equipped and manned to handle any type of installation or service.

On the basis of the information we were able to gather, the third company, advertising calls at \$4.50 with company identity included in the ad, is getting about three times as many calls from its ad as the first two combined. It again bears out the statement that TV set owners want to feel that they get full value for the money they pay out for TV service but they do not want cheap service. They want competent, reliable service.

Industrial Electronics

Most electronic devices for industrial applications are either custom-built for the particular operation they perform or are adapted to suit the individual requirements of an installation. Because of those factors the sale of industrial electronics equipment is usually made on the basis of recommendations and specs developed from an engineering study of the function the equipment is to accomplish. Since most of this equipment has been going into large plants, they usually set up their own maintenance departments to install and service it.

However, the easing of the defense program will probably be closely followed by an expansion of the development of electronic control devices for use in smaller plants. This will open a new market for competent independent service.

Become an ELECTRICAL ENGINEER in 36 MONTHS
Bachelor of Science Degree — Major in Electronics or Power

It is estimated by 1955 there will be at least two positions for every engineering and technician graduate. This college offers a tested plan that permits you to enter these vast employment opportunities at an early date. Save a valuable year through optional year-round study. Receive advanced credit for prior training gained in the armed forces, other schools or field experience.

ENTER BOTH RADIO AND TELEVISION 12 months or one-third of the B. S. degree course (Electronics major) — also brings you the Radio Technician's certificate. An added 6-month course qualifies you for the Radio-TV Technician's certificate. Recent developments open unlimited opportunities for TV technicians and engineers.

THE PROVEN "UNIT CHASSIS SYSTEM" of teaching was developed here. It "breaks down" the TV set by stages. You learn every component of all types and makes — and are prepared for future design changes, including the advent of color.

6 to 12-MONTH TELEVISION SERVICE COURSE... trains for good servicing jobs and shop ownership in the shortest practical time under expert instructors.

Terms open April, July, October, January. Over 48,000 former students from all states and 23 overseas countries. Faculty of trained specialists. Modern laboratories and equipment.

Write for free 110-page catalog, 48-page pictorial booklet "Your Career" and "Occupational Guidance Bulletins."

MILWAUKEE SCHOOL OF ENGINEERING

APPROVED FOR VETERANS • NONPROFIT • FOUNDED IN 1903



Milwaukee School of Engineering
 Dept. RN-253, 1025 North Milwaukee
 Milwaukee 1, Wisconsin

Without obligation send Catalog for Electrical Engineering, B. S. Degree, major in Electronics; Power; "Your Career"; Occupational Guidance Bulletin on: Radio-TV; Electrical Power; Welding; Heating, Refrigeration, Air Conditioning; Mechanical Engineering, B. S. Degree; Preparatory; Television Service.

Name.....Age.....

Address.....

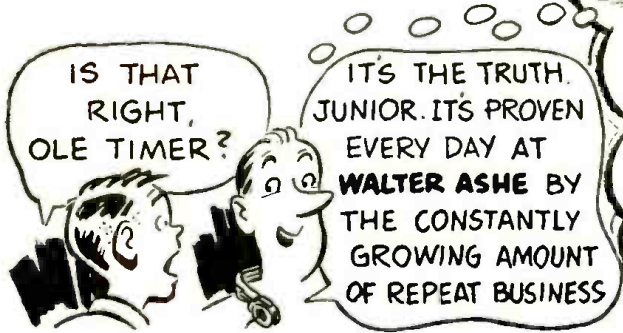
City.....Zone.....State.....

If veteran, indicate date of discharge.....



Make Your Dollar Go Farther!

The father of our country made a dollar go a long way, but your dollar will go a longer way when you get a Walter Ashe "Surprise" Trade-In.




JOHNSON VIKING II TRANSMITTER KIT. Complete with tubes. Shpg. wt. 85 lbs. Only \$279.50
JOHNSON VIKING II Wired and tested. Only \$336.50

There's no doubt about it—you're money ahead when you take advantage of the one and only "Surprise" Trade-In Allowance on your used (factory-built) test and communication equipment. For fast action, use the convenient coupon to tell us what you have to trade and to indicate your choice in new equipment. Get your trade-in deal working today!



NEW COLLINS 75A-3 RECEIVER. Complete with tubes and 3 kc Mechanical Filter. Less speaker. Only \$530.00.

NATIONAL HRO-60T
 Less spkr. Shpg. wt. 90 lbs.
 Only \$483.50

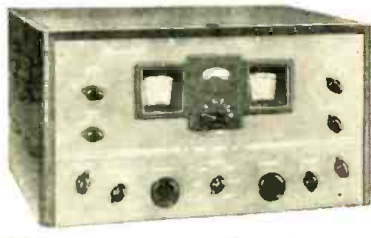


All prices f. o. b. St. Louis



HALLICRAFTERS SX-71
 Less speaker.
 Shpg. wt. 51 lbs.
 Only \$224.50

HAMMARLUND HQ-129X
 Less speaker.
 Shpg. wt. 74 lbs.
 Only \$239.50



Phone Chestnut 1125

Walter Ashe
RADIO CO.
 1125 PINE ST. • ST. LOUIS 1, MO.

-----FREE CATALOG!----- RN-53-2

WALTER ASHE RADIO COMPANY
 1125 Pine Street, St. Louis 1, Missouri

Rush "Surprise" Trade-in-offer on my _____
 for _____
(show make and model No. of new equipment desired)

Send new 1953 Catalog.

Name _____
 Address _____
 City _____ Zone _____ State _____



Trav-Electric

\$15⁹⁵
LIST

Model 6-1160

MIGHTY MIDGET CONVERTER

*Just plug into
Cigar Lighter on Dash*

Converts 6 volts D.C. to 110
volts A.C. 60 cycles 40 watts.

Ideal for phono-
graphs and turntables
at beach, or picnic.



PORTABLE PHONOGRAPH

Radios, short wave
or broadcast bands
in car, truck and
cabin, etc.



IN THE CAR—IN THE TRUCK

Small dictating ma-
chines . . . ideal for
salesmen, business
or professional men.



Dictating Machine

Electric shaver works
beautifully when it
is plugged into Trav-
Electric. A great time
saver.



ELECTRIC SHAVES

Boats—the 110 volts
A.C. operates radios,
lights, etc.



IN BOATS

Ideal for outdoor
musical entertain-
ment from table ra-
dio to phonographs,
including most wire
and disc recorders.



AT PICNICS—OUTINGS

**Fully Guaranteed
THOUSANDS IN USE**

See your Electronic Dealer or
Jobber, or write direct



Model 6-1160

Size
2 1/2" x 2 1/2" x 3 1/2"

TERADO Company

Manufacturers of Precision Equipment
1068 Raymond Ave. St. Paul 14, Minn.

In Canada, write: Atlas Radio Corp., Ltd., 560 King
Street West, Toronto 28, Ontario

EXPORT SALES DIVISION, Scheel International, Inc.
4237 N. Lincoln Avenue, Chicago 18, Illinois, U.S.A.
Cable Address—Harscheel

Manufacturers of electronics equip-
ment for industrial and commercial
applications have indicated they would
prefer to deal with a single organiza-
tion that could insure adequate main-
tenance and servicing facilities in all
parts of the country rather than to
have to ferret out competent organi-
zations on an individual basis.

In order to provide these manufactur-
ers with a national servicing "pack-
age" of independent servicing com-
panies a group of major service busi-
nesses recently formed the National
Industrial Electronics Service Affili-
ates, as incorporated organization
whose aim it is to tie together in a
cooperative program the leading serv-
ice companies in every town, city, and
hamlet across the nation.

It is the objective of NIESA to
provide manufacturers with a service
that will include the preparation of
the necessary operating, installation,
maintenance, and servicing informa-
tion that its affiliates will need to
efficiently handle the manufacturer's
products.

Major service companies who are in-
terested in receiving detailed informa-
tion on NIESA may write to the
Service News Editor, RADIO & TELE-
VISION NEWS, 366 Madison Ave., New
York 17, N. Y.

Industrial Television

While u.h.f. TV and the new v.h.f.
stations that are building in areas not
previously served by local or nearby
televasting stations will bring an in-
creased volume of business to many
service shops in those areas, the next
big "national" boost the independent
service industry will get will come
from industrial or "closed circuit"
television.

The needed elements to get wired
television underway on a large scale
are now available. There is a com-
paratively low-priced camera tube
built into a compact, easy-to-use
camera. Such cameras are now in
production. Extensive advertising and
sales promotion campaigns will soon
be "breaking" that will create a
widening interest in this newest phase
of TV.

The *Dage* TV camera, now in pro-

duction, is a compact, completely self-
contained unit about the size of a
large brief case. It develops a 525-line
picture with interlaced scanning so it
will work into any standard television
receiver. It is simple to adjust and
operate. An installation consists of
running a cable from the camera to
the receiver or receivers to be used.

The *Dage* camera is to be sold
through regular parts distributing
channels and it is planned to leave the
installation and servicing in the hands
of competent independent servicing
companies. It is presumed, of course,
that progressive TV service companies
will arrange for some of their techni-
cal personnel to study TV camera cir-
cuitry.

Many service technicians are now
studying TV camera circuitry through
a ten-lesson course prepared by the
Television Technicians Lecture Bu-
reau. The pulse generator, constructed
as a part of the course for use with
the TTLB camera, is a very useful
servicing tool in itself.

The TTLB course includes complete
construction details for a camera. All
parts for this inexpensive unit are
available from parts distributor. Infor-
mation on the TTLB course may be
obtained by writing to the Service
News Editor, RADIO & TELEVISION
NEWS, 366 Madison Ave., New York
17, N. Y.

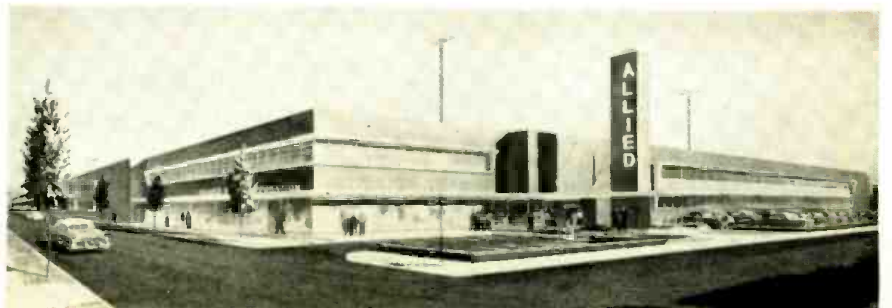
WESTERN SHOW DATES

THE Board of Directors of the Western
Electronic Show and Convention
(WESCON) has set the 1953 conclave for
August 19 through 21 at San Francisco's
Municipal Auditorium.

In 1952, a total of 15,092 individuals
attended WESCON in Long Beach, Cal-
ifornia and plans for 1953 envision a
substantial increase, not only in gen-
eral attendance, but also in the 1952
figure of 2692 persons who registered for
the technical sessions and the 199 ex-
hibitors who displayed products and
services in 224 booths.

WESCON, as an operating organiza-
tion, is jointly sponsored by the West
Coast Electronic Manufacturer's Assn.
and the Seventh Region of the Institute
of Radio Engineers, NEDA and the
California Chapter of "The Representa-
tives" have pledged their cooperation.

Allied Radio Corporation, one of the leading national distributors of electronic
parts and equipment, is building a new \$2,000,000 home at Washington Blvd. and
Western Avenue in Chicago. The new location will give the firm 150,000 square
feet of floor area in which to handle an anticipated 25,000 items. A system of con-
veyor belts, chutes, and electronic controls will move orders and merchandise quick-
ly from one section to another. The building is expected to be ready by summer.



versed from a positive to a negative. He moved the dial a little farther, and the picture returned to normal but the sound was blotted out.

"As you can see," Mac continued, "the grid-dip oscillator is a powerful little signal generator that covers, with the coils that come with it, a range of 2 to 250 megacycles. I have wound additional coils that allow me to go down to 350 kilocycles for use in radio servicing. The one I am plugging in now covers most of the broadcast band. Note when I flip this little switch on the back of the instrument the grid current falls to zero, for I am cutting off the plate voltage; but also notice when I bring the inductance close to the oscillator coil of this little a.c.-d.c. set and tune the instrument to the frequency at which the set oscillator is working, I get a reading on the meter. The grid of the 6AF4 is now acting as the plate of a diode and is rectifying the voltage induced into the plug-in inductance. That gives a means of determining the frequency of any oscillator or other circuit handling a substantial amount of r.f. power. Furthermore, by noting the amount of coupling and the reading of the meter, I can get a rough idea of the amount of r.f. energy present in the circuit being investigated.

"And now," Mac continued as he plugged a pair of phones into the jack of the GDO and switched its plate power back on, "there remains but one more basic function of the grid-dipper to demonstrate. Listen in here while I tune the signal generator across the frequency at which the oscillator is working. Hear that heterodyne? Now we are using the instrument as an oscillating detector, and it provides us with still another method of determining the frequency of an unknown signal when that signal is too weak to give a reading on the rectifying-diode set up."

"These coils you wound have three connections on them. Why?"

"The Colpitts circuit employing a split-stator tuning condenser as the sole 'capacity-voltage-divider' for providing feedback does not work well at low frequencies, especially when the tuning condenser approaches the all-out position. I simply wound my coils in two equal portions and brought out the center tap and grounded it through an extra pin-jack on the frame of the tuning condenser. In effect, this changes the oscillator from a Colpitts to a Hartley; and then the low-frequency, home-made coils work just as well as the ones that come with the instrument. Now that technicians are buying the grid-dippers, I am sure that soon low frequency coils will be sold with them as standard equipment."

Barney picked up a little air-wound coil with a pair of alligator clips fas-

UHF-VHF Signal Testing is QUICK, EASY with...

THE NEW HEAVY DUTY

Alprodco EREC-TOWER

TEST SIGNALS UP TO 80 FT. ▶

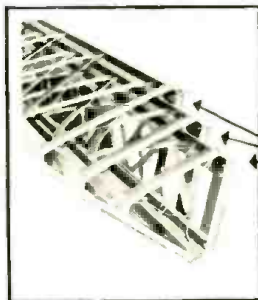
EREC-TOWER—and only EREC-TOWER—goes up a full 80 feet. You test signal strength anywhere along the way up... determine just exactly how high the permanent antenna must be!

ERECT PERMANENT TV TOWERS ▶

Use the EREC-TOWER as a gin pole to raise permanent antenna towers. With an EREC-TOWER, for example, two men can erect a 100-foot Alprodco Tower in less than two hours. You save time, money, labor on every job!

DEMONSTRATE TV SETS ▶

EREC-TOWER helps you demonstrate sets quickly, anywhere. Here's the ideal way to show razor-sharp pictures to your fringe area prospects... right in their own homes. EREC-TOWER is a real sales closer!



BETTER BUILT

EREC-TOWER is constructed of lifetime aircraft aluminum. Each leg and track (see opposite illustration) is extruded in one solid 24-foot length... will not buckle, crack, stick or rust.

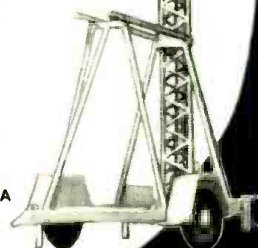
HEAVY EXTRUDED ONE-PIECE ALUMINUM TRACKS

FREE! WRITE TODAY for full information and literature on the Alprodco EREC-TOWER as well as Alprodco Aluminum TV-FM-AM Towers.

Alprodco, Inc.

302 E. MAIN ST., KEMPTON, INDIANA
MINERAL WELLS, TEXAS • DUBLIN, GEORGIA

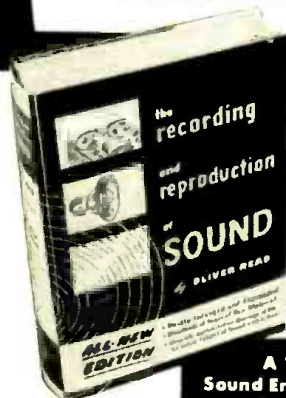
Dealer
Net Price
(For Tower)
\$233.50



NEW! 2ND EDITION of the only complete reference on AUDIO!

"The Recording & Reproduction of SOUND"

by OLIVER READ



Completely revised and vastly enlarged new edition

OVER
800
PAGES

A "Must" for
Sound Engineers, Hi-Fi
Enthusiasts, P. A.
Men, Broadcasting
Stations, Recording
Studios, Students

largest selling
book in its field

CONTENTS:

A Partial List of Authoritative Chapters:

Behavior of Sound Waves; Basic Recording Methods; Lateral Disc Recording; Microgroove Recording; The Decibel; Phono Reproducers; Styli; Microphones; Loudspeakers and Enclosures; Dividing Networks and Filters; Attenuators and Mixers; Home Music Systems; P.A. Systems; Amplifiers; AM and FM Tuners—PLUS HUNDREDS OF OTHER SUBJECTS

Now you can have all the *right* answers to any subject in the field of Audio. Learn how to select and get the most out of recording equipment. Tells you how to select the proper amplifier for given applications, how to test amplifier performance, how to eliminate hum. Explains microphone, speaker and pickup principles and selection factors. Shows how to utilize inverse feed-back, expanders and compressors. Covers hundreds of subjects—a vast wealth of reliable information found in no other single volume. If you work in the field of Audio, this book belongs in your library. Order your copy today!

6" x 9" **ONLY \$7.95**
Hard Covers
800 pages 700 illustrations

**ORDER
TODAY**

Order from your Parts
Jobber, or write direct to
HOWARD W. SAMS & CO., INC.
2203 E. 46th St., Indianapolis 5, Ind.

My (check) (money order) for \$.....
is enclosed.

Send copy(ies) of *The Recording &
Reproduction of Sound (RR-2)*. \$7.95 per copy.

Name

Address

City State

tened to the ends. "Did this come with it?" he asked.

"No, that is a *Barker & Williamson* #3006 'Miniductor' with the ends un-wound until they both take off from the same supporting bar, leaving a full sixteen turns between those ends. I use it to determine the capacity of unknown mica or ceramic condensers. When any condenser of from 2 or 3 $\mu\text{fd.}$ to .005 $\mu\text{fd.}$ is clipped across that coil, the resonant frequency falls within the range of the five lowest-frequency inductances furnished with the instrument. I simply find this frequency with the dipper and then refer to this graph I made in which resonant frequency is plotted against capacity, and I know the value of the condenser. This is the old mustard for identifying condensers when you are not sure of the color code or when one of the colored dots cannot be identified."

"This is rather funny-looking graph paper."

"It is double logarithmic paper with two vertical cycles and four horizontal cycles. The vertical cycles from the bottom up read 1 to 10 and 10 to 100 megacycles. The horizontal cycles from left to right indicate 1 to 10, 10 to 100, 100 to 1000, and 1000 to 10,000 $\mu\text{fd.}$ The resonant frequency of the coil and a small-tolerance 100 $\mu\text{fd.}$ silver mica condenser was carefully measured with the grid-dipper and plotted on the graph. I know that as long as I use the same inductance and vary the capacity, the resonant frequency doubles every time I divide the capacity by four and is halved every time I multiply the capacity by four; so this gives me any number of other points on the graph. On this kind of paper, these points all lie in a straight line; so all you have to do is determine a couple of points a goodly distance apart and draw a straight line through them. Were our coil a pure inductance, this line would be accurate throughout its length; but because of the distributed capacity of the coil, there is a small error at the low-capacity end. To correct this I measured several *Ceramicon*s of low capacity and high accuracy and curved the upper left-hand end of my line to pass through these plotted points. There are many other ways of determining capacity with a GDO, some producing greater accuracy; but this method is the easiest and most practical for the needs of the technician."

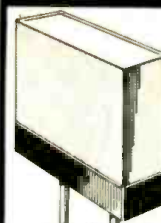
"Can you measure inductance with the gadget?"

"Why not? All you have to do is place a known condenser across the coil you're measuring and find the resonant frequency with the dipper. Then you refer to a resonance chart to learn what inductance will produce resonance at that frequency with that capacity."

While he was talking Mac clipped a twenty-ohm resistor in series with the coil and condenser lying on the bench. Then he placed a clip across the resistor so that it was shorted out.

"See how sharp the dip is with the

RADIO Surplus Buys



CRYSTALS

... in FT 241-A Holders— $\frac{1}{2}$ " Pin SPC. Marked 54th OR 72nd Harmonic MC Freq. Listed below by fundamental frequency with fractions omitted.

500 KC Crystals ea. **\$1.95**
1000 KC Crystals ea. **\$3.95**

370	407	444	476	509
372	408	445	477	511
374	409	446	479	512
375	411	447	480	513
376	412	448	481	514
377	413	450	483	515
379	414	451	484	516
380	415	452	485	518
381	416	453	486	519
383	418	454	487	520
384	419	455	488	522
385	420	456	490	523
386	422	457	491	525
387	423	458	492	526
388	424	459	493	527
390	425	461	494	529
391	426	462	495	530
392	427	463	496	531
393	429	464	497	533
394	430	465	498	534
395	431	466	501	536
396	433	468	502	537
397	434	469	503	538
398	435	470	504	540
400	436	472	505	
401	437	473	506	
402	438	474	507	
403	440	475	508	
404	441			
405	442			
406	443			

\$1.00 EACH

10 for \$8.00, Postpaid

FOLLOWING CRYSTALS AVAILABLE IN FT 243 HOLDERS $\frac{1}{2}$ " PIN SPACING

3500	5035	7350
3590	5127.5	7450
4165	5285	7750
4280	5587	7875
4335	5660	8006.7
4350	5730	8025
4370	6073.3	8200
4440	6075	
4445	6140	
4540	6150	
4580	6350	
4620	6525	
4635	6700	
4710	6875	
4880	6975	
4980	7075	
4995	7150	

\$1.00 EACH

11 for \$10.00, Postpaid

PLEASE ENCLOSE FULL AMOUNT WITH ORDER
QUANTITIES AVAILABLE
WRITE FOR YOUR REQUIREMENTS

C & H SALES CO.

BOX 356-FT EAST PASADENA STA. • PASADENA 8, CALIF.

Please Mention
RADIO & TELEVISION NEWS
When Answering $\frac{1}{2}$ " Advertisements



**more
dough
from Generous Joe!**

JOE POSSNER Needs Your Equipment for New Operation. Your MONEY rushed by return mail! No Red Tape!
Just write one letter. List items. EXACT condition, price You want!

ALL QUERIES ANSWERED IMMEDIATELY
You Get More Because We Have No Stock.
We Will Swap - Tell Us What You Want.
Equipment - Relays - Switches
Condensers

POSSNER ELECTRONICS
(Formerly Electronics Sales Co.)

DEPT. R-1
5279 West Pico Blvd. • Los Angeles 19, Calif.

resistor out of the circuit," he said to Barney. "Then notice how it broadens out when I cut the resistance in. This difference in dipping action is really an indication of the 'Q' of the tuned circuit. A sharp dip means a high 'Q'; a weak dip, a low 'Q'. Since high resistance or shorted turns in a coil lower the 'Q' of a circuit in which it is used, the dipper can often be used to detect such a coil defect. The manual that comes with the meter tells you how to find the numerical value of 'Q'; but for our purposes, the rough indication of the sharpness of dip is sufficient."

"It's too bad," Barney sighed, "you can't use it to spot intermittents."

"But you can!" Mac exclaimed. "Look on page 108 of the August, 1952, issue of RADIO & TELEVISION NEWS, and you will find an article by Lewis Hughes explaining how the GDO can be used to spot intermittent condensers without removing them from the circuit or turning off the set."

"That thing's got more uses than chlorophyll," Barney muttered.

"Let's talk about using it in everyday radio service," Mac suggested. "Take the case of a receiver in which the r.f. stage will not track with the oscillator. The GDO can be used to check the tuning range of both the r.f. and oscillator circuits and will immediately reveal which one is not covering the span it should. In the same way, without ever plugging the set in, we can trim the turns of a new 'universal' loop antenna until it and the tuning condenser track perfectly with the dial markings. 'Loopstick' antennas can be adjusted just as easily and quickly.

"The instrument also makes an excellent portable signal generator that can be carried in the shopcoat pocket. With it tuned to the proper frequencies, you can quickly tell if a signal will pass through a set from the antenna, the grid of the mixer, or the grid of an i.f. stage. All you have to do is hold the inductance close to the point where you want to insert the signal. This makes for very speedy troubleshooting. We have already shown how the diode-rectifying action of the GDO can be used to determine if the oscillator is working.

"Remember that set we had a while back that gave us such a hard time because of parasitic oscillations? If we had had the dipper, we could have used the oscillating detector to locate the frequency of the parasitic, and then we could have switched off the receiver and used the instrument as a grid-dip oscillator to locate the circuit components yielding resonance at that frequency. Incidentally, as an oscillating detector, the dipper can trace a signal through the i.f. stages, too; and in an emergency, you can even use it as a signal generator to align those i.f.'s"

"The frequency settings could not be too accurate with plug-in coils and that small dial," Barney objected.



HERE ARE JUST A FEW OF THE
BIG VALUES
IN THE LATEST 148 PAGE
B-A CATALOG
WRITE US IF YOU HAVE NOT RECEIVED IT

BURSTEIN-APPLEBEE CO.

1012-14 McGee St., Kansas City 6, Mo.

Send Free B-A Catalog No. 531.

My order is attached for items from below.

\$..... enclosed.

Name.....

Address.....

City.....

State.....

35 MA.—130 VOLT
SELENIUM RECTIFIER

EACH
35c

Very compact 3/4"x1/2" dia. in tubular fibre sleeve, sealed with high temp. wax—easy to mount anywhere with the self supporting 2" tinned wire leads. An exact replacement for Standard B51 and many other TV boosters and ideal for countless other rectifier needs.

No. 15A1172 35c 10 Lots 29c
Spec. Ea.

MIDGET
POWER TRANSFORMER

EACH
89c

117 V., 60 cycle AC primary, 110 V. @ 20 MA H.V. Secondary 6.3 V. @ .3 amp for Filament. Fully enclosed, compact size 1 1/2"x1 1/2"—mtg. ctr. 2 1/8". Color coded leads. An exact replacement for many popular TV Boosters as well as for use in construction of phono pre-amps, bias supplies, phono oscillators, etc. No. 19C714.

Special Each 89c 10 Lots, 79c
As above: 110 V. @ 40 MA H.V. Secondary, 6.3 V. @ 1 amp. for Filament. Size 1 1/2" x 1 3/4" x 1 5/8" — 2 3/8" ctrs. No. 19C731 \$1.29 10 Lots, \$1.19
Special Each

SWITCH ASSORTMENT

10 FOR
\$1.19

10 Assorted—toggle, push-button and slide type switches. The use of only several will pay for the lot. No. 18A935. Per Assmt. Only... \$1.19

A HEAP OF PARTS
ONLY
29c

Assembly consists of 140 mmf midget variable coil socket, dual crystal socket, RF coil socket, 10 contact terminal strip, resistors, etc., neatly assembled on metal chassis with fibre bottom plate 4" x 1 1/4" x 1 1/8" high. Easy to dis-assemble. No. 18B1044.

Per Assembly Only 29c
10 Lots Each..... 25c

16MFD.—150 WKG. V.—225 P.V.
TUBULAR ELECTROLYTIC

EACH
15c

Top make, hermetically sealed in aluminum tube with kraftboard insulating jacket and 3" tinned wire leads. Compact only 1 3/4"x3/8". Fresh stock—fully guaranteed, a widely used capacity at a crazy Low Price. No. 14B995 15c 10 Lots 13c
Spec. Ea.

6AK5 TUBES

6 FOR
\$4.79

Made by Sylvania and bears the name "Standard" because they were originally intended for use in Standard Boosters—otherwise the identical 6AK5 you would get if buying tubes bearing the Sylvania name and for which you pay up to \$2.06 Net Each (List Price \$3.90 Ea.). Here you get 6 for little more than the regular price of 2 and believe us—they are perfect—new—fully guaranteed—a popular type widely used in Radio, TV, Boosters, etc. No. 70A98. Pkg. of Six 6AK5 Sylvania Made Tubes ONLY \$4.79

PAPER & MICA CONDENSERS

99c

25 assorted useable capacities paper tubular, paper molded and mica condensers. Regular values up to 25c each. No. 18B203. A Wonderful Value... 99c

TRIMMER CONDENSERS

ONLY
39c

25 Assorted ceramic base mica trimmer condensers popular capacities. Regular cost up to 20c each. You can afford to have several assortments, even if the use is only occasional. No. 18A156. PER ASS'T. ONLY 39c

36 MOLDED PLASTIC
TUBULAR
CONDENSERS

\$11.70 List Value

\$3.88

Compact, yet with the rugged construction needed to withstand the high temperature in TV, Auto and AC-DC sets. Top quality. Fully guaranteed by the maker as well as B-A. Kit of 36 all 600 Volt: 4 each .001, .002, .005 and 6 each .01, .02, .05, .1. No. 18A263 \$3.88
Your Cost.....

Kit of 36 Paper Tubulars at 600 volt assorted as above. \$10.50 List Value. No. 15A389. \$2.39
Kit of 36.....

ROTARY SWITCHES

99c

Assortment of TEN—any one of which is worth more than the price of the lot. Anyone experimenting or building will find good use for all. No. 18A436. Per Ass't. of TEN..... 99c

INSULATED RESISTORS

ASSTD.
\$1.49

Do not confuse with non-insulated, foreign makes etc. offered by others. 50 Assorted top quality 1/2 watt insulated resistors in most popular capacities. No. 19B796. Per Ass't. of 50 \$1.49

ASSORTMENT OF 100
Consists of 75-1/2 watt and 25-1 watt insulated top quality resistors. No. 19B796. Per Ass't. of 100..... \$2.49

6 FT. BROWN AC CORDS

10 FOR
\$1.69

All are of U/L approved size 18-2 conductor zip apart cord and top quality plugs. No. 19B811. Per Bundle of 10..... \$1.69

FLEXIBLE
MICROPHONE CABLE

Special silver stranding gives extreme flexibility plus unusual tensile strength. Top quality filler, shielding and overall rubber covering. Only 3/8" dia. No. 28132. 100 Ft. \$2.95
Per 25' Coil 95c

INCLUDE ALLOWANCE FOR POSTAGE—ALL OVERPAYMENTS WILL BE REFUNDED

B-A BURSTEIN-APPLEBEE CO. 1012-14 MCGEE ST. KANSAS CITY, MO.

THE AUDIO PERFORMANCE OF

New **BROOK** ALL TRIODE HIGH QUALITY AUDIO AMPLIFIERS
IS BEYOND DESCRIPTION
Let your Ears Pass Judgment



- **Nine distinct positions for record playback provide complete bass and treble equalization for best-known recordings.**
- **Bass effective to 15 cycles results in improved transient response that makes all bass tones sound more natural.**

Write for complete technical data, and be sure to listen to the new **BROOK** at your local dealer's Sound Department.

BROOK ELECTRONICS, INC.
 34 DeHART PLACE, ELIZABETH 2, N.J.

Dept. RB-3

**EARN MORE MONEY—
 BE A PROFESSIONAL
 TELEVISION
 SERVICE
 TECHNICIAN**



STEP INTO THE TOP PAY \$5,000—\$10,000 A YEAR CLASS. YOU CAN WITH WTI SHOP TRAINING.

If you want to reach your goal as a Successful Service Technician you will need plenty of "KNOW HOW" to qualify for the better servicing jobs or profitable shop ownership.

SEND FOR
FREE
 BOOK TODAY!

WESTERN TV offers real experience on live equipment in our BIG SHOPS AND LABORATORIES in the shortest practical time under expert instructors. Graduates are in big demand because they have the "field experience" necessary for immediate "bench" or supervisory positions. You learn every phase of Radio and TV servicing (AM, FM, VHF, UHF). WTI men win fast promotion... can demand better pay... develop highly profitable businesses of their own with the latest and most PRACTICAL PERSONALIZED TRAINING BEHIND THEM. You concentrate all your time on being a PROFESSIONAL TV SERVICE TECHNICIAN — non-essential math and engineering theory omitted. YOU CAN EARN WHILE YOU LEARN. Special Finance Plan. APPROVED FOR VETERANS. Find out how you can get into the TOP PAY GROUP — Send for this fact-packed book NOW!

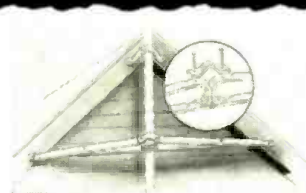
**WESTERN
 TELEVISION
 INSTITUTE**

America's Leading
 Television
 Servicing School

Western Television Institute Dept. R-23
 341 W. 18th St., Los Angeles 15, Calif.
 Without obligation, please send FREE fully illustrated booklet. (No salesman will call.)

NAME _____
 ADDRESS _____
 CITY _____ ZONE _____ STATE _____

South River
 ★ ★ NEWS ★ ★



**EAVE MOUNT
 MODEL EM-1**

Heavy steel of a novel, bridge-type, truss construction, hot dip galvanized. Upper bracket provides 4" clearance from eave; lower bracket, generous 48" spread. Complete with hardware.

South River Antenna Mounting Accessories are carried by every leading TV Parts Jobber from coast to coast.

Write for your copy of our new 1953 catalog.

**SOUTH RIVER METAL
 PRODUCTS CO., INC.**
 SOUTH RIVER, N. J.

PIONEER AND OUTSTANDING PRODUCER
 OF FINEST LINE OF ANTENNA MOUNTS

"You're right; a GDO is not intended to be a precision frequency instrument in itself. However, by letting a harmonic fall on a known broadcast station, or other known signal, such as WWV's transmissions, you can set the grid dip oscillator very closely. Ordinarily, though, the markings on the dial of the GDO are plenty accurate for most purposes.

"But now let's talk about how the instrument can be used in TV service. You have already seen how it can produce a signal on either the sound or picture frequency of any TV channel, but it will also produce any frequency found in the i.f. channels of either separate sound and picture sets or those of the intercarrier type. I don't need to tell you how such a compact little signal generator as this can be used to isolate trouble in a TV set by simply injecting the proper signal at different parts of the circuit. All you have to do is just hold the inductance of the GDO close to the point where you want to introduce the signal. For example, in the case of a dead oscillator, if the GDO is tuned to the proper oscillator frequency and held close to the mixer tube, a picture can be obtained.

"A very important function of the grid dip meter is to check the frequency of traps and stagger-tuned transformers before any attempt at alignment is made. This can be done in a matter of seconds before the set is turned on and will often save much useless work. It is important that the transformers be set to approximately their correct frequency before alignment with a scope is started—especially if there is reason to believe the original settings may have been changed. Otherwise it is often possible to produce a curve similar to the correct one with the individual transformers set away off their specified frequencies, but the curve will not have the proper amplitude because the mistuned transformers will not have the 'Q' for which they were designed.

"Still another important use for the GDO," Mac went on, "is as an auxiliary 'exploring' marker to be used to determine characteristics of a curve while the regular marker is left fixed at an important point. By positioning the GDO just right with regard to the set, a marker of the desired size can be obtained. If you want a precision marker, a crystal can be plugged into the coil socket, using an adapter, and the oscillator will function at the fundamental frequency of the crystal and produce strong harmonics. The tuning condenser setting serves as a broad control of the amplitude of oscillation and permits the frequency to be varied over a few cycles. I have used ham crystals for the 160, 80, 40, and 20 meter bands in this fashion and all oscillate strongly. A surplus tank-transmitter crystal with a fundamental of about 510 kc. would not work, however.

"But we can't cover all the possible

uses of such a versatile gadget now," Mac broke off; "but I'll tell you what I'm gonna do: for every new use for the GDO you come up with, I'll give you a couple of bucks. Said use, however, must be one in which the dipper does a job quicker or better than an instrument normally used for the purpose, or it must be one in which the portability of the grid dip meter is an important item. How does that sound?"

"Like money in the bank!" Barney said enthusiastically. "Come with Papa, Mister Grid Dip Oscillator; we're going to bankrupt this tight-fisted Scotchman!"

-30-

C.W. TRANSMITTER

By GLENN W. DYE

THIS true pocket portable can be built up from scratch or from one of the surplus BC-746B tuning units, some of which are sold with one 80-meter crystal. The basic unit supplies the chassis, tuning condenser, a usable crystal socket, and tie lugs. A 7-pin miniature socket and the small parts listed in the circuit diagram must be added, along with a small coil form and coil form socket, though a fixed-mounted coil can be used.

A home-made, U-shaped chassis about 4"x1 1/4"x1" can be bent from a strip of scrap metal 1 1/4" wide. The tuning condenser can be the familiar APC type or anything similar.

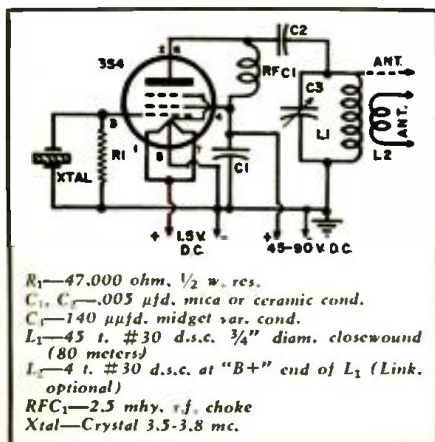
The best above-chassis parts lineup, for simplest and most efficient below-chassis wiring, is crystal-tube-condenser-coil. If a BC-746B is used, its crystal socket should be moved to the end of the chassis and the tube socket installed in its place.

With a 67-volt supply, the plate-screen current of the 3S4 tube will be 12 to 15 ma. in the operating condition. A flashlight cell can power the filament. Keying is done in the "B—" lead from the battery. The antenna (about 135 feet of small magnet wire will do) can be connected to the plate pin of the coil socket (see diagram) and the ground to "B—", or the optional link coil may be used.

Even a beginner can build this tiny rig and have it on the air in the course of an afternoon.

-30-

Circuit of the ultra-midget transmitter.



to the
**ELECTRICAL
ENGINEER**

or
PHYSICIST

with experience in

RADAR
or
ELECTRONICS

Hughes Research and Development Laboratories, one of the nation's leading electronics organizations, are now creating a number of new openings in an important phase of their operations.

Here is what one of these positions offers you:

THE COMPANY

Hughes Research and Development Laboratories, located in Southern California, are presently engaged in the development and production of advanced radar systems, electronic computers and guided missiles.

THE NEW OPENINGS

The positions are for men who will serve as technical advisors to government agencies and companies purchasing Hughes equipment—also as technical consultants with engineers of other companies working on associated equipment. Your specific job would be essentially to help insure successful operation of Hughes equipment in the field.

THE TRAINING

On joining our organization, you will work in the Laboratories for several months to become thoroughly familiar with the equipment which you will later help users to understand and properly employ. If you have already had radar or electronics experience, you will find this knowledge helpful in your new work.

WHERE YOU WORK

After your period of training—at full pay—you may (1) remain with the Laboratories in Southern California in an instructive or administrative capacity, (2) become the Hughes representative at a company where our equipment is being installed, or (3) be the

Hughes representative at a military base in this country or overseas (single men only). Compensation is made for traveling and moving household effects, and married men keep their families with them at all times.

YOUR FUTURE

In one of these positions you will gain all-around experience that will increase your value to our organization as it further expands in the field of electronics. The next few years are certain to see large-scale commercial employment of electronic systems. Your training in and familiarity with the most advanced electronic techniques now will qualify you for even more important future positions.

How to apply:

HUGHES
RESEARCH AND
DEVELOPMENT LABORATORIES

Engineering Personnel Department
Culver City,
Los Angeles County, California

If you are under thirty-five years of age, and if you have an E.E. or Physics degree, write to the Laboratories, giving resumé of your experience.

Assurance is required that relocation of the applicant will not cause disruption of an urgent military project.

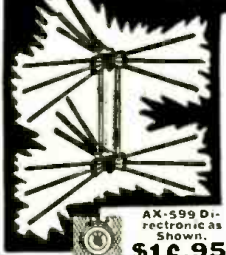
GIANT BARGAINS BECAUSE WE'RE

SPECIALISTS in TV ANTENNAS ACCESSORIES, EQUIPMENT FOR ALL LOCATIONS



Amazing New Motorless TV ANTENNA

All Channel TV RECEPTION IN ALL DIRECTIONS



Rocket DIRECTRONIC MOTORLESS TV ANTENNA
360° Electrically Switched Beam

AX-599 Directronics Shown
\$16.95

No Motors
No Roof Orientation
No Electric Power
No Ghosts
Flick of Switch Clears Picture Instantly

Beam Selector

Provides same clear pictures as rotating aerials costing 4 times as much. Electrically beams in all directions with full 360° rotation. You select direction with Directronic Beam Selector located at set. Model AX-509 stacked array includes 18 hi-tensile aluminum elements, 1 set connecting studs, Universal U-Clamps for mast, Directronic Beam Switch, and 75 feet of TH-1 lead-in.

Model AX-59 Directronic 9-element Single **\$10.35**

Rocket ALL CHANNEL CONICALS



This sturdy, all-aluminum constructed TV antenna is designed for broad-band reception on all TV channels. Plus FM. High Gain, 4 to 1 front to back ratio. All channels 2-13. Uni-directional. Maximum signal to noise ratio. For use with 72-150-300 ohm lines. Low inception angle. Complete with all hardware—less mast.

Single Bay Array **\$ 3.95**
2 Bay Array with Tie Rods **8.65**
Fringe Area 4 Bay Array including 4 Bay Stacking Bars **18.95**

With any order of \$10 or more you will receive our Rocket 7 Ft. Intersect Line Cord. Permits adjustment, testing, repair of set while operating with back removed when ordering, state that you want this gift. Don't delay as quantities are limited. Only one given to a customer.

FREE
OF EXTRA COST
CATALOG AVAILABLE ON REQUEST



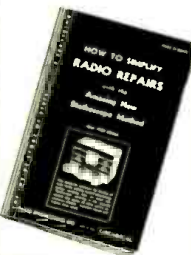
EVERY RADIOMAN

Can Use These

SERVICE HINTS!

Valuable Manual Yours—FREE!

Every page of "How to Simplify Radio Repairs" is packed with on-the-bench, practical ideas. Contains photos, charts, diagrams—no fluff—no vague theory. In plain every-day language it gives you priceless suggestions—new servicing ideas. You'll use and benefit from the experience of experts. Partial list of contents: How to Localize Trouble; How to Service Amplifiers; How to Test for Distortion; How to Test Audio Circuits; How to Test Speakers; How to Find Faults in Oscillators; How to Test Radio Parts—and It's all yours—FREE! No obligation.



SEND COUPON OR GOVERNMENT POSTCARD FOR YOUR FREE COPY TODAY!

FEILER ENGINEERING CO., Dept. 2-M-3
8026 N. Monticello Ave., Skokie, Ill.
(Suburb of Chicago)

Please RUSH my FREE copy of "How to Simplify Radio Repairs."

Name

Address

City

Zone

State

ROCKET 5 ELEMENT YAGI

Excellent Pictures in Fringe Areas

Designed for high gain with minimum interference from ghosts and noise due to directive pattern. Produces clear sharp pictures. 5 heavy aluminum elements include one folded dipole, one reflector, three directors. Strong molded insulator. Non-slip mast clamp. Completely pre-assembled, less mast.

Channels 7 through 13... **\$3.95**
Channels 5 or 6... **\$6.95**
Channels 2, 3, or 4... **\$7.95**

When ordering, specify exact channel number desired.

Rocket 35-foot Mast Kit

Economy mast kit contains 3-10' seamless dualcoated 1 1/2" OD masts, one 5' mast, 300 feet of 6/20 galvanized steel guy wire, and everything else needed including guy rings, mast connectors, insulators, cable clamps, guy hooks, and swivel mounting base.

35-Foot \$15.95 Mast Kit **25-Foot \$11.95 Mast Kit**

LOWEST PRICES ON ANTENNA ACCESSORIES

Mast Steel (Dualcoated 5' crimped) 1 1/2" O.D. **\$1.05**
Mast Steel (Dualcoated 10') 1 1/2" O.D. **1.95**
Mast Connectors for 1 1/2" O.D. mast **.59**
Chimney Mount Complete with Straps **1.19**
Peak Roof Saddle (will take up to 1 1/2" O.D.) **1.59**
Lightning Arrester-TV **.69**
Galvanized Steel Guy Wire—8/20 **3/8c ft.**
Galvanized Steel Guy Wire—11/20 **1 1/2c ft.**
Rocket Twin-Lead—7/28 stranded **2c ft.**
UTP-type Tubular 300 ohm Twin-Lead **4.95**
100' coil **20.95**
Rocket Open Line Twin-Lead 500' feet **.10**
Mast Stand-off Insulators—3" **.03**
Stand-off Screw Insulators—3" **1.49**
Wall Bracket—6" clearance **2.49**
Wall Bracket—12" clearance **2.49**

ALL PRICES F.O.B. CLEVELAND, OHIO
Do not remit more than complete purchase price. Pay shipping charges on receipt of goods. 25% deposit on C.O.D. orders, please. Money-back guarantee.
Prices Subject to Change Without Notice

National Electronics OF CLEVELAND THE HOUSE OF TV VALUES

102 Delco Bldg. Cleveland 3, Ohio

ROUND, SQUARE, KEY and "D" OPENINGS QUICKLY MADE with Greenlee Radio Chassis Punches



Save hours of hard, tedious work... cut accurate holes in chassis for sockets, plugs, controls, meters, panel lights, etc. with GREENLEE Punches. In 1-1/2 minutes or less make a smooth hole in metal, bakelite or hard rubber up to 1/16" thick. Easy to operate... simply turn with ordinary wrench. Wide range of sizes. Write for details. Greenlee Tool Co., 1882 Columbia Avenue, Rockford, Ill.



Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

PARTS BULLETIN

Greylock Electronics Supply Co., 115 Liberty Street, New York 6, New York has released an 8-page television and radio technician's bulletin which lists a number of timely buys in television and radio tubes and parts.

The company is also accepting requests for its 1953 catalogue which will be available shortly. The complete catalogue will contain 68 pages of offerings.

PARTS DIRECTORY

The Tube Department, RCA Victor Division, Radio Corporation of America has recently issued a comprehensive, 142-page "Service Parts Directory" containing schematic diagrams, parts lists, and top and bottom chassis views for the seventy-one 1950 and 1951 RCA Victor television receivers.

Designed for the convenience of television service dealers and technicians, the directory speeds and facilitates the selection of service parts.

The directory's pages are 11 x 17 inches in size and so arranged that the parts lists and top and bottom chassis views for a particular model face the corresponding schematic diagram. Service parts are listed by symbol number. This arrangement facilitates the location of the stock number of any part shown on the schematic.

The TV receivers in the directory are indexed by model name, model number, and chassis number. The r.f. tuner chassis number appears on each schematic. The model name, and model and chassis numbers are listed on the right-hand page margins to help locate information quickly.

The directory (SP-1014) is now available from RCA tube and parts distributors.

FACILITIES BROCHURE

The products of Raytheon Manufacturing Company, Waltham, Massachusetts, are shown in the illustrated, three-color catalogue recently published by the electronics firm.

A brief history of the company and a photo layout of its various plants are followed by detailed descriptions of the products of each of the company's four divisions: receiving tube, power tube, equipment, and radio-television. A page is devoted to an outline of the concern's research activities.

—THE BEST IN ELECTRONIC SURPLUS—

12 V. DC HEAVY BEAM MOTOR



Rated at 1/12 horsepower at 1725 rpm, but actually with built-on reducing gears develops many, many times more power. Worm gear at end of reducer is 43 rpm. As is, can be used for hoisting, electric platforms, portable electric trucks, conveyors, etc. Operates from 12 volts DC (two 6 volt storage batteries). Additional 7 inch heavy brass worm gear available to reduce rotation to 2 1/2 rpm, for antenna rotator. NEW, unused surplus.

PRICE, EACH MOTOR \$15.95

7-inch Brass Worm Gear, for 2 1/2 rpm. \$1.50

Hi-QUALITY COMPASS AND ADJ. TRIPOD



For orienting beam antennas, boat owners, hikers and many other useful applications where a real hi-quality compass is required. Compass is deluxe with ball and socket mount adapter, jewel mounts, built-in levels, a zero set, a screw for locking needle when not in use, two vertical sights—folding type, 4 inch pointer on 5 inch compass. 0-360 azimuth calibration (counter-clock-wise). Tripod is exceedingly well made, telescoping from 20 inches to 47 inches, and can be adapted for camera work. PRICE, Complete, as above, NEW unused surplus.

EACH \$14.95

VARIABLE AUDIO OSCILLATOR



For service test bench, code practice (by keying), tone modulation of ham or commercial transmitters, or with oscilloscope for audio amplifier testing. Has 5-point switch to provide 5 different audio tones. Uses a 12A6

pentode to give plenty of audio power. Additional 12A6 in spare socket, for spare. No. 1S4 spare as shown. With diagram. PRICE, EACH **\$5.95**

SCR-283 X'MTTING-RCVG. EQUIPMENT, COMPLETE

Excellent Condition material. R'cvng range: 200 to 400 KC and 4,150 to 7700 KC; X'mting range 2,500 to 7,700 KC. Uses plug-in coils for band changing both transmit and receive. Receiver is superhet, transmitter uses VFO and has power output of 4 watts CW, 3.3 W. on phone. COMPLETE with tubes, all coils, 24 V. DC Dynamotor, Radio Control Box, Antenna Sw. Relay, cables, etc.

A REAL BUY AT . . . PER SET \$34.50

CONDENSER MICROPHONE With 2-Stage Pre-Amp.

Real. Precision quality construction, double Helmholtz Resonator type, with combination microphone and amplifier built-in cylindrical brass case 16 x 6 ins. Uses types 30 and 32 tubes in amplifier. Employs acoustical low-pass filter plugs (removable) for 5-25 cycle response; removing plugs (threaded) and venting cylinder case will result in high-quality, wide-range studio-type microphone. As is, excellent for vibration testing, percussion noises, shock sounds, oil exploration work. Original use—Sound (Artillery) Ranging Eqt. NEW UNITS.

EACH \$34.95

INDUSTRIAL CAPACITORS

G. E. TYPE 18F75
Synco—Capacitor

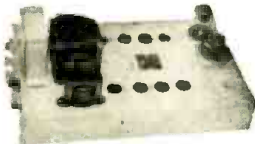


50-50-50 mfd., Pyranol filled, Delta connected, 90 V. AC, 60 cps. All NEW, packaged capacitors. For power-factor correction on 115 V. 3 phase AC, etc. Large quantity available.

EACH \$6.95

G. E. VOLTAGE REGULATOR

AND
POWER
SUPPLY

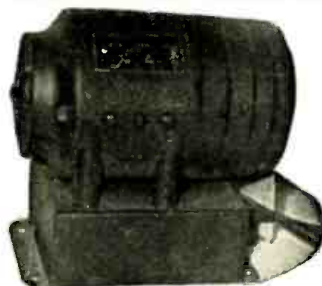


MODEL
3GVD14B3

Output 750 volts at 10 ma; complete power supply using 8 tubes; with selector switch for regulating or non-regulating. Operates from 110 V., 60 cycles AC. NEW units, less tubes, with operational data and diagram.

EACH \$15.95

32 VDC-110V AC CONVERTER



Mfd. by Kato Engineering, for marine or farm installation. Rotary type, compact and ruggedly built for continuous duty. Rubber shock mounting on filter case, with complete input and output filtering. Output 110 volts, 60 cycles AC, .225 KVA, but will operate efficiently on loads up to 300 watts. New units only.

PRICE, EACH \$39.95

INFRA-RED IMAGE "SNOOPERSCOPE" TUBE Extra-Special!!

We've sold thousands of them to Labs, experimenters, Industrials, studios, etc. By using Infra-Red rays, this tube enables you to see in the dark. No scanning, no amplifiers, just a high-voltage power supply is all you need with this tube. Shows image in greenish-white on 1 1/2" screen. For night photography, signaling, snooper or sniper scopes, underwater detectors, etc. British mfr. SOLD IN LOTS OF 6 ONLY! Literature and diagrams furnished with each sale.

6 for \$15.00

FRONT-END LENS, for Infra-Red Tube. Bausch & Lomb. Ea. \$10.00
Plain, Mounted Type. Ea. 7.00

ATTENTION, Please!

To N. Y., N. J., Conn., and other nearby Hams and Experimenters, we invite you to visit our Retail Dept. and Bargain Counters, at this address. We have a terrific quantity of transformers (all types), capacitors of all types, relays, receivers, transmitters, electronic devices that will intrigue you, etc.—all at sensationally low prices. We're in the heart of Coney Island, so visit the Beach, the Amusement area, and our Retail Display. No Parking Problem here! Please, do not write for catalogues or listing of this material.

All Above Material Subject to Prior Sale. 25% Minimum Deposit with All C.O.D.'s. All Prices F.O.B. Our Address.

—TELEMARINE— COMMUNICATIONS CO.

3040 W. 21st Street, Brooklyn 24, N. Y.
Phone: ES 2-4300

20-40 MC FIELD STRENGTH AND WAVEMETER

Uses a 0-100 Micro-ammeter with a 1S4 Pentode, to receive signals in the 20-40 mc range. 1.5 volts battery required. Tuning dial has lock, for fixing position, and telescopic Antenna permits adjusting for strong or weak signals. Calibration chart in the base. With instruction sheet and diagram. NEW, unused eapt. Dim: 6 1/4" x 4 1/4" x 5 1/2". With antenna.



PRICE, Each \$14.95

50-60 W. SPEAKER UNIT



Western Electric Speaker units, for horn or baffleboard mtg. Shock and blast proof diaphragm, will handle up to 60 watts. Response to 7,000 cps, favoring high freq. Impedance 13 ohms. Dim: 6" x 6" x 4 1/2" deep. Throat opening—1 1/2" dia. Anico 5 slug wt. 6

lbs. SPECIAL, PRICE EACH **\$18.75**

BC-221 FREQUENCY METER

Precise Signal Generator and Heterodyne Meter, with crystal calibrator for check points every 1,000 KC. Range .125 to 20.0 MC. Complete with tubes, crystal. Excellent Condition units. BUT NON-MATCHING Calibration Books. Follow the Instruction Manual for "Adjustments," and you can make the instrument and calibration book jibe. We could do it and charge you \$95.00 per unit, but we think you would prefer to do it yourself and save \$30.00.

BC-221 Freq. Meter, \$65.00
as Described. EACH

MISCELLANEOUS SPECIALS

The following items are for Exporters, Governmental Agencies, and Industrial Companies. Wholesale Only! All material is in stock and available for immediate delivery. Descriptive literature and prices available upon request.

MARINE

TCS X'mtr-Receiver for Ship or Shore.
TAJ 500 Watts Output, 175-550 KC. New Equipment, with Spares, Motor Generator (AC and DC available) Starter, Tubes, Complete.
TBK HF 500W. Transmitter with MG, Starter, and Spares.
GO-9 100/125 W. 1F/HF Ship or Aircraft Transmitter, A1 or A2 Emission. All New with Spares.
150-AY Mackay 1F Ship X'mtrs.
8707 RMCA Ship Radio Compass.

MISCELLANEOUS

DZ-2 Direction Finders.
GP-7 Aircraft Transmitters.
ZB-3 ILS Eqt.
SCR-283 RCVG and X'mting Eqt. Complete.
RT-3/ARN-1 Altimeter.
RADIOSONDES AN/AMQ-1A to D. New.

SCR-610 Crystals, in sets (120 channels) or individually. TESTED. Write for PRICES.

EXTRA!

PE-104 POWER SUPPLIES for Receiver of SCR-284, NEW, with Spare Vibrator, Export-Packed. Large Quantity Available. WRITE FOR PRICES.

GROUND AND AIR COMMUNICATIONS

TDQ VHF 100-156 MC 50W. AM X'mtr for 110 V. 50/60 C. AC.
BC-797 VHF 110-126 MC. 50W. AM Output or 110 V. 50/60 C. AC.
SCR-284 Ground Portable AM, Trans-Reer Eqt. for Field Communications.
SCR-522 VHF, 4-Channel, 100-156 MC Trans-Rer Eqt. for Plane or Ground Communications.
SCR-511, Walky-Talky, 3-6 MC. Crystal Controlled Trans-Reer, with Plug-In Units for Freq. Changing.
96-200A, 2 KW Wilcox X'mtr, 125-525 KC, 3 Cabinets: RF Unit, Modulator, Rectifier; A1, A2 and A3 Emission.
10 KW GE FM RF AMPLIFIERS, Type BF-3-A, 88-108 MC. Complete with RF Power Supply (separate unit). New Eqt. For increasing power FM and Television stations. Write for descriptive sheets and prices.

NEW!

2 GREAT BOOKS

By Milton S. Kiver

**IF YOU SERVICE TV
—YOU NEED THEM!**

**"TV Servicing Short-Cuts
Based on Actual Case Histories"**



shows you how to solve commonly recurring troubles

the book that really teaches fast, expert service techniques

This book describes a series of actual TV service case histories, each presenting a specific problem about a specific receiver.

The symptoms of a trouble are described and then followed by a step-by-step explanation of how the service technician localized and tracked down the defect. Finally, there is a detailed discussion of how this particular trouble can be tracked down and solved in any TV set. The discussions which follow each case history are invaluable—they explain how to apply the proper time-saving servicing techniques to any TV receiver. Here, in one volume, is the successful experience of experts—to make your service work easier, quicker, more profitable. Over 100 pages, 5 1/2 x 8 1/2", illustrated. Pays for itself on a single service job.

ORDER TK-1. Only \$1.50

**"HOW TO UNDERSTAND AND USE
TV TEST INSTRUMENTS"**



shows you how to get the most from your test instruments

Provides basic explanations of how each test instrument operates; describes functions of each control and shows their proper adjustment to place the instrument

in operation. Covers: Vacuum Tube Voltmeters, AM Signal Generators, Sweep Signal Generators, Oscilloscopes, Video Signal Generators, Field Intensity Meters, Voltage Calibrators. Describes each in detail; explains functions; tells proper use in actual servicing; shows how to avoid improper indications. Because this book gives you a clear, complete understanding of your test instruments, you get more out of them, save time, and add to your earning power. Over 175 pages, 8 1/2 x 11", illustrated.

ORDER TN-1. Only \$3.00

HOWARD W. SAMS & CO., INC.

Order from your Parts Jobber today, or write direct to Howard W. Sams & Co., Inc. 2203 East 46th Street, Indianapolis 5, Ind.

My (check) (money order) for \$..... enclosed. Send the following books:

- TK-1 (\$1.50) TN-1 (\$3.00)

Name.....

Address.....

City..... Zone..... State.....

The catalogue also lists the addresses of the principal sales offices of the company throughout the United States.

INTERCOM DISPLAY

Vocaline Company of America, Inc., 300 Vocaline Building, Old Saybrook, Conn., has released a new counter display featuring its portable intercom.

In the form of an eye-catching arrow, the display "points" to a "Vocatron" intercom on which it stands. In this way the display takes no more counter space than the compact intercom itself.

The sales message is concise and "quick reading" and urges passers-by to "ask for a no-obligation demonstration".

The company will provide complete details on how the new display may be obtained.

PHONO NEEDLE CHART

Jensen Industries, Inc., 329 South Wood Street, Chicago 12, Illinois, has issued a new replacement phonograph needle wall chart which incorporates several exclusive features.

Designed to simplify the work of the record dealer and the service technician, this guide also aids retailer inventory control and shows authorized needle substitutions.

A total of 78 different replacement needles are silhouetted on the chart, each with its Jensen "Durosium" or sapphire equivalent. Representing the requirements of the 16 leading cartridge manufacturers, it shows all the existing cartridge numbers in quick, easy-to-read style.

The chart also features a "best seller list" which indicates the relative turnover of each needle and, in effect, tells the dealer which of the many needles in the line he should stock heavily.

Copies of this 8" x 22" chart, which is printed in two colors, are now available from the company's distributors or by writing the company direct.

DU MONT SCOPE

Allen B. Du Mont Laboratories, Inc., 1500 Main Avenue, Clifton, New Jersey, has recently issued a 12-page catalogue covering its Type 304-A oscilloscope.

The publication outlines the features of the new instrument, instructions on calibrating the unit, data on the various controls, specifications, and other pertinent information.

The catalogue is lavishly illustrated with actual photographs of the unit and scope patterns obtained at specified settings of the controls.

CENTRALAB PRODUCTS

Centralab, A Division of Globe-Union Inc., 900 East Keefe Avenue, Milwaukee 1, Wisconsin, lists 470 new items in its new industrial and distributor stock catalogue, No. 28.

The book has been expanded from 28 to 32 pages and covers the company's five product divisions: variable resistors, ceramic condensers, rotary

and lever switches, printed electronic circuits, and steatite insulators.

The fully-illustrated and indexed catalogue is available free of charge from any Centralab distributor or by writing the company direct.

NEWARK'S 1953 CATALOGUE

Newark Electric Co., 223 W. Madison St., Chicago 6, Ill., has issued its 1953 catalogue, No. 55.

This 194-page listing covers components, equipment, manuals, etc. for industry, laboratory use, high-fidelity applications, and for radio and TV. This complete manual carries a comprehensive index for ready reference.

HUDSON CATALOGUE

Hudson Radio & Television Corp., 48 W. 48th St., N.Y.C. has just issued its catalogue H-53 comprising 194 pages of parts and equipment listings.

Of particular interest to purchasing agents is the inclusion of the latest JAN cross-reference guide. The catalogue is fully indexed to facilitate locating specific parts.

AUDIO CATALOGUE

Terminal Radio Corp., 85 Cortlandt St., New York 7, N. Y. has just published a 132-page audio equipment catalogue which contains fifty pages devoted to high-fidelity home music system components and seventy-six pages covering p.a. institutional, recording and broadcasting equipment as well as audio test instruments and similar specialized equipment.

The new catalogue is available without charge to interested persons or firms on request.

1953 POCKET BOOK

The Tube Dept. of RCA has completely revised and expanded the 1953 edition of its yearly pocket reference and calendar notebook to provide even more technical data on its kinescopes, receiving and transmitting tubes, electronic components, test equipment, radio and industrial batteries, and miniature lamps, than before.

A section on troubleshooting hints, prepared by John Meagher, is included along with 16 pages of full color maps, a 58-page diary, and a memo, address, and telephone number section.

THORDARSON CATALOGUES

Thordarson-Meissner, Mt. Carmel, Ill. has issued three new catalogues of interest to the industry.

The #400-K catalogue lists replacements types of power, filament, and audio transformers for the service industry as well as standard types. A special section is devoted to TV replacement transformers. The second catalogue is a TV replacement guide for the service industry. It provides complete information on over 2500 TV models. Manufacturers parts numbers and the company's replacement types are listed for power and filament transformers, filter chokes, audio, vertical, and horizontal output transformers, focus coils, booster transformers, and deflection yokes.

The #53-A general catalogue gives specifications on the *Meissner* line of AM-FM tuners, receivers, and amplifiers and includes a section on receiver and amplifier kits. The company's new novice transmitter kit and hi-fidelity 10 watt amplifier are listed for the first time.

TV REPLACEMENT GUIDE

Standard Transformer Corp., 3580 Elston Ave., Chicago 18, Ill. has issued a simplified television transformer catalogue and replacement guide which lists replacement information on over 4400 TV models and chassis.

All the technician has to do is look up the manufacturer's part number, listed in numerical order by type of transformer, then the *Stancor* replacement will be found listed next to it.

U.H.F. ANTENNA DATA

The LaPointe-Plascomold Corp., Rockville, Conn. is now offering an 8-page catalogue, entitled "UHF Antenna Systems—How, What and Where for Every UHF Area", to interested persons.

The brochure includes valuable u.h.f. data of interest to the installation technician. It is now available at all "Vee-D-X" jobbers on request.

PRINTED CIRCUITS

Erie Resistor Corp. of Erie, Pa. has issued a new bulletin on its complete line of five types of electronic printed circuits, each in a range of capacities: diode filters, triode plate couplers, vertical integrators, pentode plate couplers, and audio output circuits.

MERIT CATALOGUES

Merit Coil & Transformer Corp., 4425 N. Clark St., Chicago 40, Ill. has issued two replacement guides, one a 36-page book covering practical recommendations for replacements in over 6000 TV models and chassis and the other an 8-page catalogue covering transformers, i.f. and r.f. coils for auto radios.

The auto radio guide is available from jobbers as Form No. 3 while the TV handbook is designated as No. 405. The company will also furnish copies on request.

TAPE RECORDER DATA

The Pentron Corporation, 221 E. Cullerton Street, Chicago 16, Illinois, now has available several brochures describing its line of magnetic tape recorders and recorder accessories.

The first pamphlet is a six-page folder which describes the company's multi-speed portable tape recorder unit. The booklet points out applications for the unit and gives concise data on performance and operation.

The second booklet covers accessories for tape recording, including tape player-amplifier, mike mixer, radio tuner, foot pedal, phonograph, tape player-preamp, speaker in baffle, recording tape, telephone pickup, waterproof cover, accessory cords, and a tape carrying case.



AN/APS-4
Airborne radar. New. Complete P.U.R.

AN/APS-6
Airborne radar set. New. Complete P.U.R.

AN/APR-4
RECEIVER & TUNING UNIT P.U.R.

AN/APS-3
AIRBORNE RADAR SET. Now Complete.... P.U.R.



POWER UNIT PU-41/G

Power Unit PU-41/G (Kohler Model 1M21A) is an electric generating set consisting of a 4-cylinder, 4-cycle valve-in-head, liquid cooled, manual starting (crank) gasoline engine directly converted to an a-c generator of the revolving armature type. Engine is rated 4.25 horsepower at 1,200 r.p.m. and consumes approx. 0.45 gallon of fuel per hour at rated load. Generator is rated at 1.5 kilowatts, 60 cycles, single phase, 110 V., 13.6 amperes at 100% power factor. Length: 45"; width: 16"; height: 36". Weight (crated) 880 lbs. New in original box with spare parts.\$475.00

Monthly Specials!

RT-34/APS-13 420 MC. TRANSCIVER with 5 stages of 30 MC. IF amplifier strik. Less tubes & R.F. section. With dynatron. **\$9.95**

2 TRANSMITTERS
BC-457 (4-5.3 MC) and BC-458 (5-3.7 MC). Constant transmitters. Substnmt just in. Limited quantity. Less tubes and xtals. Good cond. EACH \$1.95 PER SET \$9.50

AN/ARC-5
R-28/ARC-5 RECEIVER 100-156 MC. With tubes. Like New. **\$49.50**
T-23/ARC-5 TRANSMITTER 100-156 MC. With tubes. Like New. \$17.50
BOTH UNITS FOR ONLY **\$92.50**

SCR-625 FAMOUS MINE DETECTOR
For prospectors, miners, oil companies, plumbers, etc. New. **\$59.50**
WHILE THEY LAST!

COMMAND EQUIPMENT (SCR-274N)

	Used	New		Used	New
BC-442 ANTENNA RELAY. Less cond.	\$1.95		BC-453 With tubes	\$19.95	
With cond.		3.95	Less tubes	14.95	
BC-451 TRANSMITTER CONTROL BOX		1.50	MC-211 90° ANGLE COUPLING UNIT.		\$0.95
BC-450 3-RECEIVER REMOTE CONTROL BOX		2.95	FT-234 MOUNTING RACK for single transmitter	2.95	3.50
MC-215 MECHANICAL DRIVE SHAFT. Per length		2.95	FT-226 MOUNTING RACK for 2 Command Xmitters.		3.95
BC-496 2-POSITION RECEIVER CONTROL BOX		2.95	FT-221 MOUNTING PLATE for FT-220		1.50
BC-459 Less tubes	12.95		FT-220 MOUNTING RACK for 3 Receivers		2.25
BC-455 6-8 MC RECEIVER. With tubes	9.95	14.95	FT-225 MOUNTING PLATE for BC-456		2.25
Less tubes	7.95		BC-456 MODULATOR. For SCR-274.		4.50
BC-454 43-0 MC With tubes	9.95		Complete set of 4 tubes for transmitter		1.95
Less tubes	6.95				

RADAR TEST EQUIPMENT

TS-3, TS-12, TS-13, TS-15, TS-33, TS-31, TS-35, TS-36, TS-45A/MB.

ARC-4 TRANSCEIVER

140-144 Mc. Complete with control box, tubes, 12/24 VDC dynamotor with schematic. This is a special reduction for this month only. **\$32.50**
Like new \$31.50
MT-101 ARC-4. New \$1.50

TUBES! NEW! ORIGINAL BOXES!

Limited Quantities Available
250TL..... Ea. \$11.50 250TH..... Ea. \$14.50

234-258 MC RECEIVER

11-tube UHF tunable receiver with schematic. New **\$17.95**
Rack \$3.50
Control Box 1.50

Miscellaneous Specials!

HS-1R HEADSET. 8,000 ohms. New \$2.45
HS-23 HEADSET. High Imp. New 4.95
HS-30 HEADSET. Featherweight type. Low Imp. New \$2.49 USED 1.49
HS-33 HEADSET. Low Imp. New 6.95
HS-38 HEADSET. USED, excel. cond 1.49
NEW 3.50
T-26 CHEST TYPE MIKE. New 2.75
T-32 DESK STAND MIKE. Good, used cond 2.75
LIP MIKE. Navy type. New98

SURPRISE PACKAGE!

20 lbs. of good, useable radio parts **\$2.95**

TUBES!	TUBES!	TUBES!	TUBES!	TUBES!
10J14 \$19.95	304TH \$8.95	6CP1 \$4.95	5BP7 \$2.25	5BP7 \$2.25
12A14 24.95	304TL 8.95	3BP4 4.95	3AP10 1.49	6D02 ..... .89
16D14 19.95	830-B 2.75	5BP7 2.25	211C ..... .69	6D01 ..... .99

MP-22 MOBILE ANTENNA. MOUNTING RACK. Complete with hardware. New \$ 3.95
T-17 TUNING UNIT. (2-3 MC.) For BC-223. Used 2.95
NEW 2.50
WOBULATOR. See B. 43 Dec. 71 RADIO NEWS
BC-1023 75 MC. MARKER BEACON RECEIVER. Complete with tubes, etc. New 10.95
TU-25 TUNING UNIT. (3.5-5.2 MC.) For BC-223. Xmit. Used 2.95

IN-48 L.R. TUNING METER. Used \$ 3.95
FL-5 RANGE FILTER 1.25
TS-13 HAND SET TELEPHONE. NEW 7.75
BC-1033 75 MC. MARKER BEACON RECEIVER. Complete with tubes, etc. New P.U.R.
FIELD TELEPHONE. LF-8. Complete BRAND NEW. SPECIAL ONLY 27.50

INDUSTRIAL CORPORATIONS

We carry one of the most complete stocks in U. S. of Military Electronic Equipment, Test Equipment, and Aircraft Electronics. Call or write for free catalogue.

COMBO
BC-624 VHF RECEIVER. Freq. range 100-156 MC. Less tubes & crystals, with conversion dope. Used, good cond. **\$19.95**
BC-625 VHF TRANSMITTER. Freq. range 100-156 MC. Less tubes & crystals, with conversion dope. Used, good condition. **\$12.95**
BOTH TRANSMITTER & RECEIVER. Per Set **\$29.95**

\$5.00 MINIMUM ORDER ACCEPTED. All items subject to prior sale. All shipments F.O.B. warehouse. Calif. residents add tax with remittance. 20% deposit required. Please specify shipping instructions with order. EQUIPMENT WANTED! Highest prices paid for all types of Electronic Gear!

ARROW SALES, INC.
Cable Address: ARROWSALES PO Box 5-1210
Mailing Address: P. O. Box 3878-R, N. Hollywood, Calif.
Office-Warehouse: 7460 Varro Ave., N. Hollywood, Calif.



What Do You Want to Trade In on a New hallicrafters?

I have a complete stock of Hallicrafters receivers and transmitters. We will give you the best doggone trade-in in the world because we need used receivers badly for our trade. What do you have? Write me about it. I give you prompt delivery, 90-day FREE service and the world's lowest credit terms. Write, wire, phone, or visit either store today for the best deal. Export orders solicited.

Bob Henry
WPARA



Popular Double-IF Model SX-71

A double superheterodyne circuit receiver at modest cost. Built-in narrow band FM reception. Temperature compensated, voltage regulated. 5 position band selector for 538-1650 kc, 1600-4800 kc, 4.6-13.5 mc, 12.5-35 mc, 46-56 mc. 11 tubes plus voltage regulator and rectifier. Only \$199.50



All-Wave Receiver Model SX-62

Covers 540 kc to 109 mc—including AM, FM, and SW broadcasts. Six bands: 540-1620 kc, 1620 kc-4.9mc, 4.9 mc-15 mc, 15-32 mc, 27-56 mc (AM-FM), 54-109 mc (AM-FM). Only \$289.50. Other popular Hallicrafters models: S-76, \$169.50; S-40B, \$99.95; S-72, \$109.95; S-72L, \$119.95; S-81, \$49.50; S-82, \$49.50.

Butler 2, Missouri

HENRY RADIO STORES

11240 Olympic Blvd.
LOS ANGELES 25
CALIF.

WORLD'S LARGEST DISTRIBUTORS OF SHORT WAVE RECEIVERS

THE ORIGINAL ULTRA-LINEAR WILLIAMSON AMPLIFIER

by Brociner

with the famous ACRO-SOUND TO-300 Transformer



Model UL-1 Power Amplifier,

20 watts, Ultra-Linear Williamson-type Circuit.

AVAILABLE SEPARATELY

Completely independent, self-powered, remote control unit. Incorporates the famous Model A-100 Phonograph Preamplifier-Equalizer and the Model CA-2 Control Amplifier.



Producer of the widely acclaimed

BROCINER CORNER REPRODUCERS

BROCINER

ELECTRONICS LABORATORY
1546 SECOND AVENUE • NEW YORK 28, N. Y.

TV Receiver Sensitivity Measurements made Simple with

The New "SensiMeter" *
... a "must" in fringe areas



Net \$129.50
*Pat. Applied For

Approved by leading television manufacturers!

Consult your Jobber or write for further information

- * Takes the guesswork out of TV service
- * Checks receiver from antenna terminals to picture tube
- * Microvolt scale is divided into 3 sections as a guide for the servicemen
- * Sensitivity testing is accepted by servicemen as the best method of determining the cause of bad pictures

SI SERVICE INSTRUMENTS COMPANY
422 South Dearborn Street, Chicago 5, Illinois

The third brochure is a small folder briefly describing the portable tape recorder and its accessories and is designed as an envelope stuffer or mailing piece.

Details on any or all of these brochures are available from the company.

-30-

U.H.F. Antennas (Continued from page 58)

again provide a 300-ohm termination at (L-L).

The close positioning of B-B, D-D, and E-E form an array possessing a very low "Q". This low "Q", in effect, represents a dipole of a large electrical diameter which, in turn, accounts for the broad (all v.h.f. channel) frequency characteristics of the entire array.

So much for the v.h.f. sections of the composite array of Fig. 9. To this is added the tilted dipole in front of rod F-F for reception of signals over the u.h.f. band. F-F, as we have said, acts as its reflector.

Now, to prevent interaction between v.h.f. and u.h.f. sections, another printed circuit filter is added to the array. The low-frequency electrical equivalent of this filter is shown in Fig. 8A, while its physical appearance is indicated in Fig. 8B. The transmission line to the set is connected across points P-P. The u.h.f. antenna is then connected to one end of this filter and the v.h.f. section to the other. The various resonant circuits comprising this filter are shown, together with their resonant frequencies. Isolation, now, is achieved in the following manner. The u.h.f. signals leaving the u.h.f. array see short circuits in the 195 mc. and 70 mc. resonant circuits because the u.h.f. signals can pass through the condensers of these sections. On the other hand, u.h.f. signals see high impedances in the 680 mc. tuned circuits. Therefore, there is no tendency for any u.h.f. signal picked up by the v.h.f. antenna to reach points P-P. Any u.h.f. voltages reaching the transmission line must thus come from the u.h.f. antenna.

Considering v.h.f. signals, those coming from the v.h.f. section will encounter little opposition from the 680 mc. resonant filters and therefore v.h.f. signals will reach points P-P undiminished. However, v.h.f. signals picked up by the u.h.f. array will be largely lost across either the 70 mc. tuned circuits (for low v.h.f. band signals) or the 195 mc. filters (for high v.h.f. band signals). Very few of the v.h.f. signals from this source will reach points P-P.

The antenna is designed to operate with any 300-ohm balanced line and at present this means either the 300-ohm flat twin-lead or the 300-ohm tubular. There are, however, other low-loss lines being developed to provide better u.h.f. operation than the lines now available.

(To be continued)

Signal Distribution (Continued from page 47)

plifier can overcome some of the difficult problems of signal levels on the system. With individual channel amplifiers it is possible to adjust the level of each station in relation to a uniform signal distribution amplitude and establish an optimum signal-to-noise ratio for each station. In a difficult local-fringe reception area the strong signals can be held down to a level that will just prevent overload by high amplitude levels. Fringe signals are amplified as much as possible to bring them near what is considered to be the desirable distribution amplitude.

Possible combinations of these basic units in practical distribution systems are illustrated in the block diagrams of Fig. 3. The first shows a simple system that can be used for a small apartment building or a store demonstration arrangement in a strong signal area. In this basic arrangement the amplifiers are for matching and isolation. Some losses occur, so it is really only satisfactory with strong signals and a limited number of outlets. Notice that the larger distribution outlet amplifier can feed individual receiver groups as well as a line running to smaller distribution amplifiers.

A fringe or weak signal installation would require the addition of a wide-band amplifier or a channel-strip amplifier group to bring up the signal levels. Such an arrangement can also be used in a strong signal area for supplying the signal to a larger group of receivers. When the signal level declines to a specified minimum level another amplifier is inserted to re-establish signal distribution levels for continuance of the line. Each amplifier point recovers the losses encountered in the previous section of the distribution system so signal division can be continued.

Still another distribution plan is shown in Fig. 3 and can be used to supply hotels and apartment houses or groups of dwellings. Line lengths must be evaluated (db loss-per-hundred-feet) and made no longer than is required so signals can be amplified to the prescribed level of 10,000 microvolts by the next amplifier of the chain.

Distribution Problems

In a difficult multi-outlet area such as that north and east of Philadelphia, a distribution mixer with individual channel amplifiers is a necessity if New York and Philadelphia reception is desired. In this area there are very strong local signals and weak fringe signals (some 60-80 miles to New York). There are many stations to be received (10 stations maximum) and strong adjacent channel interference must be overcome. Practically all reception difficulties exist that would tax

SEE THESE GREAT BUYS TODAY AT PLATT'S NEW BRANCH STORE

Branch Store: 159 GREENWICH ST., N. Y. C.
(Off Cortlandt Street)

Main Store: 489 BROOME ST., N. Y. C.
(Send All Mail Orders Here)

PLATT BREAKS ALL PRICES! TEST EQUIPMENT SALE

AT NEW BRANCH STORE

No doubt about it, you haven't seen buys like these in many a month! Why don't you check them yourself? All merchandise is on display at PLATT'S New Branch Bargain Store. And you'll find many more items not listed here. First come, first served! (Send Mail Orders to Main Store.)

NATIONALLY FAMOUS VTVM

4 1/2" meter with adjustable pointer to zero center for TV & FM discriminator alignment. AC range: 0-5/10/100/500/1000 V. Resistance Ranges: 2 ohms-1000 megs. dB scale for audio and S meter measurements. Completely wired & tested—ready for use—SPECIAL WHILE THEY LAST! **\$34.95**



TOP BRAND SIGNAL GENERATOR Model 320

Freq. Coverage on fundamentals: 160 KC to 1200 KC. 1.3 harmonics on 7 calibrated to 102 megs on 7 calibrated harmonics. Completely wired & tested—ready for operation. SPECIAL! **\$24.95**



Radio City Products
Model 449

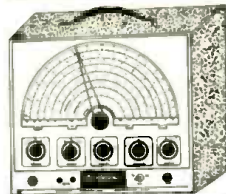
VOLTOHMMETER

AC-DC output: 1000 V. ohmage up to 2 megs. In metal case with zero adjusting knob on front panel. Ready for use. ONLY A LIMITED NUMBER. RUSH! **\$14.95**



APPROVED Model A-200 SIGNAL GENERATOR

Freq. Range: 100 KC to 75 megs in 8 signal bands. AC operated. Excellent for TV & FM alignment. This special buy cannot last long—please hurry so that you aren't disappointed. **\$21.95**



BRAND NEW SPEAKER SALE!

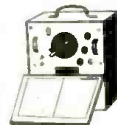
4" P.M. . . . \$1.39 8" P.M. . . . \$2.95
5" P.M. . . . \$1.49 12" P.M. . . . \$4.95



SPECIALS!
A full line of Recording Tape, Crystals, Pickups, Phono Motors, and the New G.E. Resistance Cartridge are available at Platt's Branch Store. It will pay you to come in and browse around a bit!

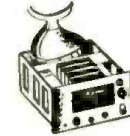
BC-221 Frequency Meter

Real Value! QUANTITY IS LIMITED—so hurry, come, first come, first served. They are just like new, with original calibration charts. Range 125-20,000 KC with crystal check points in all ranges. Complete with crystal and tubes. **\$129.50**
MODULATED TYPE WITH AC Power Supply \$189.50
These Frequency Meters are factory tested, checked for frequency alignment and GUARANTEED.



MN-26 INSTALLATION

MN-26 RECEIVER—Remote control commercial type navigational. Indicates direction of any desired transmitting station. 3 bands—frequency range 150KC to 1500KC; has 2-BV type tubes. Brand New. **\$39.95**
Original Cost \$600.00



ARMY TEST UNIT I-236

Meter is contained in a metal box 5 1/2" long x 3 3/4" wide x 3 1/4" deep. Comes complete with test leads and instruction book. Can be used for testing between AC and DC measuring resistances of circuits, checking fuses and testing capacitors. **SPECIAL \$4.19**

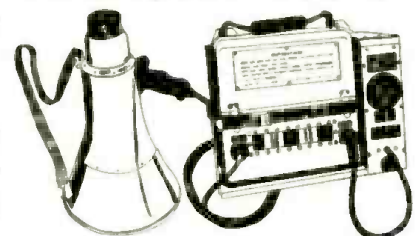


MINIMUM ORDER \$2.00

Immediate Delivery—Send 25% deposit on C.D. orders. All shipments F.D.B., N.Y.C. (N.Y.C. residents add sales tax to your remittance.)

TUBES	BRAND	NEW!	TUBES
	JAN!	BOXED!	
1B22 69c	100R 49c	841 19c	
1B23 \$3.75	114B 29c	951 13c	
2B22 49c	215A 9c	110 49c	
2C21 9c	221 29c	1025 29c	
2C26A 09c	304TH \$5.95	1020 19c	
3B22 \$1.19	310A 29c	1021 22c	
3C24 98c	388A 59c	7193 19c	
3D6 39c	471A \$1.19	0002 69c	
7C4 39c	532A \$1.19	0006 19c	
10Y 19c	532A 95c	11148 49c	
12KV 39c	801A 19c	1154 99c	
15H 39c	826 81c	29C 14c	
30/44 29c	843 17c	VT127 15c	

ELECTRIC MEGAPHONE SYSTEM



For Rural Arcos, Hotels, Commercial Steamers, Ball Parks, Etc.

U. S. NAVY Type PA-1 Electric Megaphone equipment is designed for voice reinforcement in much the same manner as, but to a greater degree than, the familiar acoustic megaphone. Consists of Megaphone Unit (which contains a microphone and reproducer in a single assembly), Portable Amplifier which electrically amplifies the output signal of the microphone section of the megaphone and feeds this amplified signal to the reproducer section. Charging Rack for recharging the self-contained storage battery of the portable amplifier. **10 AND NEW-A TRIMMED V.A. SET DEMONSTRATION GIVEN AT EITHER OF PLATT'S STORES \$149.50**

SCR-274N COMMAND and ARC-5 EQUIPMENT

EXCELLENT

RECEIVERS	USED	NEW
BC-453—190 to 550 KC	\$29.95	\$49.95
BC-454—3 to 6 MC		24.95
BC-455—6 to 9 MC	\$13.95	19.95

TRANSMITTERS	USED	NEW
A-958—2.1 to 3 MC		29.95
BC-458—5.3 to 7 MC	7.95	17.95
ARC5-T-19—3 to 4 MC	24.95	34.95
BC-459—7 to 9 MC		24.95
T-15 ARC 5—500 to 800 KC		29.95

ADDITIONAL EQUIPMENT

BC-455 Modulator	2.49	2.95	5.95
BC-450 Control Box (3 Receiver)	1.49	1.95	2.75
BC-451 Control Box (Transmitter)	1.29	1.79	2.39
BC-442 Relay Unit (ANT)			3.69
Plugs: PL-147, 148, 151, 152, 153, 154, 156—EACH		1.25	
Flexible Shafting with gear to fit receivers			2.69
3 Receiver Rack	1.79	2.29	2.98
2 Transmitter Rack	1.69	2.39	3.97
Single Transmitter Rack			3.97
DM-32 Dynamotor for Command Set		3.95	5.95
DM-33 Dynamotor for Command Set		2.95	3.95
Mounts for 2 Trans. Rack, 3 Rec. Rack, Modulator, & Antenna Relay Unit		1.95	

HEADSETS

HS-33 low impedance with cord and plug, used, fine condition **\$2.79**
HS-23 high impedance, BRAND NEW with ear pads, **5.95**
HS-13 low impedance, BRAND NEW with ear pads, cord and PL-34 plug **55.39**
HS-21 BRAND NEW—Western Electric **5.95**
CD-307A Cords, 6 ft. NEW **.89**
H-16/U high impedance. Includes two receiving units **3.95**
HS-16 high impedance—used **2.49**



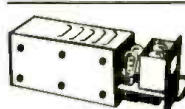
20 POUNDS OF ASSORTED RADIO PARTS

A TERRIFIC BUY
AT
ONLY **\$2.79**



TURBO AMPLIFIER

4 tube Amplifier used by U. S. Air Force. 115 V. Input at 400 cycles. Without tubes—**\$119**
BRAND NEW
SPECIAL



PLATT ELECTRONICS CORP.
DEPT. A, 489 BROOME ST., NEW YORK 13, N. Y.
PHONES: WO 4-0827 and WO 4-0828

UHF—CONCORD HAS IT—UHF
VEE-D-X All-Channel UHF-VHF Antennas

The VEE-D-X "V"
 All channel primary aza. Excellent broad-band characteristics. Supplied as a straight UHF antenna. List \$1.62
 \$2.75. Your net cost.

VR-MM30
 Vee-D-X "V" as listed above, supplied with Vee-D-X Mighty Match for use in combination with VHF antenna using single transmission line. List \$3.97
 \$6.75. Your Net Cost.

VEE-D-X MIGHTY MATCH
 Model MM-30. Provides best method of combining UHF-VHF antenna systems with single transmission line. Automatic action. Printed circuit filters. List \$2.35
 List \$1.00. Your Net Cost.

UHF ADAPTING BRACKET
 Permits addition of UHF antenna to existing VHF installation. Mounts three different ways to most of antenna boom. List \$1.50.
 Your Net Cost. **88c**

VEE-D-X "Ultra Q-Tree"
 Combines both UHF and VHF into single antenna using single transmission line. Designed for primary areas, will receive a 11 channels 2-83. List Price Single \$14.25.
 Your Net Cost. **\$8.38**
ULTRA-Q-TREE Stacked. High gain 2-bay array, similar to above. List \$24.55.
 Your Net Cost. **\$17.58**

"Smartest Booster Buy of Them All!"

SUTTON UHF

BOOSTER CONVERTER

ONLY
\$34.95



More than a Booster—It's a Booster AND CONVERTER—at the SAME PRICE! Converts any TV set to UHF reception, and boosts all VHF and UHF channels. Very easy to install. 7"x5"x6". Wt. 6 lbs.

GET ON OUR SPECIAL BARGAIN BULLETIN MAILING LIST!

For our Special Bulletins, listing Red Hot Limited Quantity Buys,—write your name and address on postal card, and send it TODAY—to Dept. N-2.

RECEIVING TUBES

BRAND NEW
 BOXED
60% OFF LIST PRICE!
 GUARANTEED



Type	Net	Type	Net	Type	Net
1B3GT	\$1.02 6BF5	.88 6V6G	1.00		
1H5GT	.68 6BG6G	1.92 7N7	.88		
1L4	.84 6BE6	.84 12AT6	.62		
1L6	1.06 6BJ6	.84 12AT7	1.16		
1N5GT	.84 6BK6	.60 12AU6	.72		
1R5	.84 6BQ6GT	1.36 12AU7	.96		
1S5	.76 6C4	.68 12AV6	.62		
1T4	.84 6CB6	.84 12AV7	1.16		
1T5GT	1.04 6D6	.88 12AX7	1.00		
1X2A	1.06 6F6	.84 12BA6	.76		
3Q5GT	1.00 6F6GT	.66 12BA7	1.00		
3V4	.80 6FG6	1.34 12BE6	.76		
3V4	.80 6M6	.66 12SA7GT	.74		
5V4G	.60 6H6GT	.74 12SK7GT	.74		
5V4G	.98 6J5	.60 12SL7GT	1.00		
5Y3G	.54 6J5GT	.60 12SN7GT	.92		
5Y3GT	.44 6J6	1.00 12SQ7GT	.64		
6AR4	.80 6K6GT	.64 12SG6G	2.40		
6A6S	.90 6L6G	1.25 19CR	1.28		
6AK5	1.66 6L6GA	1.42 25BQ6GT	1.36		
6AK6	.94 6A4	.68 25L6GT	.68		
6AL5	.72 6A7GT	.74 25Z5	.66		
6AQ5	.80 6S7	.66 25Z6G	.54		
6AQ6	.76 6K7	.66 35A5	.72		
6AR5	.66 6SK7GT	.66 35L6GT	.68		
6A55	.84 6SL7GT	.98 35L6GT	.68		
6AT6	1.28 6W6GT	.88 35W4	.80		
6AU6	.62 6V6GT	.60 35Z5GT	.50		
6AU7	.88 6T8	1.16 50B5	.50		
6AV6	.62 6V6GT	.80 50C5	.80		
6B4G	1.28 6W6GT	.74 50L6GT	.68		
6BA7	.76 6W6GT	.88 117L7	1.56		
6BA7	1.00 6X4	.62 117Z3	.62		
6BC5	.80 6X5GT	.62 117Z6GT	1.00		
6BE6	.76				

Concord Radio

55 Vesey Street. Phone
 New York 7, N. Y. Dlgy 9-1132

the performance of a multi-outlet installation. Consequently, we can consider this as an ideal testing area.

In this section the individual channel amplifier and mixer combination affords greater versatility. Individual amplifiers tune to specific channels and amplify only those signals that require amplification. Strong signals are not amplified (and for some installations must be attenuated) and, therefore, are not permitted to reach overload levels. Here is a definite aid in overcoming adjacent channel interference. A wide-band amplifier would only accent adjacent channel spill-over and intermodulation because of over-amplification of strong local signals.

In a typical installation, Fig. 1, a *Blonder-Tongue* MA4-1-M was used. This unit will accommodate four individual channel amplifiers. The most consistent New York channels are 2, 4, and 5 and individual amplifiers were used for these channels. A Channel 10 amplifier occupied the fourth position because it is the weakest local channel.

Two antenna arrangements were employed, each performing satisfactorily. In the first plan, Fig. 4A, a compromise low-band yagi was used to receive New York Channels 2, 4, and 5 and a separate conical type for local channels. The yagi was applied to the Channel, 2, 4, and 5 amplifiers; the conical to the Channel 10 amplifier and the wide-band antenna input of the mixer. The strong local Channels 3 and 6 signals entered the mixer at this point and consequent attenuation reduces their levels to safe interference limits. The mixer output feeds the distribution system. Weak signals have been strengthened; strong ones, retarded. Thus, from this point conventional wide-band amplifiers can be used to maintain distribution signal levels. In areas where there are fewer stations, a separate and peaked antenna could be used for each weak station and, it is apparent, the individual channel amplifiers afford maximum antenna versatility.

The same plan can be used for a two-receiver home installation. Just a single "Directronic" antenna was used to supply the signal to the four channel amplifier (2, 4, 5, and 10), Fig. 4B. The wide-band antenna input of the mixer was not used. Instead, by properly connecting a jumper on the mixer, the wide-band antenna input circuit can be used as a second output and two receivers in the house were supplied with all signals and no interaction. It is important to realize that the Channel 3 and 6 signals entered the mixer at a useful level via the Channel 2, 4, and 5 amplifiers.

The advantages of the second plan insofar as a dwelling is concerned are single simple antenna installation and two-receiver feed without any additional equipment. Disadvantages are that "Directronic" switching is required as the switch must be set properly for either New York or Philadel-

Columbia
GEM OF THE SURPLUS

WALKIE TALKIE
 Long range, 9 tube s, portable transceiver. Crystal control. Freq. 3,000-6,500 kc. Metal carrying case. Complete, ready to operate with collapsible antenna. 5 PM mike-speaker, all tubes and batteries. New. **\$125.00 PER PAIR**

DYNAMOTORS 6 & 12 V.
PE-73: 24 V. in. 1,000 V. out. @ 350 ma. Used, good cond. \$ 5.95
PE-101: 12 or 24 V. in. 400 V. @ 130 ma output. See Dec. '52 CQ for conv. to 6 VOLTS. New boxed. 4.95
BD-77: 12 V. in.; 1,000 V. out. @ 350 ma. 14.95
COMMAND RECEIVER DYNAMOTOR: 12 V. used 7.95

WET CELL BATTERIES
 24 V. EXIDE AIRCRAFT. New, orig. box. \$15.95
 12 V. 27 amp @ 5-hr. rate. NEW 12.95
 6 V. 13 amp @ 10-hour rate. New 6.95
 4 V. For TBY Transceiver. NEW. HOT! 4.95

ADJUSTABLE 2-METER TANK COIL: Can also be used for parallel lines. Silverplated. Approx. freq. range 100-200 MC. Will handle a full kw. Excel. cond. SPECIAL \$4.95

TUBES! NEW! GUARANTEED!
 832-A .. \$8.50 6L6M .. \$1.50 3AP1 .. \$7.95
 829-B .. 7.95 2AP1 .. 7.95 807 .. 1.35

APN-1 TRANSCEIVER
 For 420-440 A-1 band for ham or citizens' band. With tubes & schematic. Excel. cond. **\$17.95**

STOP! Make extra dough NOW by rushing us your new and used radio gear. We buy it fast at peak-high prices. WRITE TODAY! We will meet and beat any bid!

ARC-5 OR 274-N TRANSMITTERS
 2-1-3 mcs. \$19.95
 4-5-3 mcs. Used, good cond. 24.50
 5-6-7 mcs. 5.50
 7-9-1 12.50

ARC-5 OR 274-N RECEIVERS
 19-55 kc. Excel. cond. \$14.95
 1-5-3 mcs. Brand new 24.50
 4-6 mcs. Less tubes 8.95
 3-4 mcs. With tubes 9.95
 0-9-1 mcs. Excel. cond. with tubes 14.95
 0-9-1 mcs. Used. Less tubes 8.95

MD-7 ARC-5 PLATE MODULATOR. Excel. cond. 14.95
RACK FOR DUAL TRANSMITTER (274-N) 2.95
RACK FOR DUAL TRANSMITTER ARC-5 3.95
TRIPLE RECEIVER RACK 5.00
DUAL RECEIVER CONTROL BOX, BC-106. New 2.95
BC-442-A ANTENNA RELAY with 50 mcs. cond. Excel. cond. 3.95
COMMAND RECEIVER FLEX CABLE. 0-1-2 mcs. 2.95
12 V. COMMAND RECEIVER DYNAMOTOR, NEW 12.95

BC-625 TRANSMITTER: Part of SCR-522. Freq. 100-150 MC. Less tubes. A **\$13.95**
HOT BUY!
BC-624 RECEIVER: Part of SCR-522. Freq. range 100-150 MC. Less tubes. **\$19.75**
TELETRIC THE PAIR ONLY \$29.95

ARC-4 VHF TRANSCEIVER: For police, 2-meter, Ct. or CAP. All tubes. Excellent cond. SPECIAL. **\$32.50**
 All orders F.O.B. Los Angeles. 25% deposit required. All items subject to prior sale.

COLUMBIA ELECTRONIC SALES
 522 South San Pedro St. Los Angeles 13, Calif.

TELEPHONE EQUIPMENT & PARTS

New TW handsets with Flip switch in handle. Each **57.00**
 New W.E. FIW handsets with cord & PL-47 plug. Each **7.00**
 Reconditioned TR9 handsets with 3 Cond. Cord. Each **4.95**
 C-191 repeat coils. Each **3.50**
 New HM29A remote control units export packed. Each **16.00**
 Desk telephones with dial & ringer box. Complete **9.00**
 ERB field telephones reconditioned in stained leather bags & tested. Each **20.00**
 New transmitter and receiver units, like & interchangeable with WECO HA1 & P1. Each **1.25**
 Reconditioned Sound power Army field telephones. Each **25.00**
 Corus 2 cond. w/Alligator clips 6 Ft. Each **.60**
 New C-158 holding coils. Each **.50**
 New Kellogg R2A induction coils. Each **.75**
 New 4 1/2 foot rubber cords W/PL-47 plug. (Rubber jackets) Each **.75**
 Keys, Lock, make and break positions, each strip contains 10 complete. Each **7.00**
 WECO 20 line Jack strips 275-217A mtg. #60-70 per strip. Each **9.00**
 Reconditioned operators' head & chest sets. H.S. 10. Each **5.50**

Terms: Check with order—F.O.B. Brooklyn 5, N. Y.
EASTERN TELEPHONE CO.
 323 Vanderbilt Avenue Brooklyn 5, N. Y.

phia reception. Also, New York signals do not receive the benefit of the full antenna gain obtained with a yagi-type antenna.

To amplify more than four channels, a second mixer amplifier can be connected in series with the first mixer, Fig. 4C. For this area it was expedient to insert Channel 7, 9, 11, and 13 amplifiers into the second mixer. These are the most inconsistent stations because of erratic signal levels which vary widely due to weather conditions. Daytime reception is not possible in most of the area. Evening signals vary from very poor to quite good. However the second mixer furnishes fairly good reception of these stations in the evening.

For a single dwelling installation two antennas are advisable in order to make full use of the high-band signals when levels rise—a "Directronic" can be used for Mixer #1 (as discussed previously) and a modified stacked yagi for the New York high-band channels to be introduced via the second mixer. In a multi-outlet system serving a number of families, the most practical plan is to use a low-band yagi for Channels 2, 4, and 5; a stacked high-band yagi for Channels 7, 9, 11, and 13; and a conventional conical for local reception.

In summary, the examples given demonstrate the versatility of the channel amplifier-mixer combination in reducing the problem of distribution in areas where there are numerous stations with great variations in signal level.

CODE PRACTICE

By DR. T. H. LIPSCOMB, W4RTJ

WSC and WSL send out nightly (at 2318 WEST) weather, baseball scores, political information, and human interest news at a rate of approximately twenty-five words-per-minute.

I have recently recorded some of this material at seven and one-half inches-per-second on tape and play it back at just half this speed. This gives twelve and one-half words-per-minute of straight matter at a speed which is ideal for code practice required for the "Amateur Conditional" and "General Class" licenses.

This same material could equally well be recorded at 78 rpm on discs and played back at 33 1/3 or 45 rpm.

The table below lists the times, calls, and frequency of broadcasts which are suitable for obtaining this code practice material.

Stations transmitting code signals.

TIME (EST)	CALL	FREQ. (kc.)	ORIGIN	SPEED
11:18 p.m.	WSC	125	N.J.	25
		6350		
		8430		
		11,175		
11:18 p.m.	WSL	5555	N.Y.	25
		11,115		
		6270		
1:05 a.m.	KFS	12,550	Calif.	25
3:10 a.m.	KPH	126	Calif.	25
		6370		
		8440		
		12,735		
12:00 noon	DZM	8670	Manila	25 ¹

¹ "Learning the Radiotelegraph Code," ARRL

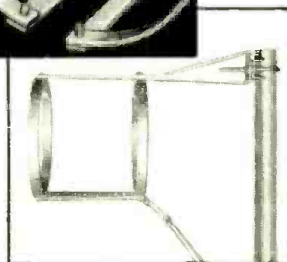
THE PLUS VALUE ANTENNA for perfect ULTRA VISION TV!

Rytel

DOUBLE "O" UHF ANTENNA



UHF stations are springing up all across the country. Demand is terrific. Start right with a performance antenna that can't give you "customer headaches."



SIMPLICITY . . . NO ELECTRICAL OR MECHANICAL BREAKDOWNS

The facts: high signal-to-noise ratio. Here is why. The Double-O antenna has high directivity along horizontal planes, acts like a wall in blocking noise from vertical sources and cancels out at the feed point all noise and multipath reflections. In addition, 2-circle antennas fed 90° out of phase with a gain of 3.8 db, plus 1 db gain over a single dipole in each of two circles, give an overall gain in forward direction of 5.8 db. Result . . . low noise, high gain . . . Perfect Vision.

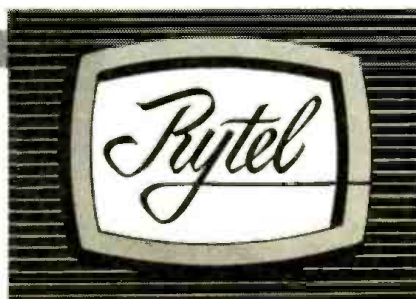
PLUS ECONOMY . . . simple, tough aluminum construction means low price, no maintenance, long life.

PLUS RUGGED CONSTRUCTION . . . simplicity of design avoids fragile, expensive insulators, no chance of electrical or mechanical breakdown. Supported at current node (ground potential).

PLUS APPEARANCE . . . no more monstrosities on the roof . . . just simple, attractive . . . perfect Double-O.

PLUS INSTALLATION . . . no more "servicemen's nightmares" . . . Double-O is a serviceman's dream . . . comes completely assembled, just a "U" clamp to tighten, no "adjustments."

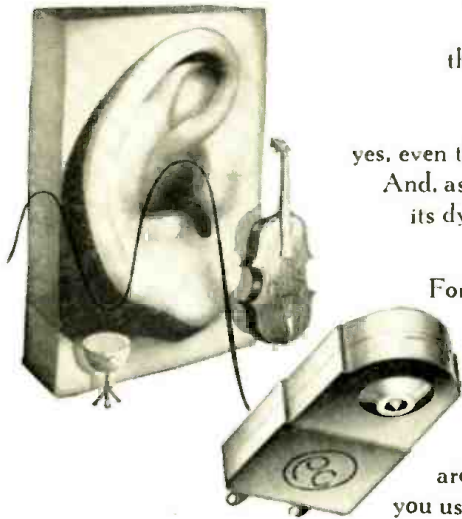
It's the DOUBLE-O for PERFECT ULTRA VISION . . . ACT NOW
AND BE READY WITH A UHF ANTENNA THAT
NEEDS TO BE SOLD JUST ONCE.



RYTEL ELECTRONICS MFG. CO.
9820 Irwin Avenue • Inglewood, California

Also connector clips, impedance matches, tube reactivators, tube-pullers, etc. Over 800 Rytel distributors in the United States. Write for further information.

"For those who can hear the difference"
Listen...



it comes to you
 in the subtle shading of a piano . . .
 in the clean brilliance of violins,
 the purity of a flute. Your ear detects
 the sweet mellowness of cellos,
 the roundness of a clarinet . . .
 yes, even the iridescence of clashing cymbals.
 And, as the symphony swells to crescendo,
 its dynamic energy adds a flood of color
 to your musical canvas.

For those who can hear the difference,
 these are the elusive pleasures
 that often remain hidden
 in the grooves of fine recordings.

These are the thrilling
 new listening experiences that
 are released for your enjoyment when
 you use quality components by Pickering.

PICKERING and company, incorporated

Pickering High Fidelity Components are available through leading Radio Parts distributors everywhere; detailed literature sent upon request. Address Department C-1

Oceanside, L. I., New York



INSURANCE
 against KICKBACKS
 because of
NOISY
CONTROLS

Your guarantee for quieting noisy television and radio controls, switches and other moving parts is QUIETROLE . . . the original, quality lubricant-cleaner. There is no substitute for "real insurance" to satisfy your customers.

In 3 sizes
 2 oz., 4 oz., 8 oz.

Carried by recognized jobbers . . . everywhere.



manufactured by
QUIETROLE
COMPANY
 Spartanburg, South Carolina

COMPETITORS*

Team Up to Bring You One
 Great Electronics Firm
 Geared for Greater Values!

LOOK AT THESE BUYS!

- PROP-PITCH MOTORS, new, original boxes . . . \$17.95
- MICRO SWITCHES, new . . . 29c ea. 4 for 1.00
- RC-42 ANTENNA MOTOR & REEL, 24 V., DC, new . . . 5.95
- DM-53AZ DYNAMOTORS, 12 V. Input (for RC-733D) . . . 9.95

Special Value Combination!
954 ACORN TUBES & SOCKETS
 Brand New **29c** per set or buy **4** sets **\$1**

- METER SPECIAL O-1 MA METER, 2" round, new, boxed . . . \$3.95
- ARC-4 complete with tubes, less dynamotor. Excellent condition . . . 29.50
- LIP MICROPHONES, MC-419, brand new98
- TUNING KNOBS, slotted postpaid59 ea.
- TELEPHONE HANDSET HANGERS, postpaid1.98

POWER TRANSFORMERS
 110 V., 60 cy. primary.
 150 V., 30 MA secondary. **79c** ea.
 6.3-1 Amp. Fil.
 PB for grid dip kits, test equipment, etc.

New Partnership Will Pay More Cash for Your Equipment!

Get what you want for your radio equipment without red tape or haggling! Fast action—and no kick-backs! Write today!

HARJO SALES CO.

* Formerly CANDEE-AIRCO combined with ALVARADIO SALES CO.
 4109 BURBANK BLVD.,
 P.O. Box 1187 Magnolia Park Station
 BURBANK, CALIFORNIA
 Phone: RÖckwell 9-1070

What's New in Radio

(Continued from page 86)

company's "Sensicon" circuit with "Permakay" filter and employs 21 tubes (only 5 types, however, for economy in maintenance). The transmitter, which has a nominal power output of 20 watts, uses 9 tubes.

HIGH RATIO CONDENSER

Johanson Mfg. Corp., Boonton, N.J. is marketing a new concentric high-ratio condenser with a range of 1 μ fd. to 35 μ fd.

Designed for low minimum capacity, high "Q", applications, it has been used successfully in ten-channel transceivers. A friction spring locks the rotor to insure stability. Constructed of silver-plated brass and Pyrex glass, it operates well at the higher frequencies.

OVAL RESISTORS

Milwaukee Resistor Co., 700 W. Virginia, Milwaukee 4, Wis. is producing a new line of oval-type wirewound resistors to provide higher wattage ratings in small areas.

The resistors are currently available in 10 watt ($\frac{3}{8}$ " x $\frac{3}{4}$ ") and 15 watt



($\frac{3}{8}$ " x 1") sizes. Spacers attached to ends of aluminum mounting strips permit easy stacking and better heat conduction.

HIGH-SPEED CONDENSER

A butterfly-type variable condenser capable of continuous operation at speeds as high as 3200 rpm is available from Hammarlund Mfg. Co., Inc., 460 W. 34th St., New York 1, N.Y.

Units are available with series effective capacity values ranging from 5.4 to 17 μ fd. nominal. Air gap between plates is .030" nominal. Outside dimensions of each silicone-treated steatite base are 1 $\frac{3}{8}$ " x 1 $\frac{3}{8}$ ".

PORTABLE TAPE RECORDER

A battery-powered portable tape recorder with spring-wound motor, the "Broadcaster Model 610-SD", is now available from Amplifier Corp. of America, 398 Broadway, N.Y. 13, N.Y. Measuring only 11 $\frac{1}{2}$ " x 10" x 7 $\frac{1}{2}$ ", the unit weighs 15 lbs. with batteries. It operates at 7 $\frac{1}{2}$ inches-per-sec., furnishing 15 minutes of playing time on

a 5" diameter, 600-foot reel of tape. A single-track head with double-gap is used. Recordings may be played back on any a.c.-operated studio unit at equivalent speed.

ENGINE FOR MODELS

Production is underway at the Herkimer Tool and Model Works, Inc., Herkimer, N. Y. on a new class A



engine designed for radio-controlled model plane operation.

The "OK Cub .14" weighs only 2 3/4 ounces but will carry sturdy radio equipment even in bumpy air. The company points out that the FCC now allows any model fan to fly his ship by radio control on the Citizens band (27.522 or 465 mc.) with approved equipment by just filing a registration form with the Commission.

"META-GUN"

A volt-ohmmeter in gun form has been introduced by Jersey City Technical Lab., 880 Bergen Ave., Jersey City 6, N.J. for radio and TV service work.

It has a built-in light, a flexible probe for reaching test points, and a trigger range selector. All work can be performed with one hand. The Model



3A has 1000 ohms/volt sensitivity and the Model 3B 20,000 ohms/volt sensitivity. The gun measures 5 1/2" x 8" x 3", operates on four self-contained pen-light cells, and weighs just 2 lbs.

MOBILE CONVERTERS

Radio Manufacturing Engineers, Peoria, Ill., a division of Electro-Voice has release three new mobile converters for hams.

The MC-55 is a five-band model covering the 10-11, 15, 20, 40, and 75 meter bands. The Model MC-53 is a three-band converter for 2, 6, and 10-11 meters. The Model MC-57 is a three-

ORDER BY MAIL FROM WHOLESALE RADIO

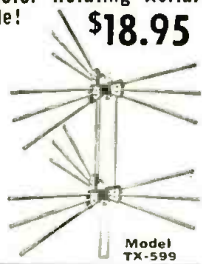
Low Prices • Complete Stocks • Fast Shipments

All Directional TV AERIAL

Same Clear Pix as Motor Rotating Aerial Systems Costing Triple! **\$18.95**

FOR FRINGE AREA

COMPLETE with three 3 1/2 ft. masts, 75 ft. 3 cond. cable, beam selector sw., guy rings and mounting base. Electronically beams complete 360° rotation to give clear pix on all elements. You choose direction with electronic selector sw. installed on or near TV set. Complete double stacked array with 18 hi-tensil double alloy aluminum elements. AX-599 same as TX-599 less masts, guy ring & mtg. base. **\$16.95**

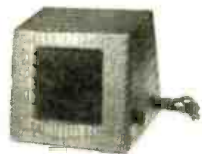


Model TX-599

New! Sensational, Sound AMPLIFIER

COMPLETE WITH TUBES & SPEAKER. **\$9.50**

Nearly everyone has a use for this sensational new amplifier. Use with all speed record players and eliminate special wiring and hookups to radio or TV. Use with FM tuner. Use a pair with microphones as intercom. Use for parties, meetings, baby minder, etc. Full range volume control with on-off switch. 5" Alnico 5 PM speaker. Input jack for phone or mike. Attractive cabinet covered in simulated alligator leather. 7 1/2" x 6 1/2" x 6" d. Complete with tubes: 6X250T, 6AU6GT, 12SQ7, AC or DC 105-120 V., 25-60 cycles. Wt. 2 1/2 lbs. Order Model S-311.



TV ANTENNA ACCESSORIES

- STEEL EXTENSION POLES. Weather treated.
 - 10 ft. long, 1 1/2" d. Straight ends. **\$1.95**
 - 5 ft. long, 1 1/2" d. Crimped ends. **1.39**
- CHIMNEY MOUNT BRACKETS.
 - CM-100 Complete with strap. Pr. **1.59**
- ANTENNA SWIVEL BASE. Aluminum.
 - 2 1/2" O.D. mast section. **.39**
- GUY WIRE. 0 stranded #20.
 - 50 Feet. **.39**
 - 21 Impregnated 50 ft. reels. 1200 ft. **6.00**
- 300 OHM TWIN LEAD.
 - Per ft. 21 g. 100 ft. **\$1.95** 1000 ft. **17.50**
- DOUBLE POLE DOUBLE THROW KNIFE SWITCH. **.45**
- RMS LIGHTNING ARRESTOR. Model LA-3.
 - Standard or open 300 ohm line. UL approved. **.59**
- ANTENNA WALL MOUNTS.
 - PAM-1 for poles 1 1/2" d. 6" from mast to wall **1.15**
 - PAM-4 for poles 1 1/2" d. Up to 12 1/2" from wall **1.89**
 - PAM-B for poles 3/4" d. 1 1/2" d. Adj. 1" to 10" from wall **3.45**

Address Orders to Dept. RN-2

WHOLESALE RADIO PARTS CO., Inc.

311 W. BALTIMORE ST., BALTIMORE 1, MD.

Immediate Shipment!

UHF YAGI TV ANTENNAS

Hi-tensil aluminum elements. **\$4.95**
For all UHF channels

We Have Complete Line! EICO KITS!

5" SCOPE! PUSH-PULL DEFLECTION
High sensitivity and response for precise servicing of TV, FM and AM receivers. Push-Pull amplified vertical and horizontal amplifiers. Boosted sensitivity. .05 to .1 rms volts/inch. Useful to 2.5 mc TV type multi vibrator sweep circuits. 15 cps-7.5 kc. 2-axis intensity modulation feature. Dual positioning controls move trace anywhere on screen. Complete with tubes including CRT. 3-color etched rub-proof panel; rugged steel case. 1 1/2 x 8 1/2 cycle **\$44.95**
8 1/2 x 17 1/2 x 17 Model 425K Model 425K Model 425K



Model 425 Factory wired—\$79.95

OTHER FAMOUS EICO KITS!

	KIT	WIRED
RF Probe Kit for 'Scope	P76K	\$ 3.75 P-76 — \$ 5.95
Tube Tester	425K	24.95 025 — 49.95
VTVM	214K	25.95 221 — 49.95
VTVM with 7 1/2" meter	214K	34.95 214 — 54.95
RF probe for VTVM	753K	3.75 P-75 — 5.95
RV probe	RVPL	6.95
RC Bridge & RCL Comparator	950A-K	19.95 930A — 29.95
20,000 Ohms/volt Multimeter	565K	24.95 565 — 29.95
As above with 1 1/2" precision resistor	555K	29.95 555 — 34.95
1000 Ohms/volt multimeter	566K	14.90 566 — 18.95
Same as above with 100 precision resistors	556K	16.90 556 — 23.50
1000 Ohms/volt multimeter. Ranges 0-1V up to 0-400V	536K	12.90 536 — 14.90
As above with 1 1/2" precision resistors	526K	13.90 526 — 16.90
Voice ohm meter	511K	14.95 511 — 17.95
RF Signal Generator	320K	19.95 320 — 29.95
RF Signal Generator	322K	23.95 322 — 34.95
Deluxe RF Sig. Generator	315K	39.95 315 — 59.95
TV-FM Sweep Generator	360K	34.95 360 — 49.95
Sine & Square Wave Audio Generator	377K	31.95 377 — 49.95
Multi-Signal Tracer	145K	19.95 145 — 28.95

GE REPLACEMENT STYLI

	Single Speed	
RP1-001 Sapphire, .0025		\$ 2.10
RP1-002 Diamond, .0025		16.50
RP1-003 Diamond, .003		16.50
RP1-004 Diamond, .001		2.10
RP1-005 Sapphire, .001		2.10
RP1-006 Sapphire, .0025		2.10
Assemblies for Triple Play		
RP1-007 Sapphire, .001 & .0025 comb.		\$ 3.57
RP1-010 Sapphire, .001 & .003 comb.		3.57
RP1-011 Diamond, .001 & .0025 comb.		29.97
RP1-012 Diamond, .001 & .003 comb.		29.97
RP1-013 Diamond, .001, Sapphire, .003.		18.60

Write for Free FYI Bulletin

THE MARCH ISSUE

of
RADIO & TELEVISION NEWS

Will Be on Sale Feb. 24

Be Sure to Reserve Your Copy Now!

New Electronic Headquarters— VAN SICKLE RADIO SUPPLY CO.

1320 So. Calhoun St. Phone E-4136

FORT WAYNE 2, IND.

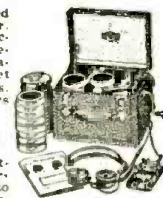
Please note new address. Eugene Van Sickle, Owner

EASY TO LEARN CODE

It is easy to learn or increase speed with an Instructograph Code Teacher. Affords the quickest and most practical method yet developed. For beginners or advanced students. Available tapes from beginner's alphabet to typical messages on all subjects. Speed range 5 to 40 WPM. Always ready—no QRM.

ENDORSED BY THOUSANDS!

The Instructograph Code Teacher literally takes the place of an operator. Instructs and enables anyone to learn and master code without further assistance. Thousands of successful operators have "acquired the code" with the Instructograph System. Write today for convenient rental and purchase plans.



INSTRUCTOGRAPH COMPANY

4711 SHERIDAN ROAD, CHICAGO 40, ILLINOIS

STAN-BURN SPARKS

ANTENNAE SPECIALS

DOUBLE V 3/8"	1-11	12 or more
DOUBLE V 1/2" Dowel	52.98	52.20
DOUBLE V 1/2" Dowel	3.45	2.45
10 Element Conical 3/8"	3.95	2.95
10 Element Conical 3/8"	3.55	2.55
Folded Hi Straight Low Quick Rig		
4/8 elements	4.25	3.25
WINDOW CONICALS	4.95	3.75
5 FOOT SWEDGED MASTS		
10 FOOT PLAIN	.79	.69
TV WIRE	1.39	1.29
42 Mil.		\$ 9.95 M Ft.
55 Mil. 300 OHM		14.95 M Ft.
72 OHM COAXIAL		45.00 M Ft.

CATHODE RAY TUBE SPECIALS

Standard Brands—Unconditionally Guaranteed			
G. E.			
5TP4	\$43.55	21EP4A	\$37.35
7JP4	18.15	24AP4A	73.20
SHELDON			
10BP4A	18.35	10BP4A	14.30
10FP4A	24.40	12LP4A	17.80
12KP4A	27.50	14BP4A	20.35
12LP4A	21.40	15DP4	22.55
12UP4B	27.10	16FP4	24.85
14CP4	22.60	16EP4A	24.85
14EP4	18.45	16DP/HP4A	24.85
16AP4A	29.10	16JP4A	24.85
16DP4A	26.65	16LP4A	24.85
16GP4	27.85	16KP4A	24.85
16KP4	25.25	17BP4	26.05
16RP4	23.90	19DP4	28.50
17CP4	23.90	19AP4	30.80
19AP4A	34.80	20CP4	30.80
20CP4	35.45	21EP4	32.45
20LP4	36.95	16EP4A	Rauland 42.00

CHASSIS 630 REGAL with Cascode Tuner. \$149.50
OPEN FACE CABINET 42.00

SPECIALS

4 Prong Vibrators, each	\$ 1.29
Lots of 12 or more	1.19
12" Heavy Slug Speaker	Special 4.98
Audio Devices, Discs and Scotch Tape in Stock	
Audio Plastic Food Oxidize Plastic tape—	
Half-hour special	\$2.30
One-hour special	\$3.30
WIRE RECORDERS IN STOCK	
WILCOX GAY—Model 2210	\$ 89.97
PENTRON—Model 9T3C—2-speed Tape Re-	
order	Net 134.50
RADIO CRAFTSMAN	
Model RC2—HiFi Amplifier	Net 42.89
Model RC10—AM-PM Tuner	Net 130.84
Model CS—Williams Amplifier	Net 99.45

AUTHORIZED DISTRIBUTORS for General Electric, Kenrad, Tung-Sol, National Union, De Wald, Reuland, Automatic and General Motors.

We carry a Complete line of HI-FIDELITY and sound equipment. Send us your requests. We also carry a complete line of popular makes of Radio and TV tubes at 50% discount. Also many other special purpose and transmitting types, and all electronic parts and equipment at lowest prices. Send us a list of your requirements for prompt quotations. Terms: 20% with order. Balance COD. All prices FOB. NEW YORK Warehouse. Minimum order \$5.00. Write for our latest price list to Dept. RN-2

STAN-BURN RADIO and ELECTRONICS CO.
(C.B.S. THEATRE BLDG.)
1697 BROADWAY • NEW YORK 19, N.Y.

band unit covering 10-11, 20, and 75 meter bands.

All models have edge-lighted dials, side-knob tuning through a 25:1 worm gear drive, individual slug-type coils for each band, three-gang tuning, four tuned i.f. circuits, and an output frequency of 1550 kc.

Bulletin #169 covering all of the company's converters is available on request.

PENCIL SOLDERING IRON

A pencil-type soldering iron for precision applications has been introduced by *The Lenk Mfg. Co.*, 30-38 Cummington St., Boston 15, Mass.

Available in either 25 or 40 watt sizes, the new tool weighs 2 ounces, measures 7 1/2" over-all, and comes equipped with a 1/8" dia. tip. The handle is of plastic.

5-INCH SCOPE

Electronics Measurements Corp., 280 Lafayette St., N. Y. 12, N. Y. is offering a new 5" service scope, the Model 600.

The vertical amplifier has a wide band and can be used up to 5 mc. A two-speed attenuator input is available. Synchronization is available on either positive or negative phase of input voltage through the vertical amplifier or from an external source.

RECTIFIER TESTER

Jackson Electrical Instrument Co., 18-46 S. Patterson Blvd., Dayton 2, Ohio has developed an instrument for testing all radio and television selenium rectifiers rated from 20 to 650 ma.

The Model 710 operates on 110 to 125 volts a.c. and has a variable indicated voltage range of 25 to 300 volts a.c. Use of the instrument is simple. After the load and voltage indicators are set and the line voltage adjusted, the test lead clips are placed on the rectifier terminals, the correct

meter range is selected, and test switch pressed. The "Good-Bad" dial shows the condition of the rectifier and indicates life expectancy.

TRANSISTOR SOCKETS

Transistor sockets are now available in limited quantity from *Mycalex*



Tube Socket Corp., 60 Clifton Blvd., Clifton, N.J.

Contacts can be supplied in brass or beryllium copper. The sockets, the "Mycalex 410", are readily solderable and will not warp or crack when subjected to high soldering temperatures.

NEW ELECTROLYTICS

Aerovox Corp. of New Bedford, Mass. has introduced a new series of twist-prong base electrolytics for filtering in selenium rectifier circuits.

The Type AFHS series has been especially designed for this service with provision being made for handling the high ripple currents found in selenium rectifier circuits.

CONNECTOR KIT

Elco Sales Co. is now offering a "Varicon" miniature connector kit through its jobber outlets.

The new kit contains all parts needed to assemble the company's miniature connectors. Detailed instructions accompany each kit of components.

-30-

Regency

LARGEST SELLING BOOSTER

at any price!

International Short-Wave
(Continued from page 65)

closedown. (Ridgeway, South Africa)

Brazil—The new *Radio Cultura* outlet, ZYR57, 9.745, Sao Paulo, can be heard best on Mon. when HCJB, Quito, Ecuador, is absent from that channel; noted with identification 2300. (Niblack, Ind.) Wants reports to Av. S. Joao 1285, Sao Paulo, Brazil. (Villela, Md.) The Brazilian which tested some time ago on 11.855 was an experimental transmitter, PRB4, *Radio Club de Santos*, Rua Jose Cabalero 60, Sao Paulo, Brazil. ZYR63, *Radio Emissora de Piratininga*, Praca do Patriarca 26, Sao Paulo, Brazil, operates on 6.025, 50 kw., 0400-2300. (Serrano, Brazil, via Radio Sweden)

Radio Nacional, Rio de Janeiro, is scheduled in Portuguese 0345-1500, 1800-2310 on 9.720; 1703-1937 on 15.295; Spanish at 1400-1420; by this time should also have a service in *English*. (WRH) ZYK3, 9.565, noted 1705 in Portuguese. (Tonsi, Wisc.) ZYR59, Sao Paulo, *A Voz de Sertas*, is noted on 3.338 at good level 1830-2100. (Ridgeway, South Africa) PRLA, 9.770, Rio de Janeiro, noted with *English* session 1700-1800 recently. (Sutton, Ohio)

British Honduras—*Radio Belize* on announced 4.950 can be heard occasionally in USA with weak to fair signal, much CWQRM and aircraft phone QRM, around 1830-1904A sign-off. Uses *English*. (West, Va., others)

Bulgaria—*Radio Sofia*, 7.671, announces *English* for Europe now 1345-1400, 1600-1630 on this channel parallel with 6.070; for North America 2000-2030, 2300-2315 on 9.700 (is slightly lower). (Pearce, England) Noted on 9.700A with good level in the 2000-2030 period. (Lund, Iowa)

Canada—VE9AI, 9.540, Edmonton, Alba., noted at fair level 1845; at 1900 announces for medium-wave CJCA. (Brown, N.Y.) Calgary, 6.030, Alberta, has good signal around 1400; announces "The Voice of the Prairies"; power is listed 100 w. (Gaylord, Washington State) CBNX, 5.970, St. John's, Newfoundland, noted to 2235 sign-off; is in the clear after 2230 when H14T signs off. (Machajewski, N.Y.)

Cape Verde Islands—CR4RA, 7.112, Praia, noted 1515 with call in Portuguese. (Pearce, England) And signing off 1700. (Saylor, Va.)

Ceylon—*Radio Ceylon* sent these current schedules—*Commercial Service*—2045-0230, 15.120, 100 kw., *English* to India, Pakistan; 0730-0830, 15.120, 100 kw., Urdu, Hindi (VOA relay) to India, Pakistan; 0844-1145, 11.975, 100 kw., *English* to India, Pakistan; 2045-0230, 7.190, 7.5 kw., *English* to India, Pakistan; 0630-1145, 7.190, 7.5 kw., Hindi (0630-0830), *English* (0830-1145) to India, Pakistan; 0015-0130, 17.820, 7.5 kw., *English* to Africa; 0415-0615, 17.820, 7.5 kw., *English* to Southeast Asia; 0630-0845, 11.975, 7.5 kw., Hindi to

SEE LEO FIRST FOR . . .

hallicrafters

I can SAVE you money . . . Liberal Trade-ins



SPECIAL NOTICE—NEW SX-73 NOW AVAILABLE AND IN STOCK — \$975.00



\$179.50

S-76 RECEIVER

Extra selectivity with double superheterodyne circuit. One RF, two conversion and 3 IF stages. Range 550-1550 Kc, 1.7-34 Mc in four bands. 8 tubes plus voltage regulator and rectifier. Complete with tubes, less speaker.



\$224.50

SX-71 RECEIVER

Double Conversion sharp selectivity, plus built-in NBFM at moderate cost. 11 tubes plus voltage regulator and rectifier. Low down payment.

NAME YOUR TERMS • LOW DOWN PAYMENTS • PERSONALIZED SERVICE

HALLICRAFTERS RECEIVERS AVAILABLE FOR IMMEDIATE SHIPMENT

S-81	\$49.50	S-40B	\$119.95	ST-83	\$129.95
S-82	\$49.50	S-53A	\$ 89.95	S-78A	\$ 89.50
A-84	\$99.50	S-72L	\$119.95	SX-62	\$299.50
S-38C	\$49.50	S-77A	\$119.95	S-72 Portable	\$109.95
R-46 Speaker	\$19.95	HT-20 XMTR	\$449.50		

Famous WRL RADIO REFERENCE MAP 25c



CU on 10-20 & 75 Meters

NEW LOG BOOK 25c

For mobile or fixed station. Spiral binding. Full column log listing all FCC required info. Will accommodate 1,325 stations. "Q" signals, phonetic alphabet, amateur international prefixes.

PHONE 7795

WRITE—WIRE



IT'S NEW! IT'S FREE! WRL 1953 CATALOG

Send for your copy today. Contains everything new in radio and television. Jam-packed with bargains. Leo I. Meyerson, WØGFO



Send For FREE Copy

WORLD RADIO LABORATORIES
744 West Broadway
Council Bluffs, Iowa

R-2

Please send me:
 Radio Map
 New Catalog
 Used Equipment List

SX-71 Info
 S-76 Info
 New Log Book

Name
Address
City..... State.....



- 1220 pages
- 80,000 items
- 8,000 illustrations
- 8" x 11" — 5 lbs.

publisher's price \$6.50—your price through your regular parts distributor **\$1.95**

The right part when you need it for service

This permanent, hard cover Official Buying Guide of the electronic-TV parts and equipment industry with its comprehensive detailed index, eliminates the need for maintaining files of small catalogs and manufacturers' literature. RADIO'S MASTER catalogs 90% of TV and electronic equipment. Not merely part number listings—complete descriptions, specifications and illustrations written and compiled by each manufacturer. Enables you to make comparisons or substitutions right now!



UNITED CATALOG PUBLISHERS, INC.
110 Lafayette St., New York 13

Sensational Performance!

MATTISON

SILVER ROCKET 630 CHASSIS

• with **TUNEABLE** •

**BUILT-IN BOOSTER
for Better DX Reception**

*Featuring **NEW CASCODE TUNER**
made for UHF interchangeable
tuning strips and 70° **COSINE YOKE**

Tube
Complement:
28 tubes
3 rectifiers
1 CRT

32



All Channel Booster

• Broad band single knob control pre-amplifier built in to eliminate long leads which may cause regeneration and attenuation of signal.

• **ONLY THE MATTISON 630 CHASSIS HAS AN ALL CHANNEL TUNEABLE BUILT-IN BOOSTER THAT INCREASES SIGNAL STRENGTH UP TO 10 TIMES. THE SILVER ROCKET WILL OUT-PERFORM ANY CHASSIS MADE AND IS PRICED RIGHT TO SELL FAST WITH**

AN EXTRAORDINARY MARGIN OF PROFIT FOR YOU. WRITE FOR CONFIDENTIAL PRICE SCHEDULE.

• Mattison features a complete line of cabinets **MADE IN MATTISON'S OWN CABINET FACTORY.** 36 breathtaking designs that blend perfectly in any setting, traditional or modern.

**All
CABINETS
MADE IN
MATTISON'S
OWN
CABINET
FACTORY!**



The **AMBASSADOR 17" and 21"**

Best Looking . . . Best Value, Too!
Full size console for eye level television. Available in genuine mahogany or blond mahogany. Featuring removable safety glass. Dimensions height 42 inches, width 26 inches, depth 23 inches.

DEALERS! SERVICE DEALERS! Here is your opportunity to become the "important" TV Dealer in your area for the **FINEST CUSTOM-BUILT LINE OF TV RECEIVERS. FREE!** Write for Mattison's merchandising portfolio explaining the "UNASSEMBLED PLAN" and "\$1,000,000 FLOOR PLAN."



When you buy from Mattison you need only one source of supply! You can buy a Mattison Chassis, a Mattison Cabinet or a complete Mattison TV Set!

Manufactured with integrity

Mattison Television & Radio Corp.

10 West 181st St., Dept. RN, N.Y. 53, N.Y.

India, Pakistan; 2100-1145, 6.006, 7.5 kw., *English* (2100-0630), Oriental (0630-0830), *English* (0830-1145), relaying Home Service (Sun. opening is at 2045 Sat. *EST*). *Home Service (Western)*—2000-0330. 0530-1130, 6.075, 250 w., *English*; 2000-0330, 0530-1130, 3.395, 250 w. *Home Service (Oriental)*—2000-0300, 0600-1200, 4.900, 250 w., Sinhalese, Tamil. *Schools Service*—2315-0215, 0315-0500, 6.075, 250 w., 4.900, 250 w., *English, Sinhalese, Tamil.* (Scheiner, N.J.)

Chile—CE920. 9.200A, Punta Arenas, has been at fair level recently to 2200A sign-off; slogan is "Radio Militar Austral." CE960, 9.593A, noted around 2000 at good level; announces "Radio La Americana." (Niblack, Ind.) Closes 0030. (Kary, Pa.)

CE1175. 11.73A, noted with powerful signal 2303. (Bellington, N.Y.) CE622, 6.220, Santiago, heard with news in Spanish 2130, then music. (Levy, N.Y.)

China—*Radio Peking's* 11.69AV channel has been noted with *English* 1730-1800 again lately. (Niblack, Ind., others) Noted in Britain with strong signal on 15.060AV with *English* session 0400; announced *English* broadcasts as 1730 on 6.100, 7.500, 9.040, 10.260, 15.060, 15.170, 0400 on 6.100, 10.260, 11.690, 15.060, and 0830 on 11.690, 15.060. (Pearce, England) Noted on 7.500 early mornings (*EST*) and evenings to around 2000. (Chatfield, N.Y.)

Schedule received by Scheiner, N.J., from *Radio Peking*, listed these Peking outlets for use in relay of Home Service—6.100, 7.500, 9.040, 10.260, 15.170 at 1800-1830, 2100-2150, 2255-0145, 0425-0845, 0900-1300; listed Mukden, Manchuria, on 7.660; Shanghai on 5.985, 6.812; Wuhan on 6.645; Chungking on 6.154, 11.000; Sian on 6.400, 9.480. Rosenauer, Calif., notes slow-speed Chinese 1000 on 6.100, 7.500, 9.035A, 9.435 outlets.

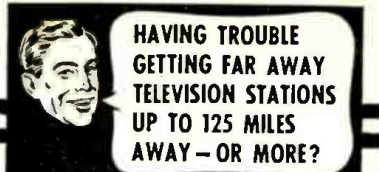
Another Chinese channel noted is 6.05 heard lately after 0400 and as late as 1030 in parallel with 6.105A Peking; 15.060AV and 15.130A are heard in parallel often after 2000. (Balbi, Calif.) *Radio Sian*, 9.480, is heard at good strength opening 0600. (N.Z. *DX Times*)

Costa Rica—TIDCR. 9.62, has news in Spanish daily 2350-2400 sign-off. (Bellington, N.Y.)

Cuba—Tests in *English* around 0030-0130 (at least Sun., Mon., perhaps other days) to learn how well the medium-wave transmitter on 590 kc. is heard in USA, have been carried also on the 11.727A and 6.450 short-wave channels of COCY. (Guentzler, Ohio, others) Asks for reports to CMCY, P. O. Box 770, Havana, Cuba. (Levy, N.Y.)

Cyprus—ZJM6, 6.790, logged 1100-1130 with Arabic music; time signal 1115. (Wada, Japan) Noted parallel recently on 6.12A and 6.168A around 2345 in Arabic. (Bellington, N.Y.)

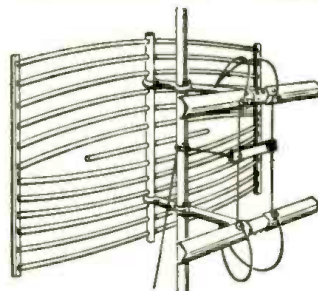
Dominican Republic—HI2A, Santiago, *La Voz de la Reeleccion*, opens 0700 with Dominican National An-



**HAVING TROUBLE
GETTING FAR AWAY
TELEVISION STATIONS
UP TO 125 MILES
AWAY—OR MORE?**

WHAT'S YOUR ANSWER TO THIS QUESTION?

If you're in FRINGE area — not right next door or fairly close to the television stations you want to get, you need the DAVIS VHF SUPER-VISION ALL-CHANNEL ANTENNA. For ALL CHANNELS.



DAVIS SUPER-VISION FOR FRINGE AREA & DX

"The Original Antenna Sold With A Money-Back Guarantee"

Built By America's Fastest Growing Antenna Manufacturer

The DAVIS SUPER-VISION is one of the three basic elements necessary for FINE RECEPTION. It's actually as important as the finest television receiving set. So, when you buy, BUY RIGHT — all the way through: Set, Antenna and Leadline. And the services of a competent television technician to make the installation. If you miss an one, you'll miss what you're really buying: AMERICA'S FINEST TELEVISION RECEPTION.

The DAVIS STORY is a BIG STORY—in performance. Get all the facts. Aside from distance and DX reception, know about the "other ten" important features.

PRICED RIGHT for such fine reception. List only \$34.95. Worth every cent of its cost with "the price forgotten long after fine reception remains."

AT YOUR JOBBERS, or MAIL COUPON TO:

DAVIS ELECTRONICS	1-25
4313 West Magnolia Blvd., Burbank, California	
SIRS: RUSH INFORMATION TO ME AS CHECKED BELOW:	
<input type="checkbox"/>	Send Free Technical Data on new SUPER-VISION ANTENNA.
<input type="checkbox"/>	Send Name and Address of NEAREST JOBBER.
Name	_____
Street	_____
City	_____ State _____

SPEAKER RECONING

Complete line Cones, Spiders, Rings and Voice Coils. Custom Built Voice Coils. Low prices. Write for Parts List and Reconing information.

WESTERN ELECTRONICS CO.

3164 West Colfax Denver 4, Colo.

ON-THE-SPOT BATTERY RECORDER

WALKIE-RECORDALL 8 lb. miniature BATTERY RECORDER-PLAYBACK. Continuous, permanent, accurate, indexed recording at only 5c per hr. Instantaneous, permanent playback. Picks up sound up to 60 ft. Records conferences, lectures, dictation, 2-way phone & sales talks while walking, riding or dining. Records in closed briefcase with "hidden mike"! Write for Detailed Literature.

MILES REPRODUCER CO., INC.

812 BROADWAY Dep't RN-2, NEW YORK 3, N. Y.

RADIO & TELEVISION NEWS

them; is readable to 0745 when begins to fade out; during hours of darkness is usually snowed under by strong QRM. (Kary, Pa.) H18Z, 5.023A, is sometimes intelligible around 2000, but has bad CWQRM, Kary says.

Ecuador—HC1AC, 6.210A, noted with call 2216; nice level; announced "La Voz de La Democracia." (Niblack, Ind.) Excellent opening 0600 with news in Spanish. (Kary, Pa.) HC2BK, listed 4.710 but nearer 4.700A, *Radio El Mundo*, Guayaquil, is best after 2200 to 2300A sign-off; programs then are entirely musical, with many commercials in Spanish; HC4AS, 4.202, Bahia de Caraquez, is fair to poor daily, with bad CWQRM; has news in Spanish 1945-2000A; mentions "La Voz de las Caras." (Kary, Pa.) HC1JB, 11.915, noted at good level 0015-0130. (Lieberman, N.Y.) And to 0300 at good level in Ill. (Gustafson)

Egypt—SUX, 7.866A, sometimes has strong signal 1400-1700; all-Arabic. (Chatfield, N.Y.) At least some days runs to 1800. (Brown, N.Y.)

El Salvador—YSAXA, 11.950, San Salvador. *La Voz Panamericana*, was audible recently from interception 0945 to past 1200, had sporting event. (Kary, Pa.) YSUA, now on 6.190A, noted to after 2030; should sign-off around 2400. (Stark, Texas)

Ethiopia—ETAA, *Radio Addis Ababa*, 15.017AV, noted recently 1320-1420 with *English* recordings of popular music and *English* announcements; poor level, heavy CWQRM. (Saylor, Va., others) Is heard often in Britain now from 1030A sign-on; some days has religious (missionary) programs in *English* around 1030-1100; has *English* news some days 1110A; format is irregular. (Pearce, England)

Finland—Helsinki, 15.190, noted with news 0700, parallel 9.555, 17.800. (Pearce, England) *English* should be repeated on these channels around 2200.

France—*English* from Paris is daily 0245, 6.145, 7.240; 1445, 11.970; Sundays only 0800-0900, 7.240. (ISWC, London) Noted on 6.200 at 0200-0300 with musical session, strong level; on 6.145 signing on 0300 with program in French weak. (Chatfield, N.Y.)

French Cameroons—Douala sends on 7.287 at 1230-1500 (Sun. also 0500-0800) according to "Malmo DX-aren", Sweden. Not confirmed.

French Morocco—*Radio Maroc*, 15 Avenue du Congo, Rabat, sent schedule for CNR3, 6.006, 1 kw., as 0200-0330, 0600-1000, 1200-1800 (Sun. 0200-1800). (Kary, Pa.)

French West Africa—*Radio Dakar*, 9.560, noted opening with French march 0200. (Pearce, England) Current schedule is 11.896A weekdays 0130-0300, 0700-0900, 1400-1810, Sun. 0200-0900, 1300-1810; 9.562A, weekdays 0145-0315, 0730-0845, 1200-1730, Sun. 0430-0845, 1330-1730; news in French on 11.896A at 0230, 0800, 1500, 1800; on 9.562A at 0800, 1700. (WRH) Sometimes opens on 9.560A as early as 0130. (Radio Sweden)

Germany—By this time, the German

NOW...AT LOWEST PRICES!

