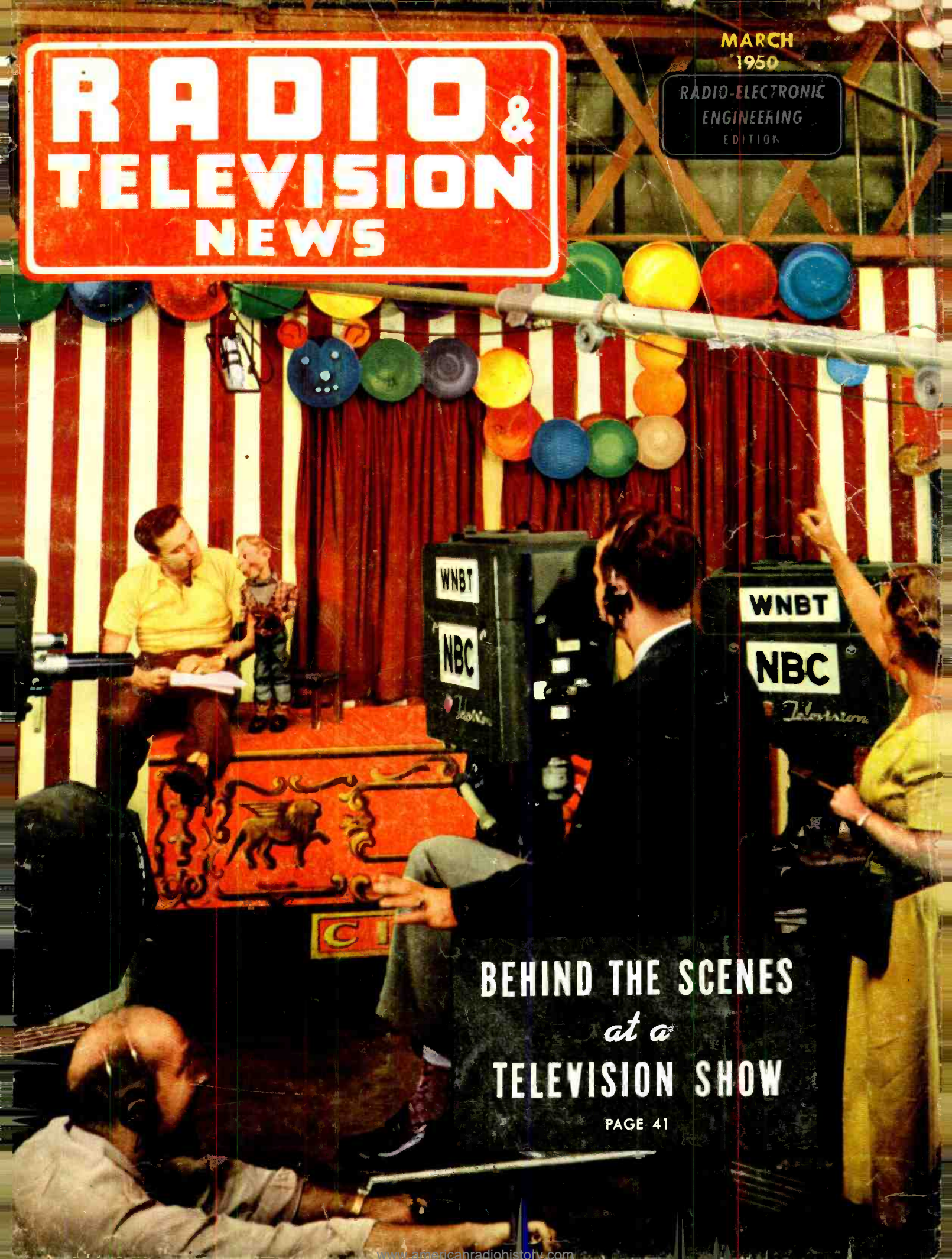


# RADIO & TELEVISION NEWS

MARCH  
1950

RADIO-ELECTRONIC  
ENGINEERING  
EDITION



BEHIND THE SCENES  
*at a*  
TELEVISION SHOW

PAGE 41



THE QUALITY OF RCA TUBES IS UNQUESTIONED



ANOTHER MILESTONE IN

*Television Progress*

...the new RCA-16GP4 short  
metal-cone kinescope with  
"Filterglass" face plate

UNCEASING RESEARCH in television tubes by RCA engineers is responsible for the development of the new, short 16GP4 metal kinescope.

This 16-inch-diameter tube is actually  $\frac{5}{16}$ " shorter than the 10BP4 . . . nearly 5" shorter than the 16AP4. Thus, greater flexibility and compactness is made possible in receiver and cabinet design.

Also, a superior picture is realized from the RCA "Filterglass" face plate. Picture contrast is improved by minimizing the effects of reflected room light, and of light reflections within the face plate itself.

RCA's engineering leadership adds *value beyond price* to the RCA tubes you sell. And you benefit directly from this *continued* research by the new enterprises which it creates.

*Always keep in touch with your RCA Tube Distributor*

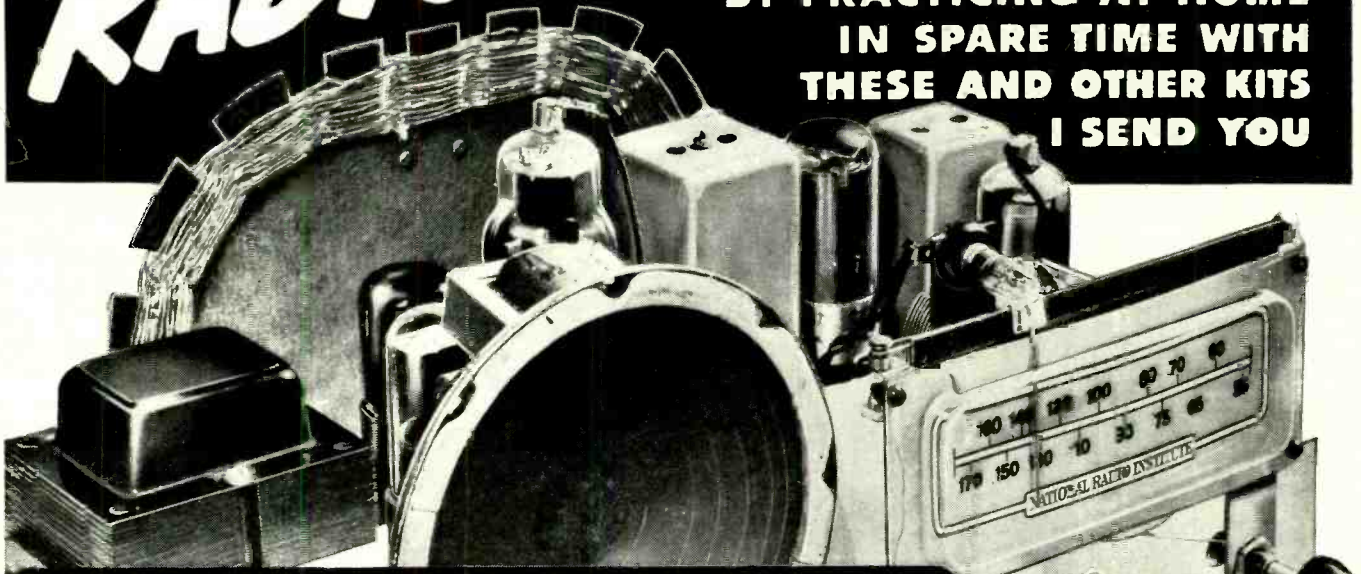


**RADIO CORPORATION of AMERICA**  
ELECTRON TUBES

HARRISON, N. J.

# LEARN RADIO-TELEVISION

BY PRACTICING AT HOME  
IN SPARE TIME WITH  
THESE AND OTHER KITS  
I SEND YOU



**I WILL TRAIN YOU AT HOME FOR  
GOOD PAY-SUCCESS  
A BRIGHT FUTURE**  
*in America's Fastest-Growing Industry*



J. E. SMITH, President  
National Radio Institute

## TRAINED THESE MEN

"N. R. I. helped qualify me for position as Radio Mechanic with United Airlines. Have my Radiotelephone 2nc Class License."—L. M. Hager, San Bruno, Calif.

"Work only spare time at Radio and average about \$40 a month. Knew nothing about Radio before enrolling with N. R. I."—Samuel T. DeWald, S. Clair, Pa.

"I am operating a Radio Sales and Service business. With FM and Television in the offing, we have a very profitable future."—Albert Pa-rick, Tampa, Florida.

Want a good-pay job in the fast growing RADIO-TELEVISION Industry? Want a money-making Radio-Television shop of your own? Here's your opportunity. I've trained hundreds of men to be successful Technicians... MEN WITH NO PREVIOUS EXPERIENCE. My tested and proved training-at-home method makes learning easy. You learn Radio-Television principles from illustrated lessons. You get practical experience building, experimenting with MANY KITS OF PARTS I send. All equipment yours to keep.

### MAKE EXTRA MONEY IN SPARE TIME

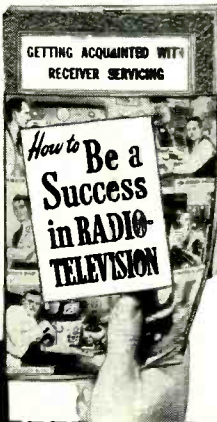
The day you enroll, I start sending SPECIAL BOOKLETS that show you how to make \$5, \$10 a week or more EXTRA MONEY fixing neighbors' Radios in spare time while learning. From here, it's a short step to your own shop or a good-pay Radio-Television servicing job. Or be a licensed Radio-Television Operator or Technician. The number of Radio Stations has nearly tripled in the last few years—and within three years, experts predict there will be 1000 Television stations on the air. Then add developments in FM, Two Way Radio, Police, Marine, Aviation, Microwave Relay Radios! Think what this means! New jobs, more jobs, good pay for qualified

men. The man who prepares now will reap rich rewards;

### MAIL COUPON FOR BOOKS FREE

Act now! Send for my FREE DOUBLE OFFER. Coupon entitles you to actual lesson, "GETTING ACQUAINTED WITH RECEIVER SERVICING." It shows you that learning at home is easy, practical. You also get my 64-page book, "HOW TO BE A SUCCESS IN RADIO-TELEVISION." It tells what my graduates are doing and earning, how quickly you can be on your way to good pay, success, a bright future. Send coupon in envelope or paste on penny postal. J. E. SMITH, President,

Dept. OCR,  
National Radio  
Institute, Pioneer  
Home Study Radio  
School, Washington 9, D. C.



## Good for Both—FREE

MR. J. E. SMITH, President, Dept. OCR  
National Radio Institute, Washington 9, D. C.

Mail me Sample Lesson and 64-page Book about How to Win Success in Radio-Television—both FREE. (No Salesman will call. Please write plainly.)

Name..... Age.....  
Address.....  
City..... Zone..... State.....  
 Check if Veteran  Approved under G. I. Bill

## VETERANS

GET THIS TRAINING  
WITHOUT COST  
UNDER G. I. BILL



Editor  
**OLIVER READ**, Litt.D., W9ETI

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

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

Associate Editor  
**RAY FRANK**, W9JU

Contributing Editor  
**R. HERTZBERG**, W2DJJ

Television Consultant  
**MILTON S. KIVER**

Short-Wave Editor  
**KENNETH R. BOORD**

Editorial Assistants  
**I. M. CARROLL**

**E. V. HITZEL**

**P. B. HOEFER**

Staff Artist  
**R. S. KUPJACK**

Advertising Manager  
**L. L. OSTEN**

Midwest Adv. Manager  
**JOHN A. RONAN, JR.**

Art Director  
**HERMAN R. BOLLIN**



COVER PHOTO: NBC's "Howdy-Doody" television show, originating from the studios of WNBT in New York, requires a skilled staff to produce flawless performances. (Kodachrome by Art Selby)

Chairman of the Board and Publisher  
**WILLIAM B. ZIFF**

President  
**B. G. DAVIS**

Secretary-Treasurer  
**ARTHUR T. PULLEN**

Vice-Presidents  
**MICHAEL H. FROELICH**  
Dir. Eastern Div.

**H. J. MORGANROTH**  
Production Director

**H. G. STRONG**  
Circulation Director

#### BRANCH OFFICES

NEW YORK (1)  
Empire State Bldg., WI 7-0400

LOS ANGELES (14)  
815 S. Hill St., TUCKER 9213  
Manager, WILLIAM L. PINNEY

# RADIO & TELEVISION NEWS

First in  
radio-television-electronics

Average Paid Circulation over 200,000

Radio News Trademark Reg. U.S. Pat. Office No. 378427 • Television News Trademark Reg. U.S. Pat. Office No. 517468  
Radio & Television News Trademark Reg. U.S. Pat. Office No. 517025

## CONTENTS

## MARCH, 1950

The Antenna Research Laboratory.....	Joseph M. Boyer	31
The Batwing FM Receiving Antenna.....	R. Cameron Barritt	35
Wide Frequency Range Square-Wave Clipper.....	Louis E. Garner, Jr.	36
Broadband Converters.....	Alvin B. Kaufman, W6YOV	38
Behind the Scenes at a Television Show.....	Milton Brown	41
A Home-Built Electronic Organ.....	Jim Kirk, W6DEG	42
An Effective Sync "Lock-in" Circuit.....	David Gnessin	44
The Mini-Rack Transmitter.....	John F. Clemens, W9ERN	45
Small Capacity Condenser Tester.....	T. A. Benham	48
Simulating TV Interference Patterns.....	E. G. Louis	49
Modern Television Receivers (Part 23).....	Milton S. Kiver	50
Elimination of Radio Interference by Off-Frequency Inversion.....	Samuel Freedman	53
Around the Clock with Short-Wave English Newscasts.....		58
Mac's Radio Service Shop.....	John T. Frye	60
A TVI Filter for Coaxial Transmission Lines.....	John Forrest	61
A Versatile Recording and Playback Amplifier.....	Glen Southworth	62
Television Troubleshooting Without Instruments.....	Walter H. Buchsbaum	64

### DEPARTMENTS

For the Record.....	The Editor	8	What's New in Radio.....	78
Spot Radio News.....		16	Technical Books.....	92
Within the Industry.....		22	New TV Products.....	117
Short-Wave.....	K. R. Boord	59	Manufacturers' Literature.....	130
MARS.....		68	AFCA News.....	150



COPYRIGHT 1950  
ZIFF-DAVIS PUBLISHING COMPANY  
185 North Wabash Ave., Chicago 1, Ill.  
VOLUME 43 • NUMBER 3



Member  
Audit Bureau of  
Circulations

RADIO & TELEVISION NEWS is published monthly by the Ziff-Davis Publishing Company, 185 N. Wabash Ave., Chicago 1, Ill. Subscription Rates: in the United States \$4.00 (12 issues), single copies 35c; in Canada \$4.00 (12 issues), single copies 40c; in Mexico, South and Central America, and U. S. Possessions, \$4.00 (12 issues); in British Empire, \$5.00 (12 issues)—all other foreign countries \$5.00 (12 issues). Subscribers should allow at least 2 weeks for change of address. All communications about subscriptions should be addressed to: Director of Circulation, 185 N. Wabash Ave., Chicago 1, Ill. Entered as second class matter July 21, 1948, at the Post Office, Chicago, Illinois, under the Act of March 3, 1879. Entered as second class matter at the Post Office Dept., Ottawa, Canada. Contributors should retain a copy of contributions and include return postage. Contributions will be handled with reasonable care but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever revisions and byline changes and interest in and to accepted material, including photographs and drawings.

RADIO & TELEVISION NEWS





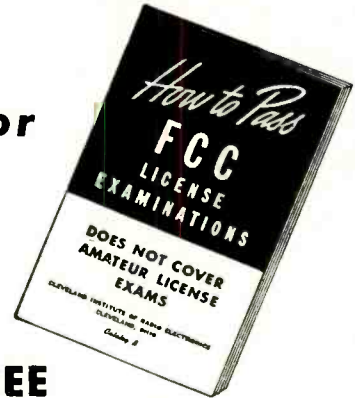
EDW. H. GUILFORD,  
Vice President.

I can train you to pass your FCC License Exams in a few short weeks if you've had any practical radio experience—amateur, Army, Navy, radio servicing, or other. My time-proven plan can help put you, too, on the road to success.

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."

# How to Pass FCC Commercial Radio Operator License Exams

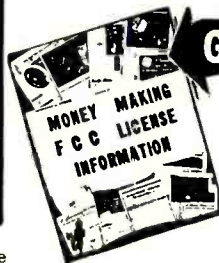


FREE

Tells where to apply for and take FCC examinations, location of examining offices, scope of knowledge required, approved way to prepare for FCC examinations, positive method of checking your knowledge before taking the examinations.

## Get your FCC ticket in a FEW SHORT WEEKS

IT'S EASY IF YOU USE CIRE SIMPLIFIED TRAINING AND COACHING METHODS AT HOME IN YOUR SPARE TIME



### Get This Amazing New Booklet

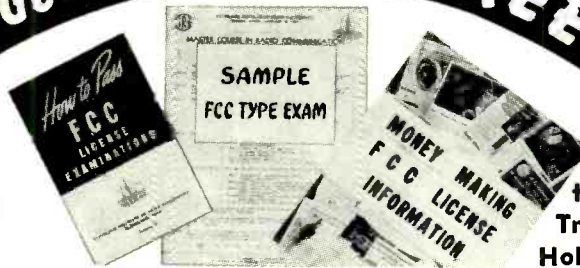
1. Tells of Thousands of Brand-New Better Paying Radio Jobs Now Open to FCC License Holders.

2. Tells How We Guarantee to Train and Coach You Until You Get Your FCC License.

3. Tells How Our Amazing Job-Finding Service Helps You Get the Better Paying Radio Job Our Training Prepares You to Hold.

Get your license easily and quickly and be ready for the jobs open to ticket holders which lead to \$3000 to \$7500 (average pay reported by FCC nationwide survey). CIRE training is the only planned course of coaching and training that leads directly to an FCC license. Your FCC ticket is recognized in all radio fields as proof of your technical ability. Employers often give preference to license holders, even though a license is not required for the job. Hold an FCC "ticket" and the job is yours!