BROADCAST BAND & AERO



MN-26-C Remote Controlled Navigational Direction Finder and communications receiver. Manual DF in any one of three freq. bands, 150 to 1500 KC., 24 V. Self contained dynamometer supply. Complete installation, including receiver, control box, loop, minimum control, left-right indicator, plugs, drop transmission line and flex. shafts. **LIKE NEW \$69.50**

MN-26-Y 150 to 325 KC. 325 to 695 KC. 3.4 to 7 megacycles, comp. Installation \$69.50
Receiver alone like new \$39.50
MN-26-C alone like new \$39.50
MN-26-C or MN-26-Y as is less tubes \$13.95
with tubes, Used Road \$24.95
MN-20-E Loop, Brand New \$6.95
MN-52 Crank drive, New \$2.50

SCR-274N COMMAND and ARC-5 EQUIPMENT

RECEIVERS	AS IS	EXC. USED	NEW
BC-458-190 in 550 KC	\$10.95		
BC-451-3 to 6 MC.	4.95	\$11.95	
BC-453-8 to 9 MC.	4.95	11.95	
TRANSMITTERS			
BC-457, 4 to 5.3 MC.	4.95	9.95	
BC-458, 5.3 to 7 MC.	4.95	9.95	
BC-459, 7 to 9.1 MC.	5.95		
BC-458 Modulator	2.95	4.95	
ADDITIONAL EQUIPMENT			
BC-450 Control Box (3 Receiver)		1.95	3.95
BC-451 Control Box (Transmitter)		1.95	3.95
BC-452 Relay Unit ANT With Condenser		3.95	
Without Condenser		1.29	2.95
Flexible Shielding w/ 1 h Gear to fit receivers		2.29	2.45
3 Receiver Rack		2.39	3.97
2 Transmitter Rack		2.25	2.95
Single Transmitter Rack		2.25	2.95
DM-12 dynamometer for Command Set		3.25	7.95
DM-33 dynamometer for Command Set		2.95	3.95
Shock Mtg. for 3 Receiver Rack, 2 Trans. Rack, Modulator or Ant. Relay Unit		1.95	2.45

MONTHLY SPECIAL!

16PA only \$9.95 16DP4 only \$9.95
WHILE THEY LAST... only 40 left of each...
90-day guarantee!

TUBES.....10 for \$3.50

12SR7	6SL7	Your choice of these nationally advertised tubes.
1613(6F6)	6V6GT	
9006	6Ns	
6Z7G	1626	
211	954	
6AG6	12M6	

TUBES

9002	50.59	6AJ5	\$1.59
9003	.98	4AP10	.95

RT/34 AP5 13 Transceiver used as a tall warning radar on 415 MC. Containing a 30MC IF Strip and various other parts, these units have been stripped of RF sections and all tubes, but are an excellent buy if only for parts and IF Strip. Used \$4.95
BC-624 receiver (SCR 522), less tubes. Used 19.95
100 A 156. 1255. Used 9.95
BC 625 transmitter (SCR 522) less tubes. Used 9.95
SCR 522 transceiver, complete in case with top bracket, less tubes. 29.95
Transceiver-110-144 mc. 2 meter, used, excellent condition, less dynamometer, with tubes. only 24.95

WANTED!

All TS, APR, AP5, ARC, ARN, ART, SCR, R89 and BC equipment. Write today!
Quote lowest prices in your first letter

MIKES and HEADSETS

M5-33 Low Impedance Headset, exc. \$2.95 new \$4.95
M5-23 Headset used \$2.95 new \$4.95
CD-307 Ext. cord for HS 23-33 like new .79
Throat Mike-T 30 New .98
Lip Mike-Navy Type New .98
Extension Cord and Switch Assembly for Lip and throat Mikes New .98
CW 40505 High Impedance headset complete with leather headband and rubber cushions. **08c**
T-17, Microphone Used \$3.75
M5-38 Used exc. \$1.95 new 2.29
M5-30, miniature headset, used 1.49 new 2.49

DYNAMOTORS

The best dynamotor for conversion to 6v. Multiple windings! After conversion you get choice of 190 or 350 v. at 60 MA or 250 v. at 100 MA. Complete dope sheet furnished. **\$9.95**
BRAND NEW (See "CQ" Aug. Issue)

PE 103	used exc.	\$19.95
DM 53A	new \$7.95; used	2.95
BD 83	used exc.	8.30
DM 34	used exc.	9.95
DM 28	new \$9.95; used	5.95
PE 94	new \$7.95; used	4.95
DY 22	used exc.	14.95
DM 21	used exc.	7.95

WOBULATOR

BUILD TV-FM-AM SWEEP GENERATOR

You can build "Versatile Sweep Frequency Generator" with APN-1 magnetic units. \$5.95

RT7/APN1 TRANSCIVER UNIT—Used as an altimeter. It may be converted for signaling control circuits, etc. Complete with 14 tubes and dynamotor they are in good used condition at the amazingly low price of \$17.95. Used, less tubes, with wobulator. 9.95

MISCELLANEOUS EQUIPMENT

FL 8 used, exc. \$1.19 BC 347 each, used 95c
BC 906 each. 9.95

SELSYN TRANSMITTER

Loop Motor and Autosyn Transmitter Assembly for matching to I-R2 indicator. Used, excellent condition. ONLY \$5.95. Complete with Indicator. \$14.95

SCR 625 FAMOUS ARMY MINE-DETECTOR

For Prospectors, Miners, Oil Companies, Plumbers, etc. This unit is being offered now at a considerable reduction in price. Recently advertised at \$79.50 it is now available in the same brand new wrappings in suitcase style carrylign case (less batteries) at

\$59.50 WHILE THEY LAST! Used, like new, \$39.50

RL-42 Reversible Motor with antenna reel and clutch, used \$2.95
BC-433 RADIO COMPASS RECEIVER, 200 to 1700 KC, used, excellent condition, with tubes, exc., less tubes. 39.95
Used, as is, less tubes and cover, exc. for parts 24.95
8.95

PLUGS for 274N \$1.25 each

ARMY SURPLUS PORTABLE TELEPHONE

Complete with TS 13 handset. \$14.95 ea.
2 for \$27.50

Shipments F.O.B. warehouse. 20% Deposit on orders. Minimum order \$5.00. Illinois residents, add regular sales tax to remittance. Prices subject to change without notice.

R W ELECTRONICS

Dept. N, 1712-14 S. Michigan Ave., Chicago 16, Ill.

PHONE: HARRISON 7-9374

STRIP-IT A New Precision Tool

For Removing Insulation from Wire and Cable
Designed for the Electronic Industry



- Fits in Tight Spots
- Cuts as Well as Strips
- Speedy, Efficient, Rugged
- Tool Steel Blades for Long Life
- INSTANT Adjustment to All Wire Sizes



The simple design and fool-proof operation of STRIP-IT makes this a tool that will become indispensable for electronic technicians and assemblers. Held in the palm of the hand, the operation is merely to bite into the insulation, twist, pull, and the wire is ready for the terminal connection. The sliding adjustment bar is set with a touch of the finger. STRIP-IT is engineered for thousands of operations, using only one set of blades.



THE **CM** SEE YOUR LOCAL DISTRIBUTOR, OR WRITE
MANUFACTURING COMPANY

Norman R. Mac Innis, 1430 Mass. Ave., Cambridge, Mass., Notional Sales Representative



Economically Priced
\$1.95 net

YOU SAVE AT POLY-TECH

GOING MOBILE? CO-AXIAL 6 VDC RELAY. SPDT, WILL HANDLE UP TO 75 W. RF. uses standard co-ax connectors. Send your order in today 'b'cuz they'll go like hot cakes. PP USA..... **\$6.75**

MOBILE VHF ANTENNA MFD. BY G. E. 152-162 MC, complete with 12 ft. RG58U Coax cable, removable antenna rod, mount, 831SP (PL-259) Coax connector, installation hardware and instructions. Special, only..... **\$2.45**

NOVICE 115V, 60 CY PWR SUPPLY KITS
A 600 VCT 95 MA, 6.3V 3A, 5V 2A; 8 HY 100 MA chokes (2 ea.); 8 x 8 MFD 600 VDC oil capacitors..... **\$6.50**

B Plate transformer 740VCT 305 MA; 5V 6A x 6.3V 6A dual fil. transformer; 4.6 HY 310 MA chokes (2 ea.); 8 x 8 MFD 600 VDC oil capacitors..... **\$12.50**

C **IDEAL KIT FOR NOVICE X-MITTER.** Transformer 880 VCT @ 125 MA, 2.5V 3A, 5V 3A, 6.3VCT 3A, 7 HY 125 MA choke (2 ea.), Dual 8 MFD 600 VDC oil cap. Chassis, 5U4G, jewel, Tog. Sw., Line cord, Fuse post, Bleeder. Hook up wire and Schematic..... **\$15.95**

D 750 VDC @ 225 MA Pwr Supply, ideal for powering from one source ARC-5 X-Mitters, or any 150 Watt rig. Transf. 750-600-0-600-750 VDC @ 225 MA, 6 HY 250 MA choke (2 ea.), 6.3V 4A x 6.3V 4A Fil. Transf., 2 MF 1.5 KVDC and 3 MF 1 KVDC oil cap. 5V 4A Fil. Transf. chassis, 5R41GV, Bleeder, jewels, Tog. Sws., line cord, Schematic, etc. Only..... **\$29.50**

* Free Telegram Key on request when ordering C & D kits.

CHOKES

200 HY 0 MA, cased	\$1.95
9 HY 95 MA, cased	1.15
15 HY 100 MA, cased	0.90
10 HY 200 MA, cased	2.75
15 HY 250 MA, cased	3.75
3 HY 250 MA 15 ohm, cased	.95
5 HY 300 MA 70 ohms	2.99
8 HY 300 MA 110 ohms, cased	5.59
6 HY 300 MA 35 ohms, cased	7.25
.05 HY 3A 1 ohm	2.95
.02 HY 5A .5 ohm, cased	4.95

1N34 DIODES LIMITED QUANTITY
10 for only..... **\$3.95**

ZA GLIDE PATH RECEIVER BLACK CRACKLE ALUMINUM CASE 6"x7"x12" complete with shock mount, 130 6CG tubes, resistors, capacitors, etc. Used, excellent condition. Limited Quantity..... **\$2.95**

OHMITE DUMMY ANTENNA LOAD
TYE D-250 250W, 600 or 75 ohm non-induct. Resist., ea..... **\$6.95**

OIL CAPACITORS
5 MF 236VAC 50.95
10 MF 330VAC 2.95
14 MF 275VAC 3.49
4 MF 1000VDC 6.95
8 MF 1000VDC 2.95
35 MF 1000VDC 7.50
2 MF 1500VDC 1.85
16 MF 1500VDC 6.95
2 MF 2000VDC 2.25
4 MF 2000VDC 4.50
8 MF 2000VDC 5.50
2 MF 3000VDC 3.95

SENSITIVE PLATE RELAY

Sigma 5 Prong Plug In Relay Polarized Coil 3000 ohms DC, operates on 2-4 MA. SPDT contacts. Limited Supply..... **\$3.25**

STRUTHERS-DUN

115 VAC 40-60CY. Relay, SPST, No. 1 Amp 115VAC Contacts Quantity Ltd..... **\$1.95**

Mailroy Inductancor, 3 Section..... **\$3.95**

TELECHRON

3.0 RPM Synchronous 115v 60CY Mo- Kors. Special..... **\$1.95**

Isolation or Bias Transformer, Prim. 117V, Sec 135V TAP, 6.3V 35W..... **\$1.95**

115V FILAMENT TRANSFORMERS 60 CY
2.5 VCT 10A, 10 KV Insulation..... \$4.50
5V 4A 2.5 KV Insulation..... 3.95
5.0 V 6A, 6.3 V 6A..... 3.95
5.0 V 12A, 2.5 KV Insulation..... 5.95
5.0 VCT 20A, 2.5 KV Insulation..... 6.85
6.3 VCT 3A, 2.5 KV Insulation..... 2.25
6.3 VCT 6A, 2.5 KV Insulation..... 3.15
6.3 V 10A..... 3.95
10 VCT 10A, 2.5 KV Insulation, cased..... 6.00
Dual 25V 1 Amp..... 1.95
3-4-1V 1A..... 1.49

115V POWER TRANSFORMERS 60 CY
68 to 83 V Half Wave, 1.5A..... 5 1.25
300 V Half Wave .02..... .75
435 VCT 145 MA 6.3V 3A, 5V 3A..... 2.95
700 VCT 100 MA, 5V 3A, 2.5V 10A..... 2.25
740 VCT 185 MA, 6.3V 4A, 5V 3A..... 5.95
800 VCT 200 MA, 5V 2A..... 3.95
680 VCT 225 MA..... 2.95
750-680-0-600-750 VDC 225 MA..... 11.50
3600 VCT 350 MA..... 29.50

POLY TECH

Dept. B-3, 919 Dawson St., New York 59, N. Y.
Send for Bulletin Murray Hill 6-2650

Short-Wave Overseas Service should be on the air. I hope to have details shortly.

Baden-Baden, 6.320, was noted fair a recent Sat. at 1830 with popular recordings; this extended schedule may be Sat. only. (Kary, Pa.)

Gold Coast—Accra, 4.915, tuned 1230 when had music; 1245 Gold Coast news, followed by weather forecast, then dance music to 1300 closedown with "God Save the Queen." (Pearce, England)

Greece—Radio Athens is now using 9.607 to North America on winter schedule of 2000-2100; English news around 2035. (Bellington, N.Y.) Noted on 7.300 with news in Greek 0215; on 15.345 with light music 0800; heard on 9.607 with news 1430, then news in French 1445. Larissa, 6.745, noted with call 1530, now signs off 1600 (formerly 1500). "Radio Amateur", London, reports a Greek Forces Station at Kozani operating around 7.940-7.950, heard at good level 1300.

Greenland—OXI, 9.310A, Godthaab, on a recent Sun. had extended schedule to 2012 sign-off. (Stark, Texas) Normal sign-off is around 1850. (Niblack, Ind.; Kary, Pa.)

Guadeloupe—Basse-Terre, 7.445A, noted at fair level some days shortly before 0600 in French. (Kary, Pa.) May sign on 0530.

Guatemala—TG2, 6.620, logged 2015 in Spanish. (Tonsi, Wisc.) TGZA, 6.675AV, Zacapa, Radio Oriental, is audible to 0805A mornings and to 2210A sign-off evenings; has bad QRM. (Kary, Pa.)

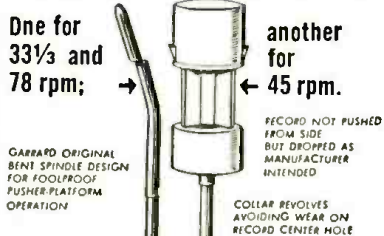
Haiti—The "wandering" 4 V R W, Radio Haiti, has been varying lately around 10.070-10.092A. (Niblack, Ind., others) A badly distorted signal has been noted from a Haiti outlet on 6.230A to 2015 sign-off. (Stark, Texas) 4VEH, 9.685AV, Cap-Haitien, heard signing on 0630. (Chatfield, N.Y.) A letter from Radio Citadelle indicates that power of 4VWA, 6.235, is 150 w. (to be increased to 1 kw.); slogan is "Ici Radio Citadelle. Cap-Haitien, capitale touristique de la Republique d'Haiti." (Kary, Pa.) Is heard to after 0800 and past 1815; may sign off around 2015. (Stark, Texas) 4VPL, 5.902, Petionville, is audible from as early as 1830 to past 2000 with varied musical programs. (Kary, Pa.)

Honduras—HRP1, 6.35, El Eco de Honduras, San Pedro Sula, noted 1715-1730 at fair level in Spanish. (French, Mass.) Good level 2246-2323. (Patterson, Ga.) HRXW, Radio Comoyaguella, noted moved to 6.105 from 8.985A and 6.110; is best after 2200; signs off around 2300. (Stark, Texas, others) At times, HIROW, Radio Monserrat, uses both 6.675 and 6.660; noted parallel one night recently past 2015. (Stark, Texas) Signs off around 2130. (Dexter, Iowa) IRLP, 6.410, Tegucigalpa, Radio America, is best prior to 1900 with recorded music and commercials in Spanish; after 1930, signal weakens rapidly. (Kary, Pa.)

Hong-Kong—ZBW3, 9.525, Victoria, noted at good level 0530. (Ballou,

What to look for in a record changer...

INTERCHANGEABLE SPINDLES...



For greater convenience and longer record life; Eliminates "spiders" One of many features which make

GARRARD

The World's Finest 3 Speed Record Changer

Fully automatic with automatic stop

Can be used with your present set.



MODEL RC 80

Garrard Sales Corp., Dept. R-164 Duane St., N. Y. 13, N. Y.
Send GARRARD Fact Sheet.

Name.....
Address.....
City..... Zone..... State.....

\$42.30 net less cartridges

CHECK JSC for COMPLETE 300 Ohm TV Lead-In Wire Needs!

22 Gauge Copper	20 Gauge Copper
40 mil	40 mil
55 mil	55 mil
70 mil	70 mil
80 mil	80 mil
100 mil	100 mil

4-Conductor Rotor Wire Perforated 300 Ohm Open Wire JSC has highest quality wire at lowest possible prices. Lithographic pools of Orange and Blue individually poked 1000 feet to the metal spool.



See your nearest JSC distributor who proudly displays the Blue and Orange disc of quality.

ELECTRONIC'S LATEST TROUBLE-SHOOTER

A compact—complete—circuit analyzer



ONLY \$24.95

THE AMAZING TV SERVISSET

Model E-C
(Pat. Pending)

A precision engineered professional quality electronic test instrument. Ideal for field or bench servicing of Radio, Television, Radar, Communications gear, etc.

Now—Quickly—Conveniently—At Low Cost

CHECKS: sync, sweep, video, audio circuits, TV high voltage supplies (DC, RF, or Pulse), low voltage supplies, coils, condensers, resistors, tubes, transformers, speakers, etc. Will localize trouble to a particular stage, determine defective component and can actually be clamped in circuit to restore circuit operation temporarily in 80% of component or tube defects. Ideal for locating and confirming intermittents.

SPECIFICATIONS:

RF & AF Signal Tracer, RF & AF Signal Injector, AC & DC Voltage Indicator 0/60/950/20,000, DC Polarity Indicator 50/50/20,000 volts, Lo ohms 0-5, Hi ohms 0.500k-20 megohms, Tests Condensers .00023-12 mfd., Tests Resistors 2 ohms-20 megohms, 2 Capacitance Sub ranges 51-1 & 4-40 mfd., 3 Resistance Sub ranges 50-500 ohms, 5k-25k, 100k-1 meg.

Will complement your existing equipment and will outperform other testers costing many times more.

A MUST FOR THE MODERN TV AND ELECTRONICS SERVICE ENGINEER.

Comes in handy cloth pouch, complete with all accessories including ALNICO phone, TV high voltage adapter, phone extension cord, test lead, Klipzon adapter and complete detailed instruction Manual, disclosing latest TV trouble-shooting techniques.

Be sure to ask for and see **SERVISSET** at your distributor or send today for complete information and name of your local distributor.

LEE ELECTRONIC LABS., INC.

233 Dudley Street

Boston 19, Mass.

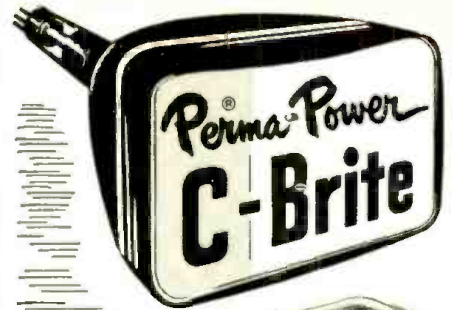
Calif.) Has been closing lately 1030; has BBC's Radio Newsreel (probably recorded) at 1000 now. (Ridgeway, South Africa)

Hungary—Budapest. 9.833, noted with *English* to North America 1700-1730, 1930-2000. (Lubell, N.Y.) Should be parallel on 7.222A and 6.240A.

India—AIR, 11.790, noted signing on 2030 with *English* identification; the 15.160 outlet noted closing down 0730 with *English* announcement. (Niblack, Ind.) Noted with European Service 1445-1545 now over 11.780, 9.565A, 7.120; asks for reports; heard signing on 1445 on 7.125 with French session, also audible over 5.960; with Indonesian program 1745-1800 on 7.125, 5.960A; with news 0300 on 17.705, 15.160, closing 0330. Bombay, 4.840, noted 1200 with native program, signed off 1230; Delhi. 4.910, strong in native 1200, closed 1330 at end of Persian session. Madras. 4.920, noted with news relay from Delhi 1030. (Pearce, England) Is strong level opening 0830 with news on 11.780. (Brown, N.Y.) Noted with news 0730 on 17.760. (Gillett, Australia)

Indo-China—Radio France-Asie, 9.754A, Saigon, still noted with *English* session to Europe 1734A-1800; announces next *English* for 1830 on 7.230; noted on 15.430 with news 0500, and closing with "Knightsbridge March" 0513. (Pearce, England) Heard on 11.935 with bilingual (*English-French*) sessions from 0900. (Ridge-

(Continued on page 132)



to add increased brilliance to any TV PICTURE TUBE

manufactured by

Perma-Power COMPANY

Chicago 25, Illinois

Manufacturers of Electronic Equipment Since 1928

New RADIO COURSE only \$2.50



MADE MONEY FIRST WEEK

"You should get more money for your course. The first week I studied it, I made \$10.00 repairing sets. I built my own test outfit from details given in this course. I have repaired 100 radios to date."

Signed: Robert C. Hammel, 120 W. 13th, Davenport, Iowa.



COMPLETED IN 8 WEEKS

"I am very satisfied with the course. When I was at the twelfth lesson I started repairing radios. It took me two months to master your course." From a letter written by Roger Langlois, 1679 Pompat St., Montreal, Canada.



MODERN, UP-TO-DATE

"Your course is modern and up-to-date. There is not one page in the whole course which anyone can afford to miss. Your course started me on the road to a well paid job and has repaid me many times." Charles Alpaech, 433 Elm St., Reading, Pa.

AMAZING BARGAIN OFFER

Here is a practical home-study course that will teach you how to repair all radio sets faster and better. These newly reprinted 22 lessons cover all topics just like other correspondence courses selling for over \$150.00. Our amazing offer permits you to obtain the course complete for only \$2.50, nothing else to pay. Easy-to-follow, well illustrated sections on test equipment, circuit tracing, alignment, F.M., use of oscilloscope, amplifiers, and every other topic needed to be an expert in radio repairing. Trouble-shooting hints, circuits, short cuts, service suggestions, new developments. Send coupon today, and use the complete course at our risk. Satisfaction guaranteed. All 22 lessons, in large manual form, + self-testing questions, \$2.50 complete, your cost only.....

INTRODUCTION TO TELEVISION

These 22 practical lessons making up this course-book are easy to follow and apply to actual radio jobs. Use this training to get ahead in radio and as an introduction to television. Radio facts that puzzled you will be quickly cleared up. You will find yourself doing radio repairs in minutes instead of hours—instantly finding faults or making needed adjustments. Every new radio development of importance and thousands of time-saving radio facts are packed into this complete course-manual. For example, there is a large lesson on servicing F.M. sets and another full lesson on audio amplifiers. Use coupon below to order Course for 10-day examination in your own home. Look over the material, read a few lessons, apply some of the hints. Then decide to keep the lessons at the bargain price of \$2.50 (full price), or return the material and get a cash refund.



Supreme Radio & TV Manuals

Your complete source of all needed RADIO and TV diagrams and service data. Most amazing values. Still sold at pre-Korean prices. Only \$2 for most volumes. Every Radio manual contains large schematics, all needed alignment facts, parts lists, voltage values, trimmers, dial stringing, and service hints. Each TV manual is a practical treatise on servicing the year's sets, with giant blueprints, patterns, waveforms, hints, charts, suggested changes. See coupon at right for a complete list of these low-priced manuals.

NO-RISK TRIAL ORDER COUPON

SUPREME PUBLICATIONS, 3727 W. 13th St., Chicago 23, ILL.

Radio Diagram Manuals

Year 1952 Manual. \$2.50
 1951 Radio } EACH
 1950 Manual } \$2.50
 1949 Radio }

1948
 1947
 1946
 1942
 1941
 1940
 1939
 1926-1938 Manual. \$2.50

PRICED AT ONLY \$2 EACH

Send Radio and TV manuals checked at left and below. Satisfaction guaranteed or money back.

Complete RADIO COURSE, all 22 lessons... \$2.50
 1952 Television Manual. \$3. 1951 TV. \$3.
 1950 Television Manual. \$3. 1949 TV. \$3.
 1948 TV. \$3. 1947 TV & FM. only \$2.

I am enclosing \$..... Send postpaid.
 Send C.O.D. I am enclosing \$..... deposit.

Name:
Address:

Supreme Publications

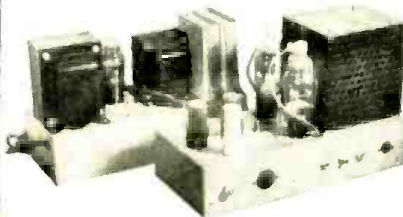
Sold by All Leading Radio Jobbers

HARVEY

The House
of Audio



THE ORIGINAL WILLIAMSON HR-15 AMPLIFIER KIT



The famous, original Williamson HR-15... still acclaimed the leader... in kit form, with the Partridge Output Transformer specified by Williamson in his original design. Assemble this kit, and in 3 hours or less, enjoy the finest sound you ever heard. Operates from a tuner, phono-preamp, crystal pick-up, or other signal source. Absolute gain is 70.8 db with 20db of feedback. Frequency response: $\pm .5$ db, from 10 to 100,000 cps. Output impedances to match all speakers from 1.7 to 109 ohms. Kit is complete with 5 tubes (1-5V4, 2-6SN7, and 2-5881 (or 807 if requested), 2-Punched Chassis, 2-Resistor Mounting Strips, Sockets, Partridge WWFB Output Transformer, Assembly Instructions, and All Other Necessary Parts for Amplifier and Power Supply. **\$76.50**

PARTRIDGE OUTPUT TRANSFORMERS

Available Separately. WWFB **\$26.00**

NOTE: HR-15 may be had with British KT-66 Output tubes for \$3.00 additional.

WESTERN ELECTRIC 755-A
High Quality 8" PM Speaker
Special **\$24.60**

The MAGNECORDette



A truly professional tape recorder for the discriminating listener... designed for home use.

- Quickly interchangeable speeds: 7½ or 15 inches/sec.
- Rewinds 1200 feet in 40 seconds.
- Frequency response: ± 2 db, 50 to 15,000 cps. at 15 inches/sec. and 50 to 7000 cps. at 7½ inches/sec.
- Dual AC motors for operation and rewind.
- Maximum flutter 0.3%.
- Housed in an attractive cabinet, natural or walnut.

\$395.00



**10½ INCH
REEL ADAPTER
MECHANISM**

Attaches simply and easily to all MAGNECORD and MAGNECORDette Tape Recorders. Permits playback, rewind, and high speed forward with 10½-inch reels. In stock for immediate delivery.

\$35.00

NOTE: All prices are Net, F.O.B., N. Y. C., subject to change without notice.



Harvey

RADIO COMPANY, INC.

103 W. 43rd St., N. Y. 36, N. Y. • LU 2-1300

way, South Africa) *Radio Hue* can be heard in Japan very well but with some hum around 0500-0800 on 7.205; closes 0800 with identification in French. *Radio Dalat* is at fair strength, sometimes QRM'd by *Radio Moscow*, on 7.265, closes 0630 daily except Sat. when runs to 0700; has French on Sat. 0630-0700. (Wada, Japanese Short-Wave Club)

Iraq—Radio Baghdad, 11.724A. noted 1145 with Arabic music; at 1200 clock chimes the hour, call, then news in Arabic. (Pearce, England) Should have *English* 1415-1500A closedown.

Italy—Rome, 9.575A, noted with news to North America 1930, good level. (Nblack, Ind.) Noted on 6.010 in Russian 2215-2245. (Lubell, N.Y.)

Jamaica—Due to requests of listeners. *Radio Jamaica* has announced it no longer changes from 4.950 to 3.360 at 1515 but remains on 4.950 to 2300 closedown; opens 0600. (Levy, N.Y., others) Station officials list this one as 5 kw., using omnidirectional antenna. (Baitzel, N.J.)

Japan—AFRS, Tokyo. noted parallel over JKL, 9.605, and JKI, 11.825, at 0100. (Stein, Calif.) Good signal over JKL, 4.860, at 0825, moderate fading. (Ballou, Calif.)

Mexico—A Mexican has been noted on 9.575 identifying as "La Hora" (Continued on page 137)

Transistor Receiver (Continued from page 37)

grounded base circuit. The value of R_2 should be chosen so that the collector current is about 1 milliamper. The collector current of the detector/amplifier transistor will depend on the strength of the received signal but will average about 200 microamperes with a strong signal.

Battery life with only one transistor will probably equal the shelf life of the battery. With two transistors, the

life will depend on average hourly use but should be at least 100 hours for two penlight type cells.

If magnetic phones are used, they may be connected directly in the collector of either transistor. Low impedance phones or a speaker will require the use of a matching transformer. A load impedance of 2000 ohms in the output stage is correct for the voltage and current indicated.

Alignment is perfectly straightforward but should be done carefully in order to realize maximum sensitivity. Any good service oscillator or signals from broadcast stations may be used to accomplish the alignment. The collector current of the first transistor is a good indication of resonance. The parallel trimmers are used to line the set up on the high frequency end and the slugs on the low frequency end.

The output power of this receiver is about 1.5 milliwatts and is sufficient for adequate earphone volume. An efficient speaker can be connected to the output circuit and adequate volume will be obtained in a quiet location. However, the addition of a class B output stage to drive the loudspeaker is recommended.

The receiver, as originally built and as shown in the photos, included a CK705 germanium rectifier and several parts associated with this rectifier. The junction transistors were used as straight audio amplifiers. Tests proved that the diode was not essential and in fact provided no advantage, so the receiver has been modified to the circuit of Fig. 4.

BIBLIOGRAPHY

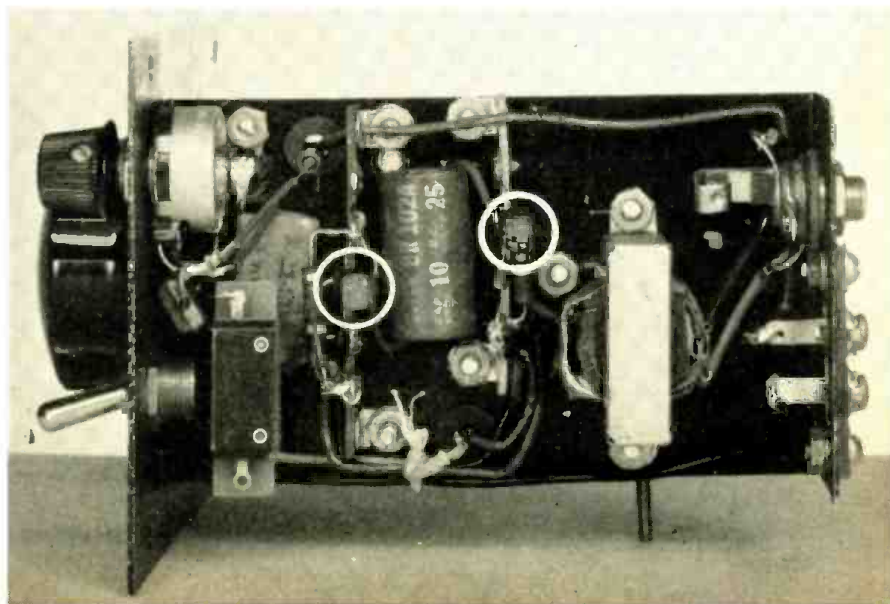
Doremus, John A.: "Point-Contact and Junction Transistors," *Radio-Electronic Engineering Edition of RADIO & TELEVISION NEWS*, April 1952.

Reich, Dr. Herbert J.: "Transistors and Transistor Circuits," *Electrical Manufacturing*, November, December 1952.

Proceedings of the IRE, Vol. 40, November 1952.

-50-

Under chassis view of the transistor receiver designed around the CK722 transistor.



Writing for Profit
(Continued from page 59)

ing time. In addition, there is the real satisfaction of doing creative work.

Articles prepared for the popular technical magazines must still meet reasonable standards of neatness and, to be easily salable, should be prepared with certain basic rules in mind. We will discuss these factors separately.

1. *Choose Your Market:* Before starting a technical article, decide how the article is to be slanted and to which magazine (s) the article is to be submitted. This will determine the style of presentation and, to some extent, the subject matter. Obtain copies of the magazine and *carefully* read the majority of articles published. In this way, you can obtain a better insight into the style preferred by that magazine, the types of articles desired, and the general level of writing.

It is a good idea to send an outline of the proposed article to the editor of the magazine before writing the article. If the editor is interested, the chances of selling the finished article are many times better. However, if the editor is not interested in the suggested article, he will often tell why, and may, at the same time, list the type of articles desired at that time.

Most of the technical magazines can be grouped into five general classifications, as follows:

Semi-Technical Magazines: In this group are the very popular "home mechanic" magazines. Articles for these magazines must be extremely simple, should include detailed sketches and photographs, and must be fairly short. Preferred are construction articles on phonographs, radios, amplifiers, "gadgets," and electronic toys.

Technical Magazines: In this group fall the majority of radio, television, and electronic magazines. Articles may range from semi-engineering in nature to simple construction. All phases of the electronic field are covered. However, construction articles, in general, are the most popular. Articles written for these magazines should not be over-simplified, but extensive theory and complex mathematical expressions should be avoided.

Specialized Technical Magazines: In this group fall a number of magazines designed to appeal to a specific group in the electronic field. There are *audio* magazines for the audio and high fidelity enthusiasts, *service* magazines for the radio-TV technician and service-dealer, and *amateur* magazines for the amateur radio operators or "hams."

Engineering Magazines: Magazines in this group are designed to appeal to practical engineers and, to some extent, to engineering executives. Preferred articles include descriptions of new circuits and specialized electronic equipment, production and management methods, practical design techniques, and new laboratory techniques.

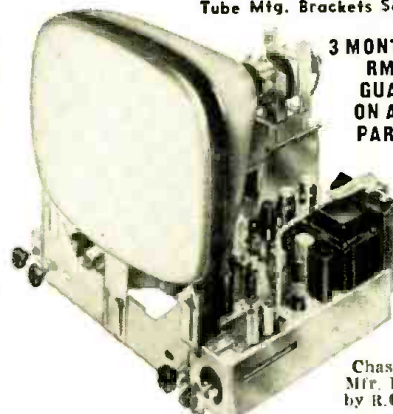
**NEW 1953
630 FA-2***

**ONLY AT AIREX...THE MOST
POWERFUL FRINGE AREA
TV CHASSIS MADE**

Tube Mfg. Brackets \$6.50

The CHASSIS That Television Engineers and Servicemen Are Buying for Themselves . . .

This amazingly advanced 31-tube TV chassis is years ahead in engineering and gives you the ultimate in TV viewing and listening pleasure. To assure you trouble free TV our engineering staff has incorporated into the "630 FA-2" design the experiences of hundreds of TV servicemen and engineers. Receiving range includes stations up to 200 miles away. Nothing has been spared to bring you the finest of TV chassis. Only the best and most expensive parts are used. There is no other chassis that compares with the "630 FA" * for fringe area reception.



**3 MONTHS
RMA
GUAR.
ON ALL
PARTS**

Chassis
Mfr. Lic.
by R. C. A.

**THE ONLY CHASSIS WITH
PUSH-PULL AUDIO OUTPUT AT**

\$169⁹⁵

Less C.R. Tube
and Brackets

Complete with 12" ROLA Hi-Fi Speaker
(Fed. Tax Incl.)

Complete Service Manual & Schematic—\$1

✓ CHECK THESE EXCLUSIVE FEATURES ✓

- 10 WATT push-pull audio output. Frequency range from 40 to 12,000 cycles • Link coupled Standard Coil Cascade Tuner prevents radiation
- Retrace Blanking Circuit allows you to raise the brightness without the annoying vertical retrace lines • Heavy duty front focus control • Automatic gain control potentiometer allows you to adjust the threshold sensitivity as low as 4 microvolts & still keep the full 4MC band width
- Improved sync amplifier • Improved automatic brightness control • Set aligned for 40 MC. New Ham band will not interfere • Improved fused high voltage power supply gives full 14.5 KV under load • Will handle all picture tubes up to 24 inch with full sweep • Improved video amplifier has a gain of 40 • All moulded plastic condensers give long life & trouble-free operation • Easily adapted to new

UHF stations in 2 minutes by just changing a strip in the tuner • Extra heavy duty power transformer with large safety factor • 6CB6 tubes in Video IF to give full gain • Extra filtering in power supply for hum & ripple free operation • Color connection on chassis which is adaptable to the cathode follower circuit of color converter • Phono Connection & switch on chassis allows you to play your phonograph or tuner through the built-in 10 watt hi-fidelity amplifier • Extra heavy duty focus coil, which runs cool • Full focus cosine yoke.

SUPER 630 DX
30 Tube Chassis
Standard Coil Cascade
Tuner, 12" RCA Hi-Fi
Speaker, Fed. tax incl.
\$154.95

Complete Service
Manual For "630FA"
or Super 630DX—\$1

**OVER 100 BARGAIN-PRICED
CABINETS, TV & AUDIO IN-
STALLATIONS . . .** Send for
FREE folder and price list. Full
line table models, consoles, con-
solettes and TV-Radio Phono
combinations. Many styles. Ma-
hogany, blonde, etc.

**SEND FOR FREE NEW TV
PARTS & HI-FIDELITY
EQUIP. CATALOG**

**TV TUBE EXTRA
STANDARD BRANDS
FACTORY NEW**

1ST QUALITY—GUAR. 1 YEAR

17BP4 \$27.95	21" TV tube \$39.95
20" TV tube 34.95	24" TV tube 64.95
Ring & Sleeve for 24" Tube \$7.50	
TV Gold Plastic Masks	
16" and 17" \$4.95	24" \$14.95
20" and 21" \$7.95	

All merchandise is brand new, factory fresh & fully guaranteed. Mail & phone orders filled upon receipt of certified check or money order for \$25 as deposit on TV chassis, 20% on other items. Balance C.O.D., F.O.B. N. Y. Prices & specifications subject to change without notice. No Fed. Taxes to pay. Prices lower than OPS Regs.

AIREX RADIO CORP.

171 Washington St., N. Y. C. 7, N. Y.
Phone WOrth 2-4029

BC 453

. . . 190—550 KC. Receiver, complete with DM32 28V. Dynamotor; 1 RF and 2 IF Stages, BFO and AVC; 12A6 Audio Output; LIMITED NUMBER in A1 Shape. ORDER IMMEDIATELY **\$19.95**

OUTSTANDING "BUYS"
from



ASSOCIATED INDUSTRIES, Inc.

AN/ARC-4

Terrific crystal-controlled, 4-channel, 100 to 150 Mcs. receiver-transmitter, 12 or 28V. power input, originally used plane-to-ground and plane-to-plane. Receiver has 1 RF and 3 IF stages. Cost U.S. GOVT. HUNDREDS. Excellent shape, like new. (Less dynamotor) **\$27.50**

SEMLER BUYS & SELLS
Semler Pays TOP Buck
for electronic equipment.

PHONE COLLECT if you have TS 12, TS 13, TS 25, TS 35, TS 45, TS 62, TS 117, TS 120, TS 146, TS 147, TS 148, TS 155, TS 174, TS 175, TS 239, TS 251, TS 268, TS 375; WRITE on other items.

20% Deposit required on purchases; balance C. O. D.

NC 100



Like new 5-band communications receiver; 1 band 200-400 KC.; 4 continuous bands from 1300 KC to 31 Mcs. Power input: 110V-60 Cycles. BFO & Noise limiter. S meter. Separate RF & AF Gain controls; 1 RF and 2 IF Stages. A HONEY of a set, at LESS than the **\$69.50** cost of the tubes!

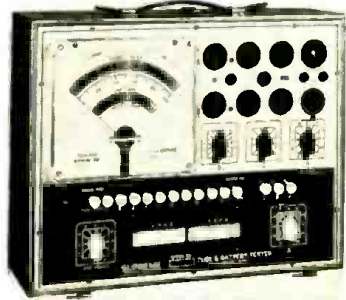
6855 Tujunga Ave., North Hollywood, Calif.
Phone: STANley 7-5458

SMASH SALE!

SUPREME TEST EQUIPMENT

MODEL 600 TUBE & SET TESTER

SUPREME'S Time Tested Emission Tube Tester with all Multi-meter functions—Battery Tester (including the 47.5 volt. Sockets for all tubes (including nine pin) and a spare. **METER** 7" Clear Plastic. Over 6" of calibrated scale plus mirror for accurate readings. **FLEXIBLE**—SUPREME'S Patented Filament Return selector switch insures only one socket for each type tube. **ROLL CHART**—Illuminated—double width—ample room for all tube ratings. Plus one year free tube setting service. **MULTI-METER RANGES**—Operate at the touch of a button. **CASE** Metal in beautiful Hammer-rod finish with removable cover, new type leather carrying strap. **DC VOLTS**—7 ranges of 0.5/1.0/5.0/25.0/50.0/100.0/250.0 volts. Lowest reading of .1 volts. All ranges 1000 ohms per volt. **AC VOLTS**—4 ranges of 0/10/50/250/500/1000/2500 volts. Rectifier guaranteed as any other part. Double bridge circuit affords maximum of scale linearity and rectifier protection. **DC CURRENT**—7 ranges: 0/100 microamperes 1/5 10/50/250 and 1000 milliamperes and 1/10 ampere. Lowest reading 1 microampere. All shunts wire wound. **OUTPUT VOLTS**—4 ranges of 0/5/10/50/250/500/1000 volts. Ideal for receiver alignment. No ext. transformer. **OHMMETER**—5 ranges of 0/200/20,000/200,000 ohms and 2-20 megohms. Center scale of low range 3.5 ohms. Lowest reading 0.1 ohms. Ideal for checking low resistance coils such as voice coils and oscillator coils. **BATTERY TESTS**—Provides proper loads for most commonly used A and B portable batteries. **POWER SUPPLY**—100-130 volts—30/60 cycles. Special voltages and frequencies on request. Note: Test leads furnished with this instrument. Size—11" x 15" x 6 1/2". Shipping Weight—20 pounds. Regular Net Price \$117.50. **SPECIAL ONLY \$89.50**



In Canada order from: CANADIAN RADIO SUPPLY, 262 Queen St. W. Toronto, Ontario.

MODEL 616 TUBE & BATTERY TESTER

CHECKS AM FM TV RECEIVING TUBES AND PORTABLE RADIO BATTERIES. The Supreme Model 616 cannot be beat for EFFICIENT bench or counter tube testing. Minimized obsolescence by use of Supreme patented element selector system. Socket facilities for all AM, FM and TV receiving tubes. **Illuminated Roll Chart** with hundreds of types listed. **TUBE SETTING DATA** on future tubes supplied by Supreme as they come into use. Quality test conditions for both tubes and batteries on "Menther-rod" scales of beautiful BIG SEVEN INCH FULL VISION METER. Non-breakable window. Also checks portable Universal PHONO LOAN. Tests batteries with rated voltages of 1.5, 1.2, 0.45, and .90 volts. Hammer-rod finished metal case with detachable cover. Approx. dimensions 11 x 15 x 6 1/2 inches. Shipping weight 20 pounds. Regular Net Price \$87.50. **Special only \$69.50**

OLYMPIC ELECTRONICS SUPPLY

DISTRIBUTORS

1440 W. OLYMPIC BLVD. • LOS ANGELES 15, CALIF.

EXPERIMENTERS SPECIALS

1 RPM MOTOR
115 volts, 60 cycles. Synchron model 600. Use for timing devices models, displays, gadgets, etc.
Stock No. R-5
Price **\$2.95** each

FILTERED OUTPUT DYNAMOTOR AND SPARES
Model EN-2. 12 volts DC input @ 2.2 Amps. Filtered outputs of 150 v. DC at 0.040 Amps and 3.0 v. DC at 4 Amps. 10 ft. cable with battery clamps. Spare capacitors and chokes, etc. BRAND NEW.
Stock No. R-111

A bargain @ \$17.50 each

AMPERE DEMAND METER
Stewart Warner-748A. Indicates up to 20 Amperes long time average current drain. High time lag—follows heating effect of supply transformers. Use to check motor and line overload as well as peak average demand. Indicating average and average peak recorder pointers.
Stock No. R-119
Special @ **\$3.95** each

Tachometers—Stewart Warner—0-2000 rpm \$5.95 each.
Tachometers—Stewart Warner—0-4000 rpm. \$6.95 each.
Mercury Switch—711 to actual 1 Amp. 4 for \$2.00.
CIB Thyatrons—1 Ampere rating Special. \$4.25 each.
Plastic Box—12 compartments—10" x 1 1/4" \$1.49 ea.
Plastic Box—18 compartments—10" x 1 1/4" \$1.49 ea.
Plastic Box—18 compartments—8" x 1 1/4" \$0.66 ea.

Write for free catalogue of Electronic, Aircraft, Hydraulic, and other equipment. See January Radio and Television News for our Motor Adapter Special.

Minimum order \$2.00. F.O.B. Paterson, N. J.

Electro Devices

INCORPORATED

247 BROADWAY PATERSON, N.J.

New TUBES Standard Brands

Guaranteed	Standard Brands
0A2 \$1.00	6AJ5 \$1.95
0A3 VR75 1.10	6AKSW 1.50
0B2 1.40	6ALSW 2.00
0B3 VR90 1.20	6AN5 3.95
0C3 VR105 1.00	6AN6 2.75
0D3 VR150 1.30	6AR6 2.25
1A3 1.25	8B1 11.95
1B22 2.25	8B8 2.75
1B23 8.95	8B8B 34.95
1B28 West 16.50	8C3A 4.45
1B27 14.50	837 1.45
1B32 2.10	845 8.50
1N21B 1.20	852 19.95
1N22 1.25	861 3.75
1N23A 1.25	861 19.95
1N23B 3.50	868 53.90
1N28 1.50	6F4 4.50
1N40 8.50	6J4 6.95
1N55 2.75	6K4 3.95
1N58A 1.50	15E 1.25
1N63 2.39	15R .69
175GT 9.95	250R 6.95
2C40 25.00	250TH 20.00
2C43 9.95	304TH 7.95
2C44 15.00	307A RK75 4.25
2C52 4.95	350A 5.95
2D21W 2.49	350B 5.95
2K22 39.50	388A 1.49
2K23 39.50	393A 8.95
2K24 39.50	394A 8.95
2K28 32.00	417A 8.50
2K29 23.95	423A 4.50
2K41 110.00	434A 19.95
2K45 110.00	446A 1.19
2K48 Write	446B 3.50
2X2 9.95	450TH 44.00
3A4 .65	464A 10.95
3A5 .85	60CX Write
3AP1 8.95	701A 4.50
3B23 4.95	702A 2.75
3B24 4.95	703A 4.95
3B24W 7.50	705A 1.50
3BP1 3.50	707B 14.95
3C22 8.50	715R 8.95
3C24 24G 1.50	717A 8.95
3C27 2.75	721A 2.95
3C33 9.50	722A 1.95
3C45 14.95	724R 2.75
3DP1 3.95	730L 25.00
3E29 1.95	750TL 3.25
3FP7 1.95	802 10.95
3GP1 3.95	802 3.95
3P7 3.95	804 12.95
4B24 6.95	807W 1.59
4-125A 25.00	807 9.95
4K150A 22.50	809 5.95
4X500A 100.00	810 10.95
5B1 4.25	811 2.90
5B2 4.25	812 6.026
5C22 35.00	812 2.25
5E29 19.95	812 4.95
5FP7 1.95	50-15 55.95
5GP1 4.50	50-20 10.00
5R4CY 1.50	50-32 12.00
6G6W 1.10	12-20 7.50
6AC7W 2.75	100-20 14.50

YOUR SURPLUS WANTED
We pay Highest Prices!

Vacuum Capacitors

Thousands of other receiving and transmitting types in our stock. If you don't see it listed, ask for it. Send cash with order and save C.O.D. charges.

J. S. H. SALES CO.

Dept. R-18, 7552 Melrose Ave., Los Angeles 46, Calif.

A reasonable amount of math may be included, but it must be remembered that the articles are slanted towards practical men, many of whom don't have time to "wade through" page after page of advanced mathematics.

Professional Journals: Articles or "papers" written for these magazines must be on a high academic level. Considerable math is permitted and often desired. Articles are generally concerned with new developments in fundamental research and, more specifically, with the derivation of new circuits and design methods.

2. **Pick Your Subject:** The prospective writer should pick a subject he knows well, but also one that will carry appeal to the readers of the chosen magazine. In general, commonplace subjects are to be avoided. While a top-notch author may be able to write and sell an article on "A Three-Tube Phonograph Amplifier," for example, the beginner will stand a better chance if he chooses a less common subject.

Above all, take care not to "borrow" from previously published material. To do so is not only poor taste, but may also be a criminal offense.

It is possible to write a number of articles on the same, or similar subjects, of course, but deliberate copying may cause legal action against the writer.

Timely subjects are especially good, but care must be taken that the material will not become "dated" in a few months. Often, an article may not be published until several months after acceptance. If the material cannot stand a few months' delay in publication without detracting from its interest, there is a good chance the article will not be accepted regardless of the quality or interest of the writing.

When writing for the general technical magazines, avoid subjects appealing only to very limited groups. To use an analogy, don't write articles appealing only to "one-armed paper-hangers with red hair."

3. **Preparing the Article:** Once the possible market (magazine) and the subject have been chosen, the article itself may be written. Here, again, there are certain basic rules to follow.

Some authors work from an outline, preparing first a "rough draft," then second and third drafts and the final copy. Others prepare only a rough draft, followed by the final copy, thus permitting the first writing to serve both as outline and rough draft. The author generally prepares final copy directly, working from a preliminary outline.

However, until experience is gained in writing, it is suggested that both an outline and rough draft be prepared before starting the final article.

Avoid superfluous words. While some magazines pay on a "per word" basis, and others on a "space" basis, there is an increasing tendency to pay on the relative merits of the article

itself, regardless of length. Thus, a well-written 2500 word article on an interesting subject may result in a larger check than a longer and more wordy article on the same subject.

Articles must be typewritten and should be written on plain white 16 lb. or 20 lb. paper. Double-spacing and good margins are mandatory.

While an occasional error and correction in the body of the finished manuscript is permissible, if there are an excessive number of errors, the manuscript should be retyped.

When writing an article, good grammar is important, but letter-perfect grammar is not as important as an interesting and clear presentation of the written material. Thus, a stiff, cold, and very formally written article may stand less chance of acceptance than an easy-to-read and "straight-from-the-shoulder" style, even with an occasional minor grammatical error.

4. *Illustrations:* When writing an article, remember that the final published material should "look good" if the reader's interest is to be held. Page after page of the printed word may become boring.

Illustrations are especially important in the case of construction articles, where both sketches (schematic diagrams) and actual equipment photographs must be included.

In most cases, the magazines prefer to have any final drawings prepared by their own art staff in order to maintain a consistent style and quality. Therefore, schematic diagrams and other drawings may be submitted as pencil sketches. However, care should be taken in preparing the sketches so that the magazine artist or draftsman will have no difficulty in interpreting and redrawing the illustrations.

It is perfectly all right to use a straight-edge and compass to prepare the pencil sketches. An example of an acceptable diagram is given in Fig. 2.

Photographs must be suitable for direct reproduction. Small snapshots are definitely not acceptable to most magazines. Preferred are 7" x 9" or 8" x 10" glossy prints with good contrast. If possible, the photographs should be made by a commercial photographer and prints prepared "for reproduction."

Fig. 1 (right) shows a poor photograph of a small laboratory meter. It lacks contrast, is slightly out-of-focus, and is improperly lighted. Another shot, from the same angle and of the same instrument, is shown in Fig. 1 (left). Notice the superiority of the second photograph.

Avoid writing on or marking the photograph itself in any way. If it is necessary to identify parts or objects in the photograph, do so on a piece of tracing paper laid over the photo and secured to its back with rubber cement or Scotch tape.

5. *Submitting The Article:* Once the article is finished and "ready-to-go,"

at Last!



Once you make contact with a jobber or distributor who handles the complete line of Sangamo Type PL "Twist-Tab" electrolytics, you will never again have to "shop around" for odd sizes or capacities. Why? ... because the Sangamo line is the most complete in the industry.

Used by all leading manufacturers of TV sets, Sangamo Type PL "Twist-Tab" electrolytics are exact replacements. They assure long life and dependable performance at 85° C and under conditions of high surge voltages and extreme ripple currents often found in TV applications.



Ask your distributor for a copy of the Sangamo TV Replacement Catalog. It's easy to use and helps you choose the right replacement every time.

Deal with your Sangamo "Headquarters."

Those who know ... choose Sangamo.



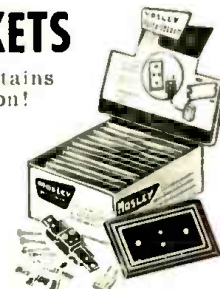
SANGAMO ELECTRIC CO. MARION ILLINOIS

3 easy STEPS TO BETTER TV INSTALLATIONS

with MOSLEY FLUSH SOCKETS



1. Get the PK Package (right)—contains everything needed to complete installation!
2. No outlet box needed. Mounting brackets fit any type wall—easily, quickly installed!
3. Here's a neat, efficient installation. TV owners like the convenience of plug-in connection to lead-in!



Available at Radio Parts Jobbers

MOSLEY Electronics

2125 Lackland Rd.
Overland, Missouri

SUPER SENSITIVE RELAY BK-7-B

Single pole, double throw. Coil 4000 ohms. Sensitivity accurately adjustable. At 5 milliwatts (1 milliwatt, 2 volts) and from 5 to 40 on scale the sensitivity decreases linearly to 1.5 ma (9 milliwatts, 6 volts). Thousands of uses: telemetering, voice-operated or capacity operated or thermocouple operated circuits, relay circuits, etc. Fully enclosed. 1 1/2" x 1 3/4" x 1 1/2" deep. Weight, 1.7 oz. With contact inspection door and screwdriver adjustable stationary contacts.

BRAND NEW, only \$1.95 each (plus 15c mailing charge anywhere in U.S.)
10 for \$17.50, postpaid

A SENSITIVE RELAY!

Closes at 4 to 5 ma. (Extra set of SPST contacts for additional sequences, close at 6.5 ma.) Coil 6000 ohms. Sensitivity easily altered by bonding limit arm or changing spring. Only 1 1/2" x 2 1/4" x 1 3/4" overall. Dozens of applications, and offered at a "stock up" price. Removed from clean equipment.

ONLY 98c each, 3 for \$2.75
Boxed, reconditioned, like new... \$1.69

12 CHANNEL T-V TUNER

Complete front end, famous make "Silver Circle." Furnished with original factory instructions, less tubes, dozens of tubes; receivers, converters, etc. The TV bargain of the year for holidayers, amateurs, students. These are factory selected for minor damage. TUBE & TUBE SHIELD kit for this tuner, ONLY 98c, 3 for \$2.50

RF AMMETER, 0-4 amps, 2" round, thermocouple type, has 1" scale spread between 1 and 3 amps. NEW \$3.95

NOVICE 80 METER CW XMTR

This is the 4-5.3 MC Command xmtr which may be easily converted to Novice operation. We furnish complete instructions, including keyed photos and before-and-after schematics.

EXCELLENT, with tubes... \$8.95
5.3 to 7 Command Xmtr, with tubes, converters, etc. The best requires two more conversion steps... \$7.95

6-9.1 MC Command Receiver, EXCELLENT, with tubes... \$6.95

274N PLUG, 7-prong male plug to fit back of command rxvrs. and xmtrs. This is the same plug as used in the racks. NEW, each 21c five for \$1.00
Local Control Adjuster Parts for 274N or AIC-5 rxvr. Exact pot. switch, knobs, etched plate, and instruction data. Ready to mount... \$1.29
SPRING TUNING KNOB... \$1.75

12 VOLT COMMAND DYNAMOTOR

For receivers SCR-274N, AIA, AIC-5. Plugs onto rear end. 250 V, 60 ma. Guaranteed good condition. Less plug-in base... \$7.95
5.95

A VIBRATOR BUY, 6 or 12 volts, self-rectifying, hermetically sealed. Can take high overloads. With socket and schematic. Specify volts. ONLY 89c

ANTENNA MAST SECTIONS, NS-49, 50, 51, 52. 39c each. New, original packing.

PHASE SPLITTER, or low-level mixer, or hybrid, or push-pull unit. Built-in variable and selectivity. 1:1 to any other; essentially flat 100-15,000 CPS. BRAND NEW, ONLY... 69c

VINYLLITE SPAGHETTI, clear, 0.166 ID, three 2 1/2" lengths for only... 96c

BUILD TV-FM-AM SWEEP GENERATOR

(See Dec. 1951 Radio & TV News)
Now you can build a "VERSATILE" SWEEP FREQUENCY GENERATOR! We've got a few more of those vital APN-1 magnetic units. With reprint of the article... \$6.95

PRECISION CALIBRATED TUNER

Build a Q-meter or an audio oscillator, a signal generator, a VFO, an ultra-stable receiver, or you name it. Lab-standard accuracy and selectivity. 3-gang condenser assembly with 4" precision dial etched 1.5-12 mc in 3 bands plus a reference scale. Triangular plastic hairline indicator; 40:1 ratio drive assembly, all gears spring-loaded double-section. Has tuning lock. Plates are two single speed 250 uf, and one double-speed 250 uf section. Use double section to eliminate drift. ONLY \$4.95

BROADCAST BAND & AERO

MN-26-C Remote Controlled navigational direction finder and communications receiver. Manual DF in any one of three freq. bands, 150 to 1500 KC. 24 V. Self-contained dynamotor supply. Complete installation, including receiver, control box, loop, azimuth control, Left-Right Indicator, plugs, loop transmission line, and flex. shafts. BRAND NEW, ORIG. PACK... \$69.50

SUPER HI-FI HEADSET BUY!

Uses angular-grooved plastic fibre cones with voice coils as in speakers, and built-in transformer to obtain spacing for correct acoustical load. Gives finest music reproduction, flat far beyond upper and lower limits of auditory perception. Pair in series has measured impedance of 600 ohms at 1000 cycles, obtained with built-in high quality transformers. However, severe mismatching makes no apparent difference. Far superior to crystal phones. Manufacturer's net price is \$45.00 per pair! (Each unit can also be used as high quality dynamic mike with 300 ohm output impedance.) They came to you checked out with freshly laundered chamolais pads in cellophane bag. ONLY \$7.95

PORTABLE POWER KITS

1. Includes 2 volt, 20 AH wet cell, lightweight transparent plastic, flurite separators, 3 ball hydrometer, 4" x 3" x 3 1/2" high shippable dry cell, 2 volt charger, chronus vibrator, no tube needed, also 2 volt charger, 115 v 50/60 cy in. This high quality unit uses step-down transformer and dry disc rectifier, with pilot lamp in output to indicate and regulate charging rate. With eyedropper type battery filler and instructions. ALL 4 ITEMS, BRAND NEW... \$4.95
2. Six volt vibrator kit. Vibrator plus non-sens transformer with two outputs: 345 v, 145 ma for plates, 15 v for bias. With schematic. BRAND NEW \$2.75

OUTPUT TRANSFORMER, 5000 ohms input to TWO outputs, 300 ohms or 3.5 ohms. Use as output for 12A6, 6V6, etc. or to match speaker or headset. NEW, potted, shielded... 79c

EASY MONEY!

We're still buying surplus gear. Tell us what you've got, its condition, and your price. If we like it you'll get our check quick.

G. L. ELECTRONICS

905 S. Vermont Ave., Los Angeles 6, Calif.
All Prices F.O.B. Los Angeles. Calif. Buyers Add Sales Tax
SEND FOR OUR LATEST FLYER.

determine the number of words in the article, and give this information along with the number of illustrations and photographs and the author's full name and address on the title page (even if a pen name is used). Some magazines also like the author's name and the title of the article repeated on each succeeding page.

Mail the article in a manuscript type envelope—don't fold the article and send in a conventional envelope, even if the article is short. Articles should *always* be mailed flat. If photographs are included, chipboard or corrugated board stiffening should be included to minimize bending or folding.

If the material is a construction article, be sure to include a complete parts list. Any "special" parts should be indicated, along with the manufacturer's name and type number.

A self-addressed and stamped envelope should be included for the return of the manuscript should it not prove acceptable for use. If this is not done, the article may not be returned to the author if rejected.

If the article is rejected, don't be discouraged. It may only indicate that the magazine already has an article on hand covering the same subject. The article may still be submitted to other magazines and may be sold on the second try. Try and try again!

However, don't submit the same article to more than one magazine at the same time. Both publishers may accept the article, resulting in undue embarrassment all around.

Often, the editor of the magazine will send a letter of general criticism on the article. In such cases, a revision of the article may turn otherwise wasted work into a salable effort. Accept the criticism in the same good spirit in which it is offered, and profit by the greater experience of the editor.

Good Luck! Probably every technician and engineer in the nation has, at one time or another, completed a piece of work which would be a suitable subject for a technical article. Use that subject, follow the general hints given, and write that technical article!

You will find two thrills awaiting you, and it's difficult to tell which is the greater—receiving that first check in the mail, or seeing *your* article in print.

Like many states on this side of the border, the Province of Quebec, Canada, recognizes the emergency value of amateur radio and issues special call-letter automobile registration plates to amateurs.



Special Get-Acquainted Offer!
TUBES AND ACCESSORIES
60%-70% OFF TOP STANDARD BRANDS ONLY. 100% GUARANTEED BUY NOW AND SAVE!

024	\$0.59	6AUG	.69	12K7	.79
1B3	.93	6BE6	.69	12SA7	.66
1Y4	.79	6BG6	1.92	12SK7	.66
1X2	1.16	6BJ6	.64	12SQ7	.53
5Y3GT	.39	6K6	.64	35Z5	.68
5V4G	.49	6SN7	.69	50L6	.68
6AG5	.89	6W4	.63	7C4	.39

CONDENSER SPECIALS

20-20 MFO, 150V	29c	50 MFO, 150V	500
40-40 MFD, 150V	.39c	MFD, 5V (2 in one unit)	.49c
50-30-20 MFO, 150V	.49c	6000 MFD, 15V	.99c
150V	.49c	Mallory	.99c

60" DEFLECTION YOKE complete with made & all necessary resistors & condensers wired in... \$2.95 ea.
RCA FLYBACK TRANSFORMER No. 75585 1.49 ea.
UNIVERSAL TYPE FLYBACK (Regular \$11.50) SPECIAL 2.50 ea.
CRT TUBE REJUVENATOR SPECIAL 1.95 ea.

SPEAKERS

2 1/2" P.M.	50.69	5" P.M.	\$1.39
4" P.M.	1.19	6" P.M.	1.79

5" 62 OHM TV Speaker 99c
WINDOW ANTENNAS: Flying V Antenna 2.85
Straight Low, 2.99
Folded High, 1.40
Folded 101, 5.75
3 1/2" Wall Bracket .29
ROOF ANTENNAS: 100 Ft. 300 Ohm Lead TV Wire, Best Grade 1.89
FREE CHEATER CORD WITH EVERY ORDER!
Write today for FREE CATALOG & MONTHLY SPECIALS on tubes, accessories and equipment.
20% deposit with order, balance C.O.D. All merchandise subject to prior sale. F.O.B. N.Y. Prices subject to change without notice.

ADAMSON ELECTRONICS CO.
589 East Tremont Ave., N.Y. 57, N.Y. Phone: CY9-0979

YOUR OWN ELECTRONIC MUSIC

How to build and play my latest model electronic organ without a knowledge of music.

Send stamp for details
JIM KIRK, W6DEG,
1552 Church St., San Francisco 14, Cal.

ADAMSON'S T.V. RADIO SERVICE LIBRARY

HERE IS LATE INFORMATION IN A HANDY FORM FOR RADIO & TELEVISION REPAIRMEN, SERVICEMEN & STUDENTS



2 VOL. \$6 COMPLETE \$1.00 PAY ONLY 1 MO.
IT PAYS TO KNOW!

AUDELS T.V.-RADIO SERVICE LIBRARY presents the important subjects of Modern Radio, Television, Industrial Electronics, F.M. Public Address Systems, Auto, Marine & Aircraft Radio, Phonograph Pick-Ups, etc. Covers Basic Principles—Construction—Installation—Operation—Repairs—Trouble Shooting. Shows How to get Sharp, Clear T.V. Pictures. Install Aerials—How to Test. Explains Color Systems & Methods of Conversion. 1001 Facts—Over 1260 Pages—625 Illustrations—Parts & Diagrams—Valuable for Quick Ready Reference & Home Study. Tells How to Solve T.V. & Radio Troubles—Answers T.V. & Radio Questions.

Get this information for Yourself.
7 DAY TEST—ASK TO SEE IT!

MAIL ORDER

AUDEL Publishers, 49 W. 23 St., N.Y. 10
Mail AUDELS T.V. Radio Service Library 2 Vols. \$6 on 7 days free trial. If O.K. I will remit \$1 in 7 days and \$1 monthly until \$6 is paid. Otherwise I will return them.

Name _____
Address _____
Occupation _____
Employed by _____

International Short-Wave
(Continued from page 132)

Nacional;" heard from interception 0745 past 0900. (Kary, Pa.) XESC, 15.205, noted 1700 with call in Spanish. (Baitzel, N.J.) XEBT, 9.625, noted around 1300-2100 in Spanish only. (Simpson, Kans.)

Monaco—Radio Monte Carlo noted on the new 7.350 channel (replacing 9.785) in parallel with 6.035 at 0200, strong level in French, commercials interspersed with music. (Pearce, England, others)

Mozambique—The Portuguese Service from Lourenco Marques is noted on 15.285A some days as early as 1515, good level; noted closing 1515 with "A Portuguesa." (Niblack, Ind.) Heard in Britain on this channel from 1045A opening. (Pearce) Lourenco Marques was noted on a channel of 4.825 recently at 1345; was found another day near 4.865 with news in Portuguese 1300, says Pearce.

Lourenco Marques is now on "summer" schedule in English 2300-0200, 11.742, 4.916; 0200-0800, 11.742, 9.766, 7.262; 0800-1200, 11.742, 4.916; 1200-1500, 9.766, 4.916, 3.490; still announces 11.761 but has been measured 11.742; Portuguese Service is 0000-0100, 9.804AV, 4.830; 0430-0630, 9.804AV, 8.005, 7.216; 1100-1500, 4.830, 15.285 (Ridgeway, South Africa)

Nicaragua—Granada, 7.850A, heard 1800 with strong signal in Spanish. (Chatfield, N.Y.) YNBH, 6.015. Radio Panamericana, was heard recently around 2215 with news in broken English, interspersed with short musical interludes and short Spanish announcements. (Stark, Texas)

North Korea—In answer to a query by your short-wave editor, Hahn Ki Syun of Radio Korea, Republic of Korea, says the Communist radio at Pyongyang, North Korea, is using frequencies of 970 kc., 1080 kc., 4.440, and 6.230 (varies). Rosenauer, Calif., says the latter channel now appears to be 6.275A, heard 0950 with speech in Korean, good level.

Northern Rhodesia—Lusaka, 4.826, noted 1300 with BBC news relay, signing off 1400 with "God Save the Queen." (Pearce, England)

Norway—Oslo, 11.735, noted signing on to South America 1800. (Pearce, England) Heard on 15.175 in Norwegian at 1100. (Hoffman, N.Y.)

Pakistan—Radio Pakistan, 17.715A, noted with news 0330; to Indonesia on 15.270 and 17.835, 0630-0715. (Pearce, England) Latter transmission noted in New York. (Mast) Dacca, 4.807, heard in Britain 1110 with native program, fair level, CWQRM. (Catch) Noted on 9.647A from tuning 0750 to close-down 0815; no English; good signal. (Ferguson, N.C.)

Panama—HOJA, 9.645, Chitre, Radio Provincias, is fair from 0600 past 0700. (Kary, Pa.) HO50, 5.995.5, noted 0558 signing on with S7 signal. (Oskay, N.J.) HOLA, 9.505, Colon, on Satur-

SPEED UP YOUR SERVICING WITH "STANCOR TRIOS"



(Groups-of-three most frequently used Stancor TV Replacement Components listed below)

Don't Waste valuable time waiting for a replacement—carry it in stock!

STANCOR CHOKES	C-2325 C-2326 C-2327	COVER 70% of your TV REPLACEMENTS*
STANCOR DEFLECTION YOKES	DY-1 DY-8 DY-9	COVER 70% of your TV REPLACEMENTS*
HORIZONTAL DEFLECTION OUTPUTS	A-8127 A-8128 A-8130	COVER 45% of your TV REPLACEMENTS*
VERTICAL DEFLECTION OUTPUTS	A-8112 A-8115 A-8123	COVER 70% of your TV REPLACEMENTS*
VERTICAL BLOCKING OSCILLATORS	A-8111 A-8121 A-8122	COVER 65% of your TV REPLACEMENTS*

* Based on a statistical analysis of all replacement recommendations in the Stancor TV Replacement Guide.

Stancor Transformers are listed in HOWARD W. SAMS' Photofact Folders and JOHN RIDER'S Tek-Files.

FREE!

Stancor's new 24-page catalog listing over 475 transformers and related components for all types of electronic applications. Includes over 100 TV units. Get your free copy from your Stancor distributor or write Stancor direct!



STANDARD TRANSFORMER CORPORATION

3584 ELSTON AVENUE, CHICAGO 18, ILLINOIS

RCA INSTITUTES, INC.
A Service of Radio Corporation of America, 350 West 4th St., New York 14, N. Y.
OFFERS COURSES IN ALL TECHNICAL PHASES OF RADIO, TELEVISION, ELECTRONICS
Approved for Veterans
Write Dept. RN-53 for Catalog

SOUND POWERED PHONES RCA-MI-2454
Complete with 24' of Rubber Covered Wire. **NEW EXPORT PACKED** Shipping weight 6 lbs. **\$9.95 per set** **2 for \$19.50**
EACH SET GUARANTEED Brand New. Gov't Cost \$42.00
RCA MI-2475 SOUND POWERED PHONES
complete with 22' rubber covered cable press to talk switch are light weight, the mic is on a swivel boom that can be moved to any position in front of face. Cost \$62 ea.
BRAND NEW Price **\$14.95** Ea. Include postage with order.
McCONNELL'S 3834 Germantown Ave. Phila., Penna. RA 5-6033

ARKAY
world's finest radio kits
Write for free Brochure
RADIO KITS, INC., 120 Cedar St., N. Y. 6

Superior's Model 660-A NEW A. C. OPERATED SIGNAL GENERATOR



PROVIDES
COMPLETE COVERAGE
FOR A.M.-F.M.
and TV ALIGNMENT

\$42⁹⁵

DEALERS NET PRICE

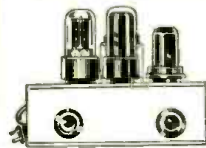
Write Dept. RN-2 for
catalog of complete
line.

**AT YOUR
RADIO
PARTS
JOBBER**



Manufactured and Guaranteed by
SUPERIOR INSTRUMENTS CO.
227 Fulton Street, New York 7, New York

AC-DC MUSIC AMPLIFIER



Volume and tone control.
1.5 w. output.
See your jobber.

MICHEL MFG. CO.
227 N. Water St.
Milwaukee 2, Wis.

LEARN TELEVISION

ELECTRONICS and RADIO
Engineering Laboratory and Classroom
Training. Day and Evening Classes.

Write

for illustrated Catalog

ELECTRONICS INSTITUTE, Inc.
21 HENRY, DETROIT 1, MICH.



Standard Brands

Individually
Boxed

TUBES

PRICES SLASHED

Brand New—Standard Warranty

0Z4S .54	5Y3GS .39	6BA6S .54	6F6GTS .54	6W4GTS .54	12SQ7GTS .63
1B3GT87	6AB461	6BA776	6H657	6W6GT65	198G6G . 1.75
1L445	6AC798	6BC565	6J5GT54	6X449	19T887
1R565	6AC564	6BE657	6J676	6X5GT43	25AV5GT 1.05
1S476	6AG71.05	6BF569	6K6GT54	12AT647	25BQ6GT 1.08
1S564	6AH61.05	6BG6G1.69	6L6GA1.05	12AT776	25L6GT . . .54
1T464	6AK594	6BH672	6SA7GT61	12AU765	25Z6GT . . .49
1U469	6AL554	6BJ661	6SC776	12AV788	35B561
1U561	6AO554	6BL798	6SH758	12BA654	35C561
1X2A79	6AO649	6BN672	6SH758	12BE658	35L6GT . . .61
30A75	6AR554	6BO71.08	6S1764	12BH782	35W441
30Q5GT72	6AS562	6C449	6SN7GT73	12SA7GT62	35Z5GT . . .39
35A65	6AT646	6C557	6S7GT49	12S7GT61	50B561
3V465	6AU654	6C665	6T887	12SH749	50C561
5T41.31	6AV5GT1.05	6CD6G1.82	6V6GT57	12SK7GT63	50L6GT . . .59
5U4G54	6AV646	6E576		12SN7GT73	117Z354
5V4G98	6B4G98				

Many other types equally low priced—include all your tube needs with your order.

One of the largest stocks in the country!

Min. Order \$25.00. Terms: 25% with order, balance C.O.D.

All prices subject to change without notice, F.O.B. New York City. Mail order division.

TeleVision Materials Corp.

125 Cedar St., New York 6, N. Y. • COrlandt 7-4307

days has "late dance music" to 0200 (Sun.) (Vilella, Md.)

Paraguay—The outlet on 6.270A is best before 2100. (Stark, Texas) Is ZPA1, Asuncion.

Peru—*Radio America*, OAX4W, 9.405A, was noted a recent Sun. at 2150 with American recordings and announcements in *English*; mentioned this as a request program; may be weekly feature. (Niblack, Ind.) Heard signing off 0050. (Sutton, Ohio) *Radio Nacional del Peru* is now using OAX4T, 9.550A, to 1800, then changes to OAX4Z, 6.082A. (Vilella, Md.) Latter channel heard closing down 0030 with announcements in *both Spanish, English*. (Saylor, Va.)

Philippines—*Radio Free Asia* relay, 6.110, Manila, noted at good level with news 0920. (Balbi, Calif.) Far Eastern Broadcasting Co., 17.805A, Manila, a new channel, noted 0430 with identification in *English*, wiped out by Rome coming on air 0445; on 11.855 at 1030 with *English* identification, then "Bringing Christ to the Nations" in native dialects. (Pearce, England) DZH7, 9.73, noted 0750 at excellent level. DZH2, 9.64, Manila, heard at weak level 0452. (Ballou, Calif.) DZI4, 6.110, Manila, noted with weak signal 0613. (Oskey, N.J.)

Portugal—Lisbon, 6.374, noted 1900-2005. (Patterson, Ga.) CSA32, 11.995A, opens 1230 in Portuguese. (Baitzel, N.J.) *Radio Sweden* says a new transmitter at Coimbra is testing daily 1300-1500 on 7.020A.

Portuguese India—*Radio Goa* is scheduled 2100-1230 on 6.025, 9.610; has *experimental* transmissions on 3.425. (WRH) Heard on 9.610 in Hindi 0930; Portuguese 1000; *English* 1030; has guitar interval signal; closes 1230; good level in South Africa.

Reunion—St. Denis, 7.168, broadcasts 0900-1200 (Wed. to 1330, Sat. to 1400). (ISWC, London)

Sao Tome—CR5SB, 17.683A, is noted Sun. with strong signal 0700-0800, musical session with Portuguese announcements. (Ridgeway, South Africa)

Sarawak—Scheiner, N.J., has received this information direct from the Information Officer, Sarawak Information Service, Kuching, Sarawak: "The broadcasting station here does not yet exist. Our plans are made, our money voted, and the chief members of our staff engaged, but the station will not be completed and in operation before the end of 1953. In the beginning, it will be operated as a department of this office." Promised further information on developments.

Saudi Arabia—Djeddah, 7.245, noted signing on around 2249 with 8-note signature tone, march, then Arabic music; signal is sometimes S8. (Brown, N.Y.) Noted parallel on 6.102A. (Stark, Texas; Bellington, N.Y.)

South Africa—SABC, 9.870, noted 1400-1500 with *English* program, fair level; QRM at times. (Chatfield, N.Y.) The African Service is radiated from a 5 kw. post office transmitter of the

radio telegraph station at Roberts Heights, 15 miles south of Pretoria; is beamed northerly 0330-0715 weekdays, 0330-0845 Sat. and Sun. on 15.230; 0900-1130 daily on 11.937, and 1145-1505 over 9.870; *English* on Tue., Thur., Sat.; Afrikaans, Sun., Mon., Wed., Fri. (Ridgeway, South Africa) Johannesburg is using 9.680 now for its *new* South-west African transmission 2345-0130, 0315-0715, 0900-1405 (Sun. opens 0055). (*N.Z. DX Times*)

South Korea—Wada, Japan, confirms that Seoul's HLKA is using 9.555 in parallel with Pusan's HLKA on 9.735. The latter outlet is noted from as early as 0340 with Western classical music; commentary in Korean 0345, fair signal in Calif., reports Rosenauer. Measured recently 7.9342 by Ballou, Calif. Heard by Balbi, Calif., from around 0450; cannot hear the Seoul 9.555 channel, however.

Spain—*Radio Mediterraneo*, 6.995A, Valencia, noted strong 1315 tune-in. *Radio S.E.U.*, 7.088, Madrid, strong with call 1930, then popular music; *La Voz de Falange, Madrid*, noted on 7.380A at 1435, still on the air 1535. (Pearce, England) Malaga appears to vary in frequency, is now about 6.960, possibly slightly higher; some days becomes audible as early as 1445. (Kary, Pa.)

Sweden—*Radio Sweden*, 11.880, noted to North America with *English* 0700-0715, then in Swedish; heard with *English* on 9.535 at 2300. (Niblack, Ind.) Heard on 6.065 closing period to North America with *English* announcement 2000. (French, Mass.)

Switzerland—International Red Cross, 7.210, Geneva, recently was heard with test broadcasts in various languages, including *English*, at 0130-0230, 1630-1730. (Kary, Pa.; Pearce, England, others) Wants reports.

HER5, 11.865, noted 0945 with music, good level in N. Y. (Hoffman) Heard opening 1015A to Western North America on 9.535 at excellent level, parallel with (announced) 6.165, 7.21, 9.665, 11.865. (Bishop, Ohio)

Syria—Damascus, 11.913A, noted with news, in clear, 1720-1730 sign-off. (Black, Pa.)

Taiwan—BED7, 7.130A, noted at good level 0435 and again 0630. BED29, 6.095, is fair signal around 0630. (Ballou, Calif.) Taipeh is noted on 11.735 in Chinese dialects from around 0830 to 1145 when has had QRM from *Radio Nederland*; from 0930, BED7, 7.130A, is in parallel. Is good level in *English* on 15.235 at 2300-2400 when goes into Chinese. (Ridgeway, South Africa) BEC32, 9.778V, noted 0500 with *English* program, children's session; BED26, 10.080, heard 0830 with Western music, then Chinese news. (Sanderson, Australia)

Tangier—*Radio Africa* has returned to 7.126 after a brief move to 7.193A; noted with call 1515. (Pearce, England, others) VOA, 7.215A, noted 0830-0922; news in Arabic 0900; had announcements in *English*. (Maynard, Ky.)

Thailand—Bangkok, 7.105, strong 0914. (Ballou, Calif.) Strong signal on 6.24 and 15.625 from 0915 to closedown 1030 when gives call in *English*, then Thai. (Ridgeway, South Africa) Noted on 11.910A with chimes 0615, then news. (Sanderson, Australia)

Trans-Jordan—Ramallah has ceased broadcasts on short-wave. (WRH)

Trinidad—*Radio Trinidad* has news 0700 on 9.625. (West, Va.) Sent this schedule—on 9.625, 0430-1515; on 3.275, 1500-2200. (Levy, N. Y.)

Turkey—TAT, 9.515, heard with powerful signal to North America in *English* 1815-1900. (Machajewski, N. Y.)

Uganda—The station projected for Uganda will use 7.5 kw., to give complete coverage to this Central African colony; will operate in vicinity of 4.000; will not be completed for about a year yet. (Radio Amateur, London)

Uruguay—CXA10, 11.90A, seems to have settled down on 11.895A right atop *Radio Dakar*. (Bellington, N. Y.) Noted with strong signal 1850. (Gerran, N. Y.) CXA3 heard on *measured* 6.0755 at 2125; signed off 2201; announced "CXA3, Integrante de la Radiodifusoras Ariel." (Rastorfer, N. Y.)

USI (Indonesia)—In response to an inquiry, officials of *Radio Republik Indonesia*, Djakarta, explained—Ambon does not operate on 11.089 or in that vicinity as reported by listeners some months ago, but transmits *only* on 4.865. A new transmitter of 50 kw. has been put into service with test transmissions on 9.868A (is heard on *meas-*

BUILD 15 RADIOS

AT HOME ONLY

With the New Improved 1953 Progressive Radio "EDU-KIT" **\$19⁹⁵**

NOW INCLUDES

**SIGNAL TRACER
and
CODE OSCILLATOR**

- FREE TOOLS WITH KIT
- ABSOLUTELY NO KNOWLEDGE OF RADIO NECESSARY
- NO ADDITIONAL PARTS NEEDED
- EXCELLENT BACKGROUND FOR TELEVISION
- 10 DAY MONEY-BACK GUARANTEE



WHAT THE PROGRESSIVE RADIO "EDU-KIT" OFFERS YOU

The Progressive Radio "Edu-Kit" offers you a home study course at a rock bottom price. Our Kit is designed to train Radio Technicians, with the basic facts of Radio Theory and Construction Practices expressed simply and clearly. You will gain a knowledge of basic Radio Principles involved in Radio Reception, Radio Transmission and Audio Amplification.

You will learn how to identify Radio Symbols and Diagrams; how to build radios, using regular radio circuit schematics; how to mount various radio parts; how to wire and solder in a professional manner. You will learn how to operate Receivers, Transmitters, and Audio Amplifiers. You will learn how to service and trouble-shoot radios.

You will learn code. You will receive training for F.C.C. license. In brief, you will receive a basic education in Radio exactly like the kind you would expect to receive in a Radio Course costing several hundreds of dollars.

THE KIT FOR EVERYONE

The Progressive Radio "Edu-Kit" was specifically prepared for any person who has a desire to learn Radio. The Kit has been used successfully by young and old in all parts of the world. It is not necessary that you have even the slightest background in science or radio.

The Progressive Radio "Edu-Kit" is used by many Radio Schools and Clubs in this country and abroad. It is used by the Veterans Administration for Vocational Guidance and Training.

The Progressive Radio "Edu-Kit" requires no instructor. All instructions are included. All parts are individually boxed, and identified by name, photograph and diagram. Every step involved in building these sets is carefully explained. You cannot make a mistake.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" comes complete with instructions. These instructions are arranged in a clear, simple and progressive manner. The theory of Radio Transmission, Radio Reception, Audio Amplification and servicing by Signal Tracing is clearly explained. Every part is identified by photograph and diagram. You will learn the function and theory of every part used.

The Progressive Radio "Edu-Kit" uses the principle of "Learn by Doing." Therefore you will build radios to illustrate the principles which you learn. These radios are designed in a modern manner, according to the best principles of present-day educational practice. You begin by building a simple radio. The next set that you build is slightly more advanced. Gradually, in a progressive manner, you will find yourself constructing still more advanced radio sets, and doing work like a professional Radio Technician. Altogether you will build fifteen radios, including Receivers, Transmitters, Amplifiers, Code Oscillator and Signal Tracer.

The Progressive Radio "EDU-KIT" Is Complete

You will receive every part necessary to build 15 different radio sets. Our kits contain tubes, tube sockets, chassis, variable condensers, mica condensers, paper condensers, resistors, line cords, selenium rectifiers, tie strips, coils, hardware, tubing, hook-up wires, solder, etc.

Every Part that you need is included. These parts are individually packaged, so that you can easily identify every item. Tools are included, as well as an Electrical and Radio Tester. Complete, easy-to-follow instructions are provided. In addition, the "Edu-Kit" now contains lessons for servicing with the Progressive Signal Tracer, F.C.C. instructions, quizzes. The "Edu-Kit" is a complete radio course, down to the smallest detail.

TROUBLE-SHOOTING LESSONS

Trouble-shooting and servicing are included. You will be taught to recognize and repair troubles. You will build and learn to operate a professional Signal Tracer. You receive an Electrical and Radio Tester, and learn to use it for radio repairs. While you are learning in this practical way, you will be able to do many a repair job for your neighbors and friends, and charge fees which will far exceed the cost of the "Edu-Kit." Here is your opportunity to learn Radio quickly and easily, and have others pay for it. Our Consultation Service will help you with any technical problems which you may have.

FREE EXTRAS IN 1953

- ELECTRICAL AND RADIO TESTER
- ELECTRIC SOLDERING IRON
- BOOK ON TELEVISION
- RADIO TROUBLE-SHOOTING GUIDE
- MEMBERSHIP IN RADIO-TELEVISION CLUB
- CONSULTATION SERVICE • QUIZZES
- TRAINING FOR F.C.C. LICENSE

The Progressive Radio "Edu-Kit" is sold with a 10-day money-back guarantee. Order your Progressive Radio "EDU-KIT" Today, or send for further information.

We pay shipping charges all over the world, if you send check or money order for \$19.95 with your order. On C.O.D. orders, you pay cost of delivery.

PROGRESSIVE ELECTRONICS CO.

497 UNION AVE., RN-15, Brooklyn 11, N. Y.

TOP TV SERVICE

REQUIRES

TOP Quality

COMPONENTS

and for
TOP QUALITY
ask for

Elmenco Paper Tubulars



That white, ceramic-cased paper tubular is appearing in more and more TV circuits as new models roll off the lines... your assurance that this unit excels those which preceded it.

Follow the lead of these manufacturers by offering your customers complete satisfaction with components which will require no further replacement during the life of their sets...

**Air-Tight,
Water-Tight,
Yet
Reasonably
Priced**

Just
Wire In
and
Forget.



And you can keep a stock of Elmenco Capacitors on hand without worry of deterioration on the shelf. They have unlimited shelf life.

Contact your local jobber for full information and ask him about our handy paper tubular kits.

STANDARD PAPER KIT

5 Each
of 25
Capacities

.001 to .1—600V; .25—400V & .5—200V
List Price \$37.50

1000 Volt Paper Kit 5 Each of 17 Capacities
.001 to .05 MFD
List Price \$35.00

ARCO ELECTRONICS INC.
103 LAFAYETTE ST., N. Y. 13, N. Y.

ured 9.866 at 0430-1030 in parallel with 6.045, according to Balbi, Rosenauer, Calif., others). A service is planned for the whole of USA but when it will be inaugurated is yet unknown. PLB9 and PLQ2, reported heard some months ago, are not stations of *Radio Republic Indonesia*; officials said these might be amateur stations or stations used by the Post-Telegraph and Telephone Service as transmitters for telephone communications. (Scheiner, N.J.)

YDF6, 9.580. Djakarta, has been heard with "Voice of Indonesia" program in *English* for Europe 1400-1500, evidently replacing YDF7, 11.770. (Fairs, England, via URDXC) However, may be using both 9.580 and 11.770 at 1400 since Pearce, England, more recently heard this broadcast on the 11.770 outlet; announced three daily broadcasts in *English*—for 0600, 0930, 1400; announced use of 11.77, 15.15. Radio Sweden says Djakarta has been heard with an *English test* program on 11.935 at 0630-0725 sign-off. Gillett, Australia, notes an Indonesian on 3.960A at 0600 with good level.

Vatican—HVJ, 11.685, noted recently with *English* 1315-1330. (Niblack, Ind.) Heard signing off on 9.55 at 1615 after 15-minute period in Russian. (Baitzel, N. J.) Noted on this channel with news 1000. (Balbi, Calif.)

Venezuela—Radio Barquisimeto verified reception of 9.510, call YVXJ, by hectograph form letter in Spanish; QRA is Avenida 20 No. 491 (or Apartado Postal 76); listed YVMQ, 4.940, 4 kw., and YVMR, 1490 kc., 3 kw. YVKT, 3.350. Caracas, has newscast in Spanish 1830-1900; one night recently had news in Italian 1900-1915, then news in Portuguese to 1930.

Western Samoa—From 2AP, Box 23, Apia, Western Samoa, Scheiner, N. J., has received word that this (medium-wave) station has two short-wave fre-

quencies, one of which, 6.040, will test soon, but no date could be fixed; 2AP operates on 1420 kc.

Press Time Flashes

Radio Free Europe can be heard at excellent strength 1900 on 9.695 in foreign language. (Niblack, Ind.) Madrid, 15.625, noted with news in Spanish 1146, signing off 1155A. (Pearce, England) Leon, Spain, more recently has been heard on 7.590A concluding relay from Madrid 1625. (Kary, Pa.) A station heard in Arabic on 5.000 around 1340-1403 close (with short band ant- them), is probably Al Kuwait, Kuwait, in the Persian Gulf. (Pearce, England)

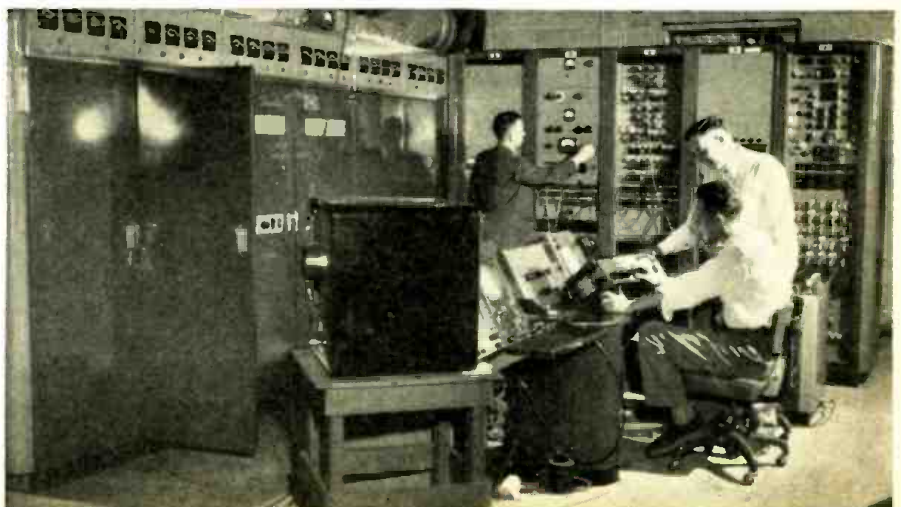
Pearce, England, says he has been unable to log EA8AB, Canary Islands, for some weeks now, although WRH reports it is currently operating on 7.295. Kary, Pa., recently noted this one on 7.305A with bad QRM to 1800 closedown; news in Spanish 1705. The *Voice of America*, New York 19, New York, has informed Kary, Pa., it is now set up to verify reports on reception of the relay base outlets overseas.

The station manager of medium-wave ZNS, Bahamas, has thanked Kary, Pa., for a report on reception of ZNS on 7.308A, but did not indicate if this is a fundamental operation or a spurious frequency. This one has been heard with weak signal here in West Virginia with BBC relay 1800, then local program from 1815 when gives the time in EST.

Radio Athens, 7.300, more recently has had news 0000. (Bellington, N. Y.)

Emisora Nuevo Mundo, 6.000, Bogota, Colombia, verified with attractive QSL card; listed HJKC, 830 kc., 10 kw.; HJKD, 6.100, 10 kw., and HJKF, 9.520, 10 kw. (Kary, Pa.) A station heard on 7.126A around 0830-0900 with native music is probably Hargeisa, British Somaliland. (Stark, Texas) Is scheduled 0815-0930 according to QSL

The transmitter room of Station KPTV, Portland, Oregon, the first u.h.f. station to go into operation in the country. The transmitter is the same as that used by RCA-NBC at its experimental station in Stratford, near Bridgeport, Conn. At the control desk is Russ Olsen, station's chief engineer. Looking on is Bill McAllister, NBC engineer who helped install the transmitter. Working at the panel in the far corner is Victor Bary, another National Broadcasting Co. engineer.



received. (Radio Sweden) At press time, *Radio Jamaica* appeared back on 3.360 from 4.950 to 2300 sign-off. (Saylor, Va.) *Radio Brazzaville*, 11.970. French Equatorial Africa, takes relay from Paris 1445 of *English* lesson ("The French Have a Word For It"); good strength in Britain. (O'Sullivan) *Radio Journal do Commercio*, Recife, Pernambuco, Brazil, sent schedule of 15.145, 455-1300; 11.825, 1100-2120; 9.565, 0455-1105, 1300-2120. (Boggs, Mo.) Zurich sunspot prediction for March is 21; for April, 20. (Ferguson, N. C.)

Radio Juventud de Sabadel is on a new channel of 7.312, audible from around 1400. (Buettner, Germany) Direct from Taipei, Taiwan, comes this current schedule of "Voice of Free China"—2300-2400, 15.235, 11.735, *English* to USA 0530-1230, 7.130, 11.735, 6.095 (latter 1100-1230 only), to Japan, Korea, Malaya, Chinese Mainland; 1400-1600, BED4, 11.800 (reported "heard," however, on 11.920—K.R.B.) to Europe and the Near East with *English* 1420-1445. (Kary, Pa.)

The Ecuador station on measured 6.7873 announces as *Radiodifusora Costa Azul*, Portoviejo, Province of Manabi; noted 2026-0041; the measured 6.8298 outlet announces "Radio Equinoccial," Ibarra, Province of Imbabura. (Rastorfer, N. Y.)

Here is the complete schedule of *Radio Pakistan* as received by Scheiner, N. J. Service for East and West Pakistan—Karachi, 2125-2300, 5.980; 0210-0230, 15.270; 0230-0430, 9.645; 0730-0810, 7.096.6; 0915-1045, 5.990; 0815-0900, 7.096.6; 2115-2300, 15.335; 0210-0230, 17.710; 0230-0430, 17.710; 0730-0750, 17.835; 0915-1045, 6.945, 9.630.

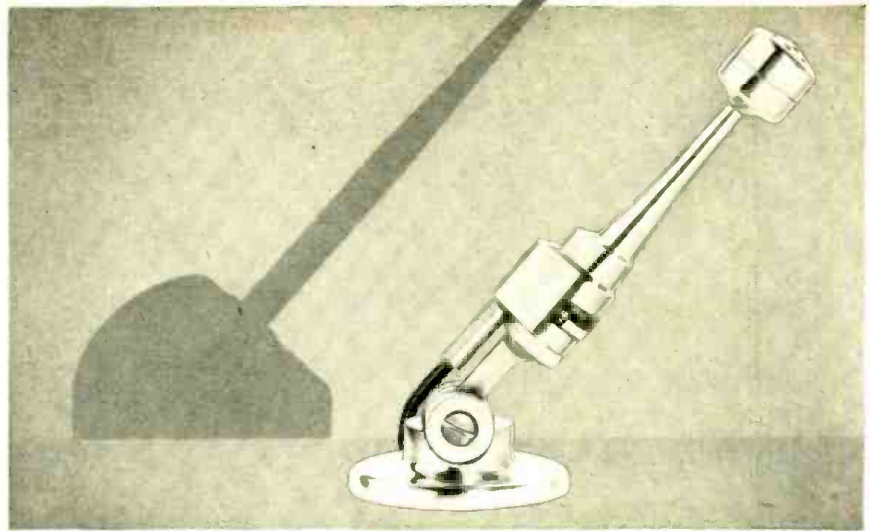
Zonal Service—Lahore, 2115-2330, 3.915; 0230-0310, 6.138; 0730-0930, 3.469; 0930-1300, 3.469. Dacca, 2000-2200, 4.807; 0100-0130, 7.150; 0600-0800, 4.807; 0815-1130, 3.325. *External Services*—Karachi, 1430-1515, 6.235, 7.010 in Turkish Service; 1515-1600, 6.235, 7.010, to United Kingdom; 2015-2100, 11.885, 15.335 to Southeast Asia; 2315-2400, 17.750, 15.335 to East and South Africa; 0445-0530, 9.645, 15.335 to South Asia; 0630-0715, 15.270, 17.835, Indonesian to Indonesia; 0830-0915, 9.630, 9.645 Burmese to Burma; 1100-1200, 6.235, 7.010. Afghan-Perisian program; 1210-1230, 6.235, 7.010. General Overseas Service (slow-speed news in *English*); 1230-1315, 6.235, 7.010, Iranian Service; 1315-1415, 6.235, 7.010, Arabic program; power for Karachi was listed 50 kw., for Lahore, 300 w., for Dacca, 7.5 kw. To East and West Pakistan uses *English*, Urdu, Bengali, Sindhi, Kashmiri, Baluchi, Gurati, Pushto; Lahore uses *English*, Urdu, Punjabi; Dacca uses *English*, Urdu, Bengali.

Acknowledgment

Thanks for the fine reports. Just keep them coming to Kenneth R. Board, 948 Stewartstown Road, Morgantown, West Virginia, USA. Good listening! K.R.B.

February, 1953

Smaller than a desk pen — just as convenient



The NEW Turner C-4 Stand for Model 80 Microphone

The new C-4 stand gives complete maneuverability and convenience with the Model 80. It pivots the microphone in a 135° arc for any operational angle — swings parallel to base needing little more packing space than two packs of cigarettes.

The microphone is held firmly by the unique, positive-action hinge, yet moves smoothly and easily to any desired position without adjustment. Microphone quickly and easily removed.

This new, matching stand is solidly built of die-cast zinc overlaid with beautiful satin chrome plate. It is heavy enough to prevent tipping — it will not slide with the weight of the cord. The C-4 stand complements the graceful shape of the Model 80; the combined unit is an attractive but inconspicuous addition to a speakers' table. Ideal for use with wire recorders, public address systems, pulpits, office and factory call systems, amateur operators and other similar uses.

Model C-4 matching stand. 3/8" — 27 thread. List Price.....\$ 5.75
Model 80 Microphone. List Price.....\$15.95



THE TURNER COMPANY

900 17th St., N. E. Cedar Rapids, Iowa

In Canada: Canadian Marconi Company, Toronto, Ont., and Branches
Export: Ad Auriema, Inc., 89 Brood Street, New York 4, N. Y.

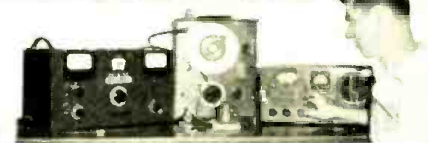
SCHEMATICS—CONVERSIONS FOR SURPLUS GEAR

NEW LIST! MANY ADDITIONS!

Send stamped, self addressed envelope for List B. Add 25c for chart explaining AN nomenclature.

R. E. BOX 1220
GOODHEART BEVERLY HILLS, CAL.

GET INTO ELECTRONICS



You can enter this unovercrowded, interesting field. Defense expansion, new developments demand trained specialists. Study all phases radio & electronics theory and practice: TV; FM; broadcasting; servicing; aviation, marine, police radio. 18-month course. Graduates in demand by major companies. U.S. or equivalent required. Begin Jan., March, June, Sept. Campus life. Write for catalog.

VALPARAISO TECHNICAL INSTITUTE
Dept. RD Valparaiso, Indiana

FREE

Write today for "How to Service T. V. Receivers" with the HICKOK VIDEO GENERATOR.

The Hickok Electrical Instrument Co.
10824 Dupont Ave., Cleveland, Ohio



Special Offer On This Complete RADIO ENGINEERING LIBRARY

New, Up-To-Date Edition of Famous Library Covers Whole Field of Radio Engineering. Places Latest Facts, Standards, Data, Practice, and Theory At Your Fingertips.

The five big volumes of the new edition of the Radio Engineering Library now include the very latest facts, standards, data, and practice. This Library will help solve hundreds of problems for designers, researchers, engineers, and students in any field based on radio.

Written by leading radio engineers, these books cover circuit phenomena, networks, tube theory, vacuum tubes, amplification, measurements, etc.—give specialized treatment of all fields of practical design and application. They provide you with a complete and dependable encyclopedia of facts.

- 5 Volumes, 3872 Pages, 2770 Illustrations.
- Eastman's **FUNDAMENTALS OF VACUUM TUBES**, 3rd Edition.
- Terman's **RADIO ENGINEERING**, 3rd Edition.
- Everitt's **COMMUNICATION ENGINEERING**, 2nd Edition.
- Hund's **HIGH FREQUENCY MEASUREMENTS**, 2nd Edition.
- Henney's **RADIO ENGINEERING HANDBOOK**, 4th Edition.

SEND NO MONEY

Special Low Price—Easy Terms

On this special offer you get this Library for \$37.50, instead of \$43.50. You save \$6.00 and may pay on easy terms. Mail coupon below to examine the Library FREE for 10 days. No obligation. These books are recognized as standard works; you are bound to need them. So take advantage of this special money-saving offer. *Mail coupon at once!*

McGraw-Hill Book Co., Dept. RTN-2-53
327 West 41st St., New York 36, N. Y.

Send for 10 days' FREE trial, the RADIO ENGINEERING LIBRARY. If not satisfied I will return books. Otherwise I will send \$7.50, plus delivery charges, then; and \$6 a month for 5 months. (Reg. price \$43.50; you save \$6.)

Name.....
Home Address..... RTN-2-53
City & State.....
Employed by.....
 We'll Pay Delivery Charges if you enclose \$7.50 first payment WITH coupon. Same return privilege.

14 mc. Rotary Beam

(Continued from page 68)

A matching device between the transmission line and the driven element is necessary because transmission lines on the order of 5 to 15 ohms are not obtainable. Depending somewhat on the height above the ground, the impedance of the driven element of a three-element array is usually about 10 ohms. A 600-ohm open-wire untuned line, which can be any length, was used for the transmission line. In order to match this 600 ohms to the 10-ohm impedance of the radiator, a 75-ohm coaxial cable (RG-11U) ¼ wavelength (electrical) was used. For a given transmission-line impedance, Z_L , and radiator impedance, Z_R , the impedance of the quarter-wave transformer, Z_T , is determined by the following relation:

$$Z_T = \sqrt{Z_L \times Z_R}$$

For example, if a 300-ohm transmission line were used with the 3-element array, then

$$Z_T = \sqrt{300 \times 10} = 54.8 \text{ ohms.}$$

In this case, 52-ohm coaxial cable could be used.

The actual physical length of the quarter-wave transformer is not ¼ wavelength, but is somewhat shorter due to the "velocity factor" of the particular cable used. Most manufacturers give this "velocity factor" in the data for their cable. Using this figure, the following equation may be used to calculate the actual physical length required for the transformer:

$$L = \frac{KV}{f}$$

where: L = length in feet of the transformer,

K = a constant, 246,

V = velocity factor of cable used for transformer.

f = resonant frequency of the array in megacycles.

The RG-11U cable used has a velocity factor of 0.65; the length of the transformer, therefore, was:

$$L = \frac{246 (0.65)}{14.25} = 11.2 \text{ feet}$$

A further improvement may be made by using a shielded cable such as "Twinax" for the transformer. With such a cable, a capacitive unbalance to ground does not occur when the transformer is run up inside the metal pipe shaft. The cable length within the shaft of the array should be kept to a minimum if conventional coaxial cable is used.

The standing-wave ratio of the transmission line is about 4:1. This is negligible for the 600-ohm line, but it must be remembered that the power carried by the quarter-wave transformer would then be quadrupled. It is important to select coaxial cable

POLYSTYRENE					
ROD — 12" or 48" lengths					
Dia.	12"	48"	12"	48"	
1/8"	\$.03	\$.12	3/4"	.80	3.20
3/16"	.06	.24	1"	1.55	6.20
1/4"	.10	.40	1-1/8"	2.00	8.00
5/16"	.16	.64	1-1/4"	2.30	9.20
3/8"	.21	.84	1-3/8"	3.00	12.00
7/16"	.30	1.20	1-1/2"	3.30	13.20
1/2"	.40	1.60	1-3/4"	4.50	18.00
5/8"	.57	2.28	2"	5.90	23.60

SHEET-masking paper both sides.

Thickness	Size	Price
1/16"	12" x 12"	\$2.50
3/32"	12" x 12"	2.75
1/8"	12" x 12"	3.00
3/16"	12" x 12"	3.75
1/4"	12" x 12"	4.60
1/16"	12" x 24"	4.90
3/32"	12" x 24"	5.25
1/8"	12" x 24"	5.90
3/16"	12" x 24"	7.25
1/4"	12" x 24"	8.25
1/32"	20" x 20"	7.75
1/16"	24" x 24"	9.50
3/32"	24" x 24"	10.25
1/8"	24" x 24"	11.75
3/16"	24" x 24"	14.00
1/4"	24" x 24"	16.00
5/16"	20" x 20"	14.50
3/8"	20" x 20"	16.00
3/8"	24" x 24"	23.75
1/2"	20" x 20"	21.50
1/2"	24" x 24"	31.88
5/8"	20" x 20"	34.50
3/4"	20" x 20"	41.00
1"	20" x 20"	55.50

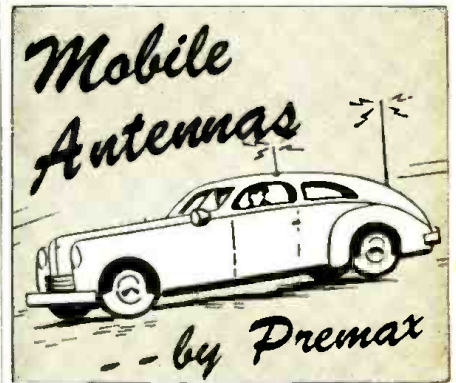
TUBING — 12" or 48" lengths.

O.D.	I.D.	12" lgth.	48" lgth.
1/4"	1/8"	\$.07	\$.28
5/16"	3/16"	.10	.40
3/8"	1/4"	.13	.52
1/2"	3/8"	.18	.72
5/8"	1/2"	.23	.92
3/4"	5/8"	.29	1.16
1"	7/8"	.38	1.52
1-1/2"	1-1/4"	1.13	4.52
2"	1-3/4"	1.50	6.00

All prices F.O.B. our warehouse New York

LEEDS RADIO CO.
75 Vesey St. Dept. A New York City 7

Amateur and CD



From 2 to 75 Meters

Tested and proven Antennas for the 1¼, 2, 6, 10, 11, up to 75-meter mobile installations—designed to increase the signal strength and yet offer low-cost equipment for amateurs and Civil Defense Corps.

Send for special Bulletin and prices.

PREMAX PRODUCTS
DIVISION CHISHOLM-RYDER CO., INC.

5304 Highland Ave. Niagara Falls, N. Y.

RADIO & TELEVISION NEWS

for the transformer which will carry the power required. The approximate power in the cable may be determined by assuming a final class C amplifier efficiency of about 75 per-cent. In the array described, therefore, the power would be 600 x 0.75, or 450 watts. With a standing-wave ratio of 4:1, however, there would be 1800 watts of power being carried by the coaxial cable, as well as by the 600-ohm line.

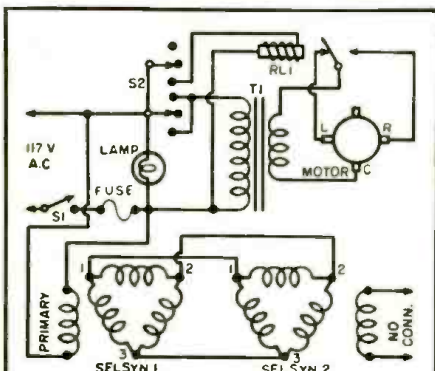
The fundamental reason for a mismatch which creates standing waves is that the transmission line is not terminated in a pure resistance. Mismatch may be caused by a radiator cut to the incorrect length, by nonsymmetrical transmission lines, by unbalance to ground along the line, or by an incorrectly tuned quarter wavelength transformer. If the radiator is cut accurately according to the equation given previously, and if the transmission line is mounted symmetrically and kept at least a few feet away from metallic objects, this loss due to mismatch may be neglected for all practical purposes.

The 600-ohm transmission line was connected to the 75-ohm, quarter-wave matching transformer by means of slip rings. A set of slip rings was mounted on the shaft of the array with brass brushes (1/8" diam. rod stock) connected to the 600-ohm line making contact with the rings. The 75-ohm coaxial cable which runs up the center of the shaft connects to the inner surface of the rings, thus making possible continuous rotation in either direction.

Electrical Controls

As mentioned previously, a propeller-pitch control unit is used to rotate the described 20-meter array. These rotator units come complete

Fig. 8. Wiring diagram of 14-mc. beam rotator and selsyn-indicator systems.



S₁—S.p.s.t., 125 volt, 10 amp. switch
 S₂—D.p.d.t., 125 volt, 3 amp. switch ("center off")
 T₁—Trans. 117 v. primary, 50-60 cycles, 10-20 v. sec. @ 10-15 amps.
 RL₁—S.p.d.t. relay, normally closed, 15 amp. contacts, 117 v. a.c. coil.
 Lamp—117 v. pilot lamp (see text)
 Motor—Propeller-pitch type motor (see text)
 Fuse—125 v., 5 amp. "Slo-Blo" type
 Selsyns (2)—117 v., 60-cycle type. Lower-voltage surplus types can be used (see text).
 *Note: The motor will have four connection terminals. Consult the instruction sheet supplied with the motor to determine which three of the terminals to use for this application.

RADIO SHACK BUYS OUT APPROVED HI-FI FM-AM TUNER INVENTORY!



Reg. \$63.25

12 MIN. TUBES
 DOUBLE LIMITER
 DISCRIMINATOR
 TUNED RF (AM)
 TUNED RF (FM)
 10 uv @ 92 MC
 12 uv @ 106 MC
 ORDER BY MAIL

Another exclusive Radio Shack value. The nationally cataloged *Approved Electronics* Model A-710 hi-fi genuine Armstrong circuit PM-AM tuner at a price more than 45% below regular dealer net! With 12 miniature tubes, escutcheon, knobs, schematic and full guarantee. Compact 8 1/4 x 5 3/4 x 8" deep chassis. Less power supply: requires 170V DC @ 20 mls and/or 150V DC @ 40 mls, and 6.3V AC @ 4 amps — see A-620 supply below. Tuner: Ord. No. 36-206, \$34.50.

MORE APPROVED ELECTRONICS BUYS!

\$37.50

APPROVED PREAMP-EQUALIZER!



\$19.95

Model A-800, almost half off! Preamp for magnetic pickups, 6 pos. equalizer for G-E and Pick. Separate tone controls and all remote features. Take power off Williamson and other amps. Ord. No. 33-246, \$19.95.

APPROVED'S
 A-610 SUPPLY
 ONLY \$12.05



For A-710 Tuner, scores of other uses. 6.3V AC @ 4 amps, 150V DC @ 40 ma, 170V DC @ 20 ma. Ord. No. 36-207, \$12.05.

TECHMASTER
 WILLIAMSON
 Amplifier KIT



Williamson type kit, complete to the last component, can be wired by anyone. Includes power supply, 9 x 12 x 6 1/2". Ship wt. 27 lbs. Order No. RN33-340 \$49.95

FREE! 224-PAGE
 1953 CATALOG —
 WRITE TODAY!



MAIL ORDER
 FACTS:

Include estimated postage, we refund any overpayment. Min. 20% deposit on COD's. Write for time-pay form!

RADIO SHACK

CORPORATION

167 Washington St., Boston 8, Mass.

BEFORE YOU SELL, LET US BID ON YOUR ART-13's

Also need CFI units for above—and will pay top \$5 for BC-788, 1-152, and BC-348 receivers.
 For Top Prices, Write
BOB SANETT
 5404 1/2 Packard St. Los Angeles, Calif.
 Phone: WEBster 1-7414



BARGAIN HUNTING?
RADIO SERVICEMEN!
 Write for SENSATIONAL CATALOG
HENSHAW RADIO SUPPLY
 3619 TROOST KANSAS CITY, MO.

REG. \$8.20
 DUAL PICKUP
 ONLY \$5.70



The most famous make variable reluctance cartridge (requires preamp) and a Radio Shack exclusive. Separate sapphire styli for 78 and 33-45. Same as reg. stock except for packaging which is mfg's bulk. Ord. No. 15-092, \$5.70, 3/\$16, 6/\$30.

EQUALIZER FOR GE CART.



Also for Audox, and another Radio Shack exclusive. 6 position switch for all domestic and foreign 78 and LP records, including noise eliminator. No wiring: plug tone arm lead into equalizer, plug equalizer lead into preamp; mounts on any panel. Ord. No. 15-568, \$11.95. Special, with above cartridge, \$16.95.

AUDIOPHILES! COOK LABS. 10" LP HI-FI DISCS, \$4 EACH

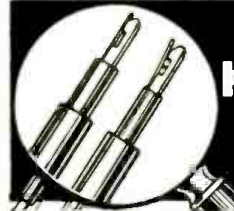


#1025 *Kills On Parade* (bagpipes). #1070 *Rail Dynamics* (RR sounds). #1035 *Great Barrelhouse Piano* (hi-fi on the nickelodeon). #1030 *Harp solo*. #1050 *Pipe Organ Vol. 1*. #1051 *Pipe Organ Vol. 2*. Also Cook test records \$4.80 each: Series 10 (78 rpm); Series 10A (10" LP). Both have 35-20,000 cycle tones accurately calibrated. Add 50c per ship't for packing and mailing.

ACROSOUND TO-300 XFMR. FOR ULTRA-LINEAR "WILLIAMSON" AMPLIFIERS

Half the size of competitive units. Freq. response ± 1 db, 10 cps to 100 kc. 24 watts @ 3% intermodulation with only 3/4 volt input. Gray Hammerstone case. Order No. R14-343. \$24.75

LOOK! KLIPZON FREES BOTH HANDS!



UNIQUE SELF-HOLDING POINTS bring new convenience and timesaving to service work.

- V.H.F. CRYSTAL PROBES
 - ADAPTORS
 - STREAMLINED TEST PRODS
 - CONNECTORS
 - LOW LOSS — LOW CAPACITY LEADS
- See KLIPZONS at your distributor. Send for FREE folder #36.

UNITED TECHNICAL LABORATORIES
 Engineers • MORRISTOWN, N. J. • Manufacturers



PREAMPLIFIER-EQUALIZER • MODEL 50-C

THE HIT of the
AUDIO FAIR!

The Fisher Master Audio Control

MODEL 50-C

■ This is the equipment (50-C and 50-A) used to reproduce WQXR's binaural broadcast to the AES Annual Banquet. You can pay considerably more but you cannot buy finer! THE FISHER Master Audio Control can be used with any amplifier. Intermodulation distortion is virtually unmeasurable; complete, professional phonograph equalization settings and tone controls; genuine F-M loudness control; 5 inputs and 5 independent input level controls; cathode follower outputs. Finest preamplifier. Self-powered.

As shown, 50-C: \$97.50
Chassis only, 50-CH: \$89.50

The Fisher All-Triode Amplifier

MODEL 50-A

■ THE FISHER Laboratory Standard Amplifier is, beyond a shadow of a doubt, the world's finest all-triode amplifier—and yet moderately priced! FEATURES: High output—less than .3% harmonic distortion at 40 watts (.08% at 10 watts.) Intermodulation distortion below .8% at 40 watts. Uniform response within .1 db, 20-20,000 cycles; 1 db, 5 to 100,000 cycles. Hum and noise better than 98 db below full output. Quality components used throughout. Beautiful workmanship. \$159.50

Write for illustrated brochure

FISHER RADIO CORPORATION
39 EAST 47th STREET • NEW YORK
ALL-TRIODE AMPLIFIER • MODEL 50-A

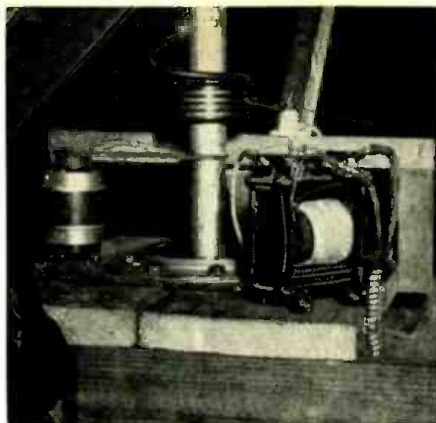
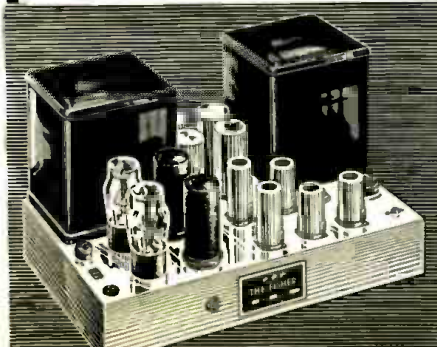


Fig. 9. Side view of the rotator mechanism, showing the indicator selsyn, the motor transformer, and the coaxial matching section entering the pipe shaft.

with motor and gear box and are ideal for this purpose. They are presently selling for about \$15.00 and are well worth it.

The simple electrical system employed with the rotator, as shown in Fig. 8, consists of a d.p.d.t. switch, normally open in the center position, a 10-to-20-volt, 15-ampere transformer, and a s.p.s.t. 110-volt a.c.-operated relay, normally closed, with contact points capable of making and breaking a 15-ampere circuit. BX cable was used for all the wiring shown in Fig. 8.

The transformer and relay were mounted as close to the motor as possible to provide for short leads in the motor circuit. The switch, S_1 , fuse, and lamp were mounted together near the beam-heading indicator shown in Fig. 6. The lamp is used to light the beam-heading indicator, which can be a compass card or great-circle map, so the lamp can be of any convenient size and brilliance. The switch S_2 was mounted at the operating position for convenience.

Selsyn #2 was mounted upright near the shaft of the array and coupled to the shaft by means of a rubber belt, as shown in Figs. 2 and 9. The pulley for the selsyn is a 1-inch length cut from the pipe shaft, thus providing a 1:1 ratio. Gears may be used to couple the shaft of the array to the selsyn, but this method is much more expensive and is not necessary. Although some error may be introduced due to slight differences in the circumferences of the shaft and the pulley and to slippage, this error can be kept to a minimum by rotating the beam backwards to return it to its final position of rest. To keep the array properly oriented, the beam-direction indicator should be marked with a small arrow to indicate the position of rest.

You will notice that the primary of only one of the two selsyns was connected to the a.c. line. The other was left "floating." Both primaries could have been connected, but it was unnecessary since no appreciable power was needed to drive the arrow on the indicator map or compass card. If both are connected some fussing with phas-

MID WINTER SALE PRICES SLASHED

T.V. TUBES—ROCK BOTTOM PRICES

In lots of 6 each No. only
6BG6 89c 6CB6 39c 6AQ5 38c
19BG6 89c 6AK5 69c 6CD6 \$1.09
12AX7 47c 6BQ6 57c 654 49c

Tube Special—Broken Keys—Electrically Perfect
12SK7 8 for \$2.00 12SK8 4 for \$1.00
6L6 69c; 4 for 2.25 12K8 49c; 7 for 3.00
Tube Sale—2A7-35-27-85-31-50-57, No Mixed Ass'n.
6 of Any Type \$2.25

Heavy Duty Shielded P.P. Input Trans. \$1.00
Signal Corps Transmitting Keys 49c
Bat Handle S.P.S.T. or D.P.S.T. Toggle Switch, 25c
In Lots of 12, each 23c

2 Gang Var. Cond. 456 K.C. with Osc. Section. 49c
2 3/4 in. Pulley on 3/8" Shaft. 49c

2 Gang S.W. Var. Cond. 50 MMFD per Sec. Double Spaced, 10-30 Meters with Tank Coil 1/2 in. Shaft 39c

Westinghouse Kuprox Rectifier 0.64 Amp. 28 Volts. Reg. \$11.00 ea. Special. \$1.95

BRAND NEW 10" PHONO RECORDS—ASST. Jazz—Popular, Rhythm—Blues. Please specify. 12 for \$1.79 or 24 for \$3.00

Single Pole—10 Pos. 2 Gang Switch 29c

2 piece, 5 pole Male and Female separable Amphenol plugs, Both with Flex. shielded cables, Approx. 5 ft. long, 35c pair 3 pr. for \$1.00

Grid your own Crystals. Pure Brazilian Quartz. Various sizes and thicknesses. 1/2 lb. blk. \$1.00

4 Tube Drilled Chassis. 4 1/2" x 6 1/2" x 1 1/2". 29c each

5 in. 450 ohm Dynamic Speaker \$1.35

Signal Corps Phones—2 M. Ohms (8 M. Ohms Imp.) \$1.25

2 Ft. Ext. Cord (and Plug) 40c

TOBE TUBULAR ELECTROLYTICS

20-20 MFD. 150 V. 49c 30-30 MFD. 150 V. 57c

40-40 MFD. 150 V. 89c

Low-Loss Short Wave Lock Type Air Trimmer Variable Condensers

5 Pl.—20Mmfd. 14c

7 Pl.—25-30 Mmfd. 15c

8 Pl.—30-35 Mmfd. 16c

14 Pl.—56 Mmfd. 24c

3 GANG T.R.F. VARIABLE CONDENSERS

D.P.D.T. SLIDE TOGGLE SWITCH 15c

1,000 OHM WIRE WOUND POTENTIOMETER. 13c

30 MV-FILTER CHOKE SHIELDED 3 for \$1.25

PIZZO CRYSTAL HOLDERS. 12 for \$1.00—\$8.00 per C

RCA Band Switches—

3 Gang, 3 pos. 3 band, 30c 6 gang, 4 pos. 4-5 band, 40c

Trimmer-Padder Ass't—all isolantite—singles, dual, triples—100 ass't. \$2.25

ATTENTION: Prospectors. Explorers for Hidden Treasures! Construct a U.S. Army Type of Metallic Mine Detector Amplifier. Amplifier unit only (less tubes and batteries) with cables, headphone cord, and jack. Army wiring diagram. Type AN/PRS-1. \$1.95

MINIMUM ORDER \$3.00—NO C.O.D.

SHIPMENTS—PLEASE INCLUDE POSTAGE

NEWARK SURPLUS MATERIALS CO.

324 Plane Street Dept. FE NEWARK 1, N. J.

Handy, New Pfan-Tone PICK-UP KIT!



Discover the hidden music in your records—untapped by standard phonograph pickup equipment. Let amazing new Strain-Sensitive PFAN-TONE Pickup bring out the best in your records—old and new.

- ✓ Exclusive New Principle Modulates current from preamplifier—reproduces faithful electrical image.
- ✓ Free From Hummmm—No coils to pick up induced current from turntable motor.
- ✓ Easy to Install—Now in handy KIT form. No soldering necessary.

Ask your radio supply man or write today for FREE INFORMATION. If you use a single play, professional turntable, ask about the new functional PFAN-WOOD TONEARM.

Pfanstiehl

CHEMICAL COMPANY

100 Lake View Avenue Waukegan Illinois

RADIO & TELEVISION NEWS

ing may be required, although this amounts to reversing one set of primary leads. It does not matter which selsyn has its primary energized. It was convenient in this case to connect selsyn #1, at the indicator position, to the 117 v. line, as a handy outlet was already there.

The selsyns used in this system have 117-volt primaries. The low-voltage selsyns being sold on the surplus market may be substituted by using a suitable voltage-dropping arrangement, preferably a transformer.

Final Assembly

When the rotator was in place, and all the electrical wiring had been completed and tested, the final assembly of the beam was made. The array had previously been assembled on the ground, balanced, and then disassembled. The following method was used to transfer the array to the rooftop and re-assemble it:

1. The 1½-inch pipe shaft was placed in the roof bushing, and the rotator platform was shifted until the threaded end of the shaft could be screwed into the flange at the rotator. The rotator platform was then fastened into position with wood screws.

2. The coaxial-cable matching transformer was inserted into the shaft, as shown in Fig. 4.

3. The slip rings and selsyn belt were attached to the shaft from inside the attic, and the shaft was screwed into the rotator flange.

4. The boom was transferred from the ground to the roof peak by means of ropes, and was temporarily held in position.

5. The 1½-inch pipe guy-wire support with all six guy wires attached was transferred to the roof, and the guy-wire pipe flange and boom were fastened in place on the shaft flange by means of four bolts, as shown in Fig. 4.

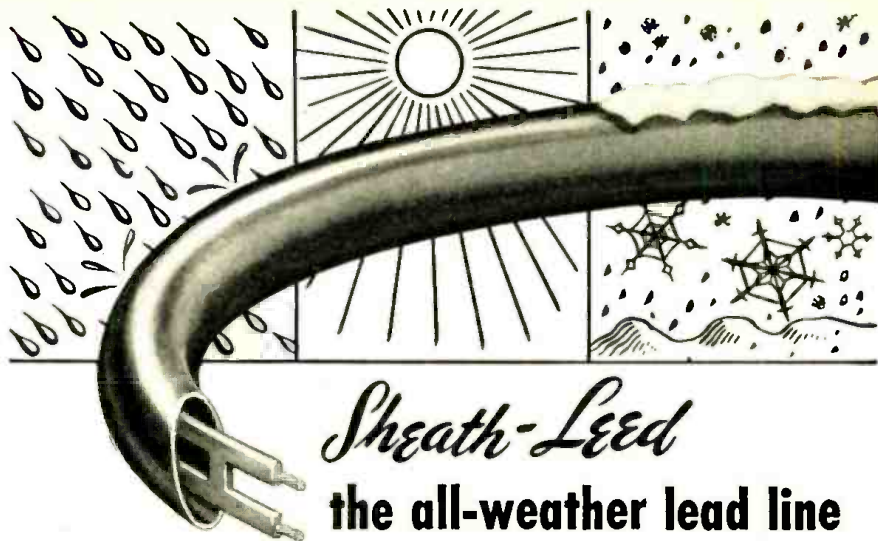
6. The radiator assembly, director assembly, and reflector assembly were transferred to the roof peak and bolted in their proper positions along with the 1" x 2" side pieces.

7. The guy wires were connected as shown in Fig. 5, and were adjusted until the entire array was parallel and squared away.

8. The entire array was rotated by hand until the threaded end of the shaft began to tighten at the rotator flange; the shaft was then pulled up with a large pipe wrench from the attic.

9. The array was synchronized with the indicator needle. When a great circle map is used, it should be remembered that north is geographic north, and not magnetic. When the array had been adjusted for true north, the needle of the indicator was set to north by slipping the belt on the shaft of the array.

10. The array was rotated continuously in both directions several revolutions from the operating position to make sure that everything was positioned correctly.



Sheath-Leed the all-weather lead line for finest TV reception

SHEATH-LEED—the DON GOOD super-fine leadline is built for use wherever tough weather conditions prevail. It's especially recommended for use in coastal areas where salt spray encrusts the regular leadline and devitalizes it. And also in hot humid areas, where much alternate rainfall and strong sunlight prevails, and where leadlines are subjected to frost, snow and icy conditions.

- PURE POLYETHYLENE TUBING—ENCASING GOODLINE AIRLEAD
- TWO COLORS—STANDARD BROWN or SILVER-GRAY TUBING
- RECOMMENDED FOR FINEST VHF or UHF RECEPTION
- GIVES MAXIMUM LONG-LIFE SERVICE VS WEEKS OF SERVICE WHERE A REGULAR TYPE LEADLINE IS USED

Goodline Airlead—Nationally Accepted as the Basis of Finest Television Reception

- 80% OF LOSS PRODUCING DIELECTRIC WEB IS REMOVED
- CORRECT IMPEDANCE FOR SHARP, CLEAN, "SNOW-FREE" PICTURES
- PACKAGED: 100'—250'—500'—1000'—2500'

GIVE TELEVISION SETS A CHANCE TO GIVE YOU FINEST RECEPTION
INSIST ON SHEATH-LEED or GOODLINE AIRLEAD

Don Good, INC.

SOLD BY LEADING
JOBBER & DEALERS

Send coupon NOW for complete information. Get samples "in your hands" —you'll realize why Goodline Products give the finest possible in television reception.

DON GOOD, INC. I-1
1014 Fair Oaks Ave., So. Pasadena, Calif.
Please rush Samples and Complete Information covering Sheath-Leed and Goodline Airlead.

Name _____
Street _____
City _____ State _____

SUPER SURPLUS VALUES

VARIAC GENERAL RADIO CO. 200C 5 to 7½ AMP 115VAC in 0-135VAC \$13.95
out from new equip. 4.95

AC-METER 0-150VAC Weston or West. 2" B. \$3.95

MOTOR 4 pole shaded pole induction 1700 RPM G.I. 1.70 HP running torque 12 oz. inches list \$12.00 F type wire or disc recording \$3.50
HEADSET TELEX monoset Mod. 2570 reg. 14.00 4.95
MICROPHONE SHURE 707A & 814B desk stand. 4.95
RECTIFIERS Fed. Sel. 403B2787 150 MH 130V75
CIRCUIT BREAKERS Homemann Cal. 0711 5 amp 115VAC curve D \$1.25 30 Amp 115VAC 1.65
POWER TRANS. Thordarson 70R32 350-350 145 mil 5V 3 Amp 6.3V 4.5 Amp from used equip. 2.95
OUTPUT TRANS. RCA pair 61.6 class AB 10 watt sec. 4-8-15-250 ohms a real buy new. 1.50
CHOKES THORD. 11C10 8 H. 170 MH 200 ohm. 1.25
CHOKES CHICAGO trans. Co. 6 H 80 mil 50 ohm75
1000 MFD 15 VDC Sprague C81A Condenser.95
3500 X 3500 MFD 25VDC Solar D2P 3 pin can. 1.50
XTALS 2 meters 144-10 MC 103 holder. 1.50
XTALS 300 KC standards CII-2U U special. 1.50
Include postage with order. Min. order \$3.00

McCONNELL'S 3834 Germantown Ave. Phila., Penna. RA 5-6033

Unlimited Opportunities in RADIO ENGINEERING

DEGREE IN 27 MONTHS

Complete Radio Engineering course, including Telev., U.H.F. and E.M. Bachelor of Science Degree also in Mech., Civil, Elect., Chem., and Aero. Eng.; Bus. Adm., Acct., Extensive campus, modern buildings, well equipped labs. Low cost. Prep courses. Personalized, practical instruction. Founded 1884. Placement service. Growing shortage of engineers. Prepare now for unlimited opportunities ahead. Approved for Korean vets. Enter March, June, September, January. Write for catalog.



TRI-STATE COLLEGE

1623 College Avenue, ANGOLA, INDIANA

TV Technicians—

Show your Skill

Let your customers SEE that GOOD service is your business. Your skill is your most precious asset. Dress it up with the right tools to make sure it's appreciated.



\$14.95*

Carries TOOLS and TUBES, Saves TIME, MONEY

PAYS for ITSELF

Technicians who carry the Tube Caddy make the right impression. Handy top tray for tools, soldering gun, or meter. Regimented drawers give tube inventory at a glance. Slip-apart hinges on cover, with clips inside for price list or mirror.

Its efficiency saves time, its neatness inspires confidence—builds business. Can pay for itself in three weeks time. Size 18 x 14 1/2 x 9 1/4 in. Ask your Parts Jobber or write.

*Net to Dealer. Higher on West Coast. Other Models \$13.50 and \$7.75.

Craftsmanship in Cabinets
Argos
 PRODUCTS COMPANY
 310 MAIN STREET • GENOA, ILLINOIS

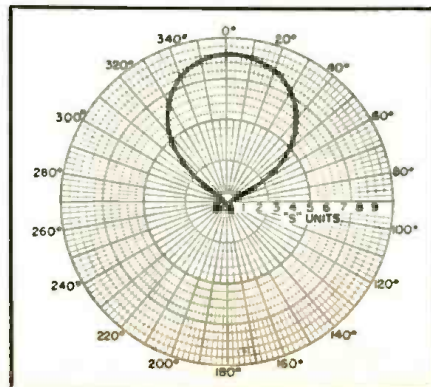
The array may be tuned with the aid of a field strength meter or a receiver with an "S" meter. When the field strength meter was used, it was placed several wavelengths from the array and turned so that the back of the array was facing the meter. The transmitter was connected to the array, and its frequency was tuned to the frequency of the array. With as small an input to the transmitter as possible, the field strength meter was tuned to the operating frequency. The shorting bars of the director and the reflector were adjusted to the position corresponding to the minimum reading at the field strength meter. The director adjustment is more critical than the reflector adjustment, and should be made carefully. This method of adjustment tunes the beam for maximum front-to-back ratio. If maximum forward gain is desired, the array is pointed toward the field strength meter and the stubs are adjusted for maximum field strength.

The pattern for the array, shown in Fig. 10, was obtained with the aid of W2GMN. Fred C. Read. With full input to the transmitter on phone, the array was pointed toward Fred's receiver, located two blocks away. The receiver "S" meter was set to S9, and the reading was recorded. Readings were taken at every 10-degree rotation point, and were transmitted back to the author by means of 40-meter c.w. The entire procedure was repeated several times to check the readings.

Conclusion

As stated at the beginning of the article, the main purpose of building the rotary-beam antenna was to be able to work DX; this antenna has certainly accomplished this goal. To present a clearer picture of the improvement that resulted, it might be worthwhile to look at the record. During the years 1949, 1950, and 1951, 860 DX calls were made and 413 replies were received. The percentage of replies, therefore, was 48. During a previous two-year period, a 66-foot "zepp" antenna showed a reply percentage of 25, while a 33-foot "zepp" showed a reply percentage of 18. The two "zepp" antennas were at the same location as the beam antenna, were

Fig. 10. Field pattern of the 3-element beam, showing high front-to-back ratio.



BIG VALUE at a Low Price



Model M-G 18

You'll look long and hard before you'll find an 18-watt amplifier with mike and phono inputs, bass and treble controls, output impedances from 4 to 500 ohms, and two speaker outlet sockets, that will outperform this M-G unit. You'll pay much more for one of equal performance.

Compare its value . . . or that of any of the six other M-G models . . . with amplifiers of other makes. You'll say it's the biggest value on the market for the money.

FREE Catalog



Catalog 200 shows the entire line of M-G Sound Equipment. Get your copy today!



DON McGOHAN, INC.

3700 W. ROOSEVELT RD., CHICAGO 24, ILL.

SURPLUS VALUES

MOBILE DYNAMOTORS

- (SMALL SIZE—BRAND NEW)
- 8 volts input, 425 volts @ 375 MA **\$27.95 ea.**
- 12 volts input, 425 volts @ 375 MA **\$19.95 ea.**
- Each supplied with Mounting Brackets and Brush Filters

G.E. RELAY CONTROL

- (Ideal for Model Controls, Etc.)
- Contains a sigma midret 8,000 ohm. relay, (trips at less than 2 MA), high impedance choke, bi-metal strip, neon pilot and many useful parts.
- The sensitive relay alone worth much more than the total low **\$1.25 each, 10 for \$9.90**

WESTINGHOUSE OIL CONDENSER

- 10 M.F.D.—1000 VDC (Marked 440 VAC) **\$1.95 ea.**
- A terrific bargain at . . .

FILTER CONDENSER BARGAIN

- 8x8 M.F.D. 600 vdc oil compound filled. **.95 each**
- NEW, but scratched. ONLY . . .

BAKELITE CASED MICAS

MFD	VDC	Price	MFD	VDC	Price	MFD	VDC	Price
.001	600	5.18	.002	1200	35.005	2500		.55
.002	600	.24	.024	1500	.65	.002	2500	.45
.01	600	.26	.033	1500	.75	.044	2500	.50
.02	600	.26	.02	2 KV	.90	.0001	5 KV	.70
.01	1 KV	.45						

PANEL METERS

* 0-10 MA AC	2.95	50 mfd 600 vdc	\$4.95
* 0-4 AMP RF	2.95	3.75 mfd 660 vac	2.45
* 0-200 Microamp	6.95	15 mfd 1000 vdc	4.95
* 0-500 Microamp	5.95	1 mfd 1500 vdc	.89
* 0-2 MA	4.95	1 mfd 2500 vdc	1.75
* 0-100 VDC (1MA)	5.95	1 mfd 3600 vdc	1.95
* 0-150 VDC (1MA)	5.95	.1 mfd 7500 vdc	1.95
* 0-250 VDC (1MA)	5.95		
* 0-15 KVDC (500 UA) with multi-plier	9.95		
* 0-4 METERS	8.95		
* 0-200 UA	12.95		
* 0-50 UA			

H.D. FILTER CHOKES
 6 Hy 50 ma. . . . \$.75
 6 Hy 500 ma. . . . 4.95
 4 Hy 1 Amp, 10KV insulation 22.50

WIRE WOUND RESISTORS

- 5 watt ohms: 25-50-84-200-2500 \$0.09 ea.
- 10 watt ohms: 25-40-1325-2K-4K15 ea.
- 20 watt ohms: 150-300-750-1K-1.5K, 2.5K-2.7K-10K-20K20 ea.
- 30 watt ohms: 100-2500-5300-18K22 ea.

PEAK ELECTRONICS CO.
 66 West Broadway, New York 7, N. Y.
 Phone WOrth 2-5439

of the same height, and were fed by the same 600-watt transmitter. A further comparison shows that about 75 per-cent of the DX calls made with the "zepp" antennas were Canadian and Central- and South-American stations within about 2000 miles, whereas the calls made with the beam antenna included stations from all over the globe.

Spot Radio News

(Continued from page 18)

areas. In Ceylon, batteries are also charged at central stations and are often transported to different sites by motor vans and laborers. Access to most of the sites is often through thick jungles, an arduous task involving up to four days of travel just to replace a single battery. And at this time, this antiquated method of providing radio reception is still in use.

ON A 210-acre site directly south of Boulder, Colorado, near the campus of the University of Colorado, the Bureau of Standards has begun construction of a \$4,500,000 lab, to conduct research on the propagation of radio waves and on the expanded utilization of the spectrum for FM, television, facsimile, and radar.

The building will house a staff of about 500, including scientific and clerical personnel, whose efforts will not only be directed to specific problems of research, but to key problems posed by the Defense and State Departments as well as the FCC, for the benefit of the nation and Mr. and Mrs. America.

TRANSISTOR TRANSMITTER

GEORGE M. ROSE, K2AII, an RCA development engineer, was the principal in an "historic ham first" when he built and successfully transmitted v.h.f. signals over a transmitter based on a single RCA point-contact transistor.

Mr. Rose's equipment was used to contact three ham stations in New Jersey, one 25 miles away.

Over-all view of the home-built transistor transmitter constructed by George M. Rose.



ARB NAVY RECEIVER

105 to 9050 KC. Four Bands. Calibrated Dial, LF-Ship-BC-80 & 40 Meter—Complete with Tubes and Dynamotor. For 24 Volt operation; easily converted to 110 V—12 or 6 Volt. Size: 8 1/4" x 7 1/4" x 1 1/2". Price: \$29.95

COMMAND TRANSMITTERS Complete with Tubes & Crystals

BC-457 Transmitter—4 to 5.3 MC.—Used..... \$ 8.95
 BC-458 Transmitter—5.3 to 7 MC.—Used..... 7.95
 BC-459 Transmitter—7 to 9 MC.—NEW..... 22.95
 BC-456 Modulator—NEW: \$5.95—Used..... 2.95
 Transmitter Rack—Single: \$1.50—Dual..... 2.00
 Rec. Rack—Dual: \$1.50 Modulator—Mtg..... 1.50
 Rec. Dyn.—Used: \$2.95, Trans. Dyn.—Used..... 2.95

TRANS.—REC.—AMPLIFIERS

TA-12B TRANSMITTER with Tubes—Used..... \$39.95
 RI ARR-1 Receiver—easily converted to 220 MC. (See R.N. Jan. '49) Complete w Tubes. NEW..... \$4.95
 BC-1206—200-400 KC. Delco. w Tubes..... 9.95
 BC-216 Amplifier—2 Tubes—6F7, 39/41..... 1.95
 BC-367 Amplifier—w Tubes, less Dyn & Case..... 4.95
 BC-605—With Tubes. Used..... 3.95
 BC-709—W Tubes—New: \$4.95—Used: 3.95
 BC-347—Less Tubes—New: \$2.95—Used: 1.95

AIRCRAFT CONTROL CABLE

3 32"—7x7 Strand, Weatherproofed, Galvanized, Preformed, 920 lb. test. Ideal for Television Guying and many other uses. Prices:
 1/2" per Ft.—1000 Ft. or more @ 4c Per Ft.

BLOWERS—115 VAC 60 CYCLE

SINGLE TYPE: (Illustrated at left) 100 CFM. 2 1/2" intake; 2" outlet. Complete size: 5" x 6". Order No. IC939..... \$8.95
DUAL TYPE: 100 CFM. 4" intake; 2" Dis. Each Side. Complete Size: 8" x 6". Order No. IC880..... \$13.95
COMPACT TYPE: 108 CFM. Motor built inside squirrel cage. 3 1/2" intake; 3 3/4" x 3" Dis. Complete size: 4 1/4" W x 8 3/4" H x 8 3/4" D. Order No. 2C067..... \$11.50
FLANGE TYPE: 140 CFM. 3 1/2" intake; 2 1/2" Dis. Complete size: 7 1/2" W x 7 1/4" H x 6 3/4" D. Order No. IC807..... \$13.95
FLANGE TWIN: 275 CFM. 4 1/2" intake; 3 1/4" x 3" Dis. Complete size: 11 1/4" W x 8 3/4" H x 8 1/16" D. Order No. 2C069..... \$21.95

DYNAMOTORS

DYNAMOTOR and BLOWER: 9 Volts DC input; output 450 Volts 60 MA. 4500 RPM. At 6 Volts DC input; output 260 Volts 65 MA. 3000 RPM. Price: \$4.95

PE-101C DYNAMOTOR..... NEW \$4.95

INPUT:	OUTPUT:	STOCK No.:	PRICE:
14 V. DC	600 V. 300 MA.	BD-86	\$9.95
12 V. DC	220 V. 70 MA.	DM-24	6.95
12 V. DC	220 V. 100 MA.	DM-18	4.95
14 V. DC	375 V. 150 MA.	DM-375	8.95
14 V. DC	330 V. 135 MA.	DM-330	7.95
14 V. DC	500 V. 500 MA.	PE-59	14.95
12 or 24 V. DC	275 V. 110 MA.	USA 0516	3.95
12 V. DC	250 V. 50 MA.	DM-25	8.95
12 or 24 V. DC	500 V. 50 MA.	USA 0515	3.95
12 or 24 V. DC	440 V. 200 MA.		
	225 V. 100 MA.	D-104	14.95
28 V. DC	250 V. 60 MA.	PE-86	5.95

Address Dept. RN • Minimum Order \$5.00 • Prices F.O.B., Lima, O. • 25% Deposit on C.O.D. Orders

FAIR RADIO SALES 132 SOUTH MAIN ST. LIMA, OHIO

VACUUM CONDX.: 40, 50, 150, 200 and 300 Mm. 20-500 V. Special: Only \$6.40 ea.
 TOBE DUAL 8 MFD. 600 V. OIL COND. 2.50 ea.
 ASSORTED RUBBER GROMMETS: Box of 10..... .59
 OHMITE 15 OHM 50 W. RESISTORS: New 6 for 1.00
 4 to 25 MMF. AIR TRIMMERS: New 6 for 1.00
 4200 KC. COMMAND I.F. X-FMRS: 1-1/2" interstage-out. Also BFG. Coil set of 4..... 1.39
 DUAL ERIE 4-30 MMF. CERAMIC TRIMMERS 3 for 1.00
 CENTRALAB T.V. HI-VOLT CONDX. 500 1.00
 SIMPLI-12 (12-000) VAC. 12 for 1.00
 TRANSFORMER 113 V. pri. Sec. 125 V. 1 1/2 ma. 1/2 wave and 6.3 V @ 6 amp. Write for small converter or preamp. New 1.39
 Send remittance with order and we pay postage.
K. & L. RADIO PARTS CO.
 1406 Venice Blvd. Los Angeles 6, Calif.

ANTENNA EQUIPMENT

MAST BASES—INSULATED:
 MP-132 BASE—Illustrated at left—1" heavy coil spring, 2" insulator. Overall length: 11 1/2". Weight: 2 1/2 lbs. Price..... \$3.95
 MAST BASE—Insulated type with heavy coil spring and 5" dia. insulator. Requires 1" hole for mounting. Weight: 9 lbs. Price..... \$5.95
MAST SECTIONS FOR ABOVE BASES
 Tubular steel, copper coated, painted, in 3 ft. sections, screw-in type. MS-53 can be used to make any length with MS-52-51-50-49 for taper. Any section..... .50 Each
 Larger Diameter Sections: MS-55-54..... \$1.25 Each

CORDS—CABLES

CD-501 Cord f GN-45 Generator..... \$2.50
 CD-318 Cord w PL-68 & SW-141 & JK-48F..... .89
 CD-307 Cord—6.5 Ft. w/PL-55 & JK-26..... .89
 CD-604 Cord w/C-410 Trans. & PL-54 Plug..... .89
 CD-365 Cord for LP-21 Loop..... 1.50
 MC-215 Tuning Shaft for 274N..... 2.00

POWER SUPPLIES

PE-157 POWER SUPPLY—2 Volt Vibrator Supply, operates from BB-54 2 Volt Battery mounted in Case. Output voltage 1.4 V. 1/2 Amp. 125 V. 50 MA. Less Battery, Speaker, & External Power Cord—with Vibrator..... Used \$4.95
 BB-54 2 Volt Dry Battery..... 2.95
 MP-28 BA Power Supply & Modulator f/TA-12—New..... 24.95
 Power Supply No. 3 f/Mark II No. 19 Radio Set 12 or 24 V. Two PM Dynamotors: 500 V. 50 MA: 275 V. 110 MA—New..... 12.95
 PE-104 Vibrator Unit f/BC-654..... Used 10.95
 550C Vibrator f/PE-104—New..... 1.95
 VB-16 Vibrator f/PE-237—SCR-694—New..... 4.95

TRANSFORMERS AND CHOKES

TRANSFORMERS—110 V. 60 CYCLE PRIMARIES:
 5 Volt CT-25A—10,000 V. Ins. OPEN FRAME—6" x 5" x 4 1/2"..... \$7.95
 6.3 V. 1 Amp..... 1.25 24 V. 1 Amp..... 1.95
 24 V. 1/2 Amp..... 1.50 24 V. 6.5 Amp..... 5.95
 6—24—or 30 Volt 8 Amp..... 5.95
 Two 12 V. 4 A. windings, gives 12 V. 8 A. or 24 V. 4 A..... 5.95
 325-0-325 V. 50 MA—6.3 V. 2.5 A; 6.3 V. 6 A (Reel. 6x5) Half Shell—2 1/2" x 3 1/2" x 3"—No. T-23-28..... 2.75
 440 VCT 70 MA—5 V. 2 A.—6.3 V. 4 A..... 3.95
 490 VCT 60 MA—5 V. 2A.; 6.3 V. 4 A.; 6.3 V. 2A 3.25
 460 VCT 90 MA—5 V. 3 A.; 6.3 V. 4 A..... 3.75
 175-0-175 V. 40 MA—6.3 V. @ 2-4 A; 6.3 V @ .6 A; Halfshell 2 1/2" x 2 1/2" x 3"—No. T-23-30..... 1.75
 350-0-350 V. 90 MA—6.3 V. @ 3 A; 5 V. @ 3 A; Upright—3 1/2" x 3 1/2" x 3 1/2"..... 3.25

CHOKES

15 Henries—165 MA. 125 ohms..... \$2.95
 5 Henries—150 MA. 85 ohms OC—Res. Cased..... 1.95
 8 Henries—150 MA. 200 ohms..... 1.95
 5-20 Henries—300 MA. 110 ohms. 1000 V. Ins..... 3.95

AERIAL WIRE—Phosphorus Bronze #16 Stranded, 200 lb. test. Weatherproof. 150 Ft. on Reel. RL-3 w Clips..... \$1.50
 Telephone Wire—3 Cond. copper & steel, 525 Ft. 4.75

TRAIN FOR A SUPERVISORY POSITION IN ELECTRONICS

Thorough 2-year course covers electrical circuits and machinery, basic electronics and industrial electronics. Franklin Technical Institute graduates are in demand as junior engineers for research and test work, sales engineering, supervisory work on production lines and drafting room design work. Other engineering and technical courses. Coed. Day, evening, 44th year. Write for catalog.

FRANKLIN TECHNICAL INSTITUTE
 46 Berkeley Street Boston 16, Mass.

GET YOUR COPY OF THE NEW ZIFF-DAVIS PUBLICATION
SEA STORIES Thrilling Tales of the Deep!
 NOW ON SALE

20-20 PLUS!

S-226-Q Output Transformer

±1 db 10—100,000 cycles
20 watts 30—40,000 cycles

5 watts at 10 cycles
10 watts at 15 cycles

Insertion loss
0.5 db

Primary impedances
6,600 CT & 1,650 CT

Connected between halved impedances, frequency response is extended at each end; between doubled impedances, ±1 db 15—45,000 cycles.



Write today for the new 1953 Peerless Catalog

Dimensions:
4 1/8" x 3 3/8" x 3 3/8"

PEERLESS
Electrical Products

A DIVISION OF



9356 Santa Monica Blvd., Beverly Hills, Calif.
161 Sixth Avenue, New York 13, New York

Current TV Topics (Continued from page 51)

tube receives the video signal and the cathode is at a d.c. potential determined by the brightness control. Therefore a positive pulse must be applied to the cathode and this pulse can be obtained either from the plate of the vertical output tube or from the low side of the deflection yoke. R_1 is used to reduce the amplitude of the pulse to avoid interference with either the sound or synchronizing sections. The leads from the vertical section should be short and kept far away from either the sound or synchronizing circuits.

Where the cathode receives the video signal, the circuit of Fig. 4B is suggested. In many sets this circuit is not possible because instead of a regular output transformer an autotransformer is used. This means that only positive polarity pulses are available at the output section which cannot be applied to the picture-tube grid. An alternate scheme is shown in Fig. 4C, where the negative pulse is obtained from the output of the vertical oscillator. The pulse amplitude usually is no more than about 50 volts peak and it is therefore possible to tap down on the oscillator plate resistor R_1 by substituting a 330,000 ohm and 680,000 ohm (R_A and R_B) for the original 1 megohm value. This avoids loading down the oscillator and keeps the signal on the output tube substantially unchanged. In Fig. 4, the coupling condenser, C_1 , is given as .01 μ fd. because this is a good value for most cases. In order to get sufficient blanking in some sets it may be necessary to increase this condenser to .02, .05, or even .1 μ fd. On the other hand it may be necessary to reduce the blanking pulse if the top or bot-

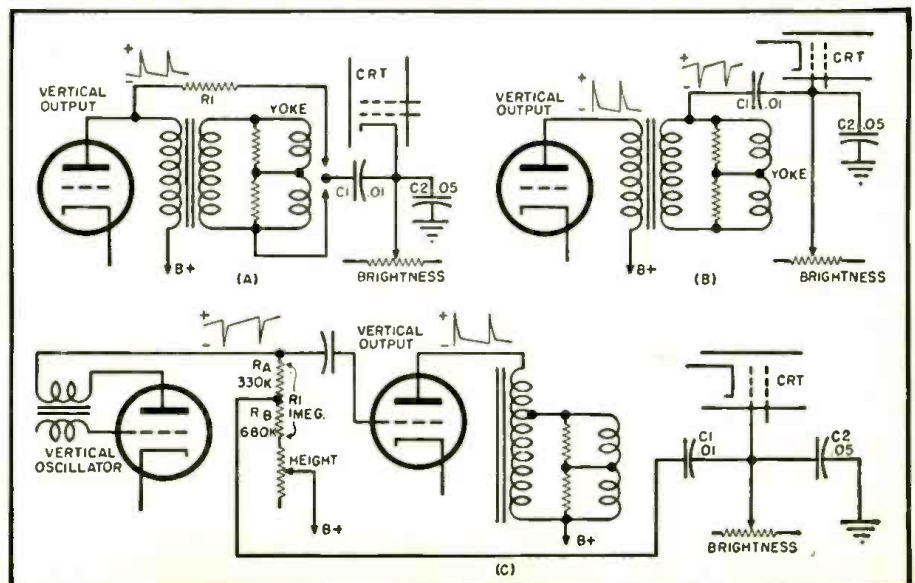
tom of the picture appears darkened. Reducing either the condenser to .005 μ fd. or connecting a 10,000 to 100,000 ohm resistor in series with it usually achieves good, even blanking.

Foldover

Until the latest TV models came out, quite a few sets were plagued with horizontal foldover. The technician will by now be quite familiar with the complaint: part of the picture appears folded back on itself at either edge. Adjustment of the various horizontal controls sometimes reduced this trouble, sometimes it was removed by extending the picture beyond the edge of the mask and occasionally, incorrect centering hid it. It was soon recognized that in most cases the trouble could not be corrected by the technician but was due to the circuits and components used. The main drawback of the new high-efficiency flyback transformers was their excessive retrace time which caused most foldover. Fig. 5A shows the relation between the horizontal sweep, the retrace of this sweep, and the horizontal blanking pulse which is part of the video signal. As shown, the foldover will appear at the righthand edge of the picture. In reality, the length of the line is much greater than shown in the diagram and the duration of the retrace period proportionally much smaller, but for illustrating the idea this relation was chosen. From Fig. 5A, we see that the retrace period of the sweep is longer than the picture tube blanking. To reduce the retrace time of the sweep would often require a complete redesign of the horizontal deflection section. As a matter of fact most late model receivers use autotype flyback transformers in which retrace periods are much shorter and foldover does not occur.

For the technician faced with the

Fig. 4. Three basic circuits for blanking vertical retrace lines. (A) Circuit in which the grid of the picture tubes receives the video control signal and the cathode is at d.c. potential as determined by the brightness control. (B) The circuit to be used where the cathode receives the video signal. (C) Alternate circuit for use when the negative pulse is obtained from the output of the vertical oscillator.



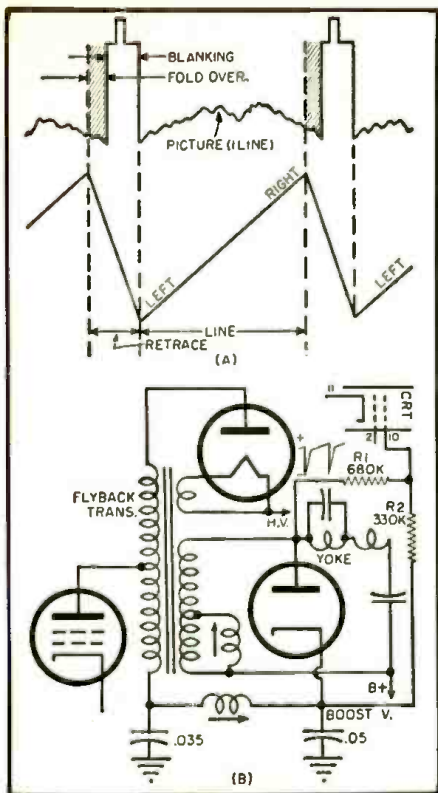


Fig. 5. (A) Relation between the horizontal sweep, the retrace of this sweep, and the horizontal blanking pulse. (B) A simple scheme for extending the blanking period slightly so as to cut off the picture tube during the entire retrace period.

problem of foldover due either to a flyback replacement, big screen conversion, or any other reason, it is only necessary that the blanking period be extended slightly so that the picture tube is cut off during the entire retrace period. Fig. 5B shows a fairly simple and popular scheme for accomplishing this. To get a blanking pulse of the same length as the retrace time, the actual flyback pulse from the flyback circuit is used. To avoid interference with other circuits this pulse is applied to a normally passive picture tube element, the first anode or accelerator grid. This anode is usually at the highest available "B plus" value, the boost voltage from the flyback circuit. A strong negative pulse makes the first anode less positive and thereby cuts off the tube. Such a pulse, ranging up to 2000 volts, is present at the deflection yoke-transformer junction. A portion of this pulse is applied to the first anode through the voltage divider R_1 and R_2 . The values shown for these two resistors were found to work in many cases, but are not absolutely the best in all sets. If the foldover does not completely disappear, R_2 should be increased. If either side of the screen appears darker than the rest, R_1 should be increased. A combination of resistor and condensers could also be used, but this introduces additional problems such as wave-shape voltage rating, etc.

Installation of U.H.F. Strips

With the opening of the first few


"CONICAL-V-BEAMS"

*REGISTERED TRADE MARK

It's *Telrex* across the nation -FOR UHF AND VHF!

-TESTED, TRIED, AND PROVEN FOR EVERY RECEPTION AREA...NEAR OR FAR!

Now you can depend on Telrex for all antenna needs, both UHF and VHF. The same sterling quality featured



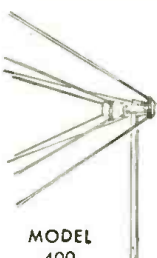
MODEL BW-1

Bat Wing Model

FOR UHF AND VHF RANGE - FROM 5 TO 10 MILES

in VHF models, combined with reliable factory ratings, assure antenna satisfaction on every UHF installation. There's a Telrex UHF and VHF antenna for every area - city, suburban or remote-from-transmitter.

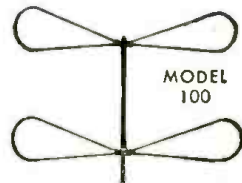
UH DUBL CONICAL-V-BEAM



MODEL 400

FOR UHF AND VHF RANGE - FROM 10 TO 50 MILES


Clover-V-Beam



MODEL 100

FOR UHF AND VHF RANGE - FROM 10 TO 20 MILES

Be sure it's a "CONICAL-V-BEAM" look for the *telrex* TRADEMARK



AMERICA'S OUTSTANDING TELEVISION BEAM

ASBURY PARK 7, N. J.

WILL PAY UP TO \$300 FOR ART-13's

Also desperate for CFI units for above—plus BC-788, 1-152 and BC-348 receivers. Also interested in other airborne electronics. Top dollar paid. Inquiries answered promptly. V & H Radio & Electronic Supply Co. 2033 W. Venice Blvd. Los Angeles 6, Calif. Phone: REpublic 3-1127

PEN-OSCIL-LITE

Extremely convenient test oscillator for all radio servicing; alignment • Small as a pen • Self powered • Range from 700 cycles audio to over 600 megacycles u.h.f. • Output from zero to 125 v. • Low in cost • Used by Signal Corps • Write for information.

GENERAL TEST EQUIPMENT
38 Argyle Buffalo 22, N. Y.

RADIO ENGINEERING DEGREE IN 27 MONTHS

Radio engineering is a big field. There's room for you in it—if you're good. Get first-class training at Indiana Tech. Intensive specialized course. Including strong basis in mathematics and electrical engineering, advanced radio theory and design, television, electronics, Modern laboratories. Low rate. Also B.S. DEGREE IN 27 MONTHS in Aeronautical, Chemical, Civil, Electrical and Mechanical Engineering. G.I. Government approved. Enter December, March, June, September. You can earn part of your expenses right here in Fort Wayne while you are studying.

INDIANA TECHNICAL COLLEGE

923 E. Washington Blvd., Fort Wayne 2, Indiana

Please send me free information on B.S. Engineering Degree in 27 months as checked.

- Radio-Television Aeronautical
 Civil Mechanical Electrical

Name
Address

IT'S **NEWARK**

For the Best Buys in Audio

NEWARK'S FM-AM RECEIVER

Hi-fi FM-AM chassis featuring push-pull audio output. FM circuit is drift-compensated. Has full range bass-treble tone control and phono jack with built-in preamp for magnetic pickups. Chassis is complete with 12" PM speaker, built-in AM and FM antennas, 12 tubes (including rectifier), all hardware, and escutcheon. Size, 13 1/2 x 9 x 9". Wt., 20 lbs.

946034. SPECIAL PRICE..... **69.50**

SAVE ON THE FAMOUS BRUSH MICROPHONE

It's another sensational Newark value—the famous Brush BA-116 microphone which originally sold for \$8.61—now selling, while quantities last, at the very low price of \$5.95! This rugged microphone is ideal for tape recording, PA, or Amateur use. Response, 50 to 6,000 cycles. Output level, -53 db. High impedance. Shock-mounted crystal cartridge. Has 3/8"-27 thread. Brown finish. Wt., 1 1/2 lbs.

54F350. SPECIAL PRICE **5.95**

Send for

NEWARK'S NEW CATALOG No. 55

196 Pages of the Latest Releases in Radio, T.V., High Fidelity and Industrial Electronics

WRITE TO DEPARTMENT R-23



FREE!

The New Electronics Reference Book

223 W. MADISON ST.

NEWARK
ELECTRIC COMPANY

CHICAGO 6, ILLINOIS

Editors and Engineers
PUBLICATIONS



RADIO HANDBOOK, GIANT 13TH EDITION. A one-volume library of radio information with extensive, simplified theory. Detailed how-to-build-it data on dozens of items of practical radio equipment. Book No. E&E-RH13... \$6.00*

BETTER TV RECEPTION (in fringe and low-signal areas). **NEW SECOND EDITION.** The standard guide for installation technicians. A popular text for TV enthusiasts. Book No. E&E-TR2..... \$2.50*

RADIOTELEPHONE LICENSE MANUAL. Typical study questions with concise answers for any commercial U.S.A. radiotelephone operators license. Book No. E&E-RL1..... \$3.75*

ANTENNA MANUAL. A practical, comprehensive book on antennas, for everyone interested in transmission and reception. Over 300 pages. Book No. E&E-AM1..... \$3.50*

RADIO HANDBOOK, 12TH EDITION. Selected constructional items only. English edition. Book No. E&E-RH12..... \$3.00*

Spanish edition. Book No. E&E-RHSP12... \$4.00*

WORLD'S RADIO TUBES (BRANS' VADE MECUM). **NEW 9TH EDITION.** Lists over 15,000 tubes from every tube making country. Printed in 16 languages. Book No. E&E-VM9... \$5.00*

SURPLUS RADIO CONVERSION MANUAL, VOL. 1. Practical conversions. Write for list of contents. Book No. E&E-SM1..... \$2.50*

SURPLUS RADIO CONVERSION MANUAL, VOL. 2. Companion to Volume 1. Book No. E&E-SM2..... \$2.50*

*Plus any tax.

BUY FROM YOUR DISTRIBUTOR

ADD 10% ON DIRECT MAIL ORDERS TO EDITORS AND ENGINEERS, Ltd. OX 689A, SANTA BARBARA, CALIF. Bookstore order from BAKER & TAYLOR, Milliner, N. J.

STAR-SPECIALS

NEWEST ITEMS! LOWEST PRICES!

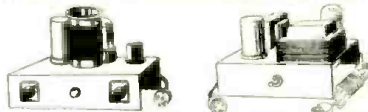


PERMOFLUX REAR DECK SPEAKER KITS

Easy to install; provides greater radio enjoyment in your car. Requires only connection to speaker terminals in auto radio. 3-way wired switch permits speakers to operate separately or together. Complete with metal grille and protective speaker screen, hardware, template, Instructions, etc.

RS16A 4" x 6" Speaker Kit..... **\$7.94**
RS96J 6" x 9" Speaker Kit..... **\$10.29**

NOVICE TRANSMITTER KIT



Ideal for beginning amateur or for use as a stand-by rig. Operates on 80 and 11 meters. Big pictorial and schematic diagrams for easy assembly by anyone. Complete with two punched chassis, coil forms and wire, tuning indicator, and all other assembly parts plus standard telegraph key and tubes (6V6, 6L6 and 5Y3GT). Less crystal and small amount of hookup wire and solder required. Novice Transmitter Kit..... **\$32.58**

BARGAIN LOW PRICE FLYBACK TRANSFORMER



(Similar to GE 77J1)
Regular \$11.00 list price high voltage transformer similar to General Electric 77J1. Used for general replacement in many sets up to 14KV and with up to 19" tubes. Not available elsewhere at our low price! A-1827 Flyback Transformer..... **\$2.49**

COMPLETE STOCKS Just off the press
All Standard Brands **BIG BARGAIN BULLETIN**

STAR ELECTRONIC DISTRIBUTORS, INC.
Dept. RN-2—7736 S. Halsted, Chicago 20, Ill.

u.h.f. stations many technicians are confronted with the problem of converting existing v.h.f. sets to receive the u.h.f. channels. In the June and July 1952 issues of RADIO & TELEVISION NEWS various u.h.f. conversion methods were shown. Since then some of these units have been installed and a certain number of difficulties were encountered. The major problem lies in the double superheterodyning used by most u.h.f. tuners. This requires that the u.h.f. station signal beat with the local u.h.f. oscillator to produce a first i.f. corresponding to one of the v.h.f. channels. The regular v.h.f. tuner contains another oscillator which beats with this first i.f. to produce a second i.f. signal, usually in the 22 to 26 mc. range. In intercarrier receivers a third i.f. signal is obtained at the second detector when the sound and picture carrier beat to produce the 4.5 mc. FM sound signal. It becomes apparent that with two oscillators and three i.f. signals the chances for unwanted beats are quite great and indeed this has been one of the major drawbacks of the double superheterodyne system.

Another source of trouble is from v.h.f. stations adjacent to the v.h.f. channel which now carries the first i.f. signal from the u.h.f. transmission. A good example is the case where Channel 8 is used as the first i.f. to receive the beat from a u.h.f. station and the local u.h.f. oscillator. Assume now that a strong local station exists on Channel 7. Under normal conditions the sound from Channel 7 might come through on Channel 8, but since no station is located there, this does not matter. Now, however, the sound from Channel 7 can interfere with the u.h.f. station if it reaches the v.h.f. tuner.

There are a large variety of frequency combinations where such troubles can be expected. To complicate matters, many v.h.f. tuners can be modified by means of added u.h.f. strips. Such strips were described in detail in the June issue. Fig. 3 shows one set of strips for the *Standard Coil* tuner. In this system the local v.h.f. oscillator is tuned to a predetermined v.h.f. frequency, its output passed through a crystal which generates harmonics and either the second or third harmonic is then used to beat the u.h.f. station signal down to a v.h.f. channel. Basically the same scheme is used by *Zenith* and other manufacturers who supply tuning strips to adapt the v.h.f. tuner for u.h.f. By adding these strips no provision is made to exclude unwanted v.h.f. signals which could readily interfere with the u.h.f. station. Thus the chance for v.h.f. interference is considerable in such installations. Most u.h.f. converters use a special hi-pass filter preceding the tuner to prevent v.h.f. interference.

The best method found to date for dealing with such v.h.f. interference is the use of either a suitable wave trap or else a shorted half-wave or open quarter-wave transmission line tuned to the offending channel. In

each individual case it will be necessary to adjust and experiment somewhat before an acceptable solution is found. In order to remove unwanted beats, the offending signal must first be located and this is best done by substituting a generator for either of the two oscillators or else by using a wavemeter to determine the frequency of the beat signal. The cure is to shift the frequency of either of the two oscillators and in this connection it might be suggested that the u.h.f. oscillator be left alone. Where the strip type of conversion is used the frequency of the basic oscillator can be varied by means of the fine tuning control. A 1-mc. variation of the fine tuning control may mean a 2- or 3-mc. variation of the u.h.f. harmonics, shifting the entire beat sufficiently. The only drawback to shifting oscillator frequency at any time is that it also affects the r.f. passband and, more important, the i.f. section. It is often possible to shift the entire i.f. section by 1 or 2 mc. without substantially changing its characteristics.

Many more u.h.f. conversion troubles are bound to occur and solutions to each of them will, in due time, be found. New u.h.f. techniques, new u.h.f.-v.h.f. tuners and completely new i.f. systems will be developed, but at present the TV technician in a u.h.f. area will have his hands full. A knowledge of the various stations, u.h.f. oscillator, v.h.f. oscillator, v.h.f.-r.f. and i.f. frequencies and their possible beats will be a great help in correcting this type of interference.

In preparing a chart showing such frequencies it should be kept in mind that each time two different frequencies are mixed, four different frequencies are obtained, the two original ones and the sum of both and the difference of both. Local oscillators in the v.h.f. band are usually operated above the incoming signal, but for u.h.f. they are often set below the u.h.f. station signal. When all these possibilities are noted and the frequencies of local v.h.f. stations considered, most of the likely beats and interferences can be anticipated.

-30-

HAM CONTACTS

THE FCC has recently warned that American amateurs are forbidden, in accordance with international agreement, to contact foreign stations whose governments prohibit their amateurs from working stations outside their country. Governments currently making this prohibition are Austria, Cambodia, Indonesia, Iran, Viet Nam, Laos, and Thailand.

U. S. hams are also required to comply, when working VK (Australian) DX, with an Australian regulation restricting Aussie hams to sending and receiving only experimental data and remarks of a purely personal nature.

The Commission stresses that this list is not to be confused with one published last Spring of countries which permit outside contacts but forbid their hams to handle international third-party traffic.

-30-

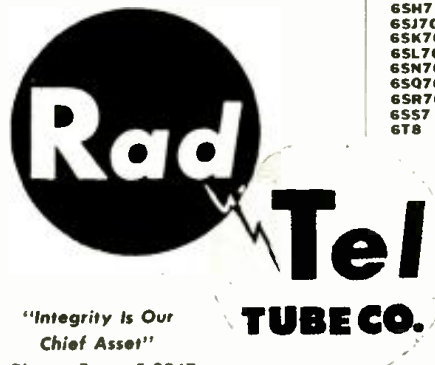
February, 1953



70% to 90% off list! TOP TUBE BUYS

All Tubes Individually Boxed! Same Day Service!
Check this list for Fully 90-Day Guaranteed Tubes

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
0B3/VR90	.75	5U4G	.45	6BF5	.41	6AU6	.60	14W7	.40
1A5GT	.46	5V4	.73	6BF6	.37	6U5	.44	19BG6G	.95
1A6G	.59	5W4	.50	6BG6G	1.25	6U6	.63	19C8	.70
1A7GT	.47	5X4	.40	6BH6	.46	6U8	.61	19T8	.79
1A85	.59	5Y3G	.32	6BJ6	.39	6V6GT	.39	19V8	.89
1B3	.65	5Y3GT	.32	6BK7	.59	6W4GT	.44	24A	.63
1B5	.59	5Y4G	.35	6BL7	.59	6W6GT	.44	25AV5	.83
1B7GT	.59	5Z3	.46	6BQ6GT	.59	6X4	.37	25B06GT	.62
1C5GT	.43	6A3	.59	6C4	.37	6X5GT	.37	25L6GT	.39
1E7	.29	6A7	.59	6C5GT	.39	6Y6G	.48	25Z5	.40
1H4G	.48	6A8	.62	6C6	.58	7A4	.47	25Z6GT	.37
1H5GT	.40	6A8A	.44	6C8B	.44	7A7	.53	25W4	.56
1G6	.60	6AC5	.43	6CD6G	1.11	7B4	.44	26	.45
1L4	.46	6AJ5	.90	6D6	.45	7C6	.40	27	.39
1LCS	.51	6AK5	.75	6E5	.48	7E6	.49	32L7	.89
1N5	.46	6AL5	.38	6F5GT	.39	7X7	.70	35B5	.40
1P5	.57	6A05	.39	6F6	.37	12AL5	.37	35C5	.39
1Q5	.58	6A06	.37	6G6G	.52	12AT6	.37	35L6GT	.41
1R5	.45	6AR5	.37	6H6GT	.41	12AT7	.56	35W4	.37
1S5	.39	6AS5	.50	6J5GT	.37	12A06	.38	35Z4	.39
1T4	.45	6AT6	.37	6J6	.52	12AU7	.43	35Z5GT	.37
1T5	.53	6AUG	.38	6J7G	.43	12AV6	.39	36	.60
1U4	.45	6AV5	.83	6J8	.69	12AV7	.59	41	.42
1U5	.39	6AV6	.37	6K5	.47	12AX4	.48	42	.42
1X2	.63	6AX4	.53	6K6GT	.37	12AX7	.48	43	.55
2A3	.70	6B4G	.64	6K7	.44	12A27	.69	45	.55
2X2	1.50	6B5	.64	6L6	.64	12BA6	.38	50B5	.39
3A4	.45	6BA6	.39	6M7	.45	12BD6	.45	50C5	.39
3E5	.46	6BA7	.57	6S4	.38	12BE6	.39	50C6	.59
3Q4	.48	6BC5	.44	6S8	.53	12BF6	.39	50L6GT	.41
3Q5GT	.49	6BD5GT	.59	6SA7GT	.43	12BH7	.63	50Y7	.50
3S4	.46	6BD6	.45	6SD7GT	.41	12J5GT	.42	70L7GT	1.09
3V4	.47	6BE6	.38	6SF5GT	.46	12Q7G	.39	75	.41
				6SG7GT	.41	12S8	.70	76	.44
				6SH7	.73	12SA7GT	.44	77	.57
				6SJ7GT	.41	12SG7GT	.52	78	.47
				6SK7GT	.41	12SJ7	.44	80	.35
				6SL7GT	.48	12SK7GT	.48	83	.68
				6SN7GT	.52	12SL7GT	.47	85	.59
				6S07GT	.37	12SN7GT	.52	117L7	.99
				6SR7GT	.45	12S07	.44	117Z3	.37
				6S57	.42	12S7	.49	807	.99
				6T8	.56	14J7	.60	2050	1.85



TERMS: A 25% deposit must accompany all orders—balance C.O.D. All shipments F.O.B. Irvington warehouse. Orders under \$10—\$1.00 Handling Charge. Subject to prior sale.

Don't Delay . . . Order Today!

115 COIT STREET
DEPT. RN-253
IRVINGTON 11, N. J.

THE NEW

Regency

VB-1 Voltage Booster*

Get peak performance from your TV set or any electrical device drawing 350 watts or less. This manually operated autotransformer maintains full 117 volt power supply. Insures full size TV picture when low line voltage shrinks picture size.

THE VB-1, \$19.95 LIST

*by the makers of the Regency VHF TV booster and UHF TV converter

Ask any radio parts jobber for further information or write:
I.D.E.A., INC., REGENCY DIVISION
7900 Pendleton Pike, Indianapolis 26
Cherry 2466



If you're in television

THESE BOOKS CAN BE IMPORTANT TO YOU

Movies for TV

By John Battison. The practical information you need for making the most effective use of movies on TV programs. Explains why some types of pictures are better than others; how to make titles and special effects; what types of lighting to use; various ways to present commercials; causes of technical flaws and how to avoid them, and a wealth of other information on principles, techniques, and equipment. \$5.00

Painting with Light

By John Alton. A leading Hollywood Director of Photography, winner of the 1951 "Oscar" for photography, explains his professional lighting techniques—what equipment to use and how to place it for a particular mood or effect, indoors or out; how, for instance, to get candlelight or a moving train at night, what lighting to use for rain, for close-ups, and hundreds of other special scenes—information as vital for good TV pictures as for movies. \$6.75

Mandl's Television Servicing

By Matthew Mandl. Detailed, illustrated instructions for locating and correcting every flaw or failure you're likely to encounter, including those hard-to-find troubles. Simple signal tracing procedures, trade tricks in diagnosing troubles in minimum time, essentials of VHF and UHF servicing, complete master trouble chart. Fully and clearly explains each stage in today's receivers, showing what faults may occur in each and why. \$5.50

Television for Radiomen

By E. M. Noll. Very clear, non-mathematical explanations of the function and operating principles of every element and circuit in TV reception, together with practical instruction on the installation, alignment, adjustment and troubleshooting of modern receivers. Provides the THOROUGH UNDERSTANDING of TV needed for effective servicing. \$7.75

Television and FM Antenna Guide

By E. M. Noll & Matthew Mandl. Are interference, fringe reception, ghost reception your problems? This book tells you how to overcome them—how to improve gain, minimize noise from the transmission line, get the MOST out of the antenna system at any location. A brief clear course in antenna theory is followed by instructions for determining the right type of antenna for the site, the best position for it, the right installation, with full, tested data on all types of antennas including those for UHF and VHF locations. \$6.25

See these most helpful books at your book store, or write for on-approval copies to

THE MACMILLAN COMPANY
60 Fifth Avenue, New York 11, N.Y.

V.F.O. Multiplier (Continued from page 53)

gang may be used for S_{1c} . The underside of the first gang is located just about right for S_{1b} . S_{1a} can be the top half of the first gang (looking at it from the underside of the chassis).

After all wiring has been completed, the unit can be connected to a suitable power supply for initial testing and adjustment. The first step is to check all voltages at the tube sockets. If these are correct, the v.f.o. trimmer can be adjusted so the v.f.o. will cover the proper range. It should tune over the entire amateur 80-75 meter band with some extra room at each end. A communications receiver makes an excellent monitor to check output from the v.f.o.-multiplier unit. The v.f.o. tank coil slug was left all the way in on the original model. After the v.f.o. tuning range has been set, a little preliminary adjustment of the broadband couplers should result in settings which show resonance at the lower end of the 80-75 meter bands, as indicated by a small neon light touched to the "hot" side of each trimmer. The keying lead is grounded for all these preliminary adjustments.

The next step is to check for parasitics, and the keying lead should be left unconnected for this. No spurious oscillations from the v.f.o.-multiplier unit should be heard over the entire range of a communications receiver that tunes from 540 kilocycles to 30 megacycles or more. A check should be made with the bandswitch in each of the five positions. The only parasitic oscillation found in the original model was removed by inserting the 500-ohm resistor, R_6 , in the grid lead of the second multiplier tube. If other parasitics are found they should be traced to their source and eliminated before proceeding any further.

Some check should be made on the frequency stability of the unit. Frequency drift due to changing temperatures can be minimized by the use of a proper value of negative-temperature-coefficient condenser in parallel with the v.f.o. tank coil and tuning condenser together.

The third step in adjusting the multiplier unit requires the use of an experimental grid circuit exactly like the one into which the multiplier will work. Plate and screen voltages need not be applied to the experimental stage, but some means must be devised whereby the rectified grid current in that stage can be read with the tube heater lighted. This may be a low range d.c. milliammeter in series with the grid choke, or it may be a 0-200 volt d.c. voltmeter connected across a 50,000 ohm resistor which has been placed in series with the grid choke. The output of the multiplier is connected to the grid of this experimental stage through a 50 μ fd. mica trimmer. The trimmer is set for maximum capacity.

"SPECIAL!!" ALL-CHROME CRYSTAL BULLET MIKE (Famous Make) . . . 30-10,000 cycle response. . . \$2.00. Swivel head. (L.P. \$27.35.)

NOW ONLY \$8.95

50W POWERED PHONE UNITS for all types of intercom work. 2" O.D. ea. \$1.95; 2 1/2" ea. \$2.49
1/4W NEON GLOW LAMP (NE-18) ea. 29¢; 10 / 2.49
D.C. BAYONET SOCKET. Flush mtg. for NE-18. 23

LEOTONE

"JUMBO RADIO PARTS"
LBS. of COILS, SWITCHES, CONDENSERS, SOCKETS, RESISTORS, CONN. SERS, WIRE, AND MUCH, MUCH MORE! (Ship. wt. 50 lbs.)
\$3.95

RADIO HARDWARE TREASURE FULL CAN of Nuts, Screws, Lug, Washers, etc. \$0.89

5" C.R. TUBE FRONT BEZEL . . . blk. crackle . . . \$0.89
5" SCOPE VISOR . . . flexible vinylite 89
5" SCOPE GRID radial calibrated 89
5 1/2" ROUND CONVEX LENS . . . clear glass . . . ea. 39¢
16" TV MASK-ESCUTCHEON (round silver) moulded of crystal clear Lucite. Sliver gray masking ground-culture. Ship. wt. 2 lbs. 1.69
ARMY GAS MASK (fully adjust. Protects against fumes, dust, spray, etc. Less CAN. 39¢

"TUBE CLEARANCE SALE!!" . . . 90-DAY GUARANTEE! Standard brands; unsealed cartons
= 24, 26, 27, 34, 41, 42, 55, 56, 55, 59 or 6K7 ea. 29¢
= 1H4, 1H6, 1J6, 6BT, 6P5, 6G5, 6S17, 6SH7, 6U7 or 7A ea. 39¢
= 35, 45, 71, 77, 1L4, 5Y3, 5Y4, 5U3, 6F8, 6J5, 6K8, 6S47, 6SK7, 6C5, 6U7, 7A4, 7H9 or 7G7 ea. 59¢
= 1A7, 1L6, 1LH4, 2A5, 2A6, 6A3, 6AB, 6H8, 6SC7, 6SN7, 7A7, 7AG7, 7C6, 7C7, 7Y4, 12SN7, 47, 50 or 57 ea. 69¢

TUBE CARTONS . . . plain white. Prices per 100 . . .
Min (1 1/2" x 2 1/2" x 3 1/2") . . . \$1.20; GT (1 1/2" x 2 1/2" x 3 1/2") . . . \$1.45; Med (1 1/2" x 3 1/2" x 4 1/2") . . . \$1.65; Large (2" x 3 1/2" x 4 1/2") \$1.98

CONNECTOR SPECIALS!! . . . Jones 33 Contact (-33) . . . Cable female; panel male. Off cable set \$1.29; 5 \$5.00
PL-54 JK-26 CONNECTORS set \$1.39; 10 \$3.49
PL-291 JK-48 MIDGET CONNECTORS set 39¢
CABINET DRAW SLIDES client ball-bearing making excel. pr. \$2.10; 12" ext. pr. \$2.25; 18" (12" ext.) pr. \$2.39; 18" ext. all steel 10 1/2" pr. \$3.25

"KINKLESS" SUPER-FLEXIBLE BRAID WIRE (32 #10) . . . WITHSTANDS CONTINUOUS BENDING as in Relays, Slewors, etc. Cotton core; outside silk.
20 ft. / 98¢ . . . 100 ft. / \$3.75 . . . 1000 ft. / \$32.50

"DIRECT FACTORY SPEAKER REPAIRS SINCE 1927"
Min. order \$3.00. 20% deposit req. on all C.O.D.'s. Full remittance with foreign orders. Please add sufficient postage—access refunded.

LEOTONE RADIO CORP.
67 Dey Street
New York 7, N.Y.

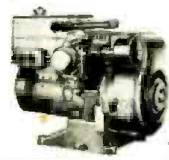
STAY ON THE AIR WHEN POWER FAILS...with an ONAN Electric Plant



**AUTOMATIC
START & STOP**

Model 10EL, 10KW A.C.

When storms, floods, or fires interrupt electricity and force you off the air, you lose listeners and income. Guard against loss, assure vital public service during emergencies by installing an Onan Electric Plant. Onan Standby Electric plants serve many network and private stations. Automatic models to 35,000 watts.



PORTABLE ELECTRIC PLANTS FOR MOBILE RADIO USES
Supply A.C. power for broadcasting at scene of events. Light in weight. Can be carried by hand or in trunk of car. A.C. models: 400 to 3,000 watts.

Write for FREE Folder

D. W. ONAN & SONS INC.
7894 University Avenue
Minneapolis 14, Minnesota

Set the bandswitch in the fifth position, and tune the v.f.o. so a signal is heard on a communications receiver with its dial set at 14 megacycles. Then adjust C_{12} and C_{13} for maximum grid current. Then set the v.f.o. so a signal is heard at 15 megacycles. Adjust C_{12} and C_{22} for maximum grid current at this setting. Again set the v.f.o. so a signal is heard at 14 megacycles and repeat the adjustment of C_{12} and C_{13} . Then follow the same procedure as before with C_{12} and C_{22} . By adjusting the broadband couplers in this way it should be possible to find settings at which the grid current in the following stage runs from $1\frac{1}{2}$ to 2 milliamperes at the 14 and 15 megacycle settings of the v.f.o., and slightly less in between. The final output curve should be two-humped, with peaks on or just outside the edges of the range from 14 to 15 megacycles, and a slight dip in the middle. If this kind of a response curve cannot be obtained by adjusting the four trimmers in the order given previously, reverse the frequencies at which each trimmer is peaked, using the 14 megacycle setting for C_{12} and C_{22} , and the 15 megacycle setting for C_{13} and C_{15} . If difficulty is still experienced, adjust C_{12} and C_{22} at one frequency and C_{13} and C_{15} at the other. If C_{22} seems to have too much capacity to allow proper adjustment, reduce the capacity of C_{21} .

After these adjustments have been made, set the bandswitch to position four and check the output over the range from 7 megacycles to about 7.2 megacycles. The same two-humped curve should be noted. If it is not, find settings of C_{12} and C_{13} which will improve output in the 7 megacycle range without materially affecting the output in the 14 to 15 megacycle range with the switch in position five. No adjustments are necessary with the bandswitch in positions one and two because the broadly resonant 80-75 meter coil is in the plate circuit of the first multiplier-buffer tube. Output should be between $1\frac{1}{2}$ and 2 milliamperes over the entire 80-75 meter range.

Minor re-adjustment will probably be necessary after the unit is permanently mounted in the equipment with which it is to be used. The output over the necessary range on each setting of the bandswitch should be checked and the broadband coupler trimmers adjusted for proper response curves.

The unit can be mounted on top of a regular chassis, with $\frac{1}{4}$ " holes drilled to give access to the broadband trimmers. It will be necessary to mount the v.f.o. multiplier unit to the panel first, so the panel bearing on the bandswitch and the four mounting screws of the National SCN dial assembly can be tightened. Care should be taken to mount the unit in such a way that none of the coils or chokes is in a magnetic field from a nearby power or filament transformer. This is particularly true of the v.f.o. tank

KESTER

Since the most important single step in Radio-Television Servicing is soldering... it's just plain good sense to use the best — KESTER SOLDER... Key Name in Solder for More Than 50 Years.

KESTER SOLDER COMPANY
4235 Wrightwood Avenue • Chicago 39, Illinois
Newark 5, New Jersey • Brantford, Canada

SOLDER

WE MADE A TERRIFIC TUBE PURCHASE!

STEVE-EL'S large purchasing power enabled us to buy the entire stock of a leading manufacturer. Every tube carries the STEVE-EL name which is your guarantee of complete satisfaction or money back. All tubes individually boxed.

SEE FOR YOURSELF

1B3GT \$0.63	6BE6 ..... .48	6SQ7 ..... .42	12BA6 ..... .47	25BQ6 ..... .77
1U4 ..... .48	6BG6 1.21	6T8 ..... .74	12SA7 ..... .52	25W4 ..... .48
1U5 ..... .48	6BH6 ..... .62	6U6 ..... .57	12SK7 ..... .49	25L6 ..... .48
1S5 ..... .48	6BJ6 ..... .53	6U8 ..... .78	12SL7 ..... .57	25Z6 ..... .42
1X2 ..... .63	6BK7 ..... .86	6V6GT ..... .46	12SN7 ..... .54	35L6 ..... .48
5U4 ..... .38	6BQ6 ..... .76	6V8 ..... .83	12SQ7 ..... .42	35Z5 ..... .33
5W4GT ..... .46	6BQ7 ..... .86	6W4 ..... .45	14AF7 ..... .59	50L6 ..... .48
5Y3GT ..... .29	6CB6 ..... .48	6W6 ..... .52	19T8 ..... .78	80 ..... .38
6A7 ..... .62	6F6 ..... .49	6X4 ..... .34		
6A8 ..... .51	6J6 ..... .79	7C6 ..... .42		
6AG5 ..... .62	6L6G ..... .89	7X7 ..... .62		
6AK5 1.14	6SA7 ..... .52	12A76 ..... .48		
6AL5 ..... .41	6SG7 ..... .49	12AU6 ..... .48		
6AU6 ..... .43	6SK7 ..... .49	12AU7 ..... .56		
6BC5 ..... .58	6SL7 ..... .52	12AV6 ..... .52		
6BC7 ..... .86	6SN7 ..... .54	12AZ7 ..... .94		

SPECIAL DISCOUNTS 50 Asst. { 5% 100 Asst. { 10%

Write Dept. RN-2 for FREE Catalog.

SPECIALS

- Web-Cor Tape Recorder #210-1B \$146.50
- Pentron Tape Recorder #9T3C 117.50
- Tape Master #PT 125 89.50
- Tape Master #SA 13 69.50
- Wen 250 Watt Soldering Gun 9.71

STEVE-EL ELECTRONICS CORP. VISIT OUR NEW STORE

61 Reade St., New York 7, N. Y. COrtlandt 7-0086

Neither

~~TRIODES~~

Nor

~~Tetrodes~~

permit the low distortion and high efficiency of the

Acrosound

ULTRA-LINEAR Amplifier Circuit

This circuit and the Acrosound TO-300* output transformer are designed to work together for the highest quality sound obtainable. The combination provides optimum performance resulting in the most linear output stage which can be made with conventional tubes.

The heart of this new circuit development is the transformer whose specifications and proven performance make it the world's finest.

ACROSOUND TO-300*



\$2475 net

At Leading Distributors

- ✓ response ± 1 db 10 cps to 100 kc
- ✓ 20 watts undistorted 20 cps to 30 kc
- ✓ 40 watts undistorted 30 cps to 20 kc
- ✓ Unequalled square wave performance
- ✓ Resonance free response
- ✓ Uniformity of characteristics
- ✓ Compact, rugged construction

Complete data and characteristics of Ultra-Linear Circuits and Acrosound Output Transformers on request.

* Patents Pending

ACRO PRODUCTS CO.
369 Shurs Lane, Phila. 28, Pa.

coil. Frequency modulation at the a.c. frequency of the power or filament transformer will result if the v.f.o. tank is in any stray magnetic field. The unit should be located so that it is protected from drafts. It is better to let it reach a certain temperature and stay there rather than to try to keep it cool. A good source of screen voltage for the v.f.o. is a 30,000 ohm wire-wound potentiometer connected across the regulated supply to the v.f.o. plate. This potentiometer can then be adjusted for most satisfactory operation of the v.f.o. multiplier over its entire frequency range and for best keying characteristics. A VR75 tube in series with a VR105 makes a good combination for delivering regulated voltage to the v.f.o. and to the multiplier screens. The plate and screen power supply should be capable of delivering around 70 milliamperes at the required voltages.

-30-

Remote B.C. Amplifier (Continued from page 63)

equipment. The all-important radio line is permanently installed. The engineer on duty at the main studio feeds program down the line right up to air time. The sports announcer listens with his earphones and starts his program on a pre-determined broadcast cue. This is usually a time announcement or a direct cue such as "We take you now to Phoenix Municipal Stadium and your sportscaster..." The engineer at the main studio opens the gain control on the remote channel of his console and the program is on the air. After the broadcast the announcer reverses his operation, pulling the a.c. plug, his mike, and earphones.

It's as simple and economical as that.

-30-

NEW LICENSE FORMS

NEW forms and a radically different procedure have been adopted by the FCC for new or modified station licenses in the Public Safety, Industrial, and Land Transportation services.

FCC Forms 400 and 400-A will be available at all Field Offices during February and will replace FCC Forms 401, 401-B, 403, 702, and 703, some or all of which have been necessary for various applications. Form 400 is for new licenses and 400-A for modifications.

A "List of Equipments Acceptable for Licensing" will be released at the same time as the forms and retained at all FCC Field Offices, where they may be inspected or reproduced by interested parties. An applicant may use any equipment on the list that fulfills the requirements of his service. Non-listed equipment can still be authorized, however, provided the proper technical data accompanies the application.

A feature of Form 400-A is the simple manner in which authority can be obtained to add mobile units to an existing system.

-30-

PHOTOCON SALES

417 N. Foothill Blvd. SY camore 2-4131
Pasadena 8, Calif. RY an 1-6751

FREE 24 PAGE WINTER SURPLUS SALES CATALOG

WANTED new or clean used electronic surplus. Please state exact description of the condition and details of modification. Include lowest price in first letter.

LM & BC-221 Frequency Meter with cal. book, crystal, and tubes.....	Exc.	\$ 99.50
TS-352/U Weston Test Set.....	Exc.	150.00
TS-148/CP.....	New Mfg.	PUR*
Signal Generator 10GA.....	Like new	PUR*
Million Signalyzer Radio & TV.....	Like new	PUR*
Dumont 208 Scope.....	Exc.	PUR*
TS-146/EP X-Band Signal Generator.....	Exc.	PUR*
TS-34/A1 Portable Oscilloscope.....	Exc.	350.00
TS-12 Test Set for X-Band Box 1 & 2 complete.....	Exc.	PUR*
TS-323 Frequency Meter 20-480 mc.....	Exc.	PUR*
Hewlett-Packard 410A VTVM. Like New	Exc.	185.00
Signal Generator Mod. 804 8-330 mc. Exc.	Exc.	PUR*
Simon Genescope, New.....	Exc.	275.00
305B Floor model Oscilloscope 7" tube	Exc.	PUR*
RCA mfg.....	Exc.	PUR*
APR-4 Search Receiver.....	Exc.	PUR*
Tuning Unit for APR-4 Receiver.....	Exc.	PUR*
BC-348, BC-312, BC-342 Receivers.....	Exc.	PUR*
APS-3.....	Exc.	PUR*
SCR-284 Fields Sets.....	Exc.	PUR*
APN4A or B.....	Exc.	PUR*
API-5A.....	Exc.	PUR*
SCR-545 Radar Trailer.....	Exc.	PUR*
Type 120A Test Set 130-210 mc.	Exc.	PUR*
Donnan Radio Corp.....	Exc.	17.50
Antenna AT 104/APN9.....	New	
Automatic Pilot Inverter		
Type DA Input 28VDC, @ 12 amps.		
Output 115V., 3 phase, 400 cps.		
115VA.....	Exc.	80.00
T-17 Hand Microphone with cord and PL-68.....	Exc.	4.50
HS-23 8000 ohm. Used \$2.95.....	New	5.95
HS-18 8000 ohm. Used 1.75.....	New	2.25
HS-33 600 ohm. Used 3.50.....	New	6.95
HS-38 600 ohm. Used 1.75.....	New	2.25

* PUR - PRICE upon request.
NOTE: One of the largest and most complete electronic surplus stocks in the country. We have thousands of tubes, capacitors, plugs, accessories, transmitters-receivers, test equipment, etc. Send us your requirements.

TERMS: Prices F.O.B. Pasadena, California. 25% on all C.O.D. orders. Californians add 3% Sales Tax. Prices subject to change without notice.

SUPER VALUE!



0-1 MA DC
4" SCALE

Only \$5.95 ea.

2 FOR ONLY \$11.00

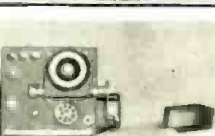
Greatest meter value ever offered! Sensitive 1 MA DC basic movement may be used for any type of current or voltage meter. Big 4" scale calibrated 0-1 for easy fractional readings. Rectangular bakelite case with corner mounting holes mounts flush on panel, projects 2" forward. Nothing behind panel except meter terminals. Meter case measures 4 1/2" high, 5 3/4" wide. These meters are slightly used but have been thoroughly checked and reconditioned. We guarantee them for absolutely top performance. Don't delay; order now! No more available after present supply is sold!

25% with order—

balance C.O.D., F.O.B. Chicago

NATION WIDE RADIO

572 W. Randolph Street Chicago 6, Ill.



RU-18 RECEIVER

Navy 6-tube aircraft receiver with DF loop and antenna input; complete coverage from 190 KC to 13.9 mc.; in 8-coil sets; less tubes; brand new with any 5-coil sets; you name the frequency you desire; F.O.B. shipping wt., 25 lbs. \$19.95

McCONNELL'S

3834 Germantown Ave. Phila., Penna. RA 5-6033

ATTENTION

Distributors in Chan. ± 12 Territory

We are in production on 5, 10 & 12-Element—most efficient YAGI ever designed. MANY TERRITORIES STILL OPEN. We Welcome your Inquiries. ALSO COMPLETE LINE OF THE ANTENNAS.

FRENCHY RADIO MFG. CO.

164 W. Parker St.

Scranton 8, Pa.

Technical BOOKS

"ESSENTIALS OF MICROWAVES" by Robert B. Muchmore. Published by John Wiley & Sons, Inc., New York. 232 pages. Price \$4.50.

With more and more services moving into the microwave region as the spectrum becomes more and more congested, interest in the subject has been stimulated to the point where there was a real need for a basic and not-too-technical work covering microwave principles.

Mr. Muchmore has met this need by writing a clear and logical explanation of the phenomena governing the action of microwaves. His style is lucid and straight forward which should prove to be a boon to the student or layman.

The book is divided into fifteen chapters which cover: introductory material, the electromagnetic laws of Maxwell, characteristic waves and wave guides, cavity resonators and filters, characteristic waves and antennas, typical microwave antennas, waves and electron streams—grid-control tubes, klystrons, traveling-wave and multiple-stream tubes, magnetrons, electrical noise, microwave radio systems—relays, radar, applications of microwaves in physical research, and microwave measurements.

A glance at these chapter headings indicates the scope of the text and those interested in microwaves should find plenty of food for thought in this volume.

* * *

"ELECTRICAL FUNDAMENTALS OF COMMUNICATION" by Arthur L. Albert. Published by McGraw-Hill Book Company, New York. 522 pages. Price \$7.00. Second Edition.

In the ten years since the first edition of this work appeared radio communications, which constitutes a third of the subject matter, have made great strides. Because of these advancements the author has reworked large portions of the original text to bring the reader up-to-date with the state of the art.

The text covers the three divisions of communications, telegraphy, telephony, and radio with its allied branches. Additional emphasis has been placed on radio fundamentals in this edition, along with its allied art—television.

Since this book is designed specifically for beginning students, the explanatory material has been made as simple as possible. One interesting technique which the author has employed is to use illustrative material from the field of communications rather than resort to electrical power analogies or non-related scientific branches.

The sixteen chapters which comprise this book cover such subjects as the fundamentals of electronics; direct voltages and currents; conductors,

Don't Gamble.... ON ULTRA HIGH FREQUENCY

"RECEPTION"

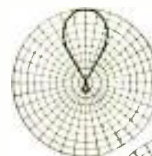
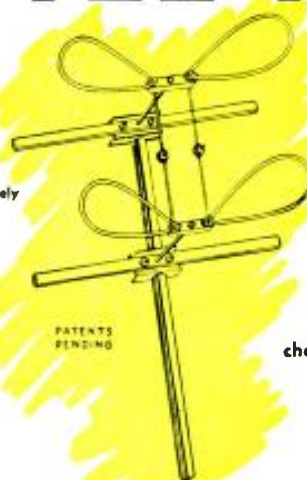


..you can count on the....

MI-TEE RAY

UHF ANTENNA

- designed and engineered exclusively for UHF
- all aluminum sturdy construction
- minimum space requirements
- matchless reception
- nationally advertised



channel 14



channel 83

Fretco

INCORPORATED
Pittsburgh 19, Pennsylvania

WANTED!

• RADCOM pays highest prices for surplus equipment, parts and tubes

- TCS-7 and up • SCR-274N, SCR-300 • ARC-1, ARC-3, ART-13
- SCR-399 Equipment JB-70, JB-60, BC-939A, BC-610-E, RA-63, EE8, BC-614-E, PE95, PE197, Trailer K-52, Gords, LS-3
- SCR-508 . . . BC-604, BC-603, FT-237. Crystal Sets
- SCR-506 . . . BC-653-A, BC-652-A, DM-40-A, FT-253-A, BC-658-A
- BC312, 342, 348, BC-1000 Receivers
- SCR522 Equipment, RA-34 Rectifiers
- Transmitters BC-696, R89/ARN-5A, MN-62, Test Equipment SCR-211, 1-208
- Selsyns—All kinds . . . Magnetrons
- Generators—GN-45—All kinds
- 5-KW Gas Generators, PE-75, PE-95, PE-197
- Plugs and Connectors
- Tubes—Special Purpose, Lots
- Technical Manuals Especially for ARC-5

Bigelow 2-6666

Always Right With Earl White

RADCOM Engineering Co. 8 Livingston St. Newark 3, N. J.

MOTOROLA-DETROIT CO.

one of the country's largest distributors of television sets and appliances

SAYS

KRYLON

100% ACRYLIC

IS A PROFITABLE ITEM TO STOCK FOR 2 REASONS

1. TV SERVICEMEN BUY IT



"Our customers use Krylon and plenty of it," reports Motorola-Detroit parts manager, Paul Wallace. "The spray nozzle makes it easy to insulate the complete chassis in a matter of minutes." Because of its high dielectric strength, Krylon helps prevent corona.

2. WE USE IT OURSELVES



Indoor service chief, John Workman, reports, "We use Krylon clear plastic coating to spray the bell part of metal picture tubes. Krylon stops dust from adhering to the tube and prevents arcing. We find Krylon is a must in television service operations."

ALSO

"Our appliance division uses White Krylon to touch up any white goods that become chipped. We're sold on White Krylon for one big reason—it won't turn yellow."

Schedule J Wapoff
Service Manager
Motorola-Detroit Co.

In U.S.A. and CANADA
SEE YOUR JOBBER
Or Write For Information
Department 2702

KRYLON, Inc.
2601 N. Broad St., Philadelphia 32



resistors, and insulators; direct current electric power and energy; alternating voltages and currents; the magnetic field and inductance; the electric field and capacitance; electric measuring instruments; alternating current circuits; algebraic representation of vectors; electric networks; bridge circuits; the transmission of electromagnetic waves; fundamental principles of electron tubes; electron tubes as circuit elements; and electro acoustics. A table of natural trigonometric functions has also been included.

"HIGH FIDELITY SIMPLIFIED" by Harold D. Weiler. Published by John F. Rider Publisher, Inc., New York. 208 pages. Price \$2.50. Paper bound.

This compact handbook has been prepared for the benefit of the audio enthusiast who knows and appreciates good music but is not cognizant of the technical "why's and wherefore's".

The author's easy and conversational style helps tremendously in putting the subject matter across to the layman. He opens the book by discussing the meaning of high-fidelity reproduction, how it may be obtained, and a brief resumé of the type of equipment that is available.

The balance of the book is taken up with a discussion of the individual components which go to make up a high-fidelity music system, i.e., speakers, amplifiers, record players, tuners, and tape recorders.

The text material is lavishly illustrated with actual photographs of commercially-available equipment. A list of high-fidelity component manufacturers is appended for ready reference.

Those planning high-fidelity music systems for their homes will save themselves time, money, and trouble by reading this book first then making their purchases.

"DATA AND CIRCUITS OF MODERN RECEIVING AND AMPLIFYING VALVES" compiled and edited by N. S. Markus & J. Otte. Published by Philips Technical Library, Eindhoven, Holland. Available in the U. S. from Elsevier Press Inc., 402 Lovett Boulevard, Houston 6, Texas. 487 pages. Price \$6.25. Book IIIA, Second Supplement.

This is the third in the Philips series covering receiving and amplifying tubes. The previous volumes covered the years 1933-1939 and 1940-1941. With this book the authors have dealt with tubes brought out by Philips in the postwar years 1945-1950.

Of special interest to engineers is the company's "Rimlock" series of tubes, and the new noval types which include the EQ 80, a specially-designed component for FM and AM-FM receiver applications.

Like the previous volumes of this series, the authors have devoted a generous amount of space to practical applications for the various new tubes. Technical details and performance data are lavishly provided, along with

Profit Building Replacement Yoke RCA-Type 74952



only
349
LIST 10.30

Used in RCA TV Models

6T53	6T65	6T75
6T54	6T71	6T76
6T64	6T74	Etc.

Servicemen, dealers—here's a terrific profit builder for you. This direct drive yoke (also known as Drawing No. 970669-1) is used in most popular RCA TV models. Fully guaranteed. Complete, ready for use, with network and octal plug. ORDER NOW!

Send for FREE catalog of other bargains.
GREEN TELE-RADIO
DISTRIBUTORS, INC.
Dept. R-2, 472 Sutter Ave., Brooklyn, N. Y.

DON'T PASS THIS BUY

GOOD VALUE MARINE BAND RADIO RECEIVERS AT LOW COST—UNITS REMOVED FROM POLICE RADIO CARS, used but in good working condition, fixed tunable in 2-3mc band. Complete with 5 tubes, speaker & 6 volt input power supply. Also suitable CD. AUXILIARY POLICE-FIRE SERVICE. As is w/money-back guarantee. \$14.95

ARMY SURPLUS SECTIONAL STEEL WHIP ANTENNAS—12 1/2 ft. \$1.85; 18 1/2 ft. \$2.50; 24 1/2 ft. \$3.25
IDEAL 30-40 meter vertical assy. 2 1/2 ft. 4.65
HINGED TYPE INSUL. WTC BASE, IDEAL/low bridge lowering of nut. Used W/insul. units. 7.95
BRAND NEW MFD 6 V. BATTERY CHARGERS, keep your battery in good cond. during winter 7.95
COMPACT ELTRON VIBRATOR PACK, 6V in. 20V/30 ma will operate on 4 D cells. 3.95
6 VOLT DYNAMOTOR, 250V/100 ma. brand new 11.95
W. E. MARINE RADIO-TELEPHONE, brand new 4 channels, w/12 volt power supply. 149.50
YOUR NEW RADIO CONTROL PARTS HEADQUARTERS CRYSTALS, 27.255mc. .04 tol. (PC) atomk 3rd harmonic oscil. newly mfd to our specs. 54.25
XFG-1, that hard-to-get English tube. 3.35
SIGMA 4F relay, 10,000 ohm .04 watt sensat. 2.45
SIGMA 5P relay, 150 ohm dual coils. 2.95
SIGMA 5P relay, 5000 ohm super-sensitive. 4 1/2 the ideal relay for your receiver. special. 6.95
MILLER RECEIVER PARTS PACKAGE, complete tube & SIGMA 4F relay, wonderful buy. 11.95
ESSCO SUPER, a new 2 tube reliable receiver at price of one tube, complete kit. 15.95
RECEIVER PARTS PACKAGE, for AIR TRAILS PLAN R-101, with XFG-1 & SIGMA 4F relay 12.95
TRANSMITTER PARTS PACKAGE, w/ tube, crystal, antenna & meter, for AIR TRAILS PLAN R-101 circuit, all first class materials 14.95
SIGNIFY BACK GUARANTEE ON ALL ITEMS Save G.O.D. Fees, Incl. Postage Extra Refunded Minimum Order—\$3.00. Please
Special Bonus 1 lb Hookup Wire Kit Free '55 Order
ELECTRONIC SPECIALTY SUPPLY CO.
58 WALKER STREET, NYC 13, N. Y. WALKER 5-8187

WATCH FOR THE NEW ZIFF-DAVIS PUBLICATION

SEA STORIES

Thrilling Tales of the Deep!
NOW ON SALE!



TWO DOTS MAKE THE LETTER



GET in on the fun of operating your own licensed transmitter. I guarantee you will memorize the International Morse Code alphabet within two hours by my simple picture method, or return method within five days and I will refund your money.

COMPLETE COURSE ONLY \$1
NOTHING ELSE TO BUY!
OTTO LUTHER, NEW PRESTON, CONN.

RADIO & TELEVISION NEWS

graphical representation of the tube's characteristics.

A separate section in the back of the book provides data on the company's latest measuring and auxiliary equipment line. Each piece of test gear is illustrated, classified, and accompanied by a detailed technical explanation of its performance, etc.

Those who are familiar with the previous volumes in the *Philips* series will find that the same high standard prevails in this newest publication. Those who are not acquainted with these particular works will find the approach stimulating and informative.

"THERMIONIC VACUUM TUBES AND THEIR APPLICATIONS" by W. H. Aldous & Sir Edward Appleton, Published by *John Wiley & Sons, Inc.*, New York. 156 pages. Price \$2.00.

This pocket-size book packs a wealth of practical information into its comparatively few pages. Although written for the student of general physics rather than the radio specialist, nonetheless the engineer or advanced ham will find much of interest.

Thirteen chapters divide the text material and cover an introduction, the construction of thermionic tubes, the internal action of the two-electrode tube or diode, the internal action of the three-electrode tube or triode, the internal action of multi-electrode tubes, the use of tubes as amplifiers, limits to amplification, the use of tubes as rectifiers, the use of vacuum tubes as frequency changers, the use of tubes as oscillation generators, miscellaneous uses of feedback, the use of space charge control tubes at u.h.f., and transit time tubes.

While some knowledge of simple mathematical procedures is requisite for a thorough understanding of the text material, the student should experience no difficulty in handling the subject matter.

Vest-Pocket Receiver
(Continued from page 61)

ing "Q". Detuning also takes place, requiring readjustment of the tuning condenser.

Once the assembly and wiring have been completed, and the unit checked for operation, a small screwdriver or alignment tool may be used to tune in the builder's favorite local station. The tuning condenser (C₂) may then be left fixed in position permanently.

If the builder does not wish to leave the receiver tuned to a single station, a small extension might be soldered in place on the trimmer adjustment screw, and a "tuning" knob provided alongside of the "On-Off" switch and volume control.

However, irrespective of the minor modifications undertaken by the individual builder to suit his own requirements, the completed "Vest-Pocket Receiver" should give many hours of pleasure.

This **TECHNICAL INDEX** is one reason you need this 28-page volume!



Not just a catalog!

Includes both technical and product data in factual, concise form with dozens of helpful explanatory photographs, charts and tables. Features much engineering information available NO-WHERE ELSE!

IT'S THE *University* **TECHNILOG**

The new 1952 compilation of valuable information that explains and simplifies the application of loudspeakers. A real time and money saver for dealers, contractors, service men and installation designers. The most authoritative, single piece of literature ever published on loudspeakers. It's yours FREE.

TECHNICAL INDEX

SELECTING THE PROPER LOUDSPEAKER SYSTEM Page 4

METHODS OF CONNECTING SPEAKERS TO THE AMPLIFIER Page 8

IMPEDANCE MATCHING Page 9

CONSTANT VOLTAGE DISTRIBUTION SYSTEM Page 12

IMPEDANCE MATCHING TRANSFORMERS Page 16

EFFECTS OF MISMATCH UPON POWER TRANSFER Page 16

CONTROLLING LOUDSPEAKER VOLUME Page 20

OVERLOAD PROTECTION OF LOUDSPEAKERS Page 22

PHASING LOUDSPEAKERS Page 23

REVERBERATION Page 23

BAFFLING A CONE SPEAKER Page 26

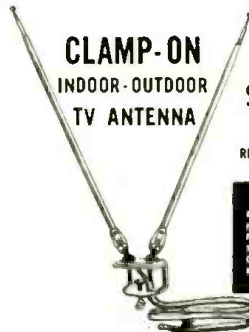
ADDRESS REQUESTS TO YOUR DISTRIBUTOR



UNIVERSITY LOUDSPEAKERS • INC
80 SO. KENSICO AVE., WHITE PLAINS, NEW YORK



Mr. FED says **HAPPY NEW YEAR**
with these **Federated MONEY SAVING SPECIALS**



CLAMP-ON
INDOOR-OUTDOOR
TV ANTENNA

Model #1N852

\$1.39

REGULAR LIST PRICE \$4.25

EXTRA:

Mention this ad at your nearest Federated Sup. Pls. Center to receive 3-ANTENNAS for \$12.50. Cash in on this money-saving offer now!

Brush Microphone

MODEL BA-116.

\$5.95.

List Price \$14.75.



Rugged, dependable. Uniform frequency response. Smart brown hammered metallic finish. Ideal for hand or desk use — requires no stand.

COMPARE THESE EXCLUSIVE FEATURES

- Special clamp for easy installation on rear of TV set, wall, or outside of window.
- Felt-lined bracket to protect cabinet finish.
- 3-section di-poles telescope to desired length for all-channel reception.
- Plated-brass construction.
- Ball socket plus swivel joint for quick extension in any direction.
- Easy-to-attach lead-in wire with lugs.

- Frequency Response 50 to 6,000 cps.
- Output level 53 db below 1 volt/dyne/cm².
- 8' cable.
- High impedance equivalent to approximately .002 mfd. (1.8 megohms at 1,000 cycles.)
- Shock Mounted.
- Metalseal crystal cartridge insures longer life.

Act and Save Now... They're Moving Fast!

Hams! Servicemen! Experimenters! Save... Visit your nearest Federated center!

Federated Purchaser

Nation's Only Coast-To-Coast Electronics Distributor

- New York City 7, N. Y., 66 Dey St.
- Newark, N. J., 114 Hudson St.
- Allentown, Pa., 1115 Hamilton St.
- Easton, Pa., 925 Northampton St.
- Los Angeles 15, Cal., 911 So. Grand Ave.



L. Veltri, busy service-dealer of Westchester, N. Y., reports:

I SAVED \$940*
by making a \$59 INVESTMENT
in a Transvision
FIELD STRENGTH METER

* Says Mr. Veltri: "... The way I figure, in the last 6 months I saved that much money in installation time alone ..."



FIELD STRENGTH METER
Saves 50% of Installation Cost
Pays for itself on 3 or 4 jobs

NO TV SET NEEDED

Works from antenna . . . Measures actual picture signal strength directly from antenna. Shows antenna orientation maxima. Compares gain of antenna systems. Measures TVI on all channels. Checks receiver re-radiation (local oscillator). Permits one man antenna installation.



Eliminate variables, insure accuracy with direct meter readings on the FSM.



Don't lug sets. The Transvision FSM makes installation easy.

PREVENT WASTE OF SERVICING TIME! By checking antenna performance with the Field Strength Meter, the serviceman can determine whether the TV set or antenna, or both, are the source of trouble. Call backs are eliminated.

Wide range: Measures field strength from 10-50,000 microvolts. Has Fringe Area Switch for weak signal areas. 13 channel selector. Individually calibrated on every channel.

ADAPTABLE for UHF

Model FSM-2, for 110V AC only. Complete with tubes. Wt. 13 lbs. net \$59.

Model FSM-3B, for 110V AC and Battery Operation (all batteries and cables included). Wt. 22 lbs. net \$79.

Order direct from factory:

TRANSVISION INC., NEW ROCHELLE, N. Y.

FREE: Sample copy of "TV and Electronics Notes". Or send 50¢ for year's subscription.



10 DAY TRIAL
Buy and try this fine instrument for 10 DAYS. Then, if you wish, you may return it. Your purchase price less 10% (our cost of handling and re-packaging) will be promptly refunded.

TRANSVISION, INC.
DEPT. RN-23F NEW ROCHELLE, N. Y.
() Send me _____ Model FSM-2; _____ FSM-3B
() Enclosed find \$ _____ deposit. Balance C.O.D.
() Enclosed find \$ _____ in full. Send prepaid.
I accept your 10 Day Trial terms.
Name _____
Address _____
City _____ State _____

NEW TV PRODUCTS on the Market.....

PORTABLE TV CAMERA

A portable, self-contained television camera is now available from Dage Electronics Corp., Beech Grove, Ind.

Designed for closed-circuit TV, the new camera measures 14" long, 9 3/4"



high, and 4 3/4" wide. It can be used with any standard television receiver, permitting an unlimited range of screen sizes. No alterations are necessary to the receiver. Daylight or normal room light is sufficient for clear transmission and reception in most cases.

U.H.F. LINE

A closer-spaced, open-wire transmission line for u.h.f. has been released by Gonset Company, 80 S. Main St., Burbank, Calif.

The No. 18 gauge solid copper wire is spaced at 1/2" by means of polystyrene spacers. The closer spacing restricts the field and minimizes dissipation losses and reflection "bumps". Surge impedance is 375 ohms. Attenuation is approximately 2 db per 100 feet at the low end of the u.h.f. band and approximately 3 db at the high end (dry). The u.h.f. attenuation increases moderately when the line is wet.

U.H.F. ANTENNA OFFERINGS

Fretco Inc., 1041 Forbes St., Pittsburgh has introduced the "Mi-Tee Ray" antenna which has been designed exclusively for u.h.f. reception. This all-aluminum unit measures 9 1/2" x 10 1/2" x 16 1/2". It is pre-assembled for easy installation.

JFD Mfg. Co., Inc. of 6101 16th Ave., Brooklyn 4, N. Y. has added a bow-tie antenna with screen reflector to its u.h.f. line. Delivering between 4 and 6 db in a single array, with gain increasing as frequency increases, the antenna is especially suited for suburban installations.

LaPointe-Plascomold Corp., Rockville, Conn. is marketing the "Ultra Q-Tee Suburban" which is similar to the company's present Channel 2-83 "Ultra" model except that the u.h.f. "V" portion of the antenna is replaced by an 8-element u.h.f. yagi. It is de-

signed for fringe area u.h.f. reception as well as reception in all multi-channel v.h.f. areas.

Telrex, Inc., Asbury Park, N. J. has added the Model #300 "Duplex" yagi to its u.h.f. line. The new antenna is a multi-element beam, small in size, light in weight, and readily installable above existing v.h.f. antenna systems.

Walter L. Schott Company, 3225 Exposition Place, Los Angeles 18, Calif. has two new all-channel u.h.f. antennas available for the trade. The "Reflecto-Fan" includes a screen reflector to give directivity in the horizontal and vertical plane. It is constructed of heat-treated alloy with insulators of special polystyrene compound. The reflector is designed for low wind resistance. The second antenna is a "Corner Reflector."

U.H.F. TUNERS

General Electric Company is now in production on u.h.f. tuners for its TV receivers. Two variations of the tuner will be available; both can be installed by field technicians without removing the chassis from the cabinet.

One type, for use in G-E sets made since January, 1949, provides control of the unit from a selector knob on the front panel. For sets made before January, 1949, the u.h.f. control is designed to be installed on the side of the cabinet.

TV TEST PROBE

General Cement Mfg. Co., Rockford, Ill. has introduced a tester for checking high-voltage TV circuits. Measuring about 7" in length, the unit glows when in contact with high voltage.

It can be used for checking high-voltage rectifier tubes, output and transmitter tubes, and high-voltage transformers. The probe is merely brought in contact with the component to be checked. For testing high-voltage filter resistors, the tester is



moved along the body of the resistor with an open or cracked resistor making the tester glow at the trouble point.

TV ANTENNA TOWERS

Alprodco, Inc., Kempton, Ind. is offering three aluminum towers for TV antenna installation applications.

**FL-8 FILTER
AND
"FILTER FACTS"
BOOKLET**

BRAND NEW!
Both for
\$1.25

CONDENSER TESTER

One of our best sellers! Useful, versatile laboratory item, in kit form. Simple, and easy to build in less than an hour. Checks condenser leakage and continuity up to 8 megs. Will test any paper, electrolytic, mica or oil capacitor from 50 mmf. to 50 mfd. Self-contained power supply and neon bulb indicator with socket and bezel. Drilled metal cabinet. Complete instructions and diagrams included with each kit. Only \$5.00.



U-V LIGHT SOURCE

8 watt ultra-violet light source. In kit form including Schumann black light tube, (for U-V light in the 3660 Angstrom unit region) ballast, starter, mounting panel, reflector, line cord/plug, hardware, instructions. An invaluable device for schools, labs, service shops, home workshop, etc. Here is a genuine value. Complete kit, (less outer housing) . . . only \$4.95

FONE PATCH!

Now available, the superior new O-R, # 6008 phone patch. Provides you with exactly what you need to patch your phone into transmitter or receiver. Featuring a bi-impedance input suitable for x1 mike. Both hi and lo impedance outputs to insure proper match to your particular receiver. Unit is complete—"sure-fire" ready to go to work for you. Only \$4.95 ea.



NOVICE TRANSMITTER KIT

A two tube, crystal controlled transmitter covering 3700 to 3750 kcs . . . can be used later for all bands, 20 to 160. Has pi coupler output to match most antennas. Uses 6V6 and 6BE. 35 watts input. Less coils, tubes and crystals . . . \$9.90
Matching Power Supply Kit . . . \$9.90
One coil, (specify band) . . . 1.05
Tube kit, (3 tubes) . . . 3.95
Crystals, (Specify frequency band) . . . 2.75

SENSITIVE RELAY

Miniature type (1) - overall SP-ST contacts. Coil resistance 6500 ohms. (2 ma). An excellent relay for voice control or model applications. \$2.50 ea. Manufacturers write for quantity prices.

**SPLINED TUNING KNOB
FOR 274N RECEIVERS**

An exclusive O-R item manufactured for us. Fits BC-453, BC-454 and other 274N receivers. This is a really hard-to-obtain item. Only . . . 89c ea.



TRANSFORMERS-CHOKES:

325-0-325 @ 225 ma. 6.3 @ 5A. 5V @ 3A. Pri. 110V. 60 cy AC. Size, 4 1/8" x 4 1/8" x 3 1/2". Only . . . \$6.95 ea.

Isolation transformer. Useful for AC-DC supplies. Pri. 117V. Sec. 120V, AC. at 25 ma. Also 6.3V at 1/2 amp. Only . . . \$1.80 ea.

Isolation transformer. Pri. 117V AC. Sec. 120V, AC. at 50 ma. Also 6.3V at 2 amps. . . . \$2.79

020-0-020 or 740-0-740 AC @ 200 ma. Pri. 115V, 60 cycle. AC. Upright shielded case. Excellent for 807's. . . . Only \$10.80 ea.

5V. 25A. Pri. 115V. 60 cy. AC. A real rugged job excellent for 301TL—4.250A etc. Limited quantity. Only \$4.50 ea.

2.5V @ 10A AC. 10,000V insulation. Pri. 115V AC only \$3.39 ea.

350-0-350 @ 300 ma. 6.3 @ 4A. 6.3 @ 8A. 5V @ 3A. Pri. 115V, 60 cy. AC. . . . only \$7.95 ea.

450-0-450 @ 200 ma. Pri. 115V, 60 cy. AC. 5V @ 3A. 6.3 @ 5 amp. 1a shielded case. Only \$8.90 ea.

350-0-350 @ 350 ma. 6.3 @ 10A. 5V @ 6A. Pri. 115V. 60 cycle. Only . . . \$8.95 ea.

**110V, AC POWER SUPPLY
FOR ANY 274-N RECEIVER**

Just plug it into the rear of your 274-N RECEIVER - any model. Complete kit and black metal case, with ALL parts and diagrams. Simple and easy to build in a jiffy. Delivers 24 volts plus B voltage. No wiring changes to be made. Designed especially for the 274-N receiver. Only \$8.95.

Filament trans. for 274N receivers. Pri. 110V, 60 cy. AC. Sec. 24V @ .6A. An excellent buy at . . . \$1.95 ea.

Minimum order \$2.00. All items subject to prior sale. All prices subject to change without notice. 20% deposit must accompany all orders. balance C.O.D.

OFFENBACH-REIMUS
1564 MARKET STREET
SAN FRANCISCO, CALIF.

The Type AT-6W standard unit will carry a static top load of 300 pounds at a recommended height of 120 feet. The Type AT-6C commercial tower will carry 400 pounds at a height of 150 feet while the Type AT-6E economy model is designed to handle 125 pounds at 48 feet. The first two units are self-supporting to 18 feet and 24 feet respectively. The economy model must be guyed every 18 feet.

All of the towers come knocked down in easy-to-handle sections. A data sheet covering the company's entire line is available on request.

"DETECTO" PROBE

Kapner Hardware, Inc., 2248 Second Ave., New York 29, N. Y. is offering an inexpensive testing tool which permits instant tracing of high-voltage TV troubles.

The "Detecto" probe is equipped with a built-in lamp which lights when



high voltage is present. It will check operation of the horizontal amplifier and high voltage transformer by indicating the presence or absence of high voltages. Complete instructions are included with each probe.

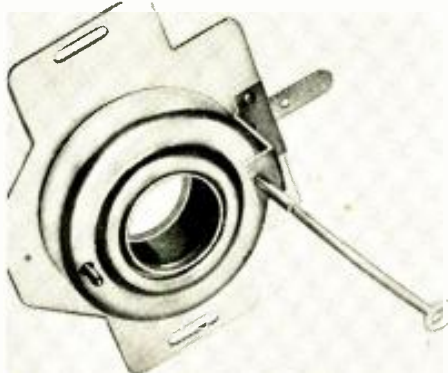
U.H.F.-V.H.F. ANTENNA

Channel Master Corp., Ellenville, N. Y. is featuring an all-v.h.f.-u.h.f. antenna, the "Ultra Fan, Model 413."

The u.h.f. section features "free-space" terminals, two stamped holes to minimize wind resistance, and single transmission line operation. The v.h.f. and u.h.f. bands are electronically isolated by a 2-stage filter which automatically eliminates all interaction. No switching is necessary in tuning from one band to the other.

FOCUS COIL

Heppner Manufacturing Company of Round Lake, Illinois, has redesigned its "P.M. Focomag" unit to fit 21" and 27" magnetically focused tubes



as well as small sized picture tubes. The efficiency of the ring magnet is said to be such that only 4 ounces of Alnico are required. Another new fea-

BIG PROFITS:
Repair
CRTs
this
Easy Way

EVERY SERVICE SHOP CAN MAKE BIG MONEY with these PATENTED INSTRUMENTS for

1. TESTING picture tubes accurately.
2. REACTIVATING dim or worn out tubes.
3. SPARKING OUT electrical leakage.

CRT TESTER—REACTIVATOR—SPARKER

3 Instruments in 1, making a complete CRT testing and repair unit . . . It's a combination of the Transvision Tester-Reactivator and a Sparker in one handy unit. It TESTS picture tubes—measures Cathode emission, locates shorts between elements, locates high resistance shorts or leakage as high as 3 meg-ohms. REACTIVATES dim tubes. SPARKS OUT electrical leakage.



\$34.95 net

CRT TESTER—REACTIVATOR

2 Instruments in 1 . . . As a REACTIVATOR it renews brightness and detail of dim CR Tubes, without removal of tube from set. It's also an accurate TESTER same as the above. 110V-60 cycles; wt. 3 lbs.

only \$19.95 net



CRT TESTER—SPARKER

2 Instruments in 1 . . . As a SPARKER, it sparks out electrical leakage between

elements. Saves many picture tubes and small tubes which would usually be discarded. Cathode-grid leakage is an especially common occurrence. The Sparker also gives a rapid check of gas condition of the tube.

As a TESTER it provides a variable 8,000-14,000 V D.C. supply—useful for analyzing hard-to-solve deflection problems . . . \$25.95 net



Order direct from factory:

TRANSVISION INC., NEW ROCHELLE, N. Y.

FREE: Sample copy of "TV and Electronics Notes". Or send 50c for year's subscription.

10 DAY TRIAL: Buy and try these fine instruments for 10 DAYS. Then, if you wish, you may return them. Your purchase price less 10% (our cost of handling and re-packaging) will be promptly refunded.



DEPT. RN-23R NEW ROCHELLE, N. Y.

() Send me _____

() Enclosed find \$_____ deposit. Balance C.O.D.

() Enclosed find \$_____ in full. Send prepaid.

I accept your 10 Day Trial terms.

Name _____

Address _____

City _____ State _____

L. A. HAM SHACK SELLS FOR LESS



METERS—WESTON • SANGAMO
ALL NEW • ALL D. C. • 2" SQUARE
 0-5 Ma \$3.29
 0-15 Ma } EACH
 0-50 Ma } 3 for
 0-100 Ma } \$9.00
 0-200 Ma }
 0-300 Ma }
 0-500 Ma }
0-2 Ma \$3.95
Mfg's inquiries: lots over 100

Voltmeter, 2" sq.—0 to 20 Volts.....\$3.29
 DC Voltmeter, 2" sq.—0 to 300 Volts w/Ext. resistance. Complete \$3.95.....3 for \$9.95
 RF Ampmeter, 2" sq.—0 to .5 Amp.....\$3.95
 Ampmeter, 2" rd.—0 to 50 Amps.....\$3.29
 Ampmeter, 2" sq.—0 to 50 Amps.....\$3.29

3" Round Meters, DC, All New, 0-15, 0-30, 0-300 Mills. \$4.95 Each.....3 for \$11.95
 Milliampmeters, 2 1/2" rd. 0-30 Mills. Each \$3.95
 Milliampmeters, 2" rd. 0-50 Ma. 0 to 5 Ma. movement. Each \$3.29.....3 for \$9.00
 Thermocouple, 2" rd. 350 Milliamp. HF.....\$3.29



"S" METER. Illuminated face. Full scale reading of 5 ma. A standard value for most "S" Meter Circuits. 2 3/8" Black face. New \$2.49
 Amp Meter, No. 60-0-60. New \$1.29

COMMAND AND/OR ARCS TRANSMITTERS and RECEIVERS
 3-6 MC Receiver.....Used \$6.95—New \$17.95
 6-9-1 Receiver.....Used 7.95—New 12.95
 Triple Receiver Rock.....1.95
 V.H.F. ARC5 Transmitter or Receiver.....Used 24.95
 Complete w/tubes.....New

4-5.3 MC Transmitter with tubes \$ 8.95
 5.3-7 MC Transmitter with tubes 6.95
 7-9.1 MC Transmitter with tubes 9.95 \$19.95
 3-4 MC Transmitter with tubes 18.95
 28V Receiver Command Dynamos.....1.95

Cash with order. Prices subject to change without notice. California orders please include 3 1/2% Sales Tax. Please include approximate postage—Excess will be refunded. What Have You Surplus? Submit

MODULATORS Used New
 BC-456 with Tubes, less dyn.... 2.95
 MD-7 Modulator Dynamotor, 28V 3.95
 BC-433 Receiver—with tubes.... 24.95
 MN-26C Compass Receiver.... 24.95 \$39.50
 MN-26Y Compass Receiver.... 24.95 39.50
 BC-357 Marker Beacon Rec. W.O. Tube 5.95

CIVIL AIR DEFENSE or 2 METERS
 522 Trans.-Receiver. W./tubes. Good, used 69.50
 Modulation Transformer. BC-375. New 2.49
 BC-306 Antenna Loading.....New 1.95
 FL8 Filters—A's, B's, C's.....New 1.95
 FL5 Filters.....New .95
 Hand Keys—J-38.....New 1.19
 Heineman Circuit 115 V., 20 amp. 1.39
 Breakers 115 V., 5 amp. .97

TRANSFORMERS
 12V 24V 20m 110V primary.....\$2.95
 Code Tapes for TG-10 15 rolls. New.....7.95

DYNAMOTORS
 PE-101C.....New \$ 4.95
 PE-103 New Case.....29.95
 PE-73 29V @ 20 amps. output 1000V @ .350 amps.....New 9.95
 PE-77 14V @ 40 amps output 1000V @ .350 amps.....New 24.95
 RL-428 Antenna Reel Ass. Less wire.....New 9.95

OIL CONDENSERS Standard Makes—New
 2 mfd 600V \$0.49
 4 mfd 600V 1.39
 1 mfd 1000V .69
 3 mfd 4000V 7.95
 .5 mfd 2500V 1.49
 10 mfd 600V 2.95
 2 mfd 2500V 3.95
 2 mfd 5000V \$8.95 2 mfd 7500V 29.59

HEAD SETS
 HS-30.....New \$1.95
 HS-23.....Used \$2.95
 Matching Transformer for HS-30 .69
 MIKE CHEST SET "F-1" button.....New 2.95

1306 BOND STREET, at PICO LOS ANGELES 15, CALIFORNIA

L. A. HAM SHACK

CODE SENDING RECEIVING SPEED

HIGH SPEED WITHOUT NERVOUS TENSION

REVEALING BOOK shows how "crack" operators develop high speed and proficiency. Learn code for Amateur or Commercial Radiotelegraph License, or improve your sending and receiving.

with the Candler System which develops radio-telegraph experts and code champions.

CANDLER SYSTEM FREE BOOK

Box 928, Dept. 2-B, Denver, Colo.

BENDIX 4-CHANNEL E.C.O.

Channel 1 1050-1700 KC Channel 2 2000-3400 KC Channel 3 3000-4800 KC Channel 4 4370-7000 KC

Unit is front end of TA-12B transmitter by adding an 807 driver and a pair of 807's for a final you have a 50 watt trans. each osc. section is completely shielded and mounted on an aluminum chassis with var. cond. shafts extended ready to odd voltage. GOVT. COST OVER \$150.00 NEW WHILE THEY LAST For That New Ham Band 3700 KC. \$5.95

3834 Germantown Ave. Phila., Penna. RA 5-6033

McCONNELL'S

ture is a specially designed, break-proof flexible nylon adjusting shaft which replaces the rigid shafts formerly employed. The flexibility of the new shafts eliminates accidental breakage during installation.

A built-in picture positioning lever is used to center the picture. Mounting arrangements are according to the user's specifications. Contact the company for full information on the new "Focomag."

TUNING SLUG RETRIEVER
 R. N. Hunter Sales Co., 3499 East 14th Street, Los Angeles 23, California, is now marketing a new tool which has been designed to retrieve



the tuning slugs in standard coil tuning units, such as those used in RCA, Admiral, Hoffman, and many other television receivers.

The slug-retrieving screwdriver incorporates a unique non-magnetized holding mechanism which enables the technician to retrieve the slug without removing the chassis.

The method employed is simple. The specially-designed blade of the retriever is slipped into the tuning unit opening until it engages the slot on the head of the slug. When contact is made, a forward pressure on the handle of the tool firmly seats the patented locking pin and the slug is then withdrawn and placed in its proper tuning position.

CONDENSER-RESISTOR TESTER
 Sprague Products Company, 51 Marshall St., North Adams, Mass. has developed a condenser-resistor analyzer to help speed TV servicing.

The Model TO-4 "Tel-Ohmike" has push-button range selection, extended capacitance ranges from 1 μfd. to 20,000 μfd., direct reading of insulation resistance to 20,000 megohms, direct leakage current reading of electrolytics at rated d.c. working voltage, and a three-range power factor measurement of electrolytics. All condensers are automatically discharged for safety after test by releasing the push-buttons.

Resistance measurement range of the unit is from 2 1/2 ohms to 25 megohms at line frequency. A 16-page technical instruction manual accompanies each instrument. A descriptive

PAY LESS FOR TUBES

INDIVIDUALLY BOXED • FULLY TESTED • EACH TUBE GUARANTEED FOR SIX MONTHS

Type	Price	Type	Price	Type	Price	Type	Price
1B3GT	\$.69	6AT6	\$.38	6K6GT	\$.41	12AZ7	\$.70
1H5GT	.46	6AU6	.43	6L6G	.80	12BA6	.45
1L4	.57	6AV6	.38	6L6GA	.80	12BE6	.47
1L6	.58	6BA6	.96	6S4	.46	12BH7	.63
1NSGT	.57	6BA6	.45	6SA7GT	.52	12BZ7	.75
1R5	.56	6BA7	.60	6S7GT	.47	12SA7GT	.52
1S5	.47	6BC5	.53	6SK7GT	.50	12SK7GT	.50
1T4	.56	6BD5GT	.89	6SL7GT	.62	12SL7GT	.61
1T5GT	.71	6BE6	.47	6SN7GT	.54	12SN7GT	.54
1X2	.67	6BF5	.60	6SQ7GT	.42	12SQ7GT	.44
3Q5GT	.65	6BG6	1.34	6T8	.78	19BG6	1.39
35A	.55	6BH6	.57	6U8	.85	19C8	.94
3V4	.56	6BG6	.48	6V6GT	.46	19T8	.79
5U4G	.43	6BK7	.85	6W4GT	.45	25B06	.89
5V4G	.73	6BL7	.83	6W6GT	.57	25L6GT	.48
5Y3G	.34	6B06	.89	6X4	.34	25Z6GT	.42
5Y3GT	.30	6B07	.85	6XSCT	.33	35A5	.48
6AB4	.46	6B27	.95	6Y6G	.59	35B5	.47
6AG5	.54	6C4	.34	7N7	.52	35C5	.47
6AK5	.95	6CB6	.53	12AT6	.38	35L6GT	.47
6AK6	.63	6CD6	1.85	12AT7	.68	35W4	.31
6AL5	.40	6F6GT	.45	12AU6	.43	35Z5GT	.30
6AQ5	.46	6F8C	.93	12AU7	.53	50B5	.47
6AQ6	.42	6HG6T	.49	12AV6	.38	50C5	.47
6ARS	.38	6J5GT	.40	12AV7	.80	50L6	.47
6AS5	.50	6J6	.62	12AX7	.61	117Z3	.39
						117Z6	.68

Motorola Ballast Tube #17A485459.....30

Each tube is performance-proven. 25% deposit must accompany all orders. Balance C.O.D. All Prices F.O.B., N.Y.C. If remittance is made with order, you can deduct 2%. \$1.00 handling charge for orders under \$10.00. Subject to Prior Sale.

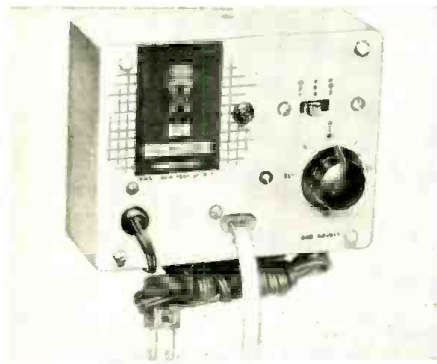
PHILLIPS TUBE COMPANY 2610 E. 16th Street Brooklyn 35, N. Y.

bulletin, M-499, is available on request.

BAR GENERATOR

RMS, 2016 Bronxdale Ave., New York 60, N. Y. is making a low-cost portable bar generator, the Model BAR-1.

The unit transmits a modulated carrier on Channels 4, 5 or 6 as predetermined by the technician, producing both vertical and horizontal bars on the screen. A control is provided for adjusting the number of bars on the screen. The instrument is moderately priced.



mined by the technician, producing both vertical and horizontal bars on the screen. A control is provided for adjusting the number of bars on the screen. The instrument is moderately priced.

PHOTO CREDITS

Page	Credit
35, 37, 40, 132	Raytheon Manufacturing Company
41, 147	Radio Corporation of America
42, 58 (Figs. 8 & 9)	LaPointe-Plascomold Corp.
43, 45	Acro Products Company
46	Blonder-Tongue Laboratories
50, 51 (bottom)	Standard Coil Products Co.
56 (Fig. 1), 57 (Fig. 5)	JFD Manufacturing Co.
56 (Figs. 2 & 3), 57 (Fig. 4)	Ward Products Company
57 (Fig. 6)	RMS
58 (Fig. 10)	Technical Appliance Corporation
65	Radio Korea
110	Allied Radio Corporation
136	Province of Quebec
140	Station KPTV, Portland

ERRATA

When using the RADIO & TELEVISION NEWS Preamplifier (November, 1952, issue) with an Audak pickup, change resistor R₁ (Fig. 3) from 22,000 ohms to 100,000 ohms. For optimum results the Audak requires a load of 47,000 ohms. R₁ in parallel with R₂ will provide 50,000 ohms which is satisfactory.

In the article "A Novel Capacitance Relay" appearing in the December, 1952, issue, the circuit diagram shows "117 volts a.c. or d.c.". The unit will not operate on d.c. and this statement should read "117 volts a.c."

In "Spot Radio News," December issue, a misstatement occurred. Station KPTV in Portland was the first u.h.f. television station in the country and in the northwest but station KING-TV, Seattle, was actually the first TV station in the Pacific Northwest. Our apologies to KING-TV for this slip-up.

In the article "A Low-Cost Audio Oscillator" appearing in the January, 1953, issue, the values of condensers C₁-C₃ (Fig. 3) are not clearly indicated. They should be as follows: C₁, C₂—1.2 μfd. (20-200 cps); C₃, C₄—12 μfd. (200-2000 cps); C₅, C₆—.012 μfd. (2000-20,000 cps); C₇, C₈—0.012 μfd. (20-200 kc.).

FREE Equipto CATALOG!
Especially Designed for the ELECTRONICS Industry

BENCHES **DRAWER UNITS**
CHASSIS STANDS **TEST STANDS**
SALES COUNTERS **STORAGE BINS**
SHELVING **WARM UP RACKS**
SERVICE COUNTERS **TRUCKS**

Equipto ELECTRONIC INDUSTRIES' TECHNICAL REQUIREMENTS

Steel is Finished in Polymerized Shock-Proof Insulating Enamel.

Equipto's especially designed Electronics Equipment is used by thousands of the country's largest radio, television and electrical service shops and stores. Combining strongest possible construction with moderate prices, even the small budget shop can take full advantage of Equipto's complete line of storage and work shop equipment.

Merchandise displayed on Equipto's well-styled units always boosts sales. These units give better than **ONE-THIRD** more display and storage space for items now occupying the same area.

Have you a storage or display problem?
We'll be glad to help you.

40TH YEAR *Equipto* Division of Aurora Equipment Co. 800 Prairie, Aurora, Illinois Phone: Aurora 9231

WRITE FOR FREE CATALOG

NEED TUBES?

Make Barry your source for FAST-DELIVERY on all types. We carry all the standard brands. All tubes individually cartoned and carry Standard RMA Guarantee.

Tube Orders Over \$8.00 with full remittance Prepaid To You in U.S.A.

Prior to shipment, all tubes INDIVIDUALLY retested (not just spot-checked) on our Hickok Mutual-Conductance Tube-Testers to insure you the perfect merchandise. For your maximum money's worth, buy in full confidence from TUBE-SPECIALISTS. Here is only a partial listing of our large stocks. You may order types not listed at approx. same savings.

0A2	.98 6F6-M	.69 274-A	2.95
0B2	1.10 6F8-G	.89 274-B	2.95
0C3/VR105	1.19 6G6-G	.95 275-a(WE)	3.00
0D3/VR105	.95 6J4	6.75 276F & G	15.00
0Z4	.59 6J5	.49 304-TH	7.00
1A7GT	.89 6J6	.59 304-TL	8.75
1AE4	.90 6J7	.75 310A (WE)	5.95
1B3GT	.85 6K6GT	.59 311A (WE)	6.50
1B22	2.00 6K7-M	.70 328-A (WE)	5.00
1B23	8.00 6L5-G	.49 337A (WE)	3.04
1B27	14.98 6L6-G	1.19 349A (WE)	1.35
1L4	.60 6L7	.98 350-B (WE)	3.95
1L21 (GE)	4.00 6N7-M	.95 359-A (WE)	4.00
1LA6	.90 6Q7GT	.80 371-B	.85
1N21-B	2.95 6S7-M	.98 373-A (WE)	4.00
1N23-A	2.25 6S07	.79 374-A (WE)	3.50
1N23-B	3.49 6S67	.88 387-A (WE)	2.50
1N34	.64 6S87	.64 400-A (WE)	2.50
1N34-A	.75 6S9	.69 401-B (WE)	3.50
1N44/400B	1.21 6SK7GT	.62 403-B (WE)	2.50
1N45/400C	1.39 6SL7GT	.60 407-A (WE)	5.00
1N48	.55 6SN7GT	.70 408-A (WE)	2.75
1N54	.89 6U3-GT	.65 421-A (WE)	3.50
2B7	.75 6V6GT	.60 GL-559	1.00
2C43(GE)	15.95 6X5GT	.52 KU-676	25.00
2C52	5.50 7A6	.65 710-C	20.00
2D21	1.37 7A8	.72 717-A	.98
2E24	2.72 7C6	.80 803	3.25
2E30	2.19 7C30	85.00 805	2.50
2J22	6.50 7F7	.74 807	1.59
2J34	27.25 7H7	.80 811	2.75
2J48	24.25 12A6	.65 811-A	3.50
2I49	3.40 12A7	.75 817	2.75
3A4	.59 12AU7	.69 812-A	3.50
3AP1	9.00 12AV6	.55 816	1.07
3B28	7.50 12AX7	.99 832-A	8.50
3B29	12.00 12BA6	.69 837	1.45
3BP1	5.75 12BA7	.90 860	3.95
3BP11	9.50 12BD6	1.25 861	22.50
3C22	85.00 12BE6	4.866-A	1.35
3C23 (GE)	10.50 12C8	.79 872-A (GE)	3.50
3C27	7.50 12M6	.75 1280	.80
3C33	9.95 12SA7	.75 1613	.75
3D6/1299	.50 12SF5	.70 1614	2.25
3Q5GT/G	.99 12SG7	.87 1616	.74
3S4	.80 12SW7	.95 1622 (6L6M)	1.95
4C35	26.50 12S17	.69 1625	.40
4X-150A	33.50 12SK7	.75 1629	3.00
5F7P	1.95 12SL7	.75 1631	1.50
5R4GY	1.29 12SN7GT	.84 1632	.70
5U4G	.55 12SR7-M	.75 2050	1.48
5X4G	.85 14F7	.80 2051	1.19
5Y3GT	.45 25AV5	1.25 5514	4.50
6AB7	.98 25B06GT	.79 5516	6.95
6AC7	.94 25L6GT	.64 5528 C6L	15.00
6AG5	.65 25Z6	.67 5608-A	3.95
6AG7	1.25 35B5	.40 5654	2.00
6AH6	1.00 35C5	.69 CK-5702	3.25
6AJ5	1.75 35L6	.49 CK-5744	2.25
6AK5	.79 35Z6GT	.65 CK-5886	3.00
6AN5	2.25 42	.50 5814	4.50
6AU6	.65 50C5	.55 5910	.75
6AV6	.65 50L6GT	.55 5912	.98
6B8	.85 117Z6	1.00 8020	.35
6BD6	.86 FG-105	19.50 9004	.85
6BE6	.45 F-123-A	.69 9002	.85
6C4	.45 211	.75 9004	.39
6CB6	.45 250-TH	18.75 9006	.39

SELENIUM RECTIFIERS FULL-WAVE BRIDGE TYPES

Current (Continuous)	18/14 Volts	36/28 Volts	54/42 Volts	130/100 Volts
1 Amp.	\$1.35	\$2.15	\$3.70	\$7.50
2 Amps.	2.20	3.60	5.40	10.50
2 1/2 Amps.			8.00	13.00
4 Amps.	3.75	6.75	10.25	
5 Amps.	4.25	7.95	12.95	25.25
6 Amps.	4.75	9.00	13.50	33.00
10 Amps.	6.75	12.75	20.00	40.00
12 Amps.	8.50	16.25	25.50	45.00
20 Amps.	13.25	25.50	39.00	79.50
24 Amps.	16.25	32.50	45.00	90.00
30 Amps.	20.00	38.50		
36 Amps.	25.00	48.50		

New Selenium Rectifier Transformers

- PRI: 115 V. 60 cycles in. } 4 Amps. \$ 8.75
- SEC: 9, 12, 18, 24, and 36 } 12 Amps. \$29.50
- SEC: 7000-7000 @ conservative 200 MA. 5"X6"X6 1/2"-NEW-WT. 15 lbs. Special @ \$17.50
- 115V. PRI.-36V. 50 amp second XFMR. \$39.95
- 115V. PRI. 5V. 190 Amp. SEC. \$59.95
- 115 230V. 60 cy. PRI. SEC.: 1.5, 30.5, 33.5, and 36.5V. @ 4 AMPS. Herm. sealed. \$6.50
- New Selenium Rectifier Chokes
- 4 Amps.-.07 hy.-6 ohm. \$19.95
- 12 Amps.-.01 hy.-1 ohm. \$14.95
- 24 Amps.-.004 hy.-.025 ohm. \$29.95

We can manufacture other Selenium Rectifiers, Selenium Rectifier Supplies, XFMRs., & Chokes.

- Biiley-Type SMC100-- Crystal Standards.
- New-100 KC and 1,000 KC BAR. \$8.50

SOLA HEAVY-DUTY PLATE TRANSFORMER.

- PRI: 200, 220, 240 volts-00 cy.
- SEC: 7000-7000 @ conservative 200 MA. 5"X6"X6 1/2"-NEW-WT. 15 lbs. Special @ \$17.50
- CARTER DYNAMOTORS 6 V DC Input-500 VDC Output @ 150 MA. Only 7" X 4" X 3". In Orig. Mfr's Cartons. Only \$28.00
- AR-11-SUPERHET PCVR. & 50 WATT XMTR w/built-in 110 vac pwr. supply. Unit 12"X9"X5" for 20, 40, & 80 meters. Brand New. \$99.50



136 Liberty Street, N. Y. 6, N. Y. REctor 2-2562. Terms: 25% with order, balance C.O.D. - Send a few cents for postage - All merchandise guaranteed. F.O.B. N.Y.C. Remember, you may order tubes not listed!

INDEX OF Advertisers

FEB. 1953

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

ADVERTISER	PAGE	ADVERTISER	PAGE
Aern Electronics Corporation	106	Mattison Television Company	128
Acro Products Company	151	Michel Mfg. Company	138
Adams Electronics	126	Miles Reproducer Company	128
Airex Radio Corporation	133	Milwaukee School of Engineering	108
Allied Radio Corporation	9	Mosley Electronics	135
Alproden Inc.	111	Moss Electronics	87
Alice Lansing Corporation	148	National Electric Products	92, 93
American Phenolic Corporation	22	National Electronics of Cleveland	116
American Television & Radio Company	82	National Radio Institute	83, 81
Arco Electronics, Inc.	140	National Schools	13
Argos Products Company, Inc.	140	Nation Wide Radio	151
Arkay Radio Kits, Inc.	137	Newark Electric Company	150
Arrow Sales, Inc.	119	Newark Surplus Materials	141
Ash Radio Company, Walter	4.00	Newcomb Audio Products Company	18
Audel & Company, Theo.	136	Offenbach & Reims Company	159
Barr Electronics	162	Ohmite Mfg. Company	26
Bell Telephone Company	32	Olson Radio Warehouse	88, 89
Belden Mfg. Company	99	Olympic Electronics Supply	131
Brocner Electronics Laboratory	120	Onan & Sons, D. W.	152
Brock Electronics, Inc.	114	Peak Electronics	146
Burstein-Applebee Company	113	Penn Tube Company	98
C & H Sales Company	112	Perma Power	131
Candler System Company	160	Pfanstiel Chemical Company	144
Capital Radio Engineering Institute	27	Phillips Tube Company	160
Centralab, Inc.	3	Photocon Sales	151
Channel Master Corporation	101	Pickering & Company	121
Cleveland Institute of Radio Electronics	91	Plant Electronics	121
Collins Audio Products	31	Polys-Tech Company	130
Columbia Electronic Sales	122	Posner Electronics	112
Communication Equipment Company	90	Premax Products Company	142
Concord Radio Corporation	122	Premier Radio Tube Company	95
Coyne Electrical School	163	Progressive Electronics Company	139
Davis Electronics	128	Pyramid Electric Company	34
DeForest's Training	5	Quietrole Company	124
Eastern Telephone Company	122	RCA Institutes	69, 137
Editors & Engineers	150	R W Electronics	129
Electro Devices	131	Rulecon Engineering Company	155
Electronics Institute	138	Radiart Corporation	12
Electronic Instrument Company - 3rd cover		Radio City Products, Inc.	85
Electronic Specialty Supply Co.	156	Radio Corporation of America	2nd cover
Electro-Voice	8	Radio Craftsmen, Inc.	145
Equipto	161	Radio Electric Service Company	110
Fair Radio Sales	147	Radio Shack of Boston	113
Federated Purchaser, Inc.	157	Radio-Television Training Ass'n	25
Feiler Engineering Company	116	Rad-Tel Tube Company	151
Fisher Radio	144	Rahund Corporation	20
Franklin Technical Institute	136	Rathcon Mfg. Company	19
Frenchy Radio Mfg. Company	151	Regency	126, 151
Fretco Television Company	155	Rinchart Books	102, 103
G. L. Electronics	136	Rose Company, The	100
Garrard Sales Corporation	130	Rytel Company	123
General Cement Manufacturing	21, 28	Sams & Company, Howard W.	70, 112, 118
General Electric Company	145	Sanett, Bob	113
General Test Equipment	141	Sangamo Electric Company	135
Good Inc., Dun	141	Schott Company, Walter L.	105
Goodheart, R. E.	141	Semler Associated Industries	133
Greenlee Tool Company	116	Service Instruments Company	120
Green Tele Radio, Inc.	156	South River Metal Products Company	114
Halliercrafters Company	7	St-Air-55 of California	163
Harjo Sales	121	Sprague Products Company	17
Harrison Radio	91	Sprayberry Academy of Radio	15
Harvey Radio Company	132	Stan Burn Radio & Electronics	126
Heath Company	71 thru 81	Standard Transformer	137
Henry Radio Stores	120	Star Electronics Distr. Inc.	150
Henshaw Radio Supply	143	Steve-El Electronics Corporation	153
Hickok Electrical Instrument Company	141	Stevens Wadden, Inc.	24
Hughes Research Labs.	143	Super Instrument	138
Hulton Radio & Electronics Company	23	Supreme Publications	131
Indiana Technical College	149	Sylvania Electric Products	29
Instructograph Company	125	TAB	161
JFD Mfg. Company	11	Tech-Master Products Company	163
J. S. H. Sales Company	131	Technical Appliance Corporation	161
Jerrold Electronics	108	Tele-Marine Corporation	117
Jersey Specialty Company	130	Television Communications Institute	100
K & L Radio Parts Company	147	Telex, Inc.	149
Kester Solder Company	153	Teraco Company	106
Kirk, Jim	136	Transvision, Inc.	158, 159
Krylon, Inc.	156	Trio Mfg. Company	30
L A Ham Shack	160	Tri-State College	115
LaPointe Plastics Mold Corporation	33	Triplet Electrical Instrument Company	10
Lee Electronic Labs., Inc.	131	Tung-Sol Electrical Company	101
Leeds Radio Company	142	Turner Company	141
Leotone Radio Company	152	United Catalogue Publishers, Inc.	127
Luther, Otto	156	United Technical Laboratories	143
McCormell's	137, 145, 151, 160	University Loudspeakers, Inc.	157
McGee Radio Company	96, 97	V & H Radio & Electronics	149
McGohun, Don	146	Valparaiso Technical Institute	141
McGrath Hill Book Company	142	Van Sickle Radio Supply Company	125
MacInnes, Norman R.	129	Weathers Industries	107
MacMillen Company	152	Western Electronics	128
Mallory, P. R.	11th cover	Western Radio & Television Institute	114
		Westinghouse Electric Corporation	14
		Wholesale Radio Parts	125
		World Radio Laboratories, Inc.	127

Classified

Rate 50c per word. Minimum 10 words

RADIO ENGINEERING

COMPLETE radio, electronics theory & practice; television; broadcasting; servicing; aviation, marine, police radio. 12 or 18 months. Catalog. Valparaiso Technical Institute, Dept. N, Valparaiso, Ind.

SALE

TAPE Recorders, Tapes, Accessories. Unusual Values. Dressner, 621-R East 20th St., N.Y.C. 9.

ALL types of Antennas for Amateur and TV. Aluminum Tubing. Willard Radcliff, Postoria, Ohio.

DIAGRAMS Radio, Record Changers, Recorders, 75c; Television with Service Data, \$1.25 up. State manufacturer and model number. Kramer's Radio Service, Dept. F53, 36 Columbus Ave., New York 23, N. Y.

BROWNING (R J-14) AM-FM Tuner. Excellent Condition: only \$65.00. B. K. Balch, 514 Jefferson Ave., Rahway, N. J.

TV-FM antennas. All types including UHF. Mounts, accessories. Lowest prices. Wholesale Supply Co., Dept. H, Lunenburg, Mass.

TUBES and equipment bought, sold, and exchanged. For action and a fair deal, write B. N. Gensler, W2LNI, 136 Liberty, N. Y. 6, N. Y.

FOR low cost DX Television, reconditioned receivers, 10", \$50; 12", \$60, up. Spltz, 1120 South Randolph, Arlington, Virginia.

FOR Sale: Tubes at 70% off list. Write for listing. Williams Electronics Co., 168 Washington St., New York 6, N. Y.

COLOR code chart. Every resistor and capacitor code ever used (total 17), 50c. No stamps. N. S. Brown Associates, 5522 Merrimac, Dallas, Texas.

WANTED

ELECTRONIC components and equipment needed, send details for offer. Bargain Literature, "Electronic Outlet," Box 72, Lawrence, Mass.

WANTED: Federal type 101B voice-frequency ringers Signal Corps type TA-3/FT. Box 529, % Radio & Television News, 185 N. Wabash Ave., Chicago 1, Ill.

WANTED: Western Electric gray-finished equipment cabinets for 19" panels. Heights of 2'6", 3'6", 7'0" and 7'6". Box 530, % Radio & Television News, 185 N. Wabash Ave., Chicago 1, Ill.

WANTED: Top prices paid. Navy Selsyns 1DG, 1F, 1CT, 5CT, 5D, 5DG, 5G, 6G, 7G, etc., and RC-31B, RC-221, AN/ART-13, AN/ARC-1, AN/ARC-3, RTA-1B, AN/APR-4. Electronic Research, 719 Arch St., Philadelphia.

WANTED: Variometer. Vario-coupler. Crystal Set or other equipment made in early 1920's by Columbian Radio Corporation of Chicago. Good price paid. Write J. W. Rubin, Allied Radio Corp., 833 W. Jackson Blvd., Chicago 7, Ill.

CORRESPONDENCE COURSE

ELECTRONIC Draftsmen—Many needed immediately by Defense Agencies and Contractors. Excellent pay. Pioneer Radio Engineer offers an original and exceptionally high class correspondence course to qualified ambitious young men and women. Details free. C. Roland Leutz, P. O. Box 368, Silver Spring, Maryland.

USED correspondence courses and educational books bought, sold, rented. Catalog free. Educational Exchange, Summerville, Ga.

MISCELLANEOUS

500 QSL Cards printed two colors, \$8. On U. S. Postals. \$15. Iannone, 2227 Camino del Reposo, La Jolla, Calif.

RUY Wholesale—25,000 items—Catalog 25c. Matthews, 1472-R5 Broadway, N. Y. C. 36.

Leading ENGINEERS and TECHNICIANS Recommend...

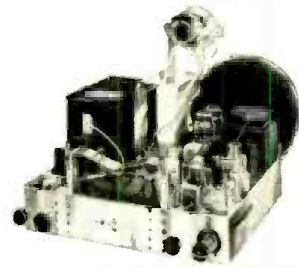
TECH-MASTER CUSTOM-BUILT TV CHASSIS

GOLD MEDAL SERIES Deluxe TV Chassis

World's Most Sensitive, Most Reliable TV Receiver—Truly custom-designed and custom-built to provide the ultimate in sight, sound, and value. Employs most advanced engineering methods, finest components, and most rigid alignment and test standards. Tech-Master improved 630-type chassis • Advanced Cascode Standard turret tuner, adaptable to UHF without tools • Full 4 Mc. bandwidth • Quick action keyed AGC circuit • New, Hi-sweep auto-transformer system • 5 microvolt sensitivity • For all picture tubes from 16" to 24".

MODEL 2430: with quality PM speaker, all tubes less picture tube, universal picture tube m't'g. brackets, phono-input jack. Equipped with audio take-off to feed sound thru external amplifier, if desired \$189.50

MODEL 2431P: Same as 2430, (less sound take-off), but with true fidelity Push-Pull Audio Amplifier \$199.95



Chassis plated, gleaming nickel finish... completely wired, aligned and tested, ready for installation.

BLUE RIBBON Custom-built TV Chassis



Tech-Master design features for high quality image and sound.

Retains the outstanding characteristics of the RCA-630 circuitry, namely the 4-stage, full bandwidth picture IF strip, and the 3-stage FM sound section • Latest innovations in synch and sweep circuits • Advanced Cascode turret tuner adaptable to UHF without tools • 5 microvolt sensitivity • Permanent magnetic focalizer • A.G.C. level control • 29 tubes (including 4 rectifiers). For all picture tubes from 16" to 24".

MODEL C-30: With quality PM speaker, and all tubes (less picture tube), completely wired, aligned and tested \$149.50

Sold by all leading Radio Parts Distributors.

Write for detailed literature



TECH-MASTER PRODUCTS CO. 443-445 BROADWAY, NEW YORK 13, N. Y.

FIELD TRANSMITTER SET



COMPLETE WITH KEY, HEADPHONES, CARRYING CASE & SHOULDER STRAP

\$795

Two for \$15.00

Here's the famous Fullerphone C.W. Field Telegraph Transmitter at a sensationally low price. Ideal for hams, scouts, rangers, etc. Removable from case for permanent station operation. Makes fine code practice unit; has extra jack for additional set of phones. Get two for complete point-to-point communication system. Wt. 20 lbs. Batteries not supplied.

FULLERPHONE TRANSMITTER, Each \$7.95
Two for \$15.00



HS-33 HEADPHONE SET
The lowest price ever on these fine, low impedance headsets. Brand new, complete with light weight, comfortable rubber ear pads, and PL-354 plug. HS-33 HEADPHONE SET \$4.49



T-17B TYPE HAND MIKE
You'll never get a chance to repeat this buy! Famous press-to-talk T-17B type hand microphone. New. Complete with 6 ft. cord and connector. HAND MIKE SPECIAL \$1.29

SP-AIR-ES, INC. OF CALIFORNIA
3108 Valhalla Drive Dept. R-2
Burbank, California

GET INTO ONE OF THESE GREATER OPPORTUNITY FIELDS

Electricity or Radio-Television

TRAIN IN THE GREAT SHOPS OF COYNE

OLDEST, BEST EQUIPPED SCHOOL OF ITS KIND IN U. S.

Come to the Great shops of Coyne in Chicago. Get practical training in TELEVISION—RADIO—ELECTRICITY—ELECTRONICS—vital in Defense Program. Prepare now for a better job in Industry or higher rating in Armed Forces.

Approved for Veterans—finance plan—enroll now, pay most of tuition later. Part time employment service while training if needed. Special tuition plan for men of Draft Age.

FREE BOOK Clip coupon for Big Free Illustrated Book. No obligation. No salesman will call. Act NOW.

B. W. Cooke, President
COYNE SCHOOL A TECHNICAL TRADE INSTITUTE CHARTERED NOT FOR PROFIT Established 1899 500 S. Paulina, Chicago

ELECTRICITY ★ TELEVISION
RADIO ★ REFRIGERATION ★ ELECTRONICS

B. W. COOKE, Pres.
COYNE School
500 S. Paulina St., Chicago 12, Ill. Dept. 23-85H

Send FREE BOOK and details on:

RADIO-TELEVISION ELECTRICITY

NAME

ADDRESS

CITY.....STATE.....

"HO" RAILPACK



0 to 12 VDC 2 Amp. Variable DC supply, unregulated, completely built-in 1.5V/600 mA. Rechargeable 1.5A supply. Element D.C. Plating, battery charging, model railroad, includes voltage or speed control and motor cut reverser. Ideal for two "HO" locomotives. **"TAB" SPECIAL... \$10.95; 2 for \$20.00**

SELENIUM RECTIFIERS

We specialize in Rectifiers and Power supplies to your immediate delivery!

Current	18/14	36/28	54/40	150/100
(Volts)	Volts	Volts	Volts	Volts
1AMP	1.35	2.70	4.05	12.15
2AMP	2.20	3.60	5.40	10.50
4AMP	3.75	7.95	10.25	25.25
5AMP	4.25	8.50	12.95	30.00
10AMP	8.50	17.25	25.50	45.00
12AMP	8.50	16.25	25.50	40.00
20AMP	13.25	25.50	39.00	79.50
24AMP	16.25	32.50	45.00	90.00
30AMP	20.00	38.50		
36AMP	25.00	48.50		

Full-Wave Silicon Rect. Trans. In Kit Form. All 115V/60 cy inputs up to 14VDC at 12 amps... \$18.98
up to 28VDC at 12 amps... 20.98
up to 28VDC at 48 amps... 117.00
up to 28VDC at 6 amps... 12.98

RECTIFIER XFMRs

18-8-12-20-24	21-4Vols	12 Amp	\$10.98	
31-32-34	36 Vols	12 Amp	2 Kvs	19.98
12-12-9-CT-9	12-18V	40mA	7.50	
18-12-9-CT-9	12-18V	12AMP	16.75	
36VCT-24V-18V	24-18V		35.75	
18V 2A 52.75	18V 2A		3.35	

RECTIFIER CHOKES

4AMP	.07 HY	.6 OHM	\$7.95
12AMP	.01 HY	.1 OHM	14.95
24AMP	.004 HY	.025 OHM	29.95

BATTERY CHARGER RECTIFIER

10-0-10V (CT) 120 Amp. fan cooled. Replace your old inefficient silicon diode with new selenium type. **SPECIAL... \$13.75**

RELAY SPECIALS

SPST Min. size, 115V, 30CY 3A CTS 98¢; 3 for \$2.75
SPDT Min. size, 115V 60cy 3A CTS \$1.39; 3 for \$3.75
SPDT 24VDC/5A CTS. 98¢; 6 for \$5.00
DIP-16 SPNO 12 V DC 100 Connects. **"TAB" SPECIAL... \$2.98; 4 for \$10.00**

INFRARED SNOOPSCOPE

Immerse-Converter Tube HiSensitivity simplified design 2" dia. Williams screen—Resistivity up to 450 Ohms—Recalling data & tube, etc. \$4.98; 2 for \$9.49
SNOOPSCOPE PWR SUPPLY
1800VDC 35MA. Using Double Cr. Transformer, Rectifiers, Sockets, Resistors, Capacitors and Diagram. \$6.98

TEST CORDS

Precision Feeler Gauge, 1/16" to 1/8" Ideal for Telephony & Relay Work
Removable Gauges—0.127, 0.187, 0.254, 0.317, 0.375, 0.438, 0.500, 0.562, 0.625, 0.687, 0.750, 0.812, 0.875, 0.937, 1.000, 1.062, 1.125, 1.187, 1.250, 1.312, 1.375, 1.437, 1.500, 1.562, 1.625, 1.687, 1.750, 1.812, 1.875, 1.937, 2.000, 2.062, 2.125, 2.187, 2.250, 2.312, 2.375, 2.437, 2.500, 2.562, 2.625, 2.687, 2.750, 2.812, 2.875, 2.937, 3.000, 3.062, 3.125, 3.187, 3.250, 3.312, 3.375, 3.437, 3.500, 3.562, 3.625, 3.687, 3.750, 3.812, 3.875, 3.937, 4.000, 4.062, 4.125, 4.187, 4.250, 4.312, 4.375, 4.437, 4.500, 4.562, 4.625, 4.687, 4.750, 4.812, 4.875, 4.937, 5.000, 5.062, 5.125, 5.187, 5.250, 5.312, 5.375, 5.437, 5.500, 5.562, 5.625, 5.687, 5.750, 5.812, 5.875, 5.937, 6.000, 6.062, 6.125, 6.187, 6.250, 6.312, 6.375, 6.437, 6.500, 6.562, 6.625, 6.687, 6.750, 6.812, 6.875, 6.937, 7.000, 7.062, 7.125, 7.187, 7.250, 7.312, 7.375, 7.437, 7.500, 7.562, 7.625, 7.687, 7.750, 7.812, 7.875, 7.937, 8.000, 8.062, 8.125, 8.187, 8.250, 8.312, 8.375, 8.437, 8.500, 8.562, 8.625, 8.687, 8.750, 8.812, 8.875, 8.937, 9.000, 9.062, 9.125, 9.187, 9.250, 9.312, 9.375, 9.437, 9.500, 9.562, 9.625, 9.687, 9.750, 9.812, 9.875, 9.937, 10.000, 10.062, 10.125, 10.187, 10.250, 10.312, 10.375, 10.437, 10.500, 10.562, 10.625, 10.687, 10.750, 10.812, 10.875, 10.937, 11.000, 11.062, 11.125, 11.187, 11.250, 11.312, 11.375, 11.437, 11.500, 11.562, 11.625, 11.687, 11.750, 11.812, 11.875, 11.937, 12.000, 12.062, 12.125, 12.187, 12.250, 12.312, 12.375, 12.437, 12.500, 12.562, 12.625, 12.687, 12.750, 12.812, 12.875, 12.937, 13.000, 13.062, 13.125, 13.187, 13.250, 13.312, 13.375, 13.437, 13.500, 13.562, 13.625, 13.687, 13.750, 13.812, 13.875, 13.937, 14.000, 14.062, 14.125, 14.187, 14.250, 14.312, 14.375, 14.437, 14.500, 14.562, 14.625, 14.687, 14.750, 14.812, 14.875, 14.937, 15.000, 15.062, 15.125, 15.187, 15.250, 15.312, 15.375, 15.437, 15.500, 15.562, 15.625, 15.687, 15.750, 15.812, 15.875, 15.937, 16.000, 16.062, 16.125, 16.187, 16.250, 16.312, 16.375, 16.437, 16.500, 16.562, 16.625, 16.687, 16.750, 16.812, 16.875, 16.937, 17.000, 17.062, 17.125, 17.187, 17.250, 17.312, 17.375, 17.437, 17.500, 17.562, 17.625, 17.687, 17.750, 17.812, 17.875, 17.937, 18.000, 18.062, 18.125, 18.187, 18.250, 18.312, 18.375, 18.437, 18.500, 18.562, 18.625, 18.687, 18.750, 18.812, 18.875, 18.937, 19.000, 19.062, 19.125, 19.187, 19.250, 19.312, 19.375, 19.437, 19.500, 19.562, 19.625, 19.687, 19.750, 19.812, 19.875, 19.937, 20.000, 20.062, 20.125, 20.187, 20.250, 20.312, 20.375, 20.437, 20.500, 20.562, 20.625, 20.687, 20.750, 20.812, 20.875, 20.937, 21.000, 21.062, 21.125, 21.187, 21.250, 21.312, 21.375, 21.437, 21.500, 21.562, 21.625, 21.687, 21.750, 21.812, 21.875, 21.937, 22.000, 22.062, 22.125, 22.187, 22.250, 22.312, 22.375, 22.437, 22.500, 22.562, 22.625, 22.687, 22.750, 22.812, 22.875, 22.937, 23.000, 23.062, 23.125, 23.187, 23.250, 23.312, 23.375, 23.437, 23.500, 23.562, 23.625, 23.687, 23.750, 23.812, 23.875, 23.937, 24.000, 24.062, 24.125, 24.187, 24.250, 24.312, 24.375, 24.437, 24.500, 24.562, 24.625, 24.687, 24.750, 24.812, 24.875, 24.937, 25.000, 25.062, 25.125, 25.187, 25.250, 25.312, 25.375, 25.437, 25.500, 25.562, 25.625, 25.687, 25.750, 25.812, 25.875, 25.937, 26.000, 26.062, 26.125, 26.187, 26.250, 26.312, 26.375, 26.437, 26.500, 26.562, 26.625, 26.687, 26.750, 26.812, 26.875, 26.937, 27.000, 27.062, 27.125, 27.187, 27.250, 27.312, 27.375, 27.437, 27.500, 27.562, 27.625, 27.687, 27.750, 27.812, 27.875, 27.937, 28.000, 28.062, 28.125, 28.187, 28.250, 28.312, 28.375, 28.437, 28.500, 28.562, 28.625, 28.687, 28.750, 28.812, 28.875, 28.937, 29.000, 29.062, 29.125, 29.187, 29.250, 29.312, 29.375, 29.437, 29.500, 29.562, 29.625, 29.687, 29.750, 29.812, 29.875, 29.937, 30.000, 30.062, 30.125, 30.187, 30.250, 30.312, 30.375, 30.437, 30.500, 30.562, 30.625, 30.687, 30.750, 30.812, 30.875, 30.937, 31.000, 31.062, 31.125, 31.187, 31.250, 31.312, 31.375, 31.437, 31.500, 31.562, 31.625, 31.687, 31.750, 31.812, 31.875, 31.937, 32.000, 32.062, 32.125, 32.187, 32.250, 32.312, 32.375, 32.437, 32.500, 32.562, 32.625, 32.687, 32.750, 32.812, 32.875, 32.937, 33.000, 33.062, 33.125, 33.187, 33.250, 33.312, 33.375, 33.437, 33.500, 33.562, 33.625, 33.687, 33.750, 33.812, 33.875, 33.937, 34.000, 34.062, 34.125, 34.187, 34.250, 34.312, 34.375, 34.437, 34.500, 34.562, 34.625, 34.687, 34.750, 34.812, 34.875, 34.937, 35.000, 35.062, 35.125, 35.187, 35.250, 35.312, 35.375, 35.437, 35.500, 35.562, 35.625, 35.687, 35.750, 35.812, 35.875, 35.937, 36.000, 36.062, 36.125, 36.187, 36.250, 36.312, 36.375, 36.437, 36.500, 36.562, 36.625, 36.687, 36.750, 36.812, 36.875, 36.937, 37.000, 37.062, 37.125, 37.187, 37.250, 37.312, 37.375, 37.437, 37.500, 37.562, 37.625, 37.687, 37.750, 37.812, 37.875, 37.937, 38.000, 38.062, 38.125, 38.187, 38.250, 38.312, 38.375, 38.437, 38.500, 38.562, 38.625, 38.687, 38.750, 38.812, 38.875, 38.937, 39.000, 39.062, 39.125, 39.187, 39.250, 39.312, 39.375, 39.437, 39.500, 39.562, 39.625, 39.687, 39.750, 39.812, 39.875, 39.937, 40.000, 40.062, 40.125, 40.187, 40.250, 40.312, 40.375, 40.437, 40.500, 40.562, 40.625, 40.687, 40.750, 40.812, 40.875, 40.937, 41.000, 41.062, 41.125, 41.187, 41.250, 41.312, 41.375, 41.437, 41.500, 41.562, 41.625, 41.687, 41.750, 41.812, 41.875, 41.937, 42.000, 42.062, 42.125, 42.187, 42.250, 42.312, 42.375, 42.437, 42.500, 42.562, 42.625, 42.687, 42.750, 42.812, 42.875, 42.937, 43.000, 43.062, 43.125, 43.187, 43.250, 43.312, 43.375, 43.437, 43.500, 43.562, 43.625, 43.687, 43.750, 43.812, 43.875, 43.937, 44.000, 44.062, 44.125, 44.187, 44.250, 44.312, 44.375, 44.437, 44.500, 44.562, 44.625, 44.687, 44.750, 44.812, 44.875, 44.937, 45.000, 45.062, 45.125, 45.187, 45.250, 45.312, 45.375, 45.437, 45.500, 45.562, 45.625, 45.687, 45.750, 45.812, 45.875, 45.937, 46.000, 46.062, 46.125, 46.187, 46.250, 46.312, 46.375, 46.437, 46.500, 46.562, 46.625, 46.687, 46.750, 46.812, 46.875, 46.937, 47.000, 47.062, 47.125, 47.187, 47.250, 47.312, 47.375, 47.437, 47.500, 47.562, 47.625, 47.687, 47.750, 47.812, 47.875, 47.937, 48.000, 48.062, 48.125, 48.187, 48.250, 48.312, 48.375, 48.437, 48.500, 48.562, 48.625, 48.687, 48.750, 48.812, 48.875, 48.937, 49.000, 49.062, 49.125, 49.187, 49.250, 49.312, 49.375, 49.437, 49.500, 49.562, 49.625, 49.687, 49.750, 49.812, 49.875, 49.937, 50.000, 50.062, 50.125, 50.187, 50.250, 50.312, 50.375, 50.437, 50.500, 50.562, 50.625, 50.687, 50.750, 50.812, 50.875, 50.937, 51.000, 51.062, 51.125, 51.187, 51.250, 51.312, 51.375, 51.437, 51.500, 51.562, 51.625, 51.687, 51.750, 51.812, 51.875, 51.937, 52.000, 52.062, 52.125, 52.187, 52.250, 52.312, 52.375, 52.437, 52.500, 52.562, 52.625, 52.687, 52.750, 52.812, 52.875, 52.937, 53.000, 53.062, 53.125, 53.187, 53.250, 53.312, 53.375, 53.437, 53.500, 53.562, 53.625, 53.687, 53.750, 53.812, 53.875, 53.937, 54.000, 54.062, 54.125, 54.187, 54.250, 54.312, 54.375, 54.437, 54.500, 54.562, 54.625, 54.687, 54.750, 54.812, 54.875, 54.937, 55.000, 55.062, 55.125, 55.187, 55.250, 55.312, 55.375, 55.437, 55.500, 55.562, 55.625, 55.687, 55.750, 55.812, 55.875, 55.937, 56.000, 56.062, 56.125, 56.187, 56.250, 56.312, 56.375, 56.437, 56.500, 56.562, 56.625, 56.687, 56.750, 56.812, 56.875, 56.937, 57.000, 57.062, 57.125, 57.187, 57.250, 57.312, 57.375, 57.437, 57.500, 57.562, 57.625, 57.687, 57.750, 57.812, 57.875, 57.937, 58.000, 58.062, 58.125, 58.187, 58.250, 58.312, 58.375, 58.437, 58.500, 58.562, 58.625, 58.687, 58.750, 58.812, 58.875, 58.937, 59.000, 59.062, 59.125, 59.187, 59.250, 59.312, 59.375, 59.437, 59.500, 59.562, 59.625, 59.687, 59.750, 59.812, 59.875, 59.937, 60.000, 60.062, 60.125, 60.187, 60.250, 60.312, 60.375, 60.437, 60.500, 60.562, 60.625, 60.687, 60.750, 60.812, 60.875, 60.937, 61.000, 61.062, 61.125, 61.187, 61.250, 61.312, 61.375, 61.437, 61.500, 61.562, 61.625, 61.687, 61.750, 61.812, 61.875, 61.937, 62.000, 62.062, 62.125, 62.187, 62.250, 62.312, 62.375, 62.437, 62.500, 62.562, 62.625, 62.687, 62.750, 62.812, 62.875, 62.937, 63.000, 63.062, 63.125, 63.187, 63.250, 63.312, 63.375, 63.437, 63.500, 63.562, 63.625, 63.687, 63.750, 63.812, 63.875, 63.937, 64.000, 64.062, 64.125, 64.187, 64.250, 64.312, 64.375, 64.437, 64.500, 64.562, 64.625, 64.687, 64.750, 64.812, 64.875, 64.937, 65.000, 65.062, 65.125, 65.187, 65.250, 65.312, 65.375, 65.437, 65.500, 65.562, 65.625, 65.687, 65.750, 65.812, 65.875, 65.937, 66.000, 66.062, 66.125, 66.187, 66.250, 66.312, 66.375, 66.437, 66.500, 66.562, 66.625, 66.687, 66.750, 66.812, 66.875, 66.937, 67.000, 67.062, 67.125, 67.187, 67.250, 67.312, 67.375, 67.437, 67.500, 67.562, 67.625, 67.687, 67.750, 67.812, 67.875, 67.937, 68.000, 68.062, 68.125, 68.187, 68.250, 68.312, 68.375, 68.437, 68.500, 68.562, 68.625, 68.687, 68.750, 68.812, 68.875, 68.937, 69.000, 69.062, 69.125, 69.187, 69.250, 69.312, 69.375, 69.437, 69.500, 69.562, 69.625, 69.687, 69.750, 69.812, 69.875, 69.937, 70.000, 70.062, 70.125, 70.187, 70.250, 70.312, 70.375, 70.437, 70.500, 70.562, 70.625, 70.687, 70.750, 70.812, 70.875, 70.937, 71.000, 71.062, 71.125, 71.187, 71.250, 71.312, 71.375, 71.437, 71.500, 71.562, 71.625, 71.687, 71.750, 71.812, 71.875, 71.937, 72.000, 72.062, 72.125, 72.187, 72.250, 72.312, 72.375, 72.437, 72.500, 72.562, 72.625, 72.687, 72.750, 72.812, 72.875, 72.937, 73.000, 73.062, 73.125, 73.187, 73.250, 73.312, 73.375, 73.437, 73.500, 73.562, 73.625, 73.687, 73.750, 73.812, 73.875, 73.937, 74.000, 74.062, 74.125, 74.187, 74.250, 74.312, 74.375, 74.437, 74.500, 74.562, 74.625, 74.687, 74.750, 74.812, 74.875, 74.937, 75.000, 75.062, 75.125, 75.187, 75.250, 75.312, 75.375, 75.437, 75.500, 75.562, 75.625, 75.687, 75.750, 75.812, 75.875, 75.937, 76.000, 76.062, 76.125, 76.187, 76.250, 76.312, 76.375, 76.437, 76.500, 76.562, 76.625, 76.687, 76.750, 76.812, 76.875, 76.937, 77.000, 77.062, 77.125, 77.187, 77.250, 77.312, 77.375, 77.437, 77.500, 77.562, 77.625, 77.687, 77.750, 77.812, 77.875, 77.937, 78.000, 78.062, 78.125, 78.187, 78.250, 78.312, 78.375, 78.437, 78.500, 78.562, 78.625, 78.687, 78.750, 78.812, 78.875, 78.937, 79.000, 79.062, 79.125, 79.187, 79.250, 79.312, 79.375, 79.437, 79.500, 79.562, 79.625, 79.687, 79.750, 79.812, 79.875, 79.937, 80.000, 80.062, 80.125, 80.187, 80.250, 80.312, 80.375, 80.437, 80.500, 80.562, 80.625, 80.687, 80.750, 80.812, 80.875, 80.937, 81.000, 81.062, 81.125, 81.187, 81.250, 81.312, 81



320K SIG. GEN. KIT \$19.95 WIRED \$29.95



145K SIG. TRACER KIT \$19.95 WIRED \$28.95



950K R-C BRIDGE & R-C-L COMP. KIT \$19.95 WIRED \$29.95



360K SWEEP GEN. KIT \$34.95 WIRED \$49.95



New 214K VTVM KIT \$34.95 WIRED \$54.95 7 1/2" METER



New 377K SINE & SQUARE WAVE AUDIO GEN. KIT \$31.95 WIRED \$49.95



1040K BATTERY ELIM. KIT \$25.95 WIRED \$34.95



OVER 1/4 MILLION

EICO INSTRUMENTS

in use the world over!