## Get ALL THREE FREE



### CIRE Job-Finding Service Brings Amazing Offers of Jobs!

"I am working at WRJM as transmitter engineer. Received this position in response to one of the employment applications sent me upon completion of my course and the receiving of my Diploma. I received my 1st class Radiotelephone License on March 2, 1949.—Student No. 2608 AT.

"Thanks for the Application for Employment you recently prepared for me. I found satisfactory employment. I submitted 57 letters, enclosing the resume you supplied. I received 17 letters indicating my application was filed for future reference, 3 telephone calls, and 1 letter requesting personal interviews.

"As a result, I am employed in a development engineering capacity."—Student No. 4255NB.

## Don't Waste Valuable Time MAIL COUPON TODAY!

Don't put off getting this valuable information. Good jobs in radio need men like you. You can earn higher income, have a bank account, enjoy vacations, and have easier and better living. But you must have your FCC License. Hurry! Fill out the coupon right now and mail it. There is no obligation. You owe it to yourself to get the full story NOW.

CLEVELAND INSTITUTE OF RADIO ELECTRONICS  
Desk RN-15 4900 Euclid Bldg., Cleveland 3, Ohio  
APPROVED FOR VETERAN TRAINING UNDER THE "G.I. BILL OF RIGHTS"

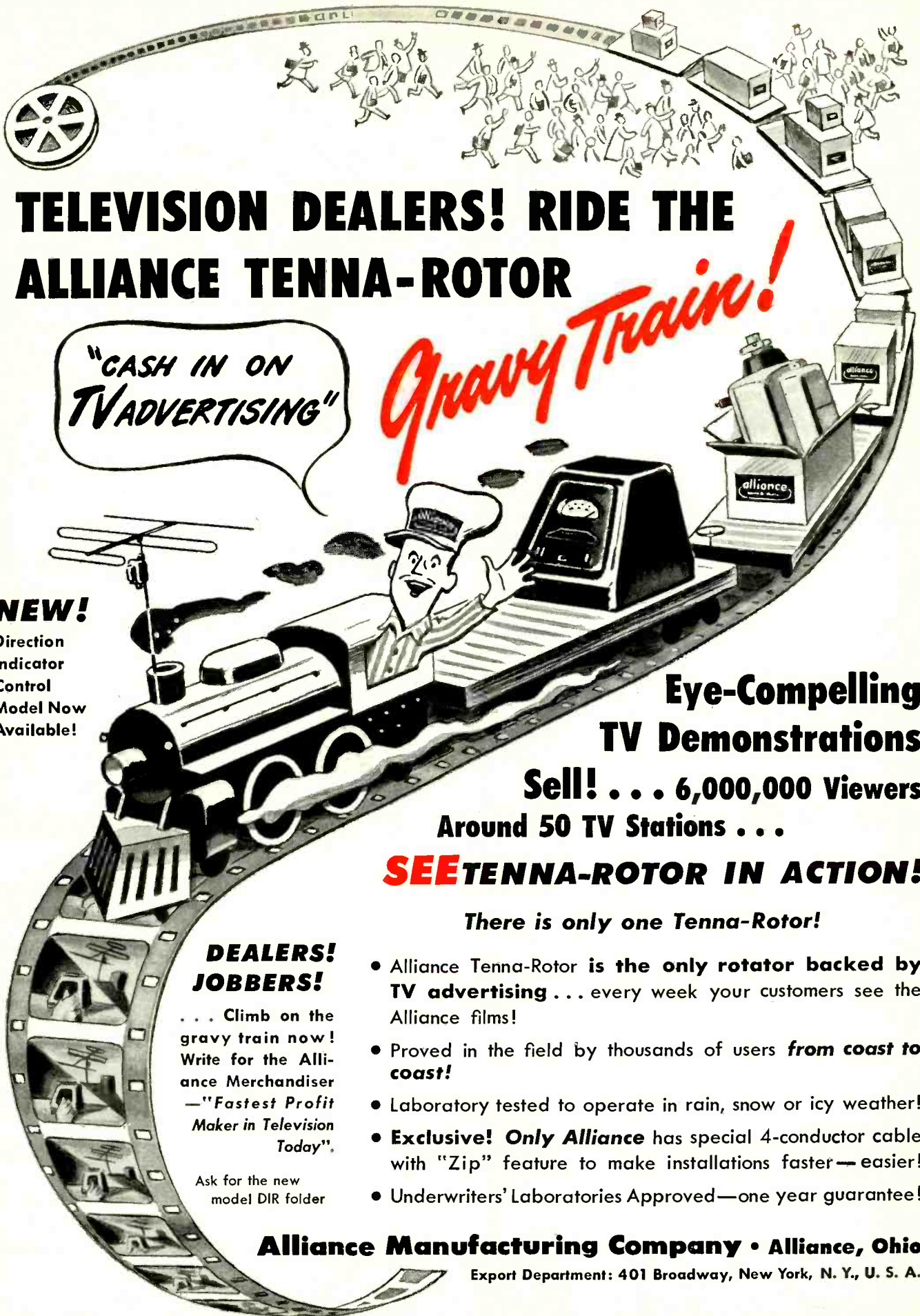
CLEVELAND INSTITUTE OF RADIO ELECTRONICS  
Desk RN-15 4900 Euclid Bldg., Cleveland 3, Ohio  
Address to Desk No. to Avoid Delay

I want to know how I can get my FCC ticket in a few short weeks. 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."

NAME .....  
ADDRESS .....  
CITY..... ZONE..... STATE.....

Veterans check for enrollment information under G.I. Bill.  
NO OBLIGATION—NO SALESMEN.





# TELEVISION DEALERS! RIDE THE ALLIANCE TENNA-ROTOR

"CASH IN ON TV ADVERTISING"

*Gravy Train!*

**NEW!**  
Direction Indicator Control Model Now Available!

**Eye-Compelling TV Demonstrations Sell! . . . 6,000,000 Viewers Around 50 TV Stations . . .**

**SEE TENNA-ROTOR IN ACTION!**

*There is only one Tenna-Rotor!*

**DEALERS! JOBBERS!**  
... Climb on the gravy train now! Write for the Alliance Merchandiser — "Fastest Profit Maker in Television Today".

- Alliance Tenna-Rotor is the only rotator backed by TV advertising . . . every week your customers see the Alliance films!
- Proved in the field by thousands of users *from coast to coast!*
- Laboratory tested to operate in rain, snow or icy weather!
- **Exclusive! Only Alliance** has special 4-conductor cable with "Zip" feature to make installations faster — easier!
- Underwriters' Laboratories Approved — one year guarantee!

Ask for the new model DIR folder

**Alliance Manufacturing Company • Alliance, Ohio**

Export Department: 401 Broadway, New York, N. Y., U. S. A.



# Only D.T.I. offers you the "BIG 5" TELEVISION RADIO-ELECTRONICS Laboratory Type HOME TRAINING

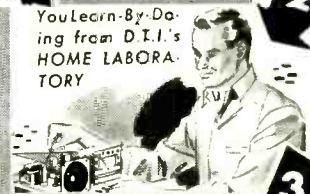
1

OPTIONAL  
FEATURE

2

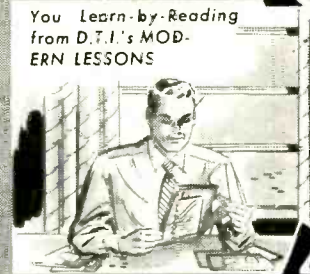
Build and Keep 10, 12½ or 16 inch Picture Tube Quality  
TELEVISION RECEIVER as you prepare for a Profitable Future

You Learn-By-Doing  
from D.T.I.'s  
HOME LABORATORY



3

You Learn-by-Reading  
from D.T.I.'s MOD-  
ERN LESSONS



4

Here is everything you need to prepare you at home for FASCINATING WORK, GOOD MONEY and a THRILLING FUTURE in one of America's most promising fields.

This includes the opportunity to build and keep the top quality Television Receiver shown above—with choice of a 10, 12½ or 16 inch picture tube that gives big, bright, sharp, steady pictures. Get the complete facts. This is an optional feature — available when you complete your training described below. See how D.T.I.'s wonderfully practical "BIG 5" method meets industry's needs. No previous experience needed. Mail coupon today!

### 16 Big Shipments of Parts — Plus Lessons

Work over 300 electronic experiments and projects from 16 big shipments of parts. This includes building and keeping all test equipment and radio set shown at left side of page. Modern easy-to-read lessons with handy fold-out diagrams simplifies your entire training.

### You Also Use Home Movies

D.T.I., alone, includes the modern, visual training aid . . . MOVIES to help you learn faster, easier at home. See electrons on the march and other fascinating "hidden action"—a remarkable home training advantage that speeds your progress.

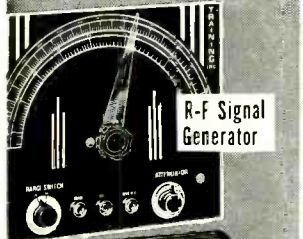
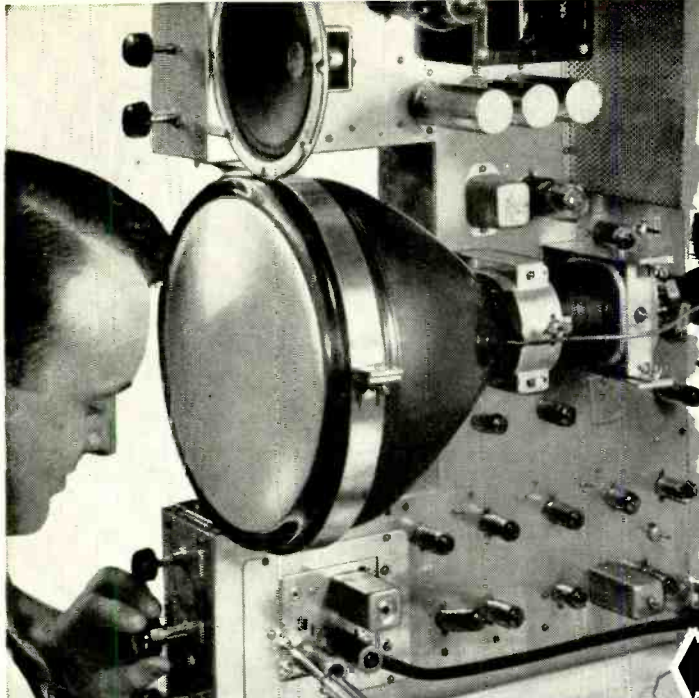
### EMPLOYMENT SERVICE

When you complete your training, our effective Employment Service helps you get started toward a real future in Television-Radio-Electronics.

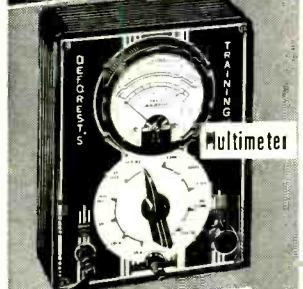
### Modern Laboratories

If you prefer, you can get ALL your preparation in our new, Chicago training laboratories . . . one of the finest of its kind. Ample instructors . . . modern equipment. Write for details!

6 Tube  
Radio  
Receiver



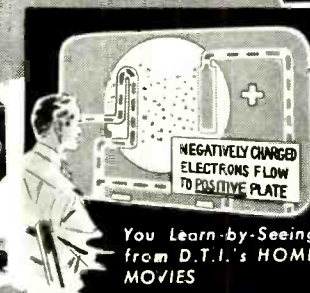
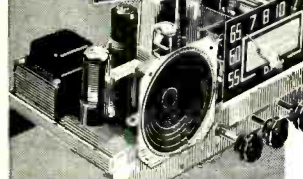
R-F Signal  
Generator



Multimeter



Oscilloscope



You Learn-by-Seeing  
from D.T.I.'s HOME  
MOVIES

MAIL THIS COUPON TODAY!

DeFOREST'S TRAINING, INC.  
2533 North Ashland Avenue, Dept. RN-G-3  
Chicago 14, Illinois.

Without obligation, give me complete facts showing how I may make my start in Television-Radio-Electronics.

Name \_\_\_\_\_ Age \_\_\_\_\_

Street \_\_\_\_\_ Apt. \_\_\_\_\_

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

**DeFOREST'S TRAINING, INC.**

Chicago 14, Illinois

A DeVry Institution





DO  
**BOTH**  
WITH

## New 250-watt **WELLER GUN**



You'll save on tools and time with the new Weller Soldering Gun WD-250. Whether the job is rugged or delicate, your Weller Gun does it with the same ease and efficiency. Chisel-shaped RIGID-TIP provides more soldering area for faster heat transfer. New "over-and-under" terminal design gives bracing action to tip. Your Weller Gun is light-weight and compact, gets into the tightest spots.

Weller Guns actually pay for themselves in a few months. Fast 5-second heating saves time on every job. Trigger-switch control saves power—no need to unplug gun between jobs. Prefocused spotlight and longer length mean easy soldering, even when the job's buried deep. No other soldering tool gives you so many time-and-money-saving features. Order your new 250-watt Weller Gun from your distributor today, or write for bulletin direct.

**SOLDERING GUIDE** Get your copy of "SOLDERING TIPS"—new fully illustrated 20 page booklet of practical soldering suggestions. Price 10c at your distributor's or order direct.



**WELLER**  
MANUFACTURING COMPANY  
810 Packer Street, Easton, Pa.

## For the **RECORD.**

BY THE EDITOR

### TELEVISION CAN KILL YOU

**I**T IS generally known that in our homes are several potential instruments of death. These include such items as our electrical lighting systems, an oil lamp, gas stoves and burners, and even a stepladder.

These items are not dangerous when properly used and they have been with us so long that we know their limitations. The introduction of power tubes in our modern radio sets, with increased voltages, presented a new hazard to the uninformed; however we now use caution in the handling of these circuits and components.

Now we have another problem—and one dangerous to the layman if he is not duly warned. It is the television picture tube. We are all familiar with the quite violent implosion (a bursting inwards) of an ordinary electric light bulb or radio tube—but very few users of television sets have ever witnessed the violent and disastrous effects from a large television tube that has let go.

The trend toward bigger and bigger picture tubes has increased the danger of implosion, flying glass, and potential injury and severe shock from high voltage. Most technicians have been duly warned by manufacturers, at lectures, and by releases from RMA. These men in general handle picture tubes with respect but some, and we have seen them, are very careless and scoff at any advice on the matter of safety precautions. These television tubes are not dangerous if handled properly. If they are handled carelessly, scratched, or dropped, they can very well become an instrument of severe injury or even death.

For those technicians handling such tubes for the first time let them heed the advice of the Cathode-Ray Committee of RMA: don't expose picture tubes until you are ready to use them, wear goggles, keep bystanders away when replacing tubes, remove old tube within carton from premises, and never leave a picture tube in the hands of a customer.

It is also important that the face of the tube, when exposed, be placed on a clean soft padding whenever necessary to set it down. Dispose of the used tubes either by; (a) placing the old tube in a shipping carton properly sealed and then drive a crowbar or similar instrument through the closed top of the container, or (b) dispose of the tube in a metal ash can with a plunger operated through the closed top, and finally, don't use regular picture tubes for display purposes.

The popularity of television kits has

presented an opportunity for experimenters to build their own sets with a consequent reduction in cost. These people should be especially careful in the manner in which they handle exposed units. Testing of high voltage is another source of danger and we have seen several individuals remove the anode cap to test for an arc in order to determine whether or not high voltage was present. Very few home builders are equipped with television test instruments and for that reason rely on make-shift methods.

As far as television customers are concerned, there are always a certain number who are willing to "diddle" with their sets when a service technician is not available. This is a most dangerous practice, especially where children are present and are watching the proceedings. It is the responsibility of both the dealer and the technician to duly warn each and every customer against the hazards that exist on the inside of their TV cabinets. This can be done tactfully and in such a manner as not to cause alarm which would, of course, discourage sales, especially those where a demonstrator is being installed on trial.

The public always needs a lot of education on things electronic. Just as in the case of the amateur radio operator when television set users were damning them for every streak or blemish that appeared on their screens, so have they blamed service technicians for a host of other bad operating conditions. In the case of an accident resulting from the contents of a television chassis, the service technician would also be blamed. All handlers of electronic equipment must, for their own protection, help to educate the public on the correct use of things electronic—particularly television.

As mentioned, the ordinary electric light bulb, when dropped, is capable of producing flying glass over quite a wide area. This implosion would be multiplied many times in the case of a similar breakage of a large television picture tube. The above may serve as an example when explaining the possible danger to the customer. It would take little imagination to foresee what might happen. If a few "case histories" of accidents, resulting from implosion of television picture tubes, appeared in local newspapers it would do much to discourage the advancement of television. Let's exercise every possible precaution so that it won't happen. . . . . O.R.

RADIO & TELEVISION NEWS



# There's Only ONE COMPLETE CATALOG that Brings You EVERYTHING IN RADIO, TELEVISION & ELECTRONICS

IT'S YOUR

**FREE**

**ALLIED** 196-PAGE  
VALUE-PACKED CATALOG!

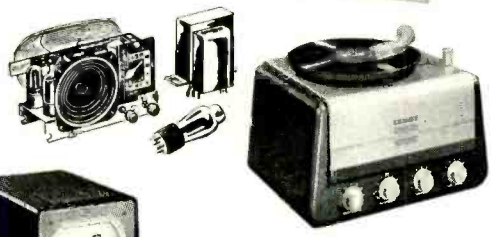
SEND FOR IT TODAY



## Get Radio's Leading Buying Guide

Here's the Buying Guide to *everything* in radio for *everyone* in radio! It's the *one complete* catalog, preferred in the field because it fills *every* TV, Radio, and Electronic supply need. It's packed with the world's largest selections of quality equipment at lowest money-saving prices. See the latest in TV, AM and FM receivers; radio-phonos; new Sound Systems, P.A. equipment and high-fidelity sound components; recorders and accessories; full selections of newest Amateur receivers and station gear; test instruments; builders' kits; huge listings of parts, tubes, tools, books, diagrams.

ALLIED gives you every buying advantage: speedy delivery, expert personal help, lowest prices, assured satisfaction—plus the most liberal Time Payment plan in radio. Get the 1950 ALLIED Catalog—it will save you time and money. Send today for your FREE copy!



## WORLD'S LARGEST STOCKS

*Radio Parts Unlimited*  
*Test Instruments—All Makes*  
*Television & Home Radios*  
*P. A. and Hi-Fi Equipment*  
*Amateur Station Gear*  
*Experimenters' Supplies*

**QUICK, EXPERT SERVICE**

## ALLIED IS YOUR TELEVISION HEADQUARTERS



You keep up with TV when you depend on ALLIED! Count on us for the latest releases and largest stocks of picture tubes, component parts, antennas and accessories—plus the latest in TV receivers, tuners and kits. If it's anything in TV—we have it in stock! So remember—for TV—it's ALLIED First!

**ALLIED RADIO**

THE WORLD'S LARGEST RADIO SUPPLY HOUSE

*Everything in Radio, TV and Electronics*

Send for Radio's Leading Buying Guide

**FREE**

ALLIED RADIO CORP.  
833 W. Jackson Blvd., Dept. I-C-O  
Chicago 7, Illinois

Send FREE 196-page 1950 ALLIED Catalog.

Name .....

Address .....

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



# CHANNEL MASTER'S

## New Improved FAN FLECTOR

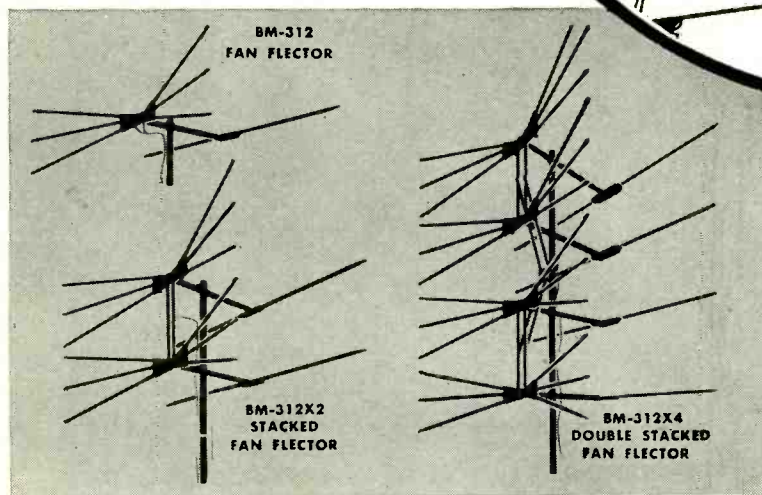
**BREAKPROOF  
HOWLPROOF**

**Sealed  
Ends**

**Solid  
Aluminum  
Inserts**

- SENSITIVITY
- STRENGTH
- RIGIDITY

**BEST ELECTRICALLY  
NOW EVEN BETTER  
STRUCTURALLY**



The new improved Fan Flector is the only antenna on the market with breakproof elements — internally and permanently reinforced by solid aluminum. This exclusive feature plus the sealed ends mean that you are getting an antenna that will withstand a half inch radial ice load without breaking and winds of gale velocity without howling or whistling. The first time you use a Channel Master Fan Flector you will be convinced that it's the best electrically and the ultimate structurally.

These models also feature *Swing-Lock-Action*, the patented preassembled feature of all Channel Master antennas. Just swing out elements and lock them in place — as easy as that.

*Send for FREE Technical Literature*



**FIRST IN PRE-ASSEMBLED ANTENNAS**

ELLENVILLE, N. Y.

### GAIN OF THE FAN FLECTOR SERIES

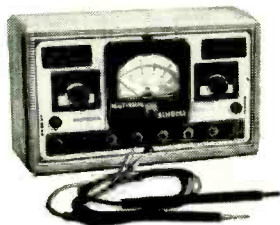
MODEL #	GAIN IN D.B. ABOVE TUNED DIPOLE												
	2	3	4	5	6	CHANNEL 7	8	9	10	11	12	13	
312	2.1	2.2	3.0	3.0	4.0		5.5	5.8	5.8	5.7	6.5	6.0	4.7
312X2	4.8	5.0	6.1	5.7	6.8		9.0	9.7	9.3	9.4	8.8	9.8	10.0
312X4	9.0	8.2	9.0	7.5	8.5		11.0	11.4	10.6	10.8	10.3	11.3	11.9





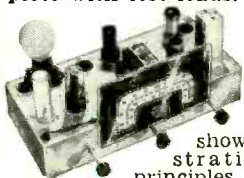
**YOU Build This Superheterodyne**

You receive complete standard equipment, including latest type High-Mu Tubes, for building various experimental and test units. You progress step by step until you build a complete Superheterodyne Receiver. It is yours to use and keep.



**YOU RECEIVE THIS PROFESSIONAL MULTITESTER!**

You will use this professional instrument to locate trouble or make delicate adjustments—at home—on service calls. You will be proud to own this valuable equipment. Complete with test leads.



**SIGNAL GENERATOR**

You construct the Transistron Signal Generator

shown here, demonstrating Transistron principles in both R.F. and A.F. stages. You study negative type oscillators at firsthand.

**AUDIO OSCILLATOR:**

An electronic device, which produces audio-frequency signals for modulating R.F. (radio frequency) carrier waves, testing A.F. (audio frequency) amplifiers, speakers, etc.



**T.R.F. RECEIVER**

You build several T.R.F. Receivers, one of which, a 4-tube set, is shown here. You learn construction, alignment, make receiver tests, and do trouble shooting.

**Get Into RADIO, TELEVISION and ELECTRONICS Master ALL Phases**

**Get Complete Training. You Receive and Keep All Tubes, Equipment, Parts and Lessons. No Extra Charges.**

**GOOD PAY and Unlimited Opportunities in JOBS LIKE THESE:**

Business of Your Own. Radio Manufacturing, Sales, Service. Broadcasting. Telecasting. Television Manufacturing, Sales, Service. Laboratories: Installation, Maintenance of Electronic Equipment, Electrolysis, Call Systems. Garages: Auto Radio Sales, Service. Sound Systems and Telephone Companies; Oil Well and Drilling Companies; Engineering Firms. Theatre Sound Systems. Police Radio.

**And scores of other good jobs in many related fields**

**YOU CONDUCT MANY EXPERIMENTS LIKE THESE!**

Checking action of condensers  
Experiments with AF and RF amplifiers  
Experiments with resonance  
Producing beat frequencies  
Calibrating oscillators  
Experiments with diode, grid-bias, grid-leak and infinite impedance detectors  
Practical experience in receiver trouble shooting  
Application of visual tester in checking parts and circuits  
Experiments with audio oscillators  
Advanced trouble-shooting and many, many others.

**Complete Training by Practical Resident Trade School, Est. 1905**

The same highly trained faculty, instruction materials and methods used here in our large, modern resident school, are adapted to your training in your own home. Shop Method Home Training has been proved by hundreds of successful graduates.

**Both Resident and Home Study Courses Offered**

**YOU LEARN BY DOING**

You receive special laboratory experiment lessons to show you how to build with your own hands various experimental units such as those shown at left, and how to conduct many tests.

You will find all lessons easy to understand because they are illustrated throughout with clear diagrams and step-by-step examples that you work out yourself. Every piece of the equipment and complete lesson material we send you is yours to keep and enjoy, including the multimeter, experimental equipment, all parts of the Superheterodyne, tube manual, radio dictionary, and complete, modern Television texts. All parts are standard equipment.

**Shop Method Home Training . . . Earn While You Learn**

With our practical resident Shop Method Home Training, you study in your spare time. You receive Spare Time Work Lessons, which show you how to earn while you learn. Service neighbors' radios and TV receivers, appliances, etc., for extra money and experience. Many National students pay all or part of their training with spare time earnings!

**DON'T DELAY! The Radio-Television Industry needs trained men NOW!**

**APPROVED FOR VETERANS!**  
Check coupon below!

For quick action, mail coupon today and we'll rush you full information.

**Free!**  
NEW, ILLUSTRATED OPPORTUNITY BOOK AND SAMPLE LESSON SHOW YOU HOW WE TRAIN YOU . . . SEND FOR THEM TODAY! NO COST. NO OBLIGATION.

**NATIONAL SCHOOLS**

LOS ANGELES 37, CALIF. • EST. 1905



**FIND OUT NOW . . . MAIL COUPON TODAY**

National Schools, Dept. RN-3  
4000 South Figueroa Street  
Los Angeles 37, California

Mail in envelope or paste on penny postal.

Send me your FREE book "Your Future in Radio" and the sample lesson of your course. I understand no salesman will call on me.

NAME \_\_\_\_\_ AGE \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_  
 Check here if Veteran of World War II





# Get On The TV Band-Wagon Now!

**GOOD PAYING JOBS ARE WAITING FOR GOOD MEN — CREI TRAINING IS YOUR BEST REFERENCE**

*Add CREI Technical Training to Your Present Radio Experience, Get That Better Television Job —Make More Money—Enjoy Increased Security.*

You can make your own opportunity in Television, if you start preparing *now*. No need to tell you how fast this great new field is expanding—or, of the great number of jobs that are being created. If you are in Television now, expect to be, or wish to get in, CREI offers the very training you need to help accomplish your aims.

CREI can show you the way with convenient spare-time study at home that gives you the up-to-date technical background you *must have* for Television. CREI courses are designed to give you a thorough grounding in basic principles and take you step-by-step through the more advanced subjects of Television and its related fields. It must be re-

**VETERANS: CREI TRAINING AVAILABLE UNDER G.I. BILL. FOR MOST VETERANS JULY 25, 1951, IS THE DEADLINE—ACT NOW!**

If you have had professional or advanced amateur experience and want to make more money, let us prove to you we have the training you need to qualify for a better radio job. To help us answer intelligently your inquiry please state briefly your background of experience, education and position.



## Capitol Radio Engineering Institute

*An Accredited Technical Institute Founded in 1927*

Dept. 293-B, 16th and Park Road, N. W., Washington 10, D. C.

Branch Offices: New York (7) 170 Broadway • San Francisco (2) 760 Market St.

membered that all new electronic developments have their roots in past techniques. CREI training is basic and helpful in your daily work right from the start. You will learn about and understand such subjects as: Optics; Pulse Techniques; Deflection Circuits; RF, IF, AF and Video Amplifiers; FM; Receiving Antennas; Power Supplies; Cathode Ray, Iconoscope, Orthicon and Projection Tubes; UHF Techniques, Television Test Equipment, etc.

### FREE SAMPLE LESSON

Now, see for yourself! Mail the coupon for free sample lesson and see how interesting it is to study at home and improve your income through ability the CREI way.

#### "THE ORTHICON AND IMAGE ORTHICON"

This lesson describes the development of the small, 3-inch image orthicon tube; theory and operation of the orthicon; image orthicon; specific features.



### MAIL COUPON FOR FREE BOOKLET

**CAPITOL RADIO ENGINEERING INSTITUTE**  
16th and Park Road, N. W., Dept. 293-B, Washington 10, D. C.

Gentlemen: Please send sample lesson and booklet, "Your Future in the New World of Electronics," together with full details of your home-study training. I am attaching a brief resume of my experience, education and present position.

Check field of greatest interest:

- |   |   |
|---|---|
| <input type="checkbox"/> PRACTICAL RADIO ENGINEERING              | <input type="checkbox"/> PRACTICAL TELEVISION ENGINEERING       |
| <input type="checkbox"/> AERONAUTICAL RADIO ENGINEERING           | <input type="checkbox"/> TELEVISION, FM & ADVANCED AM SERVICING |
| <input type="checkbox"/> BROADCAST RADIO ENGINEERING (AM, FM, TV) | <input type="checkbox"/> ADVANCED ELECTRONICS COMMUNICATIONS    |
|   | <input type="checkbox"/> RADIO-ELECTRONICS IN INDUSTRY          |

NAME .....

STREET .....

CITY ..... ZONE ..... STATE .....

I AM ENTITLED TO TRAINING UNDER G. I. BILL.



TELL THE **Inside** STORY TO

SELL **RAYTHEON** 20/20 TELEVISION

**REVOLUTIONARY, NEW 16 INCH RECTANGULAR SCREEN—138 SQ. IN.**

Now you see ALL the action because the rectangular tube uses ALL the viewing surface!

**DRAMATIC PICTURE DETAIL**

Sharp, brilliant picture assures years of outstanding T.V. enjoyment. Glareless Gray picture tube

**SIMPLIFIED CONTROL KNOBS—EASY TO OPERATE**

All adjustments on the front—easy to get at—Volume off and on—Brightness—Contrast—plus new continuous tuner

**NEW CONTINUOUS TUNER GIVES PRECISE PICTURE CLARIFICATION**

Hairline-sharp, fingertip picture adjustment (synchronized with sound) as simple and easy as tuning a radio.

**PRE-FIXED, ULTRA SHARP FOCUS**

Centers picture—locks in "Sharp Focus" position.

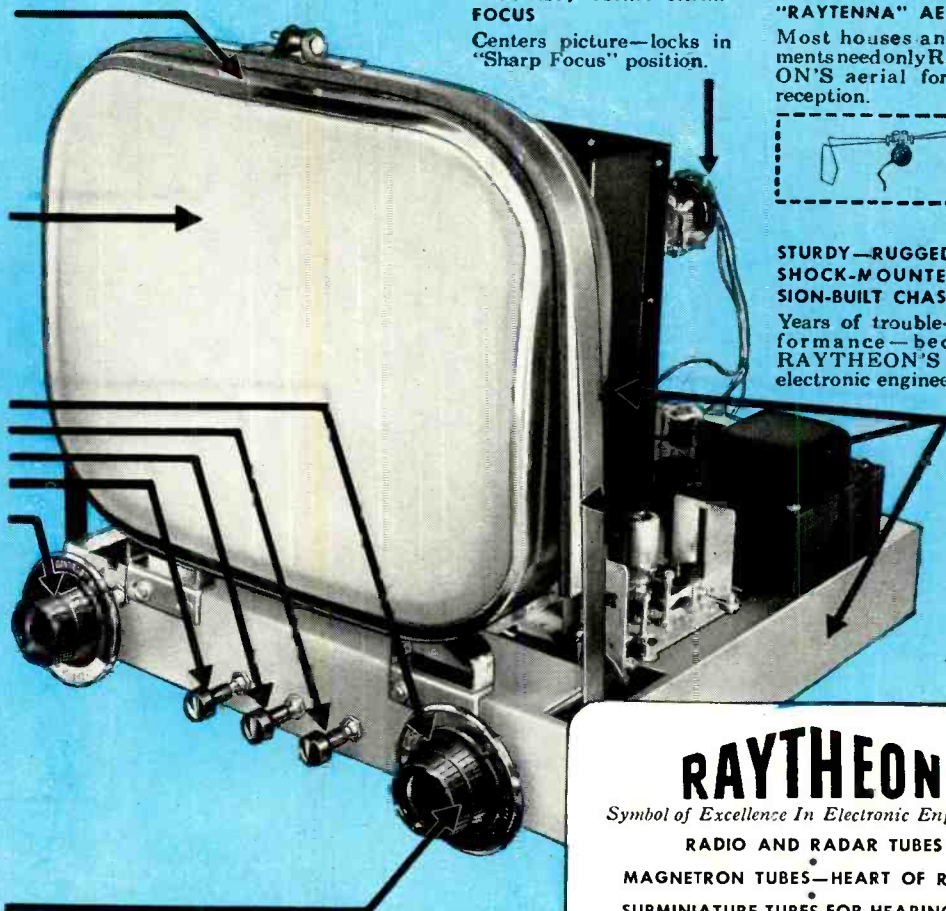
**ADJUSTABLE BUILT-IN "RAYTENNA" AERIAL**

Most houses and apartments need only RAYTHEON'S aerial for perfect reception.



**STURDY—RUGGED RUBBER SHOCK-MOUNTED PRECISION-BUILT CHASSIS**

Years of trouble-free performance—because of RAYTHEON'S superior electronic engineering.



**RAYTHEON**

*Symbol of Excellence In Electronic Engineering*

RADIO AND RADAR TUBES

MAGNETRON TUBES—HEART OF RADAR

SUBMINIATURE TUBES FOR HEARING AIDS

MARINE SAFETY DEVICES INCLUDING THE FATHOMETER\* AND SHIP RADAR

MICROWAVE RELAY SYSTEMS FOR T. V. F. M. FACSIMILE

F. M. A. M. T. V. TRANSMITTING EQUIPMENT

2-WAY MOBILE RADIO EQUIPMENT

DIATHERMY TUBES

SONIC OSCILLATORS FOR PROCESSING FOODS, DRUGS, COSMETICS

RADIO PHONOGRAPHS—RECORD CHANGERS

ELECTRONIC PHOTO-FLASH EQUIPMENT

ELECTRONIC WELDING DEVICES

DIELECTRIC HEATING MACHINES

20/20 TELEVISION RECEIVERS

RADIO TRANSFORMERS

\*Reg. U.S. Pat. Off.

**SALES APPEAL Inside and Out!**

**CHOICE OF DESIGN**—Modern contemporary in table models, tasteful conservative in floor models.

**QUALITY FINISH**—Dark, rich mahogany or blonde finishes.

**CONTEMPORARY STYLE**—Each cabinet is styled to blend with any setting.

**MINIMUM SERVICE REQUIREMENTS**—RAYTHEON sets are precision-built—not "assembly jobs."



The Silver Anniversary  
**138 Sq. In. Picture**

WRITE, WIRE OR PHONE FOR FRANCHISE DETAILS  
**BELMONT RADIO CORPORATION**

Subsidiary of Raytheon Manufacturing Corp.  
5933 W. DICKENS, CHICAGO 39, ILL.