New 536K MULTIMETER KIT \$12.90 WIRED \$14.90 1,000Ω/v; 31 ranges

EICO new modern facilities for research, development and production—your greater assurance of . . .

LABORATORY PRECISION AT LOWEST COST



1171K RES. DECADE BOX KIT \$19.95 WIRED \$24.95



625K TUBE TESTER KIT \$34.95 WIRED \$49.95



CRA PIX TUBE ADAPTOR for Tube Tester \$4.50



New 365K MULTIMETER KIT \$24.95 WIRED \$29.95 20,000Ω/v; 31 ranges



315K DELUXE SIG. GEN. KIT \$39.95 WIRED \$59.95



HIGH VOLTAGE PROBE \$6.95



221K VTVM \$25.95 WIRED \$49.95



425K 5" PUSH-PULL SCOPE KIT \$44.95 WIRED \$79.95

NEW AUDIO GENERATOR

- Accuracy: $\pm 3\%$
 - Sine Wave Range: 20-200,000 cps in 4 bands
 - Square Wave Range: 60-30,000 cps
 - Freq. Response: ± 1.5 db, 60 cps-150 kc.
 - Output Voltage: 10 volts across 1000 ohms (rated load); 14 volts across 10,000 ohms; 8 volts across 500 ohms
 - Distortion: less than 1% at rated output (100 mw)
 - Hum: less than 0.4% of rated output
- Clear, three-dimensional drawings and simplified construction information. 15-page Instruction Book describes circuitry, applications and maintenance.



377K KIT \$31.95 WIRED \$49.95

You Build EICO Kits in One Evening, but . . . They last a Lifetime! and You SAVE OVER 50%

YOU be the judge. See the famous EICO line TODAY — in stock at your local jobber — and SAVE!

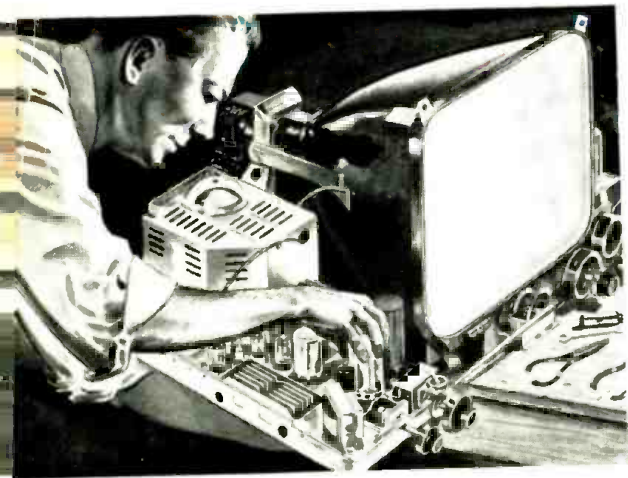
Write NOW for FREE newest Catalog 1-CA.

America's greatest instrument values bear the name—



ELECTRONIC INSTRUMENT CO., Inc., 84 Withers Street, Brooklyn 11, N. Y.

Depend on Mallory
for
Approved Precision Quality



There'll Be No Call-Back On This Job!

You can be sure there will be no time-wasting call-backs to cut down your profits when you use Mallory Capacitors. Mallory Capacitors are engineered to meet the electrical requirements of any TV or radio set. You can depend on them to give long-lasting performance that's equal to . . . and often better than . . . any original equipment component.



Rating-for-rating, Mallory FP Capacitors give longer life at higher temperatures and greater ripple currents. They'll give trouble-free performance at 185° F. (85° C.). They are the only fabricated plate capacitors on the replacement market.



For all plastic tubular replacements you can count on Mallory Plascaps® the same way you do on FP's. They eliminate problems of shorting, leakage, unsoldered leads and off-center cartridges.

Nothing will lose a customer faster than a set that won't stay repaired. That's why it is always good business to specify *brand* as well as rating when you order parts. And if you depend on Mallory you can put an end to call-backs, get precision quality, yet pay no more.

P. R. MALLORY & CO. Inc.
MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
RECTIFIERS • VIBRAPACK® POWER SUPPLIES • FILTERS
APPROVED PRECISION PRODUCTS

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

NEW LITERATURE

TRANSISTOR PROGRESS

The November, 1952, issue of the Proceedings of the Institute of Radio Engineers was completely devoted to the multitude of advances which have been made in transistor research and development. The 528-page journal, containing 51 individual articles, covered all phases of transistor progress. Many of the articles described new applications of transistors in amplifiers, oscillators, rectifiers, electronic computers, and switching circuits.

Copies of this transistor issue are available from the Institute of Radio Engineers, 1 East 79th Street, New York 21, N. Y., at \$3.00 each.

TV EQUIPMENT COMPLEMENTS

All equipment used in a television station is arranged into a few functional groups in the bulletin entitled "Television Equipment Complements for Station Planning" which has been published by the Television Transmitter Division of *Allen B. du Mont Laboratories, Inc.* 1500 Main Avenue, Clifton, N. J.

The detailed complement of each group is listed with prices and each complement is given a number for easy reference. A short description of the function of the complement is also in-

cluded in each case so that the station planner using this bulletin can select equipment for any size station, large or small, and arrive at the approximate total cost of his equipment.

TWO-WAY RADIO

Use of two-way radio for better coordination of men, materials and machines is discussed in an eight-page illustrated booklet published by the *General Electric Company*. Entitled "Instant Communication," the booklet is slanted to those who use materials handling and emergency service equipment, and others who have plant protection problems.

Also contained in this publication is a list of 27 *G-E* offices throughout the United States from which advisory service is now available on communication problems. Copies are free on request to the Advertising Inquiry Section, *General Electric Company*, Electronics Park, Syracuse, N. Y.

RADIOTELEPHONES

Eight radiotelephone models, two radio direction finder models, and various accessory units are described in a new eight-page catalog. Identified as Form 852, it is available from *Applied*

Electronics Company, Inc., 1236P Folsom Street, San Francisco, Calif.

Besides a description of the basic design features of these instruments, the catalog includes a full tabulation of models showing number and types of channels, frequency ranges, receiver sensitivities, transmitter power outputs ranging from 40 to 500 watts peak, tube complements, power requirements, dimensions, and weights.

ELECTRONIC INSTRUMENTATION

In a 32-page booklet, the *Berkeley Scientific Division of Beckman Instruments, Inc.*, 2200 Wright Avenue, Richmond, Calif., briefly describes electronic instruments which provide direct reading digital presentation of information together with their principal industrial applications. "Electronic Instrumentation" covers high-speed counting; counting plus control; precise interval timing; and measurement of rpm, pressure, temperature, flow, viscosity, velocity, frequency, distance, etc.

EMBEDDED SELENIUM RECTIFIERS

The Rectifier Division of *Sarkes Tarzian, Inc.*, located at 415 North College Avenue, Bloomington, Ind., announces publication of a new four-page folder dealing with embedded selenium rectifiers. Designated as Catalog B1, this folder gives detailed information on the various types of embedments made by *Sarkes Tarzian, Inc.* A copy will be mailed free upon request to the manufacturer.

"VIBRATRON"

Model 652 "Vibratron" is a portable instrument for vibration analysis and dynamic balancing. It can be used for balancing practically any rotating part, of any size, without removing the part from its installation, in the range from 500 to 40,000 rpm.

A four-page bulletin describing this device in detail is available from the *International Research and Development Corp.*, Columbus, Ohio.

THERMOPLASTICS

"Custom Extrusions in Thermoplastics" is a new service folder prepared by the *Anchor Plastics Company* which contains comprehensive information on the characteristics of thermoplastics. Forms and shapes of extruded plastics are discussed, and a general summary of how thermoplastics may be used by industry is given.

This folder may be obtained by writing to *Anchor Plastics Company*, 36-36 36th Street, Long Island City, N. Y.



4 CHANNEL { **CARRIER TELEPHONE TERMINALS** **CFD-B**

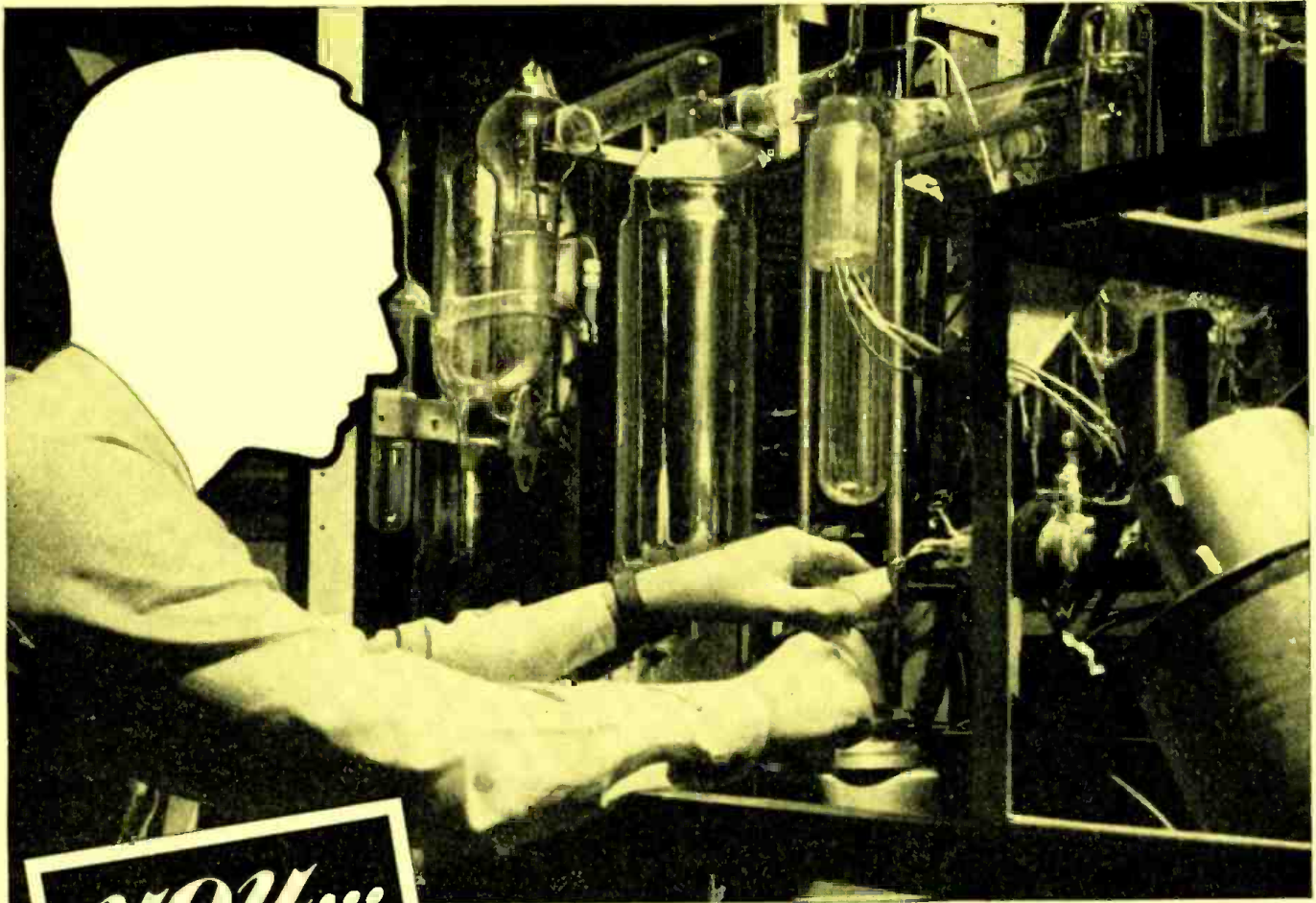
and Pilot Regulated CARRIER REPEATERS (for use in conjunction with the CFD-B Terminals on long haul circuits.)

COMPLETELY AUTOMATIC PILOT REGULATION OVER A 20 db RANGE. Built-in "SLOPE CONTROL" includes an extra 10 db equalization for non-conforming telephone pairs.

RYCOM'S CFD-B is assembled from Western Electric component parts, and is mounted COMPLETE with ringing, terminating and power supply equipment in ONE STANDARD AAR 8-FOOT RACK. Standard commercial performance is guaranteed. • Basic line Equalization of 15 db by manual controls. • The range of operation is through a maximum of 30 db over an operating range of 3 to 32.3 kilocycles. • Two-way pilot-regulated repeaters are available for circuits having more than the allowable 30 db loss. • 1000/20-Cycle Voice Frequency Ringers are available for one-, two-, three-, or four-channel ringing. A FULL LINE OF ACCESSORIES is offered, including: • Voice Frequency Repeater Balancing Nets, • Cable Matching Transformers, • Universal Way Station Filters, and • Mounted Sub-cycle Ringing Power Supplies.

RYCOM'S CFD-B provides FOUR DUPLEX VOICE CHANNELS AND RINGERS at a LOWER COST to you than most three-channel carriers now on the market! And WE CAN MAKE IMMEDIATE DELIVERY!

RAILWAY COMMUNICATIONS
INCORPORATED
FLEMING 2121 • RAYTOWN, MISSOURI • FLEMING 2122



you...

**... are headed for a better future
—when you come to RCA**

If you want to work where you enjoy the highest professional recognition among your colleagues, come to RCA. Here your accomplishments are recognized and rewarded. Here your future is brighter, through challenging assignments that lead to better opportunities, better positions. Here you set goals for future attainment at advanced levels.

If your talent and skill are not being used in a way for which your education and experience has equipped you, come to RCA. Here you will find unusual opportunities to work in close association with distinguished scientists and engineers in research . . . development . . .

design . . . and application of specialized electronic equipment for military projects as well as for an ever-increasing line of diversified commercial products.

Positions open are lifelong *career* opportunities. They are not "temporary" jobs. Unlike "feast or famine" industries,

RCA has forged ahead regardless of war or depression. You can continue advanced study at recognized universities under RCA's modern tuition refund plan. You and your family enjoy outstanding Company benefits. Yes, your future is better at RCA.

LIFETIME OPPORTUNITIES FOR

ENGINEERS—Electronic . . . Electrical . . . Communication . . . Mechanical . . . Computer . . . METALLURGISTS and PHYSICISTS

In Research—Development—Design—Application: in the following fields:

- RADAR • MISSILE GUIDANCE • SERVO MECHANISMS • COMPUTERS • TRANSFORMERS AND COILS • NAVIGATION AIDS • TELEVISION • ELECTRON TUBES • COMMUNICATIONS TECHNICAL SALES • ELECTRONIC EQUIPMENT FIELD SERVICE**



Send a complete résumé of your education and experience.

Personal interviews arranged in your city.

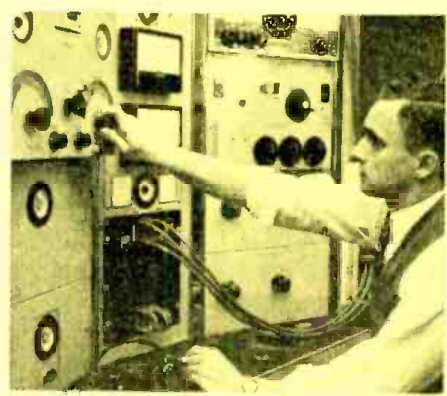
Send résumé to:
Mr. ROBERT E. McQUISTON, Manager
Specialized Employment Division,
Dept. 204B
Radio Corporation of America
30 Rockefeller Plaza, New York 20, N. Y.

RADIO CORPORATION of AMERICA

NEWS BRIEFS

COAXIAL CABLE SYSTEM

A revolutionary coaxial cable system, with triple the telephone circuit capacity of those now in use, has been de-



veloped by Bell Telephone Laboratories and is undergoing exhaustive field trials prior to its installation in the Bell

System. It is expected to go into actual service on circuits between New York and Philadelphia early in 1953.

Known as "L-3" carrier, the new system will enable one pair of coaxial pipes (pencil-size tubes of copper within the cable itself) to handle simultaneously more than 1800 telephone conversations or 600 telephone conversations plus one television program in each direction. It will be the first carrier system on which both television signals and regular telephone conversations can be sent over the same pair of coaxial pipes at the same time. (Photograph shows a Bell engineer testing transmission characteristics.)

IEC STANDARDS

Nineteen countries were represented by 418 delegates at a series of meetings of the International Electrotechnical Commission at Scheveningen, Holland, last September, to discuss international agreement on electrical standards. The United States participated in almost all of the technical meetings.

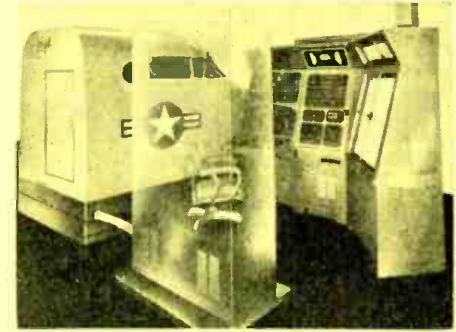
Among the important actions taken was the authorization of a new technical committee to develop standards for electronic tubes. A number of standards were completed for submission to the national committees, including safety rules for amplifiers and loudspeakers, several standards for radio components, and a revision of standards for power capacitors.

Arrangements were made for extending cooper-

ative action on standards of joint interest to IEC and the International Commission on Rules for the Approval of Electrical Equipment (CEE).

TWIN-ENGINE FLIGHT TRAINER

U. S. Navy airmen will now "fly the beam"—including the new omni-range—in twin-engine ground trainers as the



new ERCO Flightronic trainer takes its place in the fleet's All Weather Flying School at Corpus Christi. Designed by the Engineering and Research Corporation, Riverdale, Md., under contract to the Special Devices Center, Office of Naval Research, this instrument trainer features generalized twin-engine type cockpit and performance, the new Navy color- and shape-coded control knobs, and the Special Devices Center's new standard radio aids simulator and flight plotting board.

GIANT TV ANTENNA

Resembling "Big Bertha" herself, this 86-foot television transmitting antenna is undergoing preshipment tests at General Electric Company's Syracuse, N. Y., plant. Only half of the antenna is pictured, the other half being behind the test building.

This 8500-pound giant soon will boost by 12 times the transmitter power of



Station WCPO-TV in Cincinnati, Ohio. The preshipment tests are made to insure that the antenna will efficiently accept and radiate TV signals from the station's Channel 9 transmitter.

ZOPHAR

WAXES COMPOUNDS


Zophar waxes, resins and compounds to impregnate, dip, seal, embed, or pot, electronic and electrical equipment or components of all types; radio, television, etc.

Cold flows from 100°F. to 285°F.

Special waxes non-cracking at -76°F.

Compounds meeting Government specifications, plain or fungus resistant.

Let us help you with your engineering problems.



ZOPHAR MILLS, INC.

112-130 26th Street,
Brooklyn 32, N. Y.

Specify *Bliley*... For 22 Years The Foremost Name In Crystals



Military types CR15, CR16, CR18, CR19, CR23, CR24, CR27, CR32, CR36, CR47 are representative of current production by Bliley. Complete range of types and cross reference index is given in Bulletin 43.

MILITARY



SHIP-TO-SHORE



BROADCAST



SPECIAL PURPOSE



COMMUNICATIONS



STANDARD



AMATEUR



ULTRASONIC DELAY LINES



FREQUENCY STANDARDS



Types MC7, SR5 and SR8 are suggested for shipboard dependability. Price and details given in Bulletin 44.

Types BC46T, MO3B, TC92 are first choice for automatic temperature control in AM, FM and TV transmitters. Consult Bulletin 43 for basic details.

Types SR10 and MC9 provide wide range frequency choice for TV service, diathermy and citizens band. Request Bulletin 44 for price and description.

Type BH6A is the predominant choice for land mobile and airborne applications. Consult Bulletin 43 for basic information.

Types KV3, MC9, SMC100 and MS433 cover reference frequencies from 100 kc through 10.7 mc. Price and "stock tolerances" given in Bulletin 44.

Types AX2 and AX3 together with Bliley packaged oscillator Model CCO-2A were designed to bring precision and price together in the Ham Bands. Price and details are given in Bulletin 44.

Custom built fused quartz delay lines provide high stability and precision time intervals for manipulation of pulsed or pulse modulated signals. Consult Bulletin 45 for technical information.

Model BCS-1A is a high stability instrument for precision reference at 100 kc. Ideal choice for research and development laboratories. Descriptive information given in Bulletin 43.



BLILEY ELECTRIC COMPANY
UNION STATION BUILDING • ERIE, PENNSYLVANIA

Personals



DR. ROBERT ADLER, who joined *Zenith Radio Corporation*, Chicago, Ill., in 1941 as a member of its research division, has just been appointed associate director of research. During the intervening years, Dr. Adler has made numerous contributions to the advancement of the electronics industry and to the improvement of communications equipment used by the armed services. He was awarded a Fellowship by the Institute of Radio Engineers in 1951.



F. CLARK CAHILL is now chief engineer of the Engineering and Production Division of *Airborne Instruments Laboratory, Inc.*, Mineola, L. I., N. Y.; he formerly served in the *Laboratory's* Research and Engineering Division as supervisor of the Radar Section. During World War II, Mr. Cahill was associated with the Radio Research Laboratory at Harvard University as head of a war research work division. He has been with *Airborne* since 1945.



EDWARD L. COCHRANE, Vice Admiral, U.S.N., (Ret.), and Dean of the School of Engineering at Massachusetts Institute of Technology, has again been elected a director of *Raytheon Manufacturing Company*, Waltham, Mass. Admiral Cochrane first served in this capacity for *Raytheon* from 1948 until 1950, at which time he took a leave of absence from M.I.T. to direct the maritime administration in Washington as chairman of the Federal Maritime Board.



L. F. HICKERNELL, chief engineer of *Anaconda Wire & Cable Co.*, Hastings-On-Hudson, N. Y., was recently elected a member of the board of directors of the American Institute of Electrical Engineers. Mr. Hickernell served as the chairman of the Detroit-Ann Arbor Section from 1929 to 1930; since then he has worked on many AIEE committees, both general and technical. His term as director will extend from January, 1953, through July, 1954.



DR. URNER LIDDEL has joined *Bendix Aviation Corporation* to direct product development in applied physics and atomic energy. Prior to his most recent position as chief of the physics branch of the U. S. Atomic Energy Commission, Dr. Liddel served as a civilian in the Office of Naval Research where he was director of the Division of Physical Sciences. He is a Fellow of the American Physical Society and the New York Academy of Sciences.



WILLIAM C. LUPFER has been appointed director of contract relations for *Avion Instrument Company*, Paramus, N. J., where he will be responsible for technical representation of all products. In 1943, Mr. Lupfer became associated with *Sylvania Electric Products Inc.*, as contract and facilities supervisor for the Central Engineering Division, and more recently he was with *Allen B. Du Mont Laboratories, Inc.*, as government contracts administrator.

A.F. Wattmeter

(Continued from page 7)

pling is employed between the two output transformers. The difference of the outputs is taken by reversing the connections of one thermocouple.

Protection against thermocouple overload and burn out is provided by the double-diode 6AL5 clippers interposed between the two amplifiers. These are adjusted to clip or cut off the output at a voltage value just below the point at which the thermocouple heater currents reach 125% of rated value. Since the couples are rated to stand 150% current, a small safety factor is included here.

A calibration curve of meter reading vs. input power to resistive or reactive loads is shown in Fig. 3. For a given power input, change of load power factor over a wide range of capacitive or inductive angles makes no change in the reading. For all values of load voltage between zero and 150% of rated value, and with the load current circuit open, the meter stays at zero power.

The particular couples chosen for speed of response have heater ratings of 100 ma., 2 ohms, and couple ratings of 25 millivolts, 7 ohms. The indicating instrument used has a range of 50 microamperes and a coil resistance of 160 ohms. Full scale readings with a load power of 1.5 watts can be obtained.

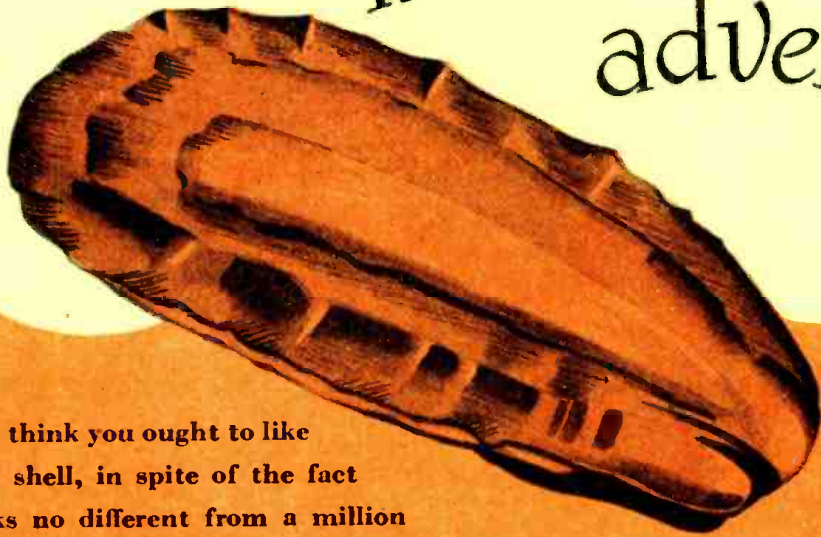
Speed of response is not as slow as might be expected, full scale being reached from zero in slightly less than one second. For small change from a median reading, the response is even more rapid. Because of the protection given by the diode clippers, there is no fear of burn out or damage due to overload, and the instrument becomes as foolproof as a vacuum tube voltmeter.

Frequency range depends on the selection of the input step-up transformer and coupling capacitors, and to a very limited extent on the choice of the output transformer. The range of 50 to 15,000 cycles can be easily covered with conventional design, and this can be extended through the selection and loading of the input transformer. For extreme frequency ranges, the input transformer can be eliminated and input taken directly from the shunt. Additional voltage gain of about 50 can then be provided with another amplifier stage of conventional design.

Assembly of vacuum thermocouple pair.



an oyster never advertises



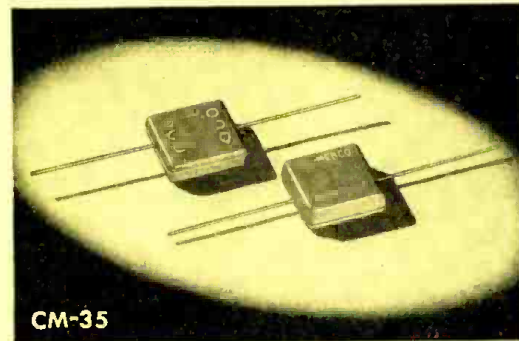
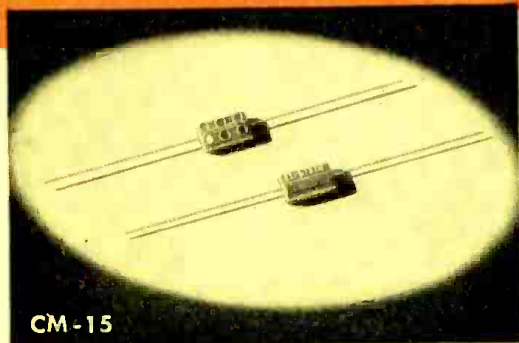
He seems to think you ought to like him for his shell, in spite of the fact that it looks no different from a million other oyster shells. If he's got a pearl inside, why doesn't he say so.

CAPACITORS LOOK PRETTY MUCH ALIKE FROM THE OUTSIDE, BUT EL-MENCO'S HAVE SOMETHING IN THEM *and we want the world to know it.*

Into every El-Menco Capacitor goes superb design, precise workmanship and the finest of materials. The finished unit is then factory-tested at *double* its working voltage to *insure* satisfactory performance on whatever job it is given.

No wonder we are *proud* to put our name on these capacitors—no wonder they have won the highest praise for their absolute reliability.

The range runs from the smallest (CM-15-2-525 mmf. cap.) to the largest (CM-35-3300-10000 mmf. cap.)



Jobbers and Distributors: For information write to Arco Electronics, Inc., 103 Lafayette St., New York, N. Y.—Sole Agent for Jobbers and Distributors in U.S. and Canada.

Write on business letterhead for catalog and samples.

MOLDED MICA **EL-MENCO** MICA TRIMMER CAPACITORS

Radio and Television Manufacturers, Domestic and Foreign, Communicate Direct With Factory—

THE ELECTRO MOTIVE MFG. CO., INC.

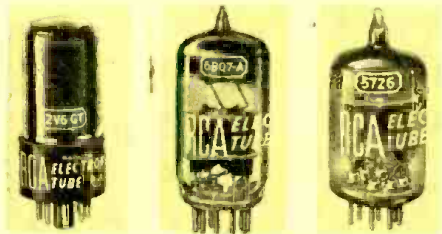
WILLIMANTIC, CONNECTICUT

NEW TUBES

RCA TUBES

The Tube Department of *Radio Corporation of America*, Harrison, N. J. has released three new tubes: a beam power amplifier, a medium-mu twin triode, and a "premium" twin diode.

Intended primarily for use in the output amplifier of automobile radio receivers operating from a 12-volt storage battery, the 12V6-GT is a beam power tube of the heater-cathode type. A single 12V6-GT operated with a plate and



screen voltage of 250 volts can deliver a maximum-signal output of 4.5 watts.

The 6BQ7-A is a medium-mu twin triode of the miniature type designed for use as the first r.f. amplifier tube in

a v.h.f. television-receiver tuner or as a low-noise i.f. preamplifier tube in a u.h.f. television receiver employing a crystal mixer. It supersedes the 6BQ7.

Especially useful as a detector in circuits utilizing wide-band amplifiers, the 5726 is a high-perveance, miniature twin diode. Constructed to give dependable performance under shock and vibration, this is a "premium" version of the 6AL5W.

HYTRON TUBES

Hytron Type 27EP4 is a 27" rectangular, 90°, all-glass, magnetically focused picture tube which provides an effective area of over 400 square inches. Features include an aluminized screen, single ion-trap gun design, and a neutral-density, spherical face plate.

Type 1N64 is a germanium diode designed to meet the requirements for a video detector in television applications. It is application-tested at both the low and high intermediate frequencies.

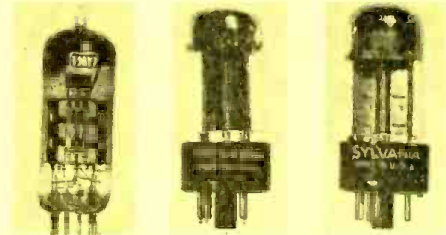
Both of these tubes are manufactured by the *Hytron Radio & Electronics Co.*, Salem, Mass.

TV PENTODE AND TWO DIODES

A new television pentode, the 12BY7, and two diodes for use in television

horizontal frequency damper circuits have been announced by the Radio Tube Division of *Sylvania Electric Products Inc.*, at Emporium, Pa.

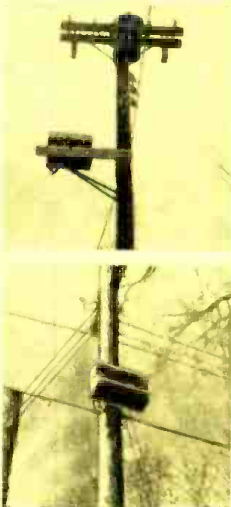
The 12BY7 is a high-transconductance sharp-cutoff video pentode de-



signed for service in television receivers. It features miniature T-6½ construction, and will furnish large output voltages across low values of load resistance and supply voltage.

Types 6AX4-GT and 12AX4-GT are half-wave, indirectly heated diodes contained in T-9 envelopes. They are designed to withstand the extremely high voltage pulses of line frequency between cathode and both heater and plate elements normally encountered in direct drive circuits. The 6AX4-GT and the 12AX4-GT are identical except for heater characteristics: the 6AX4-GT requires 6.3 volts at 1.2 amperes, while the heater of the 12AX4-GT requires 12.6 volts at 600 ma.

SKL WIDE-BAND DISTRIBUTION SYSTEM FOR TELEVISION



Two views of SKL Model 212TV Amplifier mounted in Model 420 Amplifier Cabinet, mounted on a telephone pole crossarm (top), pole (bottom). Courtesy Vermont Television, Inc.

The -SKL- Distribution System provides simultaneous distribution of up to thirteen television channels, FM signals, and, if required, broadcast signals. Although the -SKL- system is inexpensive in initial cost, no effort has been spared to provide high quality, long lasting, low obsolescence designs and equipment. An unusual feature of the -SKL- system is the Model 212TV Chain Amplifier. These broadband amplifiers continue to operate even though a tube fails, which insures the high reliability so necessary in such a system. The -SKL- system is designed to have the lowest maintenance cost of any system on the market today, not only because of the reliability of the amplifiers which require no tuning or adjustment, but also because vacuum tubes have been eliminated in all other parts of the system. Only the -SKL- system can offer the long life, low obsolescence and low maintenance costs that are required for the long, profitable operation of distribution systems.

Write today for further information.

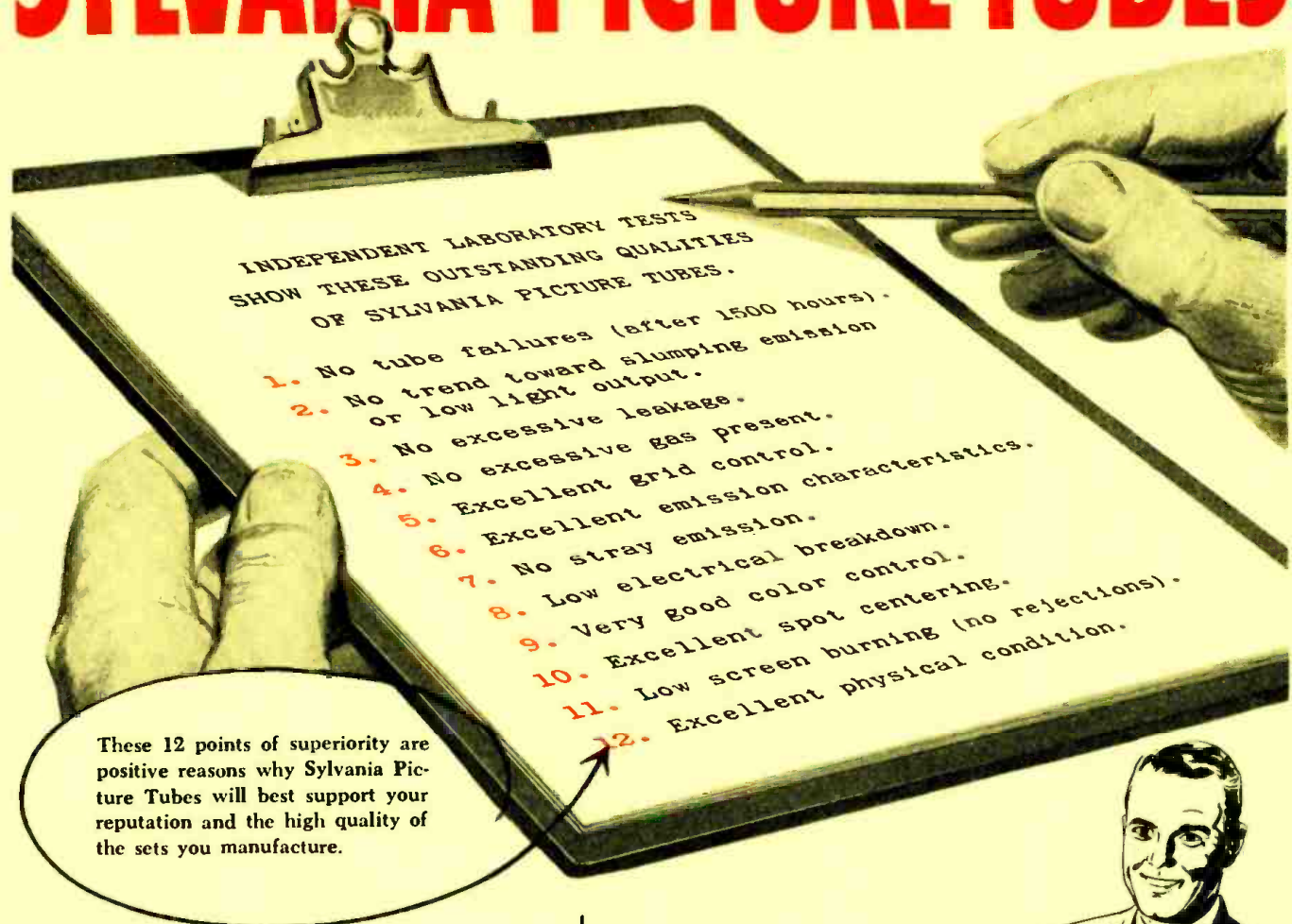
Right: Photo of erection of one of the two Horn Antennas at Barre, Vermont, for Vermont Television, Inc. These antennas, having 20 db gain, provide good signals from WBZ-TV Boston, 140 air miles, and WRGB Schenectady, 130 air miles.



SKL SPENCER-KENNEDY LABORATORIES, INC.
186 MASSACHUSETTS AVE., CAMBRIDGE 39, MASS.

*The Finest in
Precision Equipment*

12 Reasons why Electronics Engineers should specify **SYLVANIA PICTURE TUBES**



To definitely establish the superiority of Sylvania Picture Tubes, in comparison with other brands, Sylvania called an outside research organization . . . the United States Testing Company.

Eight picture tubes of nine different manufacturers were selected and submitted to identical electrical and mechanical tests.

Shown above is Sylvania's outstanding record. The test results showed that Sylvania Picture Tubes outlasted and outperformed all others tested. For the detailed report of these significant tests, write to: Sylvania Electric Products Inc., Dept. 3R-3502, 1740 Broadway, New York 19, N. Y.

"SYLVANIA'S
**SUPERIOR
QUALITY
IS BASED ON
PROVED
PERFORMANCE!**"



SYLVANIA



RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS



NEW PRODUCTS

ULTRA-LOW FREQUENCY OSCILLATOR

An ultra-low frequency oscillator with standard rack panel construction has been announced by the *Krohn-Hite Instrument Company*. Model 400-C simultaneously provides both sine- and square-wave voltages at any frequency

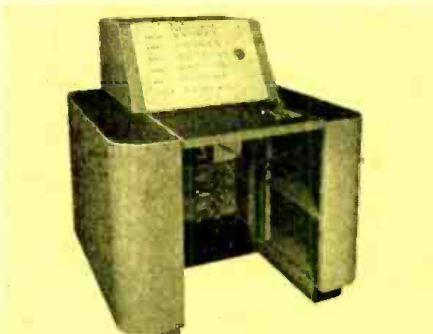


between 0.009 and 1100 cps. The sine-wave output may be used either balanced or single-ended. Maximum output is 30 volts peak-to-peak across a 1000-ohm load.

Special circuitry to eliminate tuning and bandswitching transients has been incorporated in this RC bridge oscillator. Descriptive pamphlet is available on request from the *Krohn-Hite Instrument Co.*, 580 Massachusetts Avenue, Cambridge 39, Mass.

TV MASTER SWITCHBOARD

Increased operating control and flexibility are made possible by the television master switchboard recently developed by *Federal Telecommunication Laboratories, Inc.*, Nutley, N. J. Completely self-contained, the unit permits the channeling of six separate inputs to six destinations by means of indirect relay



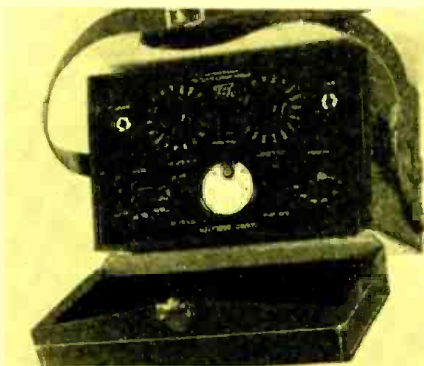
switching. These relays may be located in the console or at a remote rack.

Automatic clearing, termination and holding features have been incorporated

in the switchboard, as well as adjustment of the gap or lap switching interval. The built-in fader employs a two-channel video amplifier through which any two incoming signals may be routed; the output signal may then be reinserted as an additional signal source. Tally lights and internally illuminated push buttons aid in operating effectiveness.

NOISE ANALYZER

Hermon Hosmer Scott, Inc., has announced a versatile sound analyzer which separates noise, sound and vibration signals into their component frequency bands. The high- and low-pass filters can be independently adjusted in steps of $\frac{1}{2}$ octave, and a simple interlock permits the passband width to be fixed in any multiple of $\frac{1}{2}$ octave. The



position of this passband can then be adjusted throughout the audible range by a single control.

Housed in a saddle-leather case with a shoulder strap for portable use, Type 420-A includes a calibrated attenuator, an indicating meter meeting ASA standards, and an output jack for general purpose filter applications.

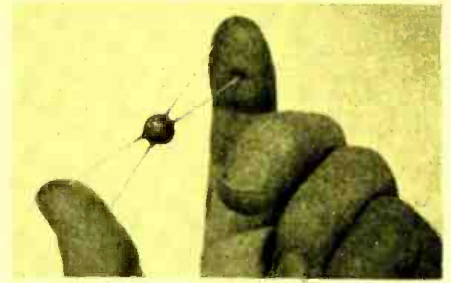
Inquiries should be sent to V. H. Pomper, *Hermon Hosmer Scott, Inc.*, 385 Putnam Avenue, Cambridge 39, Mass. Bulletin is available on request.

MINIATURE PULSE TRANSFORMER

The smallest pulse transformer now commercially available was recently developed by *P C A Electronics, Inc.* Weighing less than .03 ounces, the MPT 101-0.1 is slightly smaller than a pea, making it specially suited to miniature assemblies; it will, however, operate equally well in conventional circuits. New design techniques and a special

iron core make possible 0.1-microsecond pulse widths and rise times of less than .005 millimicroseconds when used in recommended P C A circuits.

MPT 101-0.1 meets MIL-T27 test specifications. It can operate indefinitely



at temperatures ranging from -70°C to $+125^{\circ}\text{C}$., and will operate normally for a short time at $+150^{\circ}\text{C}$.. Although it is designed for pulse forming, it can also be used for pulse coupling. For further information, write to *P C A Electronics, Inc.*, 6368 De Longpre Avenue, Hollywood 28, Calif.

WAVE ANALYZER

Analysis of the frequencies and amplitudes of signal components in a complex waveform is accomplished in a simple and direct way with the new *Sierra Model 121* wave analyzer. Signal components are read directly on a 4" indicating instrument calibrated in decibels. Voltage is calibrated with an internal 100-kc. injection oscillator, and a listening jack is provided for monitoring the signal being measured.

Just introduced by the *Sierra Electronic Corporation*, 813 Brittan Avenue, San Carlos, Calif., this 15 to 500 kc. wave analyzer incorporates a novel two-attenuator design which permits a wide range of measuring amplitudes without the introduction of instrument



distortion. It has an input level range of from +42 dbm to -70 dbm at a 600-ohm impedance level; input impedance is 10,000 ohms in the passband.

SCINTILLATION DETECTOR

A new scintillation detector, Model DS-1, has been announced by *Nuclear Instrument & Chemical Corporation*, 229 West Erie Street, Chicago 10, Ill. Designed for efficient gamma-ray counting in clinical and laboratory applications, the detector is provided with a

(Continued on page 30)

ing. The amplitude, the width, or the time of the pulse may be the analog of the function transmitted. On the other hand, in pulse code modulation the samples of the transmitted function are represented digitally.

Besides the time-sharing of equipment, another reason for sampling data is that an observation or a measurement may take a specific length of time to make. In radar, the time needed to receive an echo at maximum range defines the highest permissible pulse rate. The measured range is represented by an analog distance on the face of the oscilloscope. A motion picture is another example of sampled analog representation. Each frame is a sample of the object's illumination in terms of a chemical analog. The limitation of bandwidth due to sampling is vividly illustrated in movies when the wheel of the stage coach seems to rotate backward.

In order to indicate how an unsampled quantity can be represented digitally, Table I has been prepared. A portion of the sine wave is described in a continuous fashion within an accuracy of three decimal digits. This is done by indicating the degrees (or times) at which the function changes by a quantizing unit. No sampling is involved because the function is defined at all values of the independent variable.

One can build digital units or even digital computers to operate in a continuous manner, but time-sharing of equipment is precluded. This means that a separate element is needed for each digit (parallel unit) and for each operation. A dozen additions would call for a dozen parallel static adders. Such designs are possible and may be practical. A complex diode matrix may be designed to give the binary sum of two binary inputs, which energize the matrix. An experimental tube, the computer², has been partly developed to perform static arithmetic operations. At a recent computer symposium in Pittsburgh, a paper was presented on a special-purpose continuously operating digital computer⁴.

Elaboration on the difference and the relation between quantizing and sampling may be in order. Both processes introduce discontinuities, but while quantization produces a discontinuity in the value of a quantity, sampling produces a discontinuity in the times at which a quantity is specified. Figure 3 shows a portion of a sine curve quantized but not sampled in part (A) and sampled but not quantized in part (B). The step-discontinuities of quantization depend on the magnitude of the dependent variable, while the impulse-discontinuities of sampling depend on the independent variable.

Although quantization and sampling are fundamentally different effects,

they are interrelated. For example, it would be foolish to tabulate (sample) a sine wave at every millionth of a degree if it is defined only to three decimal places. Similarly, if sampling is done at every ten degrees, there is little advantage in a quantizing accuracy of ten decimal places. In numerical analysis, quantizing errors are called roundoff errors, while the errors arising from sampling are called truncation errors. In an efficient numerical procedure, these two types of errors are balanced.

The analogous situation has been commonplace in conventional analog equipment design. The counterparts of quantizing noise and sampling delay are respectively noise and response lag. Resulting errors (called respectively static and dynamic) should be of the same order in a well-designed analog unit.

Conclusion

It has been indicated that the division of units into digital and analog classes is often obscure and sometimes confusing. Three features have been proposed—positional notation, quantization, and sampling—as more fundamental in characterizing the nature of particular equipment.

Understanding these basic characteristics is not just of academic interest; it can also help in orienting engineers in new avenues of endeavor. By combining these basic properties in various degrees, new ideas and equipment may be more easily created than by thinking in terms of what is conventionally meant by digital and analog. Consider the future problems and solutions which may be ahead of us.

An interesting problem is the balancing of errors due to sampling and errors due to random noise. In serial digital computers, adjustable word lengths may be thought of as a means of changing the quantizing error and the real-time sampling rate simultaneously. Halving the word length could almost double the machine speed and would increase the quantizing error while de-

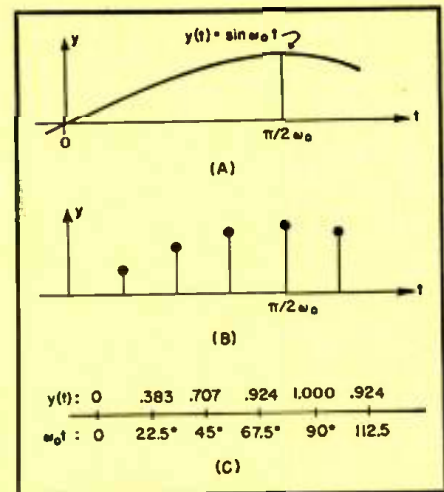


Fig. 2. The process of sampling. (A) A continuous function of time. (B) Result of periodic pulsing. (C) Sampled function displayed digitally.

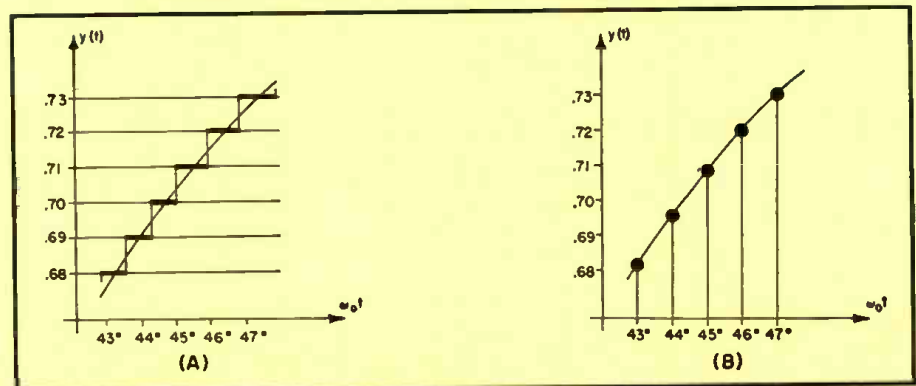
creasing the sampling error. The corresponding design change in an analog case makes the unit less accurate but also less sluggish at the same time.

A fascinating possibility is the use of units consisting of analog (nonquantized) elements combined in a digital manner, just as in the examples of the electric clock and the gas meter. For the transmission of data, such representation is not new. The coarse and fine dials with corresponding selsyns have been used in numerous cases. Could some kind of a computation be done on data so represented?

As techniques in designing compact digital equipment improve, the use of digital schemes for special purposes will become more and more popular. For fixed programs, the magnetic drum may prove a much more efficient and rapid storage element than for general purposes. Digital computations with non-sampled data may also be expected. In addition to the examples already cited, new developments, such as the perfection of ferroelectric techniques, might make such static computers generally practical. These computers will have

(Continued on page 30)

Fig. 3. (A) Portion of a sine curve quantized but not sampled. and (B) portion of a sine curve sampled but not quantized.



$\omega_0 t$ in Degrees		$y(t) = \sin \omega_0 t$
From:	To:	
.	.	.
.	.	.
44.72	44.81	0.704
44.82	44.86	0.705
44.87	44.95	0.706
44.96	45.03	0.707
45.04	45.11	0.708
45.12	45.19	0.709
45.20	45.27	0.710
.	.	.
.	.	.

Table 1. Indication of how an unsampled quantity can be represented digitally.

unit; each relay is twice as significant as one of its neighbors, although it is physically identical. Or take the time clock at the entrance of a factory; the hour wheel has a much greater effect on the weekly pay check than the physically identical minute wheel.

Now consider a gas meter. One type of gas meter in existence shows about five small dials, like small clocks. Each dial is calibrated from 0 to 9 and boasts one hand only. The gasman reads the total consumption as a five-digit number. Although the five indicators are identical, they have different influence on the gas bill. So far, everything that has been said about the meter would class it a digital unit. Only when the individual digits are examined will any doubt arise, for each hand moves in a continuous fashion. As the gas flows, so moves each hand; therefore, each hand (with its own scale factor) is the analog of the gas consumed. Were the movements of the hands rigged with some escape mechanisms so that they would go through a revolution in ten distinct and equal jumps, the gas meter would be called digital without a doubt.

Quantization

This difference in the mechanism of an individual digit belongs in the discussion of the second basic feature, *quantization*. Assume an n -digit binary relay register; then for any finite n

greater than one, it will certainly be a digital unit. Even when n goes to one, the single-relay register is still likely to be considered digital because it can occupy only two possible states, i.e., it gives a quantized measure of whatever it represents. Had a decimal register been assumed, the individual digit would again be considered a digital unit because it is capable of assuming only ten different states.

As the number of possible states increases, the quantized nature of a unit becomes obscure and it is finally called analog. Indeed, some people say an analog unit is that which is quantized into an infinite number of states. Actually no shaft, however well machined, can stop at any of an infinite number of possible angles. The voltage on a condenser is generally considered a good example of an analog; yet it cannot change in smaller steps than the voltage due to a charge of a single electron.

To have faith in quantum theory, the fact that everything is quantized must be accepted in the final analysis. If so, how many possible states must a single-digit unit be capable of occupying—a hundred, a thousand, or a million—before it should be called analog? A direct answer to this question could only be arbitrary. The important factor is that quantization introduces an uncertainty into a physical quantity.

When a three-digit decimal counter reads 115, it may indicate that the value of the represented physical quantity is between 114.5 and 115.5. Therefore, the quantized representation is accurate within a tolerance. However, so is a nonquantized representation. If the indicator of a voltmeter stops at the 115-volt mark, it may only be known that the voltage is, for example, 115 ± 0.3 .

Thus, an error is associated with both quantized and continuous indications. In what respect do these errors differ? They differ in their statistical distributions. Figure 1 shows possible distributions of errors in the examples used above. A quantized representation of 115 volts may mean anything between 114.5 and 115.5 with equal probability. If so, the error is uniformly distributed, as illustrated in Fig. 1(A). On the

other hand, the nonquantized representation generally has a less definite error distribution, which is often assumed to be normal. The tolerance limits may then correspond to the probable error, and such a distribution corresponding to the above example is shown in Fig. 1(B).

Just as statistical methods have recently been applied to noise analysis in communication engineering, they have long been applied to quantization errors or roundoff errors¹. The use of the same methods in both cases is not accidental; rather it underscores the fundamental connection between uncertainties due to varied causes.

Sampling

The third aspect that is bound to enter a discussion of this kind is the process of *sampling*. Sampling can be defined as the act of taking specimens of a dependent quantity at particular values of the independent quantity. If time is the independent quantity, sampling implies that data are measured, defined, or examined only at particular instants of time.

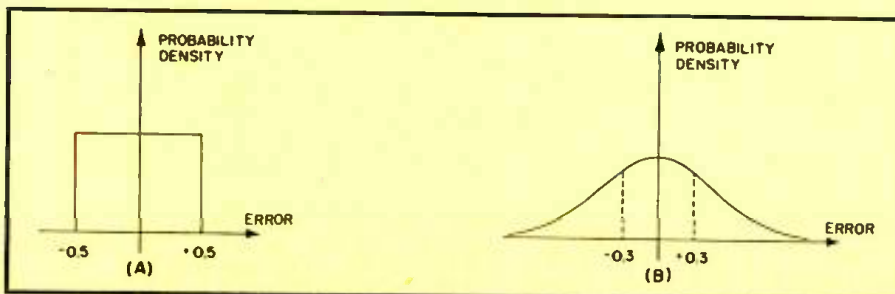
Thus, sampling is basically related to the time and manner of observing data, rather than the type of unit involved. It is true that most kinds of digital units, such as digital data transmission equipment and conventional digital computers, require the sampling of data; nevertheless, digital units can be built that operate in a continuous fashion. It is further true that information approaching or leaving an analog unit is usually continuous; however, for technical convenience, sampled data are sometimes employed in analog systems. The only generality that can be stated is that when equipment is time-shared or when the observation of data takes a discrete length of time, the data involved must be sampled.

The process of sampling is illustrated in Fig. 2. Part (A) shows a continuous function of time, which may be displayed on an oscilloscope. The height of the luminous line above the base line is the analog of $y(t)$. If the grid of the cathode-ray tube is pulsed on periodically, the sampled display of part (B) results. In part (C), the same sampled function is expressed digitally.

This simple illustration may raise two questions. First, although analog sampling is possible, why would it be used? Second, how can sampling be avoided in the digital case?

Consider pulse communication. It is well known that if it is desired to transmit a band of B cps, it will be necessary to use a pulse repetition rate of at least $2B$. The pulsed transmission of data has the advantage that the same channel may be used for several sets of information by time-multiplex-

Fig. 1. Possible distributions of errors in the examples given. (A) Uniformly distributed error. (B) Nonquantized representation of error distribution.



FUNDAMENTAL CHARACTERISTICS

OF

DIGITAL

AND

ANALOG

UNITS*

THOSE who are familiar with various complex present-day computers will have no difficulty in classifying a specific one as being either "analog" or "digital." This classification into analog or digital computation is apt to be considered both exclusive and exhaustive. It is not difficult to put such two-valued faith to task. This faith may have been strained (though not broken) for the first time, perhaps, when the digital differential analyzer appeared on the scene. Some described it as a digital computer programmed in an analog fashion. Future computers may require, not a single, but a repeated employment of both of these words.

However, no revolutionary developments in the computer field are necessary to cause hopeless entanglement with this limited vocabulary. Suppose a novice were to ask humbly for an explanation of the difference between digital and analog. It would be natural to try to clear up this difference once and for all with a few simple examples. Take the speedometer of a car. The speed indication is by means of a shaft whose angular position is the analog of the speed of the car. This is a fine example of an analog unit, although an innocent reference of the novice to the numerical calibration of the dial might leave an uneasy doubt in the mind. The mileage indicator, on the other hand, is an excellent example of a digital unit: the leftmost wheel counts one for each 10,000 miles, the next wheel for each 1000 miles, and so on down the line. Unfortunately, the purity of this example is rudely shattered by the rightmost wheel; this black wheel of the family turns in a continuous fashion as any decent analog shaft would and seems to carry those large numerals only for the sheer purpose of confusion.

By this time there would probably be a distressed expression on the beginner's face, and, in search of a better example, the electric clock on the wall might be considered. Both hands of such a clock are mounted on continuously rotating shafts whose positions are the analog of time. When about to call the clock an analog unit, however, the beginner might suddenly announce that the two hands of the clock seem to be related to each other in a manner very similar to the wheels of the mileage indicator. In fact, are not the hands of the clock like digits, one showing finer details of the measured quantity than the other?

At this juncture, it might seem like a good idea to execute a strategic retreat and call the clock a unit consisting of

By **JOHN M. SALZER**

Hughes Research & Development Labs.

The terms "digital" and "analog" by themselves are not adequate to describe a computer fully.

analog elements combined digitally. Indeed, it could even be said that this description would fit all clocks and watches. But then the pupil might point out that his watch says "tick-tock" and really measures time by counting the ticks and the tocks, that somebody had told him counting was an action characterizing a digital unit, and that this would make at least the second hand of his watch digital rather than analog! If this is not obvious, it is certainly clear that a stop watch moves in discrete jerks. To add to this burden of proof, it is only necessary to recall the big clock in any high school corridor, which jumps at one minute intervals.

After such an unhappy encounter with a novice, it would certainly be appropriate to re-examine the situation and it would not take very long to find that "digital" and "analog" are about as fortunate classifications for physical units as straw hats and round hats would be for men's headgear. Just as almost every hat is round in some respects, so is any measuring device or computer the analog of something in some respects. The analog of temperature, for example, could be a voltage in an analog unit or a number in a digital unit—in both cases within a certain accuracy. If an analog computer is the analog of a differential equation, a digital computer is the analog of a difference equation.

Whereas the analog class seems to be basically unrestricted, the digital class has more definite boundaries, as will be pointed out below. The real difficulty

with the use of these words is caused by an endeavor to make them describe too much at once. Properties which are more fundamental should be reverted to and the equipment classified in terms of these properties. The writer has proposed* the following three features as a basis:

1. Positional notation
2. Quantization
3. Sampling

A purebred digital computer would incorporate all of these features, a thoroughly analog one none. But now examine each quality separately.

Positional Notation

Positional notation is a feature that is fundamentally digital. In the number 888, there are three identical digits; however, they carry different weights according to their relative positions. The high precision attainable in a digital unit is closely tied in with this positional notation. It is only necessary to use more digits of the same kind to increase the accuracy.

There are two ways in which the relative positions of the digits of a number can be recognized: in space or in time. A parallel machine handles all digits simultaneously and requires identical equipment (arranged in space) for each digit. On the other hand, a serial machine recognizes the weight of a digit by the relative time of its appearance at a particular point.

If it is agreed that "digital" means that which consists of digits—and how could it not be so?—, then it is clear that positional notation is a cardinal property of a digital unit. A binary relay register, for instance, is surely a digital

*This article is based on a paper presented at the National Electronics Conference which was held in Chicago, Sept. 29, 30 and Oct. 1, 1952.

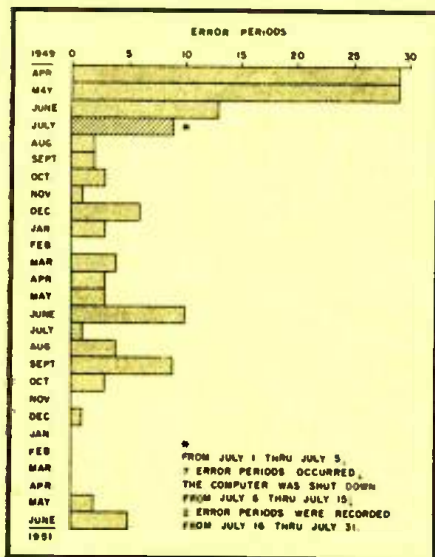


Fig. 4. Performance of the five-digit multiplier during the reliability run.

more rugged units. It is not known that all of these weaknesses would have caused operational failures if they had remained, but as a conservative measure they were regarded as potential faults and were therefore corrected.

During the 96 days following shutdown, the number of error periods decreased to seven. The error rate for the remainder of the 27-month run was an average of one every 286 hours.

Vacuum Tube Life

Significant information on vacuum tube life has been obtained from records on tubes used in the five-digit multiplier. The multiplier contains about 375 tubes (sockets) of which approximately half are types extensively used in the Whirlwind computer (40% of type 7AD7 and 10% of type 7AK7). About 18 per cent of the tube complement is type 6AS6, while small numbers of other types comprise the remainder.

Figure 3 shows the life characteristics of (1) the 7AK7, a dual-control-grid pentode which was manufactured under pilot plant conditions, (2) the 7AD7, a video amplifier pentode purchased from commercial production, and (3) the 6AS6, a miniature dual-control-grid tube also from commercial production. The plot is percentage survival vs. length of service for original and replacement tubes. The criterion for the end-of-life of a tube is the tube's failure to perform satisfactorily in the circuit to which it is assigned. Life of the 6AS6 tubes is apparently much shorter than that of the other two types, because the 6AS6's are used in circuits that have smaller operating margins and the effective life of tubes in a given piece of equipment is closely related to circuit design. If it had been possible to build circuits in which

changes in tube characteristics had no effect on circuit performance, then the percentage of survival would have been much higher than these curves show.

A question sometimes raised in discussions of tube life is whether tubes tend to have a definite period of usefulness and therefore should be replaced as a group after a certain length of time or whether the failures occur at a fixed rate so that nothing would be gained by wholesale tube replacement. Experience with the multiplier seems to point to the latter type of behavior and certainly indicates that wholesale replacement is not warranted within the period of time shown on these curves. In Fig. 3, the data are shown on a semi-log plot with smooth curves (the solid lines) drawn through the points so that the slope of a curve is a measure of the rate of tube failure. For all three types the rate of failure decreases for increasing length of service, as indicated by the flattening out of the curves. However, the samples are probably too small for this fact to be considered significant. To get a conservative measure of tube life in this equipment, points have been determined where 50 per cent of the tubes would have remained if failures had continued at their initial rates, as shown by the broken lines. These figures are 6400 hours for the 6AS6, 14,000 hours for the 7AD7, and 29,000 hours for the 7AK7.

Other Components

No capacitors or r.f. chokes failed during the test and only two pulse transformers had to be replaced. On the other hand, it was necessary to replace 29 of the 120 carbon resistors selected to less than 1% tolerance for use in flip-flop circuits. Crystal clamps were also troublesome in flip-flop circuits, where a back resistance of at least 0.5 megohm is essential. One hundred clamps of a special high-back-resistance type similar to the 1N38 were used in these circuits, and a total of 78 replacements was necessary because of the small tolerances. By comparison, 386 crystals (type 1N34 or equivalent) used in other less critical circuits required only 32 replacements.

Because a guarantee of maximum reliability was the intended goal, this sensitive clamp circuit should have been redesigned. However, rather than interrupt the test, a simple marginal-checking routine was applied periodically to the clamp circuits and the deteriorating crystals were quickly located. In this case, then, the desired reliability was ensured at the expense of additional preventive maintenance.

The importance of extensive operating experience in discovering unpre-

dictable factors that influence reliability was emphasized on several occasions. Two examples are of interest. As originally designed, the multiplier had pilot lights to indicate the presence of the +150-volt and +250-volt power inputs to each panel. These lights were 110-volt lamps fed from the respective supply points through appropriate dropping resistors. During the reliability run, it was discovered that occasionally an error count was caused by the burning out of one of these lamps. A search revealed that the dropping resistors were mounted near the filter circuits at the bottom of the panel and that the leads at the top of the panel were cabled for some distance with several wires which distributed power to the circuits on the panel. Under these conditions, interruption of current to a lamp caused a sudden jump in voltage on the wire to that lamp. This voltage jump, capacitively coupled into the power distribution circuits, was responsible for the errors observed. Relocating the dropping resistors at the lamps rather than at the filters eliminated the trouble.

The second example of unpredictable factors which can affect reliability was discovered accidentally. A metal coat tree in the multiplier room was habitually used by a few employees who worked in that portion of the building. One employee observed that a static discharge from hanging his new plastic raincoat on the coat tree caused multiplier errors. The exact way in which these were introduced was not determined. Previously, qualitative tests had been made to discover whether the system was sensitive to radiated signals and negative results were obtained. A commercial r.f. bomber was used for these tests and no attempt was made to cover the complete r.f. spectrum.

Noise Measurements

One of the aims of the multiplier reliability test was to examine the adequacy of maintenance techniques and, if possible, to discover new techniques which might be applicable to the Whirlwind I computer. Toward this end, some experiments were carried out to determine the sensitivity of the system to noise signals.

In the majority of electronic circuit applications outside the computer field, an occasional transient disturbance whose amplitude is comparable to that of the wanted signal is of little or no consequence. Interpretation of signals within these systems, whether by human beings or electrical equipment, involves an averaging or filtering process which effectively discriminates against noise. In a digital computer, however, interpretation of signals is done by memory

(Continued on page 31)

voltages, generally screen voltages, in selected circuits of the multiplier so that the components operate under great stress. Any component with a low operating margin will effectively lose this margin during the check and the circuit will not operate. When a test problem is run, the operator can then isolate the weak component and replace it.

Power for the multiplier is supplied from three motor-generator sets whose d.c. outputs are -100, +150, and +250 volts. Power for marginal checking is obtained from a G-E amplidyne whose d.c. output can be manually varied from -100 to +100 volts. During marginal checking this generator is switched in series with the d.c. supply to the circuits which are to be checked.

Extended Reliability Run

On April 1, 1949, the multiplier started a reliability run which extended for 27 months. During this time, the machine continuously multiplied two five-binary-digit numbers and checked for a correct result at the end of each multiplication. The multiplications required about 8 microseconds each and were repeated at the rate of 15,000 times a second. When errors occurred, they were recorded by electro-mechanical counters and an Esterline-Angus inking recorder. Three counters were used as a "two-out-of-three" check; twice a day they were tested carefully to be sure they would respond to a single-error pulse.

Performance requirements were rigorous. All errors of undetermined origin and those from failures of defective, deteriorating, or accidentally damaged components were counted. Those resulting from failures of power supplies were also charged against the system. The only exceptions were errors caused directly by two failures in city power, two power line failures, and a transient introduced into the power line by a local thunderstorm.

For the first 18 months, about half an hour of each working day was spent in preventive maintenance. During the last nine months, as performance improved, this checking was reduced to twice a week. In addition, troubleshooting for intermittent failures, not isolated by marginal checking, was necessary—especially for the first six months.

A log was kept during the entire run, with entries stating when errors occurred and what remedial action was taken. An operation chart was drawn daily from the information in the log to provide an over-all picture of the multiplier's reliability. The longest error-free run extended for 143 days, or nearly five months. It was interrupted when, for some unknown rea-

son, a power supply fuse burned out.

The test was terminated June 30, 1951, because operating experience on the Whirlwind I computer had reached a point where little benefit could be obtained from further studies of the five-digit multiplier.

Error Periods

Figure 4 summarizes the number of error periods that occurred during each of the 27 months. An "error period" is defined as the discrete period during which any number of errors occur without interruption. This number may range from one to several thousand, but since single errors, as well as multiple errors, can invalidate results and require the attention of an operator, each error period is considered as having the same weight regardless of the number of errors recorded. The total number of error periods over the 27 months was 142, or an average of one every 136 hours.

Work During Shutdown

Over half of the error periods (78) occurred during the first 96 days (April 1 through July 5, 1949). Considerable dependence had been placed on the marginal-checking facilities as a means of obtaining and keeping a high level of system performance, but this large number of error periods indicated that the new maintenance technique alone was not sufficient.

Because daily checking ensured that all circuits basically had wide operating margins, it was concluded that the frequent errors were caused by transient disturbances rather than by slow drifts in circuit tolerances. Intermittent connections were suspected first, and for lack of more refined methods, the search for such connections was made by

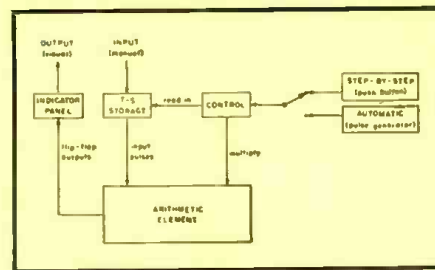
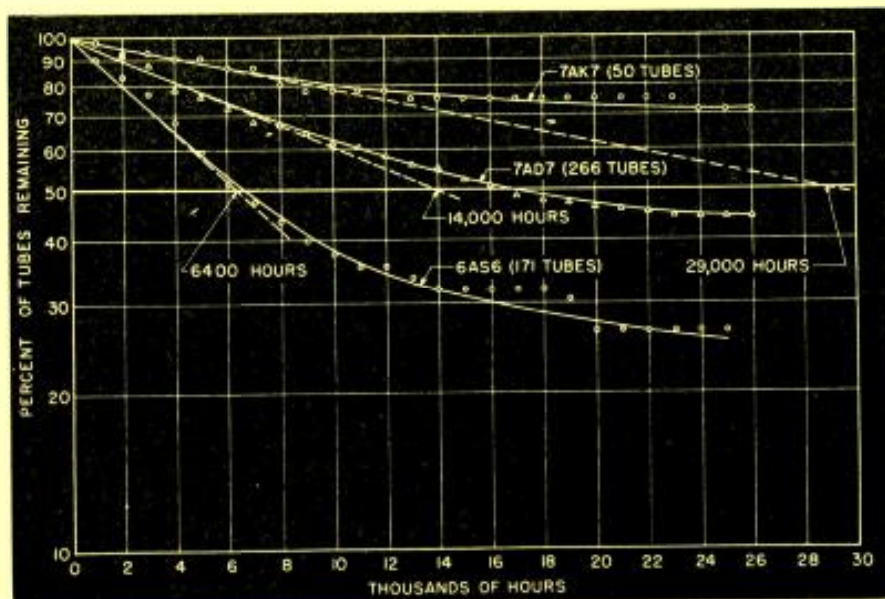


Fig. 2. Block diagram showing logical design of the five-digit multiplier.

painstakingly tapping panels and components. Within a short time sufficient weaknesses were found to indicate that a shutdown for overhaul was necessary. Nearly all of the faults discovered were ones which caused momentary rather than permanent failure. Furthermore, they would have been overlooked if evaluated by the usual criteria of performance; they were shown up in this case by the extreme sensitivity of the multiplier acting as a detecting instrument. The defects found were (1) insufficient spring pressure in cartridge-type fuse holders, (2) inadequate contact pressure in power distribution relays, (3) momentary shorts or leakage between elements within vacuum tubes, (4) poor connections in adapters which had been provided to permit use of lock-in-base tubes in circuits built for octal-base tubes, (5) loose screws on power-wiring terminal strips, and (6) unsoldered or cold-soldered component connections. The shutdown was utilized to correct all of the faults that had been discovered and to guarantee reliability further by eliminating all unnecessary contacts (such as relays and manual switches) and by replacing all fuse holders and tube adapters with

Fig. 3. Graphs of vacuum tube life in the five-digit multiplier.



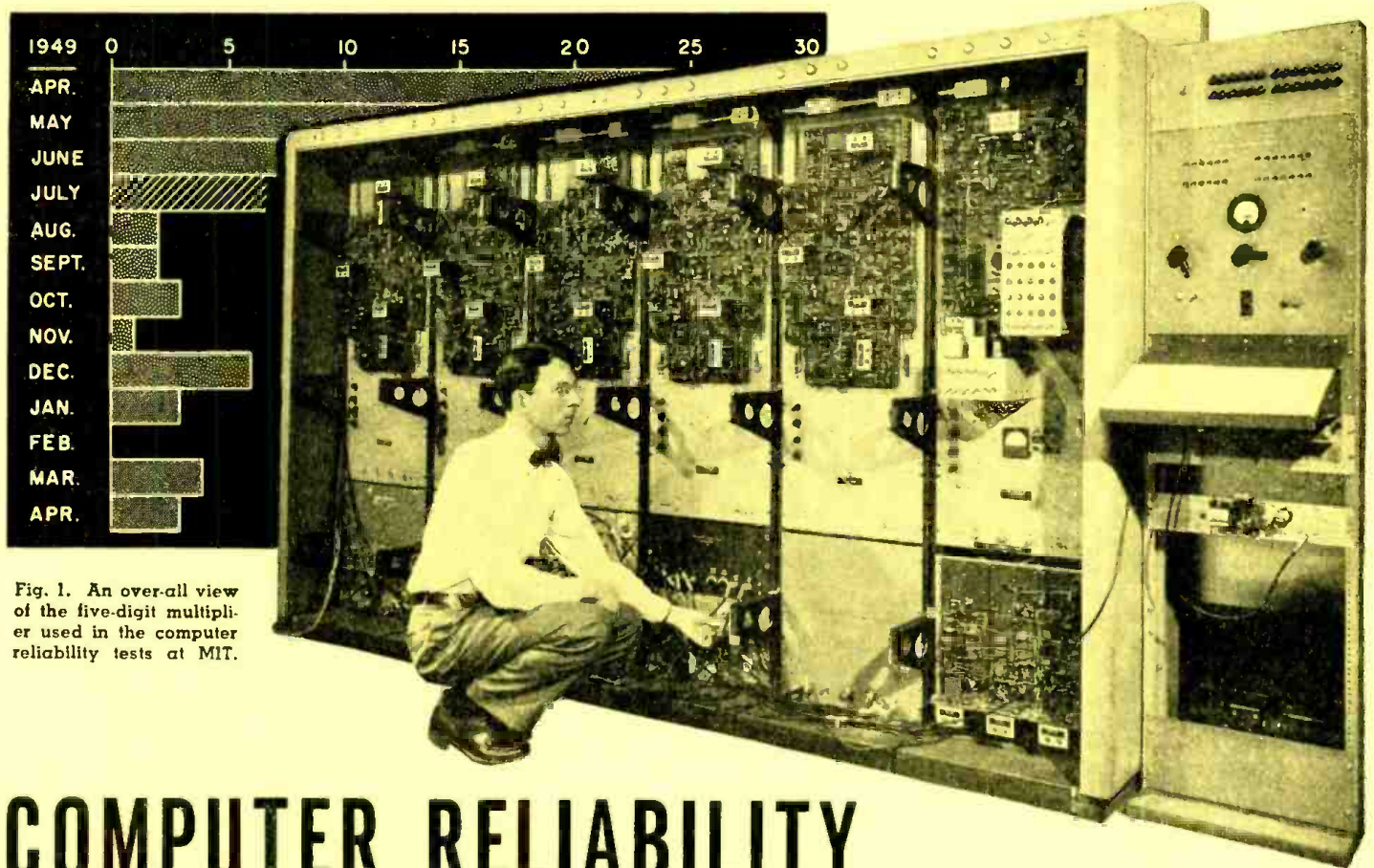


Fig. 1. An over-all view of the five-digit multiplier used in the computer reliability tests at MIT.

COMPUTER RELIABILITY

By

EDWIN S. RICH and ROBERT R. RATHBONE

Digital Computer Lab., Massachusetts Institute of Technology

Performance criteria of electronic digital computers based on results of an extended 27-month life test.

MAINTEINING system reliability in a large digital computer is a far different problem from that encountered in the operation of radar, television, and other communication systems. A stray pulse or an intermittent failure of any one of thousands of electrical components, for example, may cause a circuit to function improperly and thereby invalidate all subsequent calculations. The engineer who enters the field of electronic computation must therefore adopt an entirely new concept of system reliability, based on the elimination of single errors. Unfortunately, he cannot find the criteria for implementing this concept in any textbook; he must learn them gradually from the experience of others and through his own cut-and-try methods.

The purpose of this article is to place on record the results of a 20,000-hour reliability run of a prototype digital computer, in which the goal was error-free operation for extended periods. Although this life test does not offer a specific answer to every question

it raises, the findings may give the reader a point of departure for developing his own philosophy on the subject.

Five-Digit Multiplier

Before the construction of the MIT Whirlwind I electronic computer* could be completed, it was essential that pertinent data be obtained on the reliability of basic circuits and the life expectancy of vacuum tubes and other components. Since no information on the extended operation of a system such as the Whirlwind could be found in the literature, a five-digit multiplier (Fig. 1) was built as the proving ground for the new pulsed circuits and components.

A short description of the multiplier will aid the reader in understanding the discussion of the life test which follows. The logical design of this prototype computer is shown in Fig. 2. The arithmetic element uses 275 vacu-

*A high speed digital computer sponsored by the Office of Naval Research.

um tubes, 350 crystal rectifiers, 800 resistors, 675 capacitors, 100 pulse transformers, and 80 r.f. chokes. Design was limited to one arithmetic process because the circuits and techniques are similar for each process; multiplication was chosen because of the strict circuit requirements it imposes. Storage and input-output elements were not stressed and appear in the simplest forms: toggle switches, push buttons, and indicator lights. The control was built from special pulse-control test equipment developed at MIT* and contains approximately 100 vacuum tubes and 950 other components.

When two numbers are to be multiplied, they are inserted manually into the registers of toggle-switch (T-S) storage. The numbers are read into the arithmetic registers and multiplication is executed by 0.1-microsecond pulses. A control switch provides for either automatic (2-mc.) or step-by-step (push-button) operation. Results are displayed in binary notation by flip-flop indicator lights.

A preventive-maintenance scheme, called "marginal checking," was built into the system in order to detect deteriorating components before they could cause errors in computations. (The rack at the extreme right in Fig. 1 holds these circuits.) The function of marginal checking is to vary certain

*Described in the Aug., 1951, through February, 1952, issues of RADIO-ELECTRONIC ENGINEERING.

pulses. For amplification of the secondary emission, it is expedient for the inner surface of the receiving plate to be covered by a special layer which possesses great secondary emission.

The method of obtaining a visible picture may be altered, as shown in Fig. 3(A). Here, the piezoelectric quartz plate (1) serves as the base of the vacuum triode (2). An ultrasonic beam falls on the outer surface of the piezoelectric plate (1), the inner surface of which is covered by a photosensitive layer. Under the action of the ultraviolet beam (3), uniformly illuminating the inner surface of the plate, photoelectrons are emitted which—accelerated by the application of an electrical field—pass through the system of magnetic and electrical lenses (4) and fall on the fluorescent screen (5). On the screen, as in the usual electron microscope, only the image of the source of electrons may be seen—in this case, the image of the distribution of photoelectric emission from the surface of the piezoelectric plate (1). Distribution of photoemission on the surface of the plate is in precise conformance to the distribution of the piezoelectric charge, which reproduces the configuration of the ultrasonic field. On the screen (5), the image of the ultrasonic field can be seen; this is a repetition of the image of the object, established by the ultrasonic field, in conformance with the magnified scale.

The resolution capability in this case is dependent on the length of the ultrasonic wave, on the thickness and dielectric property used in the piezoelectric plate, and on the construction of the lens system. Ultraviolet radiation, illuminating the quartz plate, can be replaced by a homogeneous electron cluster.

Another version of the ultrasonic microscope is illustrated by Fig. 3(B). This, as in the preceding version, depicts the object received in magnified scale on the screen (5). However, in

this scheme, the screen (5) consists of a thin plate on which a photosensitive mosaic layer is drawn, causing secondary electrons under the action of falling electrons to be collected on the annular anode (6). Electrons in the beam (7) fall on the screen (5) and, as in the usual television tube, move line and frame, equalizing in such a manner on the screen (5) as to form an image of the object by electrical potential. The change in secondary-electron emission is amplified and passed to the second tube, in which the cathode beam movement is synchronized with the cathode beam (7). In this case, the image of the object is received on the screen of the second tube.

It should be noted that the capabilities have to be determined not only from the facts mentioned above but also by additional factors of another kind, primarily by the complexity of the vibrations of the quartz plate which is excited by different types of ultrasonic beams; the action of these beams induce not merely longitudinal waves but also transverse and surface waves, which will distort the image. Use of the quartz plate is accomplished by special cuts and choice of the proper method of strengthening (border conditions), which may be diametrical, and the surface waves in the quartz plate are greatly attenuated to increase the clearness of the picture. Applications for the ultrasonic microscope evidently are diversified enough and have sufficient possibilities to warrant rapid growth in this field.

Now to the description of the experimental performance of the ultrasonic microscope in scientific laboratories:

In Fig. 4, a metallic object is shown immersed in an opaque liquid (magnified ten times).

Figure 5 illustrates a glass rod and glass tube of equal dimensions. In the rod, the clear space shows ultrasonic waves partially suppressed. The tube displays uniform illumination, as the

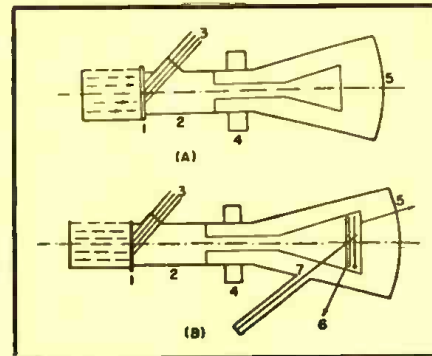


Fig. 3. Two alternate versions of the ultrasonic microscope. (A) Image is formed by acceleration of secondary electrons from treated surface of quartz plate 1. (B) Image is formed by electron beam 7 which scans element 6.

ultrasonic ray does not pass across the tube. Therefore, the shape, with the help of the ultrasonic microscope, may be distinguished by the presence of a capillary.

In Fig. 6, the rod and tube are again shown, illuminated by a different type of ultrasonic ray. This discriminates between particles illuminated with different intensities and therefore depicts alterations.

With the ultrasonic microscope, especially good observations may be made of structures. It must be determined which structure of the ultrasonic wave will give exactness of transmission without a type of deformation. When the radiating quartz plate oscillates in the fundamental mode, and no object is being examined, a light even spot is obtained. For oscillations above the fundamental, a nonuniform illumination results.

In the ultrasonic microscope, the object conforms to the tube, bound with the ultrasonic wave, and the image conforms to the transmission tube, on the screen of which the object is seen. One form of an ultrasonic microscope is shown in Fig. 1.



Fig. 4. Ultrasonic microscope image of metallic loop immersed in opaque liquid.

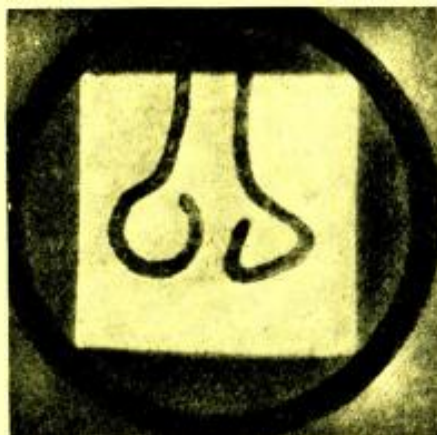


Fig. 5. Image of glass rod (left) and tube (right) in a homogeneous field.



Fig. 6. Glass rod (left) and tube (right) in a nonhomogeneous ultrasonic field.



ULTRASONIC MICROSCOPE*

Translated by
GILBERT B. DEVEY
 Office of Naval Research

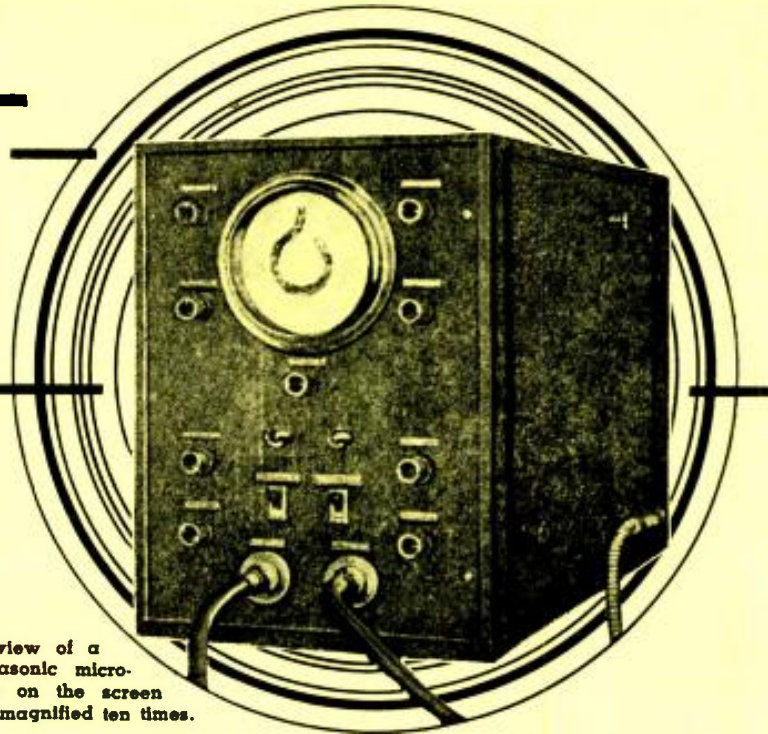
THE successful development of ultrasonics and the obtaining of very short ultrasonic waves, of the order of the wavelength of visible light, has led to the development of an ultrasonic microscope with which it is possible to view the picture of an object in magnified scale. Inasmuch as nearly all bodies in nature are transparent to ultrasonic waves, the ultrasonic microscope is expected to have a very wide field of application. Its principle of operation may be found in the proposal of S. Y. Sokolov in 1936 (U. S. patent 2,164,125, issued June 27, 1939).

Operation of the ultrasonic microscope may be described as follows. A narrow beam of ultrasound is bunched (Fig. 2), and radiated by a piezoelectric quartz plate (1) to illuminate the object under examination (2). Reflections of the ultrasonic beam from the object fall on an acoustical collector lens (3), the focus of which is set for reception at (4), consisting of a piezoelectric (e.g., quartz) plate.

The reception plate is located at the base of the tube (8). The narrow beam of the cathode rays (7), inside the cathode ray tube, falls on the inner surface of the narrow plate and dislodges secondary electrons, which are then collected by the anode (9).

Under the action of the charge, the image on the inner surface of the narrow plate comes from the region of the ultrasound, and secondary electrons are emitted when the surface of the plate is made to undergo a change. This change of secondary emission results in greater current acting on the anode (9), the magnitude being increased by special amplifiers and passed to the modulator arrangement of the cathode of the tube (6). Then the intensification of the cathode beam in the tube (6) causes a fluctuation which conforms to the variation of secondary emission from the

Fig. 1. Over-all view of a developmental ultrasonic microscope. The picture on the screen shows a wire loop magnified ten times.



Ultrasonic waves have been successfully used as the source of illumination in a microscope.

surface (4). This is accomplished by the television method of synchronism of motion by lines and frames of the cathode beams of the tubes (6) and (8). The screen of the cathode tube (6) then shows the semblance of a picture as distributed by the electrical charge on the receiver plate (4).

Piezoelectric charges appear on the surface of the quartz plate at the same points where deformation has taken place. Therefore, a picture is distributed on the surface of the quartz plate in exact conformance to the ultrasonic field in the focal plane of the lens (3).

Inasmuch as the configuration of the ultrasonic field in the focal plane in its line of conformance portrays the object, this object is immediately seen on the screen of the tube (6). Transposition of the object understandingly gives the appearance of transference of its image to the screen.

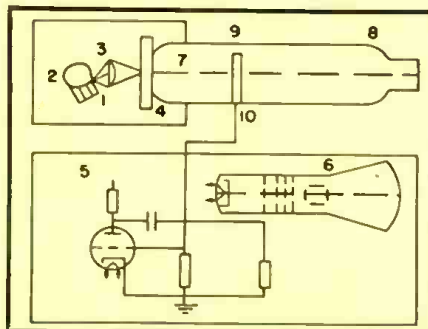
Magnification of the image, given in the description of the system, is determined by the ratio of the linear dimensions of the cathode tubes (6) and (8). Calculations show that in the ultrasonic microscope magnification approaches the order of tens of thousands of times. The resolving capacity depends on the cross-sectional area of the cathode beam in the tube (8), parameters of the piezoelectric plate, and length of the ultrasonic waves.

Experiment shows that a frequency of 10^9 cycles can be obtained without particular difficulty and that there is a good possibility of obtaining a frequency of 10^{10} cycles. In water, the length of ultrasonic waves at a frequency of 3×10^9 cycles is equal to 5×10^{-5} cm., i.e., the wavelength of visible light. At that frequency, the resolving power of the ultrasonic microscope may reach an extreme, close to the resolving power of the optical microscope.

For capillary waves, the speed of diffusion is considerably less; and the wavelength accordingly is much smaller than the wavelength of visible light. Consequently, if the radiation type of capillary waves can be obtained at higher frequencies in the future, there will be an opportunity to increase the resolution capacity of the ultrasonic microscope by one or two orders to compare with the best optical microscope.

The objects under examination can be illuminated with a continuous ultrasonic beam as well as with single im-

Fig. 2. Diagram illustrating the principle of operation of the microscope.



*Translated from an article entitled "The Ultrasonic Microscope" by S. Y. Sokolov which appeared in the Russian Journal "Progress in Physical Science," Vol. XI, Jan., 1950.

Controls may be added for additional individual adjustment, usually taking the form of resistors in the circuit. However, it should be noted that coefficient a_2 of (3) appears in the results of (7) and (8). Any additional resistance added to the circuit for adjustment purposes has the effect of linearizing the circuit, reducing the value of a_2 , and thus lowering the sensitivity of the circuit when used as a wattmeter.

Since three coefficients appear in the series (3), three independent adjustments are theoretically needed. These additional adjustments may be obtained by use of triodes or pentodes with grid bias controls, but the over-all result is not changed—to achieve and maintain a match of volt-ampere characteristics over an applied voltage range of possibly 50 to 1 is not a practical matter with commercial tubes.

Use of Thermocouples

It should be noted that the important property required of this circuit is its ability to square, or cross-multiply, the input voltages, since it is only the squared term of (3) which leads to the result of (7) or (8). Another electrical device that inherently employs this squaring property is the thermocouple, as its output is obtained from heat or i^2R input to its heater.

Actually, the thermocouple has been employed for many years as a squaring device in a wattmeter, sometimes used in the electric utility industry. When so used, the device is known as a Lincoln "thermal converter" wherein a d.c. electromotive force is generated proportional to load watts, this d.c. electromotive force then being telemetered or transmitted over telephone lines to a distant point where the power is indicated or recorded.

The desired squaring property is present in the thermocouple together with certain disadvantages, such as limited overload capacity, slowness of response, low heater resistances, and thus rather large current inputs. By using electronic amplifiers and techniques in the thermal converter circuit, it is possible to overcome all of these disadvantages except the slowness of response. This can be controlled to some extent by the selection of very small thermocouples of low heat capacity, and an anticipating electrical circuit can be added if needed.

Thermal Converter

The principle of the thermal converter is illustrated in Fig. 2, from which it can be seen that this unit is fundamentally the same as the electronic unit of Fig. 1. Thermocouples are employed to square the respective sum and difference input voltages, and to subtract the outputs, leaving a net

current through the microammeter M which is proportional to power in the load circuit. In Fig. 2, H indicates heater connections, C the couple connections; vacuum-mounted thermocouples are preferred.

There is one objection to the use of the simple circuit of Fig. 2. Theory indicates that the circuit has maximum power sensitivity when voltages E_1 and E_2 of (8) are equal. Since it is not usually desirable to make the series voltage drop of IR_2 equal to the line voltage E , because of excessive losses, some form of amplification of voltage $E_2 = IR_2$ is desirable. In order to reduce the loading effect of the wattmeter on the circuit to a minimum, an electronic amplifier is indicated. It should be pointed out, however, that the amplifier will only be required to be linear, all squaring or nonlinearity of characteristics being a function assigned to the thermocouples.

The Wattmeter Circuit

The circuit of the amplifier incorporated between the shunts and the two thermocouples is shown in Fig. 5. A 50:1 step-up transformer is used across the shunts, as this seemed an easy way to obtain isolation and a voltage increase. Shunt values are chosen to produce 20 millivolts at full-load current, and the line voltage is taken off the shunted potentiometer at a point providing one volt maximum. It is realized that the use of good transformers is necessary at this point if wide frequency response is to be obtained. However, if a poor transformer is used, its performance can be considerably improved by shunting the secondary with a loading resistor.

The first amplifier stage is conventional. The second stage employs two

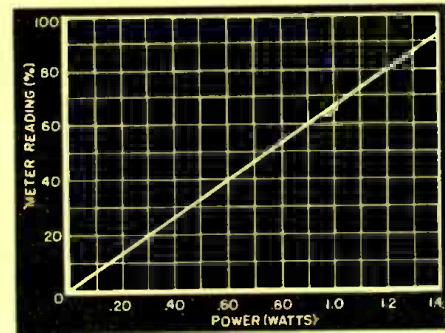


Fig. 3. Typical calibration curve.

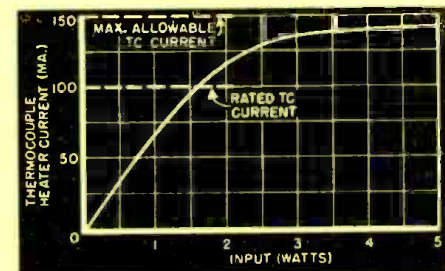
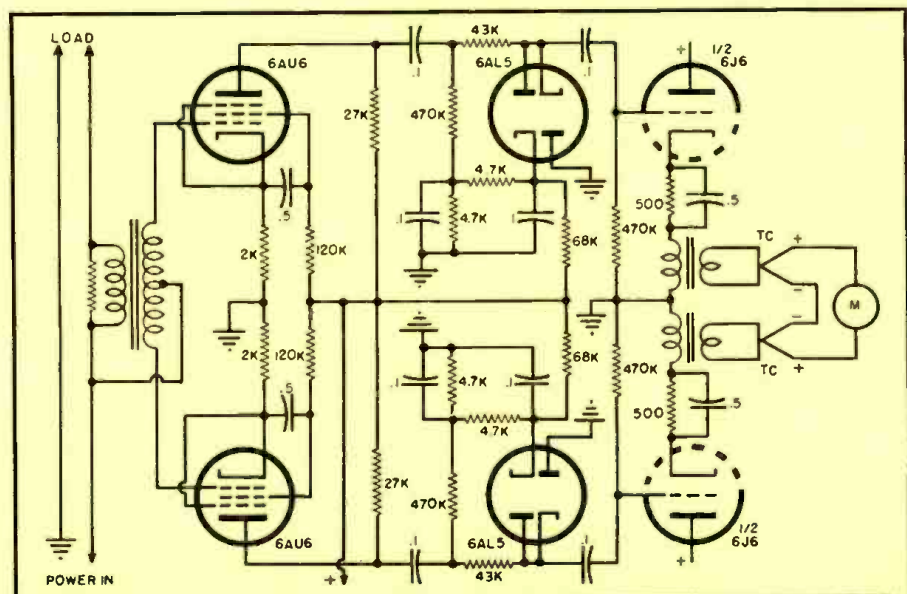


Fig. 4. Performance of vacuum tube limiters in preventing the thermocouples from burning out.

6J6 tubes, with halves paralleled, and with cathode-follower output. This form of output provides much wider frequency response from a given transformer than if the more usual plate output were used. In this case, the transformers are needed for matching the relatively low-resistance thermocouple heaters (2 ohms, 100 ma.) to the 6J6 tubes, and low-cost tube-to-voice coil transformers were found to be satisfactory.

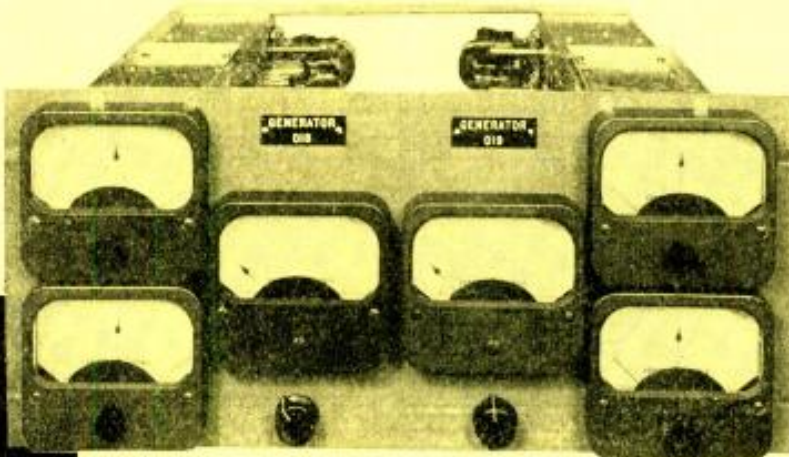
It should be noted that this is not a push-pull amplifier since the two side channels are amplifying different signals ($e - iR_2$ and $e + iR_2$), and no cou-
(Continued on page 20)

Fig. 5. Schematic diagram and parts values for the complete instrument.



A THERMOCOUPLE A.F. WATTMETER*

By
J. D. RYDER
 and
M. S. McVAY
 University of Illinois



Instrumentation for an analog computer. Central instruments are electronic voltmeters and outer vertical pairs are wattmeters.

By using electronic amplification, many disadvantages of the thermocouple for measuring power are overcome.

AUDIO-FREQUENCY power measurements have usually been made by dissipation of the power in a known resistive load, since few audio-frequency wattmeters have been available. Numerous proposals appear in the literature covering low-burden electronic instruments which usually employ some form of square-law circuit, as in Fig. 1, but practical forms of the instrument have rarely appeared.

Usual Theory

It can be seen that the input to diode (or triode) V_1 in Fig. 1 is:

$$e_1 = e - iR_2 \quad (1)$$

and the input to diode V_2 is:

$$e_2 = e + iR_2 \quad (2)$$

where e is the instantaneous value of voltage applied to the load, and i is the instantaneous value of current flowing to the load. Resistors R_2 are assumed small and equal.

In the usual manner, if the diodes

have identical volt-ampere curves given by:

$$i = a_0 + a_1e + a_2e^2 \quad (3)$$

then the anode current of V_1 is:

$$i_1 = a_0 + a_1e - a_1iR_2 + a_2e^2 - 2a_2eiR_2 + a_2i^2R_2^2 \quad (4)$$

The anode current i_2 of V_2 differs only in that the two negative signs become positive.

The output or load circuit is acted upon by the difference of currents i_1 and i_2 , and it is apparent that all positive terms appearing in both equations will cancel, leaving only a result equal to twice that of the negative terms in (4). Thus:

$$i_{out} = i_2 - i_1 = 2a_1iR_2 + 4a_2eiR_2 \quad (5)$$

If the applied electromotive force is sinusoidal, or $e = E_1 \sin \omega t$ and $i = I \sin (\omega t + \theta)$, where θ is the power factor angle of the load, then the output current is:

$$i_{out} = 2a_1IR_2 \sin (\omega t + \theta) + 4a_2E_1IR_2 \sin (\omega t) \sin (\omega t + \theta) \quad (6)$$

If $IR_2 = E_2$, the above becomes by expansion:

$$i_{out} = 2a_1IR_2 (\cos \theta \sin \omega t + \sin \theta \cos \omega t) + 2a_2E_1IR_2 (\sin \theta \sin 2\omega t - \cos \theta \cos 2\omega t) + 2a_2E_1IR_2 \cos \theta \quad (7)$$

If this difference current is applied to a d.c. or average reading instrument M , only the last term of (7) will deflect the meter, since the first two terms represent a.c. currents. These may be bypassed around M by a suitable capacitor.

If $IR_2 = E_2$, then the instrument M is deflected by a d.c. current of value:

$$i_M = 2a_2E_1E_2 \cos \theta \quad (8)$$

which is proportional to the average load power, angle θ being the load power factor angle. Thus meter M becomes an indicator of average load power.

Reasons for Dissatisfaction

Certain assumptions have been made in reaching the above results, and these are:

- The two tubes have identical volt-ampere curves, or pass identical currents for all values of applied voltage.
- The matching of (a) exists throughout the life of the tubes, and for all values of heater voltage.
- The tube volt-ampere curve is accurately expressed by (3), and no higher power terms are present.

In practice, it has been impossible to find or to maintain tubes or crystals meeting these assumptions, such that power measurement accuracies of better than 5% can be achieved without severely restricting the load current or voltage to a very small range. Two tubes or two crystals may be matched to equal quiescent currents or values of a_0 , by adjustment of the tap on R_1 , but balanced currents will probably not be obtained at other applied voltages. This action, of course, indicates unequal values of a_1 and a_2 .

*This article is based on a paper presented in Chicago at the 1952 National Electronics Conference, held Sept. 29, 30 and Oct. 1.

Fig. 1. Basic form of the square-law circuit used for power measurement.

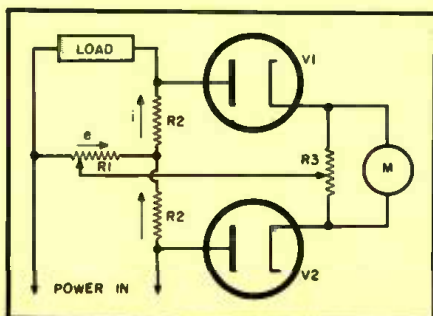
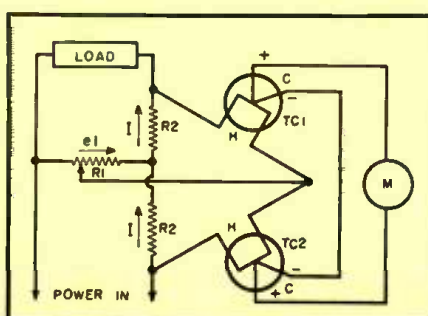
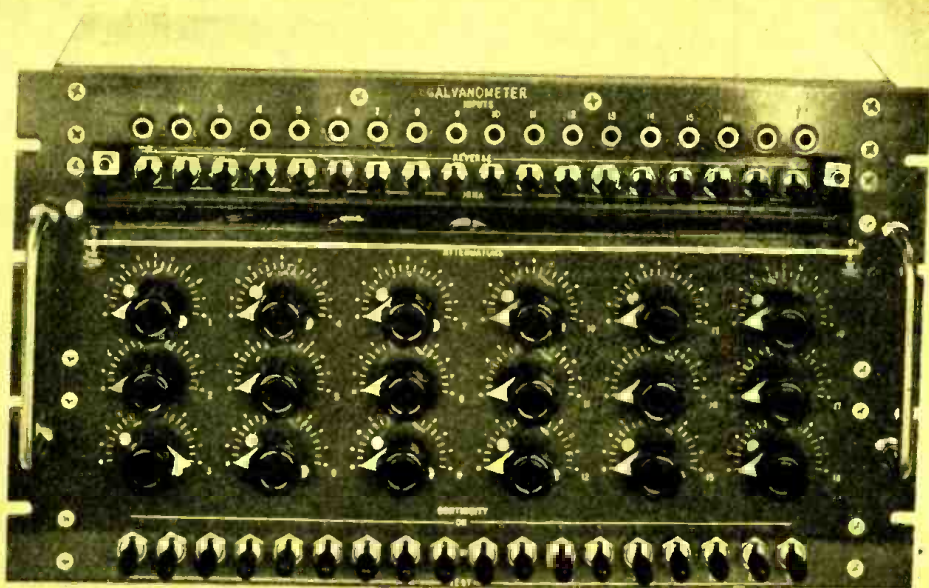


Fig. 2. Schematic diagram showing basic principles of thermal converter.





A technician is adjusting the position of a galvanometer in the oscillograph.



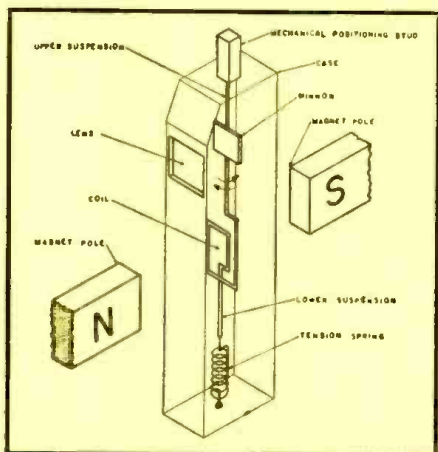
Front view of galvanometer panel, showing function controls as well as polarity switches which are recessed and normally protected by the hinged cover plate.

2. Good sensitivity (low frequency, 0.033 ma./in.; high frequency, 40 ma./in.)
3. Wide frequency response (0-2000 cps)
4. Rugged construction (suitable for field, mobile or airborne installations)
5. Accuracy (1%)
6. Replaceability (electrically and mechanically interchangeable)
7. Cost (\$100 to \$150 each)

Damping

The suspension of the galvanometer is a free moving element, so that its action under forced vibration follows all the theory and formulas pertaining to such motion. Of primary concern to the user is the motion of the element when a signal is applied. The mass of the movement and its inertia will distort the motion of the recorded output in relation to the input if rapid changes occur. Thus, the damping

Pictorial cutaway illustration of a typical D'Arsonval galvanometer element.



characteristics of the element as associated with its circuitry should be understood.

Basically, two fundamental damping mediums are used: (1) fluid damping, i.e., the suspension rotates within a viscous fluid, and (2) electromagnetic damping, which utilizes the back emf generated by the coil moving in a magnetic field. Actually, any galvanometer has additional damping effects produced by both mediums since the air in which an electromagnetically damped galvanometer moves produces some of the fluid damping effects, and the source impedance of a fluid damped galvanometer furnishes electromagnetic damping. The total damping is the arithmetical sum of all the per-unit dampings of the particular system.

Damping is used mainly to control the frequency response but it also introduces a phase shift (very slight), protects the galvanometer from violent over swings, and controls the time required to respond to sudden changes in current.

Normally, 0.64 per-unit damping or 64% of critical damping is used since it produces maximum frequency range with minimum inherent error. Unfortunately, many users procure galvanometers and standard shunts without realizing that circuitry associated with the galvanometer may at times seriously alter the damping characteristics.

Frequency Response

Whether electromagnetic or fluid damping should be used is mainly determined by the frequency response required and the driving current available. The electromagnetic type is generally more desirable since it normally has higher sensitivity and a far lower temperature coefficient. With the pres-

ent manufacturing techniques, it can be shown by the following basic formula that the limiting factor for electromagnetic galvanometers is the frequency response:

$$R = K/F$$

where R is the shunt resistance in ohms, K a constant of construction and installation, and F the frequency.

From the above, it is easy to understand how the shunt resistance R becomes lower in value as the frequency F is increased. Table 1 has been prepared from values in one of the instruction manuals furnished with a commercial recording oscillograph. Actually, the shunt resistance will never become zero but its value will become less than the internal resistance of the galvanometer and its low sensitivity will render it useless, fluid damping then being necessary.

The present oscillographs utilize a magnetic block to provide proper flux density for all the galvanometers in the instrument. Thirty-six galvanometer element installations are common in blocks of about four or five inches long. The frequency response range, linear $\pm 5\%$ at 64% of critical damping, of commercially available galvanometers is from 0-2000 cps. Greater sensitivity is obtainable by selecting elements—whenever possible—that have a flat re-

Table 1. Relationship between response, the shunt resistance, and sensitivity.

Frequency Response (cps)	Shunt Resistance (ohms)	Sensitivity (ma./in.)
0- 60	350	0.033
0-100	180	0.035
0-180	83	0.040

GUIDED MISSILE DATA RECORDING

By
JAMES B. WYNN, JR.*
and
SAM L. ACKERMAN**

Air Force Missile Test Center
Patrick Air Force Base

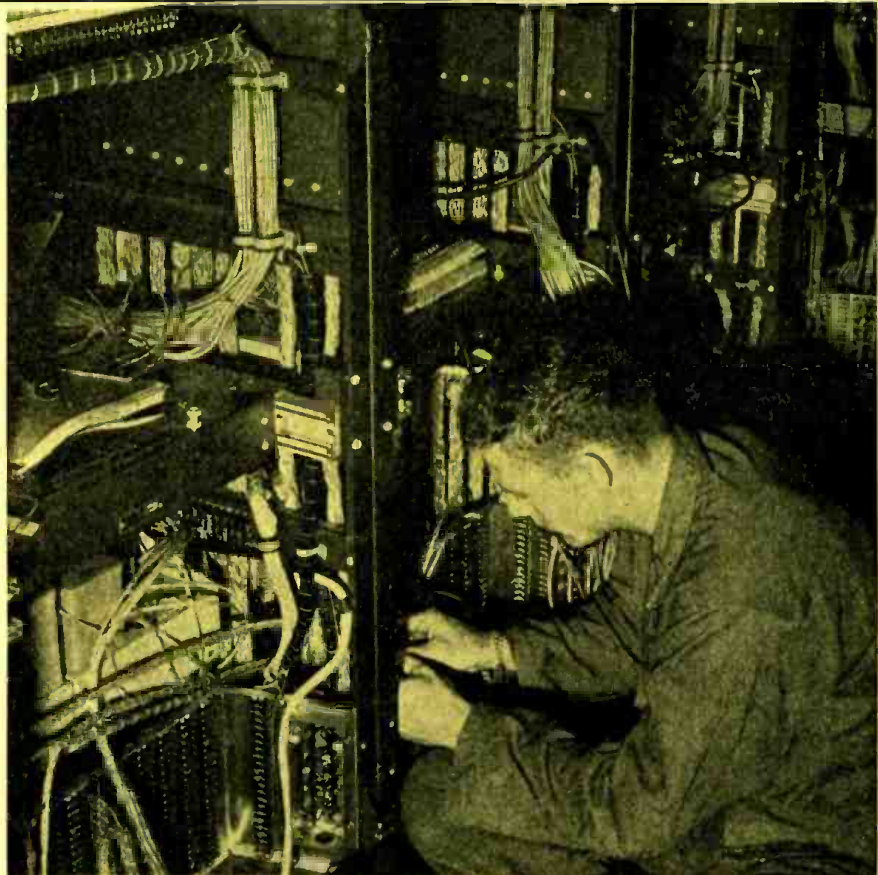
THOSE in nearly every craft or profession have at one time or another had the occasion to record data. In the fields of electricity and electronics, perhaps the furthest advances have been made in precision data indicating and recording of scientific phenomena. The recording oscillographs, utilizing galvanometer elements, provide an ideal means for observing and recording static and dynamic data, and will be the main subject of this article. Auxiliary or accessory equipment recently developed to provide flexibility and standardization of installation and operating techniques at one of the advanced missile radio telemetry stations at the Air Force Missile Test Center, Patrick Air Force Base, Florida, will be discussed in detail.

The Recording Oscillograph

For those not familiar with this type of recorder, it may be well to describe in some detail the fundamental aspects of this instrument. No doubt the oscillograph which would normally come first to mind would be a conventional electronic unit with a scope tube on the front, similar to the common TV set, and with a camera focused on the oscilloscope tube. However, as mentioned before, the equipment to be discussed uses a galvanometer as the active indicating element. The recording oscillograph is really quite simple—it is composed of a light source, a mirror moved by a sensitive meter movement to reflect the light, and a photosensitive medium to record the reflected light beam.

A review of the recording galvanometer oscillograph manufacturers listed in business guides indicates that this is a multi-million dollar enterprise. However, only a few of the available manufacturers produce recorders satisfactory for extensive use, and for precise measurements in the field of missile or aircraft testing. Most of the reasons for this will become self-evident, and a survey will show that

*Chief, Telemetry Section, Technical Systems Lab.
**Major, USAF; Chief, Internal Electronic Engineering Branch, Technical Systems Lab.



A bay of oscillograph racks being installed at the telemetry receiving site.

Photographic oscillographs are widely used to record data obtained from telemetering systems.

some of the mechanical and electrical characteristics of a few far surpass the others.

The Galvanometer

The galvanometer element, which on occasion may have been presented too mysteriously, is in reality a d'Arsonval meter movement without any pointer; a small mirror replaces the pointer. The movement of a current-carrying wire in a magnetic field is one of the basic concepts of electromagnetic theory and this principle is utilized in converting the electrical energy into mechanical energy in the galvanometer. Degree of force or motion produced is mostly dependent upon the flow of electrons, the number of turns of the conductor, and the strength of the magnetic field. Thus, with the present design, a compact element exists which very conveniently converts the flow of electrons to the proportional movement

of a mirror. The moving beam of light reflected from the mirror is then projected on a ground glass screen for viewing, calibration and setup purposes, and is simultaneously projected onto photographic material to preserve the data permanently.

Main components required to make up the galvanometer are: a coil of wire, a suspension for positioning the coil of wire, a mirror, and a case or shell. Of course, the galvanometer must be positioned in a magnetic field for operation, but this magnet is separate and external for operational reasons. A photo-optical system is used in conjunction with the mirror since it provides the means for producing a record without extracting any appreciable energy from the galvanometer. Characteristics of the galvanometers in general use conform to the following:

1. Small size (approximate dimensions: $\frac{1}{8}$ " to $\frac{3}{16}$ " by 2" to $2\frac{1}{2}$ ")



PERMALLOY DUST TOROIDS FOR MAXIMUM STABILITY...

The UTC type HQ permalloy dust toroids are ideal for all audio, carrier and supersonic applications. HQA coils have Q over 100 at 5,000 cycles... HQB coils, Q over 200 at 4,000 cycles... HQC coils, Q over 200 at 30 KC... HQD coils, Q over 200 at 60 KC... HQE (miniature) coils, Q over 120 at 10 KC. The toroid dust core provides very low hum pickup... excellent stability with voltage change... negligible inductance change with temperature, etc. Precision adjusted to 1% tolerance. Hermetically sealed.



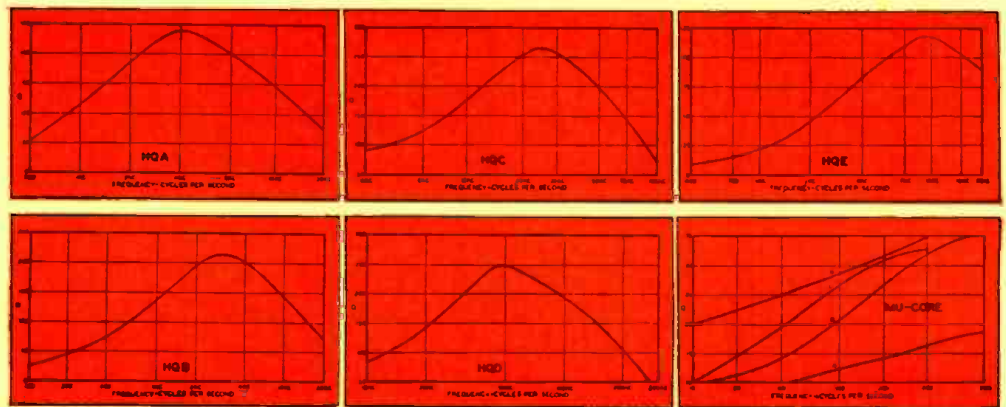
HQA, HQC, HQD CASE
1 13/16" Dia. x 1 3/16" High



HQB CASE
1 5/8" x 2 5/8" x 2 1/2" High



HQE CASE
1 1/2" x 1 5/16" x 1 3/16" High

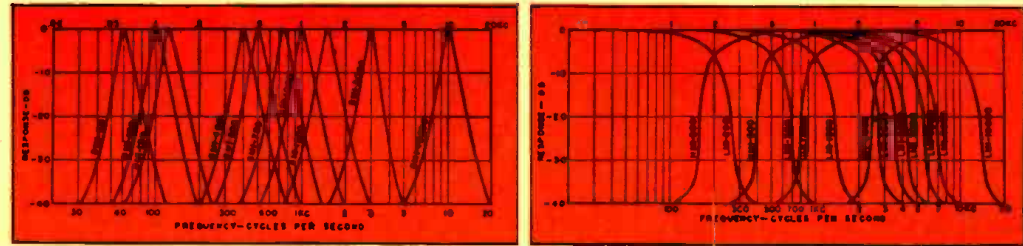


Type No.	Inductance Value	Net Price	Type No.	Inductance Value	Net Price	Type No.	Inductance Value	Net Price
HQA-1	5 mhy.	\$7.00	HQA-16	7.5 hy.	\$15.00	HQC-1	1 mhy.	\$13.00
HQA-2	12.5 mhy.	7.00	HQA-17	10. hy.	16.00	HQC-2	2.5 mhy.	13.00
HQA-3	20 mhy.	7.50	HQA-18	15. hy.	17.00	HQC-3	5 mhy.	13.00
HQA-4	30 mhy.	7.50	HQB-1	10 mhy.	16.00	HQC-4	10 mhy.	13.00
HQA-5	50 mhy.	8.00	HQB-2	30 mhy.	16.00	HQC-5	20 mhy.	13.00
HQA-6	80 mhy.	8.00	HQB-3	70 mhy.	16.00	HQD-1	.4 mhy.	15.00
HQA-7	125 mhy.	9.00	HQB-4	120 mhy.	17.00	HQD-2	1 mhy.	15.00
HQA-8	200 mhy.	9.00	HQB-5	.5 hy.	17.00	HQD-3	2.5 mhy.	15.00
HQA-9	300 mhy.	10.00	HQB-6	1. hy.	18.00	HQD-4	5 mhy.	15.00
HQA-10	.5 hy.	10.00	HQB-7	2. hy.	19.00	HQD-5	15 mhy.	15.00
HQA-11	.75 hy.	10.00	HQB-8	3.5 hy.	20.00	HQE-1	5 mhy.	6.00
HQA-12	1.25 hy.	11.00	HQB-9	7.5 hy.	21.00	HQE-2	10 mhy.	6.00
HQA-13	2. hy.	11.00	HQB-10	12. hy.	22.00	HQE-3	50 mhy.	7.00
HQA-14	3. hy.	13.00	HQB-11	18. hy.	23.00	HQE-4	100 mhy.	7.50
HQA-15	5. hy.	14.00	HQB-12	25. hy.	24.00	HQE-5	200 mhy.	8.00

UTC INTERSTAGE AND LINE FILTERS



FILTER CASE M
1 3/16 x 1 11/16,
1 5/8 x 2 1/2 High



These U.T.C. stock units take care of most common filter applications. The interstage filters, BMI (band pass), HMI (high pass), and LMI (low pass), have a nominal impedance at 10,000 ohms. The line filters, BML (band pass), HML (high pass), and LML (low pass), are intended for use in 500/600 ohm circuits. All units are shielded for low pickup (150 mv/gauss) and are hermetically sealed.

STOCK FREQUENCIES
(Number after letters is frequency)
Net Price \$25.00

BMI-60	BMI-1500	LMI-200	BML-400
BMI-100	BMI-3000	LMI-500	BML-1000
BMI-120	BMI-10000	LMI-1000	HML-200
BMI-400	HMI-200	LMI-2000	HML-500
BMI-500	HMI-500	LMI-3000	LML-1000
BMI-750	HMI-1000	LMI-5000	LML-2500
BMI-1000	HMI-3000	LMI-10000	LML-4000
			LML-12000

United Transformer Co.
150 VARICK STREET • NEW YORK 13, N. Y.

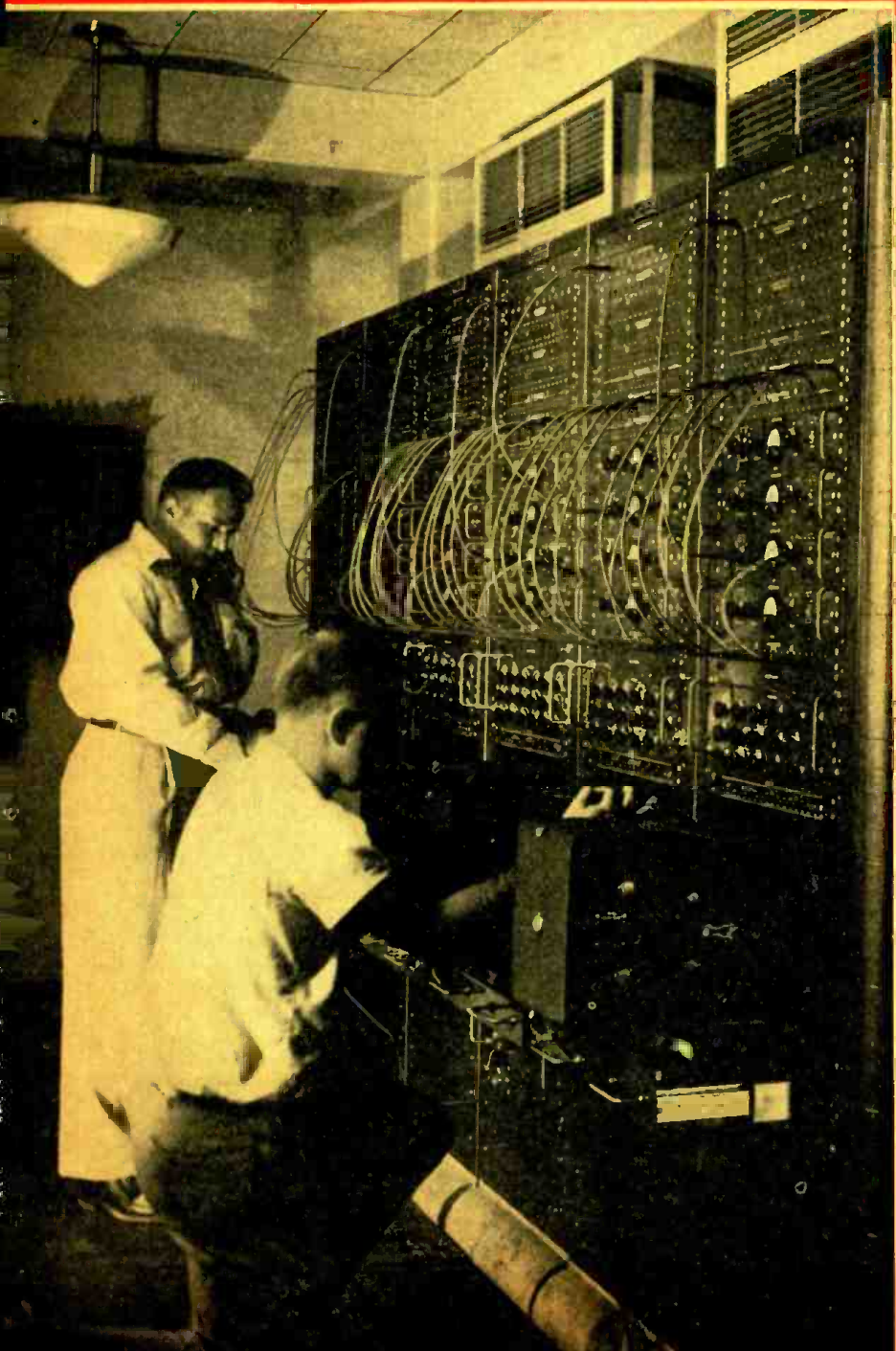
EXPORT DIVISION: 13 EAST 40th STREET, NEW YORK 16, N. Y. CABLES: "AMTAB"

RADIO-ELECTRONIC *Engineering* SECTION

**RADIO &
TELEVISION
NEWS**

Reg. U.S. Pat. Off.

TELEVISION • RADAR • ELECTRONICS • RESEARCH • COMMUNICATIONS • MICROWAVES



FEBRUARY, 1953

GUIDED MISSILE DATA RECORDING
3

A THERMOCOUPLE A.F. WATTMETER
6

ULTRASONIC MICROSCOPE
8

COMPUTER RELIABILITY
10

FUNDAMENTAL CHARACTERISTICS
OF DIGITAL AND ANALOG UNITS
13

IRE CONVENTION PROGRAM
32

DEPARTMENTS

NEW PRODUCTS 16

NEW TUBES 18

PERSONALS 20

NEWS BRIEFS 22

NEW LITERATURE 24

LOOKING AT TUBES 26

TECHNICAL BOOKS 30

CALENDAR 30



Copyright, 1953, by IRE-Davis Publishing Co.

RADIO-ELECTRONIC ENGINEERING is published each month as a special section in a limited number of copies of RADIO & TELEVISION NEWS by the IRE-Davis Publishing Company, 366 Madison Avenue, New York 17, N. Y.

Edited by H. S. RENNE
and the Radio & Television News Staff

Technicians making final oscillograph calibration adjustments on guided-missile data recording equipment at Patrick Air Force Missile Test Center. Mr. J. Wynn, Jr., co-author of article on P. 3, is at left.

EVERYBODY'S TALKING ABOUT NEWCOMB'S "AUDI-BALANCE"

PATENT APPLIED FOR

"The greatest amplifier improvement in recent years" . . . A godsend to both owner and service man." . . . "It used to take me hours to do what Audi-balance does in seconds." . . . "Does even better than I've been able to do with meters, this balances tubes dynamically." . . . "The problem has plagued us for years, it is now possible to keep perfect balance in output tubes consistently for lowest distortion." . . . "Audi-balance is the perfect solution."

Just one of the features that make the brand new Classic amplifiers by Newcomb so exciting. Write for catalog of 8 completely new home music amplifiers priced from \$39.50 to \$269.50 audiophile net.

The Classic 25

For the sound thrill of a lifetime this superb new 25 watt custom amplifier has every practical operational feature electronic engineering can offer you. Even more important is the incomparable listening pleasure it provides.



The Classic 15

This outstanding 15 watt amplifier is unique in luxury features and technical perfection at a surprisingly moderate cost. Its smartly designed remote control unit is a superlative piece of engineering, beautifully finished in brushed brass.

Substantial Installation Savings

Savings of as much as, or more than, the entire cost of these fine amplifiers are being reported by enthusiastic purchasers. This is due to their unique design which removes the usual necessity of a remote control being near the amplifier, tuner and changer. These items can now be installed in a hall closet or any similar out of the way location leaving only the beautiful remote control and

the speaker, with no messy confusion of wires, in the living room. No accessories connect directly to the remote control. All inputs connect only to the main amplifier. The savings in cabinetry and of installation labor are obvious and very real to those who take advantage of this new complete remote control design.

Write for Catalog

NEWCOMB

DEPT. F 6824 LEXINGTON AVENUE, HOLLYWOOD 38, CALIF.

15 years of quality leadership

Ernest Lawrence, who has developed a simplified tri-color tube, which will soon be demonstrated in New York again; the original model was shown a year ago. According to Resnick, Paramount has invested well over a half-million dollars in this color tube, and \$300,000 in another TV development, a subscription system, which employs a coin box to unscramble scrambled pictures as they are received over a wire or otherwise.

As this column is being prepared, the merger issue is still deadlocked and appears to be a long way from settlement.

LONG DISTANCE overseas transmission is not only a project of our Voice of America, but many European countries, too. In Belgium, two 100-kilowatt transmitters are used for French and Flemish transmissions.

Several types of antennas are used; curtains directed toward the Belgian Congo and rhombics also directed to this zone and to this country, too. A reversible rhombic is also used to beam signals to Scandinavia.

TV is attracting the attention of many new European countries, reports from the continent indicate. In Norway, a substantial sum of money has been appropriated for experimental tests on a 7-megacycle and 625-line system. It is expected that the tests will last about two years.

Extensive tests are also being conducted in Spain over the Chamartin de la Rosa station. Under consideration are the erection of TV stations at Barcelona and Bilbao.

France will expand its TV activities, and by 1958 will probably have a nationwide service featuring their 819-line system.

A NOVEL LISTENING plan is in use in Northern Rhodesia, according to EBU. About ninety community receivers are hooked up for group listening in the Lusaka area.

In the early summer of '52 a 15-kilowatt short-wave transmitter was placed in service in Rhodesia. In addition, a mobile recording unit was sent out and covered over sixteen-thousand miles, making over 1300 discs of tribal choirs and other native music.

Community listening has also been reported to be very popular in Ceylon. By the end of September of 1950, 825 receivers had been installed at different community centers, rural development society offices, preaching halls, schools, temples, cooperative stores, etc.

Community broadcasting has also been used in Bombay, Madras, and Delhi. Today there are over 4000 receivers in operation all over the country.

Most receivers are operated from batteries and thus maintenance is a problem. To provide battery power, a network of battery-charging centers is used. In Madras, there are 67 such
(Continued on page 147)

RADIO & TELEVISION NEWS



Here's The New

Model TO-4 **TEL-OHMIKE**[®] CAPACITOR-RESISTOR ANALYZER

- You'll be proud to have this completely new instrument on your service bench!
- The result of a nationwide survey of radio and television technicians makes the new TO-4 Tel-Ohmike meet your capacitor test needs to a capital "T". Trim and trustworthy, it has instant push-button range selection, magic-eye bridge balancing, safety discharge feature, direct meter readings of leakage current and insulation resistance, and a continuously adjustable test voltage for checking electrolytics at exact rated voltages.
- Two especially valuable features are the provision of a special low capacitance circuit for checking small ceramics and "gimmick" capacitors down to 1 mmf (in addition to a top capacitance range of 2000 mf) and the simplified insulation resistance circuit with a top reading of 20,000 megohms.
- See a demonstration of this new instrument at your distributor without delay!
- And the price of this new improved Tel-Ohmike is still the same Only **\$73.50** NET.



Write for full descriptive bulletin today

SPRAGUE PRODUCTS COMPANY

(Distributors' Division of Sprague Electric Co.)

51 MARSHALL STREET, NORTH ADAMS, MASS.

ANOTHER NEW DEVELOPMENT BY THE WORLD'S LARGEST CAPACITOR MANUFACTURER



**We rest our case
on evidence
you can hear**



Words can't prove the performance of this superb High Fidelity Tuner. Neither can witnesses. When it's time for a decision, your judgement of the CRAFTSMEN 10 is based on one thing: evidence you hear with your own ears. Listen—and the conclusive evidence of incomparable sensitivity and flexibility will turn your trial into a lifetime of distinctly better listening.

the
craftsmen 10
high fidelity
FM-AM tuner

- Two cathode followers furnish both audio output and detector output for remote installations.
- Built-in pre-amplifier, compensated for variable reluctance pick-ups.
- Automatic Frequency Control entirely eliminates drift, simplifies tuning.
- 5 microvolts sensitivity on both FM and AM.
- 10 kc filter on AM eliminates inter-station squeal.
- Bass and treble tone controls for boost, cut, or 20-20,000 cycle flat response.

JUDGE
THE C-500 TOO!
Williamson all-
triode circuit—
99.99% distor-
tion-free!



high fidelity by craftsmen
means distinctly better listening

For information, write to:
The radio CRAFTSMEN, Inc.
Dept. R-2, 4401 N. Ravenswood Ave.,
Chicago 40, Ill.

Spot Radio News

* Presenting latest information on the Radio Industry.

By RADIO & TELEVISION NEWS'
WASHINGTON EDITOR

THE PROJECTED TV SPAN across the nation, with stations in practically all of the states, often enthusiastically described by many in Washington and industry, seemed to be well on its way to becoming a firm reality, as the closing days of '52 appeared. With nearly 140 grants already issued to new TV operators in four-fifths of the states, and sincere promises from the Commission that hundreds more in all states would soon receive building permits, the prospects for the robust growth of TV looked bright indeed to everyone.

Whereas, only a few months ago, a few states seemed to be favored in the allocation race, nearly all were now receiving a share of the rich prize. The interesting expansion is illustrated in the partial listing of grants issued, at this writing, in the table on page 70.

In studying the table it will be noted that some existing TV areas, with v.h.f. stations, have received new stations which will be operated on the higher bands. One such market is Philadelphia, which now has three stations, and will soon have a u.h.f. station operated by WIP on Channel 29. Other cities in the new and old role are Greensboro, North Carolina and Johnstown, Pennsylvania. Here, Channels 57 and 56, respectively, will compete with the present very-high installations. The Channel 29 grant to the "City of Brotherly Love" was the first u.h.f. authorization to a major metropolitan center and represented an important trend in approvals from the processing staff. It had been felt that grants of this type would be delayed and perhaps not issued until '53. The earlier issuance was described as a major change in philosophy toward large city high-low band operation which would serve to spark sales of TV sets in areas believed riding close to a saturation point among viewers. In Philadelphia, dealers and distributors beamed when the high channel announcement appeared in the local papers. Notwithstanding the fact that the new station will not be placed in operation for some time, interest soared and sales jumped.

THEATER TV, which had a very brief airing during the late winter months of '52, became steeped in gloom as the official hearings began in '53. Many in

the theater industry felt very doubtful about the ultimate success of allocations of channels for theater circuits.

According to the general counsel for motion picture exhibitors, the Commission has shown little enthusiasm for the assignment of channels to the theater. He indicated that most of the questions asked by the Commission during the hearing seemed to indicate that the legislators were not too keen about the proposed system. It was hoped, he said, that the facts presented during the lengthier hearings will convince the Commission that the theaters should have the requested channels, and as soon as possible.

THE ROARING DEBATE in the hearing offices of the Commission concerning the merger of ABC and Paramount, which it was generally felt would taper off with the release of Hearing Examiner Leo Resnick's approval of the merger, flared up with the objections filed by the broadcast bureau of the Commission.

The Resnick report was an extremely interesting document, covering every phase of the case and revealing some intriguing data on Paramount's role in the television industry. It was noted that the motion picture producer began to study the possibilities of TV as early as 1937, when it invested in *Du Mont*. They then applied for experimental television licenses in both Los Angeles and Chicago from which developed the present stations KTLA and WBKB. The transmitters for these stations were said to be among the first built, and the antenna and transmitter at Mount Wilson near Los Angeles was noted as being the first to be established at that focal point.

The report also indicated that the flicker maker has been instrumental in the development of video recording and large-screen TV, too. They have developed a camera and projector which can record TV images almost instantaneously, after they are received, on film said to be suitable for almost immediate projection on large screens used in theaters. In addition to these activities in TV, it was said, the company has become interested in color TV, through participation in the company formed by Dr.



TRAIN **FASTER**—TRAIN **BETTER**—TRAIN **EASIER**
 IN 10 MONTHS—OR LESS—FOR
RADIO-TELEVISION
 Our 21st Year Training Men for Greater Incomes and Security in Radio-Television

I SEND YOU 18 BIG KITS

of Radio Television parts and equipment. Much of your training will be actual construction and experimentation . . . the kind of truly PRACTICAL instruction that prepares you for your Radio-Television career.



Frank L. Sprayberry
 President
 Sprayberry Academy
 of Radio

NEW! NO OBLIGATION PLAN

You Have No Monthly Payment Contract to Sign
 Pay For Your Training as You Earn and Learn

You can get into Radio-Television, today's fastest growing big money opportunity field, in months instead of years! My completely new "package unit" training plan prepares you in as little as 10 months or even less! *No monthly payment contract to sign—thus NO RISK to you!* This is America's finest, most complete, practical training—gets you ready to handle any practical job in the booming Radio-Television industry. Start your own profitable Radio-Television shop . . . or accept a good paying job. I have trained hundreds of successful Radio-Television technicians during the past 21 years—and stand ready to train you, even if you have no previous experience! Mail coupon and get all the facts—FREE!



Valuable Equipment Included With Training

The new Sprayberry "package" plan includes many big kits of genuine, professional Radio-Television equipment. You perform over 300 demonstrations, experiments and construction projects. You build a powerful 6-tube 2-band radio set, multi-range test meter, signal generator, signal tracer, many other projects. All equipment and lessons are yours to keep . . . you have practically everything you need to set up your own profitable Radio-Television service shop.

Earn Extra Money While You Learn!

All your 10 months of training is IN YOUR HOME in spare hours. Keep on with your present job and income while learning. With each training "package" unit, you receive extra plans and "Business Builder" ideas for spare time Radio-Television jobs. New television stations everywhere, open vast new opportunities for trained Radio-Television Technicians—and those in training. If you expect to be in the armed forces later, there is no better preparation than practical Sprayberry Radio-Television training.

YOU BUILD the Television set and the powerful superhet radio receiver shown above. IN ADDITION to the other test units shown here (many are not shown because of lack of space). All equipment I send you is **YOURS TO KEEP.**

SPRAYBERRY ACADEMY OF RADIO 111 NORTH CANAL ST. Dept. 25-S, Chicago 6, Ill.

MAIL COUPON TODAY! NO OBLIGATION

SPRAYBERRY ACADEMY OF RADIO, Dept. 25-T
 111 North Canal St., Chicago 6, Ill.

Please rush to me all information on your 10-MONTH Radio-Television Training Plan. I understand this does not obligate me and that no salesman will call upon me. Be sure to include 3 books FREE.

Name..... Age.....
 Address.....
 City..... Zone..... State.....

I invite you to get all the facts—
FREE TO 3 BIG RADIO-TELEVISION BOOKS

I want you to have ALL the facts about my new 10-MONTH Radio-Television Training—without cost! Rush coupon for my three big Radio-Television books: "How to Make Money in Radio-Television." PLUS my new illustrated Television Bulletin PLUS an actual sample Sprayberry Lesson—ALL FREE. No obligation and no salesman will call. Mail coupon NOW!



Approved for Veterans under the G. I. Bill

DEALERS GETTING WESTINGHOUSE TUBES PROFIT FROM HEAVY LOCAL ADVERTISING AT NO COST

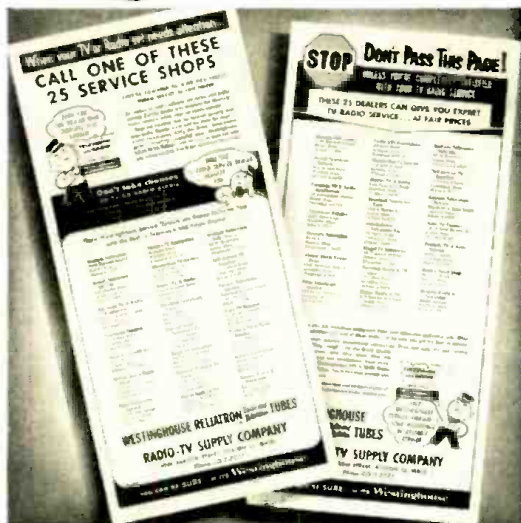
Service dealers are getting powerful local advertising support from new Westinghouse RELIATRON™ Tube Distributors. In cities now served by Westinghouse Distributors, dealers get local newspaper advertising, a complete kit of store display and imprinted mailing material.

All of it—local ads and kits—are designed to build TV-radio service business in the dealer's local area.

Best of all, none of it costs the dealer a penny!

You can get your store listed in two local newspaper ads at no charge, and get a kit to boot. If Westinghouse Tubes are now sold in your area, see your Westinghouse Distributor and take advantage of this \$900-worth-of-advertising-at-no-cost offer.

NEWSPAPER ADS



COMING YOUR WAY

If Westinghouse Tubes are not yet distributed in your area, be patient. Distributors are being established in all market areas as fast as product availability and good service permit.

You'll soon have the chance to buy RELIATRON Tubes. Keep this tremendous opportunity in mind: you'll get newspaper advertising at no cost! Imprinted material for mailings! Imprinted signs for your window!

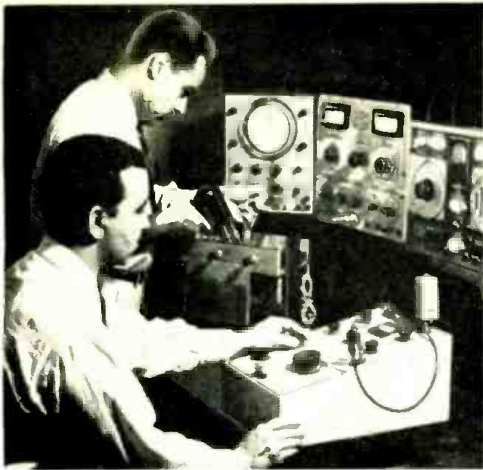
All of it is local advertising which sells your service in your own area where it counts.

For the name of your Westinghouse Distributor, or the approximate date when Westinghouse Tubes will be available in your area, drop a postal card to Dept. G-202 or have your regular distributor contact Dept. G-202 for information on how he can better serve you.

YOU CAN BE SURE...IF IT'S
Westinghouse

RELIATRON TUBES
TM

WESTINGHOUSE ELECTRIC CORPORATION, ELECTRONIC TUBE DIVISION, ELMIRA, N. Y.



EARN MORE MONEY AS AN EXPERT

Get Shop-Method
Training at Home in

RADIO TELEVISION ELECTRONICS

One Master Course - One Low Tuition
LEARN ALL PHASES - EARN WHILE YOU LEARN

AS A NATIONAL SCHOOLS GRADUATE THERE'S A PLACE FOR YOU IN THIS EXPANDING INDUSTRY...*Never before* such a demand for *you!* For *never before* such a *growing* industry as today's Television, Radio and other Electronic fields. This industry needs *you*... TODAY... and it needs you as a *trained* man... the kind of man you will be as a National Schools graduate. So don't wait. Start your National Schools training NOW...and enjoy big money, job security, SUCCESS!

LEARN from EXPERTS! BE A SUCCESSFUL MAN YOURSELF! You learn from men who are themselves successful Radio, Television and Electronics technicians. You learn the *practical* way... by *doing*... with equipment we send you. And you *advance* quickly, step by step. Get ALL the facts from FREE book and sample lesson. Mail coupon below NOW. Absolutely no obligation.

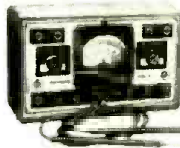


All yours at no extra cost!

You can qualify **FAST** for these big-pay jobs...plus many more

Radio Station Technician • Your own Sales and Service Shop • District Service Manager • Inspector Technician • Aircraft Radio Inspector • Special Govt. Positions • Service Specialist • Sound Truck Operator • and many others!

ONLY NATIONAL SCHOOLS GIVES YOU THIS PROFESSIONAL MULTI-TESTER



Ready to use. Easy to operate. Light enough to carry on service calls.

DRAFT AGE? National Schools training helps you get into special service classifications—get higher grades, better pay!

GET YOUR TRAINING FROM THE RADIO-TV CAPITAL OF THE WORLD

Let National Schools—a *resident* technical trade school for nearly 50 years—train you at home for today's unlimited opportunities in Radio-TV.



FREE!

Radio-TV Book & Sample Lesson JUST MAIL COUPON!

NATIONAL SCHOOLS GRADUATES IN BIG DEMAND. You'll find National Schools graduates in good jobs everywhere. For these are the jobs National Schools *trains* you for. Such complete, shop-method home training can be *your* ticket to success...your key to the job happiness you've always wanted. It's up to you. Mail coupon NOW!

FRIENDLY GUIDANCE AS STUDENT AND GRADUATE. Our special Welfare Department is constantly at your service. Helps you with your technical and personal problems. Gives you the benefit of its wide industry contacts and experience in helping you after graduation. **BOTH RESIDENT AND HOME STUDY COURSES OFFERED.**

NATIONAL SCHOOLS APPROVED FOR G. I. TRAINING

Los Angeles, Calif. • Est. 1905 • In Canada: 193 Hastings St., Vancouver, B.C.

YOU GET ALL THE PARTS INCLUDING TUBES for this superheterodyne receiver... and lots of other equipment...to keep!

NATIONAL SCHOOLS, Dept. RH-23
4000 South Figueroa Street
Los Angeles 37, California

Mail in envelope or paste on postal card

Send me FREE book "My Future in Radio-Television and Electronics." Also a FREE sample lesson. I understand no salesman will call on me and that there is no obligation.

NAME _____ AGE _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

VETS! Check here if you are a veteran.

ACT NOW

Don't put it off! Mail coupon NOW!

In a Class
by Itself



the
C·D·R Rotor



Speedy Installation ... the servicemen's dream come true! No loose parts to assemble ... no kits with loose washers, nuts and bolts ... quick mounting antenna mast collet plus four wire cable hookups!

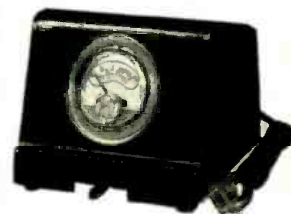
Dependable ... experience has proven that once a CDR ROTOR is up ... it's THERE TO STAY! No costly call-backs! Completely weather-sealed and streamlined ... it's the outstanding value in the field!

Powerful ... sturdy in design to support and TURN ANY TV ANTENNA array ... never a worry about the CDR rotor working! Locking instantly it will not drift! Instantly reversible ... makes a complete revolution in 45 seconds!

MODEL TR-12 A special combination value consisting of complete rotor including thrust bearing ... handsome modern design plastic cabinet with meter control dial, only **\$47.95**

MODEL TA-6 Thrust bearing accessory, separately **\$4.95**

MODEL TR-11 Same as TR-12 without thrust bearing.. **\$44.95**



SUBSIDIARY OF



THE **RADIART** CORPORATION
CLEVELAND 13, OHIO

CORNELL-DUBILIER
SOUTH PLAINFIELD, NEW JERSEY
RADIO & TELEVISION NEWS

N 3

THE ONLY COMPLETE CATALOG FOR
EVERYTHING IN TV, RADIO AND
INDUSTRIAL ELECTRONICS

get your 1953 **FREE**

ALLIED

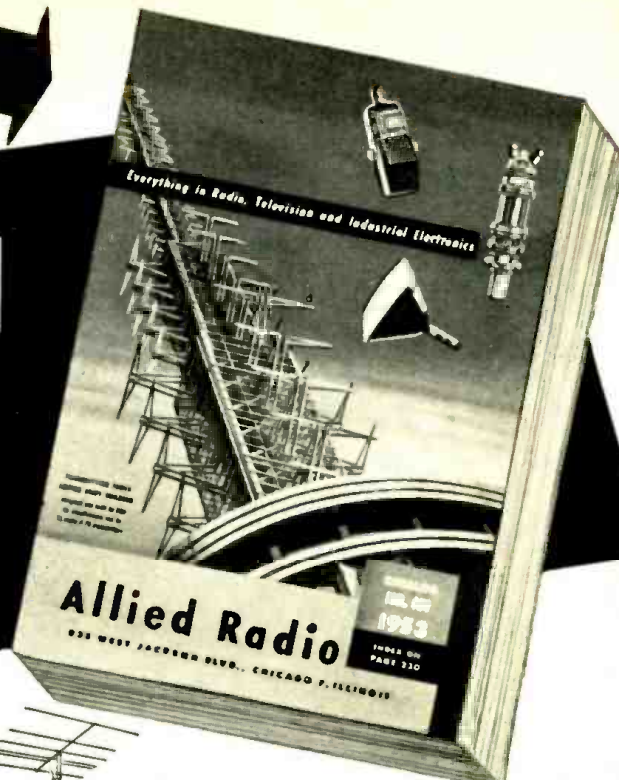
236-PAGE CATALOG

it's complete
it's value-packed

THE WORLD'S LARGEST STOCKS

- TV and Radio Parts
- Test Instruments
- Hi-Fi and P.A. Equipment
- Custom TV Chassis
- AM, FM Tuners & Radios
- Recorders and Supplies
- Amateur Station Gear
- Builders Supplies
- Equipment for Industry

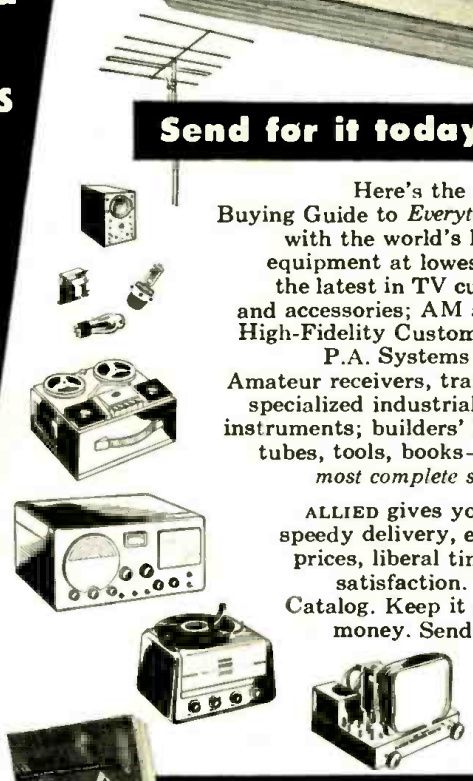
**QUICK
EXPERT
SERVICE**



Send for it today!

Here's the *one* authoritative, complete Buying Guide to *Everything in Electronics*—packed with the world's largest selections of quality equipment at lowest money-saving prices. See the latest in TV custom chassis, TV antennas and accessories; AM and FM tuners and radios; High-Fidelity Custom Sound components; latest P.A. Systems and accessories; recorders; Amateur receivers, transmitters and station gear; specialized industrial electronic equipment; test instruments; builders' kits; huge listings of parts, tubes, tools, books—your choice of the world's *most complete stocks* of quality equipment.

ALLIED gives you every buying advantage; speedy delivery, expert personal help, lowest prices, liberal time payment terms, assured satisfaction. Get the latest 1953 ALLIED Catalog. Keep it handy—and save time and money. Send for your **FREE** copy today!



**EVERYTHING IN
ELECTRONICS**

**SEND TODAY FOR RADIO'S
LEADING BUYING GUIDE**

free

ALLIED RADIO

World's Largest Electronic Supply House

EASY-PAY TERMS

Take advantage of ALLIED's liberal Easy Payment Plan—Radio's best terms—only 10% down, 12 months to pay—no interest if you pay in 60 days. Available on Hi-Fi and P. A. units, recorders, TV chassis, test instruments, Amateur gear, etc.

TV & HI-FI SPECIALISTS

To keep up with developments in TV and High-Fidelity, look to ALLIED! Count on us for *all* the latest releases and largest stocks of equipment in these important fields. If it's *anything* in Television or High-Fidelity equipment—we have it in stock!

ALLIED RADIO CORP., Dept. 1-B-3
833 W. Jackson Blvd., Chicago 7, Illinois

Send **FREE** 236-Page 1953 ALLIED Catalog.

Name

Address

City Zone State

E-V

**for PA
LIKE ON TV**

**636
Slimair
DYNAMIC
MICROPHONE**

Gives you features similar to those in the famous E-V Slim-Trim TV Microphones. That's why it is so outstanding for Public Address, Recording and other general-purpose use.
List Price \$70

SMOOTH RESPONSE
60-13,000 CPS
HIGH OUTPUT
OMNIDIRECTIONAL
ACQUSTALLOY
DIAPHRAGM
BUILT-IN
BLAST FILTER

Can be used
in the hand,
on a stand,
or overhead

SEND FOR BULLETIN

Electro-Voice
410 CARROLL ST. • BUCHANAN, MICH.
Export: 13 E. 40th St., N. Y. 16, U.S.A.

For the RECORD.

BY THE EDITOR

THE TELEVISION SERVICE OPERATOR

MANY letters coming to our desk are from technical trainees attending classes in our trade schools and colleges. These students, generally, state that they are learning radio or television theory and practice as preparation for a career in the servicing business. Typical questions asked include: "What do I need to start a service shop?", "Should I specialize in television service exclusively or should I consider both radio and television?" and "What test equipment will I need for television servicing?"

It is a well established fact that television installation and service requires considerably more test instruments and other equipment than does radio. Such equipment can be very costly and, in the case of the independent service technician, almost prohibitive in areas of limited clientele. TV test equipment must be sensitive and accurate. In many cases it is too massive or heavy for home servicing and belongs on the test bench where it can be conveniently and effectively used. A well-equipped shop is a prerequisite for television servicing.

The service shop, however well equipped, is but one link in the chain of equipment required by the progressive service operator. Successful TV service contractors have learned that to cope with the many problems that arise in TV areas they must not only have a well trained staff of technicians but that their men must be properly equipped with the tools of the trade.

Paul Forte of the *Television Contractors Association* recently named several important components that are required to render good service. They include a panel truck or specially fitted car. In it must be carried a supply of tools, equipment, and spare parts that are in most common need. When a television set can't be repaired with these facilities, the car or truck must be suited so that a chassis and/or cabinet can be brought back to the shop for bench work. Such vehicles cost money and represent another investment on the part of the service contractor.

Since there are, roughly, about eighty different makes of television sets and thousands of models, the effectively operating contractor must have a complete library of diagrams, schematics, and service notes. These cost money, and taking care of them, adding to them, and using them costs time and money. Without them no man can claim that he is ready to service television.

A service operator cannot properly

function unless he has records of all service calls. These are not things he keeps in his wallet. He's got to have files and forms and he's got to have somebody work on them to keep them up-to-date. That means he has to have an office and someone in it to handle service requests and dispatch them promptly. These things cost money, a cost that can't be borne by the independent technician. If he does bear them, then he isn't an independent technician any longer; he's either a contractor or a service operator.

He must have special equipment and facilities for installations which include the erection of antennas. This, definitely, requires a truck. He can contract the antenna installation to someone else but that is hardly a good method of conducting a business. Trucks, too, cost money and are an integral part of the investment that must be put into a television service operation, as well as into the cost of service.

Since he's dealing with expensive television equipment in the customer's home, he has to carry Public Liability and Property Damage Insurance. He has to carry other insurance on his vehicles, test equipment, parts stock, and other facilities. It costs more money! It's all part of the investment that goes into a properly handled service business.

If the so-called independent technician says he doesn't need these things in order to maintain himself in the television service business, he is kidding himself. Certainly he won't kid the public, upon whom he depends for business.

There is little time, if any, for the aggressive technician to relax and sit back with a hope that he can keep pace with the fastest growing industry in our time. Instead, he must constantly keep abreast of new developments, in addition to performing his routine tasks as each day passes. He must continually study new circuits, new products, new applications, and new techniques.

He must learn all that he can about u.h.f. behavior, circuitry, antenna theory, and troubleshooting. He must employ common sense in his relationship with the public he serves. He must conduct himself as a successful business man and be ethical.

If he trains himself *NOW* and if he builds a firm foundation based on the experience of other technicians—the television service operator can certainly look to a future of interesting opportunities in this industry we choose to call electronics O.R.

**Accepted and praised by
the most critical expert in the world**

...the American Amateur Radio Operator



hallicrafters



A Ham's Dream—The SX-71—Planned with you, the advanced amateur, in mind. Communications Receiver SX-71 is a double conversion set, built-in NBFM limiter stage. 538 kc to 34 mc. In 5 bands. Plus A 46 to 55 mc band. Temperature comp.; voltage regulator. 1 r-f, 2 converters, 3 i-f stages. Xtal. filter, 3-position selectivity. 115 V AC, 11 tubes, regulator, rectifier **\$224.50**



Precise Selectivity—The S-76—Amazingly selective! Crisp station separation. Double conversion with 50 kc 2nd i-f. Giant 4-in. "S" meter. 540-1580 kc, 1.72-32 mc in 4 bands. 1 r-f, 2 converters, 2 i-f stages. 5 position selectivity. Phono input jack, 3 watt output. 115 V AC, 9 tubes, regulator, rectifier **\$179.50**



Low Price—High Performance!—S-40B—540 kc to 43 mc in 4 bands. Electrical band spread. Temperature compensated. 1 r-f, 2 i-f. 3 watt output. Built-in speaker. 115 V AC only. 7 tubes, plus rectifier. (S-77—same as S-40B, for 115 V AC or DC) **\$119.95**

The first Hallicrafters radio was built *specifically* for the ham operator more than twenty years ago. Today, Hallicrafters sell more communications sets to the armed forces, professionals and hams, than *all other manufacturers combined*. Yet today, these Hallicrafters sets are still designed *specifically* for the most critical expert in the world—the American amateur operator. There is no higher standard.

hallicrafters

"The Radio Man's Radio"

*World's Leading Manufacturer of Precision
Radio and Television • Chicago 24, Illinois*

The Finest Buy in SW 1—The S-38C—Best performance per dollar you'll find, the S-38C is the outstanding low priced set on the market. 540 kc to 32 mc in 4 bands. Maximum sensitivity per tube—far outperforms ordinary broadcast sets. Built-in speaker. 115 V AC or DC. 4 tubes plus rectifier **\$49.50**



G-C HAS MADE... 125 MILLION STAND-OFFS FOR THE TELEVISION INDUSTRY

125 MILLION STAND-OFFS! Yes, G-C recently completed the manufacture of its 125,000,000th Stand-Off... made possible by the fact that the entire radio-TV service industry recognizes the value, the top quality built into every G-C Stand-Off—available from your jobber in 24 popular styles.




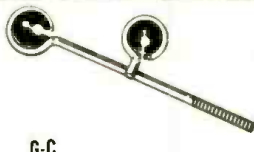


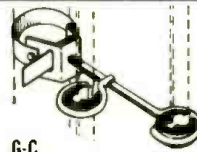

All G-C Stand-Offs are supplied with genuine Polyethylene insulators like this... featuring the exclusive G-C reinforcing rib that keeps the insulator from collapsing.



G-C KANT-STRIP MAST STAND-OFFS

Exclusive, improved mast stand-offs with strip-proof extruded threads. Extra strong; no flimsy light metal used; no loose nuts to fall out. Galvanized strap has round end for easier threading. Genuine Polyethylene insulator, unique G-C design.

No.	Size
8253	3 1/2" Single
8257	7 1/2" Single

 <p>G-C UNIVERSAL STAND-OFFS (Machine Screw Type)</p> <table border="0"> <tr> <th>No.</th> <th>Length</th> </tr> <tr> <td>8031</td> <td>3 1/2"</td> </tr> <tr> <td>8032</td> <td>5 1/2"</td> </tr> <tr> <td>8035</td> <td>7 1/2"</td> </tr> </table>	No.	Length	8031	3 1/2"	8032	5 1/2"	8035	7 1/2"	 <p>G-C UNIVERSAL STAND-OFFS (Wood Screw Type)</p> <table border="0"> <tr> <th>No.</th> <th>Length</th> </tr> <tr> <td>8027</td> <td>3 1/2"</td> </tr> <tr> <td>8028</td> <td>5 1/2"</td> </tr> <tr> <td>8029</td> <td>7 1/2"</td> </tr> <tr> <td>8030</td> <td>12"</td> </tr> </table>	No.	Length	8027	3 1/2"	8028	5 1/2"	8029	7 1/2"	8030	12"	 <p>G-C NAIL-IN STAND-OFFS</p> <p>New, speed-type nail-in stand-offs save installation time, labor and cost on each job. Easy to use. Genuine Polyethylene insulators.</p> <table border="0"> <tr> <th>No.</th> <th>Length</th> </tr> <tr> <td>8343</td> <td>3 1/2"</td> </tr> </table>	No.	Length	8343	3 1/2"	 <p>G-C DUPLIX IN-LINE STAND-OFFS</p> <p>Two styles, wood screw and machine screw types. Heavily zinc plated to prevent rust.</p> <table border="0"> <tr> <th>No.</th> <th>Size and Type</th> </tr> <tr> <td>8225</td> <td>7 1/2" Wood Screw</td> </tr> <tr> <td>8226</td> <td>7 1/2" Machine Screw</td> </tr> </table>	No.	Size and Type	8225	7 1/2" Wood Screw	8226	7 1/2" Machine Screw
No.	Length																														
8031	3 1/2"																														
8032	5 1/2"																														
8035	7 1/2"																														
No.	Length																														
8027	3 1/2"																														
8028	5 1/2"																														
8029	7 1/2"																														
8030	12"																														
No.	Length																														
8343	3 1/2"																														
No.	Size and Type																														
8225	7 1/2" Wood Screw																														
8226	7 1/2" Machine Screw																														
 <p>G-C SNAP-ON STAND-OFFS</p> <p>NEW, improved snap-on that is easier to install, then stays on. Snap... and it's on; that's all there is to it! Two standard sizes. Feature exclusive G-C reinforced insulators.</p> <table border="0"> <tr> <th>No.</th> <th>Size</th> </tr> <tr> <td>8797</td> <td>For 1" Masts</td> </tr> <tr> <td>8798</td> <td>For 1 1/4" Masts</td> </tr> </table>	No.	Size	8797	For 1" Masts	8798	For 1 1/4" Masts	 <p>G-C "WIRE-GRIP" GUY WIRE STAND-OFFS</p> <p>TV lead-ins and rotator wires can be brought down long guy wires. Fasten permanently; easy to use. Genuine Polyethylene insulators.</p> <table border="0"> <tr> <th>No.</th> <th>Size and Type</th> </tr> <tr> <td>8255</td> <td>3 1/2" Single</td> </tr> <tr> <td>8256</td> <td>Double Type</td> </tr> </table>	No.	Size and Type	8255	3 1/2" Single	8256	Double Type	 <p>G-C DUPLIX KANT-STRIP MAST STAND-OFFS</p> <p>Heavy steel stand-off with strip-proof extruded threads. A deluxe stand-off at a really low price. Galvanized strapping. For both 300-ohm and coaxial lines.</p> <table border="0"> <tr> <th>No.</th> <th>Type</th> </tr> <tr> <td>8258</td> <td>Double</td> </tr> </table>	No.	Type	8258	Double	 <p>G-C EAVE TYPE CLAMP-ON STAND-OFFS</p> <p>New type, clamp-type stand-off that quickly fastens to eaves. Easy to install. Genuine Polyethylene insulators.</p> <table border="0"> <tr> <th>No.</th> <th>Type</th> </tr> <tr> <td>8811</td> <td>Single</td> </tr> <tr> <td>8812</td> <td>Double</td> </tr> </table>	No.	Type	8811	Single	8812	Double						
No.	Size																														
8797	For 1" Masts																														
8798	For 1 1/4" Masts																														
No.	Size and Type																														
8255	3 1/2" Single																														
8256	Double Type																														
No.	Type																														
8258	Double																														
No.	Type																														
8811	Single																														
8812	Double																														



**G-C
TEE-TYPE STAND-OFFS**

Heavy zinc plated for permanent installation. Two types, wood screw and machine screw. For both 300-ohm and coaxial lines.

No.	Size and Type
8809	7 1/2" Wood Screw
8810	7 1/2" Machine Screw

FREE G-C's big, illustrated Catalog, chock-full of hundreds and hundreds of radio-TV service aids. Send a postcard for your copy today!



GENERAL CEMENT MANUFACTURING Co.
904 TAYLOR AVENUE ROCKFORD, ILLINOIS

RADIO & TELEVISION NEWS

Prepare Now... in spare time at Home ... for a New,

PROFITABLE, INTERESTING FUTURE

TELEVISION
RADIO - ELECTRONICS

RADIO CHIEF OF ILE DE FRANCE
FRENCH LUXURY LINER PRAISES D. T. I.

Radio Chief—Jean Desmas Says:

"DeForest's Training, Inc., of Chicago, is known not only throughout Europe, but also in many parts of the world as one of America's finest Television, Radio and Electronics training centers."



JACK DEMPSEY
Former World's Heavyweight Champion
TELLS WHY HE'S PROUD
TO BE WITH **D.T. I.**

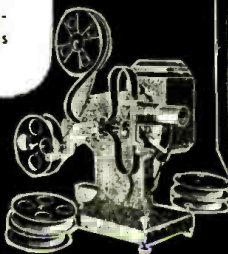
- I have been greatly impressed with D.T.I.'s wonderful spirit of friendliness and sincere determination to help its students make good in Television-Radio-Electronics.
- I admire its remarkable 20 year record of helping men build brighter futures.
- I also admire the business policy of its management and the thoroughness of its large faculty of instructors.
- Never have I heard young men praise a school as enthusiastically as do the students and graduates of D.T.I. They are its best boosters.



Prepare At Home Or In Our Chicago Laboratory!

See for yourself how readily you may prepare at home, or in our modern Chicago laboratories, for a better job or business of your own in one of America's fastest-growing fields—TELEVISION-RADIO-ELECTRONICS.

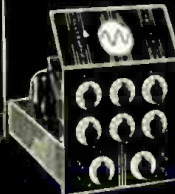
If you train at home you get (1) the use of a 16-mm. movie projector and 16 reels of animated movies to help you learn important points faster . . . easier, (2) modern lessons and (3) sixteen shipments of electronic parts enabling you to get valuable practical experience from over 300 projects—including building and keeping the electronic equipment shown below. And upon completing training, you have the optional privilege of building and keeping a big 17-INCH TV set at moderate added cost. Get the full story. Mail coupon today!



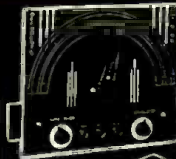
HOME MOVIES



MULTIMETER



OSCILLOSCOPE



6-TUBE RADIO

R-F SIGNAL GENERATOR



LAUD D. T. I.'s HOME MOVIES IN CONGRESS

D. T. I.'s remarkable home training benefit of visual training MOVIES has been praised from the floor of the House of Representatives in Washington, D. C. and recorded in The Congressional Record.

MILITARY SERVICE!

If subject to military service, the information we have for you should prove very helpful. Mail coupon today.



De FOREST'S TRAINING, INC.
AFFILIATED WITH
De VRY Technical INSTITUTE
CHICAGO 14, ILLINOIS



MAIL COUPON TODAY!

Dept. RN-2-J
DE FOREST'S TRAINING, INC.
2533 N. Ashland Ave., Chicago 14, Ill.

I would like your Opportunity News Bulletin showing "89 Ways to Earn Money in Television-Radio-Electronics"; also, the folder showing how I may prepare to get started in this thrilling field.

Name _____ Age _____
Address _____ Apt. _____
City _____ Zone _____ State _____

Editor
OLIVER READ, D.Sc., W1ETI

Managing Editor
WM. A. STOCKLIN, B.S.

Technical Editor
H. S. RENNE, M.S.

Service Editor
CHARLES TEPPER

Amateur Radio Editor
NICHOLAS ROSA, W1NOA

Assistant Editors
P. B. HOEFER
M. C. MAGNA

Television Consultant
WALTER H. BUCHSBAUM

Short-Wave Editor
KENNETH R. BOORD

Staff Artist
FRANK SAYLES

Draftsman
A. A. GANS, W2TSP

Advertising Manager
L. L. OSTEN

Midwest Adv. Manager
JOHN A. RONAN, JR.

Western Adv. Manager
JOHN E. PAYNE



COVER PHOTO: Every new antenna that reaches the market represents hours of engineering time and exhaustive testing like this new "Vee-D-X" unit by LaPointe-Plascomold Corp. (Ektachrome by James Pickands)

Chairman of the Board and Publisher
WILLIAM B. ZIFF

President
B. G. DAVIS

Secretary-Treasurer
G. E. CARNEY

Vice-Presidents
H. J. MORGANROTH
Production Director

LYNN PHILLIPS, JR.
Advertising Director

H. G. STRONG
Circulation Director

BRANCH OFFICES
 CHICAGO (1)
 185 N. Wabash, AN 3-5200
 LOS ANGELES (14)
 Staller Center, 900 Wilshire Blvd., Mich. Q850

First in
radio-television-electronics
 Average Paid Circulation over 220,000

RADIO & TELEVISION NEWS
 Reg. U.S. Pat. Off.

Radio News Trademark Reg. U. S. Pat. Office • Television News Trademark Reg. U. S. Pat. Office.

CONTENTS

FEBRUARY, 1953

Build this Transistor Receiver.....Robert K. Dixon 35

Oil-Cooled Load Wattmeter.....Robert M. See, W9OCL/5 38

Care of Transistors.....Rufus P. Turner, K6AI 40

V.H.F.-U.H.F. Antenna Design.....L. F. B. Carini 42

Improving the Williamson Amplifier.....David Hafler & Herbert I. Keroes 43

TV Signal Distribution Methods.....Edward M. Noll 46

An Improved Corner Horn Speaker System.....George L. Augspurger 48

Current TV Topics.....Walter H. Buchsbaum 50

A Compact Bandswitching V.F.O. Multiplier.....Earl Snader, W0ZFO 52

Sound System for Your TV Set.....John Potter Shields 54

U.H.F. Antennas (Part 3).....Milton S. Kiver 56

Writing for Profit and Prestige.....Louis E. Garner, Jr. 59

A Vest-Pocket Receiver.....E. G. Louis 60

Single-Channel Remote Broadcast Amplifier.....Leon A. Wortman 62

Mac's Radio Service Shop.....John T. Frye 64

3-Element 14 mc. Rotary Beam Antenna.....C. A. West, W2IYG 66

New TV Grants Since Freeze Lift.....70

Eliminating Oscillator Hum in FM Receivers.....Herbert Michels 82

Radio-TV Service Industry News.....104

DEPARTMENTS

For the Record.....The Editor 8

Spot Radio News.....16

Within the Industry.....24

Short-Wave.....K. R. Boord 65

What's New in Radio.....85

Manufacturers' Literature.....116

Technical Books.....155

New TV Products.....158



COPYRIGHT 1953
ZIFF-DAVIS PUBLISHING COMPANY
 Editorial and Executive Offices
 366 Madison Ave., New York 17, N. Y.
 VOLUME 49 • NUMBER 2



Member
 Audit Bureau of
 Circulations

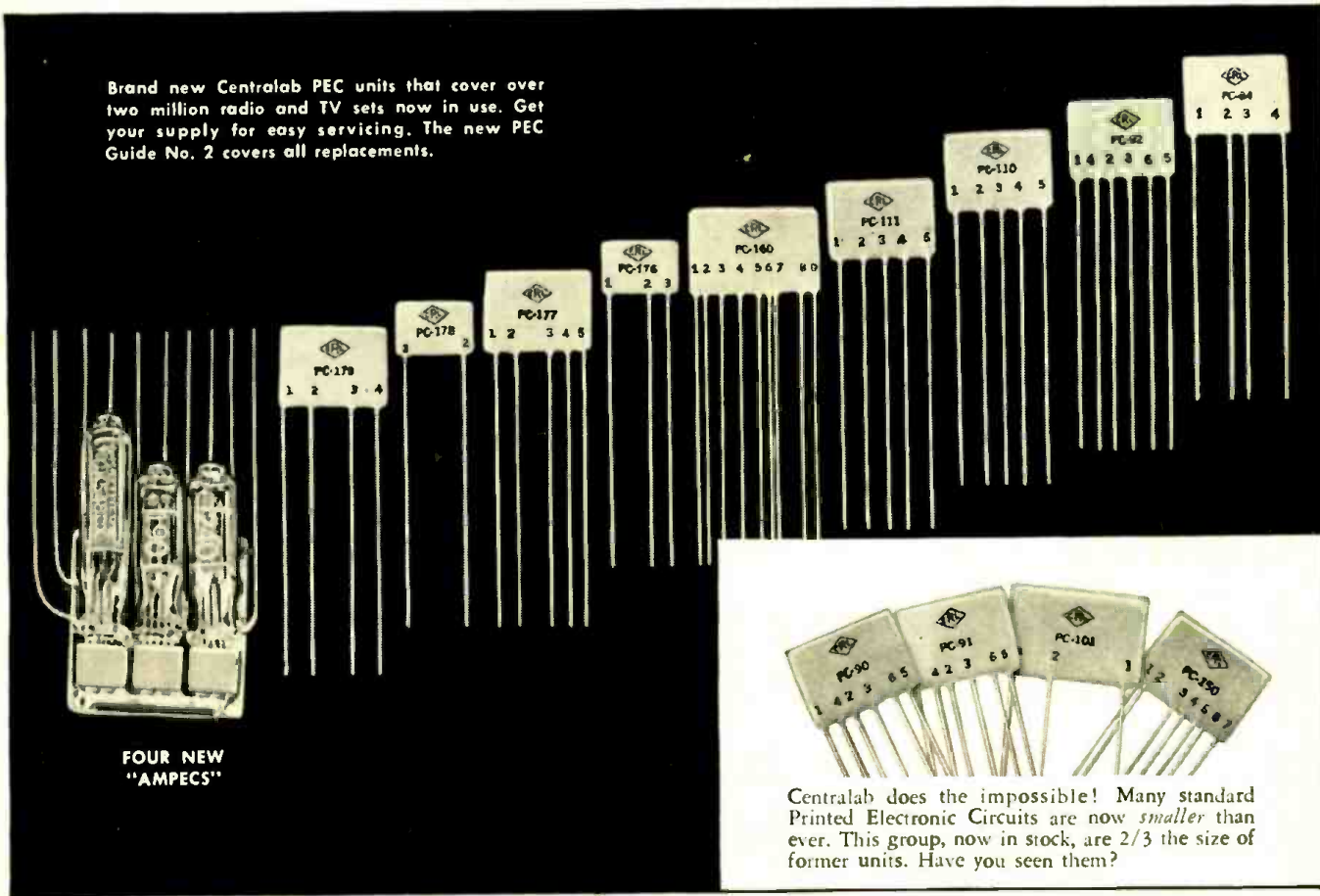
SUBSCRIPTION SERVICE: All communications concerning subscriptions should be addressed to Circulation Dept., 64 E. Lake St., Chicago 1, Ill. Subscribers should allow at least two weeks for change of address.

CONTRIBUTIONS: Contributors are advised to retain a copy of their manuscripts and illustrations. Contributions should be mailed to the New York Editorial Office and must be accompanied by return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to whatever adaptations and revisions are necessary to meet the requirements of this publication. Payment covers all author's, contributor's, and contestant's rights, title, and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of the material purchased.

RADIO & TELEVISION NEWS

Thirteen NEW CRL Printed Electronic Circuits for replacement service!

Brand new Centralab PEC units that cover over two million radio and TV sets now in use. Get your supply for easy servicing. The new PEC Guide No. 2 covers all replacements.



FOUR NEW "AMPECS"

Centralab does the impossible! Many standard Printed Electronic Circuits are now smaller than ever. This group, now in stock, are 2/3 the size of former units. Have you seen them?

Now Available from your Centralab Distributor

THESE thirteen new Printed Electronic Circuits are now in use in thousands of radio and TV sets. You should have a complete stock on hand for shop work and service calls. Centralab Circuits are safest and easiest for servicing. In most cases, the replacement PC number is the same as shown on the original part.

These new PEC units replace whole Pentode Coupling, TV I. F., Triode Coupling, or Pentode Detector networks. Four new plates, too, to replace special manufacturer's parts. Together with the other CRL stock Printed Electronic Circuits, these parts will cover 95% of all PEC replacements. Over 15 million circuits are now in use . . . are you ready to service them?

Don't overlook the new smaller sizes in older PEC units. Small size is not enough . . . Centralab makes Printed Electronic Circuits even smaller! For complete information on parts, replacements, and test data, see the new Printed Electronic Circuit Guide No. 2. Ask your distributor for a copy, or use the coupon.

Make your Centralab distributor headquarters for exact electronic replacements

Centralab

A Division of Globe-Union Inc.
Milwaukee 1, Wisconsin
In Canada, 635 Queen Street East, Toronto, Ontario

Centralab Printed Electronic Circuits are among the more than 470 new items listed in Centralab's new Catalog 28. Get your copy of this 32-page index to the latest developments in the fast-changing electronic field, plus the 20 page Printed Electronic Circuit Guide No. 2. See your distributor or use coupon.



CENTRALAB, A Division of Globe-Union Inc.
910 E. Keefe Avenue, Milwaukee 1, Wisconsin

Please send me my copy of:

P.E.C. Guide No. 2 Centralab Catalog 28

Name..... Position.....

Company.....

Address.....

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

RADIO & TELEVISION NEWS is published monthly by the Ziff-Davis Publishing Company at 185 N. Wabash Ave., Chicago 1, Ill. Entered as second-class matter, July 21, 1945, at the Post Office, Chicago, Ill., under the act of March 3, 1879. Authorized by Post Office Department, Ottawa, Canada, as second-class matter. SUBSCRIPTION RATES: Radio & Television News—one Year, U. S. and Possessions, Pan-American countries, and Canada \$4.00; all other foreign countries \$5.00; Radio-Electronic Engineering Edition—one year, U. S. and Possessions, Pan-American countries, and Canada \$6.00; all other foreign countries, \$7.00. Postmaster—Please return undelivered copies under form 3589 to 64 E. Lake St., Chicago 1, Ill.

The gun that looked 100% "perfect" ... yet never "fired a shot"

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES

How we **SPOT** "shady characters" before they can damage your business

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES

The guinea pig that "runs a fever" to bring you better picture tubes

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES

99.9% pure phosphor... yet we throw it away

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES

The evidence is clear...

RCA safeguards your reputation... with tubes of unequalled quality

In RCA Tubes and Kinescopes the difference is top-quality control



RADIO CORPORATION of AMERICA
ELECTRON TUBES

HARRISON, N. J.

TMK. ®

A DOUBLE-TAKE to safeguard your reputation

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES

The Torture Chamber that tests the strength of RCA Picture Tubes

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES

How we get **NOZZLE** that's just right for RCA picture-tube screens

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES

Quality control by feedback... the secret of RCA tube performance

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES

The Million-Dollar Test Equipment... that pays off in better picture tubes

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES

Take a look at **quality** being born

RCA RADIO CORPORATION of AMERICA
ELECTRON TUBES

RADIO & TELEVISION NEWS

**FEBRUARY
1953**

IN THIS ISSUE

**GUIDED MISSILE DATA
RECORDING**

**A THERMOCOUPLE
A.C. WATTMETER**

ULTRASONIC MICROSCOPE

COMPUTER RELIABILITY

**CHARACTERISTICS OF
DIGITAL AND ANALOG UNITS**

**BUILD THIS
TRANSISTOR RECEIVER**

**IMPROVING THE
WILLIAMSON AMPLIFIER**

**COMPACT BANDSWITCHING
V.F.O. MULTIPLIER**

**V.H.F. — U.H.F.
ANTENNA DESIGN** ▶

(See Page 42)



UHF*



*All UHF channels...
for all TV sets*

MALLORY UHF CONVERTER

The Mallory UHF converter is right for *all* your TV customers because it can be used with *any* TV set... in *any* UHF broadcast area. And it's easy to install—no adjustments or connections to make in the TV set... just connect power lines and antenna leads.

These Mallory features mean real customer satisfaction... real sales for you in the new UHF market—

- Reception of all UHF channels
- No sacrifice of VHF channels
- Built-in UHF antenna
- High quality picture definition
- Fast, easy installation

No larger than a small portable radio, the Mallory UHF converter is precision-built for long, trouble-free service. Get complete details today on the Mallory UHF converter from your Mallory distributor.

P. R. MALLORY & CO. Inc.
MALLORY

CAPACITORS... CONTROLS... VIBRATORS...
SWITCHES... RESISTORS... RECTIFIERS...
VIBRAPACK® POWER SUPPLIES... FILTERS
*Reg. U.S. Pat. Off.

APPROVED PRECISION PRODUCTS

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

*Make Sure...
Make it Mallory*



DEDICATED TO YOU!

This great new **EICO**
FACTORY... these **NEWEST**
EICO INSTRUMENTS...

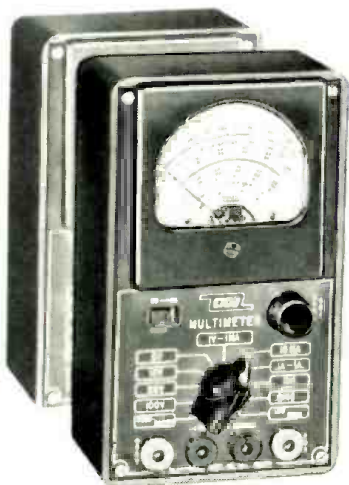
YOU made them possible with your
CONFIDENCE in EICO. We pledge to strive
with all our power, product-wise and
service-wise, to continue to merit your
trust in us.

Harry R. Ashley
President



6 NEW V-O-M KITS and Instruments

FOR LABORATORY PRECISION AT LOWEST COST



EICO New Model 536 —
1000 Ohms/Volt Multimeter
Wired \$14.90. KIT \$12.90.

- 31 full scale ranges!
- DC/AC Volts: Zero to 1, 5, 10, 50, 100, 500, 5000
- DC/AC Current: 0.1 ma, 10 ma, 0.1 A, 1 Amp.
- Ohms: 0-500, 100K, 1 meg.
- 6 DB Ranges: 20 to 69.
- Large 3" 400 μ a meter movement.
- High-impact Bakelite case. 6 1/2" x 3 1/2" x 2".

EICO New Model 526 1000 Ohms/Volt Multi-
meter KIT \$13.90. Wired \$16.90. As above, with 1%
precision resistors.



EICO New Model 566 1000 Ohms/Volt Multimeter KIT
\$14.90. Wired \$18.95. Ranges: same as Model 536 (left), plus
7 output voltages. Large 4 1/2" 400 μ a meter movement.

EICO New Model 556 1000 Ohms/Volt Multimeter KIT
\$16.90. Wired \$23.50. Ranges: same as Model 536 (left), plus
7 output voltages. Large 4 1/2" 400 μ a meter movement and 1%
precision resistors.

Compare these value-crammed EICO V-O-Ms with
any others at any price — at your local jobber — and
SAVE! Write NOW for FREE newest Catalog L.R.A.

EICO New Model 565
20,000 Ohms/Volt Multimeter KIT \$24.95.
Wired \$29.95.

- 31 full scale ranges!
- DC/AC/Output Volts: 0-2.5, 10, 50, 250, 1000, 5000.
- DC Current: 0-100 μ a; 10, 100, 500 ma; 10 Amp.
- Ohms: 0-2000, 200K, 20 meg.
- 5 DB Ranges: 12 to 55.
- Large 4 1/2" 50 μ a meter movement.
- High-impact Bakelite case. 6 1/2" x 5 1/2" x 3".

EICO New Model 555 20,000 Ohms/
Volt Multimeter KIT \$29.95. Wired
\$34.95. As above, with 1% precision res-
istors.

ONLY EICO GIVES YOU ALL 10 EICO NOMICAL FEATURES

- Laboratory Precision • Lowest Cost • Life-
time Dependability • Speedy Operation
- Rugged Construction • Quality Compon-
ents • Latest Engineering • Super-Simplified
Assembly & Use Instructions • Laboratory-
Styled Appearance • Exclusive EICO Make-
Good Guarantee.



Prices slightly higher on West Coast Due to unstable conditions, prices and specifications are subject to change without notice.

ELECTRONIC INSTRUMENT CO., Inc. 84 Withers Street, Brooklyn 11, New York

Classified

Rate 50c per word. Minimum 10 words

RADIO ENGINEERING

COMPLETE radio, electronics theory & practice; television; broadcasting; servicing; aviation, marine, police radio. 12 or 18 months. Catalog, Valparaiso Technical Institute, Dept. N, Valparaiso, Ind.

SALE

BC 348R converted for A.C. New condition. F.O.B. \$169.50. W. C. Haigh, 621 Central Ave., East Orange, N. J.

ALL types of Antennas for Amateur and TV. Aluminum tubing. Willard RadchR, Fostoria, Ohio.

NEW ARN-7 w/Inv, 1-222, BC-645, many others. Send for list. United Electric, 532 Kelly St., Renton, Wash.

DIAGRAMS Radio, Record Changers, Recorders, 75c; Television with Service Data, \$1.25 up. State manufacturer and model number. Assorted diagrams (no choice) five prewar, or three postwar, \$1.10. Kramer's Radio Service, Dept. B1, 36 Columbus Ave., New York 23, N. Y.

TUBES and equipment bought, sold, and exchanged. For action and a fair deal, write B. N. Gensler, W2LNI, 136 Liberty, N. Y. 6, N. Y.

RECORD Changer parts for leading makes. We ship everywhere. Friend's Wholesale Distr., 106 N. 6th St., Philadelphia 6, Pa.

TV-FM antennas. All types including UHF. Mounts, accessories. Lowest prices. Wholesale Supply Co., Dept. H, Lunenburg, Mass.

WANTED

AN/APR-4, other "APR," "ARR," "ATS," "IE," ARC-1, ARC-3, ART-13, everything surplus; Tubes, Manuals, Laboratory equipment. Describe, price in first letter. Engineering Associates, 134 Patterson Rd., Dayton 9, Ohio.

WANTED: Federal type 101B voice-frequency ringers Signal Corps type TA-3/FT, Box 529, Radio & Television News, 185 N. Wabash Ave., Chicago 1, Ill.

WANTED: Western Electric gray-finished equipment cabinets for 19" panels. Heights of 2'6", 3'6", 7'0" and 7'6". Box 530, Radio & Television News, 185 N. Wabash Ave., Chicago 1, Ill.

WANTED. Top prices paid. Navy Selsyn 1DG, 1E, 1CT, 5CT, 5D, 5DG, 5G, 6G, 7G, etc., and BC-348, BC-221, AN, ART-13, AN, ARC-1, AN, ARC-3, RTA-1B, AN, APR-1. Electronic Research, 719 Arch St., Philadelphia.

ALL types of receiving and transmitting tubes. Surplus receivers and transmitters. Williams Electronics Co., 168 Washington St., N. Y. C.

CORRESPONDENCE COURSE

ELECTRONIC Draftsmen—Many needed immediately by Defense Agencies and Contractors. Excellent pay. Pioneer Radio Engineer offers an original and exceptionally high class correspondence course to qualified ambitious young men and women. Details free. C. Roland Leutz, P. O. Box 368, Silver Spring, Maryland.

MISCELLANEOUS

COLOR code chart. Every resistor and capacitor code ever used (total 17). 50c. No stamps. N. S. Brown Associates, 5522 Merrilnac, Dallas, Texas.

SPEAKERS repaired, wholesale prices, guaranteed workmanship. Amprite Speaker Service, 70 Vesey St., New York City 7.

RADIOHAMS help Ham. Old RADIONEWS exchange Macao Views. Postbox 354, Macao. Silva exXU88L.

DESIGN, construction, Wheatstone Bridge, \$1.00. Construction data electronic multimeter, \$1.00; particulars free. Technological Developments, 475-P Fifth Ave., New York 17, N. Y.

January, 1953

1000 Kc mounted crystals \$2.95
RCA 100 watt 115 volt
line noise filter..... \$1.95

NEW YEAR
SPECIALS

20 watt PP 6L6 output transformer,
to standard VC, completely
shielded upright case..... \$1.95

ZA BAND PASS FILTERS, 60. \$1.25
90 or 150 cy. each.....

OIL CAPACITORS
5 MF 236VAC 50.95 16 MF 1500VDC \$6.95
10 MF 330VAC 2.95 2 MF 2000VDC 2.25
14 MF 275VAC 1.45 4 MF 2000VDC 4.50
4 MF 600VDC 1.69 8 MF 2000VDC 5.50
8 MF 1000VDC 2.95 2 MF 2000VDC 3.95
25 MF 1000VDC 7.50 2000 MF 2V elect. .99
2 MF 1500VDC 1.85 1000 MF 30V ELE: .99
5 HY 300 MA CHOKE, 70 OHMS, 2 KV
insulation, new \$2.99.
10 \$25.00

115V POWER SUPPLY KITS 60 CY
A 600VCT 95 MA, 0.3V 2A, 5V 2A, 8 1/2V 100
MA CHOKES (2 ea.) 8X8 MFD 600 \$5.95
VDC OIL CAPACITORS
B PLATE TRANSFORMER 740VCT 300 MA, 1V
GA, 8.63V 6A DUAL FIL. TRANSFORMER:
4.0 HY 310 MA CHOKES (2 ea.) 8X8
MFD 600 VDC OIL \$12.50
CAPACITORS

115V POWER TRANSFORMERS 60 CY
58 V Half Wave, 2A 1.35
68 to 88 V Half Wave, 1.5A 1.25
300 V Half Wave, 12A 1.75
425 VCT 145 MA 4.3V 2A, 8V 2A 2.95
600 VCT 95 MA 6.3V 3.5A, 5V 2A 2.95
740 VCT 100 MA, 5V 3A, 2.5V 10A 2.25
740 VCT 185 MA 6.3V 4A, 5V 3A 5.95
840 VCT 240 MA 6.3V 3A, 8V 5A 5.95
480 VCT 300 MA 2.95
740 VCT 300 MA 4.95
70-000-6-000 7.50 VDC 225 MA 10.50
3600 VCT 350 MA 29.50
3100, 3800, 6200 VCT 110 MA 29.50

CHOKES
6 HY 50 MA 5.39
8 HY 45 MA 1.35
7 HY 125 MA 1.49
8 HY 150 MA 1.95
10 HY 240 MA 2.75
15 HY 250 MA 80 ohm. cased 3.95
4-16 HY 200 MA (swinging) 4.99
3 HY 225 MA 15 ohm. cased 2.95
3 HY 300 MA 70 ohms. 2.99
8 HY 400 MA 110 ohms. 5.59
8 HY 450 MA 80 ohms. 6.50
6 HY 500 MA 35 ohms. 7.25
.05 HY 3A 1 ohm 0.00
.02 HY 2A .5 ohm cased 4.95
115V FILAMENT TRANSFORMERS 60 CY
2.5 VCT 10A, 10 KV Insulation, Cased \$4.50
5V 4A 2 1/2 KV Insulation 1.99
5.0 V 6A, 6.3 V 6A 3.95
5.0 V 12A, 2 1/2 KV Insulation 5.95
5.0 VCT 20A, 2 1/2 KV Insulation 6.85
5.0 VCT 30 A, 2 1/2 KV Insulation 7.59
6.3 VCT 3A, 2 1/2 KV Insulation 2.25
6.3 VCT 6.3 V ea. at 4A 2.95
6.3 VCT 6A, 2 1/2 KV Insulation 3.15
10 VCT 10A, 2 1/2 KV Insulation 6.00
Dual 25V 1 Amp 1.95
34-11V 1A 1.45

IN34 GERMANIUM DIODES
10 for \$3.95, 100 for \$35.00

HEARING AID TESTER

DYSONIC hearing aid tester, tests type 503, 505
submini hearing aid tubes, batteries, cords etc. Com-
plete with G.E. 3" SQUARE METER (0-1MA) en-
graved bakelite panel, tube socket etc. Very
Less portable case..... Only \$12.95

SIGMA SENSITIVE 5 Prong Plug in relay, polar-
ized coil 3000 ohms D.C. operates on 2-4 MA
SPDT contacts. Ideal for use with electric eye,
control of model hobby equipment, etc. May be
used directly in plate circuit of amplifiers, etc.
Removable dust cover permits finer adjustment of
contacts. \$2.95.
10 \$25.00

POCKET MULTIMETER

SUPREME type 542 pocket multimeter 5000 ohm/
volt 1" meter (Manufactured by TRUMPH, SU-
PREME 24 AC/DC ranges measures up to 1500VDC,
complete with test leads, batteries & 90
day guarantee Price each \$14.95

ZA GLIDE PATH RECEIVER, NEW, BLACK
CRACKLE ALUMINUM CASE 6X7 1/2", complete
with shock mount, 150 RCB tubes, resistors,
capacitors, dust cover, ideal for building test
equipment, mobile xmitters, etc. \$3.95

TV COLOR ADAPTER converts sweep frequencies
of present TV sets to requirements of color sweepers
to permit viewing on black and white receivers.
Unit comes housed in attractive brown cabinet,
completely wired ready to operate, including cables
and simple instructions, \$1.79 each. \$.99

FUSES

2A 3AG	100 2.49	30A	4AG	100 2.45
10A 3AG slo-blo	100 3.95	35A	4AG	100 2.75
10A 4AG	100 2.45	40A	4AG	100 2.75
15A 4AG	100 2.45	50A	B	100 1.99
20A 4AG	100 2.45	100A	B	100 1.99

TUBES 2E24 \$2.49 304TL \$6.95
3E29 9.95 872A 3.95

POLY TECH

Dept. A-3, 919 Dawson St., New York 59, N. Y.
Send for Bulletin
MURRAY Hill 6-2650

Live Music vs. Recorded Music

excerpt from Wall Street Journal
front page, Oct. 30, 1952

"... The Audax Co., has on hand one of Toscanini's NBC violinists and a cellist from the New York Opera, both playing instruments made by the renowned Stradivari. Intermittently they put down their bows—and the music is carried on by a phonograph recording made by the same musicians. The switch, to most listeners, is not discernible..." etc.

Thousands waited in line for a chance to hear this daring, first-time-in-music-history, performance. The audience could not tell which was playing, the artists, or the AUDAX CHROMATIC DIAMOND reproducer.

Hear, for yourself, how near to perfection the AUDAX CHROMATIC DIAMOND pickup plays the modern discs.

Convert your POLYPHASE
with a replaceable Audax CHROMATIC
Diamond Stylus, now available
at your dealer.

AUDAX COMPANY

500 Fifth Avenue Dept. C New York 36
Fine music reproducers for over 25 years

GET INTO ONE OF THESE GREATER OPPORTUNITY FIELDS

Electricity or Radio- Television

TRAIN IN THE GREAT SHOPS OF

COYNE

OLDEST, BEST EQUIPPED
SCHOOL OF ITS KIND IN U. S.

Come to the Great shops of Coyne in Chicago. Get practical training in TELEVISION—RADIO—ELECTRICITY—ELECTRONICS—vital in Defense Program. Prepare now for a better job in Industry or higher rating in Armed Forces.

Approved for Veterans—finance plan—enroll now, pay most of tuition later. Part time employment service while training if needed. Special tuition plan for men of Draft Age.

FREE BOOK Clip coupon for Big Free Illustrated Book. No obligation. No salesman will call. Act NOW.

B. W. Cooke, President
A TECHNICAL TRADE
INSTITUTE CHARTERED
NOT FOR PROFIT
Established 1899
500 S. Paulina, Chicago
ELECTRICITY ★ TELEVISION
RADIO ★ REFRIGERATION ★ ELECTRONICS

B. W. COOKE, Pres.
COYNE School
500 S. Paulina St., Chicago 12, Ill. Dept. 13-85H
Send FREE BOOK and details on:

RADIO-TELEVISION ELECTRICITY

NAME.....
ADDRESS.....
CITY..... STATE.....



Special Offer On This Complete **RADIO ENGINEERING LIBRARY**

New, Up-To-Date Edition of Famous Library Covers Whole Field of Radio Engineering. Places Latest Facts, Standards, Data, Practice, and Theory At Your Fingertips.

The five big volumes of the new edition of the Radio Engineering Library now include the very latest facts, standards, data, and practice. This Library will help solve hundreds of problems for designers, researchers, engineers, and students in any field based on radio.

Written by leading radio engineers, these books cover circuit phenomena, networks, tube theory, vacuum tubes, amplification, measurements, etc.—give specialized treatment of all fields of practical design and application. They provide you with a complete and dependable encyclopedia of facts.

- 5 Volumes, 3872 Pages, 2770 Illustrations.
- Eastman's **FUNDAMENTALS OF VACUUM TUBES**, 3rd Edition.
- Terman's **RADIO ENGINEERING**, 3rd Edition.
- Everitt's **COMMUNICATION ENGINEERING**, 2nd Edition.
- Mund's **HIGH FREQUENCY MEASUREMENTS**, 2nd Edition.
- Henney's **RADIO ENGINEERING HANDBOOK**, 4th Edition.

SEND NO MONEY
Special Low Price—Easy Terms

On this special offer you get this Library for \$37.50, instead of \$43.50. You save \$6.00 and may pay on easy terms. Mail coupon below to examine the Library **FREE** for 10 days. No obligation. These books are recognized as standard works; you are bound to need them. So take advantage of this special money-saving offer. *Mail coupon at once!*

McGraw-Hill Book Co., Dept. RTN-1-53
327 West 41st St., New York 36, N. Y.

Send for 10 days' FREE trial, the RADIO ENGINEERING LIBRARY. If not satisfied I will return books. Otherwise I will send \$7.50, plus delivery charges, then; and \$6 a month for 5 months. (Reg. price \$43.50; you save \$6).

Name.....

Home Address..... RTN-1-53

City & State.....

We'll Pay Delivery Charges if you enclose \$7.50 first payment WITH coupon. Same return privilege for full refund.

INDEX OF Advertisers

JAN. 1953

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

ADVERTISER	PAGE	ADVERTISER	PAGE
Acura Electronics Corporation	134	McConnell's	112, 131, 133, 118
Alex Radio Corporation	127	McGee Radio Company	102, 103
All Channel Antenna Corporation	138	McGraw-Hill Book Company	151
Allied Radio Corporation	9	McIntosh Laboratories, Inc.	81
Allied Sound Corporation	121	Mac Innes, Norman R.	129
Almo Radio Company	148	Mallory, P. R. & Company	83, 4th cover
Alproco Incorporated	97	Mattison Television Company	146
Alvaradio Supply Company	98	Michel Mfg. Company	132
Amber Company	139	Miles Reproducer Company	143
American Electronics	152	Milwaukee School of Engineering	149
American Phenolic Corporation	86	Moss Electronics	85
American Television & Radio Company	134	National Electronics of Cleveland	88
Amperlite Company Incorporated	81	National Radio Institute	99, 100
Amplifier Corporation of America	101	National Schools	13
Arkay-Radio Kits, Incorporated	101	Nation Wide Radio	136
Arrow Sales, Incorporated	125	Newark Electric Company	91
Ashe, Walter, Radio Company	89	Newark Surplus Materials	96
Atlas Sound Corporation	138	Newcomb Audio Products Company	26
Audak Company, Incorporated	165	Offenbach & Reimus Company	126
Barker & Williamson, Incorporated	90	Olson Radio Warehouse	80, 81
Barry Electronics Corporation	108	Olympic Electronic Supply	96
Bell Telephone Laboratories, Incorporated	10	Oxford Electronics	126
Bendix Radio	115	Peak Electronics	108
Berlund Associates	152	Perna Power	88
Brook Electronics, Incorporated	101	Phillips Tube Company	98
Burstein-Appelco Company	113	Photon Sales	94
C & H Sales Company	101	Pickering & Company, Inc.	153
Candee-Airo	132	Platt Electronics	128
Candler System Company	112	Poly-Tech Company	155
Capitol Radio Engineering Institute	93	Premier Radio Tube Company	91
Central Incorporated	3	Prentice Hall, Inc.	81
Channel Master Corporation	11	Progressive Electronics Company	111
Cleveland Institute of Radio Electronics	109	Quietrol Company	82
Collins Audio Products	22	RCA Institutes	27
Columbia Electronic Sales	151	RCA Institutes, Inc.	138
Communication Equipment Company	118	R W Electronics	143
Concord Radio Corporation	120	Radcom Engineering Company	114
Cornish Wire Company, Incorporated	139	Radiart Corporation	105
Coyne Electrical School	155	Radio Apparatus Corporation	118
Crest Laboratories, Incorporated	152	Radio City Products, Inc.	21
Davis Electronics	132	Radio Corporation of America	12, 2nd cover
DeForest's Training Incorporated	5	Radio Craftsmen, Inc.	78
Di-Co TV & Plastic Company, Incorporated	98	Radio Hum Shack	123
Dow Radio Incorporated	114	Radio Receiver Company, Inc.	117
Editors & Engineers, Ltd.	135	Radio-Television Training Ass'n	25
Elec Corporation	95	Radi-Tel Tube Company	133
Electro Devices	114	Raytheon Mfg. Company	65
Electronics Institute, Incorporated	131	Regency	112, 112
Electronic Instrument Company, Incorporated	30	Rek-O-Kut Company	90
Electronic Measurements Corporation	117	Rehy Sales Company	132
Electronic Specialty Supply Company	136	Rider, John F.	105
Electro-Voice Incorporated	8	Rhinbart Books	82, 116, 136, 147, 151
Esege Sales	112	Rohn Mfg. Company	141
Espey Manufacturing Company, Incorporated	117	Rose Company	111
Fair Radio Sales	139	Sams & Company, Howard W.	92, 118, 124
Federated Purchaser, Incorporated	108	Sangamo Electric Company	115
Feller Engineering Company	153	Sanett, Bob	131
Fisher Radio	110	Sarkes Turvin, Inc.	147
Franklin Technical Institute	137	Schott, Walter L. Company	18
French Radio Manufacturing Company	137	Service Products	141
G. L. Electronics	137	Simpson Electric Company	119
Garrard Sales Corporation	145	South River Metal Products Company	149
General Electric Company	15	Sprayberry Academy of Radio	29
General Test Equipment	114	Stan Burn Radio & Electronics	142
Goodheart, R. E.	98	Standard Surplus	151
Goodburne Corporation	106	Star Electronics Distr., Inc.	119
Greenlee Tool Company	94	Steve-El Electronics Corporation	107
Hallierafters Company	7	Stevens Wulden, Inc.	122
Harvey Radio Company	110	Sun Radio & Electronics Company	144
Heath Company	67 thru 77	Supreme Publications	107
Henshaw Radio Supply	119	Sylvania Electric Products	23
Hickok Electrical Instrument Company	16, 17, 138	TAB	156
Hughes Research Labs.	150	Television Communications Institute	145
Hytron Radio & Electronics Company	79	Television Materials Corporation	101
Indiana Technical College	133	Ternco Company	120
Intelectograph Company	141	Transvision, Inc.	87
International Correspondence Schools	19	Trio Mfg. Company	20
J.F.D. Manufacturing Company	14	Triplet Electrical Instrument Company	28
J. S. H. Sales Company	153	Tri-State College	119
Jersey City Technical Laboratories	88	United Technical Laboratories	111, 113
Kelsey Company	143	University Loudspeakers, Inc.	128
Klein Company, Manuel	135	V & H Radio & Electronics	134
Lampkin Laboratories	130	Valparaiso Technical Institute	137
LaPointe Plasmacold Corporation	6	Van Nostrand, D.	141
Lee Electronic Laboratories, Inc.	108	Van Sickle Radio Supply	151
Leeds Radio Company	148	Waldom Electronics, Inc.	144
Leotone Radio Company	145	Western Electronics Company	139
Luther, Otto	119	Wholesale Radio Parts	129
		World Radio Laboratories, Inc.	131
		YMCA Trade & Technical School	131

Ends Low Line Voltage Hazard

CREST LVB-117

Line Voltage Booster

the ultimate in

ACCURATE VOLTAGE BOOST



End low line hazard — sub-normal line voltage may cause damage of TV set or electrical equipment.

The Crest LVB-117* is engineered to restore peak performance to TV set or appliance. Insures full strength, width and height of TV picture. Corrects intermittent sync and oscillator drift. A must for low line voltage areas.

Power plus features of the LVB-117

- ★ 300 watt rating
- ★ Simple external plug-in unit
- ★ Automatically operated, turns on and off with appliance
- ★ Multi-Tap selector assures exact voltage boost
- ★ Overload cut-out protects against line increases
- ★ Visual signal for exact voltage boost

Standard RTMA Guarantee **\$17.95** LIST

Available at local jobbers or write for name of local representative.

CREST

LABORATORIES
INC.

84-11 Rockaway Beach Blvd.
Rockaway Beach, N. Y.
Far Rockaway 7-2732

Tone Controls

(Continued from page 57)

equipment and the listener. The general relationships to observe are that phase shift and subsequent mixing tends to lower the apparent frequency of transients and asymmetric waveforms and if the phase rotation is greater than 90 degrees will tend to suppress sine waves. The opposite relationship is when phase shift, inversion, and mixing takes place in which event the apparent frequency of transients and asymmetric waveforms is increased for phase rotations of less than 180 degrees. Likewise, sine waves will tend to be suppressed in the case of phase rotations of less than 90 degrees.

As mentioned earlier, the effect of phase-shift mixing is generally to increase the ratio of transients to sine waves in the reproduction. In addition to some of the previously mentioned advantages this effect may cause reproduction with greater "presence," apparently due to the fact that transients stimulate individual room resonances to a greater degree, an element apparently easily recognized by a listener thoroughly familiar with his particular acoustic environment. Nevertheless, the reproduction of a signal having a high transient-to-sine-wave ratio usually means that the peak power handling capabilities of the audio system must be considerably greater than that of a system handling continuous wave trains in order to present the same apparent loudness level to the listener. Likewise other problems may present themselves, such as an interesting form of distortion which the author characterizes as "demodulation distortion."

In considering speech or music it should be realized that the various wave trains tend to produce a modulation envelope, which can be produced either by a tone of constant pitch or by a combination of unrelated frequencies. Usually these modulation envelopes vary from a few cycles-per-second on up into the audible range. If nonlinearity or rectification is present in the audio system, such as might be caused by second harmonic distortion in an amplifier stage, then the envelope components will tend to be demodulated and will appear in the output as a spurious low frequency tone. In the case of a phonograph pickup having a serious ringing resonance, even in the ultrasonic region, the effect of demodulation distortion will be to introduce spurious noise components of a frequency dependent upon the amplitude of the exciting transient and the consequent duration of the ringing envelope. The cure for these effects is, of course, low distortion circuits, however, it is of interest to note that if nonlinearity is present in the loudspeaker system the use of tweeters and woofers with low frequency acoustic cut-off may help to

Concertone maintains its leadership through constant achievement

Concertone's leadership in the field of high fidelity recording is maintained by constantly improving the quality of Concertone magnetic tape recorders

Concertone engineers continually incorporate advancements into the design—thereby keeping consistently ahead of the field. Concertone recorders never become "dated" or outmoded. Now, more than ever before, Concertone is truly the standard of high fidelity performance.

Professional users' net prices begin at \$345.00. Write for literature.



Manufactured by

Berlant Associates

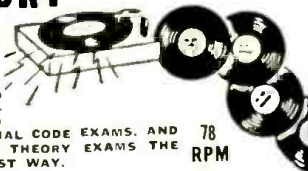
4917 W. Jefferson Blvd., Los Angeles 16, Calif.

Read
RADIO & TELEVISION NEWS
for NEWS of the Industry

LEARN CODE THEORY

AND AS LOW AS \$6.95

ECONOMICAL HOME STUDY COURSE PREPARE YOU TO PASS AMATEUR AND COMMERCIAL CODE EXAMS. AND 78 AMATEUR THEORY EXAMS THE EASY, FAST WAY.



3 "AMECO" COURSES AVAILABLE:

- 1—NOVICE CODE COURSE. You get and keep 10 recordings (alphabet through 8 W.P.M.). Includes typical F. C. C. type code exams. Free instruction book on learning how to send and receive code the simplest, fastest way; plus charts to check your receiving accuracy plus an album. **\$7.95** all for the low price of only...
- 2—SENDR CODE COURSE. You get and keep everything about in the Novice Course except that you get 22 recordings (alphabet through 18 W.P.M.) plus typical F. C. C. type code exams for General class and 2nd class commercial telegraph licenses. All this for only **\$12.95**
- 3—COMPLETE RADIO THEORY COURSE. A complete, simplified home study theory course in radio, covering the Novice Technician, Conditional General, and Advanced classes—all under one cover—with hundreds of typical F. C. C. type questions to prepare you for license exams. No technical background required. You also get, FREE, one year of consultation and a guide to setting up your ham station. All for the amazingly low **\$6.95** low price of...

If your favorite dealer does not yet stock "Ameco" courses, you may order direct. Write for Free information on courses and new "Ameco" transmitter units.

AMERICAN Electronics Co., Dept. RN-1
1451 Wilkins Ave., N. Y. 55, N. Y.
Tel. No. DAYTON 9-4815

RADIO & TELEVISION NEWS

Columbia

GEM OF THE SURPLUS

BC-348 RECEIVER
110 VAC or 24 VDC. Freq.: 200-500 Kc. & 1500-18,000 Kc. Excel. cond. \$99.50

BC-221 FREQUENCY METER: With 110 VAC power supply \$125.00
BATTERY OPERATED. Excel. cond. 99.50

EE-8 FIELD PHONE: Checked out operating. Used cond. \$22.50
SPECIAL PRICE PER PAIR 39.50

DYNAMOTORS 6 & 12 V.
PE-101: 12 or 24 V. in. 400 V. @ 130 ma output. See Dec. '52 CQ for con't. to 6 VOLTS. New, boxed. \$ 4.95
PE-103: 6 or 12 V. in. 500 V. @ 160 ma. With filter base & cords. NEW. 34.95
BD-77: 12 V. in. 1,000 V. output @ 350 mls 14.95
DM-35: 12 V. in.: 024 V. output @ 225 mls 22.50
COMMAND RECEIVER DYNAMOTDR: 12 V., used. 7.95

WET CELL BATTERIES
24 V. EXIDE AIRCRAFT. New, orig. box. \$18.95
12 V. 37 amp @ 5-hr. rate. NEW. 12.95
12 V. For TBY Transceiver. NEW. HOT! 4.95

STOP! Make extra dough NOW by rushing us your new and used radio gear. We buy it fast at peak-high prices. WRITE TODAY!

TRANSMITTER: BC-375. 100 W. Phone or CW. Complete with 24 V. dynamotor, tuning unit, all tubes & plugs. Excel. cond. \$47.50
RADIO RANGE RECEIVER: BC-1208-CM. New 9.95

ARC-5 OR 274-N TRANSMITTERS
2-1-3 mcs. \$19.95
4-5-3 mcs. Used, good cond. 6.95
6-9-1 mcs. Brand new. Excel. cond. 12.50
7-0-1 12.50

ARC-5 OR 274-N RECEIVERS
1B-55 kc. Excel. cond. \$14.95
1-5-3 mcs. Brand new. 24.50
3-6 mcs. Less tubes. 6.95
3-6 mcs. With tubes. 9.95
6-9-1 mcs. Brand new. 14.95
6-9-1 mcs. Used. Less tubes. 8.95

MD-7 ARC-5 PLATE MODULATOR. Excel. cond. 14.95
RACK FOR DUAL TRANSMITTER (274-N) 2.95
RACK FOR DUAL TRANSMITTER ARC-5 3.95
TRIPLE RECEIVER RACK. 5.00
DUAL RECEIVER CONTROL BOX. BC-490. New. 2.95
BC-442-A ANTENNA RELAY with 50 mmfl. condenser. Excel. cond. 3.95
COMMAND RECEIVER FLEX CABLE. 19-12 Ft. long. 2.95
12 V. COMMAND RECEIVER DYNAMO-TOR. New. 12.95

BC-625 TRANSMITTER: Part of SC1-522. Freq. range: 100-156 MC. Less tubes. A \$13.95
HOT BUY!
BC-624 RECEIVER: Part of SC1-522. Freq. range 100-156 MC. Less tubes. A \$19.75
TERRIFIC THE PAIR ONLY \$29.95

ARC-4 VHF TRANSCEIVER: For novice, 2-meter, CD or CAP. All tubes. Excellent cond. SPECIAL. \$32.50
All orders F.O.B. Los Angeles. 25% deposit required. All items subject to prior sale.

COLUMBIA ELECTRONIC SALES
522 South San Pedro St. Los Angeles 13, Calif.

Don't Miss a One of the Exciting New Developments in Electronics. Keep Up Your Subscription to RADIO & TELEVISION NEWS
Circulation Dept.
64 East Lake Street
Chicago 1, Ill.

New Electronic Headquarters—**VAN SICKLE RADIO SUPPLY CO.**
1320 So. Calhoun St. Phone E-4136
FORT WAYNE 2, IND.
Please note new address. Eugene Van Sickle, Owner

cal service associations should arrange themselves in small groups so that members can meet regularly at a central point close to their homes. Perhaps twice a year the entire city association could sponsor a big meeting in some central location to hear an outstanding lecturer or plan a service clinic that would feature discussions of the important technical developments or servicing problems.

Service Industry Identification
A common complaint among service shop operators is that manufacturers are not interested in the problems or welfare of the independent service industry. This is not true for the average manufacturer realizes full well that a strong, financially successful servicing industry will provide a healthy, stable market for his product. It is equally obvious that a manufacturer cannot get enmeshed in the problems of the service industry without getting involved with some laws that tell him to keep his nose out of other people's business.

The independent service industry has several unused "tools" available to it that would lift the entire activity to a much higher level of importance in the industry. The most important of these tools lies in the way you order tubes, parts, and supplies from your jobbers. How often do you specify the brand names you want when you order tubes, parts, or supplies?

How important are you in any manufacturer's "chain of distribution"? If you do not order your tubes, parts, and supplies by brand name—and insist on getting the brands you order—you are not important at all. You are merely a small part of a mass market for these products. Your parts jobber is the key man in the manufacturers' chain of distribution because he selects the brands that you accept without question.

Consider this: If you order fifty tubes from your jobber and accept any brand that he supplies, you as an individual mean nothing to any individual tube manufacturer.

But suppose you specified a particular brand when you ordered tubes—and insisted on getting that brand. Then you become very important to that tube manufacturer because your preference for his tubes has placed you on his sales team. Your jobber will become less important in that manufacturer's chain of distribution because he knows that if one jobber will not or cannot fill your order for his brand of tubes you will go to some other jobber who will. You become a very important factor in that manufacturer's distribution chain.

The independent servicing industry would increase its importance immeasurably in the eyes of manufacturers if every service shop operator would specify a particular brand on all tubes, parts, supplies, and accessories he orders from his jobber—and would insist on getting the brands he specifies.

COMPLETE TRAINING FOR BETTER RADIO-TV SERVICE JOBS



Let these two great new Ghirardi training books teach you to handle all types of AM, FM and TV service jobs by approved professional methods—and watch your efficiency and earnings soar!

Completely modern, profusely illustrated and written so you can easily understand every word, these books pave the way to fast, accurate service on any type of home radio-TV electronic equipment ever made. Each book is brand new. Each contains the latest data on the latest methods and equipment—NOT a re-hash of old, out-of-date material. Each is co-authored by A. A. Ghirardi whose famous RADIO PHYSICS COURSE and MODERN RADIO SERVICE were, for 20 years, more widely used for military, school and home study training than any other books of their type!

THE NEW Ghirardi RADIO-TV SERVICE LIBRARY

Almost 1500 Pages and over 800 clear illustrations show step-by-step how to handle every phase of modern troubleshooting and servicing.

1—Radio and Television Receiver TROUBLESHOOTING AND REPAIR

A complete guide to profitable professional methods. For the novice, it is a comprehensive training course. For the experienced serviceman, it is a quick way to "brush up" on specific jobs, to develop improved techniques or to find fast answers to puzzling service problems. Includes invaluable "step-by-step" service charts. 820 pages, 417 illus., price \$6.75 separately.

2—Radio and Television Receiver CIRCUITRY AND OPERATION

This 600-page volume is the ideal guide for servicemen who realize it pays to know what really makes modern radio-TV receivers "tick" and why. Gives a complete understanding of basic circuits and circuit variations; how to recognize them at a glance; how to eliminate guesswork and useless testing in servicing them. 417 illus., price separately \$6.

New low price easy terms

If broken into lesson form and sent to you as a "course," you'd regard these two great books as a bargain at \$50 or more! Together, they form a complete modern servicing library to help you work faster, more efficiently and more profitably. Completely indexed so you can look up needed facts in a jiffy.

Under this new offer, you save 75c on the price of the two books—and have the privilege of paying in easy installments while you use them! No lessons to wait for. You learn fast—and you learn right!

10-DAY EXAMINATION PRIVILEGE

Dept. RN-13, Rinehart Books, Inc.,
Technical Division,
232 Madison Ave., New York 16, N. Y.

Send me GHIRARDI'S NEW 2-VOL. SERVICE LIBRARY. I enclose \$3 and will send you \$3 a month for three months until the total price of only \$12.00, plus a few cents postage, is paid. It is understood I may read the books for 10 days. Then, if not satisfactory, I will return them postage paid and you agree to refund my \$3 and cancel the remaining installments. (Books shipped postpaid for full remittance with order—same return privilege.)

Name

Address

City, Zone, State

Employer's Name & Address

OUTSIDE U.S.A.—\$13.00 cash only. Same 10-day return privilege with money refunded.

to the

ELECTRICAL ENGINEER

or

PHYSICIST

with experience in

RADAR

or

ELECTRONICS

Hughes Research and Development Laboratories, one of the nation's leading electronics organizations, are now creating a number of new openings in an important phase of their operations.

Here is what one of these positions offers you:

THE COMPANY

Hughes Research and Development Laboratories, located in Southern California, are presently engaged in the development and production of advanced radar systems, electronic computers and guided missiles.

THE NEW OPENINGS

The positions are for men who will serve as technical advisors to government agencies and companies purchasing Hughes equipment—also as technical consultants with engineers of other companies working on associated equipment. Your specific job would be essentially to help insure successful operation of Hughes equipment in the field.

THE TRAINING

On joining our organization, you will work in the Laboratories for several months to become thoroughly familiar with the equipment which you will later help users to understand and properly employ. If you have already had radar or electronics experience, you will find this knowledge helpful in your new work.

WHERE YOU WORK

After your period of training—at full pay—you may (1) remain with the Laboratories in Southern California in an instructive or administrative capacity, (2) become the Hughes representative at a company where our equipment is being installed, or (3) be the

Hughes representative at a military base in this country or overseas (single men only). Compensation is made for traveling and moving household effects, and married men keep their families with them at all times.

YOUR FUTURE

In one of these positions you will gain all-around experience that will increase your value to our organization as it further expands in the field of electronics. The next few years are certain to see large-scale commercial employment of electronic systems. Your training in and familiarity with the most advanced electronic techniques now will qualify you for even more important future positions.

How to apply:

HUGHES

RESEARCH AND
DEVELOPMENT LABORATORIES

Engineering Personnel Department
Culver City,
Los Angeles County, California

If you are under thirty-five years of age, and if you have an E.E. or Physics degree, write to the Laboratories, giving resume of your experience.

Assurance is required that relocation of the applicant will not cause disruption of an urgent military project.

the complexion of the service industry. Prior to the advent of TV it was entirely possible for an ingenious technician possessed of some business acumen, able to get along well with people, and willing to work long hours, to make a pretty good living out of servicing radios. Not much equipment was needed for radio service work since the characteristics of the conventional a.c.-d.c. circuits were so well known that almost eighty per-cent of the jobs could be completed without the use of even a v.o.m.

TV changed all that. Larger chassis, more tubes per set, multiple circuits, bulky picture tubes, and on the job servicing, plus a number of other factors, made it necessary for the operator of a TV service business to get familiar with work planning, organization of time, and adequate record keeping. The need for precision test instruments, trucks, larger stocks of tubes, parts, and supplies add up to a substantial investment that can seldom be carried by the income from one man's time. So the TV service business man has employees and all of the attendant responsibilities of keeping his help profitably occupied.

TV service adds up to a tremendous dollar volume business. This attracts the attention of men who are not necessarily TV technicians. They are basically business men who know that good management can operate any business at a profit where there is such a large and growing market for the needed service.

Successful TV service operators are businessmen primarily, whose major interests are in selling service, reducing costs of operation, watching inventories, and planning the work of their employees to make a profit from the labor they are buying.

These men need service business associations. They need to know their competitors in the service business. They need to cooperate with their legitimate competitors to discourage practices that are both unprofitable and not in the best interests of the owners of TV sets. A good trade association can actually create more business in any given area through programs of user education.

Technical Associations

Then there are many thousands of men employed in servicing who are mainly interested in the technical phases of the business. Lots of men now engaged in TV receiver servicing do not aspire to own their own service businesses. They prefer the technical side of the business and would rather work as a top technician in a good service organization than run their own service businesses.

These men prefer to belong to technical associations where they can discuss circuitry and technological advances with their fellow technicians. We should have more such associations in the industry. Perhaps they could be termed ISE—Institute of Service Engineers. In large cities techni-

Hal Chase of Chase Television Service, president of the Association, gives a lot of his time in planning and directing the Association's activities. "TSA News" has been developed into a self-supporting house organ with a wide circulation in the area. Recently they launched a "consumer" bulletin which is included as a section of "TSA News." It is available in quantities to members for mailing to their customers. The consumer bulletin carries TV-connected news of interest to set owners and is supported by merchants who advertise in it.

The Association holds regular monthly business meetings. These are held in a private dining room in a downtown hotel with members and guests meeting for dinner. After dinner a guest speaker usually gives a short talk on some subject of immediate importance to service executives with the regular business meeting and round table discussion of problems following it. Parts and set distributors attend these monthly business meetings.

The technical meetings include at least one general service clinic each year. The purpose of the service clinics is to permit technicians to get circuit information on all standard TV sets in as short a time as possible. Distributors display their latest model chassis and have either factory or distributor service personnel on hand to discuss circuit individualities with service technicians.

TTLB Lecture on U.H.F. TV

The TSA recently sponsored the Television Technicians Lecture Bureau's lecture on u.h.f. TV. In this type of lecture the technician is able to get a complete picture of all possible installation and servicing requirements that may be demanded for u.h.f. reception. It covers u.h.f. converters and how they are applied to present v.h.f. receivers. Sample units of most converters are displayed and alignment procedures are demonstrated for the converters that may need to be aligned in the field.

The presentation then covers the circuitry of the new u.h.f.-v.h.f. combination receivers and technicians are shown what they may be called upon to do in servicing these new sets in the field. And, since the antenna system may possibly be the most important element in the reception of u.h.f. programs, either in converted v.h.f. sets or in the new u.h.f.-v.h.f. combinations, an extensive coverage of u.h.f. antenna and systems requirements is included as a part of the lecture.

These technical training programs as carried out by TSA and ARTSD are planned to conserve a technician's time by giving him the maximum amount of practical information in a minimum of time.

Business or Technical Associations?

Television introduced a new factor in the operation of service businesses that has made a complete change in

January, 1953

Become an ELECTRICAL ENGINEER in 36 MONTHS

Bachelor of Science Degree — Major in Electronics or Power

It is estimated by 1955 there will be at least two positions for every engineering and technician graduate. This college offers a tested plan that permits you to enter these vast employment opportunities at an early date. Save a valuable year through optional year-round study. Receive advanced credit for prior training gained in the armed forces, other schools or field experience.

ENTER BOTH RADIO AND TELEVISION 12 months or one-third of the B. S. degree course (Electronics major) — also brings you the Radio Technician's certificate. An added 6-month course qualifies you for the Radio-TV Technician's certificate. Recent developments open unlimited opportunities for TV technicians and engineers.

THE PROVEN "UNIT CHASSIS SYSTEM" of teaching was developed here. It "breaks down" the TV set by stages. You learn every component of all types and makes — and are prepared for future design changes, including the advent of color.

6 to 12-MONTH TELEVISION SERVICE COURSE... trains for good servicing jobs and shop ownership in the shortest practical time under expert instructors.

Terms open April, July, October, January. Over 48,000 former students from all states and 23 overseas countries. Faculty of trained specialists. Modern laboratories and equipment.

Write for free 110-page catalog, 48-page pictorial booklet "Your Career" and "Occupational Guidance Bulletins."

MILWAUKEE SCHOOL OF ENGINEERING

NONPROFIT

FOUNDED IN 1903



Milwaukee School of Engineering
Dept. RN-153, 1025 North Milwaukee
Milwaukee 1, Wisconsin

Without obligation send Catalog for Electrical Engineering, B. S. Degree, major in Electronics; Power; "Your Career"; Occupational Guidance Bulletin on: Radio-TV; Electrical Power; Welding; Heating, Refrigeration, Air Conditioning; Mechanical Engineering, B. S. Degree; Preparatory; Television Service.

Name.....Age.....

Address.....

City.....Zone.....State.....

If veteran, indicate date of discharge.....

★ STAR SPECIALS

NEWEST ITEMS! LOWEST PRICES!

BARGAIN LOW PRICE

FLYBACK TRANSFORMER

(Similar to GE 77J 1)

Regular \$11.00 list price high voltage transformer similar to General Electric 77J1. Used for general replacement in many sets up to 14KV and with up to 19" tubes. Not available elsewhere at our low price!

A-1827 Flyback Transformer \$2.49



Simpson Model 381 CAPACITY BRIDGE

Direct-reading in micro-microfarads and microfarads; no multiplying factors or intricate switching. Three ranges to read 20-5000 mfd., 0.005-2.0 mfd., and 1.0-500 mfd. Compact bakelite case measures only 3 3/8" x 5 1/2" x 2 3/8"; etched aluminum panel. For 115-volt 50-60 cycles. \$27.93



Price Slashed!

65 MA

SELENIUM RECTIFIERS

Brand new, famous make 65 ma. selenium rectifiers used by servicemen and builders. Standard replacement for many AC-DC sets and other transformerless power supplies. Stock up now at our low price! A-1598 65 ma. Selenium Rectifier 65c ea. 10 for only \$5.90! 100 for only \$54.00!

COMPLETE STOCKS
All Standard Brands

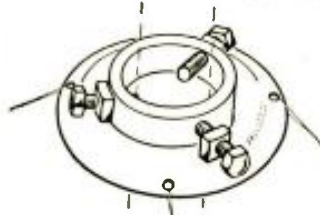
Just off the press
BIG BARGAIN BULLETIN



ELECTRONIC DISTRIBUTORS, INC.

Dept. RN1-7736 S. Halsted, Chicago 20, Ill.

South River NEWS



GUY RING Model GR-1

Constructed of heavy gauge, galvanized steel, embossed for extra strength. Set screw arrangement provides positive fit for all masts ranging from 1 1/4" O.D. to 2" O.D. Complete with installation hardware.

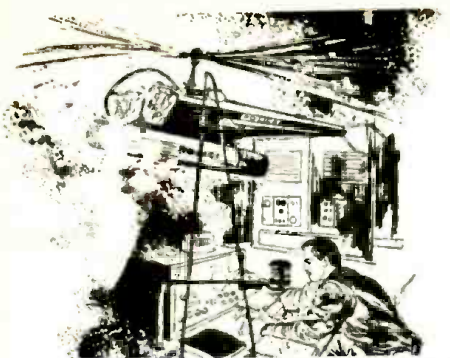
Smooth Round Edged Holes Prevent Cutting of Guy Wire

South River Antenna Mounting Accessories are carried by every leading TV Parts Jobber from coast to coast. Write for your copy of our new 1953 catalog.

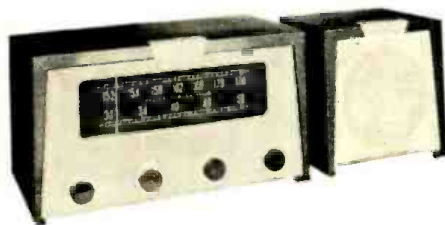
SOUTH RIVER METAL PRODUCTS CO., INC.

SOUTH RIVER, N. J.

PIONEER AND OUTSTANDING PRODUCER OF FINEST LINE OF ANTENNA MOUNTS



NEW NEW NEW NEW



MONITORADIO MODEL DR200

Model DR200 Two Band Communications Receiver newly developed—low cost—only one of its kind. Fixed and Tunable Combination AC Receiver for 30-50 MC and 152-174 MC.

Operating in two pertinent fixed frequency ranges the tunable feature can be used alternately with the flip of a switch.

Ideal for expanding communications systems of municipal police, civil defense, fire, forestry, state police, pipelines, taxis.

Built-in sensitive squelch with level control. Dual conversion, 10.7 MC and 455 KC. Fully tuned RF stage. Fourteen tubes plus rectifier. Sensitivity for 20 DB quieting, one microvolt low band, two microvolts high band. Selectivity 3 DB at plus or minus 20 KC. 80 DB at plus or minus 30 KC. Crystal selector control with provision for two crystals fixed frequency operation (one for each band).



MONITORADIO MODEL MR 32 AC RECEIVER FOR 30-50 MC

RADIO APPARATUS CORPORATION
55 NORTH NEW JERSEY STREET
INDIANAPOLIS 4, IND., PHONE: ATLANTIC 1624

MONITORADIO



burton browne advertising

market for fringe distributors and the extra discount boys in the distributor business.

Why Do Service Associations Fail?

Many service associations have been formed with a great deal of enthusiasm only to quickly wither and die from ennui. Why? The first reason is that associations usually are formed when service businesses are in trouble. Those who join think an "Association" will solve their troubles. Usually, the first acts of an association are along the lines of "forcing" someone to do something or to quit doing something that the members think is hurting their businesses.

For an association to be successful it must first be ready to "give" something to the industry in which it operates. Its members must be willing first to get their own business houses in order before they start asking others to clean up theirs.

A successful organization must have a series of self-help programs. These must be carefully planned, intelligently organized, and carried out aggressively. This requires time, effort, and thought on someone's part. It also takes money. If the officers of an association are not willing—or not able—to give unstintingly of their time and effort to develop and carry out these self-help programs the organization will wither away. If the members are unwilling to pay the dues necessary to defray the expenses necessary to operate an association it cannot exist.

The first requirement of an association is to have a carefully planned series of activities that will cover the business phases of a service company and the technical developments in the industry that affect service, and will provide an opportunity for the members to get acquainted socially. The second requirement is for the association to have an officer, or officers, who can afford to give the time and have the natural "drive" to keep this program rolling.

All too often after an association is formed the members are too hasty to engage in association activities when business is good and they can't afford it when business is bad.

A Case History

The Television Service Association of Michigan is a comparatively new organization that has created an important place for itself in the TV industry in Detroit. Like ARTSD and other successful associations, it is primarily concerned with the problems of service as a business but at the same time, keeps its members and Detroit technical service personnel abreast of technical developments by sponsoring service clinics and lectures.

TSA has the active support of both set and parts distributors in the area and they work closely with the Better Business Bureau and law enforcement agencies in policing service business practices in the city.

MERIT POWER TRANSFORMERS	
115 VOLT 60 CYCLE PRIMARY	
120V/50 MA/6.3V-1.5 AMP	\$ 2.73
150V/25 MA/6.3V-5 AMP	1.76
480VCT/50 MA/6.3V-25 AMP	3.23
480VCT/40 MA/5V-2 A/6.3VCT-2 A	3.53
520VCT/70 MA/5V-2 AMP/6.3V-3 AMP	4.53
700VCT/90 MA/5V-3 A/2.5 VCT-12.5 A	5.88
650VCT/40 MA/5V-2 A/6.3VCT-2 A	3.67
700VCT/90 MA/5V-3 A/6.3VCT-3.5 A	4.70
700VCT/120 MA/5V-3 A/6.3VCT-4.7 A	5.44
750VCT/150 MA/5V-3 A/6.3VCT-5 A	7.05
800VCT/200 MA/5V-3 A/6.3VCT-5 A	8.23
870VCT/250 MA/5V-3 A/2.5V-10 A/6.3VCT-3 A/6.3 or 5V-3 A 80 V BIAS TAP	10.29
700VCT/225 MA/5V-3 A/6.3V-10 A/6.3V-2.7 A*	12.49
724VCT/295 MA/5V-6 A/12.6VCT-5 A/5V-2 A*	16.12
700VCT/200 MA/5V-2 AMP/5V-3 AMP/6.3V-5 AMP/6.3V-7 AMP	10.58
800VCT/300 MA/5V-3 A/5V-6 A/12.6VCT-10 A*	17.64
1750V/2 MA/2.5V-2 A/6.3V-9 A/6.3 or 2.5V-2 A†	6.17
2500V/5 MA/2.5V-2 A/6.3V-3 A/6.3 or 2.5V-3 A†	8.23
† HALF SHELL MOUNT * TV REPLACEMENT	
‡ UPRIGHT MOUNT	
CONSTANT VOLTAGE TRANSFORMERS	
95-130 VOLT 60 CYCLE INPUT	
115 VOLT 60 CYCLE OUTPUT ± 1/2%	
15 WATT	\$15.68
30 W (6.0 or 7.5V OUT)	17.64
120 WATT	32.34
500 WATT	79.38
30 WATT	\$17.64
60 WATT	24.50
250 WATT	50.96
1000 WATT	132.30
2000 WATT	240.10
SELENIUM RECTIFIERS	
SINGLE PHASE—FULL WAVE BRIDGE STACKS	
MAX. AC INPUT—26 V/6-20 V DC OUTPUT	
2 AMP	\$4.99
4 AMP	6.70
6 AMP	7.20
8 AMP	8.68
MAX. AC INPUT—130 V/100-120 V DC OUTPUT	
.5 AMP	\$10.26
1 AMP	16.34
2 AMP	21.56
4 AMP	32.40
6 AMP	33.30
8 AMP	44.64
12 AMP	46.62
STEEL BOXES—BLACK CRACKLE FINISH	
4 x 4 x 2	\$.70
4 x 5 x 3	.80
6 x 6 x 6	1.10
12 x 7 x 6	2.08
15 x 9 x 7	\$2.38
12 x 7 1/4 x 6 1/2	2.40
15 x 7 1/4 x 6 1/2	2.48
SLOPING FRONT CABINETS	
8 x 8 x 8	\$3.53
8 x 10 x 8	3.93
8 x 12 x 8	4.08
8 x 14 x 8	\$4.23
12 x 19 x 12	7.70

All prices F.O.B. our warehouse New York

LEEDS RADIO CO.

75 Vesey St. Dept. A New York City 7

MAKE DIM TUBES LIKE NEW AGAIN!

WITH
PICBOOST
ONLY
\$1.95



Dim TV tubes spring back clear and bright again. Just plug in. No soldering—No fuss—Takes less than a minute to install. Will give any TV tube 3,000 more hours of bright life. Eliminates big C. R. tube inventories, excessive service trips—a real help for second year TV contracts. See how Picboost saves you real money. Try it yourself. Order Picboost today!

10% Cash with Order

ALMO RADIO CO.

509 ARCH ST. & 6205 MARKET ST.
Philadelphia, Pa.
6th & ORANGE STS. • Wilmington, Del.
4401 VENTNOR AVE. • Atlantic City, N. J.
1133 HADDON AVE. • Camden, N. J.
219 Highland Ave. • Salisbury, Md.

RU-18 RECEIVER
Navy 6-tube aircraft receiver with DF loop and antenna input; complete coverage from 190 KC to 13.9 meg.; in 8-coil sets, less tubes; brand new with any 5-coil sets; you name the freq.; shipping wt., 25 lbs. Price, \$19.95

McCONNELL'S
3834 Germantown Ave.
Phila., Penna. RA 5-6033



a Gem

a Gem IN PERFORMANCE

- (a) Long Life
- (b) Good Regulation
- (c) High Efficiency

a Gem FOR VERSATILITY

- (a) Wide Range of Power Outputs
- (b) Temperatures of -55°C to $+100^{\circ}\text{C}$
- (c) Impervious to all Humidity
- (d) Impervious to Salt Atmosphere

a Gem IN COMPACTNESS

- (a) Various sizes and shapes
- (b) Light Weight for any Power Output
- (c) "Tailor-made" for Individual Requirements

Write Janet for your free copy of the booklet on Sarkes Tarzian Embedded Selenium Rectifiers

**Sarkes
Tarzian** INC.

RECTIFIER DIVISION

Dept. R-1, 415 North College Ave., Bloomington, Ind.

January, 1953



part of a man and his wife to the customers who had made their success possible.

Close to one hundred manufacturers' representatives and company officials attended the party. It was high-lighted by the surprise presentation of a Certificate of Appreciation to John T. Thompson, replacement tube sales manager for GE, for his company's consumer campaigns on behalf of the independent service profession. The presentation was made by Fred Colton of *Graham & Colton*, president of the Associated Radio & Television Service Dealers, Inc., as an award from the Association.

Ray and Polly Whitehead were also surprised with an ARTSD Certificate of Appreciation which was presented by Sam Oppenheimer of the *Columbus TV Laboratories*, vice president of the association.

Lesson in Cooperation

For many years Columbus, Ohio, has been one of the "cleanest" radio-TV service areas in the country. When the TV boom struck it attracted, as in all other areas, some "fast-dollar" and quick change service operators. But down through the years the ARTSD had created a healthy respect for the quality and high standard of service performed by its members. They were able to get the whole-hearted support of the Better Business Bureau and other civic organizations in weeding out the parasites who were trying to feed off the ignorance of the set-owning public about what they should pay for and receive in the way of competent TV service.

There are two important factors back of the continuing success of the Associated Radio & Television Service Dealers in maintaining a healthy climate for radio-TV service as a profitable business activity in Columbus. The first is the amount of time that is given by its officers to create and carry out the Association's programs. These well-conceived programs regularly cover all facets of interest to the men engaged in the business of service. First, they hold their regular monthly sessions where they discuss frankly all phases of the operation of their businesses and all factors that influence the course of their businesses; next they conduct a regular series of technical sessions to keep their members and their members' employees abreast of the fast-growing technology of the industry; and third, they have regular social gatherings that enable the members' families to get acquainted.

The second important factor in ARTSD's success is the excellent cooperation between the Association and Columbus parts and set distributors. Every three months the members of ARTSD invite all Columbus distributors to have dinner with them and afterwards air their grievances against each other. Columbus distributors have cooperated whole-heartedly in this program and it is quite possible that, as a result, Columbus is a poor

**Makes
TV
Servicing
easier
to
learn!**



BIGGEST \$4 WORTH IN TV TRAINING HISTORY!

PRACTICAL TELEVISION SERVICING
by J. R. Johnson and J. H. Newitt
334 pages, 253 helpful illustrations

HERE, for only a small fraction of the price you might expect to pay is concise, clearly understandable television training of the most practical sort! It is the ideal book for those who already know something about basic radio service and now want to forge ahead in the better-paid television field.

First you learn where and how TV differs from radio. You learn what equipment is needed and where and how to use it properly on all kinds of TV jobs. Every phase of troubleshooting is explained from a practical, on-the-job standpoint—NOT by a lot of confusing mathematics and meaningless theory. For instance, many pages of PRACTICAL TELEVISION SERVICING are devoted to locating many common troubles just by visual observation.

DATA BASED ON ACTUAL SERVICE SHOP EXPERIENCE

Dozens of actual service case histories help make puzzling jobs easier to handle. Over 250 illustrations and pattern photos explain details step by step. Other subjects include component replacement data, wiring details, helpful hints on testing and information on subjects from fringe area reception to improving picture linearity in difficult locations.

The book that
helps radio men
**CASH IN ON
TV SERVICE
PROFITS!**

Covers every phase
of television

**CONSTRUCTION
OPERATION
VISUAL TROUBLE-
SHOOTING
INSTRUMENT
TROUBLE-
SHOOTING
SERVICING
COMPONENTS
COMPONENT
REPLACEMENT
PATTERN
ANALYSIS
SHOP HINTS, etc.**

A great book to
help you pass
TV service
license
examinations!



READ IT 10 DAYS . . . AT OUR RISK!

Dept. RN-13, RINEHART BOOKS, INC.,
Technical Division
232 Madison Ave., New York 16, N. Y.

Send PRACTICAL TELEVISION SERVICING for 10-DAY EXAMINATION. If I decide to keep the book, I will then remit \$4.00 plus a few cents postage. Otherwise, I will return book postpaid and owe you nothing.

Name

Address

City, Zone, State

Employer's Name & Address

OUTSIDE U. S. A.—Price \$4.50 cash only. Money back if book is returned in 10 days.

Amazing Performance!

MATTISON

SILVER ROCKET 630 CHASSIS

• with TUNEABLE •

BUILT-IN BOOSTER
for Better DX Reception

Featuring NEW CASCODE TUNER
made for UHF interchangeable
tuning strips and 70° COSINE YOKE

Tube
Complement:
28 tubes
3 rectifiers
1 CRT

32



All Channel Booster

• Broad band single knob control pre-amplifier built in to eliminate long leads which may cause regeneration and attenuation of signal.

• ONLY THE MATTISON 630 CHASSIS HAS AN ALL CHANNEL TUNEABLE BUILT-IN BOOSTER THAT INCREASES SIGNAL STRENGTH UP TO 10 TIMES. THE SILVER ROCKET WILL OUTPERFORM ANY CHASSIS MADE AND IS PRICED RIGHT TO SELL FAST WITH

AN EXTRAORDINARY MARGIN OF PROFIT FOR YOU. WRITE FOR CONFIDENTIAL PRICE SCHEDULE.

• Mattison features a complete line of cabinets MADE IN MATTISON'S OWN CABINET FACTORY. 36 breathtaking designs that blend perfectly in any setting, traditional or modern.

All
Cabinets
Made in
Mattison's
Own
Cabinet
Factory!



The BERKSHIRE 21"

Genuine Mahogany. Deeply paneled 1 1/8" thick doors. Crotch Mahogany design and Hi-light shading throughout. Illuminated channel selector. Chassis is side mounted. Dimensions: height 40", width 32 1/2", depth 23 1/2".

DEALERS! SERVICE DEALERS! Here is your opportunity to become the "important" TV Dealer in your area for THE FINEST CUSTOM-BUILT LINE OF TV RECEIVERS. FREE!! Write for Mattison's merchandising portfolio explaining the "UNASSEMBLED PLAN" and "\$1,000,000 FLOOR PLAN."



Manufactured with integrity

When you buy from Mattison you need only one source of supply! You can buy a Mattison Chassis, a Mattison Cabinet or a complete Mattison TV Set!

Mattison Television & Radio Corp.

10 West 181st St., Dept. RN, N.Y. 53, N.Y.

RADIO-TV Service Industry News

AS REPORTED BY THE
TELEVISION TECHNICIANS LECTURE BUREAU

WHEN officials of manufacturing organizations attend gatherings of people now engaged in the business of servicing radio and television receivers they express amazement at the evident high caliber of the men who own and operate today's service businesses. In the eyes of too many people in the industry who seldom come in direct contact with present day service business executives, the servicing of television and radio receivers is still handled by a faceless, motley mass of people who, in the aggregate, constitute a tremendous market for replacement parts, tubes, and supplies, but whose identity as individuals is of no consequence. Many people still hold the mental picture of the average individual service business operator as being an unkempt character who is content to work for a marginal income and who is either not interested or incompetent to run his service activities in a business-like manner.

A Distributor's Party

A few weeks ago we were invited to attend a parts distributor's party for his service customers. This was something new. There are endless parties given by manufacturers for their distributors and by the distributors for the representatives, and vice versa, but this was the first time we had had an opportunity to attend a party given by a parts distributor for his service cus-

tomers and their wives and sweethearts.

Seven years ago a former radio service technician started a parts distributing business in Columbus, Ohio. Ray Whitehead and his wife and partner, Polly, launched the infant business in a modest-sized storeroom not overly stocked with replacement tubes, parts and supplies. The business grew rapidly and on their fifth anniversary, the Whiteheads threw a party for the service business customers in central Ohio whose purchases were responsible for the success of the business.

They held another party on their seventh anniversary. They rented the ballroom of a popular hotel to entertain their customers and rented all of the other rooms on the same floor so their suppliers could display the latest products and meet the Whitehead customers. Enough chairs to seat eight hundred people were set up in the ballroom and another two hundred in an adjacent room to accommodate any additional guests who might attend.

The expression "the place was bulging at the seams" is the only adequate description of the tremendous crowd of service people and their wives who accepted the Whiteheads' invitation to attend their anniversary party. Possibly more than 1500 service executives, technicians, and their wives came. It was not a "sales meeting"—it was a gesture of appreciation on the

Part of the crowd of more than 1500 service executives, technicians, and their wives who attended the service party given by Whitehead Radio Company, Columbus, O.



Two insulated mounting strips attach to the top of the modulator case at each end. The r.f. chassis grounds to one point only on the modulator case to foil v.h.f. circulating currents flowing between the metals. (Those circulating currents can cause untold grief by contributing to excessive r.f. feedback!) In addition to providing insulation, the strips are saw-slotted to afford footing for the bottom edges of the r.f. chassis, preventing slippage.

The case and r.f. chassis are fabricated from heavy brass plate, silver-plated, and polished. It is emphasized that this development model was silver plated not to enhance its electrical characteristics, but only to satisfy an aesthetic whim of the designer! The reader may construct a similar transmitter upon pewter or platinum, depending upon his taste and the size of his bankbook.

In constant use for the past several months, this transmitter has worked the same DX as have stations using more than five times its power input of twenty watts. Ninety-five per cent of the DX contacts were solid QSA 5, using a four-element beam from a flat city location. This operation indicates that at W6WGD, a hilltop and kilowatt seem unnecessary for more than routine enjoyment of the two-meter band.

-30-

"THE BACKTRACKER"

By JOHN M. HAMILTON

WITH grounded plate and cathode, no grid leak nor "B" supply, maybe our little set, "The Backtracker," shouldn't work at all; yet it does, bringing in local and DX stations with plenty of head-phone volume.

The set was built around a discarded Type 56 receiving tube (any other indirectly-heated tube will work), which obviously operates as a "square law" detector. The two coils shown in the circuit diagram form a grid-plate coupler, which increases the sensitivity and selectivity.

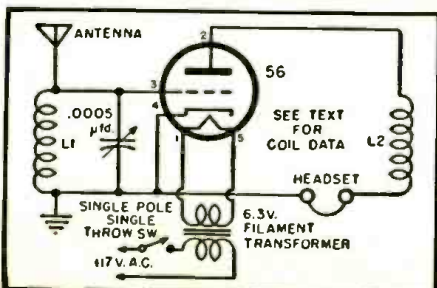
Coil L₁ consists of 100 turns of #28 enamel wire on a 1½-inch cardboard tube. L₂ consists of 300 turns of #28 on a 1¼ inch form. L₂ slides inside of L₁ to form the coupler.

Tuning is easy. Rotate the condenser until a station is heard; then pull out L₂ until the volume is strongest. The frequency may be changed considerably by pulling out L₂ several inches.

From our home in Youngstown, Ohio, using an ordinary 70-foot aerial, we've logged 27 broadcast stations. Our best DX so far is KOA, Denver, 1500 miles away—logged in the wee hours!

-30-

Complete schematic of a simple one-tube set.



January, 1953

TRAIN At Home FOR OPPORTUNITIES IN UHF-TV SERVICING

Set Your Own Pace with This Practical Program!

Get in on the ground floor of this fast-growing field. Train now to cash in on the opportunities that are yours in UHF-TV SERVICING with proven, practical T.C.I. training. Here is non-mathematical training that's complete . . . down-to-cases . . . up-to-the-minute. Here is training you take in your spare time, without leaving your present job! Think of it—in your own home you learn TV set conversion, master antenna installation, the latest in UHF-TV, money-making short cuts and much more. You learn to trouble-shoot, test and repair TV sets the only practical way—by actually doing this work yourself!

HERE'S HOW YOU LEARN BY DOING!

You get the experience you need by working on a large screen, modern TV receiver that's given to you with the course and is yours to keep. As an optional feature you get two weeks of field experience on service calls and on the repair bench with one of Chicago's largest independent TV servicing organizations. You profit from the experience and know-how of men in the field. Not through books alone but by actually doing the work yourself, you get the knowledge you need to qualify for opportunities

VETERANS
discharged since
June 27, 1950 are
eligible for G.I.
benefits. Check
coupon.

TELEVISION MAIL NOW FOR FREE BOOKLET
Communications Institute
205 W. Wacker Dr.,
Dept. 1-AE, Chicago 6, Ill.

THESE MEN LIKE YOURSELF SAY T. C. I. TRAINS YOU BEST!

"I've almost completed your course now, but I have been servicing TV sets since almost the beginning of the course." E.R.M., Rhode Island.

"Thanks to your course, jobs that used to take me several hours now take but a few minutes to complete." W.L.K., Wash.

"I like the easy way your lessons are presented. I'm very pleased with your course and have recommended it to a friend." L.R.S., Texas.

TELEVISION COMMUNICATIONS INST.
205 W. Wacker Dr., Dept. 1-AE, Chicago 6, Ill.
YES! Rush full facts on UHF-TV training. Include FREE Catalog and Sample Lesson. I am not obligated. Salesman will not call.

Name Veterans Check here
Address
City Zone State

BEGINNERS: Check here for information on Pre-TV Radio Course.

60 CYCLE AC SYNCHRONOUS MOTOR (115V) ... Part of Watt-hour meter movement; loaded with matched gears, worms, etc. ... \$1.95

Leotone

44" FLEXIBLE SHAFT & HOUSING: 1/2" x 1/4" female set screw ... \$1.49

33 CONTACT CONNECTORS (brass 333) Cable female; panel male. Off cable—set \$1.29; 5/\$5.00

SPEAKER ACCESSORIES

MENT CONES ... 4" to 12" incl. free-edge; Less voice coils, 12 asstd. ... \$1.98

SPEAKER REPAIR KIT ... Professional adjustment of: Hugs, Spiders, V.C. Forms, Felt, Chamols, Leather, Cement, Sulfur Oil & Instructions ... 2.49

BOTH CONE & REPAIR KITS FOR ONLY ... 3.95

GRILLE CLOTH ... Beautiful gold weave, 12" x 21" - 59c

ORNAMENTAL METAL GRILLE ... Brass finish; diamond design (2"x8 1/2") - 12"x12" - 98c; 12"x18" - \$1.39; 18"x18" - \$1.59; 24"x24" - 3.75

ACOUSTICAL FELT CABINET LINING ... 12"x12" x 1/4" - laminated. Separates to give 3 sq. ft. - 33c

RADIO HARDWARE TREASURE ... FULL I.B. CAN OF Nuts, Screws, Washers, Hgts., etc. \$0.89

"POLYSTYRENE" ... 12" IRth, 10D, 12" 1.39
10c; 20c; 30c; 35c; 55c; 24" - 1.25

TUBING (O.D. 1/4" - 10c; 3/4" - 12c; 1 1/2" - 17c; 2" - 23c; 3" - 27c; 4" - 36c; 6" - 47c)

SOLE SHIELDED PHONO WIRE ... coils 20-80 ft. Per ft. .03

20 PUSH-BACK WIRE ... Red, Yel., Blue or 100 ft. .89

SOUND-POWER PHONE UNITS (AMB-H-1A) Hi-fidelity. Use as mike or recvr. up to 300 ft. ea. \$1.95; pr. 3.49

CRYSTAL HEADPHONES (Brush Type "A") oak um. imosh. 5 ft. tipped cord. \$4.95

PORTABLE RADIO AMPLIFIER CABINET ... Ideal for: Tow, Medical or Industrial. Ept. Walnut finish steel. Hinged front panel, sliding rear. Ong. 14" x 8" x 8". Shkr. wt. 14 lbs. \$2.49

PERMEABILITY TUNER ... STD. B'CAST. Slip-tuned Ant. & Osc. coils; osc. paddler ... \$0.98

T-30 THREAT MIKE with neckband, PL-201, 1/2" EXT. CORD & SWITCH for T30 mike. Less PL08 ... 49c; 10/4.50

T-44A MAGNETIC MIKE w/3K20, PL-17098

HANDY CARBON MIKE (R5B3) Press-to-talk switch in cord. With PL08 type plug ... 1.98

TUBE CARTONS ... 100 Min (1" x 2 1/2") plain white. Prices per 100: (1 1/2" x 1 1/2" x 3 1/4") - \$1.45; Med (1 1/2" x 1 1/2" x 4 1/2") - \$1.65; Large (2" x 2" x 5") - \$1.98; Extra Lrg. (2 1/2" x 2 1/2" x 6 1/2") ... 3.95

!!BIGGEST BUY OF THE MONTH!!

"JUMBO RADIO PARTS KIT" ... A "Gold-Mine" of inventory odds & ends: COILS, RESISTORS, SOCKETS, WIRE SWITCHES, CONDENSERS, HARDWARE, CONTROLS, ETC., ETC. \$3.95

Shkr. wt. 20 lbs.

"DIRECT FACTORY SPEAKER REPAIRS SINCE 1927" Min. order \$1.00. 20% deposit req. on all C.O.D.'s. Full remittance with foreign orders. Please add sufficient postage—no excess refunded.

LEOTONE RADIO CORP.
67 Dey Street
New York 7, N.Y.

What to look for in a record changer...

PRACTICAL • STURDY
PUSHER-TYPE PLATFORM ON ALL MODELS

Always works Gentle to records

Simple to adjust for all record sizes

One of many features which make

GARRARD

The World's Finest
3 Speed Record Changer

Fully automatic with automatic stop Can be used with your present set.

MODEL RC 80

Garrard Sales Corp. Dept. R-1
164 Duane St., N. Y. 13, N. Y.

Send GARRARD Fact Sheet.

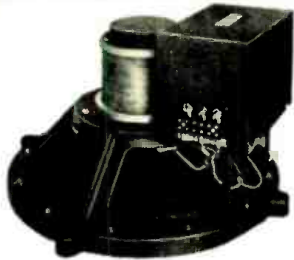
Name.....
Address.....
City..... Zone..... State.....

\$42.30 net less cartidges

TANNOY

The Sensation of the New York Audio Fair!

Great Britain's Finest Speakers Hand-Made By Master Craftsmen To Precision Standards.



Exclusive With Sun Radio in New York!

Now you can experience amazing wide range response in perfect balance. Hear the world-famous Tannoy Dual Concentric Loudspeaker System, providing optimum fidelity at any level from the audible threshold up to full room volume. So outstanding in performance that Hi-Fidelity Magazine featured this speaker in their November-December 1952 issue. Substantially flat response from 40-20,000 cps. Concentric sources for both HF and LF components avoiding interference at crossover. HF horn formed by machined center-pole and LF diaphragm, these combined with a special throat insure correct HF match. Intermodulation product less than 2%. Very wide angle of high frequency distribution. You owe it to yourself to hear these instruments before making any choice.

Check These Outstanding Features

12" Dual Concentric Loudspeaker
 Power handling capacity 15 watts.
 Impedance via crossover network 18 ohms.
 Crossover frequency 1,700 cps.
 Overall diameter of frame 12 7/8".
 Overall depth 7 1/2".
 Substantially flat response 35-20,000 cps.
 Weight 25 lbs. with crossover network.

Complete with crossover network **\$130.00**

15" Dual Concentric Loudspeaker
 Power handling capacity 25 watts peak.
 Impedance via crossover network 15 ohms.
 Crossover frequency 1000 cps.
 Overall diameter of frame 15 1/4".
 Overall depth 11".
 Substantially flat response 40-20,000 cps.
 Weight 30 lbs. including crossover.

Complete with crossover network **\$159.00**
 Mail Orders promptly filled. Send 25% deposit with your order.

SUN RADIO FEATURES

- All famous-name brands.
- Complete hi-fidelity sound studio.
- Courteous service, no high pressure.
- Free technical advice.
- Free cabinet installation.
- Pre-tested components and systems.
- Free coded connecting cables for easy component assembly.
- Prompt delivery.
- Lowest prices.

FREE! New Edition

Before buying hi-fidelity equipment check Sun's new 100-page catalog. The most complete publication of its kind in the industry. This 1953 edition, just off the press, will answer all your questions. Sun Radio is hard to beat for quality and price. So don't delay, write today or come in for your free copy.

Sun Radio
 & ELECTRONICS CO., INC.

122-G DUANE ST. NEW YORK 7, N. Y.

Open daily to 6, Saturday 9-4:30.

end of the QSO. In order to meet these requirements, the modulator was designed to offer "broadcast" fidelity, supplying approximately ten watts of undistorted peak voice power to the carrier from an unusually small package.

Exclusive use of miniature dual triodes results in the smallest practical size for the modulator. With reference to Fig. 7, note that a single cascaded 12AX7 comprises the speech amplifier for a crystal microphone. An r.f. decoupling filter, R-C, serves to isolate r.f. from the speech input grid.

The shunt-coupled UTC 0-6 "Ouncer" transformer drives a 12AT7 amplifier; this dual triode provides push-pull amplification to drive a second 12AT7 cathode-follower stage which, in turn, drives a 12AU7 as the class B modulator. Use of the cathode-follower driver tube eliminates the necessity for a driver transformer, an item of some importance where space is at a premium.

Any type of small modulation transformer designed for 10,000 ohm plate-to-plate class B service may be employed rather than the unit recommended, the prerequisite being that its secondary should encompass an impedance range of 3000 to 5000 ohms to match the class C load. The transformer used provides three secondary taps of 3000, 3750, and 4500 ohms. At a plate voltage of 300 and loaded to 70 ma., the class C load represents 4643 ohms, matching the 4500 ohm tap closely enough to result in linear modulation.

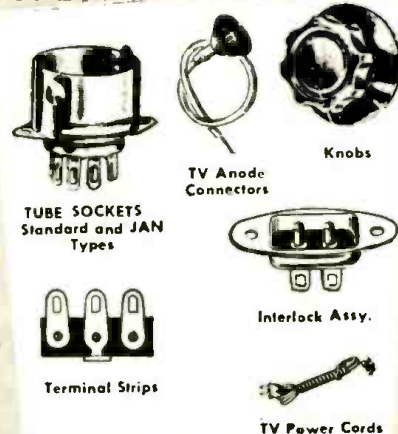
Power supply for the modulator remains identical to that required for the r.f. section, although its current rating need not exceed 100 ma. The 12AU7 has a static plate current of 15 ma. with -22 1/2 volts of battery bias and peak current of 75 ma. Oscilloscopic inspection of the 20-watt carrier shows linear modulation of approximately 97%, while signal reports place special emphasis upon the excellence of quality and the power-packed audio sidebands.

Fig. 6 illustrates modulator construction; a case measuring 10" long, 3 1/4" deep, and 3 1/2" high encloses the complete unit. Parts layout follows schematic circuitry down a straight line from input to output; components bolt to a strip of aluminum "breadboard" which mounts above the bottom of the case upon four corner stand-off spacers. Fig. 2 shows the breadboard inverted to illustrate the wiring technique and parts placement.

When constructing the modulator, it will be found that point-to-point wiring becomes necessary, as the compactness of the unit is similar to that of a hearing-aid amplifier. Extreme caution in wiring will result in the least feedback in a high-gain system of this size. When operating properly, the gain control may run wide open with zero feedback, although this offers more gain than is required for the normal modulation of 20 watts input.

WALDOM

SUPERIOR COMPONENTS



WALDOM also supplies quality **CRONAME** parts

- TV Mask, Glass and Escutcheon Kits.
- Croflex Tuners
- Escutcheons
- Title Plates
- Dial Plates
- Switch Plates
- Radio Knobs
- Instrument Drives
- Instrument Dials

FREE

SEND FOR 1952
WALDOM
CATALOGS

#52—WALDOM Superior Electronic Components and CRONAME Products.

#32—WALDOM Replacement Speaker Cone Manual.



ELECTRONICS, INC.

911 N. Larrabee St., Chicago 10, Ill.

YOUR BEST TV SERVICING GUIDE

TELEVISION AND F-M RECEIVER SERVICING

\$3.25

TELEVISION AND F-M RECEIVER SERVICING

gives you practical information on antennas and transmission lines, complete alignment and servicing instructions. How to diagnose, locate, and correct common troubles as well as install sets for best reception. 248 pages, illustrated.

And Don't Miss

TELEVISION SIMPLIFIED (Kiver).....\$6.50

F-M SIMPLIFIED (Kiver)..... 6.50

U.H.F. RADIO SIMPLIFIED (Kiver).... 4.50

D. VAN NOSTRAND COMPANY, INC.

Order from your parts jobber today, or write direct to D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York 3, New York.

Please send me the following books:

- Television Servicing Television Simplified
 F-M Simplified U.H.F. Radio Simplified

I enclose \$.....

Name

Address

City Zone State

RTN-153

RADIO & TELEVISION NEWS

Two-Meter Master (Continued from page 41)

The filter network, $R_5-C_{10}-C_{11}$, helps to isolate stray r.f. from the modulation transformer. The r.f. chokes RFC_2 and RFC_3 are identical, wound on a short $\frac{1}{4}$ " diameter polystyrene or ceramic dowel. 24 turns of #28 enameled wire provide adequate choking at 144 mc.

All tube heaters are wired so that the "B" ground return serves as half of the heaters return; at the final amplifier, the 832A heaters bypasses to ground through C_{18} .

Cross neutralization of the final shows lengths of solid hookup wire connected from the grids, across the back of the tube socket, and out through small holes in the socket mounting bracket. The holes support feedthrough bushings, which rigidly support the neutralizing wires running parallel to the plates outside the glass envelope of the tube. When neutralizing the amplifier, start with wire lengths adjacent to the tube's plates extending about $\frac{3}{8}$ " from the feedthrough bushings. Clip off about a sixteenth inch at a time until the amplifier stabilizes. Do not try to operate the amplifier without neutralization; at these frequencies, its use becomes mandatory unless one was born under a very lucky star!

The r.f. section requires 300 to 325 volts d.c. at a current of 175 ma. Any power supply meeting these requirements may be used, and most junk boxes may provide enough parts to run 20 watts input. Separate power supplies are employed for the r.f. and audio sections of the transmitter.

Physical construction of the r.f. section is made upon a "U" channel measuring 10" long, $3\frac{1}{4}$ " wide and $2\frac{1}{4}$ " deep. Inasmuch as W6WGD has been operated from hotel rooms and similarly restricted spaces for the past twenty years, an absolute minimum of space was utilized in this design, if only from force of habit. The unit may be constructed according to its builder's preference, although a similar parts layout should be followed.

Due to its small size, the transmitter uses miniature one-inch meters to read final grid and plate currents.

With reference to Fig. 4, note the point-to-point wiring; resistors R_5 and R_7 are bolted together through their lengths to form a single unit, supported by heavy wires making connections to various tie points. The power input connector provides support for this and other circuit components, as does the second tripler tube socket. Actual constructional features are left to the ingenuity of the reader.

Modulator Section

To convey maximum intelligence, the carrier must be modulated as fully as the law allows; the speech should have good fidelity and crisp response to be clearly defined at the receiving

NOW...AT LOWEST PRICES!

SCR-274N COMMAND and ARC-5 EQUIPMENT

	AS IS (Less tubes)	EXC. USED (With tubes)	NEW
RECEIVERS			
RC-453-190 to 500 KC.	\$10.95	\$23.95	.....
RC-453-3 to 6 MC.	4.95	\$11.95	.....
RC-453-9 to 12 MC.	4.95	11.95	\$16.95
TRANSMITTERS			
RC-457-1 to 5.3 MC.	4.95	9.95	.....
RC-458-5.3 to 7 MC.	4.95	9.95	.....
RC-459-7 to 9.1 MC.	7.95	9.95	.....
ADDITIONAL EQUIPMENT			
RC-456 Modulator	2.25	2.75	5.75
RC-450 Control Box			
(3 Receiver)	1.75	2.55	.....
RC-451 Control Box			
(Transmitter)	1.69	2.29	.....
RC-442 Relay Unit ANT			
With Condenser	2.79	3.50	.....
Without Condenser	1.29	2.95	.....
Plugs: PL-147, 148, 151, 152, 153, 154, 156.			
Each	1.25	.....	.....
Flexible Shafting with Gear to fit receivers.	2.29	2.45	.....
3 Receiver Rack	2.39	3.97	.....
2 Transmitter Rack	2.25	2.95	.....
Single Transmitter Rack	2.95	3.25	7.95
DM-32 dynamotor for Command Set	2.95	3.25	7.95
DM-31 Dynamotor for Command Set	2.95	3.95	.....
Shock Mts. for 3 Receiver Rack, 2 Trans. Rack, Modulator Or ANT. Relay Unit	1.95	2.45	.....

MONTHLY SPECIAL SURPRISE PACKAGE

20 pounds of assorted radio parts. A real value at **\$195**

TUBES.....10 for \$3.50

12SR7	65L7	1N5	Your choice
1613(GFG)	6V6	3B7	of these
90D	1N5	6C4	nationally
627G	6AL5	6X5	advertised
211	954	5Y3	tubes.
6HG	1625	12H6	

90 DAY GUARANTEE

16J4	\$16.95
16DP4	16.95
14CP4	16.95

TUBES

304TH	\$5.95
830B	1.69
805	2.69
90D2	.59
90D3	.98
6AJ5	1.89
4AP10	.95

RT/34 APS 13 Transceiver used as a tall warning radar on 413 MC. Containing a 30MC IF Strip and various other parts, these units have been stripped of RF sections and all tubes, but are an excellent buy if only for parts and IF Strip.....used \$ 4.95

BC 624 receiver (SCR 522), less tubes.....used 19.95

100 A 158.....used 14.95

BC 625 transmitter (SCR 522) less tubes.....used 14.95

SCR 522 transceiver, complete in case with top bracket, less tubes.....used 29.95

Transceiver-140-144 mc. 2 meter used in excellent condition, less dynamotor, only tubes.....only 24.95

BROADCAST BAND & AERO



MN-26-C Remote Controlled Navigation Direction finder and communications receiver. Manual DF in any one of three freq. bands, 150 to 1500 KC., 24 V. Self contained dynamotor supply. Complete installation, including receiver, control box, freq. admitt. control, Left-right indicator, plugs, loop transmission line and flex. shafts.
BRAND NEW \$69.50

WANTED!

All TS, APR, AP5, ARC, ARN, ART, SCR, R89 and BC equipment. Write today! Quote lowest prices in your first letter

MIKES and HEADSETS

H5-33 Low Impedance Headset, exc. \$2.95 new \$4.95

H5-23 Headset.....used \$2.95 new \$4.95

CD-307 Ext. cord for H5-23-30.....like new .79

Throat Mike-T 30.....New .98

Lip Mike-Navy Type.....New .98

Extension Cord and Switch Assembly for lip and throat mikes.....New .98

CW 49505 High Impedance headset complete with leather headband and rubber cushions.....Used 98c

T-17, Microphone.....Used exc. \$3.75

H5-38.....exc. \$1.95 new 2.25

H5-30, miniature headset.....used 1.49 new 2.49



DYNAMOTOR PE-101C

The best dynamotor for conversion to 6v. Multiple windings. After conversion you get choice of 100 or 350 v. at 50 MA or 250 v. at 100 MA. Complete dope sheet furnished.
BRAND NEW (See "CQ" Aug. Issue) \$4.65

DYNAMOTORS

PE 103	used exc. \$19.95
DM 53A	used 2.95
BD 83	used exc. 5.50
DM 34	used exc. 9.95
DM 28	new 5.95
	used exc. 2.95

WOBULATOR

BUILD TV-FM-AM SWEEP GENERATOR

You can build "Versatile Sweep Frequency Generator" with APN-1 magnetic units.....\$5.95

RT7/APN1 TRANSCIEVER UNIT—Used as an altimeter. It may be converted for signaling control circuits, etc. Complete with 14 tubes and dynamotor they are in good used condition at the amazingly low price of.....\$17.95
Used, less tubes, with wobulator.....9.95

BC 604 FM TRANSMITTER

20-27MC used, exc.....\$12.95

MISCELLANEOUS EQUIPMENT

FL 8 used, exc.....\$1.95 BC 347 each.....\$1.95

BC 906 each.....9.95 RL 42 each.....3.95

SELSYN TRANSMITTER

Loop Motor and Autosyn Transmitter Assembly for matching to I-82 Indicator. Used, excellent condition.
ONLY \$5.95. Complete with Indicator.....\$14.95

SCR 625 FAMOUS ARMY MINE-DETECTOR

For Prospectors, Miners, Oil Companies, Plumbers, etc. This unit is being offered now at a considerable reduction in price. Recently advertised at \$79.50 it is now available in the same brand new wrappings in sultane style carrying case, less batteries at

\$59.50 WHILE THEY LAST! Used, like new, \$39.50

MN-26-Y 150 to 325 KC. 325 to 695 KC. 3-4 to 7 megacycles, comb. installation.....\$69.50
Receiver alone, new.....35.95
MN-26-C alone, new.....39.50
MN-26-C or MN-26-Y as is, less tubes.....13.95
With tubes, Used good.....24.95
MN-20-E Loop, Brand New.....6.95
MN-52 Crank drive, New.....2.50

ML-42 Reversible Motor with antenna reel and clutch, used.....\$ 2.95

BC-433 RADIO COMPASS RECEIVER, 200 to 1700 KC. used, excellent condition, with tubes, exc., less tubes.....39.95

used, as is, less tubes and cover, exc. for parts.....8.95

ARMY SURPLUS PORTABLE TELEPHONE

Complete with TS 11 handset.....\$14.95 ea.
2 for \$27.50

Shipments F.O.B. warehouse. 20% Deposit on orders. Minimum order \$5.00. Illinois residents, add regular sales tax to remittance. Prices subject to change without notice.

R W ELECTRONICS

Dept. N, 1712-14 S. Michigan Ave., Chicago 16, Ill.

PHONE: HARRISON 7-9374



Print Your Own

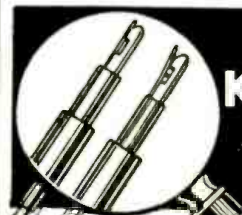
Cards, Stationery, Advertising, labels, circulars, photo and movie titles, church work, tags, etc. Save money. Sold direct from factory only. Raised printing like engraving, too. **Print for Others, Good Profit.** Have a home print shop. Easy rules supplied. Pays for itself in a short time. Write for free catalog of outfits and all details.

KELSEY PRESSES, B-72, Meriden, Conn.

ON-THE SPOT BATTERY RECORDER

WALKIE-RECORDALL 8 lb. miniature BATTERY RECORDER-PLAYBACK
Continuous permanent, accurate, indexed recording at only 9c per hr. Instantaneous permanent playback. Picks up sound up to 60 ft. Records conference, lectures, dictation, 2-way phone & sales talks; while walking, riding or flying. Records in closed briefcase with "hidden mike"! Write for Detailed Literature

MILES REPRODUCER CO., INC.
812 BROADWAY Dep't R-1, NEW YORK 3, N. Y.



LOOK! KLIPZON FREES BOTH HANDS!

UNIQUE SELF-HOLDING POINTS

bring new convenience and timesaving to service work.
★ V.H.F. CRYSTAL PROBES ★ ADAPTORS
★ STREAMLINED TEST PRODS ★ CONNECTORS
★ LOW LOSS — LOW CAPACITY LEADS
See KLIPZONS at your distributor.
Send for FREE folder #36.

UNITED TECHNICAL LABORATORIES
Engineers • MORRISTOWN, N. J. • Manufacturers

STAN-BURN SPARKS

ANTENNAE SPECIALS

DOUBLE V 3/8"	1-11	12 or more
DOUBLE V 3/8" Dowel	\$2.98	\$2.20
DOUBLE V 1/2" Dowel	3.45	2.45
10 Element Coaxial 3/8"	3.55	2.55
Folded Hi Straight Low Quick Rig		
1/2" elements	4.25	3.25
WINDOW CONICALS	4.95	3.75
MASTS		
5 FOOT SWEGGED	.79	.69
10 FOOT PLAIN	1.39	1.29
TV WIRE		
55 MIL. 300 OHM	\$14.95	50 Ft.
72 OHM COAXIAL	45.00	M Ft.

CATHODE RAY TUBE SPECIALS

Standard Brands—Unconditionally Guaranteed		
GENERAL ELECTRIC	21EP4A	\$3.98
5TP4	24AP4A	66.55
71P4	SHELDON	
10BP4A	10BP4A	13.00
10FP4A	12LP4A	18.20
12KP4A	18P4A	18.50
12LP4A	18OP4	20.50
12UP4B	16FP4	22.60
14CP4	16EP4A	22.60
14EP4	16DP/HP4A	22.60
16AP4A	16JP4A	22.60
16BP4A	16LP4A	22.60
16GP4	16KP4A	22.60
16KP4/16RP4	17BP4	23.70
17BP4A	18P4	25.90
17CP4	19P4	25.90
19AP4A	20CP4	28.00
20CP4/20HP4A	21EP4	29.50
20LP4	16EP4A Rauland	38.20
CHASSIS 610 REGAL with Cascade Tuner \$139.50		
211 TO FLY BACK (Similar to 1RA) 2.98		
OPEN BACK CABINET 39.00		

TRANSFORMERS

RCA type for 16" to 24"	\$3.85
G.E. type for 16" to 24"	3.85

DEFLECTION YOKES

COSINE FERRITE TODD YOKE 70"	\$4.20
------------------------------	--------

SPECIALS

4 Prong Vibrators, each	\$ 1.29
Lots of 12 or more	1.19
Standard TV Tuners	18.95
12" Heavy Slug Speaker	Special 4.98

Audio Devices, Discs and Scotch Tape in Stock
Audio Plastic Red Oxide Plastic tape—
Half-hour spool \$2.30 One-hour spool \$3.30

WIRE RECORDERS IN STOCK

WILCOX GAY—Model 2A10	\$ 89.97
PENTROW—Model 9TIC—2-track Tape Recorder	Net 134.50
RADIO CRAFTSMAN	
Model RC2—HiFi Amplifier	Net 42.89
Model RC10—AM-FM Tuner	Net 130.84
Model CS—Williamson Amplifier	Net 99.45

Cascade Guaranteed Tuners (with tubes) \$21.95
SPECIAL! While they last.

AUTHORIZED DISTRIBUTORS for: General Electric, Kenrad, Tung-Sol, National Union, Jewel, De Wald, Regal, Automatic and Setchel Carlson.

We carry a complete line of popular makes of Radio and TV tubes, at 50% discount. Also many other special purpose and transmitting types, and all electronic parts and equipment at lowest prices. Send us a list of your requirements for prompt quotations. Terms: 20% with order. Balance COD. All prices FOB, NEW YORK Warehouse. Minimum order \$5.00. Write for our latest price list to Dept. RN-1

STAN-BURN RADIO and ELECTRONICS CO.
(C.B.S. THEATRE BLDG.)
1697 BROADWAY • NEW YORK 19, N.Y.

Korean Broadcasting System, Office of Public Information, Pusan, Republic of Korea. Schedule is 1600-1830, 2100-2400, 0300-1030. (Cushen, N.Z.)

A station noted on 9.310A around 1710-1847 sign-off in Danish and Greenlandic is believed to be Godthaab, Greenland. Has bad QRM at times. (Bellington, N.Y.; Kary, Pa.)

A new outlet in Sao Paulo, Brazil, is noted on 11.855 around 1830. (Niblack, Ind., others)

ISWC, London, says "The Voice of Zion," Israel, has an experimental transmission to South Africa on Sundays 0630-0730 over 15.550 (frequency may be varied).

YVMG, *Radio Popular*, 4.810, Maracaibo, sent QSL card; listed YVMG, 4.810, 2 kw.; YVMG, 1250 kc., 2 kw. QRA is Apartado Postal No. 347, Maracaibo, Estado Zulia, Venezuela. Says is affiliated with *BBC*, *NBC*, *United Nations Network of Peace*, as well as *Radio Programas de Mexico*. (Patterson, Ga.)

Schedules of *Radio Tirana*, Albania, on 6.560, 500 watts, and 7.850A, 3 kw., are 2300-0100, 1100-1130, 1215-1700; *English* is listed for 2345, 1600. (Radio Sweden)

Bellington, N. Y., notes the clandestine *Yugoslav Emigrant Station* on 6.887A parallel with an outlet on 7.500A around 1750; has man and woman alternating in European language.

British Honduras is to have a better short-wave service soon; a 5 kw. short-wave station is expected to be in operation at Belize by next March. (Catch, England)

Radio France-Asie, Saigon, Indo-China (Vietnam), has been noted back on its old 11.83 channel from 11.924A, signing off 1125. (Balbi, Calif.)

Sanderson, Australia, notes a much improved signal from the Chinese Air Force Station, Taipeh, Taiwan, on 9.750A at 0700 when has *English* ses-

sion. May have installed a new and more powerful transmitter?

Radio Free Europe noted on 10.300A when tuned 1000; melody followed by call, then program in Hungarian; news in Czech 1015. (Pearce, England)

The Free Greek Radio appears to be on about 6.970; intercepted at 2255 when had Greek language session running past the hour. Signal was gone when retuned 2315. (Kary, Pa.)

A clandestine station announcing as "Freidomsender" is heard in Sweden on 7.700 at 0230-0245.

EDV10, *Estacion Escuela Radio S.E.U.*, Madrid, sent usual QSL card; said is on 7.170 but enclosed schedule for Esperanto transmission (at 1430) which gave channel as 42.33 m. or 7.088. (Pearce, England)

When this was compiled, the BBC's programs for the Western Hemisphere were listed—*North American Service*—To Canada, USA, Mexico, 1000-1215, 17.715; 1300-1545, 11.930 (Mon.-Fri.); 1500-1545, 9.825 (Mon.-Fri.); 1545-1700, 9.825, 6.195. *Special Programs*—For Falkland Islands, Sun. only, 1130-1200, 17.810; for West Indies, 1815-1845, 9.580, 6.035. *General Overseas Service*—To West Indies, Central America, South America (north of Amazon), 1500-1700, 11.750; 1700-1815, 9.580, 6.035; 1845-2200, 6.035. To South America (south of Amazon), 1500-1700, 11.820; 1700-2200, 9.410, 6.110. To Canada, USA, Mexico, 1700-1845, 9.825; 1700-2200, 6.195; 2300-0115, 6.110.

Acknowledgment

Many thanks for the splendid cooperation during 1952. May 1953 bring you the best in SWL'g. Sorry that space limitations would not permit the use of more of your fine reports this month. Please continue to send your *best tips* to Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia, USA. Thanks!—K.R.B.



Regency



Largest Selling Booster

AT ANY PRICE!

duled 0130 on 6.100, 9.505; 1100-1115, 6.100, 7.200; 1315-1330, 6.100, 6.150; 1645-1700, 6.100, 6.150 (WRH)

* * *

Press Time Flashes

When this was compiled, a station on 4.950, identifying (in *English*) as "the Broadcasting Service of Radio Belize" was being heard around 1830-1904 closedown. (West, Va.) Good level in West Virginia but with CWQRM and aircraft phone QRM. Is British Honduras.

The *Radio Clube de Angola*, Luanda, Angola, is now using a *new* channel of 4.873 in parallel with 9.632, 11.865; heard from around 1330. (Ridgeway, South Africa)

The Central Broadcasting Station, Lusaka, 4.826, North Rhodesia, is noted around 1210 with dance records; with talk in *English* 1230, BBC news relay 1300; probably signs off 1400. (Pearce, England) Ridgeway, South Africa, lists ZQP at 0700-0900 on 7.220; 0900-1100 on 7.220 and 4.826; 1100-1230 on 7.220, 4.826, and 3.275; 1230-1400 closedown on 4.826, 3.275.

The Japanese Communist station *Radio Free Japan* broadcasts on 10.180, 11.896 at 1500-1600, 2200-2300, 0500-0600, 0730-0830; uses Japanese *only*; is probably located in Communist China. (Japanese Short-Wave Club)

Legge, New York, notes *Radio Free Europe* afternoons (*EST*) on 11.855, 11.725, 9.717, 9.695, 9.607; fair signals around 0600 on 11.745, 11.675. (NNRC)

An Arabic-speaker reported some months ago by Cushen, N.Z., heard on 5.000, has been identified by Bert Bluman, Israel, as located at Kuwait in the Persian Gulf; operates 1130-1400 and identifies *only* at sign-on; programs are all-Arabic. (Radio Australia) (Al Kuwait is a sultanate in Arabia, south of Iraq, on the north-western coast of the Persian Gulf; it is a British protectorate with a population estimated at 50,000.—K.R.B.)

Latest schedules for the *COURIER*, the *Voice of America's* "Truthship," are 1200-1615 to Near East and 1730-1900 to Caucasian USSR on 6.015; 1730-1900 on 7.200 to Caucasian USSR. VOA is now sending out QSL cards for reports on reception when the *COURIER* was testing from the Panama Canal Zone some months ago.

By this time, the 1953 edition of *WORLD RADIO HANDBOOK*, compiled in Copenhagen, Denmark, by O. Lund Johansen, should be available from Ben E. Wilbur, 1000 Connecticut Ave., N.W., Washington, D.C. It is written in *English*.

"Australian DX-ers Calling" is now aired each Saturday 2300 on 15.200; each Sunday 0030 on 15.200, at 0300 on 9.580, 11.760, 17.840, and at 0902 on 9.580, 11.840, 15.320.

The Korean Broadcasting System operates a network of 15 stations, two of which are short-wave—HLKA on 2.510, 7.935, each 1 kw., and located in Pusan. A *new* short-wave station will open shortly in Seoul, using 10 kw. QRA is Hahn Ki Syan, Chief Engineer,

More Profits from the Complete line of SUPERIOR ROHN TOWERS



Standard Self-Supporting ROHN steel TOWER

Proved to be the BEST answer to your Tower needs!

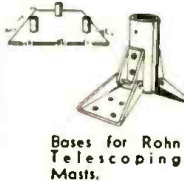
Thousands of installations prove ROHN superior in design, construction, and quality. Made in standard 10 ft. sections, using heavy duty tubular steel and electric welded throughout. Tests prove the rugged construction . . . can be climbed . . . no guying needed up to 50 ft. Double-coated with a finish that's permanent and non-corrosive. Quickly installed in cement base. These towers can be used to any height . . . even up to 150 ft. Here's true permanent installation that has real sales appeal. Get the facts — you'll be convinced ROHN is BEST!

— 2 other Rohn Models for you!