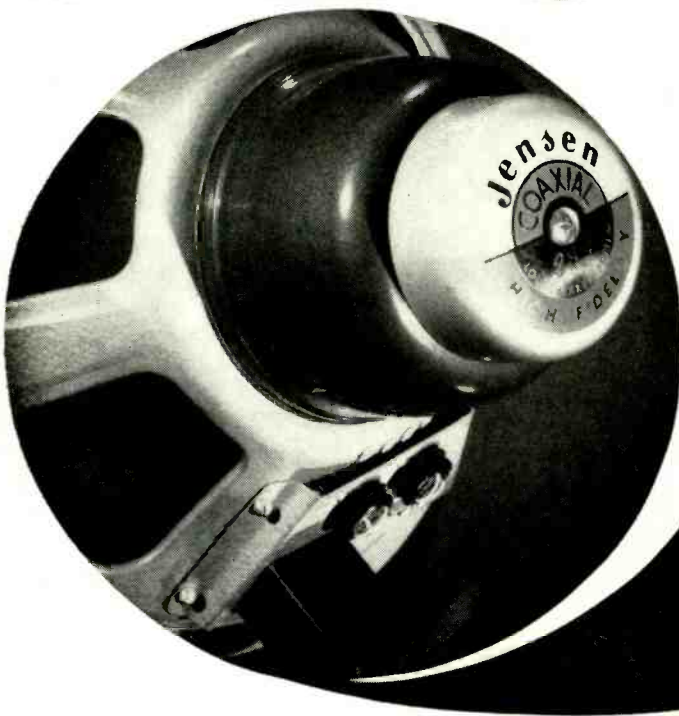
The FAMOUS GENUINE  
**JENSEN MODEL 510**  
 COAXIAL SPEAKER

**BEST AT ANY PRICE - - -**

*Comparative tests with the most expensive types of two-way speakers will prove that the Jensen Model 510 is the best regardless of price.*

*The new, wide-angle acoustic lens of the "510" is an example of Jensen leadership in loudspeaker engineering. By adapting optical principles to acoustics, this lens acts in conjunction with the h-f horn to distribute h-f radiation uniformly over a wide angle. This insures constant balance and high quality reproduction throughout the whole room.*

*Whether the "510" is used for broadcast monitoring, professional sound reproduction, or for home entertainment systems, the advanced Jensen electroacoustic design assures the finest performance.*



**JENSEN MANUFACTURING COMPANY** DIVISION OF THE HUBER COMPANY  
 6617 South Laramie Avenue, Chicago 38, Illinois • In Canada: Copper Wire Products, Ltd., 351 Carlaw, Toronto  
**RADIO & TELEVISION NEWS**



a new star in the  
**TELEVISION**  
sky...



**SANGAMO**

**6000 VOLT**

**TYPE 13**

**PAPER CAPACITORS**

**H**ere it is! A Television capacitor with a new standard of permanence. Designed to withstand continuous operation at 85°C—no wax—special polyester end seals will not crack or pull away from varnished cardboard tube—this means—capacity sealed in—moisture sealed out. Polyester end seals also provide an excellent insulator for high voltage

applications. Mineral oil impregnation provides longer life and more stable performance over a wide range of operating temperatures.

Critical users are finding the Sangamo 6000 volt Type 13 the answer to paper tubular problems—a television capacitor that fits your needs. See your jobber— If he can't supply you, write us.



**SANGAMO ELECTRIC COMPANY**

SPRINGFIELD; ILLINOIS

In Canada: Sangamo Electric Company Limited, Leaside, Ont.

March, 1950

6C50-3

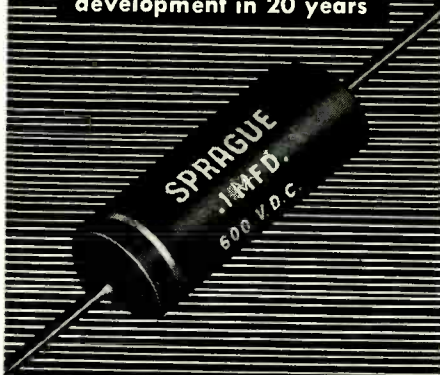
15

# SPRAGUE

Molded

# TELECAPS\*

The greatest paper tubular development in 20 years



**...premium quality**  
**...plus performance**  
**AT NO EXTRA COST!**

You really get your money's worth in Sprague high-temperature phenolic molded Telecap tubular capacitors. They're the *only* molded tubulars made by the dry process—then impregnated\* and solder-sealed just like expensive metal-encased oil-paper capacitors. They're tops on ANY job—yet you buy them at ordinary tubular prices.

\*Mineral oil impregnated from 600 to 10,000 volts d-c.

**SPRAGUE PRODUCTS COMPANY**  
51 Marshall Street  
North Adams, Mass.



## CASH IN ON THIS!

Get the better, more profitable service calls! Send postcard for Sprague booklet "YOUR MONEY'S WORTH IN GOOD RADIO AND TELEVISION SERVICE" and details on how to put this sales-builder to work for your service business!

★ Trademark

## Spot Radio News

★ Presenting latest information on the Radio Industry.

By RADIO & TELEVISION NEWS'  
WASHINGTON EDITOR

**TV**, with its color wheels, reflective optics, dichroic mirrors, triple-beam tubes, and field-sequential, line-sequential and dot-sequential red, blue and green systems, transformed Washington and New York into a tense proving ground as the early days of '50 rolled around. With transmitters in the nation's capital and New York City colorcasting on quite an extensive schedule and with specially-built color receivers in strategic locations and under observation by both a technical and man-on-the-street type audience, an all-out polling effort began to race along, viewers being asked to offer opinions which might guide the Commission as they pondered what to do about the blistering problem of color TV.

Activities in the hue quiz centered around Washington during the early days of the trial, with the FCC Commissioners as the pace setters. *CBS* felt that the gentlemen who will eventually say *yes* or *no* to the color idea should have receivers as soon as the test programs went on the air, and thus models were dispatched to six of the officials who were agreeable to the look-in plan: Wayne Coy (Chairman of the Commission), Rosel H. Hyde, Robert F. Jones, George E. Sterling, Paul A. Walker, and Edward M. Webster.

Installation in the government expert's homes was followed by a setup of some fifteen models in a building in downtown Washington, where the public could look in on programs coming from WOIC. Admissions to the showings were provided by complimentary tickets available at such points as a cigar counter at the Mayflower Hotel, assistant manager's desk at the Statler Hotel, desk and newsstand at the Willard Hotel, front desk and newsstand at the Carlton Hotel, main floor desk of the *Washington Post* and the Walker building, where the sets were located, and two stations, WOIC and WTOP. Those attending the public viewings were asked to cite what they thought about the quality, detail, and general picture impression.

In New York, the tests of a more technical nature and conducted in one of the *CBS* studio buildings, involved a small group of viewers, looking in on 10-inch screen models equipped

with magnifiers providing a 12-inch picture. In Washington, three types of receivers were provided, with 7-inch, 10-inch, and 16-inch basic picture tubes. The 7- and 10-inch images were magnified to 10- and 12-inch sizes, while the 16-inch tube had a mask to reduce the image to about 13 inches and a magnifier to bring the picture back to about 16 inches. The smaller models were featured in the public-viewing arrangements in the Walker building.

The information sought from the New York groups concerned such problems as co-channel interference. With a push-button at the viewer's disposal to vote on the acceptability of the picture as varying degrees of co-channel venetian-blind effects were introduced, *CBS* hoped to compile a report on station spacing for both color and monochrome allocations. *WOR-TV*, cooperated in the test, supplying a signal which was converted by *CBS* into co-channel type of input.

The *RCA* public tests, which hadn't begun as this column was being prepared, were expected to follow the *CBS* pattern. Technical tests were, however, under way, with the FCC's Laurel laboratories and the Condon Committee, which is conducting an investigation for the Senate Interstate and Foreign Committee, scheduled to receive direct-viewing 10-inch models.

Commenting on *RCA's* color experiences, in a report to the FCC, E. W. Engstrom said that from September 18 to December 30, 1949, a total of 409 hours of test operation on the air were provided by *WNBW* and *KG2XCL*, the former using standard channel 4 and the latter an experimental frequency in the 523 to 529 mc. band.

The usefulness of the public-poll information, based on the one-system viewing, appeared to be of little long-term value, according to many observers. They declared that unless it becomes possible to view the systems in a comparative way, the expressions offered can mean little. Answers to such important questions as color values and eye comfort cannot be provided very readily by the average person, these experts added.

When the consensus information is compiled, it may contain the testimony of one viewer who didn't have

**RADIO & TELEVISION NEWS**



For the **MOST** in Television Reception

THE **SKY HAWK**

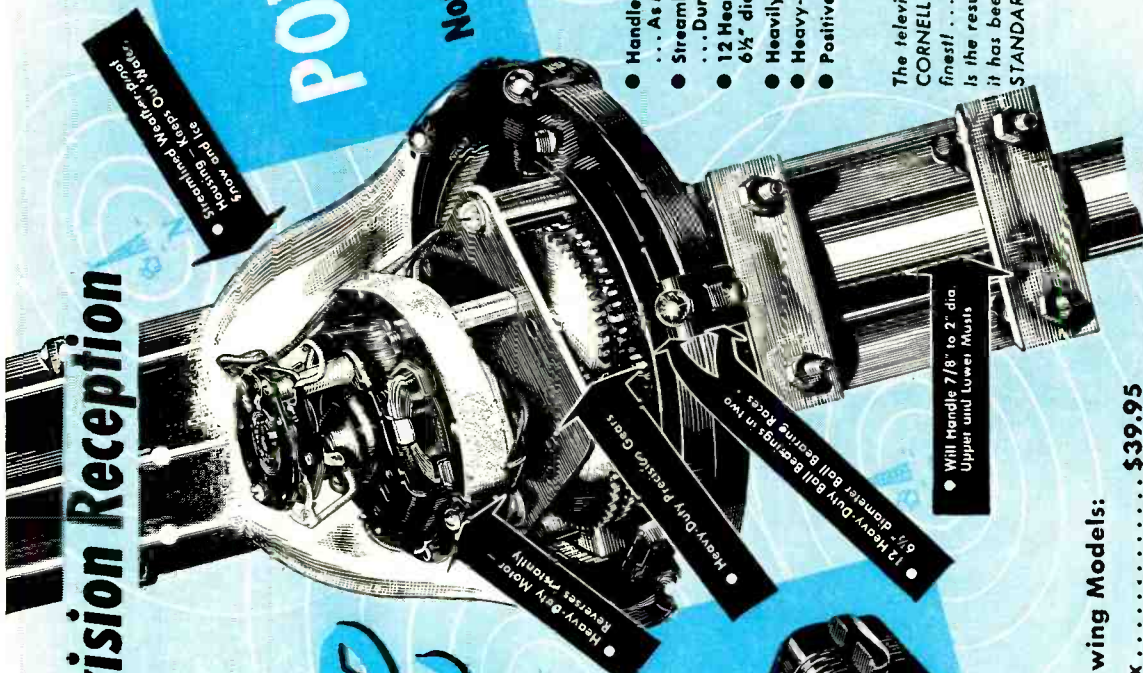
# TELE-ROTOR

For Clear Sharp Pictures and  
Perfect Trouble-Free Performance

**C-D SKY HAWK  
TELE-ROTOR  
CONTROL**  
with the "Perfect Pattern" Dial  
Gives Immediate Indication  
of Antenna Position.



**IT'S  
POWER PACKED**  
A Triumph in Design!!! There's  
Nothing Like It... It's Beyond Compare!



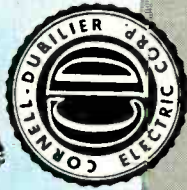
### CHECK THESE FEATURES

- Handles Heavier Loads With Ease ... As Much As 150 Pounds
- Streamlined Weather-proof Design ... Durable Sturdy Construction
- 12 Heavy-Duty Ball Bearings in two 6 1/2" diameter Ball Bearing Races
- Heavily Reinforced Die-Cast Housing
- Heavy-Duty Precision Gears
- Positive Stop at End of Rotation
- Will Handle 7/8" to 2" diameter Upper and Lower Masts
- Instantly Reverses
- Mast, Tower or Platform Mounting
- Four Heavy-Duty Guy-Wire Lugs
- Completely Weather-Sealed ... Factory Lubricated For Life

The television industry has been looking for something like this ... and it took CORNELL-DUBILIER to produce it! THIS is the last word in ROTATORS ... the finest! ... BECAUSE IT HAS EVERYTHING! It wasn't developed overnight but is the result of fourteen solid months of research and development! BUT ... it has been worth it! ... BECAUSE IT MEASURES UP TO CORNELL-DUBILIER STANDARDS.

- Available in the Following Models:
- TR-1 ... rotator with control box ..... \$39.95
  - TR-2 ... compass control rotator with "Perfect Pattern" dial ..... \$44.95

A Combination You Can't Beat ... It's a C-D  
Sky Hawk Antenna with a C-D Sky Hawk Tele-Rotor



CONSISTENTLY DEPENDABLE

**CORNELL-DUBILIER**

SOUTH PLAINFIELD, NEW JERSEY

• CAPACITORS

• ANTENNAS

• ROTATORS

• VIBRATORS

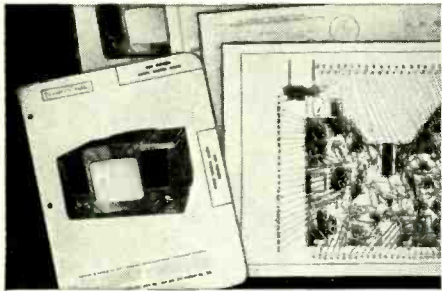
• CONVERTERS





# SERVICEMEN!

## We'll Prove You'll Save Time & Earn More with PHOTOFACT!



We'll send you absolutely

# FREE

any PHOTOFACT Folder

listed in the Photofact Cumulative Index

NOW—learn for yourself—at our expense—how PHOTOFACT makes your service work quicker, easier, more profitable! Examine an actual PHOTOFACT Folder. Use it. You'll learn first-hand why this indispensable service data is used daily by over 35,000 successful service technicians. You'll discover quickly that no other service gives you PHOTOFACT's outstanding advantages: *completeness, accuracy, uniformity and ease-of-use* at the lowest cost to you! PHOTOFACT alone is the *only* radio service data prepared from laboratory analysis of the actual equipment. Nothing in the field equals PHOTOFACT. Know the facts—get your FREE Folder now. Examine it—use it—compare it—learn why no modern service shop can afford to be without PHOTOFACT!

**NOTE:** This FREE offer is limited to Service Technicians. Attach coupon below to your letterhead and mention the name of your jobber. If you have no letterhead, send coupon to your jobber. Experimenters and others may obtain the Photofact Folder by remitting 50c.

HOWARD W. SAMS & CO., INC.  
2201 E. 46th St., Indianapolis 5, Ind.

- Send FREE Photofact Cumulative Index
- Send Full Easy-Pay Details
- I am a Service Technician:
- Send FREE Folder for set model.....
- I am an Experimenter:
- Send Folder for set model.....  
(50c enclosed)

Name.....

Address.....

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

a CBS model, but rather one that was built in a shop at home. Forrest W. Killy of Roselle, N. J., reported the color pickup news, declaring that he was able to tune in on the colorcasts by making some minor changes in his set. He accomplished this, he said, by first installing a switch to control the horizontal oscillator of his model. Turning this switch on reduced the number of lines in the picture from 525, the black and white standard, to 405, used in color work. Then he took some cardboard, and sheets of red, green and blue cellophane, and constructed a pie-shaped disc about 12 inches in diameter, with alternate layers of the red, green and blue cellophane. The disc was hooked up to a phono motor, whose speed was increased to provide color resolution. The wheel was then placed in front of the picture tube, which he claims provided good color pictures.

Although no official opinions on the color tests were available from FCC quarters, one member of the Commission did reveal in quite an explicit manner just where he stood on the issues. From color TV's staunchest supporter, Commissioner Robert F. Jones, came the expressions, and there were many, appearing before a luncheon meeting of the American Marketing Association at the Hotel Commodore in New York City, the Commissioner fired away at industry, accusing them of delaying color TV. He said that too many manufacturers had spent little or nothing on color research of their own or field testing of systems proposed by others.

"Instead of offering us the results of field tests," he went on, "we are offered new forms of advisory committees, committees which are but a part of a general scheme which frequently reminds me of the interlocking directorates the public utilities used in the heyday of that industry."

The Commissioner pointed out that in 1941, the National Television Systems Committee showed great interest in color, suggesting that the art should be encouraged and field tested at once. Unfortunately, he added, the war intervened with the steps that were to be taken in advancing color. But since the war's end, the FCC official continued, there has been ample opportunity to continue in the enthusiastic spirit shown eight years ago.

The Commissioner also directed his anger at industry in a letter to *Paramount Television Productions'* president, Paul Raibourn, declaring that the prexy had displayed a "debonaire" attitude toward the art and a "lack of work or at least enthusiasm" for the color systems. The letter was in reply to one from Raibourn which had commented on Jones' questioning during the hearings concerning the absence of the motion-picture executive. The prexy indicated that he would be very pleased to appear and offer his opinions, and had not appeared earlier since he had no new engineering data to offer. The Commissioner noted in

his letter that he hoped that when Raibourn appeared he would not . . . "join the parade" of the many who oppose . . . "anyone who dares to have a different view than the vested interests."

**THE ANNUAL DINNER** of the Federal Communications Bar Association in Washington was the scene of another sharp report on color, with color enthusiast Senator Edwin Johnson providing the views. According to the Senator, an FCC decision in favor of color TV standardization will be made and the Condon Committee's report, soon to appear, will . . . "fortify and bolster the Commission's decision that we are ready for color television now." The Senator added that . . . "Since it is generally agreed that color is practical, most emphatically the public interest would not be served by waiting until thirty million families have invested upward of six billion dollars in black and white sets, before switching to color."

In reply to the blunt words from Washington, industry announced the formation of a new National Television System Committee to help attain industry-wide agreement on technical developments needed for the expansion of television to all sections of the country and for the establishment of basic standards which will bring color television to reality.

Reporting on the formation of the committee, RMA Prexy Raymond C. Cosgrove said: "While color television is not yet ready for commercial application, laboratory development has progressed to a point where pooling of information and concerted action from all sources is essential to creation of standards which will eventually bring it out of the laboratory and controlled broadcast stage and into the home."

"Television manufacturers are eager to present color to the public just as soon as research and field testing have made it practical for broadcasting and home use, but not before," Cosgrove added.