<p>ROHN "FOLD-OVER" TOWER This type tower is built by merely using regular Rohn tower sections and an inexpensive Fold-Over kit. Has all the advantages of the standard Rohn tower, but is of the fold-over type that makes it perfect for antenna changing, rotator servicing, experimentation, etc. Kit includes hinged section, boom, reel and cable mechanism, 4 guy anchors and special base section.</p>	<p>ROHN TELESCOPING MAST is quickly installed and raised to desired height in a moment. Heavy-duty galvanized steel tubing in heights from 20 to 50 ft. An absolutely sturdy and durable mast . . . non-corrosive and indestructible. Excellent rigidity at joints. Comes complete with guy rings, and all necessary parts for instant installation. . . can be purchased with or without base. Available in 20, 30, 40, and 50 ft. sizes.</p>
---	---

FULL LINE OF ACCESSORIES:

New Quick "Drive-In" Base for use with standard towers in place of concrete base. Permits instant tower erection. Not recommended under certain conditions, however.



House Brackets for added stability.

"Sell the ROHN line . . . where Satisfaction and Quality are Assured."

WRITE PHONE OR WIRE FOR **FREE CATALOG AND PRICES!**
Designed and Mfg. only by:

ROHN MFG. CO.

Dept. RTN, 2108 Main St., Peoria, Illinois

All Rohn Products Sold only Through Authorized Representatives & Jobbers.

When Answering Advertisements
Please Mention
RADIO & TELEVISION NEWS

New Proximity Probe

Tests All TV Hi Voltage Supply Systems

INSTANTLY checks hi-voltage transformer action—horizontal oscillator—sweep output—damper—hi-voltage rectifier, etc. Used under actual operating conditions. Determines exact procedure to trouble shoot no raster problems and intermittents. No connections—no shocks—saves time—clips in pocket. Used by professional TV servicemen for home calls and bench work. Complete instructions enclosed.

Send check or M.O. **\$3.95** Fully Guaranteed
Postpaid U.S.A. Net
SERVICE PRODUCTS CO.
Lawrence, Mass.
Box 215

EASY TO LEARN CODE

It is easy to learn or increase speed with an Instructograph Code Teacher. Affords the quickest and most practical method yet developed. For beginners or advanced students. Available tapes from beginner's alphabet to typical messages on all subjects. Speed range 5 to 40 WPM. Always ready—no QRM.



ENDORSED BY THOUSANDS!

The Instructograph Code Teacher literally takes the place of an operator-instructor and enables anyone to learn and master code without further assistance. Thousands of successful operators have "acquired the code" with the Instructograph System. Write today for convenient rental and purchase plans.

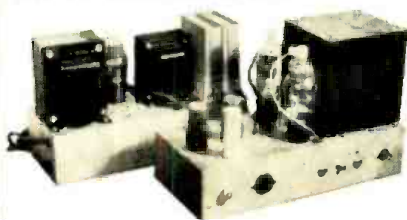
INSTRUCTOGRAPH COMPANY

4711 SHERIDAN ROAD, CHICAGO 40, ILLINOIS

HARVEY

where you FIND the FINEST

THE ORIGINAL WILLIAMSON HR-15 AMPLIFIER KIT



The famous, original Williamson HR-15... still acclaimed the leader... in kit form, with the Partridge Output Transformer specified by Williamson in his original design. Assemble this kit, and in 3 hours or less, enjoy the finest sound you ever heard. Operates from a tuner, phono-preamp, crystal pick-up, or other signal source. Absolute gain is 70.8 db with 20db of feedback. Frequency response: $\pm .5$ db, from 10 to 100,000 cps. Output impedances to match all speakers from 1.7 to 109 ohms. Kit is complete with 5 tubes (1-5V4, 2-6SN7, and 2-5881) (or 807 if requested), 2-Punched Chassis, 2-Resistor Mounting Strips, Sockets, Partridge WWFB Output Transformer, Assembly Instructions, and All Other Necessary Parts for Amplifier and Power Supply... **\$76.50**

PARTRIDGE OUTPUT TRANSFORMERS

Available Separately. WWFB **\$26.00**

NOTE: HR-15 may be had with British KT-66 Output tubes for \$3.00 additional.



ELDICO TR-75-TV TRANSMITTER KIT

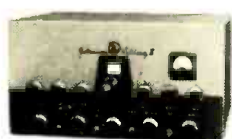
An ideal unit for the novice. New, revised circuit mini-mizes TVI. Uses 6L6 oscillator — 807 amplifier. Combination PI-network output. Husky power supply delivers 600 volts to the 807. Complete... including punched chassis and shielded cabinet. Unbelievably low priced at... **\$64.95**

MD-40 modulator kit for above... **49.95**

MD-40P as above but with power supply... **59.95**

Write for literature on the Complete Eldico Line.

New Deluxe Transmitter Kit JOHNSON VIKING II



100 WATTS ON PHONE
130 WATTS ON CW

Every desirable feature has been included in this outstanding transmitter: BAND-SWITCHING to all amateur bands, from 160 through 10 meters... TVI suppression... 100% AM modulation... PARALLEL OUTPUT 6146 tubes... PUSH-PULL 807 MODULATORS. Supplied complete with pre-punched chassis, copper-plated steel cabinet, tubes, hardware, assembly instructions, and all necessary parts and components... **\$279.50**

Viking II complete with tubes, wired and air tested... **324.50**

Viking VFO Kit... **42.75**

VFO Kit—wired and tested (with tubes)... **62.75**

Viking Mobile Kit, up to 60 Watts input... **99.50**

Viking Low Pass Filter, 4 section, 75 DB Att., handles a KW... **16.50**

Viking TVI Kit, everything to TVI suppress the Viking I... **24.75**

NOTE: Prices Net, F.O.B., N.Y.C. Subject to change without notice.



Harvey

RADIO COMPANY, INC.

103 W. 43rd St., N.Y. 36, N.Y. • LU 2-1500

nounces; 1100 gives news in French; 1115 dance music; a Soviet transmitter swamps the station around 1125. (Ridgeway)

Sao Tome—CR5SB, 17.677.5, noted Sundays 0750 when tuned with dance music; at 0757 had call, guitar music, details of next program and closing announcements in Portuguese; left air 0800A after "A Portuguesa." (Pearce, England; Ferguson, N.C.) CR5SC, 4.809, is good level opening 1430. light musical programs to closedown 1600; gives call frequently (by man). (Ridgeway, South Africa)

Saudi-Arabia — Djeddah is noted opening around 2215 on 6.177A and 7.245A with usual interval signal; uses Arabic; closes around 2304A. (Bellington, N.Y., others)

Somalia—Mogadishu, 7.383, is heard from 0915 in Arabic to 1200, when goes into Italian until 1300 closedown. (Ridgeway, South Africa)

South Korea—HLKA, 7.935A. Pusan noted 0630 with Western music and Korean news. (Sanderson, Australia) Wada, Japan, says is now operating on 7.935 and 9.555 at 1600-1800. 2130-0030, 0330-0900, all in Korean. Flynn, Calif., reports HLKA on 4.4785 at 0845, S6, in oriental language, much QRM.

Spain—Radio Mediterraneo, Valencia, is noted now near 6.995 from audibility around 1425. Radio Juventud le Murcia has been moving around, noted more recently on 7.105A with dance music 1655; gave call in Spanish 1700, and was soon buried by sign-on of a Radio Free Europe station. A Spanish Nationalist outlet has been heard on 7.420, but it is not Radio Menorca; signs on 1500 with singing of march and signs off with similar number 1705; call sounds like "Transmite Radio Cartagena." (Pearce, England) FET1, 7.006, noted 1630 with Spanish program of news music. (Sanderson, Australia) Malaga, 7.012A, is still noted with Spanish Home Programs around 1515 onwards, fairly good level. (Ridgeway, South Africa)

Sweden — Radio Sweden, 11.705, noted with news 2300, then music. (Sanderson, Australia) Heard on 15-155 with news around 1000, fair level. (Scheiner, N.J.) Noted on 9.535 at excellent strength 1900-2000. (Deem, W. Va.)

Switzerland — Damascus, 17.865, heard 0945-1045 to India-Pakistan. (Pearce, England) On 11.913A with news 1720-1730 closedown. (Black, Pa.)

Tahiti—Radio Tahiti, 6.135, Papeete, is heard around 0000; signs off 0130. (Kary, Pa.)

Taiwan — BEC26, 10.060A, noted from 0910 tune-in with Chinese session to 1000 closedown. (Pearce, England) Taipei, 15.235, heard with news 2200 to North America. (Annala, Oregon) BEC32, 9.775A, Taipei, noted 0700 with English commentary and Western music; asked for reports. (Sanderson, Australia) A Taiwan outlet is noted on 7.045A around 0500-1030 closedown; call seems BEC22, BEC32, or BEC34; is not parallel with 9.855

which is heard quite irregularly; another Taiwan station is noted on 7.340A to 1030 or 1100. (Wada, Japan)

Tangiers—Radio Africa is on a new channel of 7.192 as early as 1015, and as late as 1745. (Pearce, England; Kary, Pa.) Radio International, 6.110A, noted with news in Spanish 1700. (Pearce, England) Pan-American Radio, 7.300, is heard with clock chimes (12) at 1900 and multi-lingual announcements to 1904 sign-off. (Kary, Pa.)

Thailand — Bangkok, 11.910, has English session 0500-0630, fair level; announces also 15.630, 7.140 (is nearer 7.105—K.R.B.), 6.240. (N. Z. DX Times)

Uruguay—Radio Electrica, CXA10, has extremely good signal from around 1130 with classical music; call is given every half hour by man; has QRM from Radio Dakar at 1400. Radio Ariel, CXA3, 6.075, is noted at good strength from around 2030 to closing 2200, man gives call in Spanish. (Ridgeway, South Africa) Niblack, Ind., notes CXA10, 11.900, at good level 1800 and closing 2210.

USI (Indonesia)—A station believed Djakarta is heard with strong signal mornings to 1030 closedown on 9.865; at times location sounds like "Jogjakarta," however. (Stark, Texas; Kary, Pa., others) Noted on 9.585 from around 0800-1030 closedown. (Balbi, Rosenauer, Calif.)

USSR—Radio Tashkent, 6.825, is noted with English for India-Pakistan 1000-1030. 1115-1130 (some days English begins 1030, however). (Pearce, England) Moscow is noted on 11.68A with English (review of Moscow press) and music 0500-0530 fade-out. (Jones, France) Frequencies used by Moscow for the 1820-0100 period to North America are 15.330, 15.250, 15.230, 15-110, 11.910, 11.830, 11.810, 11.710, 9.670, 9.650, 9.550, and 7.240 (some of these are actually relays by satellite countries); the 0800-0830 transmission to North America is over 17.830, 15.440, 15.360, 15.180, 15.120, 11.910. (Kary, Pa.)

Vatican—HVJ, 5.968, noted 1545 with chimes and then news in Italian. (Sanderson, Australia) Noted on 11.74 with news 1000, fair level; also heard on this channel with English 1315. (Scheiner, N.J.) Noted with English period 1315 also on 9.550. (Kary, Pa.) According to NNRC, HVJ has news Wednesdays, only 0930-0940 on 17.775 for Near East.

Venezuela—Radio Rumbos has English session Mon.- Fri. 1800-1900 over 4.970, presented by Jay Farr; first 45 minutes is disc jockey session called "Supper Club" and last 15 minutes (1845-1900) consists of a roundup of latest world and local news. (West, Va.) YVKB, 4.8903, noted S5 at 0612; YVMM, 4.9096, was S5 at 0615; YVKM, 5.0294, noted S5 at 0619, CWQRM. (Oskay, N.J.)

Yugoslavia—Belgrade, 6.100, noted signing on 2330; has English 0130 and then is heard parallel on 9.505. (Bellington, N. Y.) English is now sched-

tests) to Turkey at 1430-1515 and to the United Kingdom 1515-1600 close-down on 7.010, 9.484. (Pearce, England, others) Heard with news 0330-0340 near 17.715. Noted with strong signal in program for Indonesia 0630-0715 on 17.835; announced 15.270 in parallel. (Pearce, England) Heard on 15.335 at 1915 with program for home listeners. (Sanderson, Australia) Is noted daily on 6.285A around 0700-1000, all-native; identifies often. (Wada, Japan) Now uses 9.762 instead of 11.844 for news 1015; heard on 6.23 with native programs 1115-1200. (Ridgeway, South Africa)

Panama—HO50, 5.996, noted in Australia 0145 with Spanish program of music and news. (Sanderson) HOJA, 9.645, noted 2140 with commercials in Spanish. (Pelegrí, N.Y.)

Paraguay—Radio Encarnacion, ZPA5, 11.945, noted at good level from 1500 onwards. ZPA1, 6.278, Asuncion, is high level 2100 to close at 2200; features dance music 2100-2200. (Ridgeway, South Africa)

Peru—Radio Central, Lima, has moved from 9.522 (listed 9.545) to 9.550; weak level; uses call of OAX4K and Andalusian Spanish. (Stark, Tex.)

Philippines—Radio Free Asia, 6.11 Manila, noted closing 0920 when announced channels of 11.94 and 6.11 for Manila. 9.49 for Guam. (Balbi, Calif.) DZH4, 6.000, Manila, noted in English 0900, CWQRM. (Flynn, Calif.)

The Far East Broadcasting Co., Manila, has brought into use a 16-m. channel of measured 17.805; is reported opening 0300; has been heard by Sanderson, Australia, also around 2300 when signal strength was especially good in Melbourne, also with news 0500; call is DZ16. The 16-m. outlet is heard by Ridgeway, South Africa, at good strength in parallel with 9.73, 11.855, 15.300, and from 0900 on 6.030; heard from around 0800 to closedown 1200, English from 1000. DZ16 has been heard in Sweden by Engberg 0500-0600.

Poland—Warsaw lists English (presumably for Europe) as 0130-0200, 6.140, 7.155, 5.995; 1200-1230, 7.175, 9.555; 1230-1300, 6.115, 9.555, 7.145; 1400-1430, 6.115, 9.555, 7.145; 1430-1455, 6.140, 7.155, 5.975; 1730-1800, 6.140, 7.155, 5.975. (Pearce, England)

Portugal—Lisbon, 6.360, noted 1754-1800 when signed off with "A Portuguesa." (Machajewski, N.Y.)

Portuguese Guinea—CQM sent QSL card and mentioned only 5.838 at 1630-1800. (Pearce, England)

Portuguese India—Radio Goa, 9.61, heard in Hindi 0930, in Portuguese 1000; in English 1030 (Mondays has "Old Fashioned Revival Hour" transcription); has guitar interval signal; is in foreign language 1130 and closes 1230, good level in South Africa. (Ridgeway)

Rennion—Radio St. Denis, 7.168, has strong signal in South Africa opening 0915 with announcements in French; 0930 light music, French songs; calls "Ici Reunion, Radiodiffusion Francaise" by man; woman also an-

BLOWERS—115 VAC 60 CYCLE



SINGLE TYPE: (Illustrated at left) 100 CFM, 2 1/2" Intake; 2" outlet. Complete size: 5" x 6". Order No. RN-520. **\$8.95**

DUAL TYPE: 100 CFM, 4" Intake; 2" Dis. Each Side. Complete Size: 8" x 6". Order No. RN-800. **\$13.95**

COMPACT TYPE: 108 CFM. Motor built inside squirrel cage. 4 1/2" Intake; 3 1/2" x 3" Dis. Complete size: 4 1/2" W x 8 1/2" H x 8 1/2" D. Order No. RN-860. **\$14.50**

FLANGE TYPE: 140 CFM, 3 1/2" Intake; 2 1/2" Dis. Complete size: 7 1/2" W x 7 1/2" H x 6 3/4" D. Order No. RN-865. **\$13.95**

FLANGE TWIN: 275 CFM, 4 1/2" Intake; 3 1/2" x 3" Dis. Complete size: 11 1/2" W x 8 1/2" H x 8-1/16" D. Order No. RN-134. **\$21.95**

DYNAMOTORS

DYNAMOTOR and BLOWER: 9 Volts DC Input; output 450 Volts 60 MA, 4500 RPM. At 6 Volts DC Input; output 260 Volts 65 MA, 3000 RPM. Price. **\$4.95**

PE-101C DYNAMOTOR... NEW \$4.95

INPUT:	OUTPUT:	STOCK No.:	PRICE:
14 V. DC	600 V. 300 MA.	BD-86	\$9.95
12 V. DC	220 V. 70 MA.	DM-24	6.95
12 V. DC	220 V. 100 MA.	DM-18	4.95
14 V. DC	375 V. 150 MA.	DM-375	7.95
14 V. DC	330 V. 135 MA.	DM-330	7.95
14 V. DC	500 V. 500 MA.	PE-50	14.95
12 or 24 V. DC	275 V. 110 MA.	USA/0516	3.95
12 V. DC	250 V. 50 MA.	DM-25	8.95
12 or 24 V. DC	500 V. 50 MA.	USA/0515	3.95
12 or 24 V. DC	440 V. 200 MA.		
	225 V. 100 MA.	D-104	14.95
28 V. DC	250 V. 60 MA.	PE-86	5.95

COMMAND TRANSMITTERS

Complete with Tubes & Crystals

RC-457 Transmitter—4 to 5.3 MC.—Used...	\$ 8.95
RC-458 Transmitter—5.3 to 7 MC.—Used...	7.95
RC-459 Transmitter—7 to 9 MC.—NEW...	22.95
RC-456 Modulator—NEW: \$5.95—Used...	2.95
Transmitter Back—Single: \$1.50—Dual...	2.00
Rec. Back—Dual: \$1.50 Modulator—Mig.	1.50
Rec. Dyn.—Used: \$2.95 Trans. Dyn. Used:	2.95

AIRCRAFT CONTROL CABLE

3/32" - 7x7 Strand, Weatherproofed, Galvanized, Preformed, 920 lb. test. Ideal for Television Cuing and many other uses. Files:

4 1/2¢ per Ft.—1000 Ft. or more @ 4¢ per Ft.

POWER SUPPLIES

PE-157 POWER SUPPLY—2 Volt Vibrator Supply, operates from RI-54 2 Volt Battery mounted in Case. Output voltage 1.4 V. 1/2 Amp 125 V. 50 MA. Less Battery, Speaker, & External Power Cord—with Vibrator. \$4.95
RI-54 2 Volt Dry Battery. 2.95
MP-28 BA Power Supply & Modulator (7A-12)—New. \$29.95
Power Supply No. 3 f/Mark II No. 19 Radio Set, 12 or 24 V. Two PM Dynamotors: 500 V. 50 MA; 275 V. 110 MA.—New. \$12.95
PE-104 Vibrator Unit f/RC-654. 10.95
550C Vibrator f/PE-104—New. 1.95
VB-16 Vibrator f/PE-237—SCR-694—New. 4.95
VB-9 Vibrator—6 Volt 4 Prong—New. 1.00
VB-8 Vibrator—2 Volt—New. 1.00

Address Dept. RN • Minimum Order \$5.00 • Prices F.O.B., Lima, O. • 25% Deposit on C.O.D. Orders

FAIR RADIO SALES

132 SOUTH MAIN ST.
LIMA, OHIO

TRANSFORMERS AND CHOKES

TRANSFORMERS—110 V. 60 CYCLE PRIMARIES:

5 Volt CT-25A—10.000 V. Ins. OPEN FRAME—6" x 5" x 4 1/2". **\$7.95**

6.3 V. 1 Amp... **1.25** 24 V. 1 Amp... **1.95**

24 V. 1/2 Amp... **1.50** 24 V. 6.5 Amp... **5.95**

6-24—or 30 Volt 8 Amp. **5.95**

Two 12 V. 4 A. windings, gives 12 V. 8 A. or 24 V. 4 A. **5.95**

325-0-325 V. 50 MA—6.3 V. 2.5 A.; 6.3 V. 6 A. (Rect. 6x5) Half Shell—2 1/2" x 3 3/4" x 3"—No. T-23-28. **2.75**

440 VCT/70 MA—5 V. 2 A.—6.3 V. 4 A. **3.35**

490 VCT/60 MA—5 V. 2 A.; 6.3 V. 4 A.; 6.3 V. 2 A. **3.25**

460 VCT/90 MA—5 V. 3 A.; 6.3 V. 4 A. **3.75**

175-0-175 V. 40 MA—6.3 V. @ 2.4 A.; 6.3 V. @ 6 A.; Halfshell 2 1/2" x 2 1/2" x 2 1/2"—No. T-23-40. **1.75**

350-0-350 V. 90 MA—6.3 V. @ 3 A.; 5 V. @ 3 A.; Up-right—3 1/2" x 3 1/2" x 3 1/2" **3.25**

CHOKES

5 Henries—150 MA. 85 ohms DC—Res. Cased. **\$1.95**

8 Henries—150 MA. 200 ohms. **1.95**

5-20 Henries—300 MA. 110 ohms. 1000 V. Ins. **3.95**

AERIAL WIRE—Phosphorus Bronze #16 Stranded, 200 lb. test. Weatherproof. 150 Ft. on Reel. (11-3 w/Clips) **\$1.50**

Telephone Wire—3 Cond. copper & steel. 525 Ft. **4.75**

ANTENNA EQUIPMENT

MAST BASES—INSULATED:

MP-132 BASE—Illustrated at left—1" heavy coil spring, 2" insulator. Overall length: 11 1/2". Weight: 2 1/2 lbs. Price **\$3.95**

MAST BASE—Insulated type with heavy coil spring and 3" dia. insulator. Requires 1" hole for mounting. Weight: 9 lbs. **\$5.95**

MAST SECTIONS FOR ABOVE BASES

Tubular steel, copper coated, galvanized, in 3 ft. sections, screw-in type. MS-53 can be used to make any length with MS-52-51-50-49 for taper. Any section. **50¢** Each

Larger Diameter Sections: MS-55-54... **\$1.25** Each

TRANS.—REC.—AMPLIFIERS

TA-12B TRANSMITTER with Tubes—Used. **\$39.95**

RI/ARI-1 Receiver—easily converted to 220 MC. (See R.N. JAN. '49) Complete w/Tubes. NEW. **\$4.95**

RA-10 DI Receiver—24 Volt with Tubes and Dynamotor—Used. **\$29.95**

RC-1206—200-400 KC. Deleo. w/Tubes. **\$9.95**

RC-216 Amplifier—2 Tubes—6F7, 30/41. **1.95**

RC-367 Amplifier—w/Tubes. Less Dyn. **\$4.95**

RC-605—With Tubes, Used. **3.95**

RC-709—W/Tubes—New: **\$4.95** Used: **3.95**

RC-347—Less Tubes—New: **\$2.95** Used: **1.95**

CORDS—CABLES

CD-501 Cord f/GN-45 Generator **\$2.50**

CD-318 Cord w/PL-68 & SW-141 & IK-48F. **.89**

CD-307 Cord—6.5 Ft. w/PL-55 & IK-26. **.89**

CD-604 Cord w/C-110 Trans. & PL-54 Plug. **.89**

CD-365 Cord for LP-21 Loop. **1.50**

MC-215 Tuning Shaft for 274N. **2.00**

SPEAKER RECONING

Complete line Cones, Spiders, Rings and Voice Coils. Custom Built Voice Coils. Low prices. Write for Parts List and Reconing information.

WESTERN ELECTRONICS CO.

3164 West Colfax Denver 4, Colo.

From the earliest days of Radio... to the present era of Television...

CORNISH WIRES

"Made by Engineers for Engineers"

CORNISH WIRE CO., Inc. — 50 Church St., N. Y. C. 7

WANTED

SCR-510, 610, 508, 608, 522, 300, etc.

BC-603, 683, 923, 620, 659, 604, 684, etc.

Receivers: BC-312, 342, 348, etc.

APR-4, APR-5; RAO, RCH, RBO, etc.

ART-13, ARC-3

Any test equipment with TS- or I-prefix— and any RADAR

WE PAY HIGHEST PRICES

Make your offer and be convinced!

Please describe condition accurately and advise price desired

AMBER COMPANY

393 Greenwich Street New York 13, N. Y.
BEekman 3-6510

World's most powerful
TV ANTENNA!

22 Db gain
over tuned dipole!

- GUARANTEED 10 times more powerful than stacked 10 element Yagis.
- GUARANTEED to extend fringe area reception an additional 40 miles.
- Motorless All Direction reception — nine different antennas in one.
- Broad band UHF — VHF plus FM reception.
- Half the cost of single channel stacked Yagis — Patented to insure price protection, U. S. Pat. Nos. 2,585,670 — 2,609,503, others pending.
- Pre-assembled, quick-rig, flip-out.
- Nationally advertised.

The only TV antenna that instantly beams the television set directly to the signal without a rotor.

The biggest antenna news of the year. TV technicians are marveling at this amazing powerful high gain antenna. The only antenna that brings strong signals from all directions to weak signal areas instantly . . . with a flick of the nine position switch located near the TV set.

Individually packaged with complete instructions

\$36.50 LIST PRICE

Includes Stacked Antenna Array, 9 Position Switch, Completely Wired Stacking Harness, A.I.M.—Automatic Impedance Matching Coupler.

MONEY BACK GUARANTEE

To outperform any present day antenna array using a rotor motor, including stacked 10 element Yagis array, 4 bay conicals, fans, double Y's, etc.

Available at local jobbers, or write for name of nearest representative

ALL CHANNEL Antenna Corp.

70-07 Queens Blvd., Woodside 77, N. Y.
Hickory 6-2304

lish daily 1000-1100A. (Pearce, England) Noted signing off 1631. (Kary, Pa.)

Liberia — ELBC, 6.022, Monrovia, noted 1830 to 1845 sign-off; announced would be back 1025. (Ferguson, N.C.)

Madagascar — Tananarive, 9.515, noted opening 2230 with "La Marseillaise." (Bellington, N.Y.; Kary, Pa.)

Malaya—Radio Malaya's Blue Network, 7.200, Singapore, noted signing off 1030 with "God Save the Queen;" on a Saturday was noted to 1100 closedown. (Pearce, England) Kuala Lumpur, 6.025, is heard well from 0900 with programs in English; has dance music 1000-1030 closedown. (Ridgeway, South Africa)

Manchuria—Mukden, 7.660, has been noted 0500-0855. (WRH)

Martinique — Nattugglan, Sweden, says FNRI, Radio Martinique, Fort-de-France, has been heard on 9.680 at 1935-2000; not confirmed; may have been confused with Paris on 9.685 which runs to 2000 closedown.

Monaco—Radio Monte Carlo, 6.035, 9.785, has English program, "Hour of Decision," Thursdays 1730-1800A sign-off, and "Back to the Bible" 1730-1800A sign-off Fridays. (Bellington, N.Y., others)

Mozambique—The English commercial service of Lourenco Marques is now using 11.742 instead of 11.765 as formerly. The Portuguese service is now using 6.14 at 0400-0630, and also 1030. (Ridgeway, South Africa) Heard signing off 1515 on 15.285A with "A Portuguesa"; fair to good level in N.Y. (Bellington) CR7BE, 9.810A, noted 0030 in Portuguese session. (Patterson, Ga.) Is heard 0000-0100. (Rosenauer, Calif.)

New Zealand — Revised schedules have just been received via airmail from Radio New Zealand—to Australia 1300-1515, ZL2, 9.540; 1530-0145, ZL10, 15.220; 0200-0545, ZL2, 9.540. To Pacific Islands 1300-1515, ZL9, 11.810; 1530.0145, ZL4, 15.280; 0200-0545, ZL3, 11.780.

Nigeria — Nigerian Broadcasting Service, 32 Marina, Lagos, Nigeria, verified reception of "7.083," stating frequency is actually 7.079; this is a 250-watt regional transmitter at Enugu in the Eastern Provinces; another regional station—low powered—is at Kaduna in the Northern Provinces on 4.925 during "hours of darkness" and 7.165 during "daylight hours" (local time). Officials said Lagos operates on 9.650, 7.5 kw., 0100-0215, 0530-0800, 1200-1500; channels of 6.100 and 7.255, low-powered, broadcast 0100-1700 with one break 0345-0530. Relays many BBC programs. Has been heard on 9.655A by Bellington, N.Y., and Kary, Pa., however, as late as 1700 closedown.

North Korea—Radio Pyongyang, the Korean Central Broadcasting Service, now broadcasts in Japanese on 4.400, 6.250 at 0800-0900. (Japanese Short-Wave Club)

Pakistan—Radio Pakistan is now on regular transmission (after completing

for dependable sound,
INDUSTRY relies on
ATLAS



DR Double-Reentrant Projectors



Paging & Talk-Back Speakers



ALNICO-V-PLUS Driver Units



Dual Speakers



FULL-GRIP, VELVET-ACTION Mike Stands

DEPENDABLE QUALITY:

The latest electro-acoustic research and engineering—and over 20 years of manufacturing know-how—are behind every ATLAS product.

DEPENDABLE SERVICE:

Coast-to-coast and around the world today—in every Industrial, Marine, Railroad, Military, Educational, Civic, U.S. and Foreign Government application—under every kind of climate and noise condition—ATLAS sound equipment is famous for highest efficiency and durability. That's the proof of ATLAS performance dependability.

DEPENDABLE DELIVERY:

Yes, ATLAS gives our Government highest priority. And yes, we too feel the pinch of material shortages. But our customers will continue to get our usual dependable delivery—because we believe in equitable and dependable distribution to all ATLAS users.

DEPENDABLE PROFITS:

Completeness of line, excellence of product, dependable delivery, right prices—that's the ATLAS combination that means high, steady Industrial Sound profits for You!

JUDGE for yourself, COMPARE ATLAS at your local Jobber today. See why ATLAS is the preferred line for utmost dependability. Write NOW for FREE latest Catalog 551



ATLAS SOUND CORP.

1446-39th Street, Brooklyn 18, N. Y.
In Canada: Atlas Radio Corp., Ltd., Toronto, Ont.

RADIO and TELEVISION ELECTRONICS



in all Technical Phases New Classes (Day and Evening) Start 1st of Dec., Mar., June, Sept.

Free Placement Service for Graduates For Free Catalog write Dept. RN-52

RCA INSTITUTES, INC.

A Service of Radio Corporation of America
350 WEST 4th ST. NEW YORK 14, N. Y.

FREE

Write today for "How to Service T. V. Receivers" with the HICKOK VIDEO GENERATOR.

The Hickok Electrical Instrument Co.
10824 Dupont Ave., Cleveland, Ohio

RADIO & TELEVISION NEWS

To W. Europe, N. Africa, and the Levant 1445-1530, 5.960, 7.125. The English news service is 1500, 11.780, 9.565, 7.115; 1930, 11.850, 9.630; 2310, 17.705, 15.130, 11.870; 0300, 17.705, 15.160; 0830, 15.190, 11.780; 1045, 15.290, 11.780.

Indo-China (Vietnam)—Radio France-Asie, 9.954AV, Saigon, noted ending English session with "Knights-bridge March" 1754. (Pearce, England) This one is at fair level some days around 0740. (Stark, Texas) Heard on 15.430 with English session 0500. (Sanderson, Australia) "Voice of Vietnam" is noted on 7.2882 and 9.620 with English 0930-1000 closedown; schedule is 1800-1930, 2215-0030, 0500-1000. **Radio Hue, 7.205, is now scheduled 1830-1900, 2300-0015, 0500-0800. Radio Dalat, 7.265, broadcasts 0530-0630 (Sat. 0630-0700) in French. Radio Hanoi is now on 9.670 at 1800-1900, 2230-0015, 0500-0830. Radio Hirondelle (Swallow Radio), "Voice of the French Army in Indo-China," broadcasts on 7.408 from Hanoi at 2300-0130, 0530-1000, all-French. Radio Laos, 7.215, broadcasts news in French 0800-0815. Radio Cambodia relays French from Saigon 1815-1845 on 6.090, has its own news in French 0700. (Wada, Japan)**

Israel—Tel-Aviv, 9.009A, now has news 1515; has English session ("Voice of Zion," relayed from Jerusalem) now 1615-1700 closedown. Announces news for 0645 over 6.830, 9.000 (actually 9.009A); has "Voice of Zion" session in French 1530. (Pearce, England; Martin, R.I.)

Italy—Rome, 9.630, noted opening 1245 and announcing for 9.63, 11.81; had news for Great Britain. (Ferguson, N.C.)

Jamaica—Radio Jamaica, 4.950, Kingston, noted opening 0600. (Ferguson, N.C.) And closing 2300 on 3.360. (West, Va.)

Japan—JK14, 11.800, Tokyo, relaying Home Service, is strong level in New Zealand 0400; before 0345 has bad QRM. (N. Z. DX Times) JBD4, 15.235, noted 0400 with program in Japanese and Western music; is "N.H.K." outlet JK16, 11.825, noted 0400 with world and local news, then music. (Sanderson, Australia) JKL, 4.860, noted 0850 with popular music; JK1, 4.910, heard 0830 in Japanese, along with JKM, 4.940. (Flynn, Calif.) AFRS, 4.860, is noted in English to 1000 sign-off. (Gaylord, Wn. State) **Radio Japan now uses JOA3, 9.675, and JOB, 6.069, to North America 0000-0100; the 0600-0700 beam to North China is radiated over JOA2, 7.180, and JOB, 6.069. Other transmissions are unchanged. (Kary, Pa.)**

Kenya Colony—VQ7LO, 4.852, Nairobi, is now on this measured frequency, heard from 1200 to close 1500; the South African Broadcasting Corporation says Nairobi is also using 6.060 in parallel. (Ridgeway, South Africa) Forces Broadcasting Service, East Africa Command, 7.265, Nairobi, noted with music 2248; has BBC news relay 2300. (Ferguson, N.C.)

Lebanon—Beirut, 8.036A, has Eng-

HAPPY NEW YEAR; WE SAY IT WITH BARGAINS!

A SENSITIVE RELAY!

Closes at 4 to 5 ma. (Extra set of SP/ST contacts for additional sequence, close at 6.5 ma.) Coil 6000 ohms. Sensitivity easily altered by bending limit arm or changing spring. Only 1 1/2" x 2 1/4" x 1 1/2" overall. Dozens of applications, and offered at a "stock up" price. Removed from clean equipment.

ONLY 98c each, 3 for \$2.75

Boxed, reconditioned, like new NEW \$1.69

SUPER SENSITIVE RELAY SCOOP!

BK-7, fully enclosed and adjustable. Single pole, double throw, fully adjustable contacts with dial calibrated spring. Will operate at low as 1.5 ma! In plastic case, 1 1/2" x 3" x 1 1/2" deep.

ONLY \$1.95 each, plus 15c mailing charge or 1c for \$17.50, postpaid anywhere in U.S.

HEAVY DUTY RELAY

40 amp contacts starting relay, SP/DT, normally closed one side. NEW, \$1.95; 3 for \$4.95

PRECISION CALIBRATED TUNER

Build a Q-meter or an audio oscillator, a signal generator, a VFO, an ultra-stable receiver, or... you name it! Lab-standard accuracy and re-stability. Precision condenser assembly with 47 precision die-cast 1.5-12 mc in 3 bands plus a reference scale. Triangular plastic hairline indicator. 50:1 ratio drive assembly, all gears spring-loaded and double set line tuning lock. Plates are two single spaced 250 uuf, and one double-spaced 240 uuf section. Use double spaced section to eliminate drift.

ONLY \$4.95

BROADCAST BAND & AERO

MN-26-C Remote Controlled navigational direction finder and communications receiver. Manual DF in any one of three freq. bands, 150 to 1500 KC. 24 V. Self-contained dynamotor supply. Complete installation, including receiver, control box, loop, azimuth control, Left-Right Indicator, plugs, loop transmission line, and flex. shafts.

BRAND NEW, ORIG. PACK \$69.50

SUPER HI-FI HEADSET BUY!

Uses annular-grooved plastic fibre cones with voice coils as in speakers, and padded chamois ear muffs to obtain spacing for correct acoustical load. Gives finest music reproduction, flat far beyond upper and lower limits of auditory perception. Pair in series has measured impedance of 600 ohms at 1000 cycles, obtained with built-in high quality transformers. However, severe mismatching makes no apparent difference. Far superior to crystal phones. Manufacturer's net price is \$45.00 per pair. (Each unit can also be used as high quality dynamic mike with 300 ohm output impedance.) They come to you checked out with freshly laundered chamois pads in cellophane bag.

ONLY \$7.95

PORTABLE POWER KITS

1. Includes 2 volt, 20 AH wet cell, lightweight transparent plastic, fibre separator, 3 half hydrometer, 4" x 3" x 5 1/2" high, shipped dry; also 2 volt synchronous vibrator, no tube needed; also 2 volt charger, 1 1/2 v 50/60 cy in. This high quality unit uses step-down transformer and dry disc rectifier, with pilot lamp in output to indicate and regulate charging rate. With cycloconverter type battery filler and instructions. ALL 4 ITEMS, BRAND NEW. ONLY \$4.95

2. Six volt Vihrapack kit. Vibrator plus non-syne transformer with two outputs: 3 1/2 v, 1 1/2 v for plates, 1 1/2 v for bias. BRAND NEW \$2.95

TRANSFORMER SPECIALS

THEMADRO SA-1225 POWER TRANSFORMER. PRI: 115 v, 50/60 cy. SEC: 600-1440-0-1440-600 v 250 ma; 6.3 v, 3 A; 6.3 v, 3 A, 5.0 v, 3 A. Type "A", fully automatic. Ideal for average ham rig. We furnish shipping. New manufacture, guaranteed. Only \$10.80

THEMADRO SA-7220 POWER TRANSFORMER. PRI: 115 v, 50/60 cy. SEC: 370 v CT, 250 ma, 6.3v, 3A, 6.3v, 3A, 5.0v, 3A. Same as above, ship. wt. 12 lbs. Only \$2.95

12 V FILAMENT TRANSFORMER or line voltage booster. PRI: 110 v, 60 cy.; SEC: 9 to 13 volts in 1 volt steps at 3 A. Free schematic shows many uses. NEW \$1.89

6 V VIBRATOR TRANSFORMER. Non-syne, two outputs: 3 1/2 v, 1 1/2 v for plates; 1 1/2 v for bias. NEW \$1.89

OUTPUT TRANSFORMER. 5000 ohms input to TWO outputs, 300 ohms or 3.5 ohms. Use as output for 12 v, 6V, etc. or to match speaker or headset. NEW, potted, shielded. Only \$1.79c

THEMADRO SMOOTHING CHOKE 7A-1225, 12 H, 250 ma. \$6.90

THEMADRO SWINGING CHOKE 7A-2250, 5 to 30 H, 250 to 25 ma. (Shipping wt. on these chokes—11 lbs.) \$6.90

12 CHANNEL T-V TUNER

Complete front end, famous make "Silver Circle." Furnished with original factory instructions, less tubes. Dozens of uses: receivers, converters, etc. The TV bargain of the year for builders, amateurs, students. These are factory rejected for minor damage, but all easily repairable. ONLY \$1.95 each, 3 for \$5.00

RF AMMETER, 0-1 amps, 2" round, thermocouple type. Has 1" scale-spread between 1 and 3 amps. NEW \$3.95

NOVICE 80 METER CW XMTR

Here's a neat and compact surplus item which converts very simply to 3700-3750 KC crystal controlled. Condition: Guaranteed suitable. Instructions? Yes, we furnish them! Complete, comprehensive, step-by-step; nothing left to guesswork. This is 5-3-7, the favorite with old-timers. ONLY \$7.95

NOVICE 2-METER VOICE XMTR-RECVR

ARC-4. A standard for two meter conversion. Excellent used, all tubes, conversion instructions. (The tubes alone are worth more than \$30.00 surplus prices!) Less dynamotor \$37.50
12 or 24 volt ARC-4 dynamotor \$10.50
TUBE GRAB BAG. At least 10 tubes of special interest: new types, old types, big ones, little ones, some new, some used but good. A big value at \$1.39

4 USES—4 DOLLARS

The most versatile dynamotor in surplus. The best dynamotor for conversion to 6 v. Multiple windings! After conversion you get choice of 100 or 350 v at 50 MA or 250 v at 100 MA. No brushes to shift around, no mechanical work. Or use it as a 2:1 or 1:2 step-up or step-down transformer for DC voltage! Changes 6 to 12, or 12 to 24, or vice versa, up to 3 A. Or use it as a GENERATOR! Turn with motor, get 12 v DC at 12.6 A or 24 v DC at 6.3 A, plus high voltage. Includes easily removable self-contained 800:1 sealed-in-oil gear reduction unit. Complete dope sheet furnished. BRAND NEW \$4.00

PE-103 SPECIAL. A standard mobile dynamotor power supply. Delivers 500 wdc, 6.14 amps, with choice of two inputs, 6 V at 21 amps or 12 V at 11 amps. Complete with filter base, relays, input cables. NEW \$24.50 (shipping weight 7.5 lbs.) LIKE NEW \$24.50

COMMAND EQUIPMENT

With free dope sheets and schematics

RECEIVERS
BC-455, 6-9 mc. NEW \$12.95, GOOD USED \$7.95

TRANSMITTERS
T-19 ARC-5, 3-4 mc. Excellent \$14.50
BC-457 or T-20 ARC-5, 4-5 mc. Like new \$8.95
MOD BC-456, Brand new \$5.95, Excellent used \$2.49

As is for parts
274M PLUG, 7-prong male plug to fit back of command receiver and xmtrs. This is the same plug as used in the racks. NEW, each 24c; five for \$1.00
Local Control Adapter Parts for 274M or ARC-5 rev. Exact pot, switch, knobs, etched plate, and instructions. Ready to mount. \$1.29

SPLINE TUNING KNOB. \$1.79c

12 VOLT COMMAND DYNAMOTOR

For receivers SCIT-274N, VMA, ARC-5. Plugs on rear end. 250 v, 60 ma. DY-1/ALIT-2X. Guaranteed good condition. \$7.95
Less plug-in base \$5.95

A VIBRATOR BUY, 6 or 12 volts, self-rectifying, hermetically sealed. Can take high overloads. With socket and schematic. Specify volts. ONLY 89c

ANTENNA MAIN SECTIONS, MS-49, 50, 51, 52, 53. New, original packing. Each 39c

AUDIO SUPER-SPECIALS

SUPER HI-Q high cut choke, 0.45 H, 55 ohms DC. Tune with .001-.0004 MF ONLY \$9c
LOW CUT, 5 H, 284 ohms, tune with 1 MF. Or use as 50 ohm filter choke ONLY 98c

UNCER Transformers, one for mike to push-pull grids, that 30 to 15,000 CPS; other for push-pull output, tapped sec., turns 1:1. In unit with resistors, condensers, etc. BOTH FOR ONLY \$1.29

PHASE SPLITTER, or low-level mixer, or hybrid, or push-pull unit. Has 3 windings, each exactly 1:1 to any other; essentially flat 100-15,000 CPS. BRAND NEW ONLY 69c

VINYLLITE SPAGNETTI, clear, 0.166 H, three 257 length for only 98c

BUILD TV-FM-AM SWEEP GENERATOR

(See Dec. Radio & TV News)

Now you can build that "VERSATILE SWEEP FREQUENCY GENERATOR" We've got a few more of those vital APN-1 magnetic units. With reprint of the article \$6.95

EASY MONEY!

We're still buying surplus gear. Tell us what you've got, its condition, and your price. If we like it you'll get our check quick.

G. L. ELECTRONICS 905 S. VERNON AVE. LOS ANGELES 6, CALIF.

ALL PRICES F. O. B. LOS ANGELES. CALIF. BUYERS ADD SALES TAX

ATTENTION

Distributors in Chan. #12 Territory

We are in Production on 5, 10 & 12-Element—most efficient YAGI ever designed. MANY TERRITORIES STILL OPEN. We Welcome your Inquiries. ALSO COMPLETE LINE OF THE ANTENNAS.

FRENCHY RADIO MFG. CO.

164 W. Parker St. Scranton 8, Pa.

Advance with ELECTRONICITY

You need firm grasp of fundamentals to keep pace with these complex fast-growing fields. In thorough 2-year course learn electricity, electronics, physics, mathematics, drafting, etc. Other engineering and technical courses. Coed. Day, evening, 15th year. Write for Catalog.

FRANKLIN TECHNICAL INSTITUTE
46 Berkeley Street Boston 16, Mass.

GET INTO ELECTRONICS



You can enter this uncrowded, interesting field. Defense expansion, new developments demand trained specialists. Study all phases radio & electronics theory and practice: TV, FM; broadcasting; servicing; aviation, marine, police radio. 18-month course. Graduates in demand by major companies. I.I.S. or equivalent required. Begin Jan. March, June, Sept. Campus life. Write for catalog.

VALPARAISO TECHNICAL INSTITUTE
Dept. RD Valparaiso, Indiana

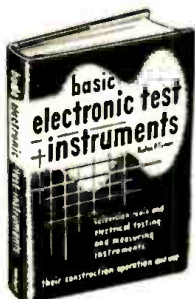
HOW FAST you work

HOW WELL you work

HOW MUCH money you make

... depends a whale of a lot on your ability to

Use ELECTRONIC TEST INSTRUMENTS effectively!



Here at last is a complete line-up of how-to-use-it data on ALL TYPES OF MODERN SERVICE INSTRUMENTS!

In complete, easily understood terms, you learn all about over 60 different instruments. You are shown exactly when, where, why and how to use them—on all kinds of service jobs.

You discover how to use familiar instruments more fully.

And you gain a first-hand working knowledge of the many newer types such as grid-dip oscillators, TV sweep and marker generators, TV linearity pattern generators, distortion meter, square wave generators and others that are so essential in servicing today's complicated equipment.

BASIC ELECTRONIC TEST EQUIPMENT

by Rufus Turner
New and completely revised edition 245 pages, 6 by 9. Price \$4.00.

Everything you need to know

about ALL instrument types used in modern Radio-TV service:

1. Simple Meters for Current and Voltage
2. Ohmmeters and Volt-Ohm-Milliammeters
3. Vacuum-tube Voltmeters
4. Power Measurement & Meters
5. Impedance Meters & Measurements
6. Capacitor Checkers
7. Inductance Checkers
8. Special-purpose Bridges & Accessories
9. Oscilloscopes and Their Uses
10. R-F Test Oscillators & Signal Generators
11. Audio Test Oscillators
12. Measuring Radio Frequencies
13. Measuring Audio Frequencies
14. Audio-Amplifier Testing Devices
15. R-F Signal Tracers
16. Tube Characteristics & Tube Checkers

WHAT INSTRUMENT TO USE... HOW TO USE IT PROPERLY

To the beginner, BASIC ELECTRONIC TEST INSTRUMENTS offers complete training in modern instrument usage. To the more experienced serviceman, it is a handy reference book that can more than pay for itself in time saved on a single job.

Each subject is covered from a practical service standpoint—NOT just as an instrument manufacturer's instruction manual. You learn the limitations of each instrument as well as its advantages! 171 photos, data tables and schematics help make things as clear as A-B-C.

And here are some of the book's EXTRA "how-to-do-it" features: How to measure resistance with a current meter; how to check power drain easily and quickly; how to measure R-F impedance with a simple T-network; how to check frequency with a "scope"; how to calculate a shunt or multiplier; how to calibrate meters... and dozens of other subjects.

Read it for 10 days at our risk! Clip 10-day examination coupon and send to: Rinehart Books, Technical Division, Dept. RN-13, 232 Madison Ave., New York 16, N. Y.

10-DAY FREE EXAMINATION

Dept. RN-13, RINEHART BOOKS, Inc. Technical Division, 232 Madison Ave. New York 16, N. Y.

Send Turner's BASIC ELECTRONIC TEST INSTRUMENTS for 10-day FREE EXAMINATION. If I decide to keep book, I will then remit \$4.00 plus postage. Otherwise I will return book postpaid promptly and owe you nothing.

Name.....

Address.....

City, Zone, State.....

Employer's Name & Address.....
OUTSIDE U.S.A.—Price \$4.50, cash only.
Money back if book is returned postpaid in 10 days.

too close to frequencies used by the government and marine services. However, the marine services have now arranged for the adoption of higher standards for auto-alarms* on ship-board, and the interference difficulty which prevailed earlier will no longer be a problem.

Canada has been using 540 kc. as a clear channel for many years, and XEWA, San Luis Potosi, in Mexico, is also operating on this band, with a power of over 100 kilowatts.

The first American station to use the new frequency may be KMBC, at Concordia, Missouri, who has been seeking that channel for years.

COMPATIBLE COLOR TV, as developed by the National Television Systems Committee, is expected to be ready for submission to the Commission next summer, according to Art Loughren, vice prexy of Hazeltine and chairman of the color video standards committee of NTSC.

The forecast was made during a meeting of the Society of Motion Picture-TV Engineers in Washington recently.

Before the FCC receives the petition to review the new color system, industry will be asked to review carefully, during a series of tests, all of the aspects of the system on the receiving as well as transmitting fronts. Then, one company will enter a plea for a hearing; NTSC will not be able to request the hearing since it represents most of industry and its views would probably be judged as biased, and thus not admitted before the Commission.

A FLEET OF 26 aircraft, operated by the Swiss Air Lines, will soon have complete visual omni-range very-high facilities for communications. The system features the use of instrument-panel navigation and is said to be useful on any course up to 200 miles to or from an airport.

* Auto-alarms serve to sound a call when a signal is received on 5011 kc.

The airlines, operating out of Zurich, Switzerland, serve principal European points, the Near East, and provide transatlantic flights to New York City.

THE COUNTRY lost one of its foremost broadcasting legislators during the late fall, when Harold A. Lafount, member of the former Federal Radio Commission, died.

As a crusading Commissioner, he sought means to improve reception through the use of higher power for key outlets. Over twenty years ago he studied the possibilities of TV development.

The nation will miss the talents of this pioneer whose mature wisdom played so vital a role in creating the sturdy base on which modern broadcasting is built today. . . . L.W.

International Short-Wave (Continued from page 86)

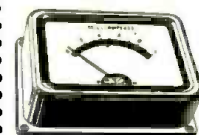
To Central Europe, United Kingdom 0230-0330, 17.705, 15.160; 0345-0415, 17.850, 15.160; 1000-1030, 11.780, 7.250. To East, Southeast Africa, Mauritius 2300-0010, 17.705, 15.130, 11.870; 1045-1215, 15.290, 11.780. To Burma 1945-1955, 9.720, 7.170; 0615-0700, 17.850, 15.160. To China 0430-0545 (to only 0530 Sat., Sun.), 17.850, 15.160; 0530-0600 (Sat., Sun. only), 17.850, 15.160. To Indonesia 1745-1800, 7.125, 5.960; 0700-0730, 17.850, 15.160. To Fiji 0200-0320, 21.700, 15.190. To West Indies 1830-1930, 11.850, 9.630, 7.170, 5.980. To Pakistan 2245-2320, 9.630, 7.125, 5.970; 0745-0815, 5.990, 3.945; 0815-0915, 7.170; 0945-1000, 3.945. To Afghanistan and adjacent areas 2215-2230, 7.125, 5.960; 0845-0930, 3.945. To Afghanistan 0030-0130 (Fri. only), 9.670, 7.170; 1130-1230, 7.170, 5.980, 4.940, 3.945. To Persia, Afghanistan 1230-1330, 7.170, 5.980, 4.940, 3.945. To Saudi-Arabia, Egypt, Lebanon, Syria, North Africa, Jordan, Sudan 2330-0030, 11.760, 9.720; 1230-1430, 7.125, 5.960. To Europe, United Kingdom 1445-1545, 11.780, 9.565, 7.115.

DON'T PASS THIS BUY

GOOD VALUE MARINE BAND RADIO RECEIVERS AT LOW COST—UNITS REMOVED FROM POLICE RADIO CARS, used but in good working condition, fixed tunable in 2-3mc band. Complete with 5 tubes, speaker & 6 volt input power supply. Also suitable for AUXILIARY POLICE-FIRE SERVICE. As is W/ money-back guarantee. Wt. 25 lbs. \$14.95

- ARMY SURPLUS SECTIONAL STEEL WHIP ANTENNAS 21 1/2 ft. \$1.85; 14 1/2 ft. \$2.50; 24 1/2 ft. \$3.25
- IDEAL 20-40 meter Vertical Assy. 12 1/2 ft. \$2.25
- HINGED TYPE INSUL. MTG. BASE, IDEAL low bridge losses in use. Used W/ above units. 7.95
- BRAND NEW MFD. 6 V. BATTERY CHARGERS, keep your battery in good cond. during winter. 7.95
- JAEGER 6 V. DC CLOCK (made for Kalar-Frazier) 2 face W/ 2 panel lamps, draws 2ma will run on dry cells, made to sell for \$17.00, only 5.95
- VIBRAPACK, 8 V. 100/100 ma HP used... 6.95
- CARTER DYNAMOTOR, same specs as above... 6.95
- COMPACT ELTRON VIBRATOR PACK, 6V. in. 90V/30 ma will operate on 4 D cells. 2 1/2 dia. x 3 1/2 in. 3.95
- YOUR NEW RADIO CONTROL PARTS HEADQUARTERS CRYSTALS, 27.25mc. .04 tol. (FCC) strong 3rd harmonic oscil. newly mfd to our specs... \$4.25
- XFO-2, flat hard-topper Enclos. tube... 3.35
- 3A4, 85C, 3A2, \$1.35; 3V4, \$1.40; 184... 1.65
- SIGMA 4IF relay, 10,000 ohm .04 watt sensiti. 2.95
- SIGMA 1F relay, 100 ohm input coils... 2.95
- SIGMA 5F relay, 5000 ohm super-sensitive, 4 oz. the ideal relay for your receiver, special. 6.95
- GENERAL ELECTRIC miniature, 10,000 ohm, a light unit suitable/hard tube receivers... 2.45
- RECEIVER PARTS KIT, W/3A4 & G.E. relay above 5.95
- TRANSMITTER PARTS KIT, W/3A4 tube & crystal 8.95
- MONEY BACK GUARANTEE ON ALL ITEMS. Save C.O.D. Fees. Incl. Postage. Excess Returned Minimum Order—\$3.00. Please
- Special Bonus—2 lb Hookup Wire Kit Free/55 Order
- ELECTRONIC SPECIALTY SUPPLY CO.
- 58 WALKER STREET, NYC 13, N. Y. WALKER 5-8187

SUPER VALUE!



0-1 MA DC
4" SCALE

Only \$5.95 ea.

2 FOR ONLY \$11.00

Greatest meter value ever offered! Sensitive 1 MA DC basic movement may be used for any type of current or voltage meter. Big 4" scale calibrated 0-1 for easy fractional readings. Rectangular bakelite case with corner mounting holes mounts flush on panel, projects 2" forward. Nothing behind panel except meter terminals. Meter case measures 4 1/2" high, 5 3/4" wide. These meters are slightly used but have been thoroughly checked and reconditioned. We guarantee them for absolutely top performance. Don't delay; order now! No more available after present supply is sold!

25% with order—
balance C.O.D., F.O.B. Chicago

NATION WIDE RADIO

572 W. Randolph Street Chicago 6, Ill.

grams was discounted by spokesmen for the film exhibitors and producers. Only special presentations, prepared for theater audiences and particularly adapted to large-screen reproduction, would be offered, the film moguls declared.

Complete briefs on behalf of others who will be involved in this new form of videocasting will be offered during the first weeks of the new year, and an extensive cross-examination period will follow. In view of the complexities of the issues involved in theater TV, many believe that there'll be no final decision from the Commission for quite awhile.

LOUDSPEAKER MANUFACTURERS have been cautioned by the NPA against a quick return to the production of electromagnetic speakers, in view of the present uncertainties in the copper supply situation.

The steel situation, disturbed by the recent strike, was also posed as a current difficulty by the government. Both issues were presented at a special meeting in Washington. In reply, an industry committee reported that speaker manufacturers are faced with a problem of seasonality and tie-in with radio and TV production. Declaring that loudspeaker steel allotments for the fourth quarter of '52 and advance allotments for the first quarter of '53 have been inadequate, manufacturers stressed that these quarters are the period of highest demand for their products. It was pointed out that speakers are the last component to be incorporated in chassis, and thus set makers do not order far in advance of their peak selling season. Therefore, it was noted, the speaker industry loses civilian business if it does not have a concentration of production material in the fourth and first quarters.

NPA officials stated their awareness of the situation and desire to alleviate the problem as soon as defense needs for steel are met.

Among those who attended the conclave in the nation's capital were H. S. Morris (Altec Lansing), George Cromartie, Jr. (Best), Austin Ellmore (Crescent Industries), Russel S. Fenton (Permoflux), Matt Little (Quam-Nichols), Stuart W. Bell (Quincy), A. I. Abrahams (Racon) and Laurence A. King (Rola).

THE SIZZLING AM-BAND EXTENSION debate has finally come to an end. A few weeks ago the Commission issued a finalized rule approving the use of the 540-kilocycle band. The AM broadcast band now extends from 535 to 1605 kc, instead of from 550 to 1600. The extension of the band had been approved at the Atlantic City conference in '47, and on December 1 of this year the extension had been officially supplemented by a Geneva agreement.

For years, broadcasters have been trying to win approval of this band, but were told that this channel was

FOR THE BEST COVERAGE

IT'S THE

RADIO HANDBOOK

GIANT 13TH EDITION

Whatever your position in the radio and electronics field . . . technician, engineer or advanced amateur . . . you'll find the answers you are seeking in the new **RADIO HANDBOOK**. This great clothbound, gold stamped one-volume encyclopedia of radio information is the largest **RADIO HANDBOOK** ever published . . . and the best!

Reference data galore, the latest in theory and practice; profusely indexed, clearly illustrated. All the information you *must* have, where you can find it quickly.

Order your **RADIO HANDBOOK** now from your favorite dealer. You can't afford to be without it . . . and it costs you less than one cent a page!

734 PAGES **\$6.00** PER COPY (plus tax)



FOR ADDITIONAL COVERAGE

BETTER TV RECEPTION in fringe and low-signal areas. **NEW SECOND EDITION** just off the press. The standard guide for installation engineers and TV owners. **\$2.50**

ANTENNA MANUAL. 300 pages of help on antenna, feed line, radiation and propagation for all frequencies up to 1000 Mc., including FM and TV. **\$3.50**

WORLD'S RADIO TUBES (Brans' Vale Mecum) New 9th edition. The only book which includes ALL MAKES OF U. S. TUBES and all foreign. Available in 16 languages. **\$5.00**

RADIOTELEPHONE LICENSE MANUAL. Complete study guide questions with clear concise answers, for all U. S. A. commercial radiotelephone operator's exams. **\$3.75**

SURPLUS RADIO CONVERSION MANUAL in 2 volumes. Conversion data for most common items of surplus electronic equipment. Write for list. . . . Each volume **\$2.50**

BUY FROM YOUR DISTRIBUTOR

AT PRICES SHOWN, OR ADD 10% ON DIRECT MAIL ORDERS TO EDITORS and ENGINEERS, Ltd., 1302 KENWOOD ROAD, SANTA BARBARA, CALIF. Bookstores order from BAKER AND TAYLOR CO., Hillside, New Jersey

WORTH 5 TIMES THE PRICE! REMOTE CONTROL UNIT

ELECTRONIC THYRATRON THERMOSTAT CONTROL THAT USES A PLATE CIRCUIT TRIGGER RELAY!

A most outstanding value! . . . an electronic unit that not only can be changed over to serve many purposes but is loaded with valuable standard component parts for anyone who knows value and wants to buy them for the parts alone . . . the relay alone is worth the price we're asking for the entire unit . . . check the list below.

TERRIFIC BUY!

FITS INTO MANY USES

DON'T PASS UP THIS OPPORTUNITY FOR ONLY

- 1—115V-6.3V Filament Transformer
- 1—S. P. S. T. Sensitive Plate Relay
- 6—Carbon Resistors
- 7—Wire Wound Resistors
- 1—S. P. S. T. Switch
- 4—Paper Tubular Condensers

MANUEL KLEIN CO.

- 1—Electrolytic Condenser
- 1—Potentiometer
- Plastic Cabinet—5¼x5x3¼
- 3—Tube Sockets
- Pilot Lamp, Dial Assembly
- Knobs, Feet & Assorted Hardware
- Schematic Diagram
- 94 Chambers St., New York 7, N. Y.
- REctor 2-6460



249 POSTPAID

COMPLETE WITH CABINET

10 UNITS

\$22.39

ATR

Makes
it easy
to DEMONSTRATE
AND TEST
D.C. APPARATUS
FROM A.C. LINES



"A" BATTERY ELIMINATORS

For DEMONSTRATING AND TESTING
AUTO RADIOS

New Models . . . Designed for testing D.C. Electrical Apparatus on Regular A.C. Lines. Equipped with Full-Wave Dry Disc Type Rectifier, Assuring Noise-less, Interference-Free Operation and Extreme Long Life and Reliability.

✓ NEW MODELS
✓ NEW DESIGNS
✓ NEW LITERATURE

"A" Battery Eliminators, DC-AC Inverters
Auto Radio Vibrators

See your jobber or write factory

AMERICAN TELEVISION & RADIO CO.
Quality Products Since 1931
SAINT PAUL 1, MINNESOTA-U.S.A.

Among the subjects included on the agenda were the technical requirements and standards for theater TV, involving the video signal (bandwidth, signal-to-noise ratio, linearity of electrical transducers and standards); audio signal; and the radio-frequency transmission of the video signal (r.f. bandwidth per channel, allocation principles for co-channel and adjacent channel operation, number of channels required per system, summary of standards, technical limitations on choice of frequencies, and possible location of theater TV service in spectrum). Also up for review were the possible systems of microwave distribution which might be used for intercity relay, intercity multiple address and intracity distribution. Methods which might be employed for projection were also up for analysis, kinescope projection, film storage, and *Eidophor*. Costs were also debated.

Quite a slice of the spectrum was asked for by the motion picture interests; a 360-mc. band in the 5925-6875 megacycle range, a band now allocated for fixed common carrier services. To assure quality transmission of 35-nm film, film engineers said that the FCC should provide 10-mc. wide video channels, radio-frequency channels 30-mc. wide, two-channels for a single system, and room for six systems for competitive reasons. It was also noted that an additional 60-mc. would be required for mobile pickup services. The Commission was told that if the channel initially requested could not be set aside, then there were two alternatives. Theater TV could be reclassified as an industrial service and be allowed to operate in the 6575-6875-mc. band, with the band being widened to accommodate the necessary 360 megacycles, which would mean that the industrial service band would have to be extended down to 6425-mc. The second possibility lay in the allocation of the band at 10,700-11,700 megacycles, now also assigned to fixed carrier circuits. If this microwave band were used, then radio-frequency channels of 55 megacycles would be required, instead of 30-mc. stated in the original specifications.

Theater TV may require an entirely new set of standards, it was disclosed at the meeting. Recommended for such a new engineering setup were a scanning rate of 735 lines; a signal-to-noise ratio of 46 db for black and white, and 42 db for color; a frequency-modulated video signal, an 8-ke. wide audio signal, multiplexed on the carrier, and a linearity not to exceed 10 per cent variation between the black and white levels.

The cost of building an intercity and intracity microwave net covering nine cities and about 1500 theaters between New York and Washington was estimated at between fifty- to sixty-million dollars, while operational expenses would run to about \$2-million.

The fear that theater TV would deprive home viewers of top-flight pro-



THE FAMOUS WILLIAMSON AMPLIFIER FOUNDATION KIT

1 Power trans. 810 volts CT @ 225 mls. 6.3v @ 8 amps. 5.0v @ 3 amps. \$ 6.95
2-10 Mfd 600 volt oil cond. with brackets. 2.28
1-12 Hvy 250 mil choke 70 ohms. 2.95
1 III fidelity Chicago output trans.
Schematic Included. Value \$45.00.
OUR VERY LOW PRICE . . . \$15.99
*Available only in kit.

POWER TRANSFORMERS

WESTINGHOUSE Pri. 115v 50-60 cy. Sec. 650v c.t. @ 250 mls.; 12.6v c.t. @ 5 amps; 6.3v @ 5 amps; 0.3v @ 5 amps; 5v @ 3 amps. Electrically shielded. Brand new. **\$4.49**

STANCOR Pri. 110v. 125v. 50-60 cy. Sec. 900v c.t. @ 325 mls.; 6.3v @ 5.5 amps; 0.3v @ 4.5 amps; 5v @ 6 amps. Bright mt. Ship. wt. 21 lbs. Reduced to. **\$8.95**

RCA Pri. 115v. 50-60 cy. Sec. 750v c.t. @ 225 mls.; 6.3v @ 8 amps; 0.3v @ 1.2 amps; 5v @ 3 amps. Half-shell mtg. Ship. Wt. 13 lbs. Reduced to. **\$5.99**



10 MFD-600V OIL CONDENSERS
Sprague and C.H. Diam.: 2 3/4". Height: 3 3/8" (99c ea. Brackets 15c ea.)
Complete with brackets. . . 3 for **\$2.95**

KIT OF 100 RESISTORS

Consists of popular 1/2 and 1 watt resistor values. Made by leading manufacturers—All Standard Brands! **\$2.99**

FP CONDENSER KIT

8 condensers, assorted. All new, standard sizes. Single & multi-sections. Complete with mounting plate. \$12 value. **\$2.95**



4 1/2" SQ. 0-200 MICROAMP MULTI-METER
Made specifically for VTVM. Following scales: ohms; d.c. & a.c.; h.c. 0-3, 0-10; d.c. 0-3, 0-10. **\$9.95**
Famous make.

630 SUPER DELUXE 31-TUBE TV KIT

Complete. Including voltage doubler and AGC. For all tubes 16" to **\$119.44**
24". Less CRT & wire.

PHOTO FLASH CONDENSERS

Cornell Dubilier. 400 mfd. @ 450 volts. 2 condensers = 80 watt seconds. **\$5.95** ea.
Very special.

BATTERY CHARGER

115v 50-60 cy. 6 amp. Charges at 6 amp rate; tapers to 3 amp. Complete with 2" mc. lead. 7" high. 4 1/2" long. 4" wide. **\$8.95**

SLEEPER SPECIALS!!

2 1/2" Simpson RF 0-8 ammeter. Built in thermocouple. . . ea. **\$2.69**
Choke: 10 HV; 85 mls; hermetically sealed 400 ohms d.c. 49c ea. 3 for **\$1.35**
GE 2 meg. volume control. . . ea. 35c
3 for **\$1.00**

TERMS: 20% cash with order, balance C.O.D. unless noted. Prices F.O.B. our warehouse in N. Y. C. Minimum order \$3. NOTE: Due to conditions beyond our control, prices are subject to change.

Phone WOrth 4-3270

ACORN ELECTRONICS CORP.

76 Vesey St., Dept. T-1, New York 7, N. Y.

EQUIPMENT NEEDED!

**BC-348, BC-342, ART-13
I-152, BC-788, BC-611**

Also interested in other airborne electronics. Top dollar paid. Inquiries answered promptly.
V & H Radio & Electronic Supply Co.
2033 W. Venice Blvd. Los Angeles 6, Calif.
Phone: REpublic 3-1272

LEARN TELEVISION

ELECTRONICS and RADIO
Engineering Laboratory and Classroom
Training. Day and Evening Classes.
Write for illustrated Catalog

ELECTRONICS INSTITUTE, Inc.
21 HENRY, DETROIT 1, MICH.

new device which perpetually cleans both rotating and stationary contact points on all standard television tuners.

Tradenamed "Tuner Kleen'r", the new product consists of a plastic back covered by nylon which, in turn, is impregnated with a special cleaning agent. Produced to close tolerances, the unit is installed in the tuner by removing a pair of the unused tuner strips and substituting the cleaner device.

-30-

Spot Radio News
(Continued from page 18)

charged the normal calm of Commissionland. For his arrival is expected to cause some broad changes, particularly in the chairmanship of the group and the nomination of a new Commissioner to replace the recess appointee, Eugene Hyde Merrill, former director of the Materials Branch in the Defense Production Administration, who succeeded Robert Jones.

The naming of a new chairman may not be possible until June 30, when Walker's term expires. Actually, the present headman is serving on a special appointment from the President, having been asked to take the chair even though he had passed the retirement age; the late President Franklin Roosevelt had named Walker as a Commissioner in 1934. According to the established mode of procedure, the chairman is expected to be of the same political party as the President. Accordingly, two members of the Commission have appeared as possibilities for the appointment: Rosel Hyde, now serving as vice chairman, and George Sterling, both Republicans.

The appointment of Merrill was quite a surprise and was made public during an address by President Truman at Brigham Young University in Salt Lake City. Said the President: "This morning I signed a paper appointing to the FCC a distinguished resident of your state, Eugene H. Merrill. I thought you might be interested in that, because I understand that Mr. Merrill's father was a member of the board of this university. Of course, that was a good recommendation for him, as far as I was concerned."

Merrill's tenure, technically, will expire when Congress convenes in '53; his name must then be submitted to the Senate committee for confirmation. It is believed that the name of another candidate for the post, a Republican, will probably be sent to the Senate for such confirmation.

THEATER TV, shelved and reshelved on a dozen occasions, received a brief airing a short time ago during a special hearing in Washington which featured testimony by the Motion Picture Association of America and the National Exhibitors Theatre Television Committee.



Sensational TUBE SAVINGS

70% to 90% Off List!

Thousands of tube buyers have recognized the tried and true performance, plus economical service of Rad-Tel fully guaranteed tubes. Each tube is rigidly tested, each tube is a standout value—sufficient reason why Rad-Tel tubes are the sensation of the nation.

All Tubes Individually Boxed! Same Day Service!

✓ Check this list for Fully 90-Day Guaranteed Tubes

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
OB3/VR90	.75	5V4	.73	6BF6	.37	6U4	.60	14J7	.60
1A5CT	.46	5W4	.50	6BG6	1.25	6U5	.44	14W7	.60
1A6G	.59	5X4	.40	6BH6	.46	6U6	.63	19BG6G	.95
1A7CT	.47	5Y3G	.32	6BK7	.39	6U8	.61	19C8	.70
1AB5	.59	5Y3GT	.32	6BK7	.59	6V3	.93	19T8	.79
1B3	.65	5Y4G	.35	6BL7	.59	6V6CT	.39	19V8	.89
1B5	.59	5Z3	.46	6BQ6GT	.59	6W4CT	.44	24A	.63
1B7CT	.59	6A3	.59	6BQ7CT	.72	6W6CT	.44	25AV5	.83
1C5CT	.43	6A7	.59	6BY5	.65	6X4	.37	25BQ6CT	.62
1E7	.29	6A8	.62	6BZ7	.90	6X5CT	.37	25L6GT	.39
1H4G	.48	6AB4	.44	6C4	.37	6Y6G	.48	25Z5	.40
1H5CT	.40	6AG5	.43	6C5CT	.39	7A4	.47	25Z6CT	.37
1G6	.60	6AJ5	.90	6C6	.58	7AF7	.53	25W4	.56
1L4	.46	6AK5	.75	6C8B	.44	7B4	.44	26	.45
1LC5	.51	6AL5	.38	6CDB6	1.11	7C6	.40	27	.39
1N5	.46	6AQ5	.39	6D6	.45	7E6	.49	35B5	.40
1P5	.57	6AQ6	.37	6E5	.48	7F7	.59	35C5	.39
1R5	.58	6AR5	.37	6F5CT	.39	7X7	.70	35L6GT	.41
1R5	.45	6A55	.50	6F6	.37	12AL5	.37	35W4	.37
1S5	.39	6AT5	.37	6G6C	.52	12AT6	.37	35Z4	.39
1T4	.45	6AU6	.38	6H6CT	.41	12AT7	.56	35Z5CT	.37
1T5	.53	6AV5	.83	6J5CT	.37	12AU6	.38	36	.60
1U4	.45	6AV6	.37	6J6	.52	12AU7	.43	41	.42
1U5	.39	6AX4	.53	6K6CT	.37	12AV6	.39	42	.42
1X2	.63	6B4G	.64	6J7G	.43	12AV7	.59	43	.55
2A3	.70	6B5	.64	6J8	.69	12AX4	.48	45	.55
2X2	1.50	6B5	.64	6K5	.47	12AX7	.48	50B5	.39
3A4	.45	6B6	.39	6L6G	.64	12A27	.69	50C5	.39
3E5	.46	6B7	.57	6Q7	.45	12BA6	.38	50C6	.59
3Q4	.48	6B8	.44	6S4	.38	12BD6	.45	50L6GT	.41
3Q5CT	.49	6B9	.71	6S4	.38	12BE6	.39	50Y6	.46
3S4	.46	6BD5GT	.59	6S8	.53	12BF6	.39	50Y7	.50
3V4	.47	6BD6	.45	6SA7CT	.43	12BH7	.63	70L7CT	1.09
5U4G	.45	6BE5	.39	6SD7CT	.41	12J5GT	.42	75	.41
		6BF5	.41	6SF5CT	.46	12J7G	.39	76	.44
				6SG7GT	.41	12S8	.70	77	.57
				6SH7	.73	12SA7GT	.44	78	.47
				6SJ7CT	.41	12SG7GT	.52	80	.35
				6SK7GT	.41	12SJ7	.44	83V	.35
				6SL7CT	.48	12SK7GT	.48	85	.59
				6SN7CT	.52	12SL7CT	.47	117Z3	.37
				6SQ7GT	.37	12SW7GT	.52	117L7	.99
				6SR7GT	.45	12S07	.44	807	.99
				6SS7	.42	12SR7	.49	2050	1.85
				6T8	.56	14AF7	.50		

TERMS: A 25% deposit must accompany all orders—balance C.O.D. All shipments F.O.B. Irvington warehouse. Orders under \$10—\$1.00 Handling Charge. Subject to prior sale.

Enlarged Quarters to Serve You Better!

115 COIT STREET
IRVINGTON 11, N. J.

SUPER SURPLUS VALUES

VARIAC GENERAL RADIO CO. 200C 5 to 7 1/2 AMP 115VAC in 0-135VAC out from new equip. \$13.95

AC-METER 0-150VAC Weston or West. 2" R. \$3.95

MOTOR 4 pole shaded pole induction 1700 RPM G.I. 1/70 HP running torque 12 oz. inches list \$12.00 F. line wire or disc recording. \$3.50

HEADSET TELEX monoset Mod. 2570 Reg. 14.00 4.95

MICROPHONE SHURE 707A & S34B desk stand. 4.95

RECTIFIERS Fed. Sel. 403D2787 150 MH 120V .75

CIRCUIT BREAKERS Holmenmann Cat. 0711 5 amp 115VAC curve B \$1.25 30 Amp 115VAC. 1.65

POWER TRANS. Thordarson 70H62 350-350 145 ml 5V 3 Amp 6 3V 4.5 Amp from used equip. 2.95

OUTPUT TRANS. RCA pair 6L6 class AB 10 watt Sec. 4-8-15-250 ohms a real buy new. 1.50

CHOKES THORD. 1BC10 8 H. 150 MH 200 ohm. 1.25

CHOKES CHICAGO trans. Co. 6 H 80 ml 50 ohm. .75

1000 MFD 15 VDC Sprague C331A Condenser. .95

3500 X 3500 MFD 25VDC Solar DZP 4 pin can. 1.50

XTALS 2 meters 144.16 MC DC3 holder. 1.50

XTALS 200 KC standards CR-2B U special. 1.50

Include postage with order. Min. order \$3.00

McCONNELL'S 2834 Germantown Ave. Phila., Penna. RA 5-6033

RADIO ENGINEERING DEGREE IN 27 MONTHS

Radio engineering is a big field. There's room for you in it—if you're good. Get first-class training at Indiana Tech. Intensive specialized course, including strong basis in mathematics and electrical engineering, advanced radio theory and design, television, electronics, Modern laboratories. Low rate. Also B.S. DEGREE IN 27 MONTHS in Aeronautical, Chemical, Civil, Electrical and Mechanical Engineering. G.I. Government approved. Enter December, March, June, September. You can earn part of your expenses right here in Fort Wayne while you are studying.

INDIANA TECHNICAL COLLEGE
913 E. Washington Blvd., Fort Wayne 2, Indiana

Please send me free information on B.S. Engineering Degree in 27 months as checked.

Radio-Television Aeronautical
 Civil Mechanical Electrical

Name _____
Address _____



NEW AND MORE
COMPREHENSIVE
1953
RELAY SALES
CATALOG
NOW READY
Be sure to send
for your copy



Telephone
SEeley 8-4146
833 W. CHICAGO AVE.
DEPT. 8, CHICAGO 27, ILL.

installation aid. With this calculator any TV service technician can quickly estimate signal strength from 5 to 100 miles and have a good "customer-convincing" basis for recommending a particular antenna installation.

Complete information on the calculator is available from Mr. Phil Jeffries, the general sales manager of the firm.

IMPEDANCE MATCHER

Rytel Electronics Mfg. Co., Inglewood, California, is now in production on a new unit which is engineered to balance the impedance between any antenna and the lead-in with which it is used.

Tradenamed "AIM", the new unit takes care of the impedance matching automatically. According to the company, the new unit will increase signal strength to the receiver on all channels (2 through 84), it will help eliminate snow and provide clear, sharp pictures in any reception area, it will give 3 to 7 additional db gain on all channels, and will prevent standing waves on the line.

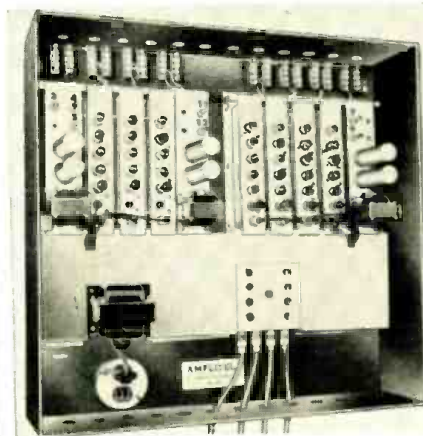
The junction box measures 2 3/8" x 1 3/8" x 1". It weighs 8 ounces complete with the U-clamp and approximately 47" of wire.

Full details on this new product are available from the company at 9820 Irwin Avenue in Inglewood.

AMPLIFIED SYSTEM

Amplitel, Inc., 360 W. 57th Street, New York 19, New York, is currently offering a new master amplifier TV antenna system which has been designed especially for large apartment buildings, hotels, hospitals, institutions, television dealers, etc.

The new unit is an amplifier system, designed to produce peak reception on each channel in an area—on every television set in the building regardless of location. According to the



company, there is no interference between sets and no cross-modulation between channels.

Complete technical specifications on this new antenna system are available upon request to the company.

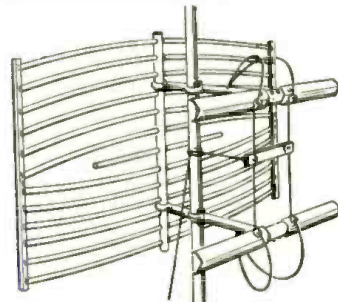
TUNER CLEANER

Conrac, Inc., 649 W. Foothill Blvd., Glendora, California, has introduced a

AMERICA'S FASTEST GROWING TV ANTENNA MANUFACTURER DAVIS ELECTRONICS

THERE MUST BE A REASON

THE REASON IS: The DAVIS SUPER-VISION is the finest antenna built for V.H.F. ALL CHANNEL and for FRINGE AREA and DX RECEPTION...With ELECTRONIC DIPOLE SEPARATORS...A steady flow of enthusiastic letters from users all over the U. S. attests to this fact—and is outstanding proof of its UNIVERSAL ACCEPTABILITY.



"THE ORIGINAL ANTENNA SOLO WITH A MONEY-BACK GUARANTEE"

1. EXCELLENT FOR FRINGE AREA and DX RECEIVING—and broad band receiving with high gain on all channels—2 through 13.
2. CLEARER PICTURES UP TO 125 MILES OR MORE—from the station.
3. GHOST PROBLEMS REDUCED or eliminated due to excellent pattern.
4. PROVIDES 10 DB OR MORE GAIN ON HIGH CHANNELS where gain is needed most.
5. EXCELLENT FRONT TO BACK RATIO on all channels. No co-channel interference.
6. MINIMIZES INTERFERENCE: Airplane Flutter—Diathermy and Ignition—F.M.—Neon Signs—X-Ray—Industrial—Etc.
7. ELIMINATES DOUBLE STACKED ARRAYS, and out-performs 2 bay yagis on low band and 4 bay yagis on high channels.
8. ONLY ONE TRANSMISSION LINE NECESSARY.
9. NO WORRY OVER POSSIBLE CHANNEL CHANGES on either high or low channels.

AT YOUR JOBBERS, OR WRITE TO:

DAVIS ELECTRONICS 1-23
4313 West Magnolia Blvd., Burbank, California
SIRS: RUSH INFORMATION TO ME AS CHECKED BELOW:
 Send Free Technical Data on new SUPER-VISION ANTENNA.
 Send Name and Address of NEAREST JOBBER.
Name _____
Street _____
City _____ State _____

SAY YOU SAW IT IN RADIO & TELEVISION NEWS

For Your
MORE CASH Radio Equipment
We've moved—and need Radio & Aircraft parts and equipment to fill our new warehouse. Write:
CANDEE-AIRCO
Dept. T-9, P. O. Box 1187
Magnolia Park Station
Burbank, Calif.

AC-DC MUSIC AMPLIFIER
Volume and tone control.
1.5 w. output.
See your jobber.
MICHEL MFG. CO.
227 N. Water St.
Milwaukee 2, Wis.

RADIO & TELEVISION NEWS

picture tubes, both magnetic and electrostatic deflection types. It will also analyze oscilloscope, radar, and other special purpose CR tubes without removal from the chassis or carton.

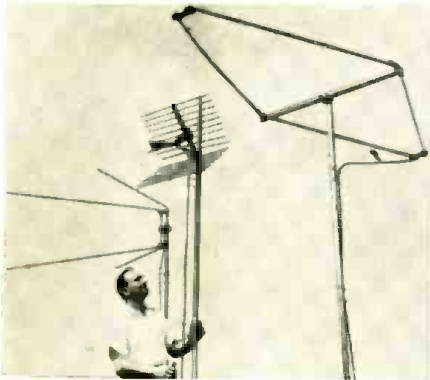
Four classes of tests are made with the analyzer. The beam current test is made to the final anode rather than to the grid or any other element. The beam current scale of the meter not only indicates sufficient or insufficient beam current, but also gives an accurate forecast of remaining tube life.

A grid test, a gas test, and inter-element leakage test are also performed by the unit.

Full data on this new Model 707 is available from the company.

JFD ANTENNA LINE

JFD Manufacturing Company, Inc., 6101 16th Avenue, Brooklyn 4, New York, has developed a complete line of antennas for u.h.f. television reception.



Included in the new line are rhombics, single and stacked "V's", corner reflectors, and a combination "JeTenna-u.h.f." antenna.

This latter unit, the Jet 283, is designed for areas where both u.h.f. and v.h.f. stations will be in operation. It combines the features of the company's "fan-front" unit with a broadband triangular dipole u.h.f. antenna. A single lead-in wire delivers signals to the set through use of the company's unique coupling device.

Literature on the Jet 283 and other u.h.f. antennas produced by the company can be obtained by writing direct to Mr. Edward Finkel, sales manager of the firm.

TV COVERAGE CALCULATOR

Pioneer Electronic Supply Company, 2135 Prospect Avenue, Cleveland 15, Ohio, is now offering a new television signal-range calculator to the trade.

Designed as an easy-to-use slide rule, the new unit will quickly show the approximate grade "A", grade "B", and city coverage for all v.h.f. and u.h.f. television channels. Practical design permits coverage radius to be read directly on the scale, with one rule setting, for stations operating with effective radiated powers from 10 kw. to 1000 kw., and for antenna heights up to 3000 feet.

While useful to television transmitter engineers, the rule was designed especially as a handy TV service and

SEE LEO FIRST FOR

hallicrafters

I can SAVE you money... Liberal Trade-ins



SPECIAL NOTICE—NEW SX-73 NOW AVAILABLE AND IN STOCK — \$975.00



\$179.50

S-76 RECEIVER

Extra selectivity with double superheterodyne circuit. One RF, two conversion and 3 IF stages. Range 550-1550 Kc, 1.7-34 Mc in four bands. 8 tubes plus voltage regulator and rectifier. Complete with tubes, less speaker.



\$224.50

SX-71 RECEIVER

Double Conversion sharp selectivity, plus built-in NBFM at moderate cost. 11 tubes plus voltage regulator and rectifier. Low down payment.

NAME YOUR TERMS • LOW DOWN PAYMENTS • PERSONALIZED SERVICE

HALLICRAFTERS RECEIVERS AVAILABLE FOR IMMEDIATE SHIPMENT

S-81	\$49.50	S-40B	\$119.95	ST-83	\$129.95
S-82	\$49.50	S-53A	\$ 89.95	S-78A	\$ 89.50
A-84	\$99.50	S-72L	\$119.95	SX-62	\$299.50
S-38C	\$49.50	S-77A	\$119.95	S-72 Portable	\$109.95
R-46 Speaker	\$19.95	HT-20 XMTR	\$449.50		

Famous WRL RADIO REFERENCE MAP 25c



CU on 10-20 & 75 Meters

NEW LOG BOOK 25c

For mobile or fixed station. Spiral binding. Full column log listing all FCC required info. Will accommodate 1,525 stations. Q signals, phonetic alphabet, amateur international prefixes.

PHONE 7795

WRITE—WIRE



IT'S NEW! IT'S FREE!

WRL 1953 CATALOG

Send for your copy today. Contains everything new in radio and television. Jam-packed with bargains. Leo I. Meyerson, WØGFO



Send For FREE Copy

WORLD RADIO LABORATORIES
744 West Broadway
Council Bluffs, Iowa

R-1

Please send me:

- Radio Map SX-71 Info
 New Catalog S-76 Info
 Used Equipment List New Log Book

Name

Address

City State

WHAT HAVE YOU?

Turn Your Excess Gear Into Ready Cash!
Especially Need BC-34R, BC-342, ART-13, I-152, BC-78B, BC-611, and any other surplus equipment.

For Top Prices, Write

BOB SANETT

5404 1/2 Packard St. Los Angeles, Calif.
Phone: WEbster 1-7414

RADIO COURSES

- RADIO OPERATING • CODE
- RADIO SERVICING • ELECTRONICS
- F.M. TELEVISION
- PREPARATION FOR CIVILIAN, MARITIME, ARMY AND NAVY LICENSE REQUIREMENTS.

Write for Catalog T.S.

Y.M.C.A. **TRADE & TECH. SCHOOL** 15 W. 63 St., N. Y. 23 INdicott 2-8117

SOUND POWERED PHONES RCA-MI-2454

Complete with 24' of Rubber Covered Wire. **NEW EXPORT PACKED** Shipping weight 6 lbs. **\$9.95 per set 2 for \$19.50**

EACH SET GUARANTEED Brand New. Gov't Cost \$42.00

RCA MI-2475 **SOUND POWERED PHONES**

complete with 22' rubber covered cable Press to talk switch are light weight, the mic is on a swivel boom that can be moved to any position in front of face. Cost \$62 ea.

Price **\$14.95** Ea. Include postage with order.

McCONNELL'S 3834 Germantown Ave. Phila., Penna. RA 5-6033

Money Makers

For 2-Way Radio Service Engineers

Make sure yours is a money-making business! Don't be stymied with "limited-range" frequency and modulation-measuring equipment. Lampkin instruments allow you to pick up extra accounts at additional frequencies, with no further investment!

The Type 205 FM Modulation Meter For Multiple Mobile Frequencies.



The Type 205 FM Modulation Meter measures peak frequency swing due to voice modulation of FM transmitters, as required by the FCC. Indicates 0-25 KC. deviation. Instantly tunable to any frequency from 25 MC. to 200 MC. Simple to use. Direct reading. No charts. No tables. \$240.00.

For Any Number of Frequencies, AM or FM. The Type 105-B Micrometer Frequency Meter



The Type 105-B Micrometer Frequency Meter measures center frequency deviation on any number of transmitters, AM or FM, from 0.1 MC. to 175 MC. The accuracy, determined by over 500 field tests, is conservatively guaranteed better than 0.0025%, surpassing FCC requirements. Readily checked against WWV. \$220.00. Return coupon TODAY for complete literature.



LAMPKIN LABORATORIES, INC.
MFM DIVISION
Bradenton, Florida

LAMPKIN LABORATORIES, INC.
MFM DIVISION
Bradenton, Florida

Please send me complete technical literature and delivery information on the following Lampkin-designed instruments:

- Type 205 FM Modulation Meter
- Type 105-B Micrometer Frequency Meter

Name.....

Address.....

City.....Zone.....State.....

NEW TV PRODUCTS on the Market.....

SYLVANIA 1953 TV

Among the new receivers being introduced by *Sylvania Electric Products Inc.*, is "The Lexington", a 21" deluxe combination, AM and FM radio, and 3-speed phonograph.

Designated as the Model 178, the new console features "HaloLight" and the company's "Stratopower 508" chassis. The cabinet is of hand-rubbed mahogany veneer with rosewood grained doors. The model is available with built-in all-channel u.h.f. reception.

Two wood finishes are offered, with the mahogany finish being designated as the Model 178M while the blonde finish is known as the Model 178B.

"PICBOOST"

C-B-C Electronics Co., Inc., P. O. Box 1556, Philadelphia 5, Pa., has introduced a new series of picture tube brighteners which have been trademarked the "Picboost Pacemaker".

The new unit is said to restore new tube brilliance, for periods up to several years, to any size or type picture tube. Other models in the series will permanently relieve heater-to-cathode shorts, thereby restoring brightness control, according to the company.

The "Pacemaker" can be installed within a few minutes, just by plugging in. No soldering is necessary and no 117 volt a.c. lines are used.

The four models currently available include the Models 1F and 2F, which



restore brightness to dim picture tubes in parallel and series circuits respectively, and the Models 3F and 4F to relieve heater-to-cathode shorts only, in parallel and series circuits respectively.

STANCOR TUBE BOOSTER

Standard Transformer Corporation, 3580 Elston Avenue, Chicago 18, Illinois, is in production on a CR tube booster, a compact, self-contained de-

vice designed to add months to the useful life of a television picture tube.

The tube booster, P-8192, can be used with all electromagnetic picture tubes irrespective of size, where dimming is due to low cathode emission.

Easy to install, the new booster measures only 3½" high and 1½" in diameter. It does not require a.c. line connection and is equipped with a "high-low" switch providing two levels of brilliance. Of autoformer construction, it has 18-inch leads between the booster and connector plug, allowing the booster to be placed anywhere in the set.

U.H.F. ANTENNAS

Technical Appliance Corporation of Sherburne, New York, has announced the availability of a complete u.h.f. antenna line.

Designed to meet the specific needs of various localities, the new line includes parabolic-reflector types, yagis, modified "X", and "V" type antennas. With the exception of the modified "X" design, all are of the sharp directivity type. The modified "X" will be marketed in areas where reception from channels in opposite directions is required. Tuning of all antennas is such that all operating u.h.f. channels will be within the antenna's bandwidth.

Catalogue 83 covering this new line of u.h.f. antennas is available on request.

"SUPER AUTOBOOSTER"

Production of a new four-stage "Super Auto booster" has been announced by *Industrial Television, Inc.*, 369 Lexington Avenue, Clifton, New Jersey.

The Model IT-102A utilizes the new 6BK7A dual-triode in a multiple resonant circuit which provides a uniform 18 db gain over both bands.

Designed for general booster applications requiring uniform high gain at moderate cost, the new unit has a low noise factor resulting in high usable gain even with the new "low noise" TV receivers.

The wideband booster has automatic "on-off", heavy-duty transformer-type power supply, and a metal cabinet. It is operated by a thermal "on-off" switch.

CR TUBE ANALYZER

The Jackson Electrical Instrument Company, 18-46 S. Patterson Blvd., Dayton 2, Ohio, has introduced a new test unit, the Model 707 dynamic cathode-ray tube analyzer.

The new instrument is designed to completely and accurately test all TV

RADIO & TELEVISION NEWS

Vibration Pickup
(Continued from page 49)

been completed, the unit may be tried by holding it against a safe or piece of machinery. Power should be on, and volume turned up.

Any noises within the equipment should be readily heard in the ear-phones (as the combination lock is manipulated, or as machinery is operated). The tone control is manipulated for easiest interpretation of the vibrational sounds heard. The ability to interpret the various sounds heard and to properly adjust the "Volume" and "Tone" controls will be gained with practice in using the instrument.

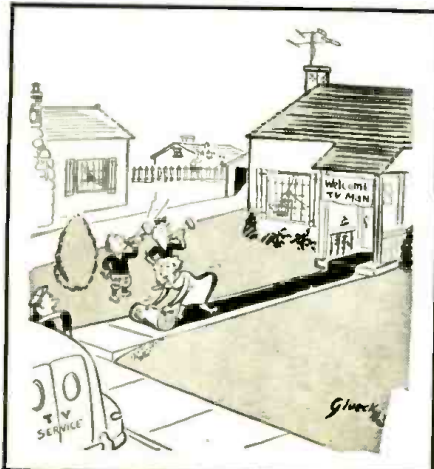
If the instrument seems to be weak, first check the batteries. Also check tubes and all connections for possible errors.

Check the operation of the amplifier alone by disconnecting the pickup cartridge and holding your finger on the input grid. Hum, clicks, and other noises should be heard in the ear-phones.

If the amplifier is operating properly, but the unit still seems to be weak, check the condition of the cartridge used. Also experiment with the exact location of the probe along the case of the crystal—sometimes the sensitivity may be doubled by taking care in locating the probe position with respect to the cartridge. There are no general rules for selecting the best location—this will vary with the type of cartridge used, and must be determined experimentally by trial and error.

When the unit is used to listen to vibrational sounds, it is often possible to select the particular sounds desired by experimenting with the way the probe is held against the machinery being checked. In some cases better results are obtained when the probe is held at right angles to the machinery housing; in other cases, holding the side of the probe against the housing will give better pickup. The pressure exerted in holding the probe will also affect the pickup. Again, experience and practice will best enable the user to develop the proper techniques.

-50-



**ORDER BY MAIL FROM
WHOLESALE RADIO**

Low Prices • Complete Stocks • Fast Shipments

SNYDER TV ANTENNAS

YOUR CHOICE
3.95
each

Reg. \$4.95
CONICAL ARRAY



All channels, 8 hi-tensil aluminum alloy elements. Snyder model XA-44 less mast.

\$2.95
each



In Lots of 6, Models may be combined for quantity discount.
Reg. \$4.39
HI-LO ARRAY
2 folded dipoles (hi & lo) with reflectors. The best all channel folded dipole anywhere near this exceptionally low price. AK-21 less mast.

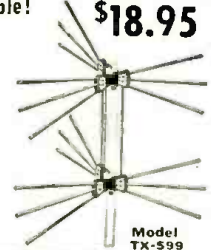
Reg. \$4.95
DOUBLE V TV ARRAY

Hi-gain for fringe areas. 4 hi-tensil 3/8" aluminum alloy elements, 2 aluminum alloy 1/2" crossarms. Completely pre-assembled. Model AK-55 less mast.

All Directional TV AERIAL

Same Clear Pix as Motor Rotating Aerial Systems Costing Triple!
\$18.95
FOR FRINGE AREA

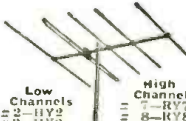
COMPLETE with three 3 1/2 ft. masts, 75 ft. 3 cond. cable, Beam selector sw., guy rings and mounting base. Electronically beams complete 360° rotation to give clear pic on all channels. You choose direction with electronic selector sw. mounted on or near TV set. Complete double stacked array with 18 hi-tensil double alloy aluminum elements. AX-599 same as TX-599 less masts, guy ring & mtg. base 16.95



Model TX-599

YAGI TV ARRAYS

For Fringe & Ultra Fringe



Low Channels	High Channels
2-11V2	7-1V7
3-11V3	8-RV8
4-11V4	9-1V9
5-11V5	10-1V10
6-11V6	11-1V11
	12-1V12
	13-1V13

\$7.95 **\$4.95**

Highly directional and closely tuned to each channel. Cuts interference and noise to a minimum. Five elements; one folded di. pole, three directors and one reflector. Individual array for each channel desired.

LOWEST PRICES ON TV ANTENNA ACCESSORIES!

- STEEL EXTENSION POLES. Weather treated. 10 ft. long, 1 1/4" di. Straight ends \$1.95
- 5 ft. long, 1 1/4" di. Crimped end 1.19
- CHIMNEY MOUNT BRACKETS. CW-100 complete with strap 1.59
- HEAVY DUTY MAST BRACKETS WB-2. Adj. to 18" from wall. Pair 3.75
- ANTENNA SWIVEL BASE. Aluminum. Fits 1 1/2" O.D. mast section39
- GUY WIRE. 6 stranded #20. 50 Feet39
- 24 interconnected 50 ft. reels. 200 ft. 6.00

- 300 OHM TWIN LEAD. Per ft. 2VAC 100 ft. \$1.95; 1000 ft. 17.50
- DOUBLE POLE DOUBLE THROW KNIFE SWITCH RMS LIGHTNING ARRESTOR. Model LA-3. Standard or open (no) chain line. UL Approved.59
- ANTENNA WALL MOUNTS. Model LA-5. PAM-1 for poles 1 1/2" di. 6" from mast to wall. Pair 1.15
- PAM-1 for poles 1 1/2" di. Up to 12 1/2" from wall. Pair 1.89
- TIE RODS for stacking 2 Yagi arrays. Sheety III or Lo Band Pr. .85

VTVM Kit with 7 1/2" Meter
Precise Deluxe Model 907



\$38.98
Factory Wired \$57.98

Meter can be mounted for vertical or horizontal use. Etched panel; 1% ceramic resistors; amplified connections; separate 5 V AC scale. Tubes: 6AL5, 6X5, 6SN7; true zero adjust; huge 7 1/2" meter for more accurate readings. Complete with construction book, battery, and test lead. Ranges: Plus DC: 0-5-25-250-500-1000 v. Minus DC: 0-5-25-250-500-1000 v. AC: 0-5-25-250-500-1000 v. Ohms: 1K, 1K10, 1K1000, 1K10,000, 1K1,000,000 ohms. DB: from -2 to +25 DB.

PRECISE RF-AF-TV MARKER GENERATOR KIT



FUNDAMENTALS THRU 110 mc 330-mc on HARMONICS
Audio: 20-20,000 cycles. Cathode follower output; variable per cent modulation. Stopping attenuator. External Modulation. Speech amplifier. Crystal marker.

With Preassembled RF head, 630 K.A. Completely factory wired. 630 W. **\$38.95** **\$33.95**

"Precise" Universal AF Sine Square & Pulse Gen. 635 K Kit **\$33.50** 635 W Factory wired **\$52.50**

Address Orders to Dept. RN-1

Write for Free FYI Bulletin

WHOLESALE RADIO PARTS CO., Inc.

311 W. BALTIMORE ST., BALTIMORE 1, MD.

STRIP-IT A New Precision Tool

For Removing Insulation from Wire and Cable
Designed for the Electronic Industry

- Fits in Tight Spots
- Cuts as Well as Strips
- Speedy, Efficient, Rugged
- Tool Steel Blades for Long Life
- INSTANT Adjustment to All Wire Sizes



Economically Priced
\$1.95 net

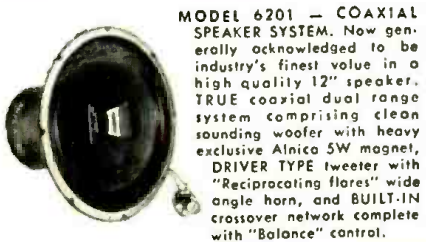
The simple design and fool-proof operation of STRIP-IT makes this a tool that will become indispensable for electronic technicians and assemblers. Held in the palm of the hand, the operation is merely to bite into the insulation, twist, pull, and the wire is ready for the terminal connection. The sliding adjustment bar is set with a touch of the finger. STRIP-IT is engineered for thousands of operations, using only one set of blades.

THE **CM** SEE YOUR LOCAL DISTRIBUTOR, OR WRITE
and M MANUFACTURING COMPANY

Norman R. Mac Innis, 1430 Mass. Ave., Cambridge, Mass., National Sales Representative

SOLVE your hi-fidelity problems with **University CONE SPEAKERS**

-HIGHEST QUALITY! -LOWEST COST!



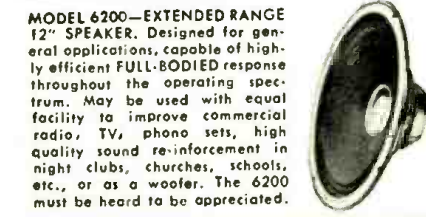
MODEL 6201 — COAXIAL SPEAKER SYSTEM. Now generally acknowledged to be industry's finest value in a high quality 12" speaker. TRUE coaxial dual range system comprising clean sounding woofer with heavy exclusive Alnico 5W magnet, DRIVER TYPE tweeter with "Reciprocating flares" wide angle horn, and BUILT-IN crossover network complete with "Balance" control.



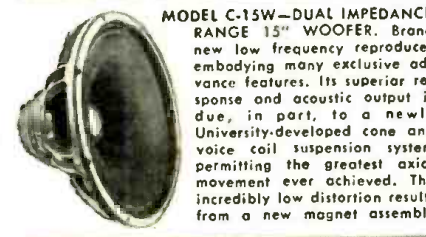
DIFFUSICONE-12 — WIDE RANGE WIDE ANGLE 12" SPEAKER. Exclusive "diffusicone" design utilizes the benefits of dual-horn loading, radial projection and diffraction principles to achieve unsurpassed quality and sound distribution from a single unit speaker. Enjoy full fidelity ANYWHERE in the room... at a surprisingly reasonable cost.



DIFFUSICONE-8 — WIDE ANGLE 8" SPEAKER. Same as the Diffusicone-12 except in 8" size. Remarkable fidelity and exceptional sensitivity and power handling capacity make this a truly outstanding eight. Ideal for use where space is limited, and is also a perfect selection for a mid-range speaker in 3-way systems.



MODEL 6200—EXTENDED RANGE 12" SPEAKER. Designed for general applications, capable of highly efficient FULL-BODIED response throughout the operating spectrum. May be used with equal facility to improve commercial radio, TV, phono sets, high quality sound reinforcement in night clubs, churches, schools, etc., or as a woofer. The 6200 must be heard to be appreciated.



MODEL C-15W—DUAL IMPEDANCE RANGE 15" WOOFER. Brand new low frequency reproducer embodying many exclusive advance features. Its superior response and acoustic output is due, in part, to a newly University-developed cone and voice coil suspension system permitting the greatest axial movement ever achieved. The incredibly low distortion results from a new magnet assembly.

There is a UNIVERSITY Tweeter for every application and pocketbook. Write for descriptive illustrated literature. Address Desk N-12.

University LOUDSPEAKERS INC
80 SO. KENSICO AVE., WHITE PLAINS, N. Y.

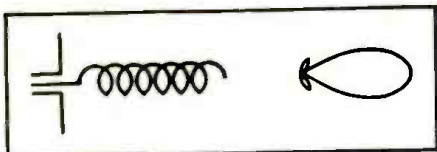


Fig. 14. Helical antenna radiation pattern.

end of the coiled helix and the outer conductor attaching to a reflecting screen. For reception the same type of response curve obtains.

Helical antennas can also be centered with a balanced transmission line, and now the radiation pattern extends in more than one direction. As might be expected, the number of turns in the helix, the distance between turns (i.e., the pitch of the helix) and the circumference of each turn all will affect the response pattern of the antenna. In general, increasing the number of turns causes the beam width to become narrower; increasing the pitch or increasing the turn circumference will have the same effect, within limits.

The response pattern for a helical antenna shown in Fig. 14 holds true when the circumference of the helix turns are on the order of 1 wavelength at the operating frequency. If the helical antenna becomes small and compressed, the radiation pattern closely approaches that of a half-wave dipole. This latter application is not desired for TV reception.

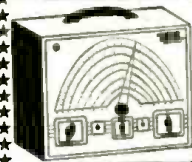
The helical antenna has a broad-band characteristic, enabling it to be used over a 2 to 1 frequency range. By the same token, the input impedance remains fairly constant over the same range.

It might be of interest to note in passing that when the helical antenna is used for transmitting, it radiates a circularly polarized wave. Now most technicians are familiar with vertically polarized waves and horizontally polarized waves. In the former the electric lines of force extend up and down and in the latter they extend in a horizontal direction, or from side to side. In a circularly polarized wave, electrical lines of force may be considered as existing vertically, horizontally, and at all angles in between. This can be readily demonstrated by taking a dipole antenna, holding it in front of a transmitting helical antenna, and then slowly rotating the dipole. The amount of signal picked up will remain constant as the dipole is rotated through a complete revolution of 360°.

For reception, a helical antenna will receive any signal, no matter what its polarization. (There are several exceptions to this but they are not of interest in commercial television.) This is frequently advantageous because while television signals are radiated with horizontal polarization, this may change before the antenna is reached. A strictly horizontally or vertically polarized antenna might therefore not adequately receive all the available signal. A helical antenna, however, will.

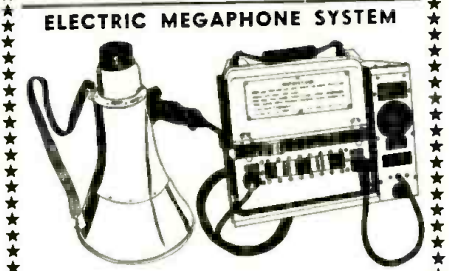
(To be continued)

PLATT BEST BUYS!



NATIONALLY FAMOUS SIGNAL GENERATOR
Freq. Coverage on fundamentals: 150 KC to 1200 KC. 1.3 to 100 megs on 7 calibrated harmonics. Completely wired & tested—ready for operation.
SPECIAL! \$24.95

TUBES	BRAND	NEW!	TUBES
	JANI	BOXED!	
1B22	69c	100R	49c
1B23	\$3.75	113B	29c
2B22	45c	21A	29c
2C26	14c	304TH	55.95
2C26A	09c	378A	29c
3C24	\$1.19	378B	59c
3D8	39c	471A	51.19
4D4	\$1.79	532A	99c
7C1	39c	722A	99c
10R	19c	801A	39c
12RBV	39c	821	29c
15R	39c	841	29c
30 44	29c	843	17c
			864
			054
			1619
			1625
			1626
			1629
			7113
			0002
			0006
			F1148
			RK34
			VR02
			VT127



ELECTRIC MEGAPHONE SYSTEM
For Rural Areas, Hotels, Commercial Steamers, Ball Parks, Etc.
U. S. NAVY Type PAE-1 Electric Megaphone equipment is designed for voice reinforcement in much the same manner as, but to a greater degree than, the familiar acoustic megaphone. Consists of Megaphone Unit (which combines a microphone and reproducer in a single assembly), Portable Amplifier which electrically amplifies the output signal of the microphone section of the megaphone and feeds this amplified signal to the reproducer section. Charging tank for recharging the self-contained storage battery of the portable amplifier. BRAND NEW—A TREMENDOUS VALUE! DEMONSTRATION GIVEN AT EITHER OF **\$149.50**

RECEIVERS	USED	EXCELLENT	NEW
BC-453—190 to 550 KC	\$29.95		\$49.95
BC-454—3 to 6 MC		\$12.95	19.95
BC-455—6 to 9 MC	9.95	11.95	16.95
TRANSMITTERS			
A-958—2.1 to 3 MC		7.95	29.95
BC-458—5.3 to 7 MC		9.95	17.95
ARCS-T-19—3 to 4 MC		24.95	34.95
BC-459—7 to 9.1 MC			24.95
T-15 ARC 5—500 to 800 KC			29.95
ADDITIONAL EQUIPMENT			
BC-456 Modulator	2.49	2.95	5.95
BC-450 Control Box (3 Receiver)	1.49	1.95	2.75
BC-451 Control Box (Transmitter)	1.29	1.79	2.39
BC-442 Relay Unit (ANT)	2.39	2.89	3.69
Plus: PL-147, 148, 151, 152, 153, 154, 156—EACH		1.25	
Flexible Shifting with gear to tilt receivers			2.69
3 Receiver Rack	1.79	2.29	2.98
2 Transmitter Rack	1.69	2.39	3.97
Single Transmitter Rack			3.97
DM-32 Dynamotor for Command Set		3.95	5.95
DM-33 Dynamotor for Command Set		2.95	3.95
Mounts for 2 Trans. Rack, 3 Rec. Rack, Modulator, & Antenna Relay Unit		1.95	

LIMITED QUANTITY
COMMAND SET BC-455—6 to 9.1 MC. Excellent. 95% completely wired—a few minor parts included reful assembling. Instructions included. **ONLY \$6.95**

COMMAND TRANSMITTER—Navy and Army Type—3 to 4 MC. 75% complete spare parts—LIMITED QUANTITY **\$8.95**

HEADSETS	
HS-33 low impedance with cord and plug, uncut, fine condition	\$2.79
HS-33 high impedance, BRAND NEW with ear pads.	4.95
HS-33 low impedance, BRAND NEW with ear pads, cord and PL-54 plug	\$5.39
HS-33—BRAND NEW—Western Electric	5.95
CD-307A Cord, G. R., NEW	.89
H-16/U high impedance. Includes two receiving units	3.95
HS-16 high impedance—used	2.49

MINIMUM ORDER \$2.00
Immediate Delivery—Send 25% deposit on C.O.D. orders. All shipments F.O.B. N.Y.C. (N.Y.C. residents add sales tax to your remittance.)

PLATT ELECTRONICS CORP.
Dept. A, 489 Broome St., N. Y. 13, N. Y.
PHONES: WO 4-0821 and WO 4-0828
BRANCH STORE: 159 Greenwich St., N.Y.C.

U.H.F. Antennas
(Continued from page 38)

nected as shown in Fig. 8A to the end of a transmission line and power is fed to these stubs by the line, very little radiated signal is obtained. This is due to the fact that currents of opposite phase flow in the stubs (as indicated by the arrows) and their fields effectively cancel each other. Only in the small end sections (labeled Y) are currents in-phase and these radiate. However, the lengths of these end wires are small and very little effective radiated power is obtained.

It has been found, however, that if a half-wave slot is cut out of a metal sheet, as shown in Fig. 8B, that the non-cancelling currents in the Y ends of the slot circulate about the entire plate and now we have a fairly efficient radiator. With a horizontal slot we get a vertically polarized wave. Since television has standardized on horizontal polarization, a vertical slot would be required.

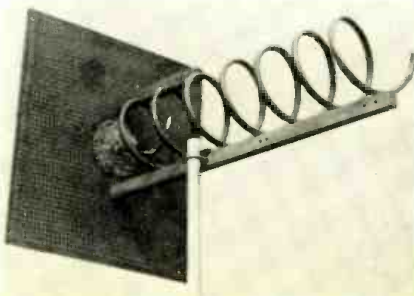
While the discussion has centered about the slot as a radiator, identical results will be obtained when it is employed as a receiving antenna.

The impedance across the center of the slot is on the order of 500 ohms. This gradually decreases to zero at either end. Hence to properly match a 300-ohm twin-lead line to the slot, it would have to be attached to the slot by connecting one wire to one edge of the slot and the other conductor to the other edge. One conductor may be bonded to the metal sheet, if desired.

The radiation pattern of the slot is similar to a dipole antenna. However, if the slot is cut out of the side of a cylinder, as in Fig. 8C, rather than out of a plate, the radiation pattern tends to become non-directional.

B. Helical Antennas. The helical antenna, Fig. 13, may be looked upon as a form of loop antenna. In fact, Kraus points out that it is related to the straight wire (or linear) antenna on the one hand and to the loop antenna on the other. If the helical antenna were employed for signal transmission, the energy fed in at one end would be "fired" out at the other end. This is shown by the radiation pattern in Fig. 14. The energy is brought to the antenna by a coaxial cable, with the center conductor connecting to the

Fig. 13. A helical television antenna.

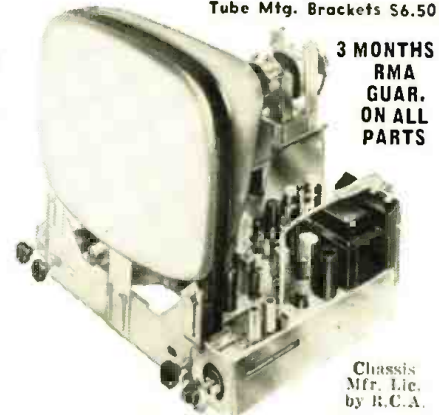


**AIREX
630 FA***

**ONLY AT AIREX...THE MOST
POWERFUL FRINGE AREA
TV CHASSIS MADE**

The CHASSIS That Television Engineers and Servicemen Are Buying for Themselves . . .

This amazingly advanced 32-tube TV chassis is years ahead in engineering and gives you the ultimate in TV viewing and listening pleasure. To assure you trouble free TV our engineering staff has incorporated into the "630 FA" design the experiences of hundreds of TV servicemen and engineers. Receiving range includes stations up to 200 miles away. Nothing has been spared to bring you the finest of TV chassis. Only the best and most expensive parts are used. There is no other chassis that compares with the "630 FA" * for fringe area reception.



Tube Mfg. Brackets \$6.50

**3 MONTHS
RMA
GUAR.
ON ALL
PARTS**

Chassis
Mfr. Lic.
by R.C.A.

**THE ONLY CHASSIS WITH
PUSH-PULL AUDIO OUTPUT AT**

\$164⁹⁵

Less C.R. Tube
and Brackets

Complete with 12" ROLA Hi-Fi Speaker
(Fed. Tax Incl.)
AND FREE SERVICE MANUAL & SCHEMATIC

✓ CHECK THESE EXCLUSIVE FEATURES ✓

- 10 WATT push-pull audio output. Frequency range from 60 to 12,000 cycles • Link coupled Standard Coil Cascade Tuner prevents radiation
- Retrace Blanking Circuit allows you to raise the brightness without the annoying vertical retrace lines • Heavy duty front focus control • Automatic gain control potentiometer allows you to adjust the threshold sensitivity as low as 4 microvolts & still keep the full 4MC band width
- Separate high & low frequency sync amplifiers • Set aligned for 21.75 MC. New Ham band will not interfere • Improved fused high voltage power supply gives full 14.5 KV under load • Will handle all picture tubes up to 24 inch with full sweep • Improved video amplifier has a gain of 32 • All moulded plastic condensers give long life & trouble-free operation
- Easily adapted to new UHF stations in 2

- minutes by just changing a strip in the tuner
- Extra heavy duty power transformer with large safety factor • 6CB6 tubes in Video IF to give full gain • Extra filtering in power supply for hum & ripple free operation • Color connection on chassis which is adaptable to the cathode follower circuit of color converter • Photo Connection & switch on chassis allows you to play your phonograph or tuner through the built-in 10 watt hi-fidelity amplifier • Extra heavy duty focus coil, which runs cool • Tuner can be removed up to 25 feet • Full focus cosine yoke.

**ESPEY FM-AM 12-TUBE CHASSIS
with RCA 12" 201S1 Speaker \$69.50**

AM TUNER CHASSIS FOR "630"

Fits in well of chassis. Complete with brackets, tubes & instructions. Easy to install. Limited quantity. **\$16⁹⁵**

**BARGAIN SPECIALS!
BRAND NEW**

- TV Telescopic Mast complete with hardware, guy wire and base...30 ft., \$14.95; 40 ft. \$19.45
- Alliance Antenna Rotors...ATR, \$20.49; Directional, \$26.29.
- Garrard RC80 3-speed changer with astatic turnover cart \$42.30
- Presto Call Intercom—2 units, with 100 ft. wire...\$24.95
- Standard coil contact cleaners. Self-cleaning action. Set of 4\$1.50

**REGENCY
BOOSTER
MODEL DB520
Deluxe**

\$1911

**STANDARD
COIL
CASCADE
TUNER**

Complete with tubes & instructions. High gain, low noise.

\$23⁹⁷

**SAVE 50%
RAM CON-
VERSION KIT**

Up to & including 24". Has 15 KV fly-back, 70" cosine yoke. Special worth coil, 10W resistor. Complete with schematic. Reg. \$23.95.

\$11⁹⁵

**Save 50%—Brand New
in Factory Sealed Cartons
SILVERTONE
PORTABLE AMPLIFIERS**

- Complete with carrying case, 12" speaker, microphone and cable.
- 10 Watt.....\$42.50
 - 20 Watt (Turntable & 2 speakers).....\$74.95
 - 40 Watt (Turntable & 2 speakers).....\$109.95

**TV TUBE EXTRA
STANDARD BRANDS
FACTORY NEW**

- 1ST QUALITY—GUAR. 1 YEAR**
- 17BP4\$27.95
 - 21" TV tube \$39.95
 - 20" TV tube 34.95
 - 24" TV tube. 64.95
- Ring & Sleeve for 24" Tube \$7.50**

TV GOLD PLASTIC MASKS

- FOR CUSTOM INSTALLATION**
- 16" and 17".....\$4.95
 - 24".....\$14.95
 - 20" and 21".....\$7.95

**38 BARGAIN-PRICED CABINETS
FOR THE "630" & OTHER CHASSIS**

Send for FREE folder and price list. Full line table models, consoles, consolettes and TV-Radio Phono combinations. Many styles. Mahogany, blonde, etc.

Complete Service Manual
For "630FA" or Super 630DX—\$1

**SEND FOR FREE NEW TV PARTS &
HI-FI AUDIO EQUIPT. CATALOG**

**SEND POSTCARD TO BE
PUT ON FREE MAILING LIST**

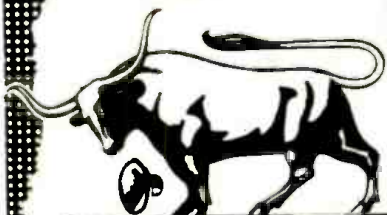
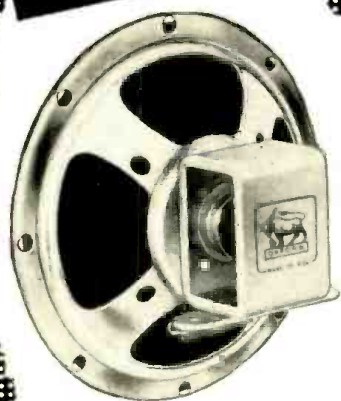
All merchandise is brand new, factory fresh & fully guaranteed. Mail & phone orders filled upon receipt of certified check or money order for \$25 as deposit on TV chassis. 20% on other items. Balance C.O.D., F.O.B. N. Y. Prices subject to change without notice. No Fed. taxes to pay. Prices lower than O.P.S. tags.

AIREX RADIO CORP.

171 Washington St., N. Y. C. 7, N. Y.
Phone WOrth 2-4029

**Preferred
for Original
Equipment**

**Proven
for
Replacement**



OXFORD

Speakers

There is an application for every Oxford Speaker . . . and an Oxford Speaker for every application.

**OXFORD
ELECTRIC
CORPORATION**

3911 S. Michigan Ave.
Chicago 15, Illinois

EXPORT: ROBURN AGENCIES,
NEW YORK CITY

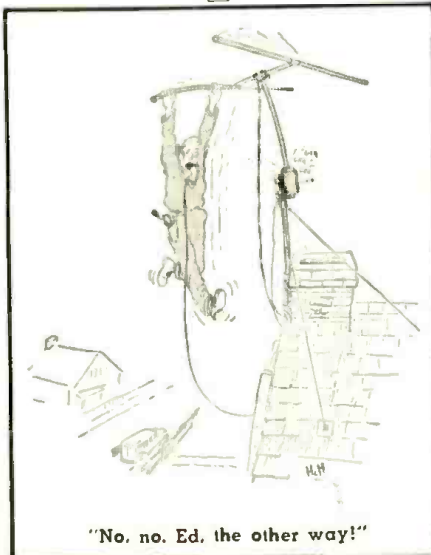
200 ma. power transformer, dual chokes, and two 8 μ d., 600 volt condensers, with a VR-150 (OD3) for the regulated 150 volts to the oscillator. A recommended supply is shown in the diagram, with pin connections shown as used by the author. A five-wire cable handles things nicely, and we simply soldered the wires directly to the socket on the rear chassis drop, using a Cinch plug for the power supply chassis end of the cable.

If any difficulty is encountered in resonating the final with your particular antenna set-up and loading condenser capacity used, short out approximately five turns of the pi-net tank coil. The final resonating condenser will then work nicely. To those not familiar with this type tuning net, a review of the pertinent chapter in current "Handbooks" is recommended. Briefly, the input condenser is the resonating one, by which the plate current of the 1625's is dipped, and the output condenser is the loading one, by which the current drawn from the 1625's is placed at a desired value. It is a simple, efficient means of power transfer, and has the happy faculty of giving a wide range of impedance matching.

It has been found in practice that almost any setting of the final pi-net will deliver an almost constant power to the antenna, with a wide frequency range covered on the oscillator tuning condenser, giving virtually one dial control, but allowing any loading desired on the final—a desirable condition.

The rig packs quite a wallop, the rule-of-thumb light bulb test showing a full 40 watts going into the antenna, which can make quite a noise. We feel the equivalent rig, if built from scratch by the ham, would entail a considerably larger monetary outlay, and much more work. So all in all the SCR-274, in its modern garb, has proven to be, for us, the answer to a long-felt problem. For a small auxiliary rig it is ideal, and for the beginner or confirmed low-power c.w. man we feel it is pretty hard to beat.

-30-



"No. no. Ed. the other way!"

FL-8 FILTER **BRAND NEW!**
AND **Both for**
"FILTER FACTS" **\$1.25**
BOOKLET

CONDENSER TESTER

• One of our best sellers! Useful, versatile laboratory item, in kit form. Simple, and easy to build in less than an hour. Checks condenser leakage and continuity up to 8 meg. Will test any paper, electrolytic, mica or oil capacitor from 50 mmf. to 5.0 mfd. Self-contained power supply and neon bulb indicator with socket and bezel. Drilled metal cabinet. Complete instructions and diagrams included with each kit. Only \$5.00.



U-V LIGHT SOURCE

8 watt ultra-violet light source. In kit form including Sylvania black-light tube, (for U-V light in the 3660 Angstrom unit region) ballast, starter, mounting panel, reflector, line cord, plug, hardware, instructions. An invaluable device for schools, labs, service shops, home workshop, etc. Here is a genuine value. Complete kit, (less outer housing) . . . only \$4.95

FONE PATCH!

Now available, the superior new O-R, 2-6008 phone patch. Provides you with exactly what you need to patch your phone into transmitter or receiver. Featuring a hi-impedance input suitable for 500 mike. Both hi and lo impedance outputs to insure proper match to your particular receiver. Unit is complete—"sure-fire" ready to go to work for you. Only \$4.95 ea.



NOVICE TRANSMITTER KIT

A two tube, crystal controlled transmitter covering 3700 to 3750 kc. . . can be used later for all bands, 20 to 160. Has pi coupler output to match most antennas. Uses 6V6 and 6L6. 35 watts input.
Less coils, tubes and crystals. . . . \$9.90
Matching Power Supply Kit. . . . 9.90
One coil, (specify band) 1.05
Tube kit, (3 tubes) 3.95
Crystals, (Specify frequency band) 2.75

SENSITIVE RELAY

Miniature type (1 1/2" overall) SP-ST contacts. Coil resistance 6500 ohms. (2 ma.) An excellent relay for voice control or model applications. \$2.50 ea. Manufacturers write for quantity prices.

SPLINED TUNING KNOB FOR 274N RECEIVERS

An exclusive O-R item manufactured for us. Fits BC-453, BC-451 and other 274N receivers. This is a really hard-to-obtain item. Only . . . 89c ea.



TRANSFORMERS-CHOKES:

325-0-325 @ 225 ma. 6.3 @ 5A. 5V @ 3A. Pri. 110V. 60 cy AC. Size, 4 1/8" x 4 1/8" x 3 1/8". Only \$6.95 ea.

Isolation transformer. Useful for AC-DC supplies. Pri. 117V. Sec. 120V, AC, at 50 ma. Also 6.3V at 1 amp. Only \$1.80 ea.

Isolation transformer. Pri. 117V AC. Sec. 120V, AC, at 50 ma. Also 6.3V at 2 amps.

920-0-920 or 740-0-740 AC @ 200 ma. Pri. 115V, 60 cycle, AC. Upright shielded case. Excellent for 807's. Only \$10.80 ea.

5V, 25A. Pri. 115V, 60 cy. AC. A real rugged job excellent for 304TL—4-250A etc. Limited quantity. Only \$4.50 ea.

2.5V @ 10A AC. 10,000V insulation. Pri. 115V AC only \$3.39 ea.

360-0-360 @ 300 ma. 6.3 @ 4A. 6.3 @ 8A. 5V @ 3A. Pri. 115V, 60 cy. AC. only \$7.95 ea.

450-0-450 @ 200 ma. Pri. 115V, 60 cy. AC. 5V @ 3A. 6.3 @ 5 amp. Only \$8.90 ea.

350-0-350 @ 350 ma. 6.3 @ 10A. 5V @ 6A. Pri. 115V, 60 cycle. Only \$8.95 ea.

110V, AC POWER SUPPLY FOR ANY 274-N RECEIVER

Just plug it into the rear of your 274-N RECEIVER . . . any model. Complete kit and black metal case, with ALL parts and diagrams. Simple and easy to build in a jiffy. Delivers 24 volts plus B voltage. No wiring changes to be made. Designed especially for the 274-N receiver. Only \$8.95.

Filament trans. for 274N receivers. Pri. 110V, 60 cy. AC. Sec. 2.4V @ .6A. An excellent buy at \$1.95 ea.

Minimum order \$2.00. All items subject to prior sale. All prices subject to change without notice. 20% deposit must accompany all orders, balance C.O.D.

OFFENBACH-REIMUS
1564 MARKET STREET
SAN FRANCISCO, CALIF.

course, the possibility of two signal sources maintaining a precise phase relationship for more than a few seconds is remote. Therefore the figure will apparently rotate, changing from a circle to an ellipse, to a straight line, and back again. It is the straight line that provides the desired criterion: any harmonic distortion greater than 1% will appear as a bump or loop in the straight-line pattern.

BIBLIOGRAPHY

1. Southworth, Glen: "Build a Sweep Frequency Audio Oscillator." *RADIO & TELEVISION NEWS*, Feb., 1950.
2. Watkins, Loren C., Jr.: "An Audio Oscillator and V.T.V.M." *RADIO & TELEVISION NEWS*, June, 1950.
3. Sulzer, P. G.: "Wide Range RC Oscillator." *Electronics*, Sept., 1950.
4. Turner, Rufus P.: "Phase Shift Oscillator." *RADIO & TELEVISION NEWS*, Oct., 1950, page 112.
5. Dorf, Richard H.: "An RC Beat-Frequency Oscillator." *RADIO & TELEVISION NEWS*, Nov., 1950.
6. Edwards, C. M.: "Precision Decade Oscillator for 20 cps to 200 kc." *Proceedings of the I.R.E.*, Mar., 1951.
7. Gallagher, Jack D.: "A Bridged-T Audio Oscillator." *RADIO & TELEVISION NEWS*, June, 1951.
8. Hekimian, N. C.: "Constant-Amplitude Oscillator." *Electronics*, July, 1951.

-50-

Modernizing the SCR-274/N

(Continued from page 59)

for the final. The use of a stand-off insulator-type r.f. choke makes this easy, using the existing hole between the 1625's for the mount, and the existing plate "B-plus" feedthrough mica insulator for power connections.

Connect the parallel-feed as shown in the top chassis photo and the diagram, forming a conventional pi-type network system, after soldering the top of the coil to the top-chassis left-hand condenser, and the bottom of the coil to the top-chassis right-hand condenser. (Positions as viewed from front of panel.) Use bits of the former tank coil wire for all this, since that silver is hard to beat for r.f.

The hole in the lower right-hand side of the front panel, due to the removal of the dial assembly, etc., is an ideal spot for the midget closed circuit jack J₁, to which is wired a lead from the final amplifier cathodes, for keying the rig.

A 5/8 in. punched hole, to the right of the meter, provides for a coaxial fitting, to carry the pi-tank output to the antenna, which can be almost anything, from a short whip to a fancy array. (With some type of antennas, it may be necessary to solder a .0001 μfd., 2500 volt mica condenser in parallel with the loading condenser, RH pi-net condenser, to get proper and adequate loading.) In our case, we can load to a hundred-and-fifty mils, with approximately 450 volts on the final, which was considered good enough.

The former neutralizing condenser, shown on the chassis lip in the under chassis photo, was not used in our case: it can be left disconnected.

Power for the rig is from a typical junk-box job, using a husky 500 volt,



AN/APS-4
Airborne radar. New. Complete P.U.R.

AN/APS-6
Airborne radar set. New. Complete P.U.R.

AN/APR-4
RECEIVER & TUNING UNIT P.U.R.

RADAR TEST EQUIPMENT
Complete line. What are your needs?

Check these Items - Write for Prices!

BC-733-D LOCALIZED RECEIVER. Complete with tubes and crystals.
DM-53-A DYNAMOTOR for above.
FT-293 MOUNT for 733.
BC-732 CONTROL BOX for 733.
ARN-7 Complete installation.
SCR-269-G Complete installation.
BC-639 VHF TUNABLE RECEIVER 100-156 MC.
SCR-522 VHF Complete installation.
DY-1 12 V. DYNAMOTOR - For converting Command Receivers to 12 V. operation.

MT-68 MOUNTING RACK for IFA-11B, R89/ARN-5 GLIDE PATH RECEIVER, R57 GLIDE PATH RECEIVER, BC-638-A FREQUENCY METER, BC-376-H TEST OSCILLATOR, 106/ARN-4 LORAN INDICATOR, R9/APN-4 LORAN RECEIVER POWER SUPPLY, RT34 APS-13 TRANSCIEVER 420 MC, TS-24/ARR-2 SIGNAL GENERATOR 234-358 MC, BC-640 50 W. VHF XMTR Crystal control 100-156 MC.
AN, APS-6 AIRBORNE RADAR SET

Monthly Specials!

RT-34/APS-13 420 MC. TRANSCIEVER with 5 stages of 30 MC. IF amplifier strip. Less tubes & R.F. section. With dynamotor. **\$9.95**

AN/ARC-5
R-28/ARC-5 RECEIVER 100-156 MC. **\$49.50**
With tubes. Like New.
T-23/ARC-5 TRANSMITTER 100-156 MC. With tubes. Like New. **\$47.50**
BOTH UNITS FOR ONLY **\$92.50**

2 TRANSMITTERS
BC-457 (4-5.3 MC) and BC-458 (5-3.7 MC). Continual transmitters. Shipment just in. Limited quantity. Less tubes and xtals. Good cond. EACH \$1.95 PER SET \$9.50

SCR-625 FAMOUS MINE DETECTOR
For prospectors, miners, oil companies, plumbers, etc. New. **\$59.50**
WHILE THEY LAST!

COMMAND EQUIPMENT (SCR-274N)

	Used	New
BC-442 ANTENNA RELAY. Less cond.	\$1.95	
BC-451 TRANSMITTER CONTROL BOX		\$ 3.95
BC-450 3-RECEIVER REMOTE CONTROL BOX		1.50
MC-215 MECHANICAL DRIVE SHAFT. Per length		2.95
BC-496 2-POSITION RECEIVER CONTROL BOX		2.95
BC-459 Less tubes	12.95	
BC-455 6-0 MC RECEIVER. With tubes	9.95	14.95
Less tubes	7.95	
BC-454 (70-B MC) with tubes	9.95	
Less tubes	6.95	

	Used	New
BC-453 With tubes	\$19.95	
Less tubes	14.95	
MC-211 90° ANGLE COUPLING UNIT.		\$0.95
FT-234 MOUNTING RACK for single transmitter		2.95
FT-226 MOUNTING RACK for 2 Command Knobs.		3.95
FT-221 MOUNTING PLATE for FT-220		1.50
FT-220 MOUNTING RACK for 3 receivers		2.25
FT-225 MOUNTING PLATE for BC-456		2.25
BC-456 MODULATOR. For SCR-274.		4.50
Complete set of 4 tubes for transmitter		1.95

TCS

12 V. operation. Transmitter-Receiver Antenna Leading Coil. 14-10 MCs. 45 W. P.U.R.

LEAR ACTUATOR

24 VDC. Turns 11,000 r.p.m. Geared to 1,100 r.p.m. Excellent condition. **\$9.95**
SPECIAL.

ARC-4 TRANSCIEVER

140-144 MC. Complete with control box, tubes, 12/24 VDC dynamotor with schematic. This is a special reduction for this month only. **\$32.50**
Like new
MT-101 ARC-4. New **\$4.50**

234-258 MC RECEIVER

11-tube UHF tunable receiver with schematic. New **\$17.95**
Rack \$3.50
Control Box 1.50

Miscellaneous Specials!

HS-18 HEADSET. 8,000 ohms. New. **\$2.45**
HS-23 HEADSET. High imp. New. **4.95**
HS-30 HEADSET. Featherweight type. Low imp. **\$2.49** USED. **1.49**
NEW. **6.95**
HS-33 HEADSET. Low imp. New. **1.49**
NEW. **3.50**
HS-38 HEADSET. USED, excel. cond. **1.49**
NEW. **3.50**
T-26 CHEST TYPE MIKE. With cord and plug. **2.75**
New. **2.75**
T-32 DESK STAND MIKE. Good, used cond. **2.75**
LIP MIKE. Navy type. **.98**

BC-705 INTERPHONE AMPLIFIER. With tubes, high imp. With manual. NEW. **3.95**
PE-101 DYNAMOTOR. Used. ONLY FEW LEFT! **1.95**
CD-307 EXTENSION CORD. For HS-23-33. NEW. **.95**
RS-38 MIKE. NEW. **4.95**
Used. **1.75**
BC-605 INTERPHONE AMPLIFIER. With dual mike input circuit. NEW. **5.95**
RM-13 COMPLETE REMOTE CONTROL BOX. For 3 separate transmitters. With TS-13 handset, detector output meter and BE-8 ringer unit. 110 V. AC operated. Excel. cond. **29.50**
FL-8 RANGE FILTER. **1.95**

TUBES!	TUBES!	TUBES!	TUBES!	TUBES!
16JP4 \$19.95	304TH \$8.95	5CP1 \$4.95	3FP7 \$2.25	5FP7 \$2.25
18AP4 24.95	304TL 8.95	5BP4 4.95	3AP10 1.49	90J2 ..... .89
18DP4 19.95	83G-B 2.75	5BP7 2.25	211D ..... .69	0001 ..... .99

MP-22 MOBILE ANTENNA. MOUNTING RACK. Complete with hardware. New. **\$ 3.95**
TU-17 TUNING UNIT. (2-3 MC.) For BC-223 Xmt. Used **2.95**
1-70 "S" TUNING METER. NEW **2.50**
WOBLATOR. See 43 Dec. '50 RADIO NEWS **5.95**
BC-1023 75 MC. MARKER BEACON RECEIVER. Complete with tubes, mtg. rack. NEW **10.95**
TU-25 TUNING UNIT. (3.5-5.2 MC.) For BC-223 Xmt. Used **2.95**

IN-4A L R TUNING METER. **\$ 3.95**
FL-5 RANGE FILTER. Used. **1.25**
TS-13 HAND SET TELEPHONE. NEW **7.75**
BC-1023 75 MC MARKER BEACON RECEIVER. Complete with tubes. **P.U.R.**
FIELD TELEPHONE. FE-8. Complete BRAND NEW. SPECIAL. ONLY **27.50**

INDUSTRIAL CORPORATIONS

We carry one of the most complete stocks in U. S. of Military Electronic Equipment. Test Equipment, and Aircraft Electronics. Call or write for free catalogue.

COMBO
BC-624 VHF RECEIVER. Freq. range 100-156 MC. Less tubes & crystals, with conversion dope. Used, good cond. **\$19.95**
BC-625 VHF TRANSMITTER. Freq. range 100-156 MC. Less tubes & crystals, with conversion dope. Used, good condition. **\$12.95**
BOTH TRANSMITTER & RECEIVER. Per Set **\$29.95**

\$5.00 MINIMUM ORDER ACCEPTED. All items subject to prior sale. All shipments F.O.B. warehouse. Calif. residents add tax with remittance. 20% deposit required. Please specify shipping instructions with order. EQUIPMENT WANTED! Highest prices paid for all types of Electronic Gear!

ARROW SALES, INC. 7460 Varna Ave., Dept R
North Hollywood, California
POplar 5-1810

Cable Address: ARROWSALES

Thousands depend on PHOTOFACT! THEY TELL YOU WHY

Unsolicited letters tell what the world's finest TV and Radio Data means to Service Technicians



William T. Duarte
8 Harbord Road
Johnston, 9, R. I.

"Thanks for introducing me to such a well-compiled and tremendously helpful data service as your PHOTOFACT."



N. A. Jacobsen
562 Martha St.
Grand Rapids, Mich.

"Your folders were recommended to me by another serviceman. I'm discovering that I should have them before I tackle any job that looks the least bit tough. It sure was my lucky day when I was introduced to your folders. Really, I don't know how one could service a set intelligently without having the PHOTOFACT Folder on it."



John J. Duplex
Duplex TV & Radio
5153 W. Huron St.
Chicago, Ill.

"I find your PHOTOFACTS a necessary must, and would not consider servicing without them."

NOW! GET THE PROOF FOR YOURSELF!

FREE

We'll send you a Free Photofact Folder on any receiver listed in "PF Index & Technical Digest."

Learn for yourself—at our expense—how PHOTOFACT pays for itself by earning bigger repair profits for you! Select any Folder from the PF Index (if you haven't an index, get a copy from your distributor). When you write us for your Free Folder, be sure to state Photofact Set and Folder Number as shown in the Index. Get your Free Folder now. Examine, use, compare—see why you can't afford to be without PHOTOFACT!

HOWARD W. SAMS & CO., INC.
2203 E. 46th St., Indianapolis 5, Ind.

HOWARD W. SAMS & CO., INC.

Preferably this element should act automatically, for adjustment of two controls when changing frequency is to be frowned upon. This function can be obtained in a number of ways, all of which resolve into an impedance element that varies with voltage or current. In other words, it does not follow Ohm's Law. Such an element may be as complex as the a.v.c. circuit in a receiver; thermistors, or a diode also exhibit the nonlinear characteristic; so does an iron wire, such as a pilot lamp. This is a convenient form, and relatively inexpensive. The 3-watt, 117-volt lamp is almost universal in this application.

The action of the lamp in automatically adjusting its magnitude or resistance to maintain the amplitude of oscillations at a constant level may be seen by the characteristic curve of such a lamp, shown in Fig. 2. In this curve resistance is plotted as a function of impressed voltage, and clearly shows the nonlinear nature of this function. The dashed vertical line indicates the approximate limit of voltage that may be applied to obtain regulator action. Don't expect any light from the lamp—even the faintest red glow of the filament indicates improper adjustment. The characteristic that permits the use of a lamp for regulation is that the voltage developed across it increases more rapidly than the current sent through it. It is the slope of the curve, that is, the incremental resistance, at any point rather than the resistance value at that point that governs the action (Fig. 4). An amplifier with such an element as the negative feedback resistance becomes a very nonlinear device. No matter what magnitude of signal is applied, the output is nearly constant. The range of input is, however, limited by the range of the nonlinear element.

Calibration of the dial involves a known frequency (from a standard oscillator, or the 60 cps power line) and a CRO. With the oscillator feeding the vertical amplifier and the reference signal feeding the horizontal amplifier, Lissajous figures will be produced. Any stationary pattern indicates an integral relationship between the two frequencies. The ratio may be calculated by counting the number of tangent points to a rectangle enclosing the figure. Let the number of tangent points along the top be H ; similarly, the number of tangent points along one side is V . Then H/V is the frequency ratio, and H/V multiplied by the reference frequency gives the frequency of the oscillator. In this manner 10 cps division marks can be made on the lowest band using the 60 cps power line for reference. If the condenser decoding is within 1%, no further calibration is necessary up to 200 kc.

A method of checking distortion content of any waveform was mentioned. This requires a CRO and an oscillator with very low distortion. A Lissajous figure of unity ratio is formed. Of



SONOCRAFT FM TUNER \$89⁹⁵

Modern design throughout. Compact size (only 4½" high x 10" wide) permits use as a replacement in almost any type of music system, bringing it up to present day standards.

DESIGN FEATURES

- Novel blackout tuning indicator in VTVM circuit
- Drift free—Automatic Frequency Control
- 5 Microvolts sensitivity
- AFC can be disabled in strong signal areas
- Full Armstrong circuit—completely shielded
- Exclusive design of dial plate provides for simple cabinet installation

NOW OPEN A new studio designed for you—right in the heart of New York City. America's finest and most flexible sound demonstration studio—At last you may experience the breathtaking realism of reproduced music.