"In the meantime, it is believed that the National Television System Committee will be able to assemble the data necessary to letting all sections of the country enjoy the benefits of television, and not just selected areas," the RMA headman concluded.

Guiding the new committee will be Dr. W. R. G. Baker, who was chairman of the 1941 systems group which drafted and recommended the FCC standards upon which black and white TV has been built. Assisting him will be Don Fink and David B. Smith, serving as vice-chairmen.

According to present plans, the committee will cooperate closely with the FCC during the allocation hearings and will submit regular reports to the Commission, in addition to serving as advisors for the study of special problems.

The NTSC of '50 should be the ant-

(Continued on page 125)

**RADIO & TELEVISION NEWS**

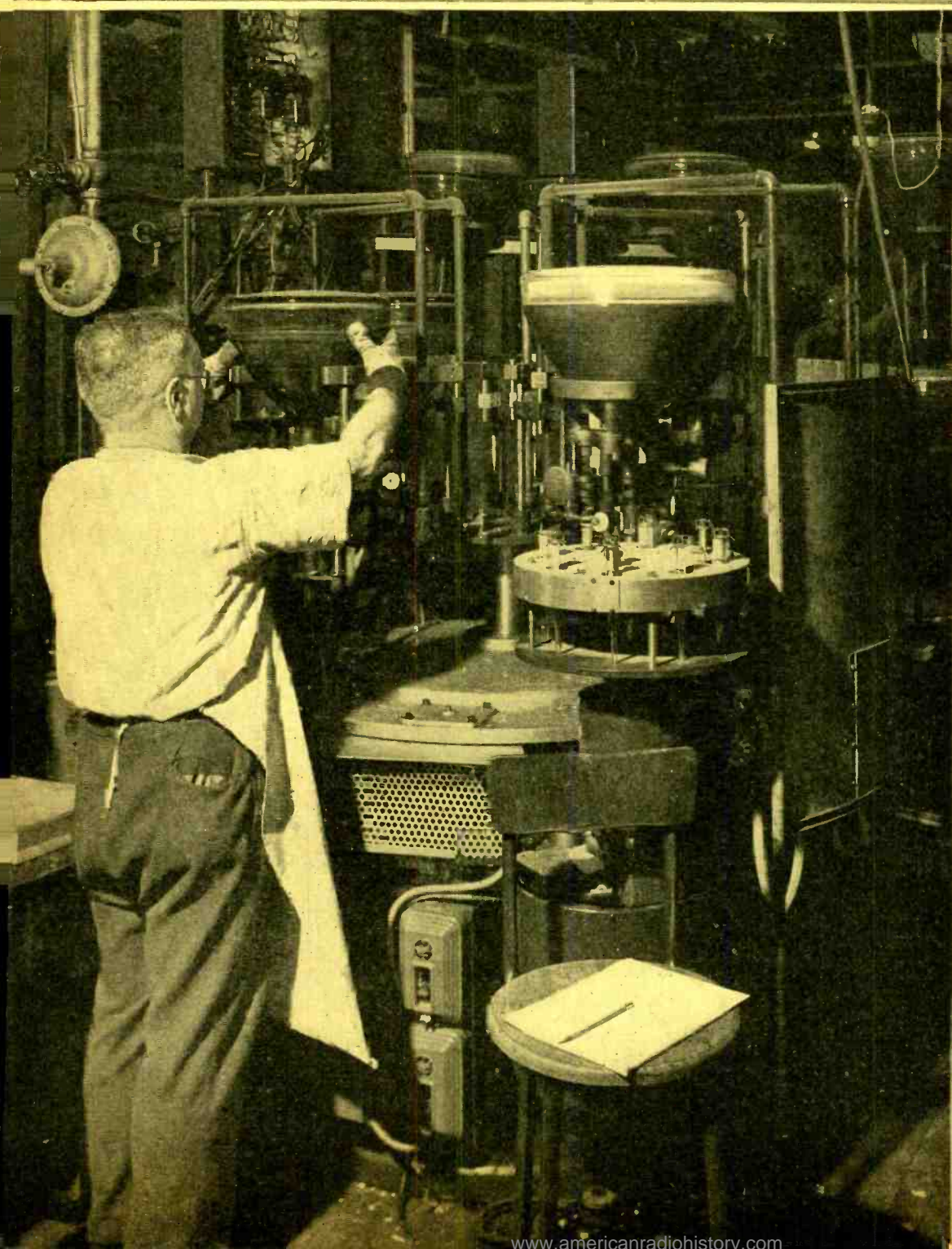


MARCH, 1950

**RADIO &  
TELEVISION  
NEWS**

**RADIO-ELECTRONIC**

# *Engineering*



TELEVISION

RADAR

ELECTRONICS

RESEARCH

COMMUNICATIONS

MAINTENANCE



# RADIO-ELECTRONIC

# Engineering

Trade Mark Registered U.S. Patent Office No. 417961

ELECTRONICS • COMMUNICATIONS • TELEVISION • RESEARCH • MAINTENANCE

## MARCH, 1950

MICROWAVE STANDING WAVE DETECTORS.....Samuel Freedman 3  
STRAIN GAUGE LINK.....Alvin B. Kaufman 7  
U.H.F. TV CONVERTER DESIGN.....Nicholas Simopoulos 10  
CRYSTAL SAVERS.....Harold E. Bryan 12  
MICROWAVE TRANSMISSION LINES.....J. Racker 14  
MAGNETIC FLUX COMPARATOR.....Edwin N. Kaufman 20  
TE<sub>0,1</sub> WAVES IN RECTANGULAR WAVE GUIDES..... 32

### DEPARTMENTS

NEWS BRIEFS..... 22	PERSONALS ..... 26
NEW PRODUCTS..... 24	TECHNICAL BOOKS ..... 29



RADIO-ELECTRONIC ENGINEERING is published each month as a special edition in a limited number of copies of RADIO & TELEVISION NEWS, by the Ziff-Davis Publishing Company, 185 N. Wabash Avenue, Chicago 1, Illinois.

VOLUME 14, NUMBER 3, Copyright, 1950, Ziff-Davis Publishing Company

COVER PHOTO—Courtesy of Sheldon Electric Co.

Automatic sealing machine for television picture tubes shown in the Sheldon Electric Company's Irvington, N. J., plant. The "guns", located at the right, are placed in a revolving holder on the automatic sealer. The operator then places the glass blank over the gun. In one stage as the machine and the holder revolve, gas flames heat the glass. A battery of gas torches then cut and seal the end of the glass.





# MICROWAVE STANDING WAVE DETECTORS

By SAMUEL FREEDMAN

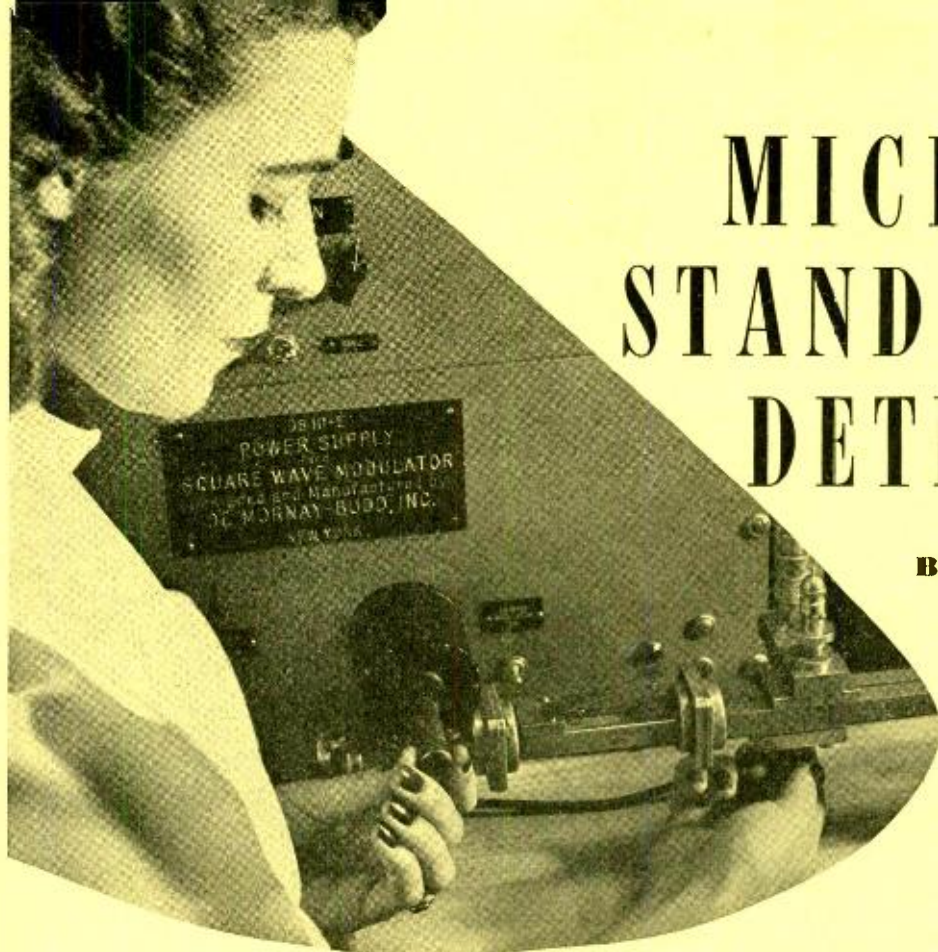


Fig. 1. Standing wave detector used in conjunction with a flap attenuator (center) and cavity wavemeter (left).

## *Design, construction and use of standing wave detectors in microwave measurements.*

**A**N alternating current may be represented as a wave having a change in voltage during a period of time. When a transmission line is not ideally terminated or matched with respect to its load the alternating current (radio frequency energy) reflects a portion of its energy back to create "standing waves". A "standing wave" means that there exists both a change in voltage with respect to time AND with distance along the transmission line.

The voltage between nodal points of a standing wave changes from positive to negative values and back during the time equivalent to one cycle of the r.f. source. Notwithstanding the designation "standing wave", the positions of the maximum and minimum points stand still while the voltage changes at the r.f. rate. The value and nature of the load determines the ratio of voltage at maximum and minimum points along the line, and also the position of these maximum and minimum points. The VSWR (Voltage Standing Wave Ratio) equals the maximum voltage divided by the minimum voltage. It is an indication of the ratio of mismatch of the load impedance.

The extremely short wavelengths existing above about 2500 megacycles make it feasible to propagate energy through wave-guide pipes of convenient dimension. As a result, it has become possible to develop test and evaluating equipment functioning in a manner which is both direct and obvious. One of the most useful of these devices is the Standing Wave Detector which is part of every modern microwave test and evaluating setup. It eliminates speculation as to the degree of correctness of theoretical results having to do with reflection coefficients, power losses, frequency, wavelength, impedance or attenuation. It is a slotted wave guide in which r.f. energy at microwave frequencies present within the wave guide can be detected at the center of the wide or "a" dimension at any point in its vertical plane and anywhere along its longitudinal center axis.

Fig. 3 shows the energy distribution in a wave-guide pipe of rectangular shape operating in the  $TE_{0,1}$  mode. This mode of energy distribution exists when a wave guide is more than a half wavelength but less than a full wavelength in width. If a slot is milled in the middle of the wide or "a" dimension of the

wave guide, a traveling pickup probe can detect the energy distribution of the electric field shown as plus and minus in sine wave fashion. The energy picked up by the traveling r.f. probe will fluctuate in phase and amplitude in accordance with this energy distribution. By connecting this probe to a crystal rectifier or a bolometer device, enough energy can be picked up and transformed to operate an indicating device such as a microammeter or a cathode-ray oscilloscope.

Along each half wavelength pattern, all the circuit equivalents specifically provided by condensers and inductance in the case of conventional lower frequency techniques are simulated as illustrated in Fig. 2. It is in reality a microwave transformer making use of inversion, capacitive, inductive and transformation effects existing along any quarter wavelength of any over-all half wavelength.

Fig. 4 is further helpful in understanding wave-guide phenomena. Here, a standard medium frequency broadcasting station antenna tower (comparable with the probe in a standing wave detector) radiates energy which makes progress to other points on earth by suitably angled reflections between the ionosphere and the earth. Figs. 4A, B and C simulate this in a piece of rectangular wave-guide pipe. Fig 4A shows total attenuation or no progress because the pipe is too small for the wavelength, or the wavelength is too long (frequency too low) for that size pipe. It is exactly comparable with the fading out of radio reception when an automobile is in a tunnel, underpass or on a steel bridge having overhead and side framework. These are all wave guides below cut-off because they are less than a half wavelength in width. Fig. 4B shows attenuation above cut-off with energy able to propagate in the wave guide. The wave guide is more than a half wavelength in its wide dimension. Fig. 4C shows still less attenuation as

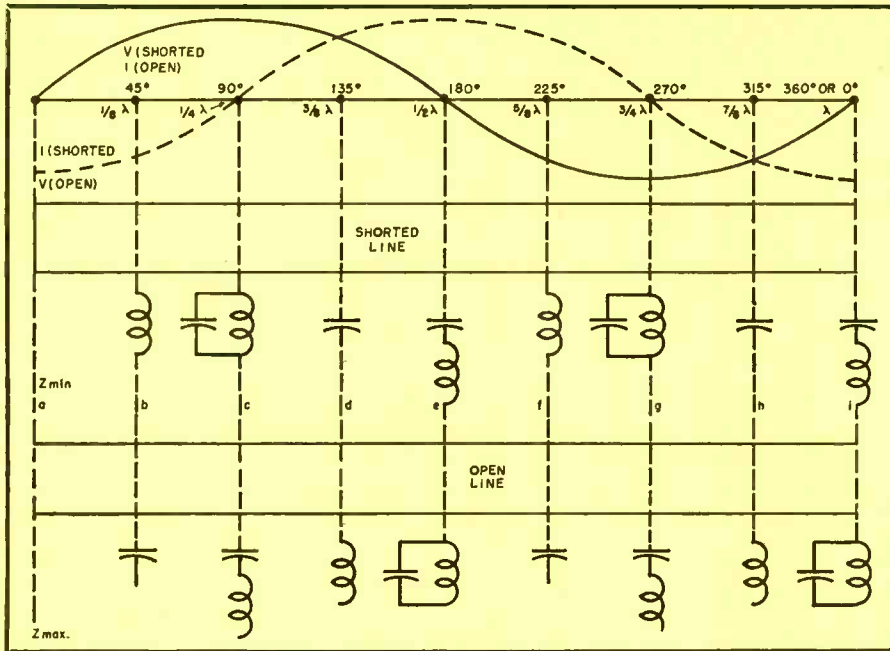


Fig. 2. Circuit equivalents in open or shorted wave guide transmission line.

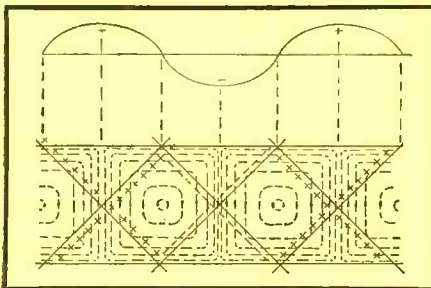


Fig. 3. Energy distribution in a rectangular wave guide operating in the  $TE_{0,1}$  mode.

the guide is increased further beyond a half wavelength but kept less than a full wavelength. The losses in transmission go down as the wavefronts have

less points of reflection in making longitudinal progress down the guide. Figs. 4B and C may be compared to mobile radio such as used by police and taxicabs where signals can be heard in the same tunnel or underpass while broadcast reception in private automobiles cannot. The 30-40 or the 152-162 megacycle mobile radio bands have wavelengths sufficiently short so that it is easy to develop more than a half wavelength (cut-off) dimension in a tunnel, underpass or bridgeway. The reduced number of reflections per unit length in the case of Fig. 4C means that more effective energy will be taken up by the load. The limit is where the guide width exceeds a full wavelength in which case the energy pattern shown in Fig. 3

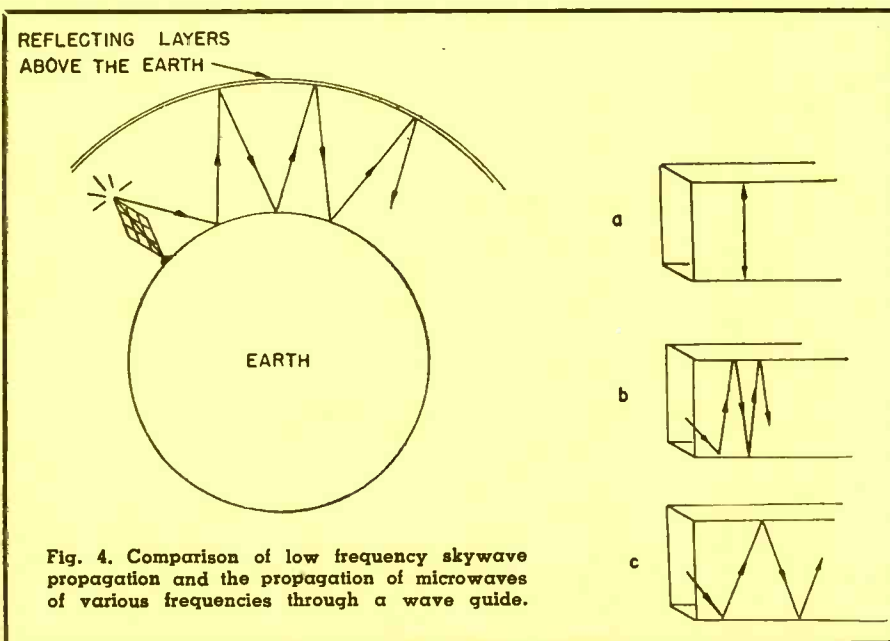


Fig. 4. Comparison of low frequency skywave propagation and the propagation of microwaves of various frequencies through a wave guide.

divides itself into two or more (depending on how many wavelengths the guide width is) as if there were two or more wave guides of energy parallel to each other. If there were two parallel patterns, the probe traveling in a slot in the center of the guide would be improperly placed for energy pickup, since the electric field cancels out or is zero at the mode boundary. The guide would then be operating in the  $TE_{2,0}$  mode, instead of the  $TE_{1,0}$  mode.

### Free Space Versus Guide Wave Length

A Standing Wave Detector measures the VSWR (Voltage Standing Wave Ratio) based on the wavelength inside a wave guide. This is different than the wavelength in free space for the same frequency. A wavelength is the distance between two points of identical phase. This will vary with the cut-off characteristic of the wave guide or how much above cut-off frequency is the operating frequency in a particular size wave guide.

On page 32 is a nomograph developed by the *Federal Telephone and Radio Corporation* to compare free space wavelength with guide wavelength. It takes into account the "caterpillar" effect existing in a wave guide made up of group and phase velocities. The "group" velocity is the velocity of propagation down a wave guide. This is less than in free space because the energy reflects from wall to wall in a wave guide and has a longer path than the actual length of the guide. It will always be less than the speed of light. It is dependent on the frequency and increases as the wavelength is decreased for a given guide dimension, or as the guide dimension increases for a given free space wavelength. The "phase velocity" changes inversely to the group velocity. It is always greater than the speed of light or the velocity of propagation in a wave guide. Its apparent speed is the true speed divided by the cosine of the angle between wall and direction of travel in a wave guide as shown in Fig. 5. The closer the frequency is to cut-off in a wave guide, the greater becomes the ratio of guide wavelength to free space wavelength, until finally at cut-off, the ratio is infinite and there is no wave propagated down the guide which is measurable.

In a rectangular wave guide operating on the usual  $TE_{1,0}$  mode, the electric vectors are parallel to one side of the guide. The width dimension is measured at right angles to the electric vector. It is based on the wide or "a" dimension.

The cut-off frequency is determined by the physical size of a wave guide. In the case of the  $TE_{1,0}$  mode, the cut-off wavelength will be twice the wide or



"a" dimension of the guide. The maximum energy indication is definable in a guide. However, at cut-off, the energy is not definable because in that region, the attenuation becomes very high or infinite. Fig. 6 shows a typical attenuation curve for a wave guide. It is based on a guide having external dimensions of 2" x 1". Allowing for a wall thickness of .064", the internal or effective dimensions are 1.872" x .972". The attenuation is infinite on frequencies below 3154 megacycles for that dimension. The lowest attenuation is just short of twice the cut-off frequency or 6309 megacycles. If used beyond twice the cut-off frequency (dimension larger than a wavelength in maximum width), it will double mode or develop two patterns of energy in the guide to radically change the energy distribution and optimum probe points. In such events, it will also bring the narrow dimension ("b" dimension) of the guide past the cut-off point so that it exceeds a half wavelength to complicate matters for a novice. The beginner in wave guide techniques should confine himself to the areas of least attenuation within the TE<sub>0,1</sub> mode before reaching cut-off point for the TE<sub>2,0</sub> mode.

The attenuation in a guide depends on losses in the conductor and losses in the dielectric (normally air). Losses in the conductor depend on the inner surface material of the guide which determines depth of energy penetration. The better the conductor, the less penetration and the less losses. To keep efficiency high, the usual metals employed either as solid or plating are silver, copper, gold, aluminum and brass. Compared to silver, copper is 96%, gold is 78%, aluminum 73½% and brass 50% as efficient. Losses in the dielectric depend on the dielectric constant of the material inside the guide. The higher this constant, the higher the losses. There is nothing lower than air with a relative dielectric constant of 1. The group velocity divided by the square of the dielectric constant gives the wavelength. In the case of polystyrene, the dielectric constant is 2.3 or close to that of air. The advantage of a dielectric constant higher than air is that it makes possible a smaller size guide for a given frequency at the cost of an increase in attenuation. If the guide can be halved in dimension by the use of a dielectric constant of four, then the attenuation is approximately four times that of air-filled guide with a dielectric constant of 1.

#### Slotted Wave Guide Transmission Line

Fig. 1 illustrates a simplified commercial standing wave detector at the extreme right coupled to a flap attenuator and a cavity wavemeter as used

in a klystron-energized microwave test setup. It is a slotted wave guide to permit loose coupling of a traveling r.f. probe to the internal energy distribution. The probe compares with an antenna in Fig. 3 except that it can be moved. A small fraction of the power flowing in the wave guide transmission line is extracted by the probe and connects through a conversion device such as a silicon crystal rectifier or a bolometer heat responding device to a meter or cathode ray indicating device with or without amplification.

By moving the probe along the slot, which is parallel to the axis of the wave guide line, the field inside of the wave guide can be explored. Because the slot is cut so that it runs parallel to the lines of surface current flow for the electromagnetic field in an unslotted guide, its presence disturbs the field configuration within the guide by only a minor amount. As illustrated for the dominant TE<sub>1,0</sub> mode, the slot must be located at the center of either of the two wide walls of the guide (center of "a" dimension). The slot should be long enough to permit observation of at least one maximum and one minimum. At least a half wavelength is necessary and in practice (particularly on the higher frequencies) the length should be sufficient to observe several maxima and minima.

The slot affects the propagation constant of the line as well as the characteristic impedance. In practice, the guide wavelength is not disturbed more than about 1%. The electric field within the guide can penetrate the slot with some loss of power by radiation. The effect is, however, small since the slot acts as a wave guide far beyond cut-off,

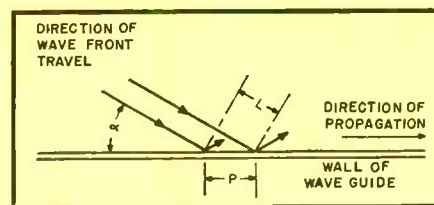


Fig. 5. Illustration of why phase velocity is greater than group velocity. In the time required for the wave front to move the distance L, the point of reflection has moved the greater distance P.

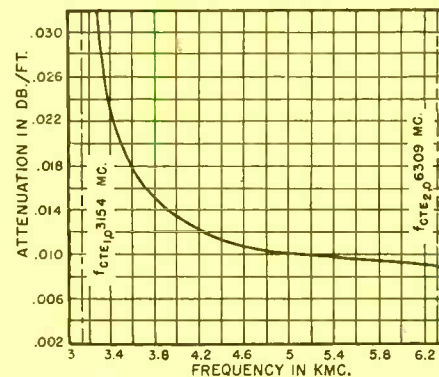


Fig. 6. Attenuation curve between cut-off points for the TE<sub>1,0</sub> and TE<sub>2,0</sub> modes in a 2" x 1" copper wave guide.

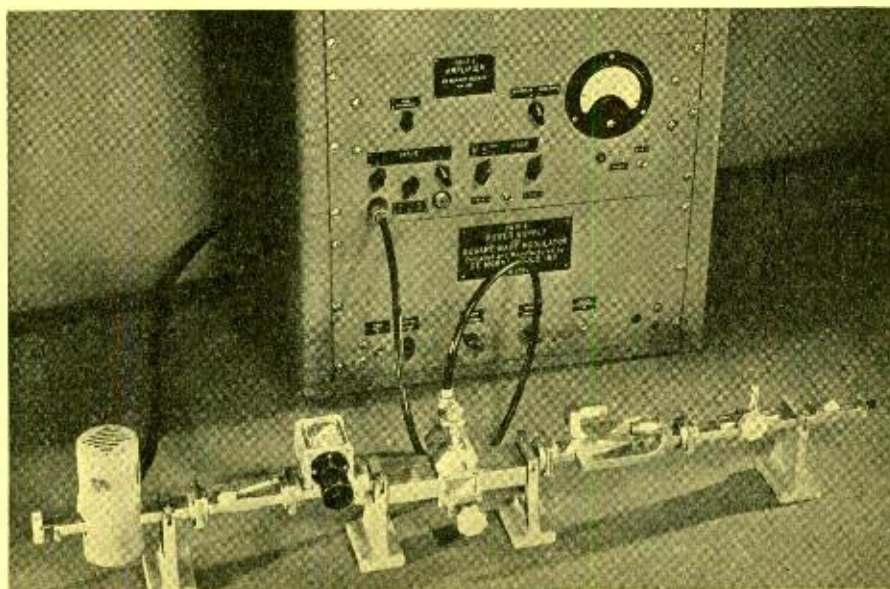
i.e. much narrower than a half wavelength.

The discrepancy caused by the slot is in the order of less than one per-cent, and so is of small concern except for the most precise calculations in the case of advanced research and development.

#### Standing Wave Detector

Fig. 9 shows the constructional details of a standing wave detector and

Fig. 7. Standing wave detector connected by coaxial cable to an amplifier and indicating meter. Setup from left to right comprises a klystron tube mount energized by a power supply and modulator in the cabinet, flap attenuator, cavity wavemeter, standing wave detector, bidirectional coupler and tunable load.





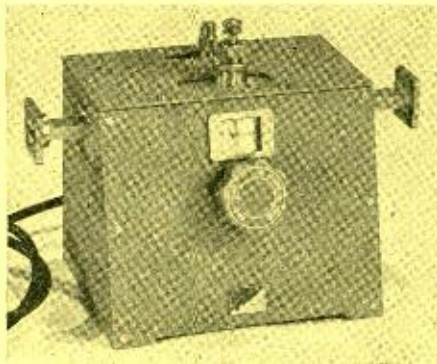


Fig. 8. Standing wave detector calibrated in one division per tenth of a millimeter of probe travel. This unit uses  $\frac{1}{2}$ " x  $\frac{1}{4}$ " wave guide for the 23,000 to 27,000 megacycle band.

Fig. 7 is a photograph showing its use in a microwave evaluation set up for some components under test.

In the best commercial models, the wave guide corresponds to the open hole shown in Flange I. It is machined out of the main block from solid brass stock to assure very close mechanical tolerance and excellent rigidity characteristics. Attached to the main block bottom is a stainless steel dove-tail and slide which in connection with a rack and pinion arrangement permits the carriage frame to keep correct position so that the probe rides parallel to the sides of the wave guide slot.

The traveling carriage has the following design provisions:

1. It can travel in either direction without slack or play.
2. It responds to the least apparent movement of the control knob such as much less than a tenth of a millimeter for which the scale is calibrated.

3. Longitudinal deviation is prevented by the high ratio pinion and gear arrangement controlled by rotation of the control knob.

4. Lateral deviation is prevented by means of the stainless steel bearing plate which exerts pressure against the moving bearing surface attached to and underneath the main block. Two allen head set screws adjust and lock the stainless steel bearing plate at optimum pressure as determined by ease of carriage movement and elimination of lateral deviation.

5. Vertical deviation is prevented by having the carriage frame ride on a closely fitted and carefully machined dove-tail which, with the rack and pinion arrangement below the wave guide block, makes for very smooth movement.

The traveling carriage includes a wave guide with a Type 1N23 crystal positioned for optimum coupling. A  $\frac{1}{200}$ th ampere *Littelfuse* may be used as a bolometer to replace the 1N23 crystal. The crystal provides much greater sensitivity. A bolometer may be superior when high standing wave ratios are to be measured since it follows a square law characteristic over a greater range of input power. The rectified low frequency is taken out from the coaxial connector by means of a solid dielectric cable such as the type RG-8/U. When the control knob is rotated, the parts which travel are details B, C, D, E, F, G, J, L, M and the crystal mount as well as the coaxial cable connecting to F.

The r.f. probe assembly comprises a very fine wire that protrudes into the

main block slotted wave guide section to couple the radio frequency energy. This connects into a coaxial section which couples into the wave guide on the carriage where the Type 1N23 crystal or the bolometer is housed. The coaxial section is tunable and is adjusted for optimum coupling to the crystal by means of an adjustable nut (detail C). The depth of the r.f. probe is adjusted by means of the round metal knob (detail D). Turning it clockwise pulls the probe out while turning it counter-clockwise will insert the probe deeper into the slotted wave guide section. The probe movement is independent of the tuning of the coaxial section when the lock nut is tightened. A very fine screw thread is used to vary the depth of the r.f. pickup probe critical amounts. The r.f. probe couples into the cavity where the crystal or bolometer detector is located. The coaxial line, of which r.f. probe is an extension, has a variable short circuit that enables the pickup probe to present a very high impedance to the main transmission line. This minimizes discontinuity effects and makes possible a maximum transfer of energy.

#### Enclosed Standing Wave Detector

Fig. 8 shows a more modern standing wave detector. It contains physical and mechanical refinements over that described in Figs. 1 and 9. It is made in a choice of sizes for each wave guide dimension or frequency band.

Three steel balls roll on the top of the main block and two on the sides. The carriage is supported and guided by these ball bearings which limit five of its six degrees of geometrical freedom. Only one degree of freedom is left, corresponding to rectilinear motion in perfect parallelism to the slot in the main block.

The traveling carriage differs from the other unit in that vertical deviations and wobbling of the carriage are prevented by the three top ball bearings. These balls furnish 3 contact points determining the plane of motion of the carriage. The carriage is therefore compelled to move in a plane exactly parallel to the inner surface of the main block.

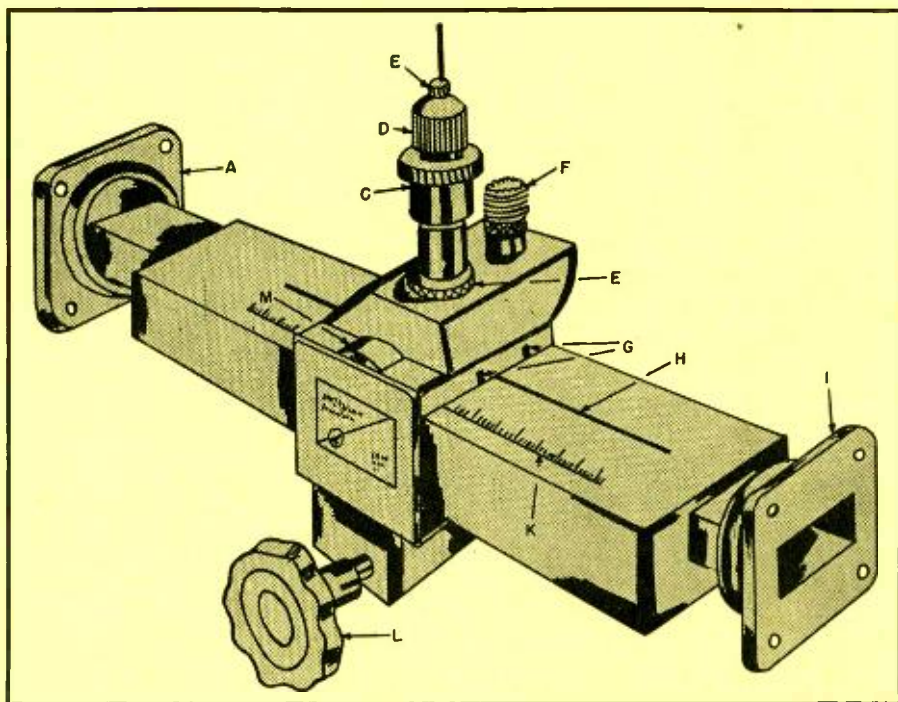
Lateral deviations are prevented by the two side balls. The carriage is pressured with constant force against these balls by a spring arrangement so that no play is possible. Since all friction is rolling instead of sliding, the movement of the carriage becomes exceptionally smooth.

#### Interpretation of Results

While basically a standing wave detector is used to measure amplitude and

(Continued on page 27)

Fig. 9. Details of a typical standing wave detector.





# STRAIN GAUGE LINK

By ALVIN B. KAUFMAN

**The design and application of force-sensitive links giving high output with conventional strain gauges.**

**T**HE use of strain gauge equipment for the measuring of stresses and forces has come into general use within the war years and the postwar period. There are many applications in industry for this equipment which because of mistaken ideas on cost, accuracy, and the skill required in interpreting and using the equipment has deterred its use.

Generally speaking, applications require three pieces of equipment. These are a power oscillator, amplifier, and output or recording meters. This is the carrier system. Other systems employ high gain d.c. amplifiers. This equipment is required mainly where strain gauges are applied to existing machinery. In the majority of these cases the strain gauge output signal with load applied to the equipment is of such low level that amplification is required.

Where test equipment is constructed to be used with machinery the chances are that the equipment may be engineered to supply a sufficient signal output to operate a microammeter directly or a recording meter of the *Esterline-Angus* type, without any amplification, a d.c. power supply being the only requirement.

The design of a system to indicate tension, compression, or bending loads as indicated may vary quite widely in expense. The system to be described, however, has a material cost of approximately one hundred dollars and a labor cost depending upon the few hours that it takes to machine the strain gauge force sensitive link or beam. With calibration, over-all accuracy of 2% is possible.

This article will concern itself mainly with the design and fabrication of force sensitive links capable of causing a 100  $\mu$ a. meter to indicate full scale for forces of 3000, 9000, and 27,000 pounds.

In fabricating a strain sensitive link there are a number of factors to be taken into account. Solid bars are very poor, possessing very little rigidity and being totally impractical for compressional loads. Generally speaking, tube type construction is the best design where a force ring is not used. This article will discuss only link type load indicating devices. Where the link is used for tension loads only, little care need be taken with the end holding design of the link. For compression loads it is necessary to have the link and equipment arranged so that very little bending load is placed on the force link. Any bending moment can be cancelled out by proper placement of the strain gauges, and will not affect the compression force indications, but excessive side or bending load can build up to the point of destroying the link. The four strain gauges used in the strain gauge circuit *should* be mounted on the link even though only two can be active gauges. Where dummy gauges are mounted separately they may not automatically temperature compensate the bridge. With the dummy gauges mounted cross-wise on the link, temperature compensation is good. Laboratory tests indicate little change in the calibration curve from room temperature to -65°F.

Another advantage of mounting dummy strain gauges



Fig. 1. Illustration showing the comparative size of a typical strain gauge.

on the link to secure a temperature and side load compensated bridge is a slight decrease of strain required to give the desired galvanometer indication. This is because when axial strain occurs in a member (tension or compression) it is always accompanied by a lateral strain of opposite sign. Thus when a bar of metal is placed under compressional load, besides becoming shorter it also increases in diameter and circumference. The ratio of the lateral to the axial strain is called Poisson's ratio and is designated as  $\nu$ . The value of  $\nu$  is usually between 0.25 and 0.33 for steel and aluminum alloys. For our calculations 30% shall be considered a fair value. As the dummy strain gauges are mounted laterally on the link, the bridge output is increased by approximately 30% due to the signal produced by these gauges.