FREE

WRITTEN FOR
MUSIC LOVERS
BY
IRVING GREENE

124 pages — chock full of valuable information and listings of high fidelity components.

**ALLIED SOUND
CORPORATION**

115 WEST 45 STREET (3rd FLOOR)
NEXT TO TIMES SQUARE
NEW YORK 36, N. Y. LUxemburg 2-1750

Audio Oscillator

(Continued from page 64)

power supply shown be adopted as all parts are standard and the over-all cost is low.

The theory of tuned RC nets has too many ramifications to be discussed here; those interested are referred to the bibliography at the end of this article. However, a brief description of oscillatory action in this circuit will be given. As stated before, the circuit is essentially a two-stage RC-coupled amplifier, with the output of the second stage brought back to the input of the first. There are three necessary components for oscillation: a gain-producing element, a phase-controlling element, and a frequency-selective element. The two-stage amplifier represents the gain-producing element. However, the output is fed back negatively through the lamp in the cathode circuit of the first stage, which limits the gain of the amplifier to slightly more than three times. Simultaneously, positive feedback is coupled through the RC net to the grid. This net is frequency selective due to its transfer-phase shift characteristic. At some frequency, depending upon the values of R and C, the voltage at the grid will be in-phase with the voltage impressed across the entire net and equal to 1/3 of the impressed voltage. At any other frequency, for the same RC values, the grid voltage will either lead or lag the impressed voltage by some angle. Thus for only one frequency will the second stage output and the first stage input be in phase. At this frequency the grid and cathode voltage are in phase, and the negative feedback voltage developed across the lamp must be just slightly less than the voltage developed between grid and ground, i.e., a slight net positive signal, for oscillation to occur at this frequency. At all other frequencies the negative feedback voltage is greater than the positive feedback voltage; hence oscillation will occur at one and only one frequency.

Although single-frequency oscillation is assured with sufficient positive feedback, good waveform is not. It is with the greatest of ease that this circuit can and will produce almost any desired waveform. Continuous sine waves are only one of a great variety, and are the result of critical damping, to borrow a mathematical term. Over-damping produces a damped wave train, usually sinusoidal in form; under-damping is multivibrator action. For continuous sine waves, the negative feedback must be adjusted so that an over-all gain of unity results. This is the condition where the energy fed back positively just cancels the circuit losses. While it is relatively easy to make this adjustment for one frequency, to do so for a wide range of frequencies requires another variable element.

RADAR—COMMUNICATIONS—TEST EQUIPMENT

- AN-ARC-1—Transceiver 100-156 MCS
- APA-11—Pulse Analyzer
- APN-1—Airborne Radio Altimeter
- ARC-4—VHF Transceiver 140-150 MC
- ARN-5—Glide Path Receiver, \$69.50
- ARN-7—Airborne Direction Finder
- ARR-2—Homing & Receiving Equipment
- BC-223—30-Watt Transmitter 2-5.2 MC
- BC-223—Receiver—1.5 to 18 MC 110v AC
- BC-348—Receiver—1.5 to 18 MC 28v DC
- BC-375E—Radio Transmitter
- BC-639—VHF Receiver 100-156 MC, \$400.00
- BC-640—VHF Transmitter 100-156 MC
- BC-1206—Beacon Receiver 200-400 KC
- RC-103—Airborne Localizer Receiver
- SCR-269—Radio Compass, \$129.50
- SCR-274N—Command Equipment
- SCR-284—Field Radio Station, \$365.00
- SCR-291—Semi-Portable Direction Finder
- SCR-300—Field Transmitter and Receiver
- SCR-522—VHF Transmitter and Receiver, \$129.50
- SCR-536—Handi-Talkie
- SCR-555—Semi-Portable Direction Finder
- SCR-694—Portable Field Transceiver
- SCR-718A-AM-C—High Altitude Altimeter
- T-50—Radio Telegraph Transmitter

- TS-3 AP—S-Hand Power Frequency Meter
- TS-10 AP—APN-1 Test Set, \$25.00
- TS-12 AP—X-Band V.S.W.I.C. Test Set
- TS-342 AP—X-Band Signal Generator
- TS-14 AP—S-Hand Signal Generator
- TS-15 AP—Flux Meter
- TS-16 AP—APN-1 Test Set, \$29.95
- TS-18 AP—Capacity Divider
- TS-23 APN—SCR-718 Test Set
- TS-23 AP—X-Band Frequency Meter
- TS-34 AP—Synoscope, complete with accessories, \$290.00
- TS-35 AP—X-Band Test Set
- TS-36 AP—X-Band Power Meter, \$140.00
- TS-45 APN-3—X-Band Signal Generator
- TS-59 APN—APN-1 Test Set
- TS-61 AP—S-Hand Echo Box, \$140.00
- TS-62 AP—X-Band Echo Box
- TS-69 AP—300-1000 MC Frequency Meter, \$69.50
- TS-89 AP—Pulse Voltage Divider
- TS-98 AP—Pulse Voltage Divider
- TS-102 AP—Range Callibrator
- TS-111 AP—S-Hand Wavemeter
- TS-118 AP—Power Meter
- TS-125 AP—S-Hand Power Meter
- TS-135 AP—Hand Signal Generator
- TS-170 ARN-5—L.S. Test Set
- TS-184 AP—Test Set
- TS-226 AP—300-1000 MC Power Meter
- TS-268 UP—Crystal Test Set
- TS-278 AP—APN-13 Test Set
- TS-282 AP—SCR-522 Test Set, \$290.00
- TS-36—SCR-522 Test Set
- BC-21—Frequency Meter, \$125.00
- BC-127—S-Hand Signal Generator, \$275.00
- TBN-3EV—Thermistor Bridge
- CLX-60 ABM—S-Hand Frequency Meter
- CLX METER—500-6000 gauss, \$32.50

- APA-10—Panoramic Adaptor
- APA-17—Automatic Direction Finder 250-1000 MC
- APQ-5—Low Altitude Tracking & Bombing Equip.
- APR-1—Radar Search Receiver 10-3100 MC
- APR-4—Radar Search Receiver 85-1000 MC
- APR-5—Radar Search Receiver 38-1000 MC
- APR-6—Radar Search Receiver 1000-3100 MC
- APR-6—Radar Search Receiver 3000-6000 MC

RECEIVING TUBES

0A2	\$.095	6AK5	\$.088	6ST7	\$.098
0A2G	1.05	6AK6	1.09	6SU7GT	2.75
0B3	1.05	6AL5	.85	6V6GT	.98
0Z4	.59	6AQ5	.57	6V6	1.85
1A3	.70	6AD6	.65	6V6GT	.65
1A4	1.40	6AR5	1.19	6V6	.65
1B3/6016	1.25	6AT6	.65	6X4	.65
1C5GT	.75	6AUS	1.19	6X5CT	.65
1A2	.65	6AV6	.55	6Y7G	.95
1G6GT	.65	6AV6	.55	6Y7G	.75
1L4	.67	6B4G	1.25	7A6	.75
1L4A	.67	6B4G	.95	7B7	.75
1L6A	.95	6B8C	.75	7C5	.75
1L8A	.98	6B8E	.65	7C7	.75
1L8	.75	6B8E	.65	7N7	.75
1L6	.91	6BE6	.65	7N7	.75
1LNS	.75	6BF6	.72	7Y4	.59
1MCT	.65	6BE6G	1.85	12A6	.65
1P5CT	.69	6B8E	.95	12A7	.90
1R4	.69	6B16	.95	12A7GT	1.19
1R4S	.65	6B06	1.25	12AT6	1.10
1S4	.69	6C4	.55	12AT7	1.10
1S5	.65	6C5	.60	12AU6	.75
1A4	.65	6C6	.85	12B6	.88
1U4	.67	6C8C	.85	12BA6	.69
1X2	.65	6D6	.72	12CR	.69
1V	1.10	6E5	.79	12K8	.69
2A2	1.50	6F6	.85	12SA7GT	.79
3A4	.65	6H6	.65	12SG6	.85
3B7 1291	.85	6HGCT	.65	12S7GT	.65
3D6 1299	.43	6J5CT	.55	12S7GT	.80
3Q5CT	.63	6J6	.95	12SN7GT	.85
3V4	.78	6J7	.60	12SV7GT	.95
354	.74	6J7C	.60	12SR7	.72
5R4CY	.74	6K6GT	.65	14B6	.75
5T4	1.32	6KRGT	1.15	25L6	.90
5V4G	.69	6L6	2.25	25Z6	.65
5W4	.98	6L6C	1.50	25Z6GT	.68
5V4G	.79	6L6GA	1.50	41	.68
5Z4C	.85	6L7	.85	43	.65
5Z3	.85	6R7	.79	50A5	.89
6A3	.85	6SA7GT	.65	50B5	.75
6A6	.82	6S4C	.85	50C5	.67
6A7	.82	6SF7	.75	50L6GT	.65
6ARGT	.95	6SH7	.75	50V6	.72
6ASGT	.98	6SJ7	.75	53	.68
6AC5T	1.05	6SK7GT	.72	75	.82
6AC5	.75	6SN7GT	.75	83	.65
6AM6	1.29	6SR7GT	.65	83V	.92
6AJ5	1.95	6S57	.80	84 6Z4	.75

WANTED! WANTED!

Needed for Government Defense Projects—all types of military electronic gear with the prefix TS, BC, SCR, APR, APS, etc. Highest prices paid or will exchange for your needs. No offer too small or too large.

Prices subject to change without notice. F.O.B. NYC. minimum order \$10.00. 20% deposit required. All merchandise guaranteed. Open account to rated firms. Telephone DICEY 9-5347.

RADIO HAM SHACK Inc.

189 GREENWICH STREET • NEW YORK, N. Y.

- APS-2—S-Band Search Radar
- APS-3—X-Band Search Radar
- APS-4—X-Band Search & Homing Radar
- APS-6—X-Band Search & Homing Radar
- APS-15A—X-Band Homing & Gun Laying Radar
- APT-4—Radar Jamming Xmitter 105-780 MC
- APT-5—Radar Jamming Xmitter 350-1400 MC
- SO-13—S-Band Marine Radar, Lightweight
- SQ—10 CM Portable Radar, \$850.00
- TPS-1—Portable Search Radar
- TPS-3—L-Band Search Radar
- UPN-1 & 2—S-Band Portable Beacon Battery or 110v AC
- RA-34—Power Supply for RC-375E, \$225.00
- RA-62—Power Supply for SCR-622
- BC-1016—Ink Tape Recorder
- PE-103—Dynamotor Power Supply, \$24.50
- GN-58—Hand Cranked Generator W/Logs & Seat
- SCR-578—Gibson Girl (Emergency Xmitter)
- CRT-3—Victory Girl Chest Freq. Emergency Xmitter—Sound Powered Head & Headsets MI-2454-B; Type O, Mig, RCA
- AS-32/APX-1—Antenna, \$2.75
- AN CRC-7—V.H.F. Handi-Talkies 112MC Xtal Controlled
- MN/26-Y—Compass Receiver
- BC-733D—Receiver with Tubes
- C-3—Navy Snooperscope in Carrying Case, \$400.00
- BC-1284—Lightsource Tube Pre-amplifier
- BC-996—Interphone Amplifier, \$6.75
- RL-42—Motor Antenna Reel, \$6.25
- 30 MC—I.F. Strips Using 6AK5
- RD-7/APA-23—Recorder for APR
- AS-27/ARN-5—Antenna
- ARA—Receiver—500-1500 KC
- Id. 80 APA-17—Indicator
- R-28/ARC-5—Receiver—100-156 MC, \$24.50
- RM-29—Remote Control
- BC-455—Receiver—6.9 MC
- BC-454—Receiver—3.6 MC
- BC-800—Transmitter/Receiver
- BC-950—Transmitter—100-156 MC, \$34.50
- RA-300—FM Exciter (Mig. Tempo)
- FL-5—Filter
- FL-5—Filter, Less Cables
- 3C-16-D CSAP—Gun Camera Computers with All Accessories; in Carrying Case, \$14.50
- AT-2A/APN-2—Antenna, \$3.75

PANEL METERS

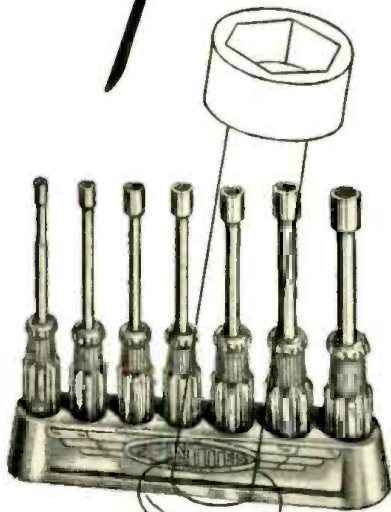
- 2" SQUARE WESTON—SANGAMO
- 0-20 Volts D.C. \$2.95
 - 0-40 Volts D.C. 2.95
 - 0-5 Ma 2.95
 - 0-500 Microamp. 4.95
 - 0-100 Ma (0-300 scale) 2.95

XMITTING TUBES

0A3 VR75	\$1.04	15R	\$.69	866A	\$1.35
0B3 VR90	1.19	2B07	1.95	866JR	1.29
0C VR105	1.39	30 Spec.	.45	869R	65.00
0O3 VR150	.95	35T	.32	874	1.19
1B23	9.75	45 Spec.	.32	874	1.19
1B27	14.95	51	.75	878	1.59
1B29	2.45	250TH	19.95	902A	9.95
1N21B	1.25	45DTL	17.95	918	1.10
1N23A	2.39	274B	3.25	923	1.25
1N28	3.99	30TH	8.95	927	1.05
1N34	.76	304TL	3.95	938	.65
1N34A	.97	307A RKT5	3.95	931A	4.45
1N41	10.50	312A	.65	954	.25
2C40	7.50	327A	3.95	958	.49
2C43	14.95	350A	6.45	956	.35
2C44	1.25	350B	3.95	957	.39
2C46	7.95	368A5	3.95	958	.56
2C51	6.25	371A	.95	959	2.95
2E21	1.75	393A	1.69	991	NE16
2E24	4.65	394A	3.95	1613	4.95
2E25	3.15	417A	3.95	1613	.79
2K25 723AB	8.45	434A	2.70	1616	.69
2K28	28.75	446A	1.15	1622	2.45
2K33A	310.00	575A	15.75	1624	1.45
3AP1	9.95	701A	5.75	1626	.25
3B24	7.95	705A	1.65	1629	.25
3B25	3.59	707E	13.95	1632	.72
3C22	115.00	715A	6.39	1638	.45
3C24 24G	1.75	715B	8.75	2051	1.18
3C28	4.39	800	1.75	2051	6.95
3CP1	1.95	717A	.98	2051	5.95
3CP151	1.95	721A	2.45	8011	.90
3DP1	4.95	723A	19.95	8012	2.65
3DP1-52A	8.95	724B	3.25	8020	.98
3E29	13.95	726A	18.95	9001	1.50
3FP7	1.65	730A	29.50	9003	1.65
4AP10	4.39	800	1.75	9004	1.35
4-125A	27.50	802	3.95	9005	1.65
4-250A	37.50	803	3.25	9006	2.27
4C35	27.50	805	3.75	9006	9.95
4E27	14.95	806	24.95	C61	6.39
5AP1	3.45	807	2.69	CK1005	7.48
5BP1	4.45	810	9.50	FI27A	27.50
5CP1	4.95	811	2.85	FI28A	89.50
5CP7	4.59	812	2.75	FC17	4.89
5D21	11.75	813	11.75	FC27A	4.95
5FP7	1.85	815	2.35	FC57	14.95
5J1	4.85	816	1.05	FC81A	3.49
5J2	22.50	828	9.95	FC122	33.50
5L1	22.50	829	10.95	GL434A	29.95
5NP1	3.30	830B	12.95	GV22A	1.79
6AN5	3.30	830B	2.75	HF100	4.95
6AS5	4.50	832	6.75	HF300	22.45
6A57	4.50	832A	8.50	HY11A	6.89
6C21	21.00	836A	3.49	HY115	.69
7B7	6.25	837	1.45	ML101	47.50
7DP4	14.50	845W	4.25	REL21	1.95
9LP7	17.45	849C	27.50	RK60/1641	2.25
10BP4	17.45	849C	27.50	RK65	26.50
10Y	17.45	860	3.95	VT172	.48
12DP7	14.50	861	22.50	VT27A	2.45
15E	9.15	861	22.50	WL616	34.50

THE Original

WRENCH WITH THE SCREWDRIVER ACTION!



SPINTITE
REG. U. S. PAT. OFFICE

120 STYLES and SIZES

for

- ASSEMBLY WORK
- REPAIR WORK
- RADIO
- TELEVISION
- INDUSTRIAL
- AIRCRAFT



STEVENS WALDEN, Inc.
WORCESTER 4, MASS.

pickup differential of approximately 15 db, which makes the microphone, for all practical purposes, dead to extraneous noise and drone, according to the company.

The internal dynamic element is floated in rubber to help insure stability. An impedance selector switch provides operating impedance of 50, 200, 500, and high impedance. The switch is located at the back of the microphone housing, flush with the surrounding grillework to prevent accidental turning. It has a center slot for easy turning with coin edge or screwdriver.

Output level is -54 db (1 volt-per-microbar) and the range is 40 to 10,000 cps. Standard equipment includes an *Amphenol* cable connector and 18 feet of two-conductor shielded cable.

PROGRAM EQUALIZER

Production on a new program equalizer, the Type 4031-B, has started at the Burbank, California plant of *Cinema Engineering Co.*

The new instrument has wide applications in sound and electronic laboratories for research and control; broadcasting, recording, and motion picture



uses include providing corrections for frequency response in audio equipment, sound pickup, and transmission lines.

Easy operation of two control knobs allows wide range of over 395 available curve combinations. Controls provide for independent adjustment of the high and low frequencies in 2 db steps. Input level minimum is -70 dbm and maximum +20 dbm.

The equalizer uses standard RTMA rack mounting and is available either from the company's New York representative, *Audio & Video Products*, 730 Fifth Avenue, or from the manufacturer direct.

RCA SHOWS EXPERIMENTAL TRANSISTOR GEAR

RCA recently demonstrated a series of electronic gear in which a wide range of transistor applications useful to radio, television, and the industry were incorporated.

Each development was in the form of a laboratory model which, it was emphasized, is still in the preliminary and experimental stage. None of the units is commercially available at the present time.

Among the equipment demonstrated at the David Sarnoff Research Center of RCA in Princeton, N. J., was a portable public address system, a personal radio which was transistorized except for one tube, an all-transistor personal radio, a portable FM receiver, a transistor portable phonograph, a wireless phono jack, a roving microphone, a toy piano, a transistor ukelele, and a portable television receiver.

Ten types of RCA developmental and experimental transistors, three of the point-contact variety and seven of the junction transistor family, were used in the equipment. The three point-contact types and one of the junction types are to be offered on a limited sampling basis for engineering advanced development to industry representatives. The other six junction-type transistors are still classed as experimental.

Among the experimental items which attracted considerable attention was a portable, battery-operated television receiver, tubeless except for the picture tube. In another approach transistors were introduced in part of the circuits of a standard television receiver. Transistors were also employed in circuits of industrial TV equipment and the "Walkie-Lookie" portable TV camera equipment to point up savings in weight, size, etc.

In summarizing the demonstration, Dr. E. W. Engstrom, vice-president in charge of RCA Laboratories Division, said:

"These demonstrations highlight the fact that transistors are today no longer entirely a research concern. They are,

in the fields of radio and television, an immediate problem for advanced development by industry engineers who can learn how to put them to work in evolving more versatile, smaller, sturdier, and eventually lower cost equipment for industry and the public."

D. D. Holmes, staff member of the David Sarnoff Research Center of RCA at Princeton, N. J., demonstrates the simple replacement of a junction-type transistor in an auto receiver operating solely from 11 developmental and experimental transistors instead of the customary electron tubes. The use of transistors makes it possible to eliminate the usual high-voltage power supply. The transistors operate directly from the car's 6-volt storage battery so that the receiver has only 10 per-cent of the usual drain on the automobile battery.



Three tips, 1/8", 3/16", and 1/4" diameter, are available for use with this unit.

A brochure describing the Model XK-72 and other units in the company's line is available without charge upon request.

H.V. TEST JACK

Alden Products Company, 117 North Main Street, Brockton, Massachusetts has introduced a new, skirted test point jack, the 110BCSH, which permits safe circuit voltage readings up to 3000 volts a.c. peak from the front of equipment panels.

Its high collar protects the operator from flashover during high voltage checks. Actual flashover breakdown-to-chassis occurs at 7-8000 volts a.c. (r.m.s.).

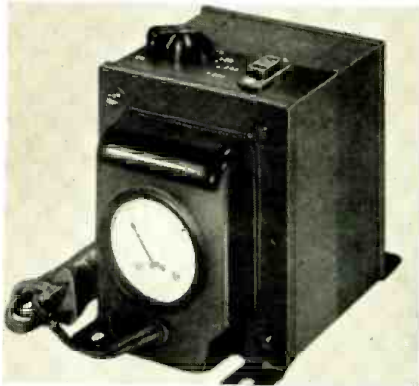
This new miniature test point jack has a beryllium copper contact, made to critical accuracy in progressive dies to insure resilient, long-life contact action. Its pre-tinned soldering tab is suitable for use with up to 14 gauge wire.

For complete information on this new product, address requests for additional data to Mr. Nelson Hearn at the company's address.

AUTOFORMER

Halldorson Transformer Company, 4500 Ravenswood Avenue, Chicago 40, Illinois, has announced the availability of a new "Varivolt Autoformer" which permits the adjustment of line voltages of 65, 75, 90, 100, 115, 130 and 145 volts to 115 volts, or to other voltage levels within the unit's range.

Voltage is set by means of a seven-



step rotary switch and indicated by a voltmeter having a red-line marker at 115 on its 0-150 volt scale. Each unit is equipped with a conventional six-foot plug-in line cord and a standard output receptacle.

The line is currently available in four wattages (resistive load rating): 150, 350, 500, and 750.

UNIDIRECTIONAL MIKE

The Astatic Corporation, Conneaut, Ohio, has announced the addition of a unidirectional dynamic model to its line of microphones.

Known as the "Dynambar" Model DR-11, the new microphone employs the company's exclusive sintered metal method of acoustic phase shifting. This accomplishes a front-to-back

SENSATIONAL '53 STANDARD SURPLUS VALUES

NEW 12 VOLT BATTERIES
 For Mobile or Light Airplanes. In original factory boxes. Weight: 37 lbs. Size: 3 1/2" wide x 10" long x 10" high. Signal Corps Type BB-33, 12 Volt. 34 Ah.
 A real terrific surplus value while they last. **\$9.95**

MIDGET SELSVYNS
 AY6 type operates from 6-12 Volt 60 Cycle. Use as both transmitter and receiver. These compact little units draw almost no current and work fine for all remote position indicating applications. 2 1/2" x 2 1/4" x 2". Has spring return shaft. All New (Apr. wt.) Each **\$2.50**
 AY-5 Type, same as above, but has a continuous rotating shaft. These compact units are all new. Each **\$4.95**

WILLARD 2 VOLT RADIO BATTERY
 NEW. Uncharged (Apr. wt. 1 lbs.) TYPE 20-2. Each **\$2.50**
 Complete set of three with Box and Connections to make a 6 volt, 20 Amp. Hrs. Battery Uncharged (Apr. wt. 15 lbs.) Set **\$8.95**

PROP PITCH MOTORS
 For your Beam Antenna: 20 Volt to 32 Volt. A.C. or D.C. 1/4 H.P. Motor: 1/4 H.P. Gear ALL BRAND NEW. Each **\$16.95**

12-24 VOLT TRANSFORMER
 Open frame type 0-12-24 Volts @ 2 Amps. 115 Volts. Limited Quantity. All New. Each **\$3.50**

HI AMP. TRANSFORMER
 11 Volt 65 Amp. Output. 115 Volt 60 Cy. Input. Ideal for welding or Heavy Fil. Tubes of Heat. In. Approx. Wt. 50 lbs. SPECIAL AT **\$15.95** Ea.

SCR-283 RADIO SET
 Brand new—Consisting of 1-BC429 Receiver (similar to RU-16) and 1-BC410 Transmitter with Coils, and all Tubes, Dynamotor, Control Boxes, Mounting Racks, Instruction Book, Antenna, Relay, etc. Less Cables. All New. **\$39.95** set

DYNAMOTORS

TYPE	INPUT V.	OUTPUT V.	M.A.	PRICE
DM-190	12	300	200	\$14.95
DM-24	12	120	80	8.95
DM-77	12	120	80	19.95
PE-88	28	250	60	2.95
DM-33	28	220	80	4.95
DV-2	28	250	60	3.95
ARC-5	28	500	100	4.95
RU-16	28	350	135	6.95
	18	450	100	2.95

REVERSIBLE MOTOR
 1/40 H.P. Ball-bearing 3450 R.P.M. in Blast-proof case. Needs only a capacitor for starting. All Brand New. 110 V. 60 Cy. Special Low Price. **\$4.95**
 Starting Capacitor. **\$0.69** Ea.

B-3A INTERVALOMETERS
 This unit was used to release bomb loads at different time intervals and now can be used ideally for dark room timers, etc. Complete with two 2050 tubes; four sensitive relays and other related apparatus. Excellent Condition. Each **\$6.95**

12 VOLT BLOWER MOTOR
 The famous Trade Winds Blower for use on Trucks, Boats, etc. Ideal for Engine Room use as motor is completely enclosed and Sparkproof. 4" outlet. All Brand New. Each **\$9.95**

ARC-4 TRANSCEIVER
 140-144 MC. Ideal for 2 meters. Complete with 20 tubes and control box. BRAND NEW. **\$29.95**

BC 357 MARKER BEACON
 7.5 Mc. uses 1-12SQ7, 1-12CR Tubes. Excellent condition. Less Tubes **\$3.95**
 With Tubes **5.95**

ARC 5 EQUIPMENT:

TRANSMITTERS
 3 to 4 MCS. **\$14.95**
 4 to 5.3 MCS. **8.95**
 5.3 to 7 MCS. **7.95**
 All above complete with all tubes and crystal, in excellent condition.

R-4 ARR-2 RECEIVER—234-258 MCS
 Complete with all tubes and dynamotor. Excellent condition. **\$19.95**

RECEIVERS
 190 to 550 KC **\$16.95**
 3 to 6 MCS. **9.95**
 6 to 9 MCS. **9.95**

COMPONENTS
 MOUNTING RACKS
 Single Trains. **\$1.00** Ea.
 Double Trains. **1.75** Ea.
 Triple Rec. **2.25** Ea.
RE-2ARC.5 ANTENNA RELAY UNIT
 Comp. with Meter and 50 MMFD vae. cond. **\$4.50**
MD-7 ARC-5 PUSH PULL MODULATOR UNIT
 Comp. with tubes and dynamotor. Exc. cond. **\$11.50**

MODEL GO-9 TRANSMITTER
 ONLY A FEW LEFT
 All brand New. 100 Watts CW or MCW emission. Operates from 110 V., 800 Cycle, easily converted to 60 Cycle operation. Low frequency range: 300 KC. to 800 KC. High frequency 3,000 KC. to 18,000 KC. using an E.C.O. We furnish complete conversion data with each transmitter. Complete with test schematics. **\$59.95**

DIAL TELEPHONES
 French type phone made by Kelllogg. Can be used for standard extension phone. Used. With Dial **\$12.95** Ea.
 Without Dial **\$9.95** Ea.

TELEPHONE DIALS
 Standard Phone Dials ideal for use in any remote control relay circuit. Each **\$2.95**

GYRO MOTOR UNITS
 Dial Gyro Unit which will use in conjunction with Auto-Pilot equip. Both Gyro Motors mounted on a single base, wired in parallel for 12 or 24 Volt operation. One used as the Azimuth control and the other as an elevation control. When ordering these units specify 12 or 24 Volt. Our price—Special. **\$4.95** ea.

SOUND POWER HANDSETS
 Use these phones without any external or internal voltage supply. Two or more can be used with only 2 wires interconnecting them. Use for TV installation, house to house or house to garage. All New. Per Pair **\$19.95**

SOUND POWERED HEAD AND CHEST SET
 Use same type as Hand Set except you have freedom of hands. No Batteries or power source required for operation. Excellent Condition. Per Pair **\$11.95**

HOBBY MOTORS
 Operates from 110 Volts, 60 Cy., AC. Two Types General Motors Type A: 4 Speeds: 1,000 RPM, 1,500 RPM, 2,000 RPM, 3,000 RPM. Type B: 3 Speeds: 4,000 RPM., 200 RPM, 5 RPM. These motors can be used for Bar-B-Que splits, Home Work rooms or any low speed application. Each speed on a separate shaft. Can be used separately or at the same time. **\$12.95** All New

CAPACITORS • FIXED • OIL FILLED
 Solar, Pyranol, C.D., Etc.

ALL O.C. VOLTAGE RATINGS

CAP.	W. VOLTS	PRICE	CAP.	W. VOLTS	PRICE
2 MFD.	400 V.	50.79	8 MFD.	1000 V.	\$1.25
3X3 MFD.	400 V.	1.95	8 MFD.	1000 V.	3.95
10 MFD.	400 V.	2.95	10 MFD.	1000 V.	4.95
7.5 MFD.	600 V.	1.95	4 MFD.	1500 V.	1.50
1 MFD.	600 V.	1.95	4 MFD.	1500 V.	2.25
5 MFD.	600 V.	1.95	8 MFD.	1500 V.	2.95
6 MFD.	600 V.	1.95	1 MFD.	2000 V.	1.95
8 MFD.	600 V.	1.95	2 MFD.	2000 V.	1.95
8x8 MFD.	600 V.	1.95	3 MFD.	2000 V.	3.50
10 MFD.	600 V.	2.25	4 MFD.	2000 V.	3.95
15 MFD.	600 V.	2.95	1 MFD.	3000 V.	3.95
20 MFD.	600 V.	2.95	4 MFD.	3000 V.	5.95
1 MFD.	1000 V.	1.00	1 MFD.	5000 V.	9.95

CAPACITORS TRANSMITTING VARIABLE
 K 12 MMFD. to 75 MMFD. 1/2" Spacing. **\$1.95**
 D 12 MMFD. to 125 MMFD. 3/8" Spacing. **3.50**
 1 28 MMFD. to 110 MMFD. 3/8" Spacing. **3.50**
 * F 12 MMFD. to 150 MMFD. 3/8" Spacing. **3.50**
 * 2 7 MMFD. to 80 MMFD. 1/2" Spacing. **1.00**
 * With National "Velvet Verter" Dial.
 All New Hammerlund, Cardwell, Etc.

ARMY AMMUNITION CANS
 Type M-3 50 Cal. Cans 12" Long x 6" Wide x 7 1/2" Deep.
 Type M-1 Cans 16 1/2" Long x 3 1/2" Wide x 6 1/2" Deep.
 All aluminum with leather handle and hinges. Top with hasp. Good for all your small parts or tools. O.D. Color. Clean them all out and buff or paint. Each **\$1.50**

MICA CAPACITORS

CAP.	W. VOLTS	PRICE	CAP.	W. VOLTS	PRICE
.001	50	1.50	.0015	5000	1.95
.002	100	1.75	.002	5000	1.75
.005	500	2.50	.005	5000	2.25
.01	1000	3.50	.0075	5000	3.50
.02	1000	4.50	.01	5000	3.25
.05	1500	7.50	.015	5000	3.25
.1	1500	7.50	.02	5000	3.25
.25	1500	7.50	.025	5000	3.25
.5	1500	7.50	.05	5000	3.25
1	1500	7.50	.1	5000	2.95
2	2000	1.50	.015	5000	3.25
5	2000	1.50	.02	5000	3.25
10	2000	1.50	.05	5000	3.50
20	2500	.95	.075	5000	3.75
50	2500	.75	.1	5000	3.50
100	2500	1.50	.01	6000	5.00
200	3000	1.00	.001	7500	2.95
500	3000	1.00	.01	7500	3.95
.0015	600	.35	.01	1200	.75
.01	600	.65	.005	1200	.65
.02	600	.75	.01	1500	.50
.05	600	.85	.01	2500	1.50
.00005	600	.35	.00005	2500	.75

COAXIAL CABLE
 RG-75 50 Ohm Transmission Cable. Made to J.A.N. Specification. 1P34B same as RG-8U. All unused, in Reels of approximately 1,000 Ft. **7c** per Ft.
 100 Ft. **1.00** Ft. **1.00** Ft. **5c** per Ft.
 10,000 Ft. **1.00** Ft. **5c** per Ft.
 RG-75-50 Ohm Coaxial Cable. **6c** per Ft.

All Mail Orders Promptly Filled, F.O.B. San Francisco. All California Orders—Add 3% Sales Tax. Do not send postage stamps. Write for new 1953 free booklet listing our stock and prices on Radio, Electronics, Tools, Harn. Wire, Motors, Batteries, Aluminum Sheets, etc. 20% off all C.O.D. orders. All items subject to prior sale and prices subject to change without notice. On purchases under \$5.00, send full amount.

STANDARD SURPLUS 1230 Market St., San Francisco 3, Cal. Telephone HEMlock 1-3106

DEPEND ON CONCORD

For OUTSTANDING VALUES!

STANDARD BRANDS—NEW—GUARANTEED

TUBES 60% OFF LIST!

TYPE	LIST	YOUR COST	TYPE	LIST	YOUR COST
1B3	\$2.55	\$1.02	6AL5	\$1.80	\$.72
1R5	2.10	.80	6AU6	1.80	.72
1T4	2.10	.84	6BG6G	4.80	1.92
1U4	2.10	.84	6AQ5	2.00	.80
3V4	2.00	.80	6SN7GT	2.20	.88
5U4GT	1.50	.60	6VSGT	2.00	.80
5Y3GT	1.10	.44	12AU7	2.40	.96
6AG5	2.25	.90	12AT7	2.90	1.16

60% off on all other Receiving Tubes.



NATIONAL TURRET BOOSTER

Finest turret tuner ever designed. Built-in Power supply. Brand New! Lots of 6 ea. **\$10.00**
Lots of 3... **\$10.95** ea.
Singly... **\$11.95**

VM 2-SPEED RECORD CHANGER

With automatic changer and shut-off. 33 1/3 and 78 RPM. Positive Intermix of 10", 12" records. Jam-proof! **\$18.95**



10 Element Conicals

Superb low-priced "all aluminum signal getter."



\$3.15 ea.
Lots of 6
Single lots
\$3.95 ea.

"V" ANTENNAS

Factory assembled for top electrical and mechanical performance.



Single V—**\$3.65** ea.
Lots of 6—**\$3.15** ea.
Double V—**\$8.95** ea.
Lots of 3—**\$8.65** ea.

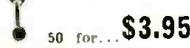
INTERLOCK TV LINE CORD

6 ft. line cord—for all popular TV sets. **27c**



3 1/2" STANDOFF

Fully adjustable, easy to mount.



50 for... **\$3.95**

LIGHTNING ARRESTOR

For Twin lead or open transmission line. Mounts flat or on mast. **1.25** Lst.



3 1/2" SCREWEYE

Insulated standoff. High quality, low price. **\$2.75**



100 for...



MAGNIFICENT BRITISH HI FIDELITY 5" PM SPEAKERS

A sensational value! 50—2,000 CPS range. Outperforms most 8" and 10" units. Highly efficient for general use in amplifiers, radios, TV sets and custom combinations. 4.6 ohms impedance—1.5 oz. Alnico magnet. Buy now—while we still have stock on hand!

Stock No. 99-A-850P. Singly **\$1.60**
In lots of 50 **\$1.59** EACH

1/2 MEG VOLUME CONTROL with SWITCH **29c**
Singly 33c, Lots of 6... ea.
300 OHM TWIN LEAD. 100 ft. **\$1.39**
1,000 ft. **\$10.95**

ALL C.O.D.'s 25% DEPOSIT
MINIMUM ORDERS: \$5.00

CONCORD RADIO

53-L Vesey Street, New York 7, N. Y.

Phone: Digby 9-1132

OPEN WEDNESDAYS UNTIL 9 O'CLOCK

CONCORD RADIO, 53-L Vesey Street, N. Y. 7 Dept. N1

Please include my name on your Special Bargain Mailing List. Free of charge.

Name

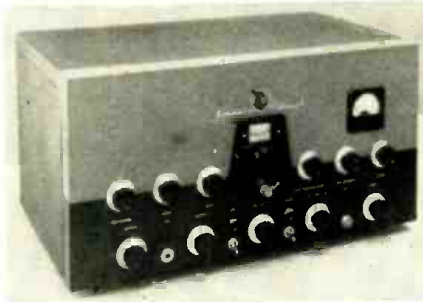
Address

City

State

bly permits the selection of any one of 10 crystal frequencies from the front panel, with an 11th position provided for use with an external v.f.o.

All stages are metered and dual power supplies are designed for econ-



omy and operating convenience. For novice operation, the final amplifier input may be reduced to 75 watts without transmitter modification.

The transmitter, TVI suppressed, is enclosed in a heavily copper-plated steel cabinet. The lid is bonded with silver-plated, phosphor bronze contact fingers. Special shields are included for the meter, dial window, and v.f.o. power socket.

A free bulletin, No. 714, giving complete specifications on the new transmitter kit, is available on request.

COMPACT CONVERTER

The Terado Company, 1068 Raymond Ave., Saint Paul 8, Minnesota has introduced a compact d.c. to a.c. converter, the "Trav-Electric Super," Model No. 6-71160.

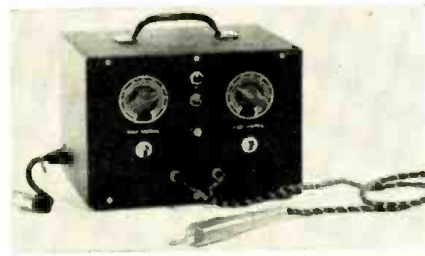
This unit converts 6 volts d.c. (car battery) to 110 volts, 60 cycle a.c. Capacity is 60 watts continuous and 75 watts intermittent. Suggested uses for the new unit include the operation of wire recorders, dictating machines, portable phonographs, radio receivers, small electric drills, hand vacuum cleaners, electric shavers, lights, and test equipment.

A catalogue sheet describing this and other converters in the company's line is available on request.

SOLDERING MACHINE

Sunrise Products Company, P. O. Box 173, Hawthorne, New Jersey, is currently featuring a new soldering unit, the Model XK-72.

This compactly-designed resistance soldering unit incorporates a sensitive interval timer (1/5 to 90 seconds) and an adjustable heat controller to per-



mit fast, precision soldering without overheating or warping of the parts to be soldered.

The electrode holder, L-14, measures 6" long and weighs just 3 1/2 ounces.

Trav-Electric

\$15.95
LIST

Model 6-1160

MIGHTY MIDGET CONVERTER

Just plug into
Cigar Lighter on Dash

Converts 6 volts D.C. to 110 volts A.C. 60 cycles 40 watts.



PORTABLE PHONOGRAPH



IN THE CAR—IN THE TRUCK



DICTATING MACHINE



ELECTRIC SHAVER



IN BOATS



AT PICNICS—OUTINGS

Ideal for phonographs and turntables at beach, or picnic.

Radios, short wave or broadcast bands in car, truck and cabin, etc.

Small dictating machines... ideal for salesmen, business or professional men.

Electric shaver works beautifully when it is plugged into Trav-Electric. A great time saver.

Boats—the 110 volts A.C. operates radios, lights, etc.

Ideal for outdoor musical entertainment from table radio to phonographs, including most wire and disc recorders.

Fully Guaranteed

THOUSANDS IN USE

See your Electronic Dealer or Jobber, or write direct



Model 6-1160

Size 2 1/2" x 2 1/2" x 3 1/2"

TERADO Company

Mfrs. of Precision Equipment

1068 Raymond Ave., St. Paul 14, Minn.
In Canada, write: Atlas Radio Corp., Ltd., 560 King Street West, Toronto 28, Canada

enough to accommodate the piece to be stripped.

Attack on the coating begins immediately and parts are normally stripped clean in 1/2 to 4 hours. Overnight immersion will remove heavy coats up to 3" in thickness.

Further information and a free sample are available from the company.

TAPE RECORDER

Allied Radio Corporation, 833 W. Jackson Boulevard, Chicago 7, Illinois is currently offering a low-priced tape recorder which incorporates many new features for a variety of applications.

The "Knight" 96-485 has "automatic keyboard" control. Five piano-key type push-buttons permit the quick and easy selection of the operating functions including "fast forward," "play-back," "stop," "record," and "fast reverse." The "fast forward" speed enables the user to locate that portion of the recorded tape desired for play-back.

Two speeds and a dual-track recording head provide four recording times. At the speed of 3.75" per second, a 7" (1200 foot) reel records continuously for one hour, or two hours by recording on the second half of the tape width. At the 7.5" speed, the recording times are one-half hour continuously and one hour over-all. Frequency response is flat from 70 to 8500 cps at 7.5" and 90 to 6000 cps at 3.75".

The unit is housed in a sturdy, two-tone green, luggage-type case which measures 14" x 12" x 7". It weighs less than 22 pounds. Ready for operation



from any 105-120 volt, 60-cycle a.c. outlet, the unit comes complete with crystal microphone, 8 feet of mike cable, a 600-foot reel of type "A" tape, a 5" take-up reel, and all tubes.

HAM XMTR. KIT

E. F. Johnson Company of Waseca, Minnesota, is now in production on a new ham transmitter kit known as the "Viking II".

Rated at 130 watts c.w. output, 100 watts phone, the new transmitter has been designed for operation on every amateur band from 10 to 160 meters, including the recently-assigned 15-meter band. The pi-network amplifier matches a wide variety of antenna impedances. A crystal selector assem-

January, 1953

M I R R O S C O P E

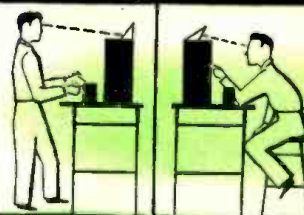
MODEL 476

Simpson

Advanced design in oscilloscopes. Vertically mounted 5" cathode ray tube is reflected in the adjustable mirror. Microscope can be used by technician seated or standing merely by adjusting mirror angle—not necessary to move the instrument.

A quality instrument with tomorrow's features.—Dealer's net price, \$179.50

Optically surfaced mirror gives distortion free image of cathode ray tube



Ask your jobber for full information or write

Simpson Electric Company
5200 West Kinzie Street
Chicago 44, Illinois
CO 1-1221

Another reason why Simpson is the world's largest manufacturer of test equipment.

BURTON BROWNE ADVERTISING



GET IN on the fun of operating your own licensed transmitter. I guarantee you will memorize the International Morse Code alphabet within two hours by my simple picture method, or return method within five days and I will refund your money.

COMPLETE COURSE ONLY \$1
NOTHING ELSE TO BUY!
OTTO LUTHER, NEW PRESTON, CONN.



BARGAIN HUNTING?
RADIO SERVICEMEN!
Write for SENSATIONAL CATALOG
HENSHAW RADIO SUPPLY
3619 TROOST KANSAS CITY, MO.

This much space ordinarily required



Vertical design of microscope gives larger control panel area—better spacing of controls for easy adjustment! All connections made in front.

MODEL 276
OSCILLOSCOPE
CALIBRATOR



Take full advantage of your microscope—Model 276 Oscilloscope Calibrator. Accurate voltage readings of the oscilloscope wave forms. For use with any oscilloscope.

Dealer's net price \$29.50.

Base is only 9" x 8"

Base dimension or bench area only 9" x 8"—less than half of the bench area used by old style oscilloscopes—you gain valuable working space with the microscope.

You save this bench space

Unlimited Opportunities in
RADIO ENGINEERING

DEGREE IN 27 MONTHS

Complete Radio Engineering course, including Telev., U.H.F., and P.M. Bachelor of Science Degree also in Mech., Civil, Elect., Chem., and Aero. Eng.; Bus. Adm., Acct. Extensive campus, modern buildings, well equipped labs. Low cost. Prep courses. Personalized, practical instruction. Founded 1884. Placement service. Growing shortage of engineers. Prepare now for unlimited opportunities ahead. Approved for Korean vets. Enter January, March, June, September. Write for catalog.



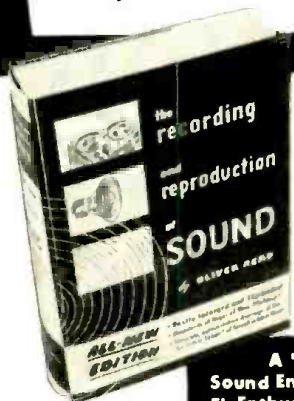
TRI-STATE COLLEGE

1613 College Avenue. ANGOLA, INDIANA

NEW! 2ND EDITION of the only complete reference on AUDIO!

"The Recording & Reproduction of SOUND"

by OLIVER READ



Completely revised and vastly enlarged new edition

OVER
800
PAGES

largest selling
book in its field

A "Must" for
Sound Engineers, Hi-Fi
Enthusiasts, P. A.
Men, Broadcasting
Stations, Recording
Studios, Students

CONTENTS:

A Partial List of Authoritative Chapters:

Behavior of Sound Waves; Basic Recording Methods; Lateral Disc Recording; Microgroove Recording; The Decibel; Phono Reproducers; Styli; Microphones; Loudspeakers and Enclosures; Dividing Networks and Filters; Attenuators and Mixers; Home Music Systems; P.A. Systems; Amplifiers; AM and FM Tuners—PLUS HUNDREDS OF OTHER SUBJECTS

Now you can have all the *right* answers to any subject in the field of Audio. Learn how to select and get the most out of recording equipment. Tells you how to select the proper amplifier for given applications, how to test amplifier performance, how to eliminate hum. Explains microphone, speaker and pickup principles and selection factors. Shows how to utilize inverse feed-back, expanders and compressors. Covers hundreds of subjects—a vast wealth of reliable information found in no other single volume. If you work in the field of Audio, this book belongs in your library. Order your copy today!

6" x 9" **ONLY \$7.95**
Hard Covers
800 pages 700 illustrations

**ORDER
TODAY**

Order from your Parts
Jobber, or write direct to
HOWARD W. SAMS & CO., INC.
2203 E. 46th St., Indianapolis 5, Ind.

My (check) (money order) for \$.....
is enclosed.

Send copy(ies) of *The Recording &
Reproduction of Sound (RR-2)*. \$7.95 per copy.

Name.....

Address.....

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

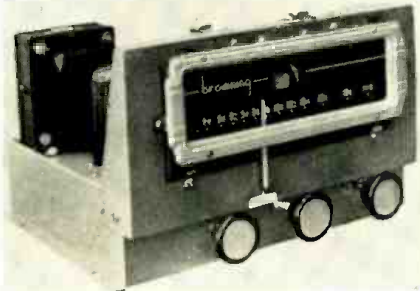
er. The cabinet measures 23 $\frac{7}{8}$ " wide, 30" high, and 14 $\frac{3}{8}$ " deep. It is available in either blonde or mahogany finishes. All the necessary mounting hardware is included, along with a mounting board for 12" speakers.

A data sheet on these new bass reflex cabinets is available from the company on request.

FM TUNER

Browning Laboratories, Inc., of Winchester, Mass., has recently introduced a new FM tuner which has been designated as the Model RV-31.

The new tuner features an all-triode r.f. section and follows the *Armstrong* receiving method with dual cascade limiters for most effective noise quieting. Input signals of 3 microvolts will



produce 20 db of quieting. An a.f.c. circuit locks the local oscillator into correct tuning but may be switched off if desired. A selector switch permits FM, phono, TV, or recorder playback to be fed through the tuner volume control to the main amplifier.

The RV-31 is suitable for custom installations where space is limited since it measures 11" wide, 9 $\frac{3}{8}$ " deep, and 6 $\frac{1}{2}$ " high. Knobs and dial escutcheon are furnished in black and silver to complement the black dial background.

EXTENSION SPEAKER

Auto radio sales and service technicians will be interested in a recent announcement from *Lovell Manufacturing Company*, 3030 Laclede Station Road, St. Louis, Missouri that it is now in production on an easily-installed rear-seat auto extension speaker baffle kit.

This "extra profit" item comes complete. It includes a 9" x 7" stamped metal louvre plate with tamperproof screening, a three-way switch, screws for mounting dial plate to car dashboard, complete mounting hardware, and detailed instructions.

The company will supply additional details on request.

VARNISH REMOVER

A non-inflammable, impregnating varnish remover that rapidly strips all types of impregnating varnish from baskets, jigs, etc. has been announced by *London Chemical Company*, 325 W. 32nd Street, Chicago 16, Illinois.

The new "*Lonco*" remover is designed for fast stripping, at room temperature, of all types of varnishes used in the electrical field. The only equipment necessary is a covered tank large

G. E. RELAYS*



CR27928116A3
SPST—50 Amp Contacts. Operates from 22-30 VDC. Coil Res. 200 Ohms. Completely enclosed in transparent plastic case, which may be removed for adjustments..... **\$1.59**

GE#CR27918116W3
Same as above, except additional terminal brought out from contact arm..... **\$1.74**

GE#CR2791-F100D3
Differential: DPST. Norm. open. Dual coil, 1500 ohms per coil—25 Ma. Operating Current..... **\$2.25**

GE#CR2791F100G3
Same as above, except has extra 1A contact. Rated 5 Amp..... **\$2.35**

GE#CR2791D101F3
All Ceramic Insulation. DPDT. Coil 12VDC, 100 Ohms DCR. Contacts designed for fast operation. Rated at 5 Amps..... **\$1.25**

GE#CR2791B106J3
3PDT, 5 Amp contacts. Coil rated 22-30VDC, 150 Ohms DCR. Contacts are designed for fast operation, and enclosed by clear plastic cover..... **\$1.35**

GE#CR2791B106C3
SPDT. Dual Contacts will handle 20 Amps. Coil: 18-28VDC 125 Ohms DCR..... **\$1.25**

THESE RELAYS AVAILABLE* IN MFRS. QUANTITIES

DYNAMOTORS

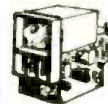
Type	Input Volts Amps	Output Volts Amps	Radio Set
PE86	28 1.25	250 .060	RC 36
DM416	14 6.2	330 .170	RU 19
DM33A	28 7	540 .250	BC 456
PE101C	13/26 12.6 6.3	400 .135 800 .020	SCR 515
BD AR 93	28 3.25	375 .150	
23350	27 1.75	285 .075	APN-1
ZA0515	12/24 4/2	500 .050	
B-19 pack	12 9.4	275 .110 500 .050	MARK 11
D-104	12	225 .100 440 .200	
DA-3A	28 10	300 .060 150 .010	SCR 522
5053	28 1.4	250 .060 14.5 .5	APN-1
PE73CM	28 19	1000 .350	BC 375
CW21AAX	13 12.6 26 6.3	400 .135 800 .020	
PE94	28 10	9 1.12 300 .200 150 .101 14.5 .5	SCR 522

RECTIFIER TRANSFORMERS

Pri: 115V, 60 Cy. Sec: 28V/3.1A, 26V/8.4A
7.3V/14A..... **\$12.95**
Pri: 210/215/220/225 235 235 240V, 60 Cy. 1
Phase. Sec: 11/10/7.5/5VCT @ 35A..... **19.50**
Pri: 115V 60 Cy. Sec: 20V @ 10A..... **3.95**
Pri: 115V 60 Cy. Sec: 8.1 V @ 1.5A..... **1.39**

FILTER CHOKES

Stock	Description	Price
CH-366	20H/3A.....	\$ 6.95
CH-322	.35H/350 MA—10 Ohms DCR.....	2.75
CH-141	Dual 7H/75 MA, 11H/60 MA 5KV DC Test.....	4.69
CH-119	8.5H/125 MA.....	2.79
CH-69-1	Dual: 120H/17 MA.....	2.35
CH-8-28	2 x .5H/380 MA/25 Ohms.....	1.79
CH-776	1.28H/130 MA/75 ohms.....	2.25
CH-344	1.5H/145 MA/1200V Test.....	2.35
CH-33A	10HY/15 MA—850 ohms DCR.....	1.75
CH-917	10H, .450 MA, 10KV TEST.....	12.95
CH-366	20H 300 MA.....	69.55
CH-999	15HY 15 MA—400 ohms DCR.....	1.95
CH-511	6H 80 MA—310 ohms DCR.....	2.45
CH3-501	2x5H 400 MA.....	2.79
CH-188M	5HY 200 MA.....	1.79
CH-303	300H .02A, 2500V Test.....	1.69
CH-932	SWING 9-60H 1.05A, 10KV.....	7.95



BC 605 INTERCOM

Easily converted to an ideal inter-communications set for office, home, or factory. Original. New w/conversion. Diagram..... **\$4.75**

Send M.O. or Check. Shipping Chgo. C.O.D.
COMMUNICATIONS EQUIPMENT CO.
131 Liberty St. Dept. NT, New York City 7, N. Y.

Flying Saucers?



Frankly we don't know if they're fact or fiction . . . but if they are fact it wouldn't surprise us a bit to learn that some extra-terrestrial manufacturer has incorporated SELETRON Selenium Rectifiers and R. R. Co. Germanium Diodes into the design.

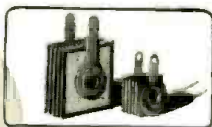
That's because—as pioneers in the field of electronic development—we've had our hand in some of the most difficult projects and met some of the stiffest requirements ever *cocked up!* Making drawing board dreams come true are daily chores at Radio Receptor Co.!

GERMANIUM DIODES

Radio Receptor's new Germanium Diodes feature polarity at a glance combined with simplicity of construction and sound design principles. The tapered shade speeds assembly because operators can see at a glance the correct direction of assembly. Users are enthusiastic over the quality of the product which is currently being used in walkie-talkies, computers, TV sets, tuners and other electronic applications.



Germanium Diode shown enlarged.



SELETRON SELENIUM RECTIFIERS

Seleton Selenium Rectifiers, in both miniature and Industrial types, are in constant demand by an increasingly large number of engineers throughout the world because they are completely dependable under the most grueling conditions. Years of experience have given Radio Receptor Co. a deep insight into the idiosyncrasies of rectification.

Our Germanium Diodes and Seleton Selenium Rectifiers may hold the answer to many of your problems. Radio Receptor Engineers will be glad to study your requirements and submit their recommendations on both of these products.

Germanium Transistors available in limited quantities.

Seleton and Germanium Division

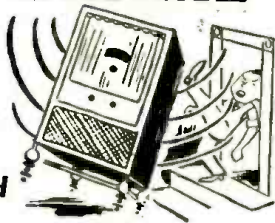
RADIO RECEPTOR COMPANY, Inc.

Since 1922 in Radio and Electronics
SALES DEPT. 251 West 19th Street, New York 11, N. Y. • FACTORY: 84 North 9th Street, Brooklyn 11, N. Y.



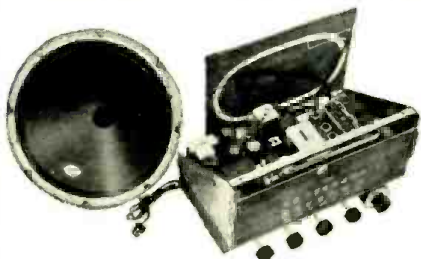
IT'S A SHAME

to throw away that beautiful old Console . . . replace the obsolete radio with a modern, easily-installed



ESPEY AM/FM CHASSIS

(Enjoy Hi-Fidelity Reception)



It is not necessary to spend a large sum of money to modernize your old radio or to become a "High Fidelity" enthusiast. ESPEY chassis provide the Highest Quality at moderate prices.

Fully licensed under RCA and Hazeltine patents. The photo shows the Espey Model 511-C, supplied ready to play. Equipped with tubes, antenna, speaker, and all necessary hardware for mounting. NEW FEATURES—Improved Frequency modulation circuit, drift compensated • 12 tubes plus rectifier, and pre-amplifier 12AT7 tubes • 4 dual purpose tubes • High quality AM-FM reception • Push-pull beam power audio output 10 watts • Switch for easy changing to crystal or variable reluctance pick-ups • Multi-tap audio output transformer supplying 3.2—8—500 ohms.

Write Dept. RN-1 for literature and complete specifications on Model 511-C and others.

ESPEY Makers of fine radios since 1928
TEL. TRafalgar 9-7000
MANUFACTURING COMPANY, INC.
528 EAST 72nd STREET, NEW YORK 21, N. Y.

Compare... prove EMC superiority



model 102

(1000 ohms per volt meter) • 3" SQUARE METER • 3 AC CURRENT RANGES (0-30/150/600 ma.) • Same zero adjustment for both resistance ranges 0-1000 ohms, 0-1 megohms) • 5 DC & 5 AC Voltage Ranges to 3,000 volts • Also 4 DC Current Ranges

\$14.90



model 103

(1000 ohms per volt meter) • 4 1/2" SQUARE METER • 3 AC CURRENT RANGES (0-30/150/600 ma.) • Same zero adjustment for both resistance ranges (0-1000 ohms, 0-1 megohms) • Same Ranges as Model 102 • Also 5 DB Ranges

\$18.75

Model 103-S with plastic carrying strap.....

\$19.25



model 104

(20,000 ohms per volt meter) • 4 1/2" SQUARE METER (50 micro-amperes-Alnico magnet) • Includes carrying strap • 5 DC Voltage Ranges at 20,000 ohms volt to 3,000 V. • 5 AC Voltage Ranges to 3,000 V. • 3 Resistance Ranges to 20 megs • Also 3 AC & DC Current Ranges • 5 DB Ranges

\$26.95

HVT 30,000 Volt Probe for Model 104

\$7.95

— See them at your Jobbers —

EMC

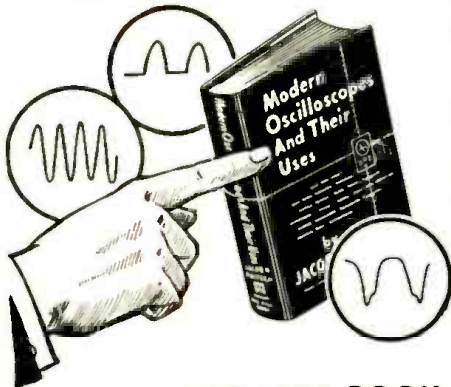
Write Dept. RN-1 for Free Complete Catalogue of these and other instruments.

ELECTRONIC MEASUREMENTS CORPORATION
280 LAFAYETTE STREET • NEW YORK 12, N. Y.

EXPORT DEPARTMENT 136 LIBERTY STREET, N. Y. C. 6, N. Y.

'SCOPES ARE "GOLD MINES"

... when you know how
to use them fully on all
types of service jobs



... AND THIS BOOK
MAKES IT EASY TO LEARN
ALL ABOUT THEM!

No question about it! The cathode ray oscilloscope is the handiest, most useful instrument in radio-TV servicing today. Servicemen who master it get the best jobs—make the most money—work lots faster—and are headed for even bigger things in the future!

MODERN OSCILLOSCOPES AND THEIR USES

By Jacob H. Ruiters, Jr.
of Allen B. DuMont Laboratories, Inc.
326 pages. 370 illustrations. \$6.00

- ✓ When, where, why and exactly how to use them
- ✓ How to interpret patterns
- ✓ How to handle tough jobs easier and faster

Now the oscilloscope won't "stump" you—nor when you have the clear explanations given by this famous book! It contains no involved mathematics—no puzzling and complicated discussions. Instead, it goes right to work explaining oscilloscopes fully and showing you exactly how to use them in lab work and on AM, FM and TV service work—from locating troubles to handling tough reassignment jobs. Each operation is carefully explained including determining where and how to use the scope; making connections; adjusting circuit components; setting the controls and analyzing patterns fast and accurately. About 370 illustrations including pattern photos make things doubly clear.

No other type of specific service method training can mean so much to you in terms of efficiency and greater earning power! Send for it today. See for yourself how this book can help you—before you buy!

READ IT 10 DAYS . . . at our risk!

Dept. RN-13 RINEHART BOOKS, Inc.,
Technical Division,
232 Madison Ave., New York 16, N.Y.

Send MODERN OSCILLOSCOPES AND THEIR USES for 10-DAY EXAMINATION. If I decide to keep the book, I will then remit \$6.00 plus a few cents postage in full payment. If not, I will return book postpaid and owe you nothing.

Name

Address

City, Zone, State

Employer's Name & Address

OUTSIDE U.S.A.—Price \$6.50 cash only.
Money back if book is returned in 10 days.

WHAT'S

New in Radio

For additional information on any of the items described herein, readers are asked to write direct to the manufacturer. By mentioning RADIO & TELEVISION NEWS, the page and the issue number, delay will be avoided.

RC OSCILLATORS

Hewlett-Packard Company, 395 Page Mill Road, Palo Alto, California, is currently introducing two new wide-range RC oscillators which are small in size and simple to operate.

The new instruments, Models 200AB



and 200CD, have high stability and quickly resettable tuning circuits. Operation is simplified and only three front panel controls are used. They are small in size, lightweight, and are mounted in an aluminum case with carrying strap for maximum portability.

The Model 200AB, for general audio tests, offers a frequency range of 20 cps to 40 kc. and a full watt output. The Model 200CD, for wide-range measurements at lower power levels, provides constant voltage output from 5 cps to 600 kc.

The company will supply additional details on request.

OIL-FILLED TUBULARS

A complete line of easy-mounting, single-stud tubular oil-filled condensers is now being offered by the Industrial Condenser Corp., 3243 N. California Ave., Chicago 18, Illinois.

The new units are oil-impregnated and filled with Indco Oil "A." Pyroteen filled units are also available. Standard capacity tolerance is +20% -10%. The temperature range with the Indco Oil is -40 degrees to +70 degrees C. and with Pyroteen -70 degrees to +90 degrees C. Power factor is .4% with the Indco Oil and .2% with Pyroteen.

A four-page illustrated catalogue, containing complete data on the new G and H types, is now available from the company.

PUSH-BUTTON SWITCH

Grayhill, 4524 West Madison Street, Chicago 24, Illinois, has developed a new push-button switch which meas-

ures only 1.047 inches from the end of the plunger to the end of the terminal tips. It is 1/2" in diameter at the widest point.

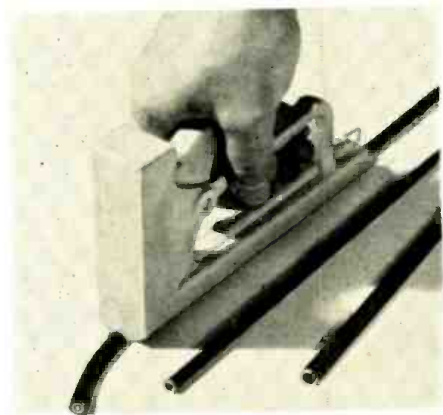
Designated as the Catalogue No. 23-1, the new switch is normally open and has a s.p.s.t. momentary contact arrangement. It is rated at 1/4 amp, 117 volts, noninductive. The bushing, providing single hole panel mounting, has a 5/16-32 thread.

Complete information on this new push-button switch is available from the company. Address letters to Mr. B. Doran.

FASTENING GUN

Of interest to service technicians is the newly-developed, hand-held automatic fastening gun which has been introduced by The Heller Stapler Company, 2153-E Superior Avenue, Cleveland 14, Ohio.

This compact unit is operated by just one hand, leaving the other hand free to guide the cable or hollow tube lines being installed. The force of the machine will drive bands around cables and tubes into hard or soft woods, plaster walls, flooring, joists,



and even mortar joints and cinder or mineralite building blocks.

An extra-size band, with leg lengths varying from 3/16" to 1/2", is used with the new fastening gun.

BASS REFLEX CABINET

Argos Products Co., 310 Main Street, Genoa, Illinois, is now offering a new bass reflex cabinet to the trade.

Featuring a solid mahogany front and matching leatherette top and sides, the new cabinet has a single grille cloth covering the entire front panel, thus concealing the two separate sound openings and giving a more modern appearance.

Known as the "Deluxe Model DBR-15," the new cabinet is designed to accommodate either a 12" or 15" speak-

RADIO & TELEVISION NEWS

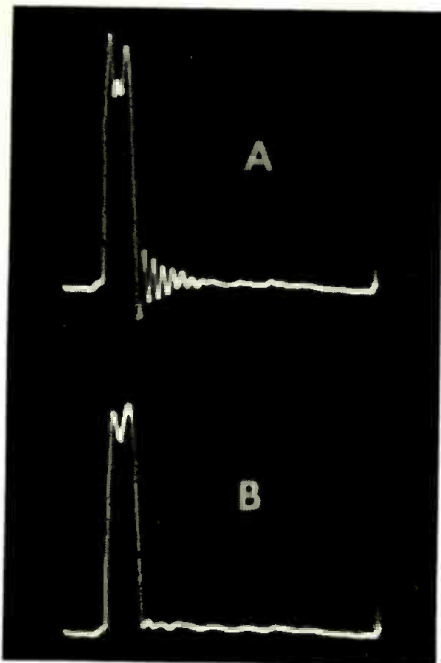


Fig. 15. Horizontal pulse as seen with high-voltage probe at high side of yoke connection. (A) Additional damped wave due to open condenser across half of yoke. (B) Normal waveform with new condenser.

Fig. 14 depicts the waveform associated with a common cause of trouble in the yoke circuits, a shorted neutralizing condenser, and subsequent burnt series resistor across half of the horizontal windings of the yoke. Three principal signs of distortion are evident. 1. The pulse, severely reduced in amplitude, indicates excessive loading of the horizontal deflecting system. 2. The bent baseline is associated with reduced damper-tube conduction, which is concurrent with insufficient pulse power. 3. The rapid decay in pulse shape agrees with other examples of excessive loading across part of the horizontal yoke winding.

If the yoke-neutralizing condenser is open-circuited instead of shorted, it causes no noticeable change in the waveform at the plate of the horizontal-output tube. Open yoke condensers, however, are known to cause "ringing," which is a condition easily recognized by the presence of a series of vertical bars at the left half of the raster. Fig. 15A shows a waveform distinctly associated with this condition. This waveform exhibits the ringing as a damped wavetrain immediately following the pulse. Connection for this test was made by probe contact at the yoke terminal connected to the high side of the horizontal winding.

Although waveforms may differ somewhat with various makes of TV receivers and detailed symptoms may not agree because of circuit or component design differences, high-voltage signal tracing can be universally applied to horizontal-deflection, pulse-type, high-voltage power supplies.

The author wishes to extend a note of appreciation to Mr. B. V. Vonderschmitt for his helpful suggestions.



at Last!



Once you make contact with a jobber or distributor who handles the complete line of Sangamo Type PL "Twist-Tab" electrolytics, you will never again have to "shop around" for odd sizes or capacities. Why? ... because the Sangamo line is the most complete in the industry.

Used by all leading manufacturers of TV sets, Sangamo Type PL "Twist-Tab" electrolytics are exact replacements. They assure long life and dependable performance at 85° C and under conditions of high surge voltages and extreme ripple currents often found in TV applications.



Ask your distributor for a copy of the Sangamo TV Replacement Catalog. It's easy to use and helps you choose the right replacement every time.

Deal with your Sangamo "Headquarters."

Those who know... choose Sangamo



SANGAMO ELECTRIC CO. MARION ILLINOIS

MAKE THIS YOUR HOME FOR IMPORTANT WORK UNDER IDEAL CONDITIONS!

- TEST & INSPECTION ENGINEERS
- ELECTRONIC ENGINEERS
- TV RECEIVER DESIGN ENGINEERS
- FIELD ENGINEERS
- LAB. TECHNICIANS

NEEDED TO WORK ON: YOU BENEFIT FROM high wages, a modern, air-conditioned plant, paid vacations and holidays, group insurance and a good chance for advancement. Housing immediately available in the beautiful suburban and country areas that surround the Bendix Radio plant.

Write, Phone or Wire Mr. E. O. COLE, Dept. O



Bendix Radio

DIVISION OF BENDIX AVIATION CORPORATION
BALTIMORE 4, MARYLAND

WANTED!

• **RADCOM** pays
• highest prices for surplus
• equipment, parts and tubes

- TCS-1 and up
- SCR 274N, SCR-300
- SCR 399 Equipment JB 70, JB 60, BC-939A, BC-610-E, RA-63, EE8, BC-614-E, PE95, PE197, Trailer K-52, Cords, LS-3
- SCR-508 . . . BC-604, BC-603, FT-237, Crystal Sets
- SCR-506 . . . BC-653-A, BC-652-A, DM-40-A, FT-253-A, BC-658-A
- BC312, 342, 348, 1000 Receivers
- SCR522 Equipment, RA-34 Rectifiers

- ARC-1, ARC-3, ART-13
- Transmitters BC 696, R89/ARN-5A MN 62, Test Equipment SCR-211, I-208, BC211
- Selsyns—All kinds
- Generators—GN 45—All kinds
- 5 KW Gas Generators PE 75, PE 95, PE 197
- Plugs and Connectors, Technical Manuals
- Magnetrons 4J-52, 720-AY—Others
- Tubes—Special Purpose, Lots

Telegraph WUX, Newark

Bigelow 2-6666

Always Right With Earl White

RADCOM Engineering Co. 8 Livingston St. Newark 3, N. J.

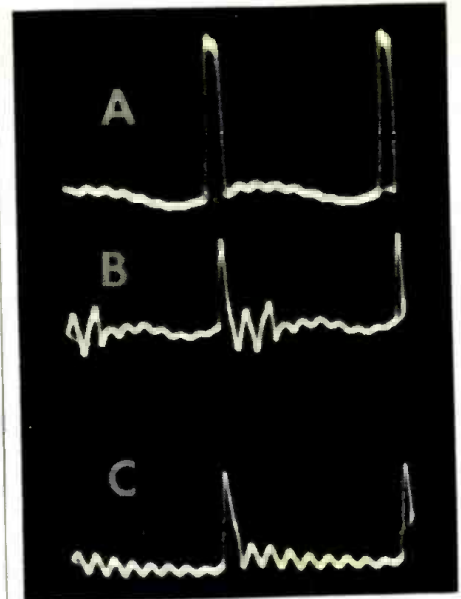


Fig. 13. Waveform at plate of horizontal output tube. Short between horizontal and vertical yoke windings. (A) Low side "H" to "Center V." (B) High side "V" to "Center H." and (C) Low side "V" to "Center H."

DOW SURPLUS

HEADSETS HI-IMP. USED. SPECIAL . . . \$1.95
HEADSETS HS33 LOW-IMP. NEW . . . 5.95
USED . . . 2.95
A62 PHANTOM ANTENNA 10 METER, NEW . . . 1.98
1 SECTION 35MMFD VARIABLE CONDENSER29
HEINEMANN DUAL CIRCUIT R AND 25 AMP . . . 3.48
4 POSITION PUSH BUTTON SWITCH . . . 3 FOR 1.00
A.C. VOLTMETERS 115V 60CY A.C. LINE3
RANGES 120, 130, 150, NEW3
TELEPHONE WIRE W-130, 2-CONDUCTOR 1000 FT. REELS, WEIGHT ONLY 8 LBS. . . . 3.95
GE RELAY COIL & FRAME LESS CONTACTS 12 VOLTS49
3 GANG 365 MMFD PER SECT. CONO9R
4 GANG 365 MMFD PER SECT. COND. . . .9R
4 GANG 150 MFD9R
5 GANG TUNING CONDENSER3.95
RAC FUSE POST, NEW7 FOR 1.00
RESISTOR KIT ASSORTED100 FOR 1.95
POWER RHEOSTATS
STANDARD BRANDS: 5 OHM OR 100 OHMS

TUBES SURPLUS		FUSES	
Part No.	Price	Amp.	Type
HY615	\$0.39	1	8AG
NE48	.29	1/8	3AG
RKR73	.29	1/8	3AG
5561	.29	1	3AG
VR150	.89	2	3AG
1LD5	.69	4	3AG
2121A	4.95	10	3AG
3DP1	1.95	15	3AG
3CP1	3.95	20	3AG
3BP1	3.89	5	4AG
5CP1	4.95	10	4AG
2FP7	1.95	15	4AG
6AC7	.70	20	4AG
6AL5	.54	30	4AG
6BG6	1.59	35	4AG
6CA	.69	40	4AG
6GG	.90	70	4AG
6MH	.59	20	5AG
6N7	.90	40	5AG
6K5	.65	50	5AG
6SN7GT	.79	30	PLUG
6SJ7	.89		Fuse
12K8	.79		.06
41	.59		.50
81	1.69		.25
250R	5.95		.25

EDWARDS BUZZERS
—1892-115 V—60 cycle .05
—15-size 0-12V DC works on 6V less cover. Fine for Code Practice Sets. EA. 10 for \$4.95

CARBON MIKE
RSH2, NEW 1.95
THROAT MIKE3
T-17-D MIKE1.00
NEW MFG. \$9.95
T-17-D MIKE1.25
SURPLUS, GUAR1.25

KEYS
J-5A . . . \$0.49
J-30 . . . 1.25
J-32 . . . 1.25
J-38 . . . 1.25
J-41A89
J-47 . . . 1.25
J-48 . . . 1.25

GP 7 TUNING UNITS, B, C, D, E . . . EA. 2.95

RHEOSTATS		PANEL METERS NEW SURPLUS	
Watts	Ohm	Scale	Price
25	1	3" RD .8B 30F	3.95
25	1	48-52 & 58-62	5.95
25	1	CY	5.95
25	25	3" 0-1 MA. BASIC	3.95
25	75	3" RD 0-1.5VDC	4.95
25	100	3" 0-2 VDC	4.95
25	145	3" RD 0-5VDC	11.95
25	150	3" RD 0-8VAC	3.95
25	370	3" RD 0-15VAC	3.95
25	500	3" 100-0-100 MIL	4.95
25	1000	DC 0-800 MA	4.95
100	5	3" EQ JURE MA	4.95
100	100	2" RD 0-3MIL DC	4.95
150	500	2" RD 0-5 AMP	4.95
150	5000	RF WEST	2.99

Write us for your meter wants. Over 3,000 in stock. Write for Our 16-Page Bulletin.
DOW RADIO, INC.
1759 E. Colorado St. Pasadena 4, Calif.
PHONE: 5Ycamore 3-1196
\$1.50 min. order 25% deposit with orders
Send full remittance to save C.O.D. charges
All merchandise fully guaranteed. Subject to prior sale.

PEN-OSCIL-LITE

Extremely convenient test oscillator for all radio servicing; alignment • Small as a pen • Self powered • Range from 700 cycles audio to over 600 megacycles u.h.f. • Output from zero to 125 v. • Low in cost • Used by Signal Corps • Write for information.

GENERAL TEST EQUIPMENT
38 Argyle Buffalo 22, N. Y.

Triplet Meters

All Brand New In Boxes

Model	Description	Price
341	0-500 ma. RF 3" rd.	56.50
337A	0-1 amp. A.C. 3" sq.	6.50
232	0-10 volts A.C. 2" rd.	6.50
334	0-15 volts A.C. 3" rd.	6.50
221	400 micro amp. voll-ohm scale 3" rd.	5.00
327A	0-1 ma. D.C. 0-100 bad-good scale 3" sq.	6.50
321T	1-0-1 ma. D.C. zero center scale 3" rd.	8.50
327A	0-60 micro amp. D.C. 0-1000 ohm scale 3" sq.	6.50
327A	0-400 micro amp. D.C. 0-25-50-100 A.C.V. scale 3" sq.	6.50
671	0-5 ma. A.C. 0-5-10-25 A.C. ma. scale 3" sq.	6.50
327A	0-35 ma. D.C. 3" sq.	6.50
327A	6.5 ma. (100 M.V.) 0-5-10-25 D.C. amp. scale 3" sq.	6.50
327A	0-1 ma. 0-10 volts D.C. good-bad scale 3" sq.	6.50
327A	150-0-150 volts D.C. 125 ohms, volt 3" sq.	6.50
327A	0-1 ma. D.C. 0-25-50-100 D.C. volt scale 3" sq.	6.50
242T	0-1 ma. D.C. 0-100 scale 2" rd.	5.00
221	0-8 ma. D.C. 0-100 scale 2" rd.	4.50
421A	20 ma. D.C. (50 MV.) 0-1 scale 4" sq.	5.00
431	0-300-600 A.C. volts 4" sq.	6.50
1200	Dual 3" meter—50 MV. D.C. 0-100 D.C. amps. and suppressed 3 to 9 volts D.C.	10.50

Our warehouses contain large quantities of Aircraft Instruments, Dynamometers, Capacitors, Switches, Relays, Hydraulic Parts, Potentiometers, etc.

SEND FOR A FREE CATALOGUE
OR CALL ARMOY 4-8989

Electro Devices
INCORPORATED
247 BROADWAY PATERSON, N.J.

by controls the return trace or flyback time. The repetition rate of the pulse is determined by the 15,750 cycle horizontal-oscillator frequency.

Weaknesses in pulse forming circuits, such as open yoke windings, cause the pulse to become broad at the base and round at the top, as shown in Fig. 9B. Pulses having little change in base width but showing deformed peaks indicate trouble in the resonant pulse-forming circuit. Because the tuning of this circuit depends on the proper operation of a number of components, a change in any one of them, or a change in their distributed capacitance, can be responsible for pulse-peak distortion.

Defects in the yoke, the output transformer, the width control, the high-voltage condenser, the horizontal-output tube, the damper tube, or the high-voltage rectifier tube, or even in the associated leads, can individually be the cause of detuning the pulse-forming circuit. With such defects, the pulse shape suffers as shown in Figs. 9A, 11, 13B, 13C, and 14.

Short circuits between horizontal and vertical yoke windings produce different reactions depending upon the sections involved. Fig. 13A shows little change in pulse shape due to a short at the low end of the horizontal winding. When half of the horizontal yoke is involved, however, rapid pulse decay occurs as pictured in Figs. 9A, 13B, 13C, and 14.

Fig. 14. Waveform at plate of horizontal output tube. Condenser shorted and series resistor across half of horizontal yoke winding subsequently was burned.



tube cathode, shows zero voltage at the base or lower line, the "B+" voltage above it, and boosted "B+" voltage and pulse waveshape at the top. The "B+" voltage alone remains when anything happens to eliminate the high-voltage pulse.

Typical Waveforms

As previously mentioned, deviation from the normal waveform at the plate of the horizontal output tube indicates failure of components in the high-voltage section of a TV receiver. The series of examples that follows is typical of modern high-voltage circuits. An RCA 17T153 television receiver chassis was employed during waveform photography. In receivers with different circuits, some modification of waveforms can be expected.

Although the normal waveform in Fig. 7A is not entirely clear of cross-talk, it is typical of waveforms found to be satisfactory as a reference for signal tracing. Subsequent illustrations each show singular changes from this normal state. The testing arrangement employed to obtain the normal signal indication of Fig. 7A was retained for all other pictures in the group.

Baseline Distortion

Figs. 7B and 7C illustrate the bent baseline caused by reduced damper-tube emission. In the previous exhibit of this condition in Fig. 6, the general bend in base line is lost because of trace expansion. It can be seen, therefore, that it is advantageous to examine at least a complete cycle of the waveform, digressing only temporarily to observe detail by trace expansion.

Fig. 8 indicates loss of pulse amplitude due to damper tube heater-to-cathode leakage. Usually such leakage is quickly checked by tube replacement but may even be traced to paths external to the tube.

Short-circuited or leaky components place undue loading on the entire deflection circuit and result in loss of pulse amplitude and base-line warping. Various degrees of such conditions are illustrated in Figs. 7B, 7C, 8, 10, 12, 13A, and 14.

Distortion of Pulse Shape

Analysis of the cause of a distorted waveform should also include inspection of the pulse shape. The shape of the pulse is closely related to the proper performance of the deflection output components, such as the horizontal output transformer, the yoke, or the damper tube. The pulse-forming circuit which includes these components has a resonant frequency of approximately 65 kilocycles and there-

Fig. 12. Waveform at plate of horizontal output tube. This pattern is obtained when there is a shorted condenser between "B+" and boosted "B+" circuit.



HERE ARE JUST A FEW OF THE BIG VALUES IN THE LATEST 148 PAGE B-A CATALOG

WRITE US IF YOU HAVE NOT RECEIVED IT

BURSTEIN-APPLEBEE CO.
1012-14 McGee St., Kansas City 6, Mo.

Send Free B-A Catalog No. 531.
 My order is attached for items from below.

\$..... enclosed.

Name.....
Address.....
City..... State.....

35 MA.—130 VOLT SELENIUM RECTIFIER

EACH **35c**

Very compact 3/4"x1/2" dia in tubular fibre sleeve, sealed with high temp. wax—easy to mount anywhere with the self supporting 2" tinned wire leads.

An exact replacement for Standard B51 and many other TV boosters and ideal for countless other rectifier needs.

No. 15A1172 10 Lots **29c**
Spec. Ea. **35c** Each

16MFD.—150 WKG. V.—225 P.V. TUBULAR ELECTROLYTIC

EACH **15c**

Top make, hermetically sealed in aluminum tube with kraftboard insulating jacket and 3" tinned wire leads. Compact only 1 3/4"x5/8". Fresh stock—fully guaranteed, a widely used capacity at a crazy Low Price.

No. 14B995 10 Lots **13c**
Spec. Ea. **15c** Each

36 MOLDED PLASTIC TUBULAR CONDENSERS

\$11.70 List Value

\$3.88

Compact, yet with the rugged construction needed to withstand the high temperature in TV, Auto and AC-DC sets. Top quality. Fully guaranteed by the maker as well as B-A.

Kit of 36 all 600 Volt: 4 each .001, .002, .005 and 6 each .01, .02, .05, .1. No. 18A263

Your Cost..... **\$3.88**

Kit of 36 Paper Tubulars all 600 volt assorted as above. \$10.50 List Value. No. 15A389.

Kit of 36..... **\$2.39**

MIDGET POWER TRANSFORMER

EACH **89c**

117 V., 60 cycle AC primary, 110 V. @ 20 MA H.V. Secondary 6.3 V @ .3 amp. for Filament. Fully enclosed, compact size 1 1/2"x1 1/2"x1 1/2"—mtg. ctr. 2 1/8". Color coded leads.

An exact replacement for many popular TV Boosters as well as for use in construction of phono pre-amps, bias supplies, phono oscillators, etc. No. 19C714

10 Lots **79c**
Special Each **89c** Each

As above: 110 V. @ 40 MA H.V. Secondary, 6.3 V. @ 1. amp. for Filament. Size 1 7/8" x 1 3/4" x 1 3/8" — 2 3/8" cts. No. 19C731

10 Lots **\$1.19**
Special Each **\$1.29** Each

6AK5 TUBES

6 FOR **\$4.79**

Made by Sylvania and bears the name "Standard" because they were originally intended for use in Standard Boosters—otherwise the identical 6AK5 you would get if buying tubes bearing the Sylvania name and for which you pay up to \$2.06 Net for each (List Price \$3.90 Ea.). Here you get 6 for little more than the regular price of 2 and believe us—they are perfect—new—fully guaranteed—a popular type widely used in Radio, TV, Boosters, etc.

No. 70A98. Pkg. of Six 6AK5 Sylvania Made Tubes **\$4.79** ONLY

ROTARY SWITCHES

99c

Assortment of TEN—any one of which is worth more than the price of the lot. Anyone experimenting or building will find good use for all. No. 18A436.

Per Ass't of TEN..... **99c**

SWITCH ASSORTMENT

10 FOR **\$1.19**

10 Assorted—toggle, push-button and slide type switches. The use of only several will pay for the lot. No. 18A935. Per Ass't. Only..... **\$1.19**

PAPER & MICA CONDENSERS

99c

25 assorted useable capacities paper tubular, paper molded and mica condensers. Regular values up to 25c each. No. 18B203. A Wonderful Value... **99c**

INSULATED RESISTORS

50 ASS'TD. **\$1.49**

Do not confuse with non-insulated, foreign makes, etc. offered by others. 50 Assorted top quality 1/2 watt insulated resistors in most popular capacities.

17A871. Per Ass't. of 50... **\$1.49**

ASSORTMENT OF 100

Consists of 75-1/2 watt and 25-1 watt insulated top quality resistors

No. 19B796

Per Assortment of 100..... **\$2.49**

A HEAP OF PARTS ONLY 29c

Assembly consists of 140 mmf midget variable, coil socket, dual crystal socket, RF coil socket, 10 contact terminal strip, resistors, etc., neatly assembled on metal chassis with fibre bottom plate 4" x 1 1/4" x 1 1/8" high. Easy to dis-assemble.

No. 18B1044.

Per Assembly Only..... **29c**
10 Lots Each..... **25c**

TRIMMER CONDENSERS

ONLY **39c**

25 Assorted ceramic base mica trimmer condensers popular capacities. Regular cost up to 20c each. You can afford to have several assortments, even if the use is only occasional.

No. 18A156.

PER ASS'T. ONLY..... **39c**

6 FT. BROWN AC CORDS

10 FOR **\$1.69**

All are of U/L approved size 18-2 conductor zip apart cord and top quality plugs.

No. 19B911

Per Bundle of 10..... **\$1.69**

FLEXIBLE MICROPHONE CABLE

Special silver stranding gives extreme flexibility plus unusual tensile strength. Top quality filler, shielding and overall rubber covering. Only 3/16" dia.

No. 28B132.

Per 25' Coil **95c** 100' **\$2.95** Fr.

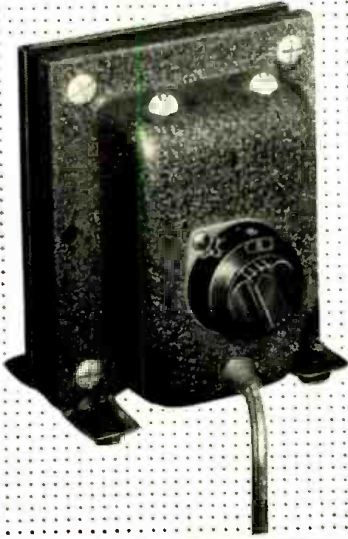
INCLUDE ALLOWANCE FOR POSTAGE—ALL OVERPAYMENTS WILL BE REFUNDED

BURSTEIN-APPLEBEE CO. 1012-14 MCGEE ST. KANSAS CITY, MO.

THE NEW

Regency

VB-1 Voltage Booster*



Get peak performance from your TV set or any electrical device drawing 350 watts or less. This manually operated autotransformer maintains full 117 volt power supply. Insures full size TV picture when low line voltage shrinks picture size.

THE VB-1, \$19.95 LIST

*by the makers of the Regency VHF TV booster and UHF TV converter

Ask any radio parts jobber for further information or write:

I.D.E.A., INC., REGENCY DIVISION
7900 Pendleton Pike, Indianapolis 26
Cherry 2466

TV Signal Tracing (Continued from page 51)

of the horizontal-output tube, its effect can be reduced to an insignificant level by both direct contact of the probe tip to the tube cap and manipulation of the probe body for minimum capacitance pickup. Actually, direct contact lowers the probe input impedance, making it less sensitive to the crosstalk field.

The small short ripple, which follows the pulse in Fig. 2B but is not apparent in Fig. 2A, is a characteristic found at the deflection voltage level. It is referred to by design engineers as the "Spook". (The spook may be noticed on television screens as a fine vertical line very close to the left edge of the raster.)

Hum

Hum also presents a continuous but not too serious problem in high-voltage signal tracing in that it spreads the horizontal lines of a high-voltage waveform vertically, as shown in Fig. 3. Very little hum interference comes through the probe-tip contact because a rather high ratio of high voltage to hum voltage exists at that point. Hum introduced near the handle of the probe, however, mixes with the high-voltage signal after the signal level is reduced by the probe resistor. Fig. 3 shows amplitude expansion of horizontal lines due to hum voltage originating in the field of a *Variac* placed near the probe handle. If the source of hum cannot be removed, movement of the probe to a different angle of approach will usually reduce the hum effect to an insignificant level. As a matter of note, strong video signals or vertical-deflection signals, or either of these mixed with hum, will cause distortion similar to hum alone.

Effect of Reduced Voltages

Low supply voltage (low line voltage, low "B+" voltage, or low boosted "B+" voltage) is another possible cause of waveform distortion, particularly because it affects pulse shape and amplitude. The three exposures in Fig. 5 are expanded trace views showing how pulse amplitude diminishes with decreasing supply voltage. These pictures, obtained by probe contact at the plate of horizontal output tube, show a simultaneous reduction of the wavetrain following the pulse.

Reduction of heater voltage at the damper tube may also cause reduced pulse amplitude along with distortion in the wavetrain as shown in Fig. 6. Reduced cathode emission within the damper tube produces a similar effect.

The use of a d.c. oscilloscope for examination of these waveshapes has one special advantage; three standard conditions of "B" voltage can be rechecked conveniently when desired. The triple exposure in Fig. 4, made with probe contact at the damper-

CODE SENDING RECEIVING SPEED

HIGH SPEED WITHOUT NERVOUS TENSION

REVEALING BOOK shows how "crack" operators develop high speed and proficiency. Learn code for Amateur or Commercial Radiotelegraph License, or improve your sending and receiving.

with the Candler System which develops radio-telegraph experts and code champions.

CANDLER SYSTEM CO. FREE BOOK

Box 928, Dept. 7-A, Denver, Colo.

BENDIX 4-CHANNEL E.C.O.

Channel 1 1050-1700 KC Channel 2 2000-3400 KC Channel 3 3000-4800 KC Channel 4 4370-7000 KC



Unit is front end of TA-12B transmitter by hand switching each channel is a complete oscillator uses a 6SK7 or 12SK7 in each channel by adding an 807 driver and a pair of 807's for a final you have a 50 watt trans. each sec. section is completely shielded and mounted on an aluminum chassis with var. cond. shafts extended ready to add voltage. GOVT. COST OVER \$150.00 NEW. WHILE THEY LAST. For That New Ham Band 3700 KC. \$5.95

McCONNELL'S

3834 Germantown Ave. Phila., Penna. RA 5-6033

L. A. HAM SHACK SELLS FOR LESS

METERS



WESTON • SANGAMO
ALL NEW • ALL D. C. • 2" SQUARE

0-5 Ma \$3.29
0-15 Ma } EACH
0-50 Ma } or
0-100 Ma } 3 for
0-200 Ma } \$9.00
0-300 Ma }
0-500 Ma }

0-2 Ma \$3.95

Mfg's inquiries: lots over 100



"S" METER
Illuminated face. Full scale reading of 5 ma. A standard value for most "S" Meter Circuits. 2 3/4". Black face.

New \$2.49
Amp Meter, No. 60-0-60. New \$1.29

COMMAND AND/OR ARCS TRANSMITTERS and RECEIVERS

3-6 MC Receiver... Used \$8.95—New \$17.95
6-9.1 Receiver... Used 8.95—New 12.95
Triple Receiver Rack... 1.95
V.H.F. ARCS Transmitter or Receiver, Complete w/tubes... Used 24.95

4-5.3 MC Transmitter with tubes \$ 8.95
5.3-7 MC Transmitter with tubes 8.95
7.9-1 MC Transmitter with tubes 9.95
3-4 MC Transmitter with tubes 18.95
28V Receiver Command 0.97
Dynamotors New

MODULATORS

BC-456 with Tubes, less dyn... 2.95
MD-7 Modulator Dynamotor, 28V 2.95
BC-433 Receiver—with tubes... 24.95
MN-26C Compass Receiver... 24.95 \$39.50
MN-26Y Compass Receiver... 24.95 39.50
BC-357 Marker Beacon Rec. W.O. Tube 5.95

Cash with order. Prices subject to change without notice. California orders please include 3 1/2% Sales Tax. Please include approximate postage—Excess will be refunded. What Have You in Surplus? Submit

L. A. HAM SHACK 1306 BOND STREET, at PICO LOS ANGELES 15, CALIFORNIA

CIVIL AIR DEFENSE or 2 METERS

ARC-4, W/tubes. Good, used... \$24.95
522 Trans.-Receiver. W/tubes. Good, used 69.50
Modulation Transformer. BC-375. New 2.49
BC-306 Antenna Loading... 1.95
GP-7 Navy Transmitter: 100 watt master os. Can use on any freq. from 350-9050 kc. by using proper plug-in. With 1 tuning unit... \$17.95
FL8 Filters—A's, B's, C's... New 1.95
FL5 Filters... New .95
Hand Keys—J-38... New 1.19
Heineman Circuit 115 V., 20 amp. 1.39
Breakers 115 V., 5 amp. .97

TRANSFORMERS

12V 24V 2am 110V primary... \$2.95
BC-434 Control... Used—\$1.95 New—\$2.95
Code Tapes for TG-10 15 rolls. New... 7.95
BC-906 Absorption Type Freq. Meter Range 150-225 mc. 0.500 DC Microm... Used \$11.50
Field Phones E-E 8's... Used \$29.50 pr.

DYNAMOTORS

PE103 New Case... \$29.95
PE-73 29V @ 20 amps. output 1000V @ .350 amps... New 9.95
PE-77 14V @ 40 amps output 1000V @ .350 amps... New 24.95
RL-42B Antenna Reel Ass. Less wire... New 9.95

OIL CONDENSERS

Standard Makes—New



2 mfd 600V \$0.49
4 mfd 600V 1.39
1 mfd 1000V .69
3 mfd 4000V 7.95
.5 mfd 2500V 1.49
10 mfd 600V 2.95
2 mfd 2500V 3.95
2 mfd 5000V \$8.95 2 mfd 7500V 29.59

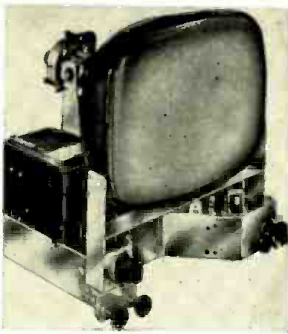
HEAD SETS

HS-30... New \$1.95
HS-23... Used \$2.95
Matching Transformer for HS-30 .69
RG-7U Coax Cable, 97.5 ohms... foot .08
MIKE CHEST SET "F-1" button... New 2.95

Great, New 1953 Model 630-DX CHASSIS

terrific savings-immediate delivery

Includes newest developments—Cascode Tuner—30 Tubes—for 16" to 24" Picture Tube—Wonderful Savings! Adaptable for color and UHF!



The great 630 with all the up-to-date improvements! Wonderful reception on long range up to 200 miles without a booster is yours today at this low-low price. Gives 3-times normal reception. Special super high-gain standard coil tuner gives greater sensitivity, top performance on any channel. Aligned and tested for 5 hours, molded condensers. 4 microvolts sensitivity. FM sound system, horizontal and linear lock and is directly adaptable for color and UHF.

Model 630 DX-1: RMA Guaranteed—Factory Wired, ready to play. Complete with 12" speaker, hardware and knobs.

14950 (less CRT)

FREE: New Trouble Shooting book with any chassis!

SUPER 630 DX-2 TV CHASSIS

- Includes the same features as the 630 DX-1 chassis PLUS the following:
- ★ Keyed AGC level control
- ★ Cornell-Dubilier plastic molded condensers
- ★ 4.5 Megacycle wave trap to eliminate interference
- ★ Phono input & switch which cuts out high voltage supply
- ★ RCA matched 70° cosine yoke & Hi-Voltage transformer
- ★ Four 14 6C16 tubes in video IF strip
- ★ RCA 12" Speaker

Net price Complete **15950** (less CRT)

Universal Mounting Brackets . . . \$5.95

SUPER DELUXE 630-DX-3 CHASSIS with Push-Pull Audio Output.

- Includes same features as 630 DX-2 chassis, PLUS the following:
- ★ Push-Pull audio output
- ★ Frequency response from 80-15,000 cycles at ± 1.5 db.
- ★ Tapped for 4 & 8 ohm speakers
- ★ High quality RCA 12" FM speaker

Net price Complete **16950**

SCOOP AM Radio tuner, made especially for any 630 or 630 DX Chassis. Complete with simple instructions, ready to install, fits in the veil of TV chassis.

ROSE Special **1495** ea.

Great Values	TV PICTURE TUBES	Full Year's Guarantee — Black Face—Brand New, Standard Brands
10BP4 \$19.95	16GP4 \$32.95	20CP4A \$35.95
12LP4A 22.95	16KP4 26.95	21FP4A 36.95
14BP4 23.95	17BP4A 23.95	24AP4 68.95
14CP4 23.95	19AP4A 39.95	27EP4 92.95
16AP4A 32.95		

ORDER NOW FOR IMMEDIATE DELIVERY

The ROSE Company

102 Park Place, Dept. R-1, New York 7, N. Y., CORtlantd 7-6195

WRITE FOR CATALOG! MIN. ORDER: \$5.00. 25% with order, balance C.O.D. Include postage with order. All merchandise subject to prior sale. Prices subject to change without notice. P.O. B., New York City.



NOW!
A
T.V. TEST PATTERN

WHENEVER You NEED one

use
MODEL CB-101
UTL PATTERN GENERATOR
SIMPLE • EFFICIENT • ACCURATE
for a STEADY NON-SHIFTING
VERTICAL or HORIZONTAL
TEST PATTERN

TESTS VIDEO AMPLIFIER LINEARITY and PICTURE TUBE PERFORMANCE
MODULATES YOUR T.V. SIGNAL GENERATOR FOR OVER-ALL TEST OF T.V. RECEIVER

\$29.50
COMPLETE WITH SHIELDED LEADS

HERE'S WHY YOU'LL LIKE IT . . .

- ★ Makes horizontal and vertical linearity, width, height and centering tests.
- ★ Checks relative gain of video stages; isolates defects in video amplifier.
- ★ Tests performance of kinescope directly.
- ★ Checks overall image reproduction when used to modulate TV signal generator.
- ★ Uses sync impulse of receiver to insure steady line or bar pattern.
- ★ No removal of chassis necessary; special leads connect to tube pins.

UNITED TECHNICAL LABORATORIES

Engineers • MORRISTOWN, N. J. • Manufacturers

BUILD 15 RADIOS

AT HOME ONLY
With the New Improved 1953 Progressive Radio "EDU-KIT" **\$19.95**

NOW INCLUDES
SIGNAL TRACER
and
CODE OSCILLATOR



- FREE TOOLS WITH KIT
- ABSOLUTELY NO KNOWLEDGE OF RADIO NECESSARY
- NO ADDITIONAL PARTS NEEDED
- EXCELLENT BACKGROUND FOR TELEVISION
- 10 DAY MONEY-BACK GUARANTEE

WHAT THE PROGRESSIVE RADIO "EDU-KIT" OFFERS YOU

The Progressive Radio "Edu-Kit" offers you a home study course at a rock bottom price. Our Kit is designed to train Radio Technicians, with the basic facts of Radio Theory and Construction Practice expressed simply and clearly. You will gain a knowledge of basic Radio Principles involved in Radio Reception, Radio Transmission and Audio Amplification. You will learn how to identify Radio Symbols and Diagrams; how to build radios, using regular radio circuit schematics; how to mount various radio parts; how to wire and solder in a professional manner. You will learn how to operate Receivers, Transmitters, and Audio Amplifiers. You will learn how to service and trouble-shoot radios. You will learn code. You will receive training for F.C.C. license. In brief, you will receive a basic education in Radio exactly like the kind you would expect to receive in a Radio Course costing several hundreds of dollars.

THE KIT FOR EVERYONE

The Progressive Radio "Edu-Kit" was specifically prepared for any person who has a desire to learn Radio. The Kit has been used successfully by young and old in all parts of the world. It is not necessary that you have even the slightest background in science or radio. The Progressive Radio "Edu-Kit" is used by many Radio Schools and Clubs in this country and abroad. It is used by the Veterans Administration for Vocational Guidance and Training. The Progressive Radio "Edu-Kit" requires no instructor. All instructions are included. All parts are individually boxed, and identified by name, photograph and diagram. Every step involved in building these sets is carefully explained. You cannot make a mistake.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" comes complete with instructions. These instructions are arranged in a clear, simple and progressive manner. The theory of Radio Transmission, Radio Reception, Audio Amplification and servicing by Signal Tracing is clearly explained. Every part is identified by photograph and diagram. You will learn the function and theory of every part used. The Progressive Radio "Edu-Kit" uses the principle of "Learn by Doing." Therefore you will build radios to illustrate the principles which you learn. These radios are designed in a modern manner, according to the best principles of present-day educational practice. You begin by building a simple radio. The next set that you build is slightly more advanced. Gradually, in a progressive manner, you will find yourself constructing still more advanced radio sets, and doing work like a professional Radio Technician. Altogether you will build fifteen radios, including Receivers, Transmitters, Amplifiers, Code Oscillator and Signal Tracer.

The Progressive Radio "EDU-KIT" Is Complete

You will receive every part necessary to build 15 different radio sets. Our kits contain tubes, tube sockets, chassis, variable condensers, mica condensers, paper condensers, resistors, line cords, selenium rectifiers, tie strips, coils, hardware, tubing, hook-up wire, solder, etc. Every part that you need is included. These parts are individually packaged, so that you can easily identify every item. Tools are included, as well as an Electrical and Radio Tester. Complete, easy-to-follow instructions are provided. In addition, the "Edu-Kit" now contains lessons for servicing with the Progressive Signal Tracer, F.C.C. quizzes. The "Edu-Kit" is a complete radio course, down to the smallest detail.

TROUBLE-SHOOTING LESSONS

Trouble-shooting and servicing are included. You will be taught to recognize and repair troubles. You will build and Radio Tester, and learn to use it for radio repairs. While you are learning in this practical way, you will be able to do many a repair job for your neighbors and friends, and charge fees which will far exceed the cost of the "Edu-Kit." Here is your opportunity to learn radio quickly and easily, and have others pay for it. Our Consultation Service will help you with any technical problems which you may have.

FREE EXTRAS IN 1953

- ELECTRICAL AND RADIO TESTER
- ELECTRIC SOLDERING IRON
- BOOK ON TELEVISION
- RADIO TROUBLE-SHOOTING GUIDE
- MEMBERSHIP IN RADIO-TELEVISION CLUB
- CONSULTATION SERVICE • QUIZZES
- TRAINING FOR F.C.C. LICENSE

The Progressive Radio "Edu-Kit" is sold with a 10-day money-back guarantee. Order your Progressive Radio "EDU-KIT" Today, or send for further information.

We pay shipping charges all over the world, if you send check or money order for \$19.95 with your order. On C.O.D. orders, you pay cost of delivery.

PROGRESSIVE ELECTRONICS CO.

497 UNION AVE., RN-14, Brooklyn 11, N. Y.



PREAMPLIFIER-EQUALIZER • MODEL 50-C

THE HIT of the
AUDIO FAIR!

The Fisher Master Audio Control

MODEL 50-C

■ This is the equipment (50-C and 50-A) used to reproduce WQXR's binaural broadcast to the AES Annual Banquet. You can pay considerably more but you cannot buy finer! THE FISHER Master Audio Control can be used with any amplifier. Intermodulation distortion is virtually unmeasurable; complete, professional phonograph equalization settings and tone controls; genuine F-M loudness control; 5 inputs and 5 independent input level controls; cathode follower outputs. Finest preamplifier. Self-powered.

As shown, 50-C: \$97.50

Chassis only, 50-CII: \$89.50

The Fisher All-Triode Amplifier

MODEL 50-A

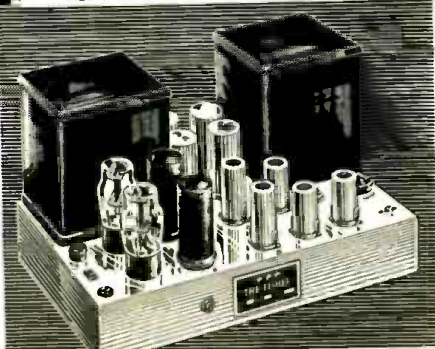
■ THE FISHER Laboratory Standard Amplifier is, beyond a shadow of a doubt, the world's finest all-triode amplifier—and yet moderately priced! FEATURES: High output—less than .3% harmonic distortion at 40 watts (.08% at 10 watts.) Intermodulation distortion below .8% at 40 watts. Uniform response within .1 db, 20-20,000 cycles; 1 db, 5 to 100,000 cycles. Hum and noise better than 98 db below full output. Quality components used throughout. Beautiful workmanship. \$159.50

Write for illustrated brochure

FISHER RADIO CORPORATION

39 EAST 47th STREET • NEW YORK

ALL-TRIODE AMPLIFIER • MODEL 50-A



and sponsors of clubs and other groups can obtain any number of copies of the free booklet by writing to Zole Csolkovits, W9TXZ at the above address.

TRANSFORMER CATALOGUE

Milwaukee Transformer Company, 5231 North Hopkins Street, Milwaukee 9, Wisconsin, has just released a new, 16-page catalogue to the electronic trade.

Designated as catalogue MTR-1, the new publication describes a varied line of transformers, reactors, filter networks, and similar components which have been specially engineered to the rigid requirements of commercial and government agencies.

-30-

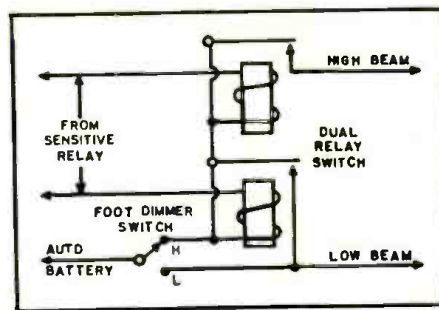
Headlight Dimmer

(Continued from page 35)

second stage because without heater excitation no plate current can flow. The current drain on all the batteries is very low and they should provide almost shelf life. The circuit could be designed to use the auto battery as one of the bias cells as well as for heater power but this is not advisable because the grid voltages are quite critical and the 6 volt system in an automobile varies considerably with engine speed.

A 0.01 μ f. condenser is connected from grid to cathode of each stage to prevent any a.c. voltages from appearing at those points. If this precaution were not taken, the circuit might oscillate and would surely pick up ignition noise and possibly even r.f. It is the combination of C_1 and R_1 in the first stage that gives the circuit the slow reaction to changes of light intensity. This reaction can be slowed even more by increasing the value of C_1 .

The sensitive relay in the plate circuit of the second stage of the amplifier has a 10,000 ohm coil and can be adjusted to close at about 2 milliam-



Wiring diagram for a conventional auto headlight system. See text for details.

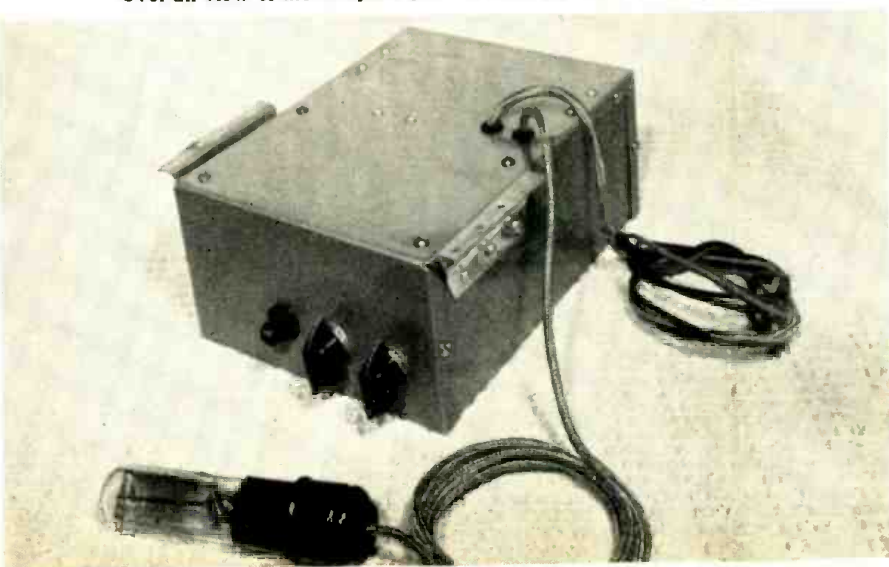
peres. The contacts form a single-pole, double-throw switch. The armature of the relay is grounded. The normally-closed contact goes to the relay switch operating the "high" lights and the normally open contact goes to the relay operating the "low" lights.

The unit was constructed in a small aluminum box 8" x 6" x 4". Care must be taken to mount the sensitive relay in a horizontal position so the vibration of the auto cannot interrupt its operation. Also, the resistance between the grid and cathode of the first stage of the amplifier should be kept as high as possible because a resistance of less than 10 megohms will cause considerable loss of sensitivity. Four wires are brought out of the box—one for filament power, two for the headlight relay switches, and one for the phototube. The wire for the phototube is shielded to prevent any stray pickup. The entire unit is mounted on two aluminum flanges beneath the dash panel of the automobile. The phototube can be mounted behind the windshield in any convenient place.

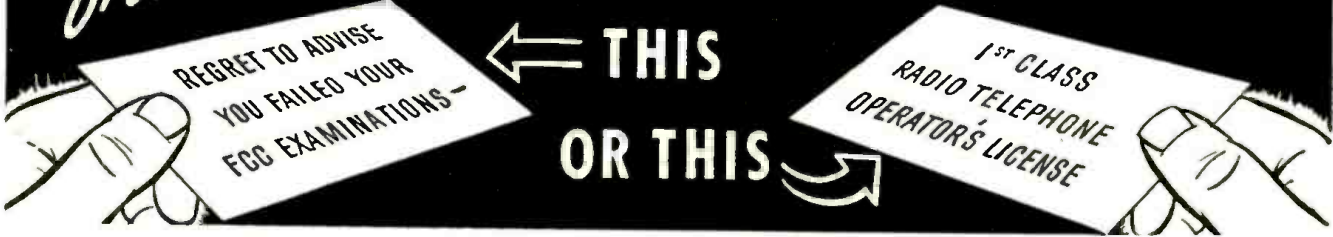
This unit was installed on a 1946 Chevrolet and a dual headlight relay had to be installed on that car. The wiring of the headlight control system would have to be adapted to the particular car, of course. In any case, the foot dimmer switch should be wired to override the photoelectric dimmer as a safety precaution.

-30-

Over-all view of the complete photoelectric headlight dimmer unit.



Six Months from Today Which will YOU hold?



ADD TECHNICAL TRAINING TO YOUR PRACTICAL EXPERIENCE

GET YOUR FCC LICENSE IN A HURRY!

Then use our Amazingly Effective
JOB-FINDING SERVICE

Get this Valuable Booklet **FREE**



TELEVISION ENGINEERING included in our Training and Coaching

HERE IS YOUR GUARANTEE

TELLS HOW —

If you fail to pass your Commercial License exam after completing our course, we guarantee to continue your training without additional cost of any kind, until you successfully obtain your Commercial license, provided you first sit for this examination within 90 days after completing your course.

WE GUARANTEE

TO TRAIN AND COACH YOU AT HOME

IN SPARE TIME UNTIL YOU GET YOUR FCC LICENSE

If you have had any practical experience—Amateur, Army, Navy, radio repair, or experimenting.

TELLS HOW —

Employers make

JOB OFFERS Like These to Our Graduates Every Month

Letter from Chief Engineer, Broadcast Station, North Carolina. "Need men with radio-telephone 1st class licenses, no experience necessary. Will learn more than at average station for we are equipped with Diesel Electric power, transmitting and studio equipment."
Telegram from Chief Engineer, Broadcast Station, Wyoming. "Please send latest list available first class operators. Have November 10th opening for two combo men."
These are just a few samples of the job offers that come to our office periodically. Some licensed radioman filled each of these jobs... it might have been you!

HERE'S PROOF FCC LICENSES ARE OFTEN SECURED IN A FEW HOURS OF STUDY With OUR Coaching AT HOME in Spare Time.

Name and Address	License	Lessons
Lee Worthy 2210 1/2 Wilshire St., Bakersfield, California	2nd Phone	16
Clifford E. Vogt Box 1016, Panama, Florida	1st Phone	20
Francis X. Foerch 38 Bouclet Pl., Bergenfield, New Jersey	1st Phone	38
S. Sgt. Ben M. Davis 317 North Roosevelt, Lebanon, Illinois	1st Phone	38
Albert Scheel 110 West 11th St., Escondido, California	2nd Phone	23

CLEVELAND INSTITUTE OF RADIO ELECTRONICS

CARL E. SMITH, E. E., Consulting Engineer, President
Desk RN-48, 4900 Euclid Bldg., Cleveland 3, Ohio

January, 1953

TELLS HOW —

Our Amazingly Effective
JOB-FINDING SERVICE

Helps CIRE Students Get Better Jobs

Here are a few recent examples of Job-Finding results:

GETS CIVIL SERVICE JOB

"Thanks to your course I obtained my 2nd phone license, and am now employed by Civil Service at Great Lakes Naval Training Station as an Equipment Specialist."
Kenneth R. Leiser, Fair Oaks, Mt. Del., McHenry, Ill.

GETS STATE POLICE JOB

"I have obtained my 1st class ticket (thanks to your school) and since receiving same I have held good jobs at all times. I am now Chief Radio Operator with the Kentucky State Police."
Edwin P. Healy, 264 E. 3rd St., London, Ky.

GETS BROADCAST JOB

"I wish to thank your Job-Finding Service for the help in securing for me the position of transmitter operator here at WCAE, in Pittsburgh."
Walter Koschik, 1442 Ridge Ave., N. Braddock, Pa.

GETS AIRLINES JOB

"Due to your Job-Finding Service, I have been getting many offers from all over the country, and I have taken a job with Capital Airlines in Chicago, as a Radio Mechanic."
Harry Clare, 4537 S. Drexel Blvd., Chicago, Ill.

Your FCC Ticket is recognized in all radio fields as proof of your technical ability

OURS IS THE ONLY HOME STUDY COURSE WHICH SUPPLIES FCC-TYPE EXAMINATIONS WITH ALL LESSONS AND FINAL TESTS.



Get All 3 FREE

MAIL COUPON NOW

CLEVELAND INSTITUTE OF RADIO ELECTRONICS
Desk RN-48—4900 Euclid Bldg., Cleveland 3, Ohio
(Address to Desk No. to avoid delay)

I want to know how I can get my FCC ticket in a minimum of time. Send me your FREE booklet, "How to Pass FCC License Examinations" (does not cover exams for Amateur License), as well as a sample FCC-type exam and the valuable booklet, "Money-Making FCC License Information."
 Tell me about your Television Engineering Course.

NAME

ADDRESS

CITY..... ZONE..... STATE.....

Paste on two-cent postcard or send air mail

FEDERATED OFFERS THE NEW LOW-PRICED RCA JUNIOR VOLTOHMST



FEATURES YOU WANT

- High input resistance on all ranges . . . 11 meg for D.C. . . . 0.2 to 2 meg for A.C.
- Zero centering for discriminator alignment
- Ohms Probe always positive
- Only 2 test leads — Direct probe measures A.C. and Ohms — D.C. probe slips over direct probe for D.C. measurements
- Flat frequency response: 30 Cps to 3 mc. 50 Kc to 250 Mc with WG-264 X-tal diode probe (available as accessory)



WV-77A

COMPLETE WITH TUBES, BATTERY, PROBES & CABLE AND INSTRUCTION BOOKLET. FULLY ASSEMBLED AND CALIBRATED . . . JUST PLUG-IN AND OPERATE!

RANGES

- D.C. volts: 0-3, 12, 60, 300, 1200
- A.C. volts: 0-3, 12, 60, 300, 1200
- Resistance: 0 to 1,000,000,000 ohms in 5 ranges . . . center scale values at 10, 1,000, 10,000, 1.0 meg. & 10 meg.

IN STOCK AT YOUR NEAREST FEDERATED OUTLET

NOW ONLY **\$47.50** NET

Registered U.S. Pat. Off.

Nation's Only Coast-to-Coast Electronics Distributor

Federated Purchaser

- New York City 7, N. Y., 66 Day St.,
- Newark, N. J., 114 Hudson St.,
- Allentown, Pa., 1115 Hamilton St.,
- Easton, Pa., 925 Northampton St.,

ready for distribution, according to word received from the company.

The new 1953 listing describes and illustrates over 30,000 products. This 224-page edition is the largest in the company's history and includes a new 32-page rotogravure section devoted to the components of high-fidelity custom music systems.

Although primarily designed for the industrial and laboratory user of electronic parts, the new catalogue includes sections on public address systems, amateur radio gear, hand tools, books, intercoms, kits, and emergency communications equipment.

The new catalogue is available from the company at 167 Washington Street, Boston 8, Massachusetts.

WRL CATALOGUE

World Radio Laboratories, Inc., 744 West Broadway, Council Bluffs, Iowa, has announced the issuance of a new catalogue covering electronic components.

Comprising 130 pages, the new WRL catalogue lists many new items of interest to the purchasers of all types of amateur and other electronic equipment and components. Copies are available on request.

AUDIO CATALOGUE

Harvey Radio Company, Inc., 103 West 43rd Street, New York 36, New York, has issued a new catalogue devoted exclusively to high-fidelity audio equipment.

Designated as Catalogue No. 54, this new 36-page publication lists hundreds of items for the audiophile. Included are AM-FM chassis and tuners, amplifiers, baffles, cabinets, cartridges, changers, disc recorders, equalizer-preamps, high-fidelity speakers, pickups, phonographs, tape units, etc.

In order to insure maximum usability, the company has not only listed and illustrated each piece of equipment but provided technical data and performance information.

MAGNETIC DOOR LATCH

A catalogue sheet which describes all of the features of its new magnetic door latch is now available from Heppner Sales Company, Round Lake, Illinois.

The product described in the sheet is suitable for either wood or metal doors, retains its magnetic properties, and since it incorporates no working parts, will last indefinitely.

HAM BOOKLET

The Allied Radio Corporation, 833 West Jackson Boulevard, Chicago 7, Illinois, in cooperation with the ARRL, is distributing a free booklet to radio clubs, radio classes, and all other groups of radio or electronic students or hobbyists.

The booklet, "You Can Be There," is a dramatic story of the romance of amateur radio and the thrills that come with the hobby of operating a ham station.

Instructors of radio classes, officers

RADIO & TELEVISION NEWS

Standard R.M.A. Warranty	TUBES	Overnight Air or P.P. Service			
0A2	5.95	6AN5	2.00	310-A(WE)	5.95
0B2	1.10	6C4	.49	408-A(WE)	2.75
1N23-A	2.45	6J6	.50	717-A	.98
1N23-B	3.70	7C30	85.00	805	2.50
1N34	.54	12A6	.65	807	1.59
1N34-A	.75	12AU7	.69	806-A	1.55
1N54	.89	C85	Mytron C.R.	872-A(GE)	3.75
2C43(GE)	15.95	Tubes	1616		.74
2E24	2.75	17BP4A	24.75	1622/6L6M	1.95
2E30	2.19	20CP4A	38.50	1625	.39
4X150-A	27.50	21EP4A	38.50	5654	2.00
5FP7	1.95	250-TM	18.75	5692 (RCA)	7.95
5U4-C	.55	304-TM	7.00	9001	1.35
5X4-G	.85	304-TL	8.75	9004 (RCA)	.39
6AK5	.75				

500 other types stocked at similar savings

Current (Continuous)	18/14 Volts	36/28 Volts	54/42 Volts	130/100 Volts
1 Amp.	\$1.35	\$2.15	\$3.70	\$7.50
2 Amps.	2.20	3.60	5.40	10.50
2 1/2 Amps.	...	...	6.00	13.00
4 Amps.	4.25	6.75	10.25	...
5 Amps.	4.95	7.95	12.95	25.25
6 Amps.	4.75	9.00	13.50	33.00
10 Amps.	6.75	12.75	20.00	40.00
12 Amps.	8.50	16.25	25.50	45.00
20 Amps.	13.25	25.50	39.00	79.50
24 Amps.	16.25	32.50	45.00	90.00
30 Amps.	20.00	38.50	...	...
36 Amps.	25.00	48.50	...	...

- New, Selenium Rectifier Transformers
- 115V. PRI.—36V. 50 amp second XFMR. . . \$39.95
- 115V. PRI.—5V @ 190 Amp. SEC. . . \$59.95
- 115/230V. 60 cy. PRI. SEC.: 1.5, 30.5, 33.5, and 36.5V. @ 4 AMPS. Herms. sealed. . . \$65.50
- New Selenium Rectifier Chokes
- 4 Amps.—.07 hy.—6 ohm. . . \$7.95
- 12 Amps.—.01 hy.—1 ohm. . . \$14.95
- 24 Amps.—.04 hy.—.025 ohm. . . \$29.95

We can manufacture other Selenium Rectifiers, Selenium Rectifier Supplies, XFMRs., & Chokes.

SDLA HEAVY-DUTY PLATE TRANSFORMER.
PRI: 200, 220, 240 volts—60 cy.
SEC: 700-0-700 @ conservative 200 MA. 5"X8"X 6 1/2"—NEW—WT. 10 lbs. Special @ **\$17.50**

• CARTER DYNAMOTORS 6 V DC Input—500 VDC Output @ 150 MA. Only 7" X 4" X 3" **\$28.00**
In Orig. Mfr's Cartons. Only.

• AR-11—SUPERHET RCVR. & 50 WATT XMTTR w/ built-in 110 vac pow. supply. Unit 12"X10"X5" for 20, 40, & 80 meters. Brand New. **\$99.50**
A complete station for only.



136 Liberty Street, N. Y. 6, N. Y. REctor 2-2562.
Terms: 25% with order, balance C.O.D.—Send a few cents for postage—All merchandise guaranteed. F.O.B. N.Y.C. Remember, you may order tubes not listed!

ELECTRONIC'S LATEST TROUBLE-SHOOTER

A compact—complete—circuit analyzer



ONLY **\$24.95**

THE AMAZING TV SERVISSET

Model E-C (Pat. Pending)

A precision engineered professional quality electronic test instrument. Ideal for field or bench servicing of Radio, Television, Radar, Communications gear, etc.

Now—Quickly—Conveniently—At Low Cost

CHECKS: sync, sweep, video, audio circuits, TV high voltage supplies (DC, RF, or Pulse), low voltage supplies, coils, condensers, resistors, tubes, trans-formers, speakers, etc. Will localize trouble to a particular stage, determine defective component and can actually be clamped in circuit to restore circuit operation temporarily in 80% of component or tube defects. Ideal for locating and eliminating inter-mittents.

SPECIFICATIONS:

RF & AF Signal Tracer, RF & AF Signal Injector, AC & DC Voltage Indicator 0-60/550/20,000, OC Polarity Indicator 60/550/20,000 volts, Lo ohms 0-5, Hi ohms 0-500k-20 megohms, Tests Condensers .00025-pacitance Sub ranges .01-1 & 4-40 mfd., 3 Resistance Sub ranges 50-500 ohms, 5k-25k, 100k-1 meg.

Will complement your existing equipment and will outperform other testers costing many times more.

A MUST FOR THE MODERN TV AND ELECTRONICS SERVICE ENGINEER.

Comes in handy cloth pouch, complete with all accessories including ALNICO phone, TV high voltage adapter, phone extension cord, test lead, Kippson adapter, and complete detailed Instruction Manual, disclosing latest TV trouble-shooting techniques.

Be sure to ask for and see SERVISSET at your distributor or send today for complete information and name of your local distributor.

LEE ELECTRONIC LABS., INC.

233 Dudley Street Boston 19, Mass.

New RADIO COURSE only \$2.50



MADE MONEY FIRST WEEK
 "You should get more money for your Course. The first week I studied it, I made \$10.00 repairing sets. I built my own test outfit from details given in this course. I have repaired 100 radios to date."
 Signed: *Robert C. Hammel,*
 120 W. 13th, Davenport, Iowa.



COMPLETED IN 8 WEEKS
 "I am very satisfied with the course. When I was at the twelfth lesson I started repairing radios. It took me two months to master your course." From a letter written by *Roger Lanlois,* 1679 Poupart St., Montreal, Canada.



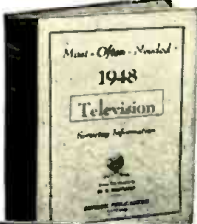
MODERN, UP-TO-DATE
 "Your course is modern and up-to-date. There is not one page in the whole course which anyone can afford to miss. Your course started me on the road to a well paid job and has repaid me many times." *Charles Alspach,* 433 Elm St., Reading, Pa.

AMAZING BARGAIN OFFER

Here is a practical home-study course that will teach you how to repair all radio sets faster and better. These newly reprinted 22 lessons cover all topics just like other correspondence courses selling for over \$150.00. Our amazing offer permits you to obtain the course complete for only \$2.50, nothing else to pay. Easy-to-follow, well illustrated sections on test equipment, circuit tracing, alignment, F.M., use of oscilloscope, amplifiers, and every other topic needed to be an expert in radio repairing. Trouble-shooting hints, circuits, short cuts, service suggestions, new developments. Send coupon today, and use the complete course at our risk. Satisfaction guaranteed. All 22 lessons, in large manual form, + self-testing questions, **\$2.50** complete, your cost only.....

INTRODUCTION TO TELEVISION

These practical lessons making up this course-book are easy to follow and apply to actual radio jobs. Use this training to get ahead in radio and as an introduction to television. Hundreds of radio facts that puzzled you will be quickly cleared up. You will find yourself doing radio repairs in minutes instead of hours — quickly finding faults or making needed adjustments. Every new radio development of importance and thousands of time-saving radio facts are packed into this complete course-manual. For example, there is a large lesson on servicing F.M. sets and another full lesson on audio amplifiers. Use coupon below to order Course for 10-day examination in your own home. Look over the material, read a few lessons, apply some of the hints. Then decide to keep the lessons at the bargain price of \$2.50 (full price), or return the material and get a cash refund. (Offer may be withdrawn at any time.)



Supreme Radio & TV Manuals

Your complete source of all needed RADIO and TV diagrams and service data. Most amazing values. Still sold at pre-Korean prices. Only \$2 for most volumes. Every Radio manual contains large schematics, all needed alignment facts, parts lists, voltage values, trimmers, dial stringing, and service hints. Each TV manual is a practical treatise on servicing the year's sets, with giant blueprints, patterns, waveforms, hints, charts, suggested changes. See coupon at right for a complete list of these low-priced manuals.

Supreme Publications

Sold by All Leading Radio Jobbers

NO-RISK TRIAL ORDER COUPON

SUPREME PUBLICATIONS, 3727 W. 13th St., Chicago 23, ILL.

Radio Diagram Manuals

- New 1952 Manual, \$2.50
- 1951 Radio
- 1950 Manual
- 1949 Radio
- 1948
- 1947
- 1946
- 1942
- 1941
- 1940
- 1939
- 1926-1938 Manual, \$2.50

EACH \$2.50
PRICED AT ONLY \$2
EACH

Send Radio and TV manuals checked at left and below. Satisfaction guaranteed or money back.

- Complete RADIO COURSE (22 lessons +) \$2.50
 - 1952 Television Manual, \$3.
 - 1950 Television Manual, \$3.
 - 1948 TV, \$3.
 - 1951 TV, \$3.
 - 1949 TV, \$3.
 - 1947 TV & FM, only \$2.
- I am enclosing \$..... Send postpaid.
 Send C.O.D. I am enclosing \$..... deposit.

Name:
 Address:



DON'T BUY BEFORE CHECKING STEVE-EL'S PRICES!

NEW IMPROVED 1953 630 TV CHASSIS

now only **\$146.50**

FEATURES: Manufacturer licensed under RCA patents • 30 tube TV receiver (including 3 rectifiers) • FREE replacement on defective tubes and parts • Full channel coverage • Discriminator-type FM sound system • Improved picture brilliance • AFC horizontal hold • Keyed AGC • Stabilized vertical hold • 3 stage sync separator and clipper • Automatic brightness control • 4 Mc band width • High-Ray tube sizes and types. 16", 17", 19", 20" and 24" Tubes. Perfect for Fringe Area Reception.—Will work where most sets fail to operate.

With Hi Gain CAS-CODE Tuner, RCA Hi-Fi 12" Speaker, all knobs and hwre. **\$146.50**

630 DF Chassis—Extra power for fringe areas. No need for booster or complicated antenna ... **\$161.50**

Cathode Ray chassis mounting brackets for above \$1.05

SPECIAL TUBE SALE!

FULLY GUARANTEED—INDIVIDUALLY BOXED tubes at sensational low prices. Stock up now! Quantities limited!

1B3GT...\$63	6B06...\$76	6V6GT...\$46	12SL7...\$57
1U4...\$48	6BQ7...\$86	6W8...\$43	12SN7...\$44
1X2...\$48	6CB6...\$48	6W4...\$44	12SQ7...\$42
5W4GT...\$46	6F6GT...\$49	6W6...\$52	19T8...\$64
5Y3GT...\$29	6L6E...\$89	6X4...\$34	25B06...\$77
6A7...\$62	6SA7...\$52	7X7...\$62	25W4...\$48
6AG5...\$59	6SG7GT...\$49	12AT6...\$48	25Z6...\$48
6AK5...\$114	6SK7...\$49	12AU6...\$48	25Z6...\$42
6BC5...\$58	6SN7...\$52	12AU7...\$56	35C5...\$57
6BE6...\$48	6SN7...\$54	12AV6...\$52	35L6...\$48
6BG6...\$121	6SQ7...\$42	12AZ7...\$41	35Z5...\$33
6BH6...\$62	6T8...\$74	12BA6...\$47	50L6...\$48
6BJ6...\$53	6U6...\$57	12SA7...\$52	80...\$38
		12SK7...\$49	

TV PICTURE TUBES

10BP4...\$17.95	16GP4...\$26.00	19AP4...\$31.40
12LP4...\$19.95	16HP4...\$19.95	20CP4...\$32.00
14BP4...\$19.95	16KP4...\$23.40	21EP4...\$34.40
16AP4...\$26.40	17BP4...\$23.40	24AP4...\$59.60

All brand new—standard brands

GUARANTEED FOR ONE FULL YEAR!

TAPE RECORDERS

Welcor 210.....	\$144.50
Pentron 9T3C.....	117.50
Tape Master PT-125 Recording Unit.....	89.50
SA-13 Power Amplifier and Speaker.....	69.50

FREE! FREE!

Write for latest catalog of hundreds of "rack bottom" values!

STEVE-EL ELECTRONICS CORP.

VISIT OUR NEW STORE

Dept. N-1 61 Reade St., New York 7, N. Y. COrlandt 7-0086

TV PROBLEMS?

GRAYBURNE
gives you **EFFECTIVE**
answers!



TV-IF SIGNAL BOOSTER

An added stage of TV-IF wired up in Adaptor form. Produces excellent results in near-fringe areas and where a modest gain is required.

- Overcomes roof antenna restrictions
- Amplifies signal over 20% on all channels
- Eliminates or minimizes "snow"
- No switches or external connections
- Simple, permanent, easy installation inside cabinet

Write for free Technical Bulletin "Plug-In TV Booster" by Jack Grand.
Model TSB-1 List \$995,
plus extra tube required.

CLEAR-PIX TV INTERFERENCE FILTERS

4 Popular, Fast-Selling Models—reject 4 most common interference causes.

Incorporate scientifically designed and proved circuits. Have high rejection efficiency. Extremely simple to install—less than one minute.

Model	Interference Rejected
CPF	FM
CPD	Diathermy
CPI	Ignition
CPH	Amateur (21 mc)

Low Cost: List \$198
each.



DUAL TUNABLE TV INTERFERENCE FILTERS

for Professional Installations and where Interference is intense.

Precision-engineered. Incorporate a dual set of coils and condensers center-tapped to ground for greater efficiency. Very easy to install and balance.

Model	Interference Rejected
SW-10	10 meter band
SW-20	20 meter band
DT	Diathermy
FM	FM

List \$275 each

BE PREPARED! Keep 1 of each type of Filter in your Tool Kit at all times!

For complete Grayburne Catalog and name of your nearest distributor, write NOW to Dept. Z

GRAYBURNE

Grayburne means Quality Electronic Components

GRAYBURNE CORPORATION
103 Lafayette Street, New York 13, N. Y.

106

MANUFACTURERS' LITERATURE

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO & TELEVISION NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented.

UTC TRANSFORMERS

United Transformer Company, 150 Varick Street, New York 13, New York, has released a new catalogue which lists over 600 stock items covering the entire scope of electronic transformer applications.

The new publication is fully indexed, giving complete technical descriptions of all items. In addition, a center insert gives circuit details for high-fidelity amplifier equipment.

Transformers for high-fidelity systems, hermetically sealed units for military applications, special transformers for hams, and a replacement line are covered along with listings of high "Q" filter coils and complete audio filters.

CRYSTAL CATALOGUE

James Knights Company of Sandwich, Illinois, has issued a completely new catalogue covering its line of stabilized quartz crystals.

The catalogue lists 45 different crystals for use in communications equipment, laboratory instruments, medical and industrial equipment, etc.

Development engineers and others will find the new catalogue of interest. Copies may be obtained by writing the company direct.

SOUND SYSTEMS

Mark Simpson Manufacturing Co., Inc., 32-28 49th Street, Long Island City 3, New York, has issued its new general catalogue of 1952, revising its catalogue No. 50.

A complete line of school and institutional sound systems using control amplifiers with microphone, radio, and phonograph inputs for up to 40 locations is only one of the many groups of modern equipment featured.

Other items listed include high-power amplifiers, high-fidelity amplifiers, transcription equipment, mobile, and preamplification equipment.

ALLIED'S 1953 CATALOGUE

Allied Radio Corporation, 833 W. Jackson Boulevard, Chicago 7, Illinois, has released its 1953 general catalogue which contains 236 pages—the largest catalogue in the company's history.

Among the 18,000 items listed in the new publication are sound systems, television chassis, boosters, rotators and u.h.f. converters, table model and portable radio sets, professional and home recording equipment, public address amplifiers and complete systems, amateur receivers, ham transmitters and other gear, industrial v.h.f. radio and radiotelephone

equipment, as well as tools, books, hardware, kits, and other supplies.

The high-fidelity section has been expanded to include many units for custom installation: amplifiers, tuners, changers, speakers, preamps, and cabinets.

Copies of the new catalogue No. 131 are available on request to the company.

SOUND EQUIPMENT

A new eight-page, two-color catalogue illustrating and describing the fifteen 1953 models of *Califone* phonographs, transcription players, and sound systems has just been released by *Califone Corporation*, 1041 North Sycamore Avenue, Hollywood 38, California.

Accompanying the catalogue is a combined specification and price sheet for easy selection of equipment to fit the customer's requirements.

Copies of the new publication are available from the company direct.

ANNIVERSARY CATALOGUE

Burstein-Applebee Co., 1012-14 McGee Street, Kansas City, Missouri, is currently distributing copies of its 25th Anniversary catalogue, No. 531.

This 148-page catalogue lists thousands of parts and equipment items for dealers, technicians, schools, broadcasters, public utilities, experimenters, factories, engineers, laboratories, and hams.

A comprehensive index has been included to facilitate locating the part or unit desired.

Copies of the new catalogue are available without charge on request.

TRADE-IN GUIDE

Publication of the first television set trade-in guide, the "1953 NARDA TV Blue Book," has been announced by the *National Appliance Guide Company*, 2132 Fordem Avenue, Madison 1, Wisconsin.

The manual provides authentic, detailed, up-to-the-minute information on all popular TV sets of over 30 leading manufacturers and covers models produced from 1947 through 1952. The annual guide tells the dealer how to evaluate trade-ins, how to service them, and how to resell them to his and his customer's satisfaction.

Details on how copies of this manual can be obtained will be supplied by the company on request.

RADIO SHACK CATALOGUE

Copies of *Radio Shack Corporation's* 30th Anniversary Catalogue are now

RADIO & TELEVISION NEWS

It's New!

It's Better!

Here's Proof!

Now, we have finally found the answer in your V8 antenna. Servicemen tell us its the best antenna we have ever had. It really does the job because it pulls in stations we could not get before.

Here's How
the new RADIART
TELEVISION
V*8 ANTENNA
Solved Mr. Hartong's
Fringe Area Headaches



SEE FOR YOURSELF
Try One On Your
Toughest Location



THE RADIART CORPORATION CLEVELAND 13, OHIO

VIBRATORS • AUTO AERIALS • TV ANTENNAS • ROTORS • POWER SUPPLIES

January, 1953

Burroughs

TELEPHONE 3-0273

Radio, inc.

DISTRIBUTORS OF
ELECTRONIC EQUIPMENT
WHOLESALE ONLY
711 SECOND STREET, N.W. CANTON 3, OHIO

October 7, 1952

Mr. William Schoneberger
Jobber Sales Manager
Radiart Corporation
3455 Vega Avenue
Cleveland, Ohio

Dear Bill,

Just a word to let you know how we feel about your new V8 antenna.

As you know, our reception problem down here is difficult because of the fringe area position. Believe me, when I tell you almost everything that has come along has been tried.

Now, we have finally found the answer in your V8 antenna. Servicemen tell us its the best antenna we have ever had. It really does the job because it pulls in stations we could not get before.

Attached is another reorder, please keep them coming.

drh/iw

Sincerely yours,
BURROUGHS RADIO INC.

D. R. Hartong
D. R. Hartong

STANDARD BRANDS **TUBES** INDIVIDUALLY BOXED
 STANDARD WARRANTY **New Low Prices** BRAND NEW!!

024	..S	.54	5Y3G	..S	.39	6BA6	..S	.54	6F6GT	..S	.54	6W4GT	..S	.54	12SQ7GTS	.63	
1B3GT	..	.87	6AB4	..	.61	6BA7	..	.76	6H6	..	.57	6W6GT	..	.65	19BG6G	1.75	
1L4	..	.65	6AC7	..	.98	6BC5	..	.65	6J5GT	..	.54	6X4	..	.49	19T8	..	.87
1R5	..	.65	6AC5	..	.64	6BE6	..	.57	6J6	..	.76	6X5GT	..	.43	25AV5GT	1.05	
1S4	..	.76	6AG7	..	1.05	6BF5	..	.69	6K6GT	..	.54	12AT6	..	.47	25BQ6GT	1.08	
1S5	..	.64	6AH6	..	1.05	6BG6G	..	1.86	6L6GA	..	1.05	12AT7	..	.76	25L6GT	..	.54
1T4	..	.64	6AK5	..	.94	6BH6	..	.61	6SA7GT	..	.72	12AU6	..	.54	25Z6GT	..	.49
1U4	..	.69	6AL5	..	.54	6BJ6	..	.61	6SC7	..	.76	12AV7	..	.88	35B5	..	.61
1U5	..	.61	6AQ5	..	.54	6BL7	..	.98	6SF5	..	.58	12B6	..	.54	35C5	..	.61
1X2A	..	.79	6AQ6	..	.49	6BN6	..	.72	6SH7	..	.65	12BA6	..	.54	35L6GT	..	.61
3Q4	..	.75	6AR5	..	.54	6BQ6	..	1.08	6SJ7	..	.54	12BE6	..	.58	35W4	..	.41
3Q5GT	..	.72	6AS5	..	.62	6BQ7	..	1.08	6SL7GT	..	.65	12BH7	..	.82	35Z5GT	..	.39
3Q4	..	.65	6AT6	..	.46	6C4	..	.49	6SN7GT	..	.73	12SA7GT	..	.62	50B5	..	.61
3V4	..	.65	6AU6	..	.54	6C5	..	.57	6SQ7GT	..	.49	12SH7	..	.49	50C5	..	.61
5T4	..	1.31	6AV5GT	..	1.09	6C8	..	.65	6SR7	..	.49	12SK7GT	..	.63	50L6GT	..	.59
5U4G	..	.54	6AV6	..	.46	6CD6G	..	1.82	6T8	..	.87	12SN7GT	..	.73	117Z3	..	.54
5V4G	..	.98	6B4G	..	.98	6E5	..	.76	6V6GT	..	.57						

Many other types equally low priced—include all your tube needs with your order.
 One of the largest stocks in the country!

Min. Order \$25.00. Terms: 25% with order, balance C.O.D.
 All prices subject to change without notice, F.O.B. New York City. Mail order division.

TeleVision Materials Corp.
 125 Cedar St., New York 6, N. Y. • COrlandt 7-4307

RADIO Surplus Buys

CRYSTALS



in FT 241-A Holders—1/2" Pin SPC. Marked in 5th OR 72nd Harmonic MC Freq. Listed below by fundamental frequency with fractions omitted.