The photographs and drawings indicate that the link is machined from a square block of steel to have a tubular cross section and square forked connecting ends. The main problem in designing the link is in calculating the area and dimensions for the tubular "force sensitive" section of the link, bolt size and clearances for the connecting ends being standard stress procedure.

In calculating the strain applied to a strain gauge, axial deflection formula applies whether the force sensitive link is in compression or tension. This strain or deflection may be found by employing the formula:  $dS = PL/AE$  where  $P$  is the total applied load in pounds,  $L$  is length,  $A$  is cross section area of the link (sq. inches), and  $E$  is the modulus of elasticity either in compression or tension.

The modulus of elasticity generally is the same for either tension or compression conditions, varying with some materials however. Steels generally run around 28 to 29 million. Information on the proportional limits of materials and general stress formulas may be found in a government publication ANC-5a, Strength of Metal Aircraft Elements. This may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. for \$1.25.

Electrically, strain gauges and recording meters must be



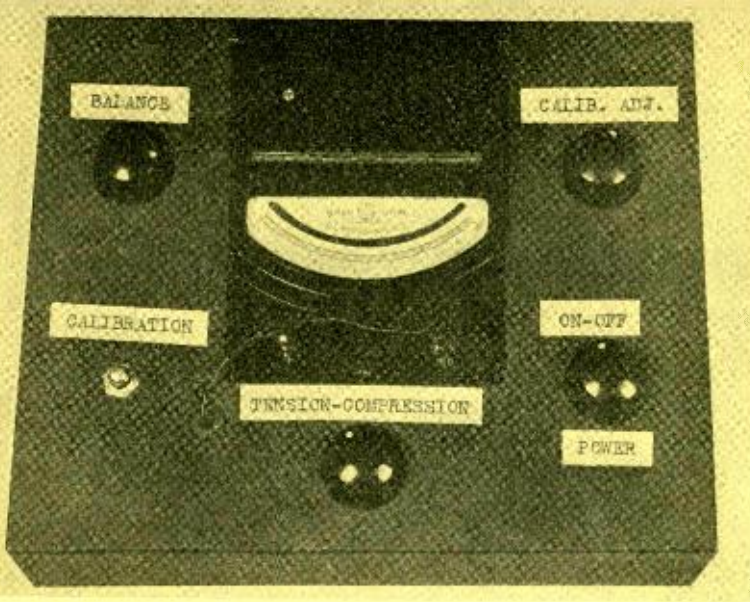


Fig. 2. Strain gauge link control and balance panel.

selected before the calculations concerning the link can begin. According to the strain gauge selected, either paper or bakelite base, and the type of resistance wire, the gauge will be rated at some "gauge factor". Gauge factor is the ratio of resistance change to strain. Most strain gauges have factors of 2 to 3, that is, their resistance change percentage is two to three times the elongation in inches per inch; Gauge Factor =  $(dR_0/R_0)/dS$ . This factor is important of course in figuring the resistive change, per leg, in the strain gauge bridge.

For devices requiring long term stability bakelite gauges are recommended. The *Baldwin* strain gauge price bulletin lists all types. These vary in resistance from approximately one hundred to several thousand ohms. These gauges may be purchased from *Baldwin Locomotive Company*, Philadelphia, Penna.

The resistance value of the gauge should be selected in regard to the indicating meter's internal resistance. For this application one milliampere meters have been used, but microampere meters are usually required for the load ranges and link design being discussed. A suitable microammeter is *General Electric's* DP-9, a 0 to 100  $\mu$ a. meter with an internal resistance of 75 ohms. Strain gauges of approximately 50 to 150 ohms could be used with this meter. As *Laws* indicates in his book "Electrical Measurements" a mismatch of two to one causes but little loss of bridge sensitivity. He also indicates that for maximum power or galvanometer current the meter's internal resistance should be equal to the resistance in one leg of the bridge where the four legs are approximately the same. Where it is not desirable to use a  $\frac{1}{2}$  of 1% meter, as the DP-9, because required accuracy is not high, then a *Simpson* Model 260 analyzer could be used. Its microammeter range is also 0-100 but its internal resistance is 2500 ohms. One thousand to two thousand ohm gauges would be required and the bridge supply voltage would be much higher than that required for lower ohmage gauges.

In any case the wattage capabilities of the different strain gauges regulates the maximum voltage that may be applied to the bridge. This wattage rating is quite variable depending largely upon the material the gauges are mounted upon. Thus it is not possible to increase the meter reading by raising the unbalanced bridge voltage by any large amount to increase the galvanometer current. In most installations the gauge can dissipate one-half watt of power without affecting the bridge operation.

Another important point is that an increase of meter indication can not be had by jumping from a 100  $\mu$ a. meter to a 50  $\mu$ a. meter, because the internal resistance increase,

usually accompanying the smaller scale meter, negates any possible improvement.

Assuming then for calculation purposes that a *GE* DP-9 100  $\mu$ a. meter will be used with *Baldwin* SR-4 75 or 120 ohm strain gauges, we may start our calculations using the following formula from *Laws*, "Electrical Measurements":

$$I_g = \frac{I_b (MP + NX)}{R_p (M + N + X + P) (M + N) (X + P)}$$

This formula indicates the galvanometer current for a given bridge voltage (or current) with an unbalanced bridge, such as would occur with full load on the force link. The total bridge current is calculated by the condensed formula  $I_b = E_b/R_p$  where  $R_p$  is the parallel series resistance of the bridge. Thus  $R_p = \frac{(M + X) (N + P)}{M + N + X + P}$

$$R_p = \frac{(M + X) (N + P)}{M + N + X + P}$$

For simplicity all four legs of the bridge may be assumed to be the same; in reality even under load they will vary but a few per-cent. In this situation with four similar legs, all of the above formulas may be dispensed with, the total bridge resistance always being equal to the resistance of one leg. Assuming a 10 volt bridge supply and determining the bridge current would leave only one unknown, the value of resistance of the active strain gauges or conversely (if this were known) the galvanometer current.

The galvanometer current formula can be transposed to secure the value of the unknown resistance of the active strain gauges so that substitution methods need not be employed as indicated below:

$$R_M = \frac{I_b NX - I_g NX - I_g R_0 N - I_g R_0 X - I_g R_0 P - I_g PX}{I_g R_0 + I_g N + I_g P + I_b P}$$

This formula may be revised again to a simpler form, as only one bridge leg, the unknown  $M$ , differs from the other three:

$$R_M = \frac{I_b XX - 2 (I_g XX) - 3 (I_g R_0 X)}{I_g R_0 + 2 (I_g X) + I_b X}$$

where  $X$  is the static resistance value of one leg of the bridge,  $I_b$  is the bridge current, and  $I_g R_0$  are respectively galvanometer current and resistance.

As this formula can indicate the value of only *one* active bridge leg, with the other three dummies, then the resistance change indicated must be divided by *two* to indicate the actual change occurring in one active gauge in the bridge with two active legs. Thus the true  $dR_0$  per active

$$\text{gauge would be: } dR_0 = \frac{R_{M \text{ static}} - R_{M \text{ loaded}}}{2}$$

The  $dR_0$  calculated from this formula would be correct where the dummy gauges were mounted separately from the link, but as shown previously Poisson's ratio otherwise indicates that this value would be too high and the meter would read 30% high. To compensate this a corrected  $dR_0$  must be made for further calculations:

$$\text{Corrected } dR_0 = \frac{dR_0 \cdot 70}{100}$$

and further mention of  $dR_0$  shall be assumed to be the corrected value.

After determining this value we come back to our  $dS = PL/AE$  formula which can now be transposed or revised to indicate the cross section area (sq. in.) required in the tubular section of the link. As it is desirable to know not the total elongation but inches per inch (strain) then the  $L$  may be deleted from the formula and it may be revised to read  $A = P/dSE$ . Here  $P$  would be the maximum load, applied to the link (i.e. calibration load) and  $E$  would be the material's Modulus of Elasticity. The strain (in inches per inch) required to produce the correct strain gauge resistance change is secured from the following formula:  $dS = dR_0/R_0K$  where  $K$  is the gauge factor and  $dR_0$ ,



is the change in resistance of one of the strain gauges, as previously calculated.  $R_0$  is the nominal resistance of the gauge. There is little need to note that regardless of the length of the strained area, the strain remains the same, and that the tubular section of the link can be made any length desirable.

Now that the area of the tubular section of the link has been determined it is a comparatively simple matter to calculate its  $ID$  and  $OD$ . For the design shown in the drawing it was thought advisable to use a  $\frac{5}{8}$  inch  $ID$  which could be drilled conveniently and then machine the outside. The outside diameter for the given area may be found with the

$$\text{following formula: } OD = \sqrt{\frac{\text{area of } ID + \text{Link area}}{.7854}}$$

where area may be found with:  $\text{Area} = .7854d^2$ .

The material the link may be machined from may be selected from ANC-5a or other references. It must have a proportional stress loading in pounds per square inch higher than the stress placed on the link so as to not cause any permanent set in the material and consequent change in calibration, with full load. Knowing the smallest cross section area of the link and the pounds applied, the stress on the material may easily be determined. This would be:  $\text{Stress (psi)} = [\text{Applied lbs (to link)}] / [\text{Sq. inches (of link)}]$ . Any steel of any heat treat can be used so long as its Modulus of Elasticity is that of the value used in the calculations. Therefore if it is necessary to change steels because of exceeding the proportional limits it would not be necessary to re-calculate if the new steel or heat treatment did not affect the  $E$ .

When the link is machined it is necessary to hold the tolerances quite close if accurate results are to be achieved. A variation of plus or minus one thousandth of an inch on these link diameters can cause the calculated results to differ from empirical tests by several per-cent. It is preferable to allow + or - tolerances in a direction that would, were error present, make the link area smaller rather than larger.

In considering the design of the link it is better to err in the direction of excessive sensitivity than lower sensitivity. It is always practical to shunt the meter down and secure full scale indication, but it is not always possible to raise the meter reading. Either of these two conditions can be corrected to a certain amount by varying the bridge supply voltage.

There are a few practical notes that must be added to the constructional section of this article to insure proper use of the equipment. Electrically the bridge diagram shows several resistors and a rheostat not needed theoretically in a simple bridge circuit. In practical use a special network must be used across one side of the bridge to allow balanc-

ing of the bridge. The resistor and potentiometer  $R_7$  and  $R_8$  allow any variation between strain gauges to be balanced out. This balance is unaffected by bridge supply voltage and is the first step in using the equipment. It is imperative to balance the bridge with no load on the link. Frequently loads may be indicated on the equipment, after just removing a hydraulic or mechanical load. Usually this indicated load is true load, not an indication due to hysteresis of the link of meter. Before rebalancing under such a situation it is necessary to loosen any mechanical connections to the link.

The first step in using the equipment then, calibration or use, is to balance the bridge with no load on the link.

Variation of the bridge supply voltage or any change in meter sensitivity can cause a change in calibration. It is preferable therefore to include some circuit in the bridge to allow setting of a specific voltage on the bridge and at the same time insure that the calibration is correct. This is accomplished with the aid of a series rheostat  $R_6$  and a calibrating resistor and switch  $R_7$  and  $S$  wired as indicated on the schematic. With full load on the link, the battery rheostat is adjusted until full scale deflection occurs on the meter. Not touching this rheostat, the load is removed and  $S$  or the calibration switch is closed. A value of resistance is then selected for  $R_7$  which will give an on scale reading. This resistor should be of the precision type, soldered in place. The on scale reading is noted and it is then the bridge's calibration indication.

From that time on, after balancing the bridge, the battery rheostat (Calib. Adj.) will be adjusted until the meter indicates the "calibration point" with, of course,  $S$  closed. Then the bridge will be ready to use, calibration checked and bridge supply voltage set to the proper value.

As the force link may be used for compression or tension and it is desirable not to use a zero center scale meter and thereby secure higher accuracy, another switch was added to the circuit allowing reversal of the meter leads with reversal of the load sign.

(Continued on page 26)

Fig. 3. Mechanical construction of a typical strain gauge link. The link is machined from solid stock.

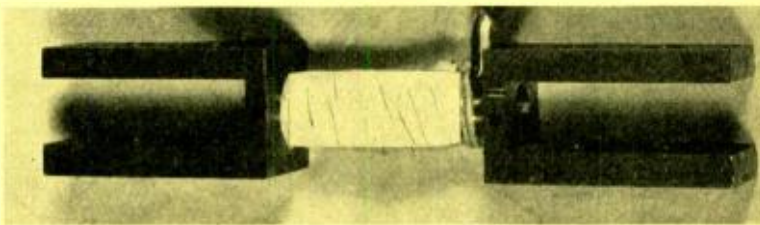


Fig. 5. Typical strain gauge with a protective felt pad hiding the strain sensitive wires. A special cement is used to cement the gauge to the surface under test.

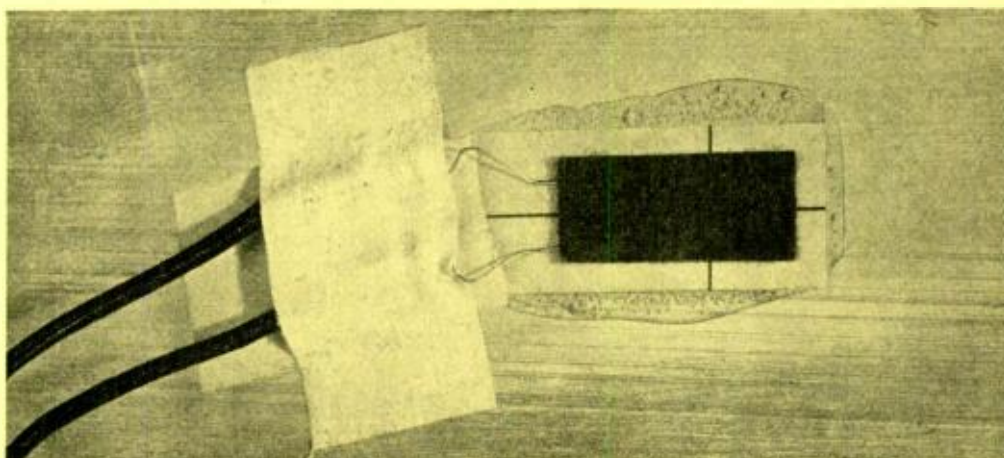
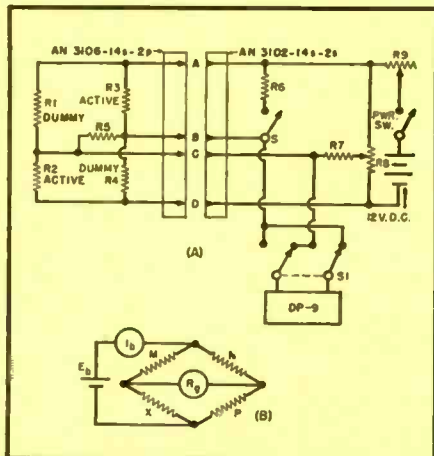


Fig. 4. (A) Practical schematic and (B) basic bridge circuit for the link.





# U.H.F. TV CONVERTER DESIGN

By

NICHOLAS T. SIMOPOULOS

*Design and development of a tuner or converter for use in the u.h.f. range of 450 to 900 megacycles.*

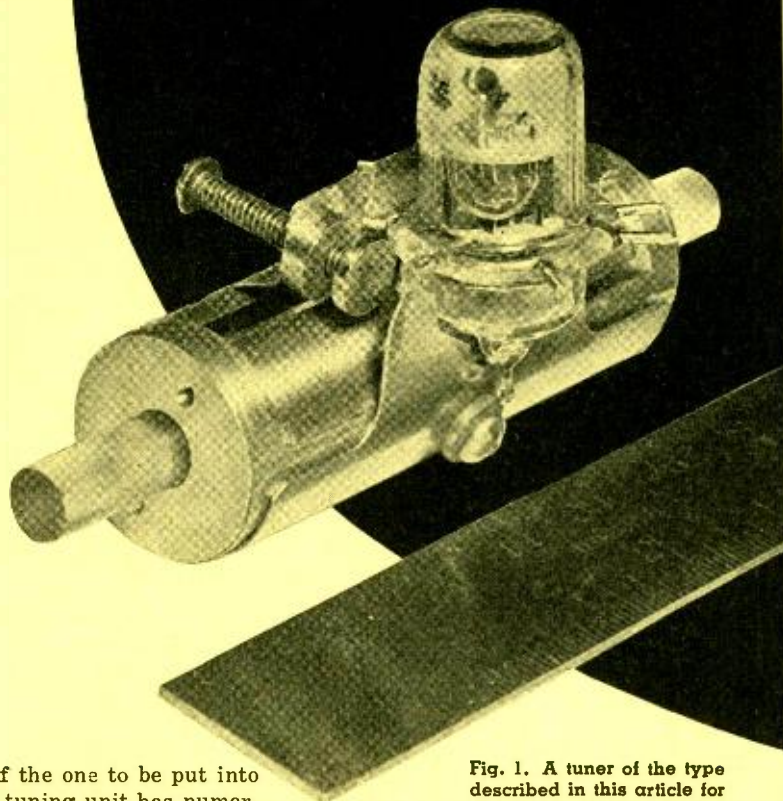


Fig. 1. A tuner of the type described in this article for use in a signal generator.

**W**ITH the forthcoming allocation of television channels between 450 to 900 megacycles, there arises the problem of continuous tracking for television "front ends" at the above frequencies. This article describes a patented tuning unit which covers this band.

The author had worked with wide range tuners during World War II in the Special Projects Laboratory at Wright Field, Dayton, Ohio for panoramic adapter use. As a result of a study of the problem, a tuner was developed which gave a tuning ratio of more than four to one.

The tuner described in this article

is a prototype of the one to be put into production. The tuning unit has numerous possibilities, finding uses in frequency meters, signal generators, and frequency modulated altimeters, in addition to its use in the r.f. and local oscillator sections of television receivers.