500 KC Crystals. ea. **\$1.95**
 1000 KC Crystals. ea. **\$3.95**

370	407	444	476	509
372	408	445	477	511
374	409	446	479	512
375	411	447	480	513
376	412	448	481	514
377	413	450	483	515
379	414	451	484	516
380	415	452	485	518
381	416	453	486	519
383	418	454	487	520
384	419	455	488	522
385	420	456	490	523
386	422	457	491	525
387	423	458	492	526
388	424	459	493	527
390	425	461	494	529
391	426	462	495	530
392	427	463	496	531
393	429	464	497	533
394	430	465	498	534
395	431	466	501	536
396	433	468	502	537
397	434	469	503	538
398	435	470	504	540
400	436	472	505	
401	437	473	506	
402	438	474	507	
403	440	475	508	
404	441			
405	442			
406	443			

\$1.00 Each

10 for \$8.00. Postpaid

FOLLOWING CRYSTALS AVAILABLE IN FT 243 HOLDERS 1/2" PIN SPACING

3500	7150	8075
3590	7350	8200
6075	8006.7	
6140	8025	
6150		
7075		

\$1.00 EACH

11 for \$10.00 Postpaid

PLEASE ENCLOSE FULL AMOUNT WITH ORDER
 QUANTITIES AVAILABLE
 WRITE FOR YOUR REQUIREMENTS

C & H SALES CO.

Box 356-JT, East Pasadena Sta. • Pasadena 8, Calif.

ARKAY
 world's finest radio kits
 Write for free Brochure
 RADIO KITS, INC., 120 Cedar St., N. Y. 6

THE AUDIO PERFORMANCE OF



ALL TRIODE HIGH QUALITY
AUDIO AMPLIFIERS
 IS BEYOND DESCRIPTION

Let your Ears
 Pass Judgment



- Nine distinct positions for record playback provide complete bass and treble equalization for best-known recordings.
- Bass effective to 15 cycles results in improved transient response that makes all bass tones sound more natural.

Write for complete technical data, and be sure to listen to the new BROOK at your local dealer's Sound Department.

BROOK ELECTRONICS, INC.
 34 DeHART PLACE, ELIZABETH 2, N. J.

Dept. RA-3

\$20.00 Amplifier
 (Continued from page 45)

The critical point here is that excessive feedback cannot be used, due to the phase shift of the circuits and the transformer, dependent on the instantaneous frequency. The attenuating resistance in the loop has been chosen to develop optimum feedback within the limits of the transformer.

Power was taken from an existing supply, but could as easily have been drawn from a radio or other source. Power supplies are all similar, and any discussion here would be redundant. All that is needed is 350-400 volts at 110-120 ma. The entire circuit is stable, as regards frequency response, and will operate as well with 350 volts as 400, with hardly noticeable loss of power under normal demands.

The cost of all the parts in this amplifier is \$20.00 or less.³ This sum can be flexible since almost endless variation is possible in the actual construction, limited only by the needs and ingenuity of the constructor.

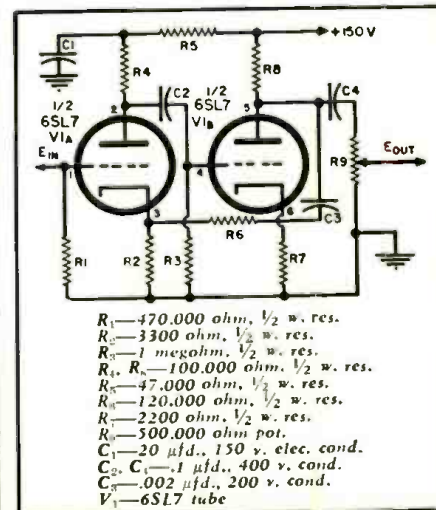
Preamplifier

Because six different preamplifiers tried in the past year have been unsatisfactory, the circuit shown in Fig. 6 was built for use with the amplifier. The preamplifier is quite simple, and without complications. Immediately apparent is the absence of tone controls. Distortion created by tone controls is apparent to most listeners only when all tone controls are bypassed, and the sound is heard through a familiar system. The circuit is designed to develop sufficient voltage to drive the amplifier to peak undistorted power when used with a G-E RPX-040, or similar type, variable reluctance cartridge.

REFERENCES

1. Tele-Tech, January 1952, pages 90-94.
2. Audio Engineering: "An Ultra Linear Amplifier," November, 1951.
3. Allied Radio Corporation; Catalogue No. 127.

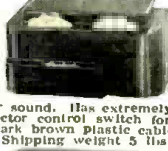
Fig. 6. Diagram of preamplifier designed to be used with the author's amplifier unit.



LOOK TO MCGEE FOR ALL RADIO AND TELEVISION MATERIAL

GENUINE STANDARD COIL T.V. BOOSTER \$11.95 Not Surplus, But Right From the Factory

Latest Model B-51 Standard Coil Television Booster. McGee makes another lucky purchase and as usual, passes the savings on to you. The famous Model B-51, 12 Channel Standard Coil TV booster, which lists for \$15.00, is offered to you for only \$11.95 each. Brand new, factory cartoned and fully guaranteed by McGee. This top quality single stage booster utilizes printed high frequency circuits, for improved performance on all channels. Uses 6AK5 tube. Average gain, 6 to 7 volts on low channels and 5 or 6 on high channels. No distortion of picture or sound. Has extremely off-on and by-passing 300 ohm lead-in set. Modern design, dark brown plastic cabinet, 8" x 14" x 4 1/2". Made for 110 volt, 60 cycle AC operation. Shipping weight 5 lbs. Model B-51. Sale price, \$11.95 each, or buy 2 for only \$22.00.



McMURDO SILVER BOOSTER \$10.95

Sensational value. Continuously variable inductance type tuner, from channel 2, including the FM band, through channel 13. This booster is self powered for 110 volts AC operation. Incorporates a 6J6 tube. Input for 300 ohm TV line and 300 ohm output to the TV set. Single knob tuning. Attractive plastic case. McMurdo-Silver Super Sonic TV-FM booster. Stock No. GH-61. Shipping weight 5 lbs. McGee's terrific sale price, \$10.95 each, two for \$20.00.



1952 MODEL ASTATIC \$19.10

New Astatic "Scanar" TV booster with improvements to match the newer model TV receivers. Minimum noise with maximum gain. Balanced cascaded circuit with 6J6 and 6H07. Input and output for both 72 and 300 ohm Mahogany finished metal cabinet 6 1/2" x 7 1/2" x 3 1/2" high. Model CT-1. Net price \$19.10.

1952 MODEL REGENCY \$19.10

New Regency DB-520 TV booster with exclusive circuit stabilizer and newly designed cabinet only 4 1/2" x 4 1/2" x 1 1/2". Improved circuit with push-pull 6J6 is equal to the best cascade circuits and has higher gain. Matches 72 or 300 ohm. Net Price \$19.10.

14-17-20 INCH CONV. KITS AT SCOOP PRICES 20 IN. CONV. KIT \$29.95

Our 20" conversion kit includes a 6-month guaranteed 20HP4, 20" rectangular blackface picture tube, plus a 14,000 volt G.E. built high voltage flyback transformer, plus a matched 70" built high voltage horizontal gold trimmed plexiglas cosine yoke, plus a 20" rectangular gold trimmed plexiglas mask and suggested diagram. The picture tube is the latest electro-static focus type that requires no focus coil. Shipped via express or truck only. Ship. weight, 40 lbs. Stock No. 20-TP. Net price, \$29.95.

14-INCH CONVERSION KIT \$19.95

Our 14" conversion kit includes an RCA 14" rectangular blackface tube, plus a 14,000 volt G.E. built flyback transformer, plus a matched 70" built high voltage horizontal gold trimmed plexiglas cosine yoke, plus a 14" rectangular gold trimmed plexiglas mask. Offered at the very low price of only \$19.95. Suggested diagram furnished. Ship. weight, 20 lbs. Via express or truck only. Stock No. RC-14X. Net price, \$19.95.

17-INCH CONVERSION KIT \$24.95

Our 17" conversion kit includes a 6-month guaranteed 17HP4 blackface rectangular picture tube, plus a G.E. built 14,000 volt flyback transformer, plus a matched 70" cosine yoke, plus a gold trimmed 17" plexiglas mask, and suggested diagram. The 17HP4 is the latest electro-static focus tube that requires no focus coil. Shipped via express or truck only. Stock No. 17-TP1. Net price, \$24.95.

RED HOT INTERCOM VALUE!

3-STATION INTERCOM MASTER, \$14.95 USE UP TO 3-SUB STATIONS, \$4.49 EACH

A red-hot intercom master value. A full 3 tube, 110 volt AC-volume control. Small compact size, 3 1/2" high. Makes an attractive intercom installation. May be used with from one to three of our 6-47 sub-stations described below. Intercom master is quiet at all times, except when pressing intercom switch, call-back switch at one of the subs is pressed. Net \$14.95. Stock No. KA-3. Master station, less subs. Net \$14.95. Stock No. G-47. Brown plastic sub-station, with call-back switch. May be purchased with or without master station. Shipping weight 2 lbs. Net \$4.49 each. 3 wire plastic intercom cable, 100 ft. \$1.95; 500 ft. \$8.95.



TERRIFIC VALUES IN SPEAKERS AND Baffles

8" PM AND LEATHERETTE Baffle, \$4.95 LOTS OF 10, \$4.75

The finest Leatherette Baffle we have ever offered. Neat self-supporting plastic grill material. Baffle is covered with matching grill. Offered with a good heavy duty 8" Amico V PM speaker with 3.2 ohm voice coil. Stock No. NV-8. Speaker and baffle, \$4.95 ea. lots of 10, \$4.75. Stock No. NV-8. \$2.29 ea. 10 for \$19.95.

12" PM AND WALNUT Baffle, \$9.95 LOTS OF 3, \$8.95

The finest built 12" Walnut plywood wall baffle we know of. Factory cost the famous Juke box manufacturer exceeds \$7.00. We offer with a 12" PM for little more. You pay only \$9.95 in single lots, or \$8.95 in lots for both a 12" Amico V PM with 3.2 ohm voice coil and a beautiful wall baffle. 12" Speaker Baffle combination. Stock No. HS-120. \$9.95 ea. lots of 3, \$8.95 ea. 12" Baffle only. \$6.95-12. \$4.95 each.



COMPLETE RADIO, TELEVISION AND AMPLIFIER KITS AT MCGEE

3-WAY PORTABLE KIT \$15.95

A NEW '52 MODEL
New 1952 Model 3-way personal portable radio kit. Operates on 110 Volts AC-DC or 07 1/2 B batteries. Features 1 1/2 volt self-contained batteries. Leatherette covered case size, 5 1/2" x 5 3/8" x 8 1/2". Receives broadcast 550 to 1650 KC. A conventional 2-gang superhet circuit with 455 KC Iron core IF's. Incorporates the new super gain stick loop antenna. All plated chassis. Lab approved circuit. Matched parts. Price includes circuit diagram, tube diagram, Amico V PM speaker. A factory quality kit. Net price, \$15.95. Shipping weight 1 1/2 lbs. The complete kit, less batteries, \$15.95. 07 1/2 V. B. \$1.59; 1 1/2 V. A. 29c extra.



Build Your Own Phono-Mike Broadcaster \$7.95

Kit Model DE-6R. With this simple kit, you can build a 3-tube phono oscillator that also has a mike input. Will broadcast over any radio within your home, (about 75 feet) from 1000 to 1500 kc. Inputs for crystal mike or crystal phono pickup. Control fades from mike to record. Ideal for home P.A. system, baby listener and home entertainment. A complete kit, including diagram, tube diagram, Amico V PM speaker, DE-6RW, wired and tested. Net price, \$7.95. Crystal mike and desk stand, \$4.95 extra. Concealed microphone unit, only 1 1/2" in diameter and 1/2" thick. Specify hidden mike when ordering. Stock No. T-001. Net. \$3.95 extra.

8-Tube HI-FI Amplifier Kit \$29.95

A complete kit, including tubes, 12AX7, 12AU7, 2-5Y6, 2-6X4, plus rectifier, diode, gram and photos, inputs for radio tuner and any kind of phono pickup (crystal or G.E. variable reluctance) and either crystal or dynamic mike. Output matches 8 ohm voice coil. Twin electronic bass and treble tone controls with range selector switch for either juke box quality with heavy bass response or brilliant symmetric range. Response is to 20,000 cps. 8 tube all triode amplifier kit, complete with tubes. Shipping weight 2 1/2 lbs. Model 7X5. Net \$29.95.

10-Watt HI-FI Amplifier Kit \$14.95

A complete kit of parts including 12AX7, 12AU7, 2-5Y6, 2-6X4, plus rectifier, diode, gram and instructions to build a high fidelity 10 watt amplifier with bass and treble controls. Inputs for radio tuner, crystal and G.E. dynamic phono pickup. Output matches 8 ohms. Response from 50 to 20,000 cps. Straight forward circuit with twin triode gain stages and 2-5Y6 tubes in push-pull. Shipping weight 1 1/2 lbs. Model AP-10R. Ship wt. 8 lbs. Sale price \$14.95.

RCA 201E1 T.V. TUNER \$7.95

Terrific buy on this RCA tuner. We have a limited quantity of the famous original 201E1, 13 channel completely wired and tested TV front end tuners. Ready to connect to your TV video I.F. strip. Offered at a sacrifice. Price was \$14.00. Now only \$7.95 each, with tubes. Each tuner in good condition but has been repaired. Stock No. RCA-13P. TV front end tuner. Converter coil type for separate sound as used in the famous 630 chassis. Complete with 3-6J6 tubes, \$7.95. Specify shaft length desired, either 2" or 4".

RCA 201E-1 T.V. TUNER

Same as pictured above only new—with tubes. Stock No. 2201. Sale Price, \$11.95.

3-TUBE SARKES-TARZIAN T.V. TUNER \$9.95

This popular Sarkes-Tarzian Type 3 tuner is widely used. 13 channel rotary type switch with individually tuned coils. Price is complete with diagram and three tubes: 6C4 osc., 6BH6 R.F. and 6AG5 mixer. Regular factory cost for this price. Each tuner is wired ready to hook up to a video and sound I.F. strip. May be used with either inter-carrier or separate sound I.F. circuits. Has built-on converter coil built in for frequency control. Sarkes-Tarzian TV tuner, with 3 tubes. Net price, \$9.95 each. Specify shaft length, either 2 1/2" or 4 1/4".



RCA PRINTED CIRCUIT T.V. TUNER \$14.95

RCA Printed Circuit T.V. Tuner with 6J6 and 6CB6 tubes. Similar mechanically to the standard coil (same knobs fit). Snap-in channel selector. Has built-in Hall effect V.I. sets. Stock No. RC-A12. 12 Channel Tuner with Tubes. New. \$14.95. Knobs, 59c.

T.V. TUNER FOR EMERSON \$12.95

STOCK NO. SC-947E
For Emerson 650D ETC. Has 2 1/2" insulated shaft and tubes 6BC5-5 filaments in series—shunted to .6 amps. Stock No. SC-947E. Sale Price, \$12.95. Knobs, 59c.

T.V.-RADIO NEWS SPECIAL \$9.95

3 Flybacks and 3 Deflection Yokes for \$9.95. You get 3 deflection yokes, 2-70" yokes, and 3-35" yokes, and 3 horizontal flyback transformers, 2 General Electric 14,000 volt ceramic core 70" and 1 early model Philco. The G.E. flyback cost regularly more than our price for the complete deal. Stock No. 33YK. Ship. weight, 5 lbs. Radio News Special, only \$9.95.

T.V. COMPONENT DEAL #CGE \$12.95

Here is a terrific TV parts deal for those who repair TV or repair TV or television experimenter. You get a Meissner 12-channel TV tuner, a Crosley 5-tube video IF strip, a 14 KV G.E. horizontal output transformer, plus a standard 1-wire vertical output transformer, plus a 70" cosine deflection yoke (no tubes included). It's worth \$20.00. Our sale price, only \$12.95.

TERRIFIC COMBINATION CABINET SALE

29.95
Originally intended for an Admiral 14" TV combination. Made of walnut veneer, 32" wide, 35 1/2" high and 20" deep. Offered at less than the factory production price. Upper left door is made to swing down, opens record changer compartment. 13 1/2" x 20" deep. Upper right door swings open for the TV compartment. (Note: The TV chassis area is only 14 1/2" wide and 15 1/2" high, 20" deep. Inside the size of TV chassis to a 14" set.) Panel is cut for the 14" Admiral. Up to a 14" speaker may be mounted in the lower right section. Lower left section has hinged door and is for record storage. Brass hardware and matching grill cloth. Shipping weight 60 lbs. Stock No. A-130 out TV panel, \$3.95 extra.

CAPEHART CABINET FOR 1000 SET—ONLY \$99.95

99.95
EITHER WALNUT OR MAHOGANY
Beautiful, finest quality walnut combination radio-phonograph cabinet, 42" high, 32" wide and 22" deep. Made of Capehart's finest combination, selling for \$900 and up. Cabinet cost, manufacturer over \$200.00. Has highly polished matched walnut panels. Made of 3/4" material. Top 1 1/4" solid stock. This cabinet weighs approximately 175 lbs. The changer ratio and speaker grill all have hinged doors. Radio compartment on right hand side is 14" high and 11 1/2" wide. Made to mount chassis vertically. Changer compartment is 14" high by 20 1/2" wide. Large enough to hold any record changer or recorder mechanism. Front and top of the changer compartment is hinged to lock for easy access to the changer. Both radio and changer compartments come with urethane blank panels. Speaker baffle is cut for a 12" speaker and the speaker combination cabinet, 275 lbs. Stock No. K-275 Capehart combination cabinet. Net price \$99.95. SPECIALLY, when ordering, whether you want Walnut or Mahogany.

10-TUBE RADIO KIT \$29.95

10 tube broadcast radio chassis, 8 1/2" x 11 1/2" x 4 1/2", complete with tubes: 2-5SK7, 05A7, 01H, 6S07, 2-12AX7, 2-6V6 plus rectifier, diode, gram and instructions. 3 gang superhet with 8" slide rule dial. Chassis size, 12 1/2" x 10" x 6 1/4" high. Features push-pull 6V6 high fidelity audio output matches 3 to 8 ohm voice coil speakers. Inputs for G.E. variable reluctance or crystal phono pickup and crystal Model Iik-R10 kit less speaker, shipping weight 18 lbs. Net \$29.95.

6-TUBE 2-BAND KIT \$14.95

Popular with school boys and college students for training in tube AC-DC. Band radio kit with plastic cabinet. Receives 5 band broadcast and 60 to 18 mc shortwave. Full 2 gang superhet with 5" speaker and slide rule dial. A complete kit with tubes: 12SK7, 12SK8, 12SK7, 12S07, 6X4 and 6X5, diagram and instructions. Factory quality. Cabinet size 13" x 8 1/2" x 6 1/2". Shipping weight 12 lbs. Model ME-2. Net \$14.95.

5-TUBE AC-DC KIT \$12.95

Model RS-5. A 5 tube AC-DC straight broadcast receiver in the same cabinet as ME-2 above. Complete with tubes. Shipping weight 10 lbs. Net \$12.95.

AC POWERED BROADCAST TUNER KIT \$12.95

A self-powered, 3-gang superhet tuner with 5 tubes. Front and top of the kit with R.F. set. This complete kit is furnished with a diagram, photos and tubes: 6AU6 R.F. 6BE6 oscillator I.F., 6AU6 I.F. detector, 6AL5 diode, AVC, plus rectifier. Connects to any audio amplifier. Ideal for use with our S-200 or 7x5 amplifier kits. Chassis size, 9 1/2" x 4 1/2" x 4 1/2" high. Shipping weight, 7 lbs. Broadcast tuner kit Model BT-38X. Net price, \$12.95.

17, 20" T.V. Kit \$59.95 Less Tubes

A complete kit of parts to build an AC transformer operated television chassis for the 17" or 20" rectangular picture tube. The 12 channel Sarkes-Tarzian tuner is completely wired, as is the 14,000 volt video I.F. strip. Circuit is the conventional design. Do not buy this unless you understand television. It is difficult to connect any electronic kit model. Will-20. Ship. wt. 40 lbs. less all tubes. Net \$59.95. Kit of 25 tubes, less picture tube \$16.95. 17" 17BP4A, \$19.95. 20HP4, \$25.00.

McGEE RADIO COMPANY

Prices F.O.B. K.C. Send 25% Deposit with Order, Balance Sent C.O.D. With Parcel Post Orders, Include Postage

TELEPHONE VICTOR 9045. WRITE FOR FLYER
1422 GRAND AVE., KANSAS CITY, MISSOURI

McGEE'S \$250,000 PUBLIC ADDRESS SYSTEM SALE!

FEATURING 3-SPEED PHONO AND TWIN 12" ALNICO V SPEAKERS
IMMEDIATE SHIPMENT AT UP TO 60% SAVINGS!

5 Trailer loads—over \$250,000 worth of underwriters lab. approved public address systems on sale at McGee for a fraction of the original price. Purchased from one of the largest mail order companies in the United States. These amplifiers are made of the finest material to U. L. standards for 105 lbs. 125 volt 60 cycle operation. Compare their weight with other amps. and you can see for yourself. Follow our ordering instructions for immediate delivery.

HOW TO ORDER: Send full remittance and you save the added C.O.D. collection fee, or if you wish include a 25% deposit and the shipment will be made C.O.D. for the balance. All prices F.O.B. Kansas City, Missouri. Specify whether you wish shipment to be made by Express or Truck. Amplifiers are not available.

28 WATT \$150⁰⁰ LIST PORTABLE P. A. ON SALE \$69⁹⁵

3-SPEED PHONO TOP—TWO 12-INCH SPEAKERS
7-TUBES PUSH PULL 6L6'S HEAVY LEATHERETTE
COVERED PLYWOOD PORTABLE CASES
CRYSTAL MIKE \$8.95 EXTRA

STOCK NO. AP-28X. Portable 28 watt public address system. You get a 7 tube heavy duty push pull 6L6 amplifier with inputs for 2 mikes, either crystal or dynamic with separate mixing volume controls. One phono input. Fully variable tone control with high fidelity, wide range frequency response. The heavy duty output transformer has high fidelity, wide range frequency response. Two heavy duty 12 inch taps for 4, 8, 16, 125, 250 and 500 ohm speaker connections. Two heavy duty 12 inch alnico V P.M. speakers, each with 25 feet of speaker cable. Each speaker is mounted in separate carrying case. Each case has a snap on back and is large enough to give good speaker baffling. Each case is 21 x 16 x 13 inches. One is used to carry the amplifier. A 3 speed phono motor and pick up is mounted in the top of the amplifier to play 33 1/3, 45 and 78 RPM records. This portable P. A. system will put out 20 watts all day long and 28 to 30 watts peak audio. McGee offers you this \$150.00 list portable P. A. system at a terrific saving.

STOCK NO. AP-28X complete portable PA system with 3 speed phono and speakers as pictured (less mike) ship. wt. 71 lbs. \$69.95.
Electro Voice model 910 \$28.50 list crystal mike with 20 feet of cable and desk stand \$8.95 extra.
Floor type mike stand instead of desk stand \$4.95 extra.
(SEE OFFERING TO THE RIGHT FOR WALL SPEAKERS INSTEAD OF THE PORTABLE SPEAKERS.)

28-WATT AMPLIFIER WITH 12-INCH WALL SPEAKERS

The 28 watt amplifier shown to the left is also offered with-out the portable speakers. In their place we will ship two Seeburg walnut wall baffles with two heavy duty 12 inch alnico V magnet PM Speakers and 500 ohm line trans. Stock No. SS-28R 28 watt amplifier with 3 speed phono top with two 12 inch wall speakers \$69.95. Extra 12 inch wall speakers \$11.95. Model 910 Electro Voice mike \$8.95 extra Floor stand \$4.95 extra.



50 WATT \$250⁰⁰ LIST PORTABLE P. A. ON SALE \$99⁹⁵

3-SPEED PHONO TOP—TWO 12-INCH SPEAKERS
10 Tubes — 4 6L6's
Heavy Plywood Tan Leatherette Covered Cases

STOCK NO. AP-60X. Portable 50 watt public address system. You get a 10 tube amp with 4-6L6 push pull parallel 6L6 output tubes. Inputs for two mikes either crystal or dynamic, with separate mixing type volume controls. One phono input. Twin tone controls one for bass the other for treble high fidelity wide range frequency response. The heavy duty output trans. has taps for 4, 8, 16, 125, 250 and 500 ohm speaker connections. Two super heavy duty 12 inch 20 oz. alnico V magnet PM speakers with 25 foot cables and plugs. Each speaker is mounted in large separate carrying case. One is used to carry the amp. Each case is 21 x 21 x 13 inches with removable snap on back. Twice the ordinary size to give proper speaker baffling. This is the most powerful portable PA system we have ever offered. Most 4-6L6 amps of this size and weight are rated 40 watts. This amp will put out 40 watts all day long and 50 to 60 watts with ease. Equipped with a 3 speed phono motor and pick up to play all records, 33 1/3, 45, 78 rpm. A \$250.00 list value. Ship. wt. 111 lbs. \$99.95.
Stock No. AP-60X portable PA system as pictured less mike. Sale price \$99.95. Reg. \$45.00 list Electro Voice model 610 dynamic mike with 20 feet of cable and desk stand \$11.95 extra.
If floor stand is desired instead of the desk stand add \$4.95.
(SEE OFFERING TO THE RIGHT FOR WALL SPEAKERS INSTEAD OF THE PORTABLE SPEAKERS.)

DYNAMIC MIKE \$11.95 EXTRA

50-WATT AMPLIFIER WITH 12-INCH WALL SPEAKERS

The 50 watt amplifier shown to the left is also offered with-out the portable speakers. In their place we will ship two Seeburg walnut wall baffles with two heavy duty 12 inch alnico V pm speakers with 500 ohm line trans. **STOCK NO. SS-60X** 50 watt amplifier with 3 speed phono top and 2 12 inch wall speakers \$99.95. Electrovoice 610 dynamic mike \$11.95 extra Floor stand instead of desk stand \$4.95 extra. Extra 12 inch speakers and wall baffles \$14.95.



10 WATT \$90⁰⁰ LIST PORTABLE P. A. ON SALE \$42⁹⁵

3-Speed Phono Top—Heavy Plywood, Tan Leatherette Case
10" Alnico PM Speaker—Crystal Mike
\$3.95 Extra

STOCK NO. AP-11X. A 5 tube 10 watt (14 watts peak) push pull 7C5 U. L. approved amplifier with wide range frequency response. Inputs for one mike and one phono. Separate mixing volume controls. Fully variable tone control. Heavy plywood leatherette covered case is equipped with a heavy duty 10 inch Alnico V magnet PM speaker. The amp fits inside the speaker case. Case size is 21 x 16 x 13 inches has removable snap on back. (note: this portable system has only one speaker whereas the 28 and 50 watt models shown above have two). The top of the amplifier is equipped with a 3-speed phono motor and pick up for all records, 33 1/3, 45, 78 rpm—this portable PA system has a list value of \$90.00. Offered by McGee at a terrific saving.

STOCK NO. AP-11X. 10 watt portable PA system with 3-speed phono. Ship wt. 41 lbs. Sale price as pictured less mike \$42.95. Crystal mike with non removable desk stand \$3.95 extra.

The 10 watt portable PA system shown on the left is offered less the phono top. Specify stock No. AP-11NO. Sale price \$34.95 less mike. Crystal mike with non removable desk stand \$3.95 extra.



McGEE'S \$62.50 LIST 15" COAXIAL SPEAKER, \$21.95 21 OZ. ALNICO V MAGNET—5" TWEETER

This is the finest 15" coaxial PM speaker value that we have ever offered. New 1952 production, of a famous manufacturer of fine speakers. The 15" speaker has a 2 1/2 oz. Alnico V magnet, equal to 48 oz. of the Alnico 3 type magnet. The cone is free floating, of one piece construction. Will reproduce low frequencies down to 20 cps. The 5" tweeter is coaxially suspended and has a rigid cone to reproduce only the high frequencies. It will respond up to 17,500 cps. The high-pass filter is concealed under the pot cover, leaving only two wires to connect both the tweeter and woofer to any 8 ohm output transformer of a radio, or high fidelity music lover's amplifier. Stock No. P15-CR, shipping weight 13 lbs. Net price \$21.95.

12" JENSEN PM, \$15.95
Another McGee Scoon! Jensen (concert 12", 14 1/2 oz. Alnico V magnet 1M speaker, 8 ohm voice coil. Will take 25 watt audio. You save dollars on this speaker. Just 100 to sell. Shipping weight 8 lbs. Stock No. P-12F. Sale price \$15.95; 2 for \$30.00.

12" COAXIAL SPEAKER, \$12.95

McGee offers the new 1952 model 12" coaxial PM speaker. Quality you would not find in your finest sets if you were a manufacturer, 12" woofer has 6.8 oz. Alnico V magnet. Tweeter is coaxially suspended and has a metal diffuser. High pass filter is under the pot cover. Only two wires to connect to your radio or audio amplifier, 8 ohm with 18 watt peak and 10 watt average. Shipping weight 8 lbs. Response from 30 to 17,500 cps. Stock No. CU-14Y. Sale price \$12.95 each; 2 for \$25.00.

G.I. 3-SPEED CHANGER WITH G.E. \$22⁹⁵ VARIABLE RELUCTANCE TURN-ABOUT CARTRIDGE

Another tremendous McGee Scoon! Brand new General Instrument variable reluctance record changer. Complete with RP-1511 G.E. 3-speed automatic record changer with turn-about stylus. Plays all 3 speeds automatically: 7", 10" or 12" records. Has reject button. Repeats last record. Base size, 12 1/2" x 7 1/2". Shipping weight 14 lbs. Stock No. 710-GE. Second price, \$22.95.

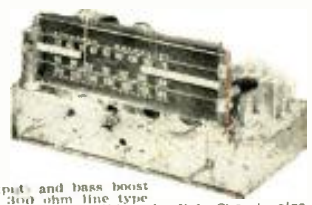


G.I. 3-speed changer same as above, but with Webster flip-over twin needle cartridge. Stock No. GI-700. Sale price, \$21.95 each.

ESPEY 12-TUBE FM-AM CHASSIS, \$59.95

- ★ BUILT-IN PRE-AMP FOR G.E. VARIABLE RELUCTANCE PICK-UP
- ★ WIDE RANGE AUDIO
- ★ WHY NOT ORDER WITH A COAXIAL SPEAKER AND A RECORD CHANGER? SEE OUR SPECIAL OFFERING

McGee's new 1952 model 12-tube FM-AM chassis. Latest design with phono inputs for all types of record players, crystal or G.E. variable reluctance. Receives standard broadcast 550 to 1740 kc and FM 88 to 108 mc. Wide range audio response (push-pull 4V6 output and bass boost 6X4). 12" x 9" high and 4" deep. Fully variable tone control. Loop antenna for broadcast and 300 ohm line type FM antenna may be stapled in cabinet. Attractive lighted slide rule dial. Chassis size, 13 1/2" x 9" x 4". Complete with tubes: 88E6, 6BA6, 6BA7, 12AT7, 6X4, 6AL5, 6SQ7, 6SQ7, 12AT7, 2-6V6GT and 5Y3GT rectifier. Shipping weight 20 lbs. Stock No. 7C-X Espey 12-tube FM-AM chassis. Sale price, \$59.95, less speaker. Output matches voice coil of our 12" or 15" coaxial speakers.



ESPEY DEAL (1), \$99.95

Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and VM-950 G.E. 3-speed changer equipped with a G.E. variable reluctance cartridge. A better home music system than ordinarily available. Espey Deal #1. Sale price, \$99.95. With 15" coaxial PM speaker or P15-CR instead of CU-14Y, \$10.00 extra.

ESPEY DEAL (2), \$118.95

Espey 7-C chassis complete with 12" coaxial PM speaker CU-14Y and the English Garrard 3-speed changer equipped with a G.E. variable reluctance turnabout cartridge. Our best home music system. Espey Deal #2. Sale price \$118.95. With 15" coaxial PM speaker P15-CR instead of CU-14Y, \$10.00 extra.

ESPEY DEAL (3) \$138.95

Espey 7-C chassis complete with THREE 12" coaxial PM speakers CU-14Y (these three 12" coaxial speakers give a cone area equal to an 18" speaker) and a Garrard 3-speed changer with G.E. variable reluctance turnabout cartridge. Espey Deal #3. Sale price \$138.95.

McGEE RADIO COMPANY Prices F.O.B. K.C. Send 25% Deposit with Order, Balance Sent C.O.D. With Parcel Post Orders, include Postage. **TELEPHONE VICTOR 9045, WRITE FOR FLYER 1422 GRAND AVE., KANSAS CITY, MISSOURI**

Mac's Service Shop (Continued from page 60)

to meet competitive prices and for not having limitless time at their disposal for working out every last bug from a new model. You do not seem to realize that you are second-guessing all of these errors. They might prove to be a lot harder to see if you were depending upon foresight instead of hindsight.

"And this prod is for your doing all your yelling where it will do no good. If you see a mistake has been made in the design of a chassis or a record-changer, why don't you sit down and write a courteous letter—not one of the smart aleck, how-can-you-be-so-dumb type—to the manufacturer telling him what you have found and making suggestions for correcting the trouble? You may be surprised at the appreciation he will show, and you can be certain he will not repeat the mistake in future models.

"I might suggest, too, O Bumptious One, that sometimes you are guilty of trying to blame your own lack of service skill and enterprise on to the set-maker. Time after time I have seen your kind try to persuade yourself that a poorly-operating set never did work any better, that it was *made* that way; consequently, nothing could be done about it. How you can make yourself believe anyone would pay his good money for a new receiver in that condition I'll never know. If you would concentrate more on improving your own knowledge and technique instead of always being so alert to catch the manufacturer off base, you'd be a better technician for it."

"Hey, lemme see that technician-doll of yours," Barney demanded as he grabbed it from Mac's hand. "Uh huh, it's just as I thought. Did you *have* to make him with red hair?" he asked plaintively.

"You know," he went on reflectively, "I'm beginning to think there is something in this voodoo stuff after all. I could have sworn that I actually felt some of those jabs you gave this little feller."

"Imagination—and a guilty conscience—can play strange tricks," Mac commented; "but let's get away from all this hocus-pocus and talk a little sense. I ran across something yesterday I think may interest you. A fellow came in with the complaint that his radio-controlled garage door had suddenly become very erratic in its behavior. It opened and closed of its own accord while the car that had the controlling transmitter was miles away and the transmitter was shut off.

"I went over and checked the thing over carefully, but I couldn't find a thing wrong with it: a good healthy signal from the transmitter was required to trip the pilot relay; there were no gassy tubes to cause trouble; running the line voltage up and down made no difference. First thought of

mine was that possibly a harmonic of a ham transmitter was getting into the receiver and making the relay trip, for I have read of that; but since Ten went dead none of the local gang are working the high-frequency bands; so I decided to look for something else. I asked the man if any new electronic equipment had been installed in the neighborhood lately, and after I explained what 'electronic equipment' was, he said all he could think of was a new TV set in the house across the street that had been in for a couple of weeks.

"Playing a hunch, I went over and asked the folks if they would mind turning on their TV receiver for a few minutes. As I stood in front of the receiver I could see the closed garage doors; and when I turned the channel selector to Channel 10, the doors opened up. I tried it two or three times, and every time the set was tuned to Channel 10, the doors worked. With the i.f. used in that set, the oscillator was on about 219 megacycles when the receiver was tuned to Channel 10, and that is squarely inside the 210-250 megacycle band in which the door-opener works. Fortunately, provision had been made for using any one of six different frequencies in the garage-door setup; so I just moved the transmitter to a different frequency and peaked up the receiver on that. When this was done the TV set could be switched to any channel without affecting the doors."

"That is one for the book," Barney said; "and it just goes to show you what a hefty signal is radiated from the oscillator of some of the TV receivers. No wonder we hams get the blame for a lot of blanking out and herringbone patterns that are caused by a neighbor's TV set tuned to a lower channel!"

-30-

Within the Industry (Continued from page 26)

Transicoil Corp. has appointed **DWIGHT W. BLOSER** to the post of chief engineer in the manufacture of control motors, induction generators, gear trains, and servo amplifiers.

* * *

DR. JOHN RUZE has been appointed director of research of *The Gabriel Laboratories, Division of The Gabriel Company.*



He joins the company from the Air Force Cambridge Research Laboratories, where he was assistant chief of the antenna laboratory. During the war he headed the antenna design section at the Signal Corps Engineering Laboratories.

A native of New York, Dr. Ruze received his doctorate from the Massachusetts Institute of Technology after completing his work for his MS degree at Columbia.

-30-

New Portable Battery-Operated Spring-Motor Tape Recorder



The Magnemite*

For all field recording without AC power! Smaller and lighter than a portable typewriter, the Magnemite* actually makes field recordings that can be played on any studio console equipment. Completely self-powered, the Magnemite* does away with bulky and cumbersome generators, storage batteries and rechargers.

Just check these unusual features:

- Noiseless and vibrationless governor-controlled spring-motor assures constant tape speed.
- 100 operating hours per set of inexpensive flashlight-type dry cell batteries.
- Earphone monitoring while recording, and earphone playback for immediate quality check.
- Operates in any position, and is unaffected by movement or vibration during operation.
- Warning indicator tells when to rewind, and shows when amplifier is on.
- Broadcast models weigh 15 pounds. Slow-speed models weigh only 10 pounds.
- Requires no more desk space than a letter-head, measuring only 11 x 8 1/2 x 5 1/2 inches.

There's a choice of 5 different models for any recording need. High fidelity units, meeting primary and secondary NARTB standards, which record and play back frequencies up to 15,000 cycles, are available for broadcast stations, critical music lovers, and scientific research. For investigation, missionaries, reporters, and general dictation while traveling, there are units which play up to 2 hours per reel of tape.

Write today for complete descriptive literature and direct factory prices.



**AMPLIFIER CORP.
of AMERICA**

398 Broadway, N. Y. 13, N. Y.

*Trade Mark Reg.

Train at Home to Jump Your Pay as a RADIO-TV Technician



J. E. Smith, President
National Radio Institute

The men whose letters are published below were not born successful. At one time they were doing exactly as you are doing now... reading my ad! But they acted. They decided they would know more... so they could earn more! They acted! Mail the card now for my 2 books FREE.

There's a Bright Future for You in America's Fast Growing Industry

Do you want good pay, a job with a bright future, security? Would you like to have a profitable business of your own? If so, find out how you can realize your ambition in the fast growing RADIO-TELEVISION industry. Even without Television, the industry is bigger than ever before. 105 million home and auto radios, 2900 Radio Broadcasting Stations, 108 TV Stations with 1800 more now authorized. Expanding use of Aviation and Police Radio, Micro-Wave Relay, Two-Way

Radio for buses, taxis, etc., are making opportunities for Servicing and Communications Technicians and FCC Licensed Operators.

You Learn by Practicing with Kits I Furnish

With both my Servicing Course and my NEW Communications Course I send you many Valuable Kits of Parts. They "bring to life" theory you learn in my illustrated texts. Mail card for my big 64-page book. It shows photos of equipment you build from kits I send.

My Training Includes Television

Both my Servicing and Communications Courses include lessons on TV principles. You get practical experience by working on circuits common to both Radio and Television. My graduates are filling jobs, making good money in both Radio and Television. Remember, the way to a successful career in Television is through experience in Radio.


Send NOW for 2 Books FREE Mail the Postage-Free Card NOW!

What will YOU be doing one year from today... will you be on your way toward a good job of your own in a Radio and Television service shop or business? Decide now that you are going to know more and earn more! ACT NOW! Take the important first step to a career and security. Send the postage-free card now for my FREE DOUBLE OFFER. You get Actual Servicing Lesson. Also my 64-page book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning; see equipment you practice with at home. Mail card now. J. E. SMITH, President, National Radio Institute, Washington 9, D.C. Our 39th year.

NRI Training Can Lead to Jobs Like These in RADIO-TELEVISION

- | | |
|--|---|
| BROADCASTING
Chief Technician
Power Monitor
Recording Operator
Remote Control Operator | GOVERNMENT RADIO
Operator in Army, Navy, Marine Corps, Coast Guard
Forestry Service
Dispatcher
Airways Radio Operator |
| SERVICING
Home and Auto Radios
P.A. Systems
Television Receivers
Electronic Controls
FM Radios | AVIATION RADIO
Plane Radio Operator
Transmitter Technician
Receiver Technician
Airport Transmitter Operator |
| IN RADIO PLANTS
Design Assistant
Transmitter Design Technician
Service Manager
Tester
Serviceman
Research Assistant | TELEVISION
Pick-up Operator
Voice Transmitter Operator
Television Technician
Remote Control Operator
Service and Maintenance Technician |
| SHIP AND HARBOR RADIO
Chief Operator
Assistant Operator
Radiotelephone Operator | POLICE RADIO
Transmitter Operator
Receiver Serviceman |

I TRAINED THESE MEN

 Handicapped but Successful "I am now Chief Engineer at WIAW. My left hand is off at the wrist. A man can do... if he wants to." R. J. Bailey, Weston, W. Va.	 \$10 a Week in Spare Time "Before finishing, I earned as much as \$10 a week in Radio servicing, in my spare time. I recommend NRI!" S. J. Petrucci, Miami, Fla.
 Control Operator, Station WEAN "I received my license and worked on ships. Now with WEAN as control operator, NRI course is complete." R. Arnold, Rumford, R. I.	 Trained Men Make Money In TV "I am now servicing Television. Your course enabled me to repair TV receivers without any trouble." R. Currier, Fair Haven, Vt.
 Has Growing Business "Am becoming expert Teletician as well as Radioician. Without your course this would be impossible." F. Brogan, Louisville, Ky.	 Got First Job Thru NRI "My first job was with KDLR. Now Chief Eng. of Radio Equipment for Police and Fire Dept." T. Norton, Hamilton, Ohio.

Find Out What RADIO-TV Offers You



SAMPLE LESSON and 64-PAGE BOOK Both FREE

Cut out and mail postage-free card today!

FIRST CLASS
Permit No. 20-R
(Sec. 34.9, P.L.&R.)
Washington, D.C.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed In The United States

4c POSTAGE WILL BE PAID BY
NATIONAL RADIO INSTITUTE
16th and U Sts., N.W.
Washington 9, D. C.

Make Extra Money While Learning

Keep your job while training. Many NRI students make \$5, \$10 and more a week extra fixing neighbors' Radios in spare time while learning. I start sending you special booklets that show you how to service sets the day you enroll. Multi-tester you build with parts I furnish helps discover and correct Radio troubles.



Want Your Own Business?

Many N.R.I. trained men start their own business with capital earned in spare time. Let me show you how you can be your own boss... Robert Dohmen, New Prague, Minn., (whose store is shown at right) says, "Am now tied in with two television outfits and do warranty work for dealers. Often fall back to N.R.I. textbooks for information on installing Television sets."



J. E. SMITH
President
National Radio
Institute
Washington, D. C.



I Will Train You at Home

For Good Pay Jobs, Success in

RADIO-TELEVISION



YOU LEARN SERVICING
by practicing with equipment I furnish

You build valuable Multitester (at left) as part of my Servicing Course. You use it to make many tests, get practical experience, make EXTRA money fixing neighbors' radios in spare time. Many of my students earn \$5, \$10 a week extra while learning. I send you many other kits too. You build a modern Radio. You build many circuits common to Radio and Television. All equipment is yours to keep. Read about and see other equipment in my free book. Mail card below.



YOU LEARN COMMUNICATIONS
by practicing with equipment I furnish

As part of my Communications Course I send you kits of parts to build the low power broadcasting transmitter shown at right and many other circuits common to Radio and Television. You use this equipment to get practical experience putting a station "on the air," performing procedures demanded of Broadcast Station operators. I train you for FCC Commercial Operator's License. Mail Card for Sample Lesson and 64-Page Book. FREE!



TELEVISION is Today's
Good Job Maker

In 1951 over 15,000,000 homes had Television sets, more are being sold every day. 108 TV stations are already operating, over 1800 are now authorized and many hundreds are expected to be on the air in 1953. This means new jobs, more jobs and better pay for trained men. The time to act is NOW! Start learning Radio-Television servicing or communications. Want to get ahead? America's fast growing industry offers good pay, a bright future and security. Cut out and mail card now. J. E. Smith, President, National Radio Institute, Washington, D.C.

There are Good Jobs, Good Pay, Success
in Radio-TV! SEE OTHER SIDE

CUT OUT AND MAIL THIS CARD NOW

Sample Lesson & 64-Page Book

Both FREE

This card entitles you to Actual Lesson on Servicing, shows how you learn Radio-Television at home. You'll also receive my 64-Page Book, "How to Be a Success in Radio-Television." Mail card now!

NO STAMP NEEDED! WE PAY POSTAGE

Mr. J. E. SMITH, President,
National Radio Institute, Washington 9, D.C.

Mail me Lesson and Book, "How to Be a Success in Radio-Television." (No Salesman will call. Please write plainly.)

NAME AGE

ADDRESS

CITY ZONE STATE

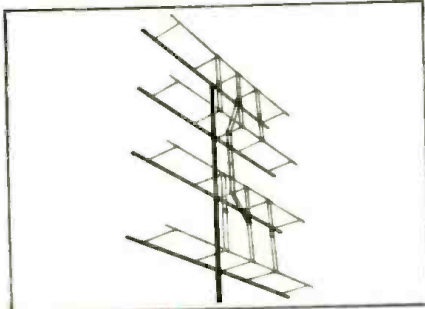
The ABC's of
SERVICING

How to Be a
Success
in RADIO-
TELEVISION

COMPARISON PROVES

the famous RAY-SCOPE antenna

gets exceptional high gain in fringe areas!



The Famous RAY-SCOPE List Price \$55.00

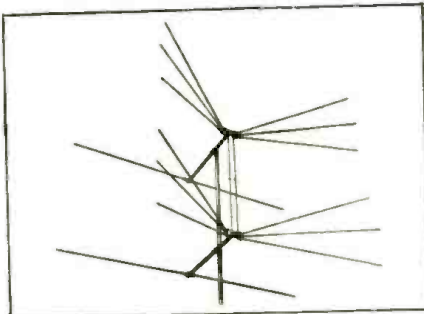
It's the most talked-about TV antenna, expressly designed for extreme fringe areas with exceptionally high gain on all channels. Completely reassembled, light in weight, life-long construction. For power plus, it's RAY-SCOPE!

Inquire About Our All Channel RAY-SCOPE UHF 14-83

Don't Delay — See RAY-SCOPE Today
Write For Catalog and Price List

Manufactured Only By
The DI-CO TV & PLASTIC CO., Inc.
Milford, Connecticut

Territories Available For Reps. and Jobbers



The Famous RAY-SCOPE "400" List Price \$20.50

THIS IS IT! Just flip out elements and tighten wingnuts. The ultimate in pre-assembled canicals. Acclaimed the supreme leader in its field. Highest gain in fringe areas, solid aluminum casting front and rear element brackets, seamless tubing thruout with all-weather inserts. Solid aluminum stacking bars, parts easily replaced and absolutely no loose hardware.

Look For This Trademark



SCHEMATICS—CONVERSIONS FOR SURPLUS GEAR

NEW LIST! MANY ADDITIONS!

Send stamped, self addressed envelope for List #. Add 25c for chart explaining AN nomenclature.

R. E. BOX 1220
GOODHEART BEVERLY HILLS, CAL.

We Pay Highest Cash \$\$\$\$ Prices for RADIO & AIRCRAFT ELECTRONICS EQUIPMENT

You'll be pleasantly and profitably surprised at the prices we pay for needed parts and equipment. Simply send us a description of what you have—tell us your top dollar asking price—and we'll shoot back a prompt reply! Convert that equipment to ready cash now!

Write: **ALVARADIO SUPPLY CO., Division R-5**
4665 Melrose Ave., Los Angeles 29, Calif.
Olympia 2155

PAY LESS FOR TUBES

INDIVIDUALLY BOXED • FULLY TESTED • EACH TUBE GUARANTEED FOR SIX MONTHS

Type	Price	Type	Price	Type	Price	Type	Price
1B3GT	\$.63	6A55	\$.50	6J6	\$.62	12AX7	\$.61
1H5GT	.46	6AT6	.38	6K6GT	.41	12BA6	.45
1L4	.57	6AU6	.43	6L6C	.80	12BE6	.47
1L6	.58	6AV6	.38	6L6CA	.46	12BH7	.63
1N5GT	.57	6B4C	.36	6S4	.46	12SA7GT	.52
1R5	.56	6BA7	.45	6SA7GT	.52	12SK7GT	.50
1S5	.47	6BA7	.60	6S7GT	.47	12SL7GT	.61
1T4	.56	6BC5	.53	6SK7GT	.50	12SN7GT	.54
1T5GT	.71	6BD5GT	.89	6SL7GT	.62	12SQ7GT	.42
1X2	.67	6BE6	.47	6SN7GT	.54	19B6	1.39
3Q5GT	.65	6BF5	.60	6SQ7GT	.42	19C8	.94
354	.55	6BG6	1.34	6T8	.78	19T8	.79
3V4	.56	6BH6	.57	6V6GT	.46	25B06	.89
5U4C	.41	6BJ6	.48	6W4GT	.45	25L6GT	.48
5V4G	.73	6BK7	.85	6W6GT	.57	25Z6GT	.48
5Y3G	.34	6BL7	.83	6X4	.34	35A5	.48
5Y3GT	.30	6BQ6	.89	6X5GT	.33	35B5	.47
6AB4	.46	6BQ7	.85	6Y6C	.59	35C5	.47
6AG5	.54	6C4	.34	7N7	.36	35L6GT	.47
6AK5	.95	6CB6	.53	12AT6	.68	35W4	.31
6AK6	.63	6CD6	1.85	12AT7	.68	35Z5GT	.30
6AL5	.40	6FGGT	.45	12AU6	.43	50B5	.47
6AQ5	.46	6F8C	.93	12AU7	.53	50C5	.47
6AQ6	.42	6HG7	.49	12AV6	.38	50L6	.47
6ARS	.38	6J5GT	.40	12AV7	.80	117Z3	.39
						117Z6	.68

Each tube is performance-proven. 25% deposit must accompany all orders. Balance C.O.D. All prices F.O.B., N.Y.C. If remittance is made with order, you can deduct 2%. \$1.00 handling charge for orders under \$10.00. Subject to Prior Sale.

PHILLIPS TUBE COMPANY 2610 E. 16th Street
Brooklyn 35, N. Y.

60 cycles for the vertical sweep system or 15,750 cycles for the horizontal sweep system). The rectangular pulse or saw-tooth waveforms in both systems have components that extend to the fifteenth harmonic (or so) and taking this into consideration only requires that the bandpass be uniform to a maximum of 240,000 cycles.

In the video amplifier stages, the full 4.0 mc. video signal is present, but in everyday servicing you are interested primarily in determining whether the video signal is present rather than accurately depicting its waveshape. Hence, any oscilloscope which possesses a uniform vertical frequency response in excess of 240,000 cycles will be quite suitable for television receiver servicing.

What about those scopes where the vertical response is less than 240,000 cycles? These units can still be used for TV servicing but, of course, the narrower their bandpass, the less accurate will be the reproduction of steep-sided waveforms. Frequently a compensating factor here is lowered cost and this can be very important to the man of limited means. The author has seen scopes with a bandpass of 100 kc. successfully used, but for the beginner the wider bandpass will lead to less confusion.

Oscilloscopes are not the simplest of instruments and individual eccentricities have a lot to do with the one best suited for you. Your best bet is to try to work with as many different scopes as possible and then buy the unit you find easiest to use.

S-38B IMPROVEMENT

By R. E. FRANKLIN, W2EUF

A number of the popular Hallierafters S-38B receivers are known to suffer a serious volume loss and frequency shift when switched from AM to c.w. These sets use regeneration in the i.f. stage to produce beat-frequency oscillation. Reducing the feedback voltage as follows will decrease the frequency shift and the c.w. volume will be stepped up tremendously.

Originally, the regeneration was obtained from an insulated wire wrapped around pin 4 of the 12SK7 i.f. amplifier tube. By cutting off about an inch of this wire and bringing it within an eighth-inch of pin 4 a point can be found, by trial and error, that will produce the desired results. This will take some care as the hand must be withdrawn each time the wire is moved to avoid body-capacity effects. The wire should be affixed in the correct spot with a generous amount of cement.

In one conversion, one end of a piece of 300-ohm ribbon about three inches long was suspended between pin 4 and a terminal strip anchored by the lug of the i.f. can. The "wrap-around lead" was brought to this terminal and soldered. There will be capacity between the two wires of the ribbon as between the plates of a condenser, and the feedback condenser thus formed can be adjusted to a suitable value by snipping off small pieces of the 300-ohm ribbon. Do not cut the ribbon until power is removed from the set.



A. C. Cossor Ltd., parent company of Beam Instruments Corporation of New York, offers the Model 1039B for the American market.

ers give the instrument user a choice between high sensitivity and wide bandpass by providing a suitable switching arrangement. This, for example, is true of the Jackson Model CRO-2 oscilloscope. The "Vertical Input" control has three positions where the vertical system possesses a wide bandpass (response uniform within 10% from 20 cycles to 4.5 mc.) with a fair amount of gain and three positions where the bandpass is reduced (uniform within 10% to 100 kc.), but the gain is up. For each of these positions, attenuation ratios of 100:1, 10:1, and 1:1 are available.

In the *Triplet* oscilloscope, there is a switch at the rear by means of which the bandwidth of the vertical system can be widened from its normal value of 2 mc. to a special value of 4 mc. However, in the 4 mc. position, the system gain is cut in half.

This matter of bandpass is a source of confusion to many technicians. Just how wide should the vertical system bandpass be for suitable application to TV receiver servicing? The answer to this can be found by analyzing where (and how) the oscilloscope is employed. Broadly speaking, the scope is used in conjunction with a sweep generator to depict the response curve of a circuit or it is used for servicing to show whether or not a signal is present at a certain point in a circuit and, if so, what its shape is.

Oscilloscope use with a sweep generator requires that it be capable of depicting a waveform having a repetition frequency of 60 cycles—this being the rate at which the response pattern is swept out. Hence, the vertical system bandpass should extend down below 60 cycles, preferably 30 cycles or less. The lower this limit, the more linear the response will be at 60 cycles.

For servicing, the oscilloscope finds its greatest application in checking voltage waveforms in stages located beyond the video second detector. These include the video amplifiers, sync separator stages, and the vertical and horizontal sweep systems. In all but the video amplifier stages, the fundamental frequencies are low (either

UHF-VHF Signal Testing is QUICK, EASY with...

THE NEW
HEAVY DUTY

Alprodco EREC-TOWER

TEST SIGNALS UP TO 80 FT. ▶

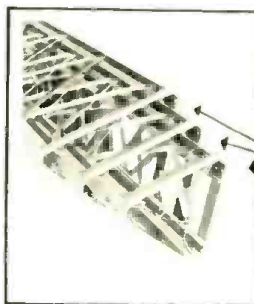
EREC-TOWER — and only EREC-TOWER — goes up a full 80 feet. You test signal strength anywhere along the way up ... determine just exactly how high the permanent antenna must be!

ERECT PERMANENT TV TOWERS ▶

Use the EREC-TOWER as a gin pole to raise permanent antenna towers. With an EREC-TOWER, for example, two men can erect a 100-foot Alprodco Tower in less than two hours. You save time, money, labor on every job!

DEMONSTRATE TV SETS ▶

EREC-TOWER helps you demonstrate sets quickly, anywhere. Here's the ideal way to show razor-sharp pictures to your fringe area prospects ... right in their own homes. EREC-TOWER is a real sales closer!



BETTER BUILT

EREC-TOWER is constructed of lifetime aircraft aluminum. Each leg and track (see opposite illustration) is extruded in one solid 24-foot length ... will not buckle, crack, stick or rust.

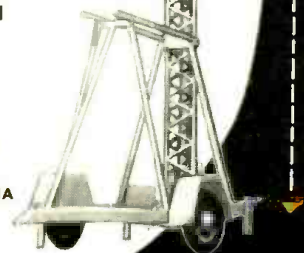
HEAVY EXTRUDED
ONE-PIECE ALUMINUM
TRACKS

Dealer
Net Price
(For Tower)
\$233.50

FREE! WRITE TODAY for full information and literature on the Alprodco EREC-TOWER as well as Alprodco Aluminum TV-FM-AM Towers.

Alprodco, Inc.

302 E. MAIN ST., KEMPTON, INDIANA
MINERAL WELLS, TEXAS • DUBLIN, GEORGIA



SMASH SALE! SUPREME TEST EQUIPMENT

MODEL 600 TUBE & SET TEST

SUPREME'S Time Tested Emission Tube Tester with all Multi-meter functions—Battery Tester (including the 0.7.5 volt). Sockets for all tubes (including nine pins and a spare).

METER—7" Clear Plastic. Over 9" of calibrated scale plus mirrored arc for accurate readings.

FLEXIBLE—SUPREME'S patented Filament Return selector switch insures only one socket for each type tube.

ROLL CHART—Illuminated—double width—ample room for all tube listings. Plus one year free tube setting service.

MULTI-METER RANGES—Operate at the touch of a button.

CASE—Metal in beautiful Hammerloid finish with removable cover, new type leather carrying strap.

DC VOLTS—7 ranges of 0.5/10/50/250/500/1000/2500 volts. Lowest reading of .1 volts. All ranges 1000 ohms per volt.

AC VOLTS—6 ranges of 0/10/50/250/500/1000/2500 volts. Rectifier guaranteed as any other part. Double bridge circuit affords maximum of scale linearity and rectifier protection.

DC CURRENT—7 ranges: 0-1000 microamperes 1/5/10/50/250/500/1000 milliamperes and 1/10 amperes. Lowest reading 1 microampere. All shuts wire wound.

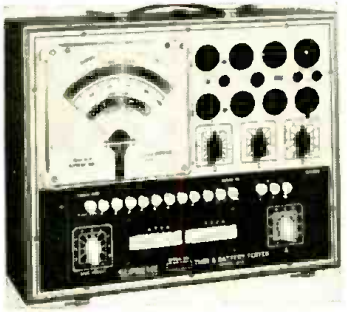
OUTPUT VOLTS—6 ranges of 0.5/10/50/250/500/1000 volts. Ideal for receiver alignment. No ext. condenser.

OHMMETER—5 ranges of 1/200/2000/200,000 ohms and 2/20 megohms. Center scale of low range 3.5 ohms. Lowest reading 0.1 ohms. Ideal for checking low resistance coils such as tuning coils and oscillator coils.

BATTERY TESTS—Provides proper loads for most commonly used A and B portable batteries.

POWER SUPPLY—100-135 volt—50/60 cycles. Special voltages and frequencies on request.

Note: Test Leads furnished with this instrument. Size—11" x 15" x 6 1/2". Shipping Weight—20 pounds. Regular Net Price \$117.50. **SPECIAL ONLY \$89.50**



In CANADA order from CANADIAN RADIO SUPPLY, 262 Queen St., W. Toronto, Ontario.

MODEL 616 TUBE & BATTERY TESTER

CHECKS AM FM TV RECEIVING TUBES AND PORTABLE RADIO BATTERIES. The Supreme Model 616 cannot be beat for EFFICIENT bench or counter tube testing. Minimized obsolescence by use of Supreme patented element selector system. Socket facilities for all AM, FM and TV receiving tubes. ILLUMINATED ROLL CHART with hundreds of types listed. TUBE SETTING DATA on future tubes supplied by Supreme as they come into use. Quality test readings for both tubes and batteries in "Bridge-Good" scales of beautiful BIG SEVEN INCH FULL VISION METER. Non-breakable window. Tests checks portable radio batteries. DEXET PROPER LOAD. Tests batteries with rated voltages of 1 1/2, 4 1/2, 6, 45, and 90 volts. Hammerloid finished metallic case with detachable cover. Approx. dimensions 11 x 15 x 6 1/2 inches. Shipping weight 20 pounds. Regular Net Price \$87.50. **SPECIAL ONLY \$69.50**

OLYMPIC ELECTRONICS SUPPLY

DISTRIBUTORS
1440 W. OLYMPIC BLVD. • LOS ANGELES 15, CALIF.

MID WINTER SALE PRICES SLASHED

T.V. TUBES—ROCK BOTTOM PRICES

In lots of 6 each No. only

68G6	89c	6C66	39c	6A05	38c
19BG6	89c	6AK5	69c	6C06	\$1.05
12AX7	47c	6BQ6	57c	654	49c

Tube Special—Broken Keys—Electrically Perfect

12SK7	8 for \$2.00	4 for \$1.00
6L6	69c	4 for \$1.25
12K8	49c	7 for \$3.00

Tube Sale—2A7-55-27-85-31-56-57. No Mixed Ass't. 6 of Any Type \$2.25

Heavy Duty Shielded P.P. Input Trans. \$1.00

Signal Corps Transmitting Keys. 49c

Bat Handle S.P.-5.T. or D.P.S.T. Toggle Switch. 25c

In Lots of 12, each 23c

2 Gang Var. Cond. 456 K.C. with Osc. Section. 49c

284 in. Pulley on 3/8" Shaft.

2 Gang 5.W. Var. Cond. 50 MMFD per Sec. Double Spaced. 10-20 Meters with Tank Coil 1/4 in. Shaft. 39c

Westinghouse Kuorox Rectifier 0.64 Amp. 28 Volts. Reg. \$11.00 ea. Special. \$1.95

BRAND NEW 10" PHONO RECORDS—Ass't.

Jazz—Popular. Rhythm—Blues. Please specify.

12 for \$1.75 or 24 for \$3.00

Single Pole—10 Pos. 2 Gang Switch. 29c

2 piece, 5 pole Male and Female separable Amphenol plugs. Both with Flex. shielded cables. Approx. 5 ft. long. 35c pair. 3 pr. for \$1.00

Grind your own Crystals. Pure Brazilian Quartz. Various sizes and thicknesses. 1/4 in. Dia. \$2.00

4 Tube Drilled Chassis. 4 1/2" x 6 1/2" x 1 1/2". 29c each

5 in. 450 ohm Dynamic Speaker. \$1.35

Signal Corps Phones—2 M. Ohms (8 M. Ohms Imp.) 40c

2 Ft. Ext. Cord (and Plug). \$1.25

TOBE TUBULAR ELECTROLYTICS

20-20 MFD. 150 V.	49c	30-30 MFD. 150 V.	57c
40-40 MFD. 150 V.	59c		

Low-Loss Short Wave Lock Type Air Trimmer Variable Condensers

5 Pl.—20Mmf.	14c
7 Pl.—25-30 Mmf.	13c
8 Pl.—30-35 Mmf.	16c
14 Pl.—56 Mmf.	24c

D.P.D.T. SLIDE TOGGLE SWITCH 15c

1,000 OHM WIRE WOUND POTENTIOMETER 15c

30 HY-FILTER CHOKE SHIELDED 3 for \$1.25

PIEZO CRYSTAL HOLDERS 12 for \$1.00—\$8.00 per C

RCA Band Switches—3 gang, 3 pos. 3 band 20c 6 gang, 4 pos. 4-5 band 40c

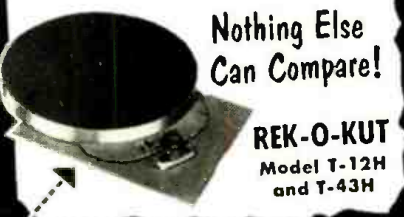
Trimmer-Padder Ass't.—all isolantite—angles. dual. Triples—100 ass't. \$2.25

ATTENTION: Prospectors, Explorers for Hidden Treasures! Construct a U.S. Army Type of Metallic Mine Detector Amplifier. Amplifier unit only (less tubes and batteries) with cables, headphone cord, and jack. Army wiring diagram. Type AN/PRS-1 \$1.95

MINIMUM ORDER \$3.00—NO C.O.D. SHIPMENTS—PLEASE INCLUDE POSTAGE

NEWARK SURPLUS MATERIALS CO.
324 Plane Street Dept. JA NEWARK 1, N. J.

the TURNTABLE with the HYSTERESIS MOTOR is AGAIN AVAILABLE



Nothing Else Can Compare!

REK-O-KUT
Model T-12H and T-43H

the only dual speed, 12" turntables that meet the standards for speed regulation and wow content specified by the National Association of Broadcasters... and recommended by every leading Sound Authority for use with ULTRA HIGH FIDELITY Amplifiers and Speaker Systems.

T-12H... 78 and 33 1/2 RPM... \$119.95
T-43H... 33 1/2 and 45 RPM... \$119.95

ACCESSORIES:

T-103A... 45 RPM idler, with record adaptor, interchangeable with 33 1/2 RPM.
T-104A... 78 RPM idler interchangeable with 45 RPM.

REK-O-KUT CO.

38-05 Queens Blvd., Long Island City, N. Y.

observe the signal waveforms in these circuits, then an r.f. probe must be employed between the scope and the receiver. The probe contains a germanium crystal or a miniature diode which detects the received signal and then applies the low-frequency modulation of the signal to the vertical input terminals of the scope for screen presentation.

A second type of probe which is finding increasing favor is the low-capacity probe. This probe permits the proper observation of waveforms in circuits that are capacity sensitive and where use of normal test leads would result in a distorted pattern on the screen.

Both probes are auxiliary pieces of equipment and are usually not included with the price listed for the oscilloscopes in Table 1. However, they do serve useful purposes and are recommended. When purchasing these units, obtain those specifically designed for your instrument. This is especially important in the case of the low-capacity probe.

Bandpass vs. Sensitivity

The function of the vertical amplifiers in an oscilloscope is to amplify applied signals in order that they may be sufficiently powerful by the time they reach the deflection plates to produce a sizable pattern on the screen. The greater the amplification available in this system, the smaller the input signal needed to produce a given vertical deflection. In other words, the oscilloscope becomes more sensitive as a measuring device.

Of importance, too, in the vertical system is its bandpass or its ability to amplify a range of frequencies. The signals whose waveshapes are portrayed on the oscilloscope screen are those found in television receivers, i.e., square waves, saw-tooth waves, and video signals, to mention the more common ones. Each of these waves contain a number of frequencies and to accurately depict their waveshapes, every frequency contained in the wave should be passed by the vertical amplifier system. For accurate television signal observation, this can mean a 4-mc. (or more) bandpass.

The objectives, then, in designing an amplifier for use in the vertical system of an oscilloscope are wide bandpass and high amplification. Unfortunately, for any given circuit, bandwidth x gain is a constant which means that if we increase the bandpass by a certain amount, we decrease its gain by the same factor. Thus, one works against the other and if we desire a wide bandpass, we must make up for the resultant gain reduction by adding more amplifier stages. This, in turn, raises the cost of the instrument.

Most manufacturers of moderately priced equipment resolve this conflict by designing the vertical system amplifiers to possess a nominal bandpass (top limit from 250,000 cycles to 1,000,000 cycles). A few manufactur-

accompany them, it will be found that the horizontal input terminals are sometimes called the "X" axis. This terminology was borrowed from mathematics where it is customary to refer to all horizontal axes as "X" axes. By the same token, the vertical input terminals are referred to as the "Y" axis. And, to complete the analogy, the intensity modulation terminal is known as the "Z" axis.

4. Self-Measurement of Peak-to-Peak Voltages. In servicing a television receiver, it is important not only to observe whether the wave possesses the proper shape but frequently also whether its amplitude is correct. The latter is especially critical in horizontal and vertical sweep systems. Inclusion of some means for measuring the peak-to-peak values of a wave is becoming increasingly popular in oscilloscopes. In its simplest form the manufacturer provides a terminal on the front panel which is internally connected to one of the windings of the power transformer. Usually this is the 6.3-volt winding. When this voltage is connected to the vertical input terminal, by means of a short jumper, the sine wave produced on the screen has a peak-to-peak value of 17.64 volts. This is because 6.3 is the r.m.s. value. When this is multiplied by 2.8 it becomes peak-to-peak.

For convenience, the height of the 17.64-volt wave is adjusted (by means of the vertical gain control) until it occupies one inch vertically on a ruled screen mask. Then the reference voltage is removed and the unknown voltage applied in its place to the vertical input terminal. The height of this wave is then compared to the height of the 17.64-volt wave and by means of a simple proportion, its peak-to-peak value is determined.

Reference voltage values of 1 volt, 3 volts, and 10 volts are also popular in place of 6.3 volts. Sometimes the values are given as r.m.s. and sometimes as peak-to-peak. If in doubt check the instruction manual before using.

Other oscilloscopes have more elaborate measuring systems, some using a selector switch with a series of different voltages available and some going so far as to include a voltmeter on the front panel. Generally, the more reference voltages there are, the more accurate the measurement of the unknown voltage.

When a scope does not contain provision for the self measurement of peak-to-peak voltages, there are voltage calibrators available. These are instruments providing reference voltages which are first placed on the scope screen to calibrate the instrument and then removed while the unknown voltage is exhibited on the screen. Since these units are specifically designed for this purpose, they are frequently simpler to use than the scope system.

5. Probes. Television receivers contain many circuits in which only r.f. signals are present. If it is desired to



NOW . . . Assemble Your Own Connectors . . . When You Want Them . . . the Way You Want Them, with ELCO'S New

VARICON Connector Kit!

From America's quality manufacturer of sockets, shields and connectors comes this sensational

new Varicon-Connector Kit, containing all parts needed (at the time needed) for almost any type connector, with any number of circuits! And . . . variations in arrangement of contacts at time of assembly makes possible the use of more than one connector, with the same number of contacts, but with different polarity! The Varicon-Connector System is entirely new, too! Identical male and female components; only 4 basic parts; high current and high voltage rating; low resistance, low capacitance! Your finished assemblies will be precision connectors of high quality, appearance, practicability and versatility! Connectors are available in general purpose black phenolic; low-loss mica phenolic, natural; alkyd, natural; or urea, in colors. Moderate price.

IF IT'S NEW . . . IF IT'S NEWS . . . IT'S FROM

At Your Jobbers
or Write Us,
Dept. RTN
and We'll Tell
You Where

ELCO SALES CO.
RADIO • TELEVISION • ELECTRONIC COMPONENTS
190 W. GLENWOOD AVE., PHILA. 40, PA.

NOW at Newark PROFESSIONAL QUALITY TAPE RECORDING AT LOW COST!

THE **New PENTRON TAPE RECORDER**

Use 2 Ways FOR CUSTOM INSTALLATION OR AS A PORTABLE RECORDER

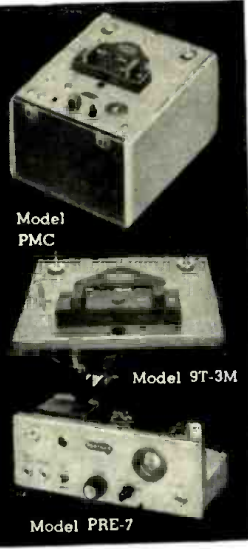
Available at last... a high fidelity recorder for the audio connoisseur, unbelievably low priced. Ideal as well for home, school, church or commercial use.

1 — FOR CUSTOM INSTALLATION
Model 9T-3M Tape Mechanism, 2 Speeds: 3.75" and 7.5" per second. 2 hours record-playback time. Super rewind-forward speeds—1200" in 40 seconds. Separate record-erase heads—removable pole, single or dual track. Flutter: -0.3% at 7.5"—0.5% at 3.75". **59.75**
 74F909. Wt., 10 1/2 lbs. NET

Model PRE-7 Pre-Amp. Push-pull supersonic bias-erase. Magic eye record level indicator. 5 Tubes. Exclusive oscillator circuit. Frequency response: ± 3 db, 50 to 11,500 cps at 7.5"; ± 3 db, 50 to 6500 cps at 3.75". Outputs: amplifier and headphones. Inputs: radio, phono and mike. **39.75**
 74F924. Wt., 8 lbs. NET

2 — FOR PORTABLE USE
Model PMC. Complete Portable Unit. Consists of tape mechanism and pre-amp above, in handsome carrying case, complete with reel of tape and take-up reel. Less amplifier; for use with your home music system or radio. **114.50**
 74F925. Wt., 25 lbs. NET

ALSO AVAILABLE
Model 9T3C. Complete Portable Tape Recorder. With built-in amplifier and speaker (See Catalog No. 55).



Precise Development Corp.'s Model 300 oscilloscope incorporates such features as 7" tube, sweep magnifier, complete push-pull vertical from input through output, blanking amplifier, internal square-wave calibrator, gated output with cathode follower, reversible polarity, driven and non-driven sweep, astigmatism circuit, and illuminated scale, to mention just a few.



Just Out! NEWARK'S New CATALOG No. 55

FREE! 196 Pages of the Latest Releases in Radio, TV, Industrial Electronics and High Fidelity.



Department R-13
 223 W. MADISON STREET
 CHICAGO 6, ILLINOIS

Easy, fast way to cut "Key" and "D" openings in chassis

...with new GREENLEE Radio Chassis Punches

Now, in 1 1/2 minutes or less make perfect "Key" or "D" holes for sockets and other equipment. Simply insert GREENLEE Punch and turn with an ordinary wrench... get a "clean" opening in a hurry! Write today for details on these as well as GREENLEE Radio Chassis Punches for round and square openings. Greenlee Tool Co., 1881 Columbia Ave., Rockford, Illinois

No. 732 "Key" Punch
 No. 733 "D" Punch

PHOTOCON SALES
 417 N. Foothill Blvd. SYcamore 2-4131
 Pasadena 8, Calif. RY an 1-6751

FREE 21 PAGE WINTER SURPLUS SALES CATALOG

WANTED new or clean used electronic surplus. Please state exact description of the condition and details of modification. Include lowest price in first letter.

LM & BC 221 Frequency Meter with cal. book, crystal, and tubes.....	Exc.	\$ 99.50
TS-252/C Weston Test Set.....	Exc.	150.00
TS-148/CP.....	New Mfg.	PUR*
Signal Generator 100A.....	Like new	PUR*
Million Signalyzer Radio & TV.....	Like new	PUR*
Impedance Bridge 650A General Radio.....	New	PUR*
Dumont 208 Scope.....	Exc.	PUR*
TS-146/CP X-Band Signal Generator.....	Exc.	PUR*
TS-34/AP Portable Oscilloscope.....	Exc.	350.00
TS-12 Test Set for X-Band Box 1 & 2 complete.....	Exc.	PUR*
TS-323 Frequency Meter 20-480 mc.....	Exc.	PUR*
Hewlett-Packard 410A VTVM. Like New.....	Exc.	185.00
Signal Generator Mod. 804 8-350 mc. Exc.	Exc.	PUR*
Simpson Genescope. New.....	Exc.	275.00
305B Floor model oscilloscope 1" tube B7A nfk.....	Exc.	PUR*
APR-4 Search Receiver.....	Exc.	PUR*
Timing Units for APR-4 Receiver.....	Exc.	PUR*
BC-34B, BC-312, BC-342 Receivers.....	Exc.	PUR*
APR-3.....	Exc.	PUR*
SCR-284 Fields Sets.....	Exc.	PUR*
APN4A or B.....	Exc.	PUR*
APR-5A.....	Exc.	PUR*
SCR-545 Radar Trailer.....	Exc.	PUR*
Type 120A Test Set 130-210 mc.....	Exc.	PUR*
Bronfion Radio Corp. New.....	Exc.	17.50
Antenna AT 104/AFND.....	Exc.	
Automatic Pilot Inverting.....	Exc.	
Type DA Input 2RVDC @ 12 amps. Output 115V, 3 phase, 400 cps. 115VA.....	Exc.	80.00
T-17 Hand Microphone with cord and PL-08.....	Exc.	4.50
HS-23 8000 ohm. Used \$2.95.....	New	5.95
HS-18 8000 ohm. Used 1.75.....	New	2.25
HS-33 600 ohm. Used 3.50.....	New	6.95
HS-28 600 ohm. Used 1.75.....	New	2.25

*PUR - PRICE upon request.

NOTE: One of the largest and most complete electronic surplus stocks in the country. We have thousands of tubes, capacitors, plugs, accessories, transmitters-receivers, test equipment, etc. Send us your requirements.

TERMS: Prices F.O.B. Pasadena, California. 25% on all C.O.D. orders. Californians add 3% Sales Tax. Prices subject to change without notice.

nal at the output which has the same phase (approximately) as the input signal. By the same token, pass a signal through one or any odd number of amplifiers and its phase will be reversed.

3. Intensity Modulation. This is a binding post on the front panel which is electrically connected to the grid (or cathode) of the cathode-ray tube. Its purpose is to permit a voltage to be applied to the cathode-ray tube so that portions of the trace may be made brighter or darker, as the case may be. This process of varying the beam intensity is known as intensity modulation and many oscilloscopes contain some provision for achieving it. Ordinarily the television technician has little need for this facility; however, it is employed in using the oscilloscope for frequency comparisons.

An application that several oscilloscopes have made of intensity modulation that can be of use to the television technician is the addition of a control known as the "Blanking Phase" control. This control, when turned from its "Off" position, applies a sine wave of voltage to the control grid of the cathode-ray tube. This has the effect of intensifying the trace during a portion of the sine wave cycle and of blanking it out during its most negative portion. The most useful application of this function is the elimination of one of the dual patterns obtained in the sweep alignment of TV and FM receivers. The 60-cycle sine wave applied to the grid of the CRT is so phased, by means of the "Blanking Phase" control, that when the second pattern should be traced out, the beam is blanked out. This results in one pattern, which is much easier to work with.

In working with oscilloscopes or in reading the instruction manuals that

Investigate this professional school— whose graduates are wanted, well paid and respected by the entire electronics industry

*An open letter to young men
of ambition from a pioneer
in the field of radio-TV education*



**E. H. RIETZKE, Founder and President of
CAPITOL RADIO ENGINEERING INSTITUTE**

IF YOU HAD TRAVELED with me on my recent trip across the United States and Canada, you would have seen with me the proud, grateful, earnest faces of CREI graduates and students. Proud that they had converted ambition into success. Grateful for what CREI had given them. Earnest in their plea to you to study for success.

Personnel Directors and Chief Engineers thanked me for personnel we had sent them—and bombarded me with requests for more.

I received the same reaction in every electronics installation, TV and radio station and factory I visited. I was proud that the professional school which I founded could point to such a fine record of accomplishment.

But I realized that our job has just begun. The growth of the electronics industry thus far is just a trickle compared to the future.

There are already 111 television stations. The FCC, by its "unfreezing" action, makes way for 2000 more stations. Over 18,000,000 TV sets are in use—that is 5,000,000 more than experts predicted there would be in 1954. There are over 100,000,000 radios in operation—in 95% of America's homes—and served by over 2500 radio stations.

Billions in electronics contracts have been awarded in the defense build-up. By 1960, it is estimated that the radio-electronics industry should do no less than \$10,000,000,000 per year, not counting military orders.

This is but a fraction of the picture of expansion.

There is already a gaping shortage of trained men to accept the thousands of openings in development, research, design, production, testing, inspection, manufacture, broadcasting, telecasting and servicing. The best jobs, the highest rewards, the posts of leadership are going to the trained men. And the better the training—the better the results.



If you are a beginner, CREI is not the school for you. There are other schools equipped to do much more for you. In a year or two, they can bring you to the point where you can profitably enroll at CREI.

If, however, you are a graduate of one of these other schools—or if you have been gainfully employed in the Radio-TV-Electronics industry for one year, or more, CREI can help change your life.

I founded CREI more than 25 years ago to provide professional level advanced training for men in the field. 98% of all our students were employed in electronics at the time they enrolled.

I can safely say that we have more contracts with leading companies for group training—than all other radio educational institutions combined. Let me mention just a few: United Air Lines,

Columbia Broadcasting System, Canadian Broadcasting Corporation, Trans-Canada Air Lines, Bendix Products Division, All-American Cables & Radio, Inc., RCA-Victor Division, the Machlett Laboratories—all have chosen CREI technical courses for group training of their own electronic personnel.

In CREI's Home Study Course you will receive authentic and complete courses, prepared by recognized experts, in a practical, easily-understood manner. You will learn under the supervision of a staff instructor. Your work will be graded by your instructor, not by machine. Return letters will indicate where you can improve. Your CREI diploma will be your key to success.

CREI's home study courses, and residence school, are accredited by the Engineers' Council for Professional Development.

The best way to find out about CREI is the way I am now going to suggest. Talk to your supervisor, to the chief engineer of your local radio or television stations, to CREI graduates, to the officials of any radio school—anywhere. I, with every member of the distinguished CREI faculty, am ready to stand on whatever answer they give you.

We have prepared a booklet called "Your Future in the New World of Electronics." In it you can find the breath-taking future of the industry, translated into *your* future. It contains an outline of the CREI curriculum that can transform your life from one of placid, plodding, ordinariness—to a full, happy, successful life of leadership in the fastest growing industry in the world.

Having expressed my pride in the past of the educational system and institution I represent, I make this pledge:

Wherever there is a man of ambition, I want to help him achieve the highest of which he is capable—in the glamorous, rewarding world of Electronics.

May I hear from you soon?



CREI resident instruction offered in Wash., D. C. VETERANS: If discharged after June 27, 1950, check last line of coupon for information about new G. I. Bill.

CAPITOL RADIO ENGINEERING INSTITUTE

Dept. 111E, 3224 16th St. N.W., Washington 10, D. C.

Send booklet "Your Future in the New World of Electronics" and course outline.

CHECK
FIELD OF
GREATEST
INTEREST

- Practical Radio Engineering Aeronautical Radio Engineering
 Broadcast Radio Engineering (AM, FM, TV)
 Practical Television Engineering
 TV, FM & Advanced AM Servicing

Name

Street

City Zone State

Check Residence School Veteran

NEW! **2 GREAT BOOKS**
By Milton S. Kiver
IF YOU SERVICE TV
—YOU NEED THEM!

"TV Servicing Short-Cuts
Based on Actual Case Histories"



shows you how to solve commonly recurring troubles

the book that really teaches fast, expert service techniques

This book describes a series of actual TV service case histories, each presenting a specific problem about a specific receiver.

The symptoms of the trouble are described and then followed by a step-by-step explanation of how the service technician localized and tracked down the defect. Finally, there is a detailed discussion of how this particular trouble can be tracked down and solved in any TV set. The discussions which follow each case history are invaluable—they explain how to apply the proper time-saving servicing techniques to any TV receiver. Here, in one volume, is the successful experience of experts—to make your service work easier, quicker, more profitable. Over 100 pages, 5½ x 8½", illustrated. Pays for itself on a single service job.

ORDER TK-1. Only \$1.50

"HOW TO UNDERSTAND AND USE
TV TEST INSTRUMENTS"



shows you how to get the most from your test instruments

Provides basic explanations of how each test instrument operates; describes functions of each control and shows their proper adjustment to place the instrument

in operation. Covers: Vacuum Tube Voltmeters, AM Signal Generators, Sweep Signal Generators, Oscilloscopes, Video Signal Generators, Field Intensity Meters, Voltage Calibrators. Describes each in detail; explains functions; tells proper use in actual servicing; shows how to avoid improper indications. Because this book gives you a clear, complete understanding of your test instruments, you get more out of them, save time, and add to your earning power. Over 175 pages, 8½ x 11", illustrated.

ORDER TN-1. Only \$3.00

HOWARD W. SAMS & CO., INC.

Order from your Parts Jobber today, or write direct to Howard W. Sams & Co., Inc. 2203 East 46th Street, Indianapolis 5, Ind.

My (check) (money order) for \$..... enclosed. Send the following books:

TK-1 (\$1.50) TN-1 (\$3.00)

Name.....

Address.....

City.....Zone.....State.....

controls. not all of them use the same names. Thus, "Range Frequency" of Fig. 1 is also known as "Fine Frequency," "Frequency Vernier" or just plain "Vernier." Alternate names for this and other controls are listed in Table 2. This is often a big stumbling block to the novice and it would help him considerably if the industry agreed on a standard name for each control.

Other Controls

In addition to the foregoing there are other controls (and their circuits) which broaden the application of the oscilloscope. The more important of these are listed below, together with a brief description of what they do.

1. *Phasing Controls.* This control, generally designated as "60 C Phasing" or "Horizontal Phasing," is brought into play when the oscilloscope is employed in conjunction with a sweep frequency generator. The sweep generator feeds its signal into one end of the system and the circuit response pattern is developed on the screen of an oscilloscope placed at the other end of the system.

In order that the observed response curve have a linear frequency base, it is necessary that the beam move in step with the changing frequency in the generator. Since the sweep oscillator is driven by a 60-cycle a.c. voltage, horizontal beam deflection should follow suit. To accomplish this, the horizontal input is switched away from its internal saw-tooth oscillator and a 60-cycle sine wave voltage is substituted. Ordinarily, the sweep generator will supply this voltage. However, some oscilloscopes have a special circuit for supplying their own.

Besides the a.c. voltage, some means must be available for bringing the beam in phase with the a.c. driving voltage used to sweep the frequencies back and forth. For this, a phasing network is employed. One of the elements of the network (a resistor usually) is made variable and this becomes the "Phasing" control. It is adjusted until a single response curve is visible on the scope screen.

2. *Vertical Polarity Reversing Switch.* This is usually a two-position switch marked "Normal" and "Reverse." When the switch is moved from one position to the other, the pattern on the screen is flipped over or reversed

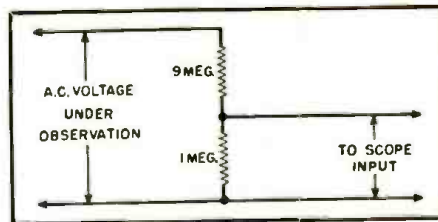


Fig. 3. Voltage divider which can be used when the applied voltage is too high.

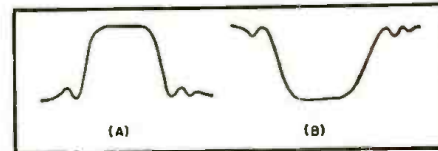


Fig. 4. Patterns for "Normal" (A) and "Reverse" (B) settings of polarity switch.

in the vertical direction. Thus, if the pattern appears as shown in Fig. 4A when the switch is in one position, it will appear as shown in Fig. 4B when the switch is turned to the other position. This is a useful device for interpreting TV video i.f. and sync or sweep waveforms, especially when the manufacturer's manual shows the pattern in one position and your scope shows it in the opposite position.

Reverse pattern on the screen is a source of confusion to many technicians. Why, for example, should the manufacturer's bulletin show the pattern pointing up when your scope has it pointing down? Does it mean that your equipment is hooked up wrong or does it indicate a defective circuit?

Actually, the answer is neither one. The polarity of the signal at various points in a television receiver is important and in general the manufacturer attempts to show the signal as it should be at each specific point. Now, this same signal, fed to your scope, may come out (at the screen) right side up or upside down, depending upon whether your scope has an even or an odd number of stages in its vertical amplifier system. Any voltage passing through an amplifier is reversed in phase by 180°. Therefore, if the signal shown in Fig. 4A is fed into the grid of an amplifier, it will appear at the plate as shown in Fig. 4B. Pass this second signal through one more stage and lo and behold, it is rightside up again.

As a general rule, two or any even number of stages will produce a sig-

Table 2. Alternate names frequently used for various oscilloscope controls. Common abbreviations, such as "Vert." for "Vertical," have been omitted from listing.

NAME OF CONTROL	ALTERNATE NAMES
Vertical Centering	Vertical Position. V Center. Y Position
Horizontal Centering	Horizontal Position. H Center. X Position
Vertical Gain	V Gain. V Vernier. Y Amplitude. Vertical Amplifier
Horizontal Gain	H Gain. H Vernier. X Amplitude. Horizontal Amplifier
Sync	Sync Amp.. Sync Lock. Locking. Sync Signal. Sync Gain. Sync Control
60-Cycle Phasing	Horizontal Phasing. Phase
Horizontal Attenuator	Horizontal Sensitivity. Horizontal Input Control
Vertical Attenuator	Vertical Sensitivity. Vertical Input Control
Fine Frequency	Frequency Vernier. Vernier. Sweep Vernier. Range Frequency
Sweep Frequency	Sweep. Sweep Range. Coarse Frequency. Steps. Saw-Tooth Sweep Frequency Range



TUBES

ALL TUBES are guaranteed for one year... individually boxed. Very BEST BRANDS available for immediate delivery!

FREE OFFER!

5 lbs. of good usable radio service parts with every 100 tubes ordered; a kit of assorted radio repair hardware free with every 50 tubes ordered!

TUBES and PARTS

074	287	.89	6AT6	.59	6C06G	1.49	6SG7	.73	12AV7	.89	1B3GT	ea. 95c	6806GT	ea. 85c	12AT7	ea. 89c		
074G	2C34	.60	6AS5	.90	6D6 78	1.10	6SH7	.69	12AW6	.95	1X2A	ea. 89c	5U4G	ea. 59	12AU7	ea. 65c		
1A5GT	2E5	.89	6AU5GT	.89	6D8G	1.15	6SH7GT	.69	12AX4	.69	6A84	ea. 59c	6A84	ea. 59c	12AX4	ea. 69		
1A7	2K2/879	.95	6AV5GT	.89	6F5GT	.69	6S17GT	.59	12AX7	.69	6A96	ea. 59c	6A96	ea. 59c	12AX4	ea. 29		
1B3GT	3LF4	.119	6AV6	.59	6F6GT	.59	6S17GT	.59	12BA7	.69	6AX4	ea. 69	6AX4	ea. 69	70L7GT	ea. 89		
1B5	3Q4	.69	6AX4	.69	6F8G	1.15	6S17GT	.69	12BA7	.69	6B6G	ea. 1.49	6B6G	ea. 1.29	715B	ea. 7.75		
1C7G	3Q5GT	1.08	6AX6	.69	6G6G	.95	6SN7GT	.69	12BF6	.69	6BK7	ea. 98c	6BK7	ea. 98c	807	ea. 1.55		
1E7	3V4	.69	6B4G	.69	6H6GT	.59	6S7GT	.59	12BH7	.69	6BL7	ea. 79c	6BL7	ea. 79c	866A	1616 ea. 1.49		
1H5GT	5V4G	.59	6B6G	.79	6J5GT	.59	6SQ7GT	.59	12C8	1.47								
1J6GT	5V4GT	.69	6B8GT	1.15	6J7G	.69	6SS7	.72	12F5GT	.69	115	14C5	1.07	35Z5	.55	75	69c	
1L4	5U4G	.59	6B8GT	.59	6J8G	1.15	6I7G	1.15	12H6	.69	14C7	.98	35Z6G	.95	77			
1LA4	5V4G	.87	6B8GT	.59	6K5GT	.69	6I7G	.69	12J5GT	.69	14F7	.89	35.51	.79	78	6D6	1.10	
1LC5	5W4GT	.89	6B8GT	.59	6K6GT	.59	6I7G	.69	12K7GT	1.07	14F8	1.30	36	1.06	80	.69		
1LC6	5V3GT	.45	6B8GT	.59	6K7GT	.69	6I7G	.69	12L7GT	.69	19B6GG	1.49	37	.72	83	1.45		
1LD5	5V4G	.54	6B8GT	.59	6K8GT	.69	6I7G	.69	12M7GT	.69	19T8	.89	38	.84	624	.72		
1LE5	5X4G	.81c	6B8GT	.59	6L5G	.95	6V3	1.29	12N7GT	.89	20	1.40	39/44	.88c				
1LH4	5Z3	1.15	6B8GT	.59	6L6G	.69	6V6GT	.69	12S7GT	.69	24	.69	41	.72	117L7	1.40		
1LNS	5V3GT	.45	6B8GT	.59	6L7G	1.40	6V8	.69	12S7GT	.69	25AC5GT	1.04	42	.69	117N7	.89		
1NSGT	6A7	.69	6B8GT	.59	6L8G	.69	6V8	.69	12S7GT	.69	25B06GT	1.15	43	.69	117P7	1.40		
1PSGT	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	25L6GT	.89	45	.69	117Q7	.59		
1Q5GT	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	25W4GT	.89	45Z5	.69	117R7	.59		
1RS	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	25Z5	1.04	46	.72	115B	.69		
1S5	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	25Z6GT	.69	47	.89	807	1.55		
1T4	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	32L7GT	1.15	50A5	.89	813	10.95		
1U4	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	35A5	.69	50B5	.89	866A/1616	1.49		
1U5	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	35B5	.69	50C5	.89	1295	.75		
1V	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	35C6G	1.04	50X6	.69	1619	.45		
1X2A	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	35C6	.69	50Y6	.69	1629	.29		
2A5	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	35C6	.69	50Y6	.69	2050	2.00		
2A6	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	35C6	.69	50Y6	.69	2051	1.15		
2A7	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	35C6	.69	50Y6	.69	7193	.87		
2B3	6A8GT	.69	6B8GT	.59	6L9G	.69	6V8	.69	12S7GT	.69	35C6	.69	50Y6	.69	70L7GT	89c		

TUBE KITS

BEST BRANDS AT BEST PRICES

- 3Q4, 1T4, 1R5, 1S5. List Value \$8.00. Tube Kit only. **\$1.98**
- 3S4, 1T4, 1S5, 1R5. List Value \$7.80. All Four Tubes for **\$1.98**
- 1U4, 3S4, 1S5, 1R5. List Value \$7.80. All Four Tubes for **\$1.98**
- 3V4, 1R5, 1S5, 1T4. List Value \$7.80. All for **\$1.98**
- 117Z3, 1U5, 3V4, 1R5, 1T4. A.C.-D.C. Portable Kit. All for **\$2.49**
- 12AT6, 12BA6, 12BE6, 35W4, 50B5. 5 Tubes for **\$2.59**
- 50L6GT, 35Z5GT, 12SQ7GT, 12SK7G, 12SA7G. 5 Tubes for **\$3.22**

TV ANTENNAS

- 8 Element Conical only **\$2.95**
- 10 Element conical rugged throughout **\$3.95**
- Double bay array, with stacking bars **\$7.75**
- 4 Bay array, with harness and stacking bars **\$14.95**

NEW DAVIS SUPER-VISION TV ANTENNA

Unbeatable for fringe area and DX - The only television antenna with a money-back guarantee. With the new Electronic Dipole Separators, **\$19.95** less mast

5" aluminum mast heavy gauge 1 1/4" diam. with interlocking end. Slip two sections together for a ten footer each **90c**

Outdoor TV Antenna Special!

Famous Make Folded Dipole Inline Antenna - no assembly necessary - elements snap in place with guaranteed positive lock. At this low price, we cannot mention manufacturer's name. **\$4.95** ONLY

Fringe Area DOUBLE "V" TV ANTENNA KIT

High Gain, Best Pictures Possible... complete with 200 ohm line, insulators, guy wire, hardware, full size antenna with double length 9 ft. mast. **\$6.95** Complete

P. M. SPEAKERS

- 12" COAXIAL PM SPEAKERS - \$12.95 ea. High Fidelity with high pass filter attached. 20 watt; 40-17500 cps. response; 8 ohm VC. Very best quality - NATIONAL BRANDS. Individually Packed.
- 3" ea. \$1.26 | 8" ea. \$3.23
- 4" ea. 1.36 | 10" ea. 5.10
- 5" ea. 1.59 | 12" ea. 6.54
- 6" SPECIAL PRICE ea. \$1.59

TV PICTURE TUBES

Send us your duds COLLECT - up to 70 lbs. via Railway Express - Send dud shipments over 70 lbs. by truck. ONE FULL YEAR GUARANTEE - All Types

SIZE	PRICE	PLUS YOUR DUD	SIZE	PRICE	PLUS YOUR DUD
10-Inch	\$10.95		16-Inch	\$16.95	
12-Inch	13.95		17-Inch	17.95	
14-Inch	14.95		19-Inch	19.95	
7-Inch	15.95		20-Inch	20.95	
15-Inch	15.95		21-Inch	21.95	

MISCELLANEOUS BUYS

- 1. F. TRANSFORMER - 456 Kc. 19c
- PILOT LIGHTS, Type No. 47 100 for \$2.95
- 10 for 39c
- VOLUME CONTROLS with switch, 2" shaft 1 meg, 1/2 meg, 1/4 meg... 34c
- SINGLE ION TRAPS... ea. 15c
- OUTPUT TRANSFORMER - for 50L6 29c for 6V6 39c
- UNIVERSAL OUTPUT TRANSFORMER, 12 watt... 79c
- CHIMNEY MOUNT for TV ant. 98c
- WELLER SOLDER GUN... \$8.95
- 3 SPEED G. I. CHANGER... 24.95
- 6 foot LINE CORD UL... 10 for \$1.95
- TV INTERLOCK CORDS... ea. 49c

300 OHMTWIN LEAD

- 55 Mil... 1,000 ft. Only **\$10.95**
- 20 GAUGE, 80 MIL WEB... 1000 ft. \$16.95
- 100 ft. 1.89

TV SET SPECIALS!

- "FAMOUS NAME TELEVISION SETS"!
- Automatic Gain Control
- Saw Tooth AFC
- Standard Coil Tuner - adaptable to UHF
- Transformer-operated throughout - no selenium Rectifiers.
- All the exclusive features of most expensive sets
- Meet all Standard RTMA requirements
- Finished in luxurious mahogany
- Manufacturer Licensed under RCA Patents.
- 17" Table Model now only \$149.00
- 20" Table Model now only \$169.00
- 21" Table Model now only \$179.00
- Console Sets \$20.00 additional.
- Lined Oak Finish... \$12.50 extra



RESISTOR KITS

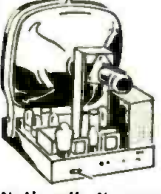
Insulated 1/2, 1 and 2 watt assortment of most used values, I.R.C. Ohmite, Stackpole, Speer, etc. 100 for **\$2.95**

21" TV CONVERSION KIT

- Consisting of rectangular tube, 70 DEGREE YOKE, Beautiful Mask and FLY-BACK TRANSFORMER comp. **\$3195**
- 20" TV CONVERSION KIT, as above, complete **\$2895**
- 17" TV Conversion Kit, as above, complete **\$2395**

Finest TV CHASSIS

- Complete with all tubes, including 17" RECTANGULAR PICTURE TUBE and SPEAKER. **\$12950**
- Complete with all tubes, including 20" rectangular picture tube and speaker. **\$14950**
- Complete with all tubes including 21" rectangular picture tube and speaker. **\$15950**
- Nationally Known
- Includes:
 - manufacturer licensed under RCA patents
 - permanent magnet 12" speaker
 - all tubes aligned perfectly
 - ideal for fringe areas... works better than other receivers and where others can't
 - ultra-sensitive fringe area tuner
 - standard 90-day guarantee on all tubes and parts
 - full band reception and output
 - gated ACC - finest automatic gain control
 - COMPLETE... READY TO OPERATE



PREMIER T.V. RADIO SUPPLY

Division of Continental Corp.
3237 W. North Ave. • Chicago 47, Ill.
ARmitage 6-5550

NEW ADDRESS!

CUSTOMERS! We have moved to much larger quarters. FREE ball point pen imprinted with our new address is available... write for yours today!

TERMS 20% DEPOSIT with order, balance C.O.D. All shipments F.O.B. Chicago. Orders Less Than \$5.00 - \$1.00 Service Charge.



ANCHOR BOOSTERS
Model ARC-101-100... \$29.10
Model ARC-101-75... 22.05
Model ARC-101-100 is a two stage super high gain booster for the most difficult reception areas. Model ARC-101-75 a single stage booster designed to give uniform response on all channels. One knob control.

B&W**MODEL
600**

Dip Meter

- ★ Frequency Range—1.75 to 260 MC. in 5 Bands
- ★ Adjustable Sensitivity Control
- ★ Wedge-shaped for Easy Access in Hard-to-get-at Places
- ★ Rust Proof Chassis, Sturdy Aluminum Case
- ★ Monitoring Jack and Diode Switch
- ★ Powered by 110 V. A.C. Line



PRICE
\$48⁰⁰
net

A HIGHLY USEFUL INSTRUMENT FOR THE

Service Man • Experimenter
Lab. Technician • Engineer • Amateur

The New B & W Model 600 Dip Meter provides you with a convenient means of doing the job in a minimum of time with dependable accuracy.

It is an extremely sensitive and reliable piece of test equipment having innumerable uses in the Ham Shack, Service Shop, Electronic Laboratory, or Production Plant.

Armed with this versatile and indispensable instrument, you eliminate the guess-work during measurement of—tank circuit frequencies, antennas, feed line systems, parasitics, and other pertinent tuned circuit characteristics, with speed and accuracy.

The handy instruction manual furnished with each instrument covers full information on how to use the Model 600 as an Absorption Meter, Auxiliary Signal Generator, R. F. Signal Monitor, and several special applications as well. See it at all leading electronic parts distributors throughout the U. S. A. and Canada; or write for descriptive bulletin.

BARKER & WILLIAMSON, Inc.
237 Fairfield Ave., Upper Darby, Pa.

fiers and their function is indicated in Fig. 1. Just beneath the "Vert. Gain" control is the "Vert. Attenuator" switch. This is a voltage divider network which limits the amount of vertical input signal reaching the first vertical amplifier. There are four switch positions labeled: .5, 5, 50, and 500 volts. These figures indicate the maximum value of input signal that should be applied with the switch in each position. Thus, with the attenuator switch in the .5 position, no signal having an amplitude greater than .5 volt r.m.s. should be applied to the "Vert. Input" terminal (and ground). Excess voltage on any range may produce a distorted pattern or may possibly cause damage. On the other hand, setting the control pointer too high—say at 500 volts—for an input voltage of 30 volts—will produce a pattern which is too small. In other words, do not set the control too high or too low.

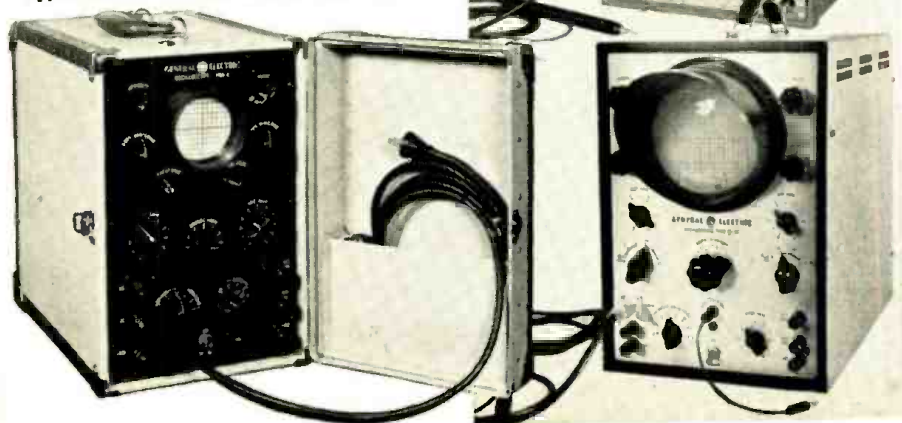
The "Vert. Attenuator" switch receives the applied signal before the "Vert. Gain" control. Hence, the attenuator switch may be considered as a rough adjustment with the gain potentiometer as its vernier.

The last remaining control on the front panel of this instrument (Fig. 1) is the "Horiz. Sens." switch. This 2-position switch is in series with the line from the "Horiz. Input" terminal to the horizontal amplifier. The "Horiz. Sens." is marked "High" for the closed switch position. At this setting the full signal is fed to the horizontal amplifier. The system is thus most sensitive with the switch in the "High" position and affords any applied signal maximum amplification (provided, of course, that the "Horiz. Gain" control is turned up, too).

The "Horiz. Sens." switch is marked "Low" for the open position of the switch and a 12-megohm resistor is placed in series with the input to the "Horiz. Gain" control.

These markings of "High" and "Low" can be very confusing since they refer to the sensitivity of the horizontal amplifier system and not to the applied voltages. Actually, strong voltages are applied to this system

(Top right) General Electric's Type ST-2A 5" scope. (Center) G-E's Model ST-2B 5" unit. (Bottom right) The same company's Type ST-2C 5" model. (Below) G-E's YNA-4.



with the switch in the "Low" position since with a strong voltage, less amplification is required. On the other hand, with a weak applied signal, the "Horiz. Sens." switch would be set "High."

Not all scopes possess attenuator controls. In some instruments the applied voltage goes directly to its respective amplifier. When using these instruments be careful not to apply too much voltage otherwise distortion and possible damage may occur. The safe maximum voltage that the oscilloscope can handle will usually be stated in the instruction manual. If it is desired to view the waveform of high voltages, reduce them first to a suitable value by the use of a resistive network such as shown in Fig. 3.

At the bottom of the oscilloscope in Fig. 1 there are six terminal posts through which connections are made to the instrument circuits. Two are for ground; the functions of the other posts are indicated in the illustration.

Alternate Control Names

The foregoing controls have all been part of one instrument. While other instruments have essentially the same

Start This New Year RIGHT!

... BY GETTING YOUR EQUIPMENT FROM *Walter Ashe*



HICKOK MODEL 539-A

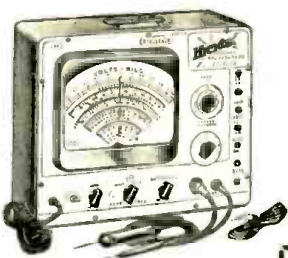
Professional Laboratory type tube tester. Shpg. wt. 39 lbs.

Net price Only **\$271.50**

HICKOK MODEL 209-A

Electronic Volt-Ohm-Capacity-Milliammeter. Features large 9 inch meter. Shpg. wt. 25 lbs.

Net price Only **\$132.50**



HICKOK MODEL 288-X

Universal Crystal Controlled Signal generator. Shpg. wt. 40 lbs.

Net price Only **\$186.00**



Industries and schools everywhere are wisely turning to Walter Ashe for the answer to their new equipment needs. The reason is clear. At Walter Ashe stocks are complete—deliveries prompt—helpful service a habit, not an empty phrase. If you have used, factory-built test equipment, see us about a "Surprise" trade-in allowance. Wire, write, phone or use the handy coupon below.

Walter Ashe
RADIO CO.
 1125 PINE ST. • ST. LOUIS 1, MO.

All prices f. o. b. St. Louis

Phone Chestnut 1125

FREE CATALOG!

Send for your copy today.

WALTER ASHE RADIO CO. R-1-53
 1125 Pine St., St. Louis 1, Mo.

Send complete information and price on _____
 (indicate make and model)

May want to trade _____

Mail 1953 Catalog containing complete line of Test Equipment.

Name _____

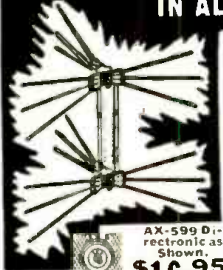
Address _____

City _____ Zone _____ State _____

GIANT BARGAINS BECAUSE WE'RE SPECIALISTS in TV ANTENNAS
ACCESSORIES, EQUIPMENT FOR ALL LOCATIONS

Amazing New Motorless
TV ANTENNA

**All Channel TV RECEPTION
IN ALL DIRECTIONS**



**Rocket
DIRECTRONIC
MOTORLESS
TV ANTENNA**
360° Electrically
Switched Beam

AX-599 Di-
rectronic as
Shown
\$16.95

No Motors
No Roof Orientation
No Electric Power
No Ghosts
Flick of Switch Clears
Picture Instantly

Beam Selector

Provides same clear pictures as rotating aerials costing 4 times as much. Electronically beams in all directions with full 360° rotation. You select direction with Directronic Beam Selector located at set. Model AX-599 stacked array includes 18 hi-tensile aluminum elements, 1 set connecting studs, Universal U-Clamps for mast, Directronic Beam Switch, and 75 feet of TR-X lead-in. Model AX-59 Directronic 8-element Single. **\$10.35**

**Rocket ALL CHANNEL
CONICALS**



This sturdy, all-aluminum constructed TV antenna is designed for broad-band reception on all TV channels, plus FM, High Gain, 4 to 1 front to back ratio. All channels 2-13. Uni Direc-
tional. Maximum signal to noise ratio. For use with 72-150-300 ohm lines. Low inception angle. Complete with all hardware—less mast. **\$ 3.95**
Single Bay Array..... **8.65**
2 Bay Array with Tie Rods.....
Print Area 4 Bay Array including 4 Bay
Stacking Bars..... **18.95**

With any order of \$10 or more you will receive our Rocket 7 Ft. Interlock Line Cord. Permits adjustment, testing, repair of set while operating with back removed. When ordering, state that you want this gift. Don't delay as quantities are limited. Only one given to a customer.

FREE
OF
EXTRA COST

ROCKET 5 ELEMENT YAGI

Excellent Pictures in Fringe Areas

Designed for high gain with minimum interference from ghosts and noise due to directive pattern. Produces clear sharp pictures. 5 heavy aluminum elements include one folded dipole, one reflector, three directors. Strong molded insulator. Non-slip mast clamp. Completely pre-assembled, less mast.

Channels 7 through 13..... **\$3.95**
Channels 5 or 6..... **\$6.95**
Channels 2, 3, or 4..... **\$7.95**

When ordering, specify exact channel number desired.

Rocket 35-foot Mast Kit

Economy mast kit contains 3-10' seamless duraluminated 1 1/2" OD mast, one 5' mast, 300 feet of 8/20 galvanized steel guy wire, and everything else needed including guy rings, mast connectors, insulators, cable clamps, guy hooks, and swivel mounting base.

35-Foot Mast Kit \$15.95 **25-Foot Mast Kit \$11.95**

**LOWEST PRICES ON
ANTENNA ACCESSORIES**

Mast Steel (Duraluminated 5' crimped) 1 1/2" O.D.	\$1.05
Mast Steel (Duraluminated 10') 1 1/2" O.D.	1.95
Mast Connectors for 1 1/2" O.D. mast	1.19
Climmy Mast Complete with Straps	1.59
Peak Roof Saddle (will take up to 1 1/2" O.D.)	.69
Lightning Arrestor-TV	34c ft.
Galvanized Steel Guy Wire—6/20	11.2c ft.
Galvanized Steel Guy Wire—11/20	11.2c ft.
Rocket Twin-Lead—7/28 stranded	2c ft.
ULF-type Tubular 300 ohm Twin-Lead	4.95
100' coil	20.95
Rocket Open Line Twin-Lead (500' reel)	10
Mast Stand-off Insulators—3"	.03
Stand-off Screw Insulators—3"	1.49
Wall Bracket—6" clearance	2.49
Wall Bracket—12" clearance	

ALL PRICES F.O.B., CLEVELAND, OHIO
Do not permit more than complete purchase price. Pay shipping charges on receipt of goods. 25% deposit on C.O.D. orders, please. Money-back guarantee.
Prices Subject to Change Without Notice

**National Electronics
OF CLEVELAND
THE HOUSE OF TV VALUES**

101 Delco Bldg. Cleveland 3, Ohio

2. "Int. Sync"—A linear (or saw-tooth) sweep voltage is applied to the horizontal amplifier. At the same time, a portion of the "Vert. Input" signal is fed into the sweep oscillator through the "Sync" control. If the frequency of the applied (or "Vert. Input") signal is near sweep frequency, the pattern can be locked steady on the screen of the cathode-ray tube.

3. "Line Sync"—The saw-tooth sweep voltage is still applied to the deflection plates through the horizontal amplifier. However, now, the synchronizing voltage is not taken from the incoming signal, but from the 60-cycle power line. The 60-cycle voltage is injected into the sweep oscillator through the "Sync" control and therefore locks the saw-tooth oscillator in sync with the line frequency. This is usable for applied signals having frequencies of 20, 30, 60, 120, and 180 cycles, and for other subharmonics of 60 cycles.

4. "Ext. Sync"—The saw-tooth sweep voltage is still active. However, now, a synchronizing pulse can be obtained only from an external signal injected into the sweep circuit through the "Ext. Sync" terminal. The setting of the "Sync" control still determines how much of this sync pulse reaches the saw-tooth oscillator.

5. "Horiz. Amp."—In this position the saw-tooth voltage of the oscilloscope's sweep generator is disconnected from the horizontal amplifier and the beam is stationary at the center of the screen in a small, round spot. To obtain any horizontal deflection of the beam, an external signal must be applied to the "Horiz. Input" terminal at the front of the oscilloscope. This signal will be amplified by the horizontal amplifier and applied to the horizontal deflection plates of the cathode-ray tube.

The most frequent use that the TV technician will make of the "Horiz. Amp." position will be in TV or FM receiver alignment. Nearly all sweep signal generators supply their own 60-cycle deflection voltage for the oscilloscope and this should be used in preference to any 60-cycle saw-tooth or sine-wave voltage the oscilloscope may be capable of supplying. (An exception to this occurs when the oscilloscope contains specific provision, in the form of a phasing control, enabling it to develop a properly phased pattern.)

The "Function" switch is a convenience that is not universally employed. In a number of oscilloscopes, the turning on or off of the power is handled by a separate toggle switch. Another two-position switch might then govern whether the sync voltages are internally or externally obtained. Or, internal sync, external sync, and line sync might be combined in a three-position switch. There are a number of ways of handling this situation and they vary from manufacturer to manufacturer.

On either side of the "Function" switch in Fig. 1 are the gain controls for the vertical and horizontal ampli-



the
Engineered
Product

**Perma-Power
TV TUBE
BRITENER**

**extends useful life
of older TV tubes!**

manufactured by
Perma-Power COMPANY
Chicago 25, Illinois
Manufacturers of Electronic Equipment Since 1928



**JCT
Meta-Gun**

An extra hand for Radio
and Television Technicians

- PRECISION VOLT-OHMMETER IN GUN FORM.
- ILLUMINATES AREA UNDER TEST.
- FLEXIBLE PROBE FOR REACHING TEST AREAS.
- METER READING AND TEST POINT VISIBLE IN ONE GLANCE.
- ALL WORK POSSIBLE WITH ONE HAND.
- TRIGGER RANGE SELECTOR
- Makes Service More Efficient
- Increases Profits ● Fully Guaranteed

Ideal For
TV TECHNICIANS ● MAINTENANCE TECHNICIANS
SOUND TECHNICIANS ● HAMS
BROADCAST ENGINEERS ● EXPERIMENTERS

Available at your nearest parts jobber
Model 3A - 1,000 ohms/volt,
including probe and ground lead - \$32.75
Model 3B - 20,000 ohms/volt,
including probe and ground lead - \$35.50

**JERSEY CITY TECHNICAL
LABORATORY**
880 Bergen Ave. Jersey City 6, N. J.

Oscilloscopes
(Continued from page 34)

instruments falls within 60 kc. to 100 kc. For most radio and TV service applications it is seldom necessary to go beyond 30 kc.

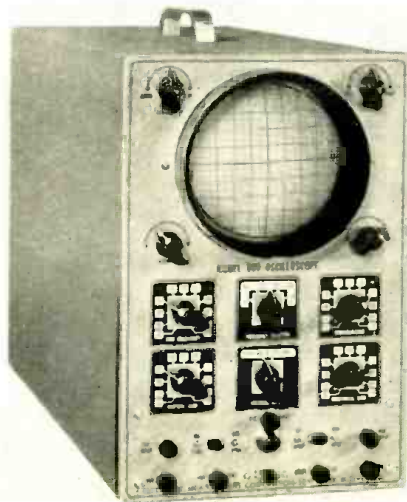
In order to work with any pattern presented on the screen, the pattern should be held stationary. With the "Range Frequency" control, it is possible with some patience to adjust the frequency of the saw-tooth generator until it exactly equals (or is an exact multiple of) the frequency of the applied vertical signal. But, unless this control is constantly adjusted, the frequency of the saw-tooth generator will change (even if only a few cycles) and the pattern will drift.

To keep the trace or pattern steady without constant adjustment of any control, a portion of the incoming signal is fed to the saw-tooth generator and serves to lock the generator in. The "Sync" control enables the operator to vary the amount of synchronizing signal fed to the sweep oscillator. The optimum position for this control is at that point where the smallest amount of sync signal causes the pattern to become stationary. Thus, you start with the "Sync" control at zero and slowly turn it to the right (clockwise) until the pattern locks-in. (It is important before using the "Sync" control to adjust the "Range Frequency" until the pattern is close to being stationary.)

The three controls just described, and especially the "Sync" control, are to be used in conjunction with the "Function" switch situated just below them. The "Function" switch is a 5-position switch which controls the power input and selects the desired horizontal deflection signal. The power is off in the "Off" position of the switch and is on in the remaining four positions. In addition, the switch makes the following connections in its 5 positions:

1. "Off"—Opens the circuit for the power input.

Electronic Measurement Corp.'s Model 600.



Service men — BOOST YOUR INCOME — SAVE HUNDREDS of DOLLARS

—these TRANSVISION Instruments are real necessities—a "must" for your shop if you are not to throw good money away.

Here's why: —

1. **TESTING**—you can accurately test Cathode Ray Tubes.
2. **REACTIVATING**—you can save many dim or worn out tubes by reactivation.
3. **SPARKING OUT ELECTRICAL LEAKAGE** — many Cathode Ray Tubes develop electrical leakage. This can now be repaired.

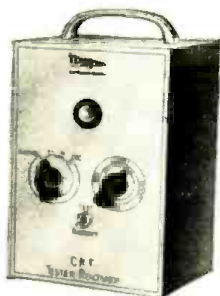
CRT TESTER-REACTIVATOR-SPARKER

3 Instruments in 1, making a complete CRT testing and repair unit. Compact, dependable, profitable.

It's a combination of the Transvision TESTER-REACTIVATOR plus A SPARKER in one handy instrument. It **TESTS PICTURE TUBES**—measures Cathode emission, locates shorts between elements, locates high resistance shorts or leakage as high as 3 megohms. **REACTIVATES DIM TUBES. SPARKS OUT ELECTRICAL LEAKAGE** in picture tubes.

Fully Guaranteed

\$34⁹⁵ net



CRT TESTER-REACTIVATOR

2 Instruments in 1. As a REACTIVATOR it renews brightness, sharpness, and detail of old dim CR Tubes, without removal of tube. It's also an accurate TESTER: Measures Cathode emission, locates shorts between elements, locates high resistance shorts or leakage as high as 3 megohms. 110V-60 cycles; wt. 3 lbs. Fully Guaranteed.

\$19⁹⁵ net

CRT TESTER-SPARKER

2 Instruments in 1. As a PICTURE TUBE SPARKER, it sparks out electrical leakage between elements. Saves many picture tubes and small tubes which would usually be discarded. Cathode-grid leakage is an especially common occurrence. The Sparker also gives a rapid check of gas condition of the tube.

As a TESTER it provides a variable 8,000-14,000 D.C. supply—useful for analyzing hard-to-solve deflection problems. Fully Guaranteed.

\$25⁹⁵ net



FIELD STRENGTH METER

for better TV installations. Make more efficient, more profitable TV installations, and save half the work, with the Transvision Field Strength Meter. Especially good for fringe areas — measures field strength as low as 10 microvolts. A great buy at this low price.

Model FSM-1, complete with tubes

\$59 net

Order direct from TRANSVISION, INC., New Rochelle, N. Y.

RUSH THIS COUPON

TRANSVISION, INC., Dept. RN-135 NEW ROCHELLE, N. Y.

Please send

\$ _____ deposit enclosed; send C.O.D. _____ in full enclosed; send prepaid.

Name _____

Address _____

teamed together for

Better TV Picture Quality



AMPHENOL
-INLINE*
ANTENNAS

AMPHENOL TUBULAR TWIN-LEAD

This combination of the famous Amphenol Inline Antenna and the extremely low-loss Amphenol Tubular Twin-Lead permits any TV set to present the best picture it possibly can.

The Amphenol Inline is the superior all-channel antenna. The Inline has uniform gain over the entire range of VHF channels—less variation than the 3 decibel change which determines "fuzziness." Its strong forward reception lobe practically eliminates any pick-up of unwanted secondary or reflected signals.

The Amphenol Tubular Twin-Lead provides very low-loss and constant impedance. The tubular construction minimizes the effect of moisture and dirt deposits on the concentrated field of energy and ends weather interference. Because of these characteristics, Amphenol Tubular Twin-Lead has been recommended by leading TV manufacturers and authorities for any installation where UHF is, or will be, available.



This illustration clearly shows that the concentrated field of energy between the two conductors, which are 7 strands of #28 copper weld wire, is contained by the tubular construction. This important field of energy is unaffected by any exterior conditions.

Nominal Impedance	300 ohms
Velocity of Propagation	84%
Attenuation dB/100 feet	30 mc — .63
	60 mc — .93
	100 mc — 1.25
	200 mc — 1.82
	400 mc — 2.7
	500 mc — 3.0
	700 mc — 3.6
	900 mc — 4.2

AMERICAN PHENOLIC CORPORATION
1830 SOUTH 54TH AVENUE • CHICAGO 50, ILLINOIS

scheduled to South America, Mon., Wed., Fri. 1730-1830; to North America daily 2030-2130, 2200-2300; for Faroe Islands, Sun. only 0900-1000; for Danish ships Mon., Wed., Fri., 1830-1850, 2130-2150, 2300-2320, and Tue., Thur., Sat. 1200-1220. OZH4, 15.165, for Middle East, India, Burma, Malaya, Indonesia. Tue., Thur., Sat. 0900-1000, for Danish ships same days 1000-1020. OZH, 15.18, for Far East, Australia, New Zealand, Tue., Thur., Sat. 0400-0500, for Danish ships same days 0500-0520; for Africa and Near East, Mon., Fri., 1200-1300. Reports are sought. (Gade-Joergensen, Denmark)

Dutch New Guinea—Radio Omroep Nieuw Guinea, 7.126, Hollandia, lists schedule of 0430-0700, Saturday also 2100-2300. (Scheiner, N.J.)

Ecuador—HCJB, 11.915, noted 2100-2130 with religious program. (Simpson, Kans.) HC4AS, 4.203, Bolivar, "La Voz de las Caras," is noted signing off weekdays 2330. (Robbins, Ind.)

El Salvador—YSASA, 11.95A, San Salvador, noted around 1830. (Bellington, N.Y.) Gives medium-wave call of YSAS; heard by 0930 and goes past 1700. (Stark, Texas) YSDR, 4.797, Santa Ana, noted with fair level signing off 2210. (Robbins, Ind.)

Ethiopia—The schedule of Radio Addis Ababa, 15.040AV, appears to be rather irregular; has been heard signing on in English 1102; on another day had a missionary program in English when tuned 1032; is identifying more frequently in English now, and some days has English news 1403A; sign-off varies. (Pearce, England) Was recently measured 15.036, but varies. Noted parallel on 6.42, latter quite good from 1230 onwards. (Ridgeway, South Africa) QRA is Box 1364, Addis Ababa, Ethiopia. (N. Z. DX Times)

Finland—OIX2, 9.555, Helsinki, heard 2345 with Finnish news and music. (Sanderson, Australia) Noted on this channel opening 2200 with news. (Annala, Oregon)

France—Paris noted signing on in French with "La Marseillaise" 0915 on 15.400 and 17.850. (Pearce, England) Paris is scheduled to Britain daily 0245 on 7.240, 6.145; 1445 on 11.970; Sundays 0800-0900 on 7.240. (Catch, England)

Fr. Equatorial Africa—Radio Chad, Brazzaville, is noted on 15.596 at 0030-0130; Radio A.E.F. is heard on 9.96, 15.596, 6.024 at 1200-1500. (Ridgeway, South Africa)

Fr. Morocco—Radio Maroc, 6.006, Rabat, is fair to good level around 0200-0300 with native session. (Saylor, Va.)

Fr. West Africa—Radio Francaise Africa Occidentale, 9.560, Dakar, noted signing on in French after a march at 0200, then in native African talks and music; noted on 11.896 at 0230. (Pearce, England) The 11.896 outlet opens 1400 with French programs; high level to 1800 closedown. (Ridgeway, South Africa) The 9.560 outlet is heard as early as 1530 to 1730 when closes with martial tune. (Levy, N.Y., Kary, Pa., others)

Germany—Nordwestdeutscher Rundfunk, Hamburg, noted on 11.795 in parallel with 7.290 when tuned 0900, had choral concert from Hanover; was strong on 6.270 with orchestral music when tuned 0345. Berlin, 7.150, Demokratische Republic, noted 0115 with news in German, call 0121, then dance and light music. (Pearce, England)

Greece—Kozani, 7.970, is heard in Sweden at 1335 with recorded music; CWQRM. (Malmo DX-aren, Sweden) Larissa, 6.760, relays news in Greek from Radio Athens 2330-2340. Athens Forces Station, 6.330, noted with recorded music 2357. (Kary, Pa.) Radio Athens, 7.300, heard with news 2300; on 9.607 with news (to North America) 1935-1950A. (Pelegrini, N.Y.)

Guatemala—Officials list TGN, 580 kc.; TGNA, 5.9525; TGNB, 9.668, and TGNC, 11.850; say "for our English short-wave broadcast we use only the call TGNA." (Ferguson, N.C.)

Hong-Kong—ZBW3, 9.525, noted 0430 with "Cantonese by Radio," then musical interlude. (Sanderson, Australia) Noted 0900 at good strength relaying BBC's "Radio Newsreel." (Balbi, Calif.)

India—Latest schedules received airmail from Delhi for All India Radio's External Services are—To East and Southeast Asia 1930-2000, 11.850, 9.630; 2030-2200, 17.740, 15.160; 0600-0815, 17.740, 15.190; 0830-0945, 15.190, 11.780.

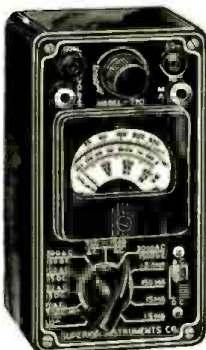
(Continued on page 136)

BUY TEST EQUIPMENT ON THIS RADICALLY NEW TIME PAYMENT PLAN

NO INTEREST!! - NO CARRYING CHARGES!!

USE CONVENIENT TIME PAYMENT ORDER BLANK BELOW

Superior's New
Model 770



Model 770 is an accurate pocket-size V.O.M. Measures only 3 3/4" x 5 7/8" x 2 1/4".

VOLT-OHM MILLIAMMETER

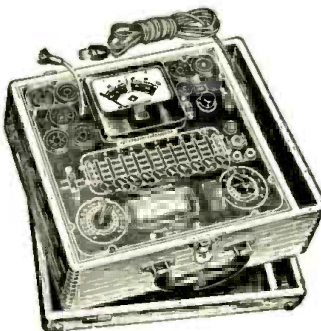
Sensitivity—1000 ohms per volt

Uses latest design 2% accurate 1 Mil. D'Arsonval type meter. • Same zero adjustment holds for both resistance ranges. It is not necessary to readjust when switching from one resistance range to another. This is an important time-saving feature never before included in a V.O.M. in this price range. • Housed in round-cornered, molded case. • Beautiful black etched panel. Depressed letters filled with permanent white. Insures long life even with constant use.

- Specifications:
- 6 A.C. VOLTAGE RANGES: 0-15/30/150/300/1500/3000 Volts.
 - 6 D.C. VOLTAGE RANGES: 0-7.5/15/75/150/750/1500 Volts.
 - 4 D.C. CURRENT RANGES: 0-1.5/15/150 MA. 0-1.5 Amps.
 - 2 RESISTANCE RANGES: 0-500 Ohms 0-1 Megohm.

\$14.90 NET The Model 770 comes complete with self-contained batteries, test leads and all operating instructions.

Superior's New
Model TV-11 **TUBE TESTER**



Operates on 105-130 Volt 60 Cycles A.C. Hand-rubbed oak cabinet complete with portable cover **\$47.50** NET

- Uses the new self-cleaning Lever Action Switches for individual element testing. Because all elements are numbered according to pin number in the RMA base numbering system, the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TV-11 as any of the pins may be placed in the neutral position when necessary.
- Uses no combination type sockets. Instead individual sockets are used for each type of tube. Thus it is impossible to damage a tube by inserting it in the wrong socket.
- Free-moving built-in roll chart provides complete data for all tubes.
- Phone jack on front panel for plugging in either phones or external amplifier detects microphonic tubes or noise due to faulty elements and loose external connections.

Superior's New

JUNIOR SUPER-METER

MOST COMPLETE AND COMPACT MULTI-SERVICE INSTRUMENT EVER DESIGNED



Hands-on round cornered molded bakelite case 3 1/2" x 5 1/2" x 2 1/4" complete with all test leads and instructions

- Measures: * Voltage * Decibels
* Capacity * Resistance
* Current * Inductance
* Reactance

Specifications: D.C. Volts: 0-7.5/75/150/750/1500 Volts. A.C. Volts: 0.15/150/300/1500/3000 Volts. Resistance: 0-10-100/100,000 ohms. 0-10 Megohms. D.C. Current: 0-7.5/75 Ma. 0-7.5 amps. Capacity: .001 Mfd. — 2 Mfd. 1 Mfd. — 20 Mfd. Electrolytic Leakage: Reads quality of electrolytics at 150 Volt test potential. Decibels: —10 Db to +18 Db. +10 Db. to +38 Db. +38 Db. to +58 Db. Reactance: 15 ohms—25 K ohms 15 K ohms—2.5 Megohms. Inductance: .5 Henry—50 Henries 30 Henries—10 K Henries. Plus Good-Bad scale for checking the quality of electrolytic condensers.

\$21.40 NET

Superior's New

TV BAR GENERATOR

THROWS AN ACTUAL BAR PATTERN ON ANY TV RECEIVER SCREEN!!



TV Bar Generator comes complete with shielded leads and detailed operating instructions. Only **\$39.95** NET

Connects direct to antenna post. No connection inside receiver.

Features.—Can be used when no stations are on the air. • Provides linear patterns to adjust vertical and horizontal linearity • Provides vertical and horizontal sweep signals • Provides signal for testing video amplifiers.

Superior's New
Model 670-A

SUPER-METER

A COMBINATION VOLT-OHM MILLIAMMETER PLUS CAPACITY REACTANCE INDUCTANCE AND DECIBEL MEASUREMENTS



The Model 670-A comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 6 1/4" x 9 1/2" x 4 1/2".

SPECIFICATIONS:

- D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts.
- A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
- OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts.
- D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes.
- RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
- CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Quality test for electrolytics)
- REACTANCE: 50 to 2,500 Ohms, 2,500 Ohms to 2.5 Megohms
- INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
- DECIBELS: —6 to +18 +14 +38 +34 to +58

\$28.40

ADDED FEATURE: The Model 670-A includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.

NEW TIME PAYMENT PLAN ORDER BLANK

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. B-42, 38 Murray Street, New York 7, N. Y.

Please send me the units checked below. I am enclosing the down payment with order and agree to pay the monthly balance as shown. It is understood there will be no carrying interest or any other charges, provided I send my monthly payments when due. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

- MODEL 770 Total Price \$14.90
\$2.50 down payment. Balance \$2.00 monthly for 6 months.
- MODEL TV-11 Total Price \$47.50
\$11.50 down payment. Balance \$6.00 monthly for 6 months.
- JUNIOR SUPER METER Total Price \$21.40
\$5.40 down payment. Balance \$4.00 monthly for 4 months.
- TELEVISION BAR GENERATOR Total Price \$39.95
\$9.95 down payment. Balance \$5.00 monthly for 6 months.
- MODEL 670-A Total Price \$28.40
\$7.40 down payment. Balance \$3.50 monthly for 6 months.
- I enclose \$..... *down payment.
- Ship C.O.D. for the down payment.

Signature

Name

Address

City..... Zone..... State.....

if you want the
BEST MUSIC
possible... you want a
McIntosh
**WORLD'S FINEST
CUSTOM
AMPLIFIER!**

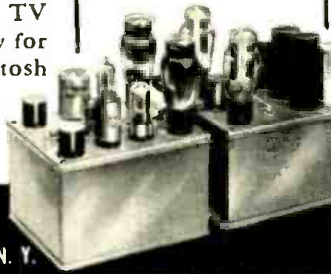


If you want greater listening pleasure from music... you want the laboratory perfection of the MCINTOSH AMPLIFIER... acclaimed by leading musicians, recording engineers and those laboratories where measurement of sound is critical.

Hear a demonstration of this unique, patented instrument... learn how easily it can become the heart of your own custom sound system... for radio, records, TV or tape. Write today for the name of a McIntosh dealer nearest you.

Get your FREE copy of "LOST INSTRUMENTS"

A light-hearted, well illustrated, non-technical discussion of what to look for in high-fidelity reproducing equipment.



50W-2 amplifier

McIntosh

LABORATORY, Inc.

2 Water St., Binghamton, N. Y.

**NOW—Get this expert SELF-TRAINING in
RADIO SERVICING**

by ABRAHAM MARCUS



co-author of famous "Elements of Radio" which has sold over 800,000 copies! Here is every detail you need to know about radio repair, replacement, and readjustment. Easy-to-understand, step-by-step self-training book shows you how to locate and remedy defects quickly.

Covers: TRF Receivers; Short-Wave Receivers; Multiband Receivers; Automatic Receivers; Power Supplies; Batteries; Motor-Generator Tubes; Beam Power, Thyristor Cathode Ray, etc.; Rectifier Circuits (Half-wave, Full-wave, Voltage-Doubler, etc.); Superregenerative Circuits (Diode, Triode, etc.); Amplifier Circuits (Audio, I-F, Mid-band, etc.); Oscillator Circuits (Crystal, Transformer, Sweep-circuit, etc.); Volume Control Circuits (Volume, Noise-Suppressor, Automatic Control, etc.);

All in one big volume — easy to read. 16 Big Chapters. 121 Sections. 400 "Show-How" Diagrams. 775 pages of practical radio instruction.

Explains how to use testing instruments such as: meter, vacuum-tube voltmeters, ohmmeters, signal generators, tube radio-ray oscilloscopes, etc. Over 100 illustrations in this section alone!

Get this authoritative radio repair handbook below brings you "Radio Servicing" on 7 days. Mail it NOW.

today! Coupon EE trial for 30 days.

PRENTICE-HALL, Inc., Dept. M-RTN-53
70 Fifth Ave., New York 11, N. Y.

Send me, for 10 DAYS' FREE TRIAL "Radio Servicing," by Abraham Marcus. I will return it in ten days and pay nothing—or keep it and send \$1.95 down (plus postage) and \$2 monthly for 2 months.

Name _____
Address _____
City _____ State _____
() SAVE! Send \$6.95 WITH COUN—we pay postage.

AMPERITE
Studio Microphones
at P.A. Prices

Ideal for BROADCASTING RECORDING PUBLIC ADDRESS

"The ultimate in microphone quality," says Evon Rushing, sound engineer of the Hotel New Yorker.

- Shout right into the new Amperite Microphone—or stand 2 feet away—reproduction is always perfect.
- Not affected by any climatic conditions.
- Guaranteed to withstand severe "knocking around."

Models
RBLG—200 ohms
RBHG—Hi-imp.
List \$42.00

"Kontak" Mikes
Model SKH, list \$12.00
Model KKH, list \$18.00

Special Offer: Write for Special Introductory Offer, and 4-page illustrated folder.

AMPERITE Company, Inc.
561 BROADWAY • NEW YORK 12, N. Y.
Canada: Atlas Radio Corp., Ltd., 560 King St. W., Toronto

with good signals from 1530. (Ridge-way, South Africa) PRL7, 9.72. Rio de Janeiro, leaves this channel daily 1730. (Bellington, N.Y.) PRL9, 6.147, the other *Radio Nacional* outlet, is usually good level around 2000, some QSB. (Gaylord, Wn. State)

Bulgaria—Sofia has replaced 15.330 with 9.700A; has *English* for North America 2000-2030. (Niblack, Ind., Kary, Pa., others)

British Guiana—*Radio Demerara*, ZFY, 5.980A, has been heard with news 1945; good level in Indiana. (Hord) When this was compiled the Cable and Wireless, Ltd., transmitter ZJA6, 15.075, Georgetown, was being heard throughout the world with relay of sports events (cricket, racing) from ZFY from as early as 1000 to around 1600; may have ceased these special broadcasts by now.

Burma—*Radio Rangoon*, 4.775, is good level in New Zealand 1000-1015 with *English*. (N. Z. DX Times) Noted on 9.54 from 0930 with programs in *English*, recorded music; has news 1000 by man, followed by weather report and program preview for next day; closes 1015A; calls "This is the Burma Broadcasting Service." (Ridge-way, South Africa)

Ceylon—*Radio Ceylon*, has strong signal 0100 with native vocal music; heard in *English* 0200. (Pearce, England) Still noted opening 2045 on 11-975. (Sanderson, Australia, others) This outlet normally closes 1145A but on Thursdays runs to 1215 closedown. (Fuller, R.I.) VOA relays are scheduled for 15.120 at 0730-0830 and on 11.975 at 1030-1100, both to India-Pakistan.

Chile—Punta Arenas, CE920. 9.200A. is heard with fair signal 2045; gives call 2100, closes 2200. CE1174, 11.74, Santiago, has very strong signal 2230 to close at 2400. *Radio Minería*, 11.73, Santiago, is heard at 2300 to after 2330; gives call at 2300 and 2315; signal deteriorates after 2330. (Ridge-way, South Africa)

China—*Radio Peking*, 15.06V, noted with news 0400 and 0830, stronger 0400. (Pearce, England) Revised schedules for *English* periods from *Radio Peking* are 1730. 6.100, 7.500, 9.040, 10.260, 11.690, 15.060, 15.170; 0400, 10.260, 11.690, 15.060; 0830, 11-690, 15.060. (N. Z. DX Times)

Colombia—*Radiodifusora Nacional de Colombia en Bogota* noted moved to 6.183 from 6.203. (Stark, Texas)

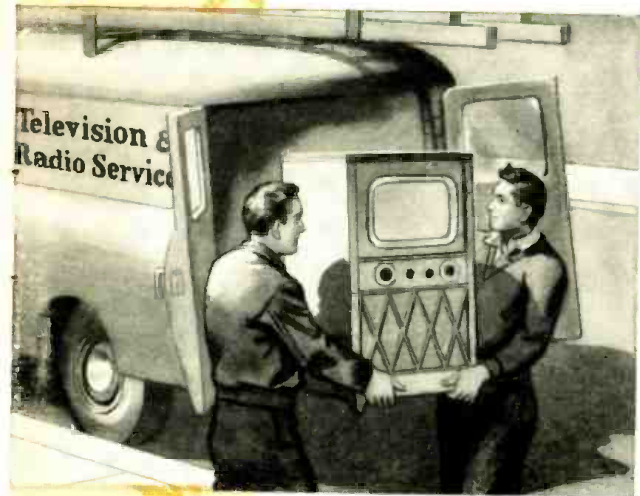
Curacao—PJC2, 5.010, Willemstad, noted at fair level with *English* session on Wednesdays 2000-2030. (Croston, Pa.)

Cyprus—Asharq-al-Adna, Limassol, noted 2255 on 6.790. 6.170. (Kary, Pa.)

Czechoslovakia—Prague is heard on 9.550 with *Radio Moscow* relay 1820-1930, with own program 1930-2030, and then resuming relay from Moscow; is directed to North America. (Grenell, Ohio) Has second period for North America at 2300. (Bellington, N.Y., others)

Denmark—OZU, 7.26, relays Home Service on Mon. and Fri. 1315-1615, other days 1240-1615. OZF, 9.52, is

Depend on Mallory
for
Approved Precision Quality



This Service Job Will Stay "Sold"!

For good reason, too. Mallory FP capacitors were used. They are engineered to duplicate the electrical characteristics of the original part in any TV or radio set that comes into your shop. They will give performance that's equal to . . . and often better than . . . the original equipment. You can count on Mallory FP's for precision quality . . . no call-backs.



Mallory FP's are the only fabricated plate capacitors available to the replacement market. They'll give you long lasting performance at high temperatures and greater ripple currents . . . even at 185° F. (85° C.).



When you use Mallory FP capacitors for all your service work, you can be sure that every job is right the first time. It just doesn't pay to take chances on capacitor performance. Always specify *brand* as well as rating when you order . . . ask for Mallory and watch your call-backs fall away to nothing. It costs no more to be sure with Mallory.

For plastic tubular replacements, ask your distributor for Mallory Plascaps®. They will put an end to premature shorts . . . leakage . . . off center cartridges . . . and unsoldered leads.

P. R. MALLORY & CO., INC.
MALLORY

CAPACITORS • CONTROLS • VIBRATORS • SWITCHES • RESISTORS
• RECTIFIERS • VIBRAPACK* POWER SUPPLIES • FILTERS

*Reg. U. S. Pat. Off.

APPROVED PRECISION PRODUCTS

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