A purely mathematical treatment is very difficult due to the fact that inductance and capacity both change with rotation of the rotor. The range of the tuner is covered in a 90° angular change of the rotor. An important advantage is its simplicity of construction. There are no wiping contacts.

A typical tuner installation in a converter is shown in Fig. 6. A tuner for a

signal generator use is shown in Fig. 1. A breakdown of the parts used in the tuner of Fig. 1 is shown in Fig. 7. A curve showing changes in frequency versus angular position of the rotor is shown in Fig. 2.

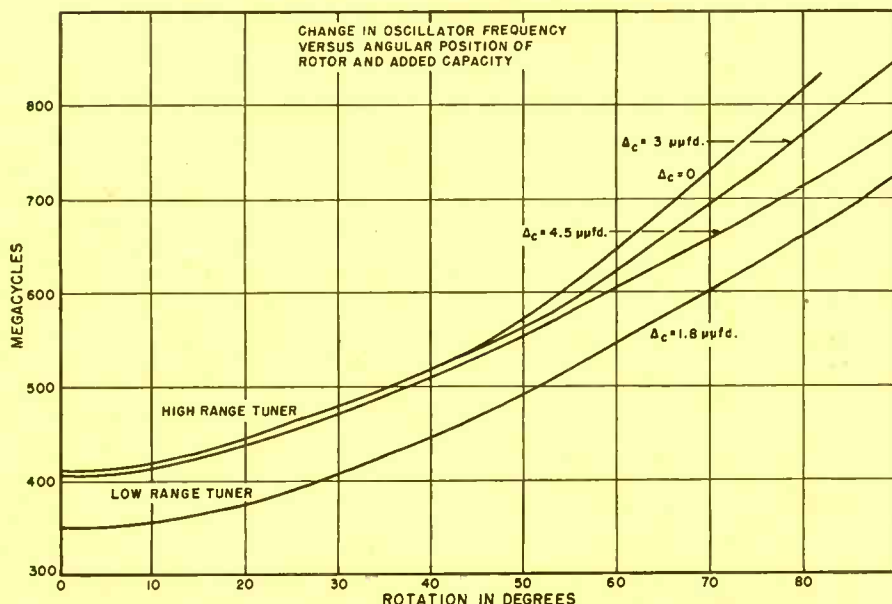
The tuner used with the oscillator of the converter shown in Fig. 1 measures 3 7/8 inches over-all with an opening of 5/16" by 1 1/4" on either side of the center web of the rotor. The outside diameter of the rotor is 5/8", and the spacing of the rotor to stator is 0.007" on the radius.

A typical circuit diagram is shown in Fig. 3B. A 6F4 type tube was used in the oscillator circuit and worked rather well in this application with some exceptions. Planar type electrodes lend themselves to easy mounting and low lead inductances. A type 5767 "rocket" tube was used on one tuner but due to its cathode construction and size, did not prove successful. A planar type tube with straps brought out at the tube electrodes (to reduce lead inductance) would prove useful in conjunction with these tuners. However, as mentioned before, the 6F4 tube gives satisfactory results.

Tuners may be made to track very closely by adjusting the shunting capacity of the tuner and if necessary the angular position of the rotor. The tuner has a bandwidth of approximately 5.1 mc. Experimental measurements give a Q of 70 at 360 mc.

Development models of the tuners are available at present for experimental use only.

Fig. 2. Curve showing change in oscillator frequency vs. angular position of rotor. Effects of added capacity are also indicated.





The equation governing the design of these tuners is approximately:

$$\tan \frac{6.28 l}{\lambda} = 1.74 \sqrt{\frac{b}{a}}$$

Refer to Fig. 5 where  $\lambda$  is the wavelength.

After a tuner is built with a specified gap and tested (a curve drawn showing frequency change versus angular rotation), then knowing the length of the tuner, we may plot  $l/\lambda$  versus rotation. This curve now holds for a tuner having the same diametral dimensions as the one tested. All that remains to be done now is to find the required frequency range of the tuner; knowing  $\lambda$  we may find  $l$ .

Typical data and a curve showing  $l/\lambda$  versus angular position for a tuner with 0.005 inch gap and a rotor whose diameter is 0.612" and  $w$  dimension is 0.400" is shown in Fig. 4.

Antenna tuner gains of approximately two may be obtained by applying the signal at the end bell and the center of the tuner. The antenna tuner may be made to track very closely by adding capacity across the antenna (or oscillator tuner). The effect of shunt capacity on the tuner shown in Fig. 6 (0.007" gap) is shown in Fig. 2. It is seen that the effect of shunting capacity is very little at the low end of the tuning range while at the high end the effect of added capacity ( $\Delta C$ ) is quite noticeable. The tuner may be made to track still closer at mid-range by solving the equations:

$$\tan \frac{6.28 l}{\lambda_1} = 1.74 \sqrt{\frac{b}{a_1}}$$

and 
$$\tan \frac{6.28 l}{\lambda_2} = 1.74 \sqrt{\frac{b}{a_2}}$$

where  $\lambda_1$  and  $\lambda_2$  are the desired wavelengths at the low and mid-points of the tuning range respectively.

$a_1$  and  $a_2$  are the arc lengths of the stator at the low and mid-point of the

Fig. 6. A typical tuner installation as mounted in a converter.

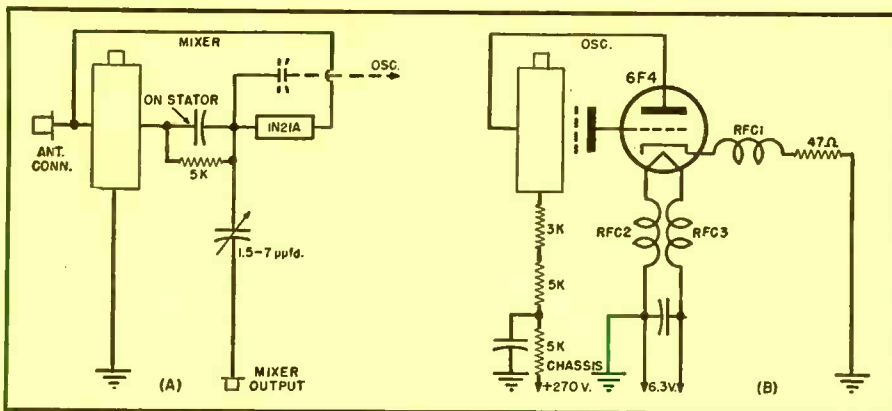
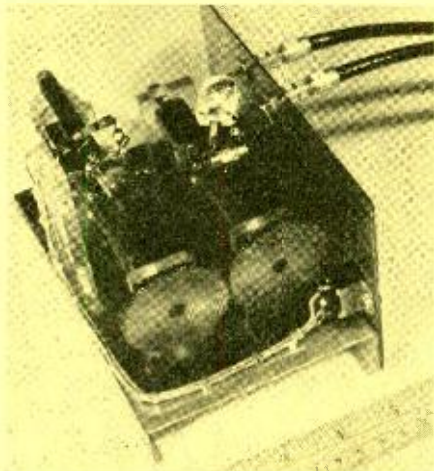


Fig. 3. Circuit diagrams of (A) mixer and (B) oscillator.

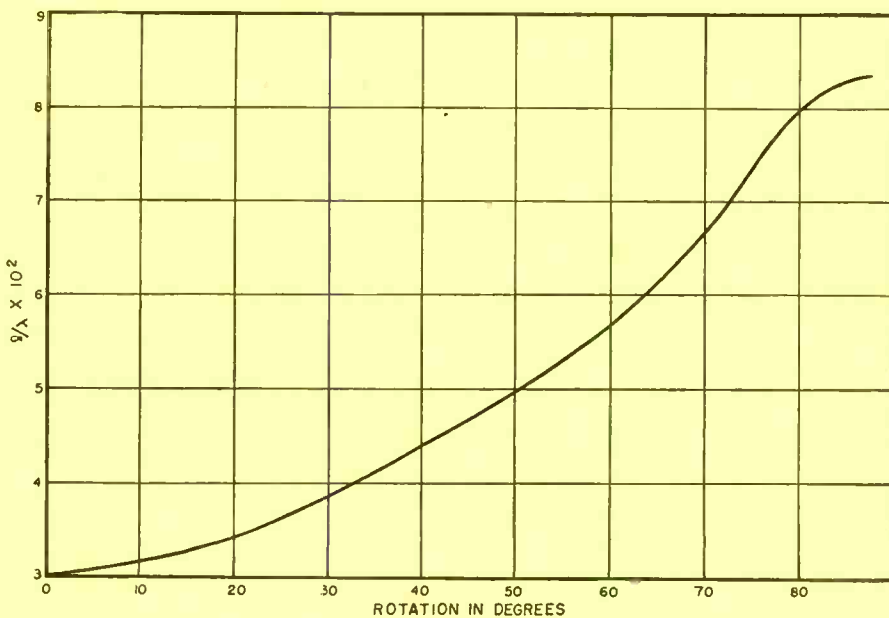


Fig. 4. Curve showing how the ratio varies with rotation.

tuning range. It should be remarked at this point that these desired dimensions are close approximations only; further refinements are usually necessary.

An experimental unit was made available to a prominent manufacturer. To check the tracking of the tuner, the gear

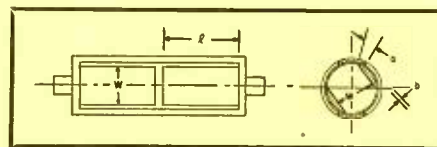
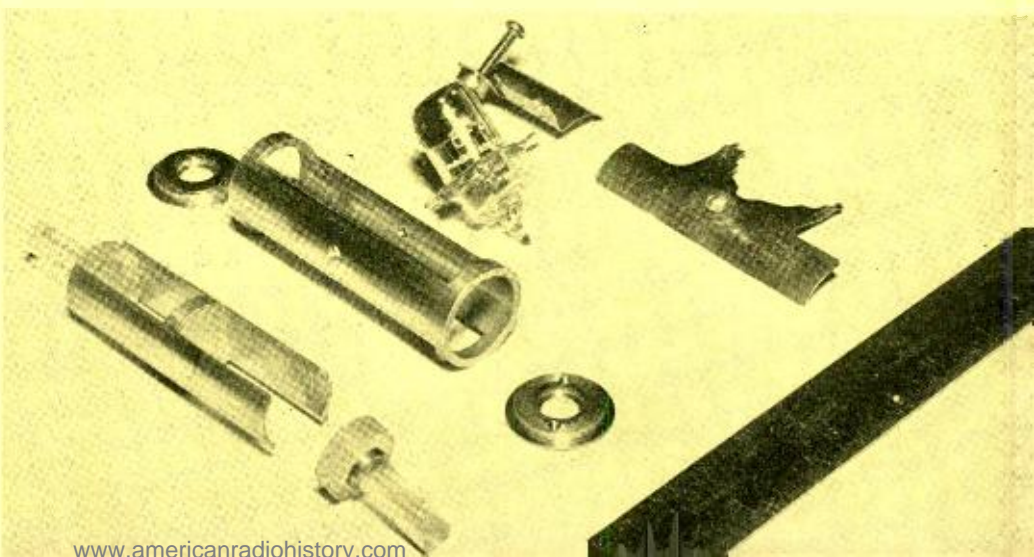


Fig. 5. End and side sketches of the tuner, showing how the values of  $a$ ,  $b$ ,  $l$ , and  $w$  are measured.

Fig. 7. A breakdown of the various parts used in the tuner of Fig. 1. A sketch of the tuner is shown in Fig. 5.





# CRYSTAL SAVERS

By  
**HAROLD E. BRYAN**

**Several methods of obtaining crystal control of a large number of channels using only a few crystals.**

**T**HE problem of frequency stability in transmitters and receivers has become increasingly important in the past few years. The tendency toward the use of higher frequencies, together with the increase in the number of occupied channels, has made the need for stability combined with flexibility more and more apparent. For example, in one of the v.h.f. bands there are 280 channels, any one of which must be instantly available to the receiver operator. These channels are spaced at intervals of 100 kilocycles, which requires high stability and makes crystal control almost mandatory.

Up until the last few years it has been common practice to obtain the necessary stability by means of low frequency crystals, multiplying to the desired output frequency. This works fine from the standpoint of stability, but leaves much to be desired in versatility. If operation is required on six channels, six crystals are required. This

is not too difficult a problem up to ten or fifteen channels, but is impracticable when operation is necessary on one hundred or more channels. Not only would the large number of crystals be expensive and space consuming, but there is not an unlimited supply of natural quartz suitable for manufacture of the crystals indefinitely.

In order to get around this difficulty, the so-called frequency synthesizers, or "crystal savers", have been developed. By means of these circuits, large numbers of crystal controlled channels may be obtained with the use of a relatively few crystals. The chief disadvantage lies in the fact that in some cases very complex circuits are required. In many cases, however, they may be relatively simple and inexpensive. Amateurs in particular should be interested in the application of crystal savers to their problems.

Actually, there is nothing basically new and startling about frequency syn-

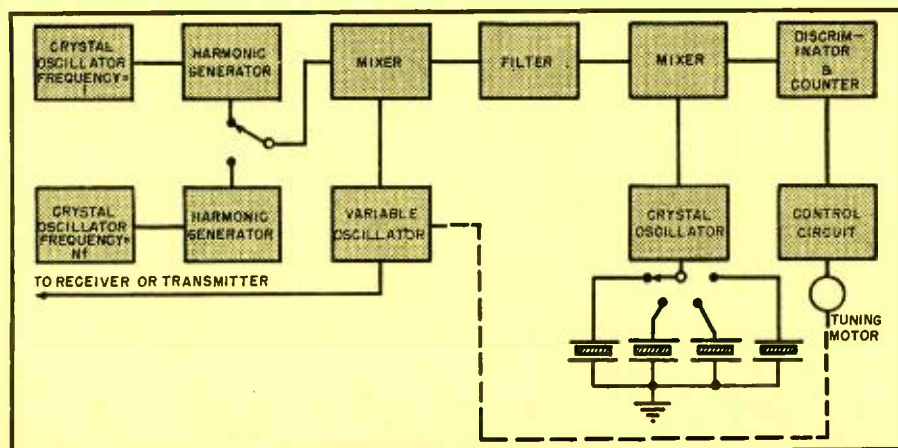
thesis. Crystal savers consist fundamentally of stable oscillators, frequency dividers and multipliers, mixers, counters and discriminators, all arranged in the proper sequence to obtain a desired result.

Generally speaking, there are two methods in use for producing the desired number of stable channels. The first sets up a stable crystal controlled monitoring system by means of which a free running oscillator is maintained on frequency by comparison with the crystal frequency. The second method synthesizes the required frequency directly from crystal controlled oscillators.

Basically, the comparison system consists of a low frequency crystal oscillator, a free running oscillator, a mixer and a discriminator-control circuit for the free oscillator. The output of the low frequency crystal oscillator is distorted such that a large number of harmonics is available for comparison purposes. The free running oscillator is then varied from some predetermined low frequency limit and the number of crystal harmonic zero beats passed by it are counted. When the desired number of counts has been made, the discriminator-control circuit is activated and the variable oscillator is maintained on frequency. This system is limited by the number of counts which can be made in a practical system. By using two crystal oscillators for comparison, the effective number of counts of the low frequency crystal harmonics may be greatly increased. If the high frequency crystal frequency is ten times the low frequency, then each count of a high frequency harmonic corresponds to a count of ten low frequency harmonics. In practice, the prescribed number of high frequency counts is made, followed by the low frequency count to the control point. By this means, several hundred channels are not difficult to produce. In commercial equipment, the variable oscillator is tuned by means of a motor and the count is made automatically. It is to be noted that only the low frequency crystal is in the circuit during the time the frequency is being controlled.

By adding another crystal oscillator and mixer, as shown in Fig. 1, another factor may be added to reduce further the number of counts required to establish a frequency. This third crystal oscillator is operated on one of several frequencies. The number of channels available then becomes the product of the maximum high frequency count by the maximum low frequency count by the number of auxiliary crystals. If the discriminator output is reversed, the number determined above is doubled. It is possible to establish in the neighborhood of one thousand channels by means of only a few crystals, using this system.

Fig. 1. A crystal saver using the counter-comparison system.





One difficulty with this type of circuit is that all control frequencies are present at all times. Thus any disturbance which could cause a change in variable oscillator frequency greater than the difference between harmonics would cause the control to take place on an adjacent channel. When this occurs, there is no indication that it has happened, with the resulting improper operation and consequent confusion.

An interesting circuit which makes use of a variable oscillator is the "Drift Cancelled Oscillator" developed by the Collins Radio Company and used in several of that company's receivers.\* The basic circuit is illustrated in Fig. 4, applied to the 108-136 megacycle band. The circuit contains four mixers and four i.f. amplifiers. Two of the mixers and amplifiers are in the active receiver section and the other two in what might be termed a monitor channel. The first oscillator is a free running variable type operating at high frequency. The output of this oscillator is mixed with the incoming signal to produce the first i.f.; and with a harmonic of a low frequency crystal oscillator to produce the second i.f. The output of this second mixer is fed to a third, where it is combined with the signal from an interpolation crystal oscillator. This latter oscillator operates at a number of frequencies determined by the spacing of the channels desired. The third i.f. thus produced is fed to a fourth mixer, where it is combined with the first i.f. to produce the fourth i.f. This latter frequency is independent of the variable oscillator frequency, since the latter is cancelled out by the operation of the circuit. The variable oscillator must have stability only sufficient to maintain its mixing products within the pass bands of the first and second i.f. amplifiers. Otherwise it is of no consequence. Thus a channel is defined by a low frequency crystal oscillator harmonic and an interpolation oscillator crystal frequency. Stability is therefore very high, since in effect the drift and instability of the variable oscillator is cancelled. The only drift that remains is that of the crystal oscillators and the incoming signal itself. A total of 280 channels can be set up using only 21 crystals with this circuit.

There are many variables in comparison types of circuits making possible almost an infinite number of different combinations to produce certain results. The equipments are often quite complex, however, and therefore lend themselves more readily to commercial than to amateur applications.

The direct synthesis method may also involve very complex circuits if carried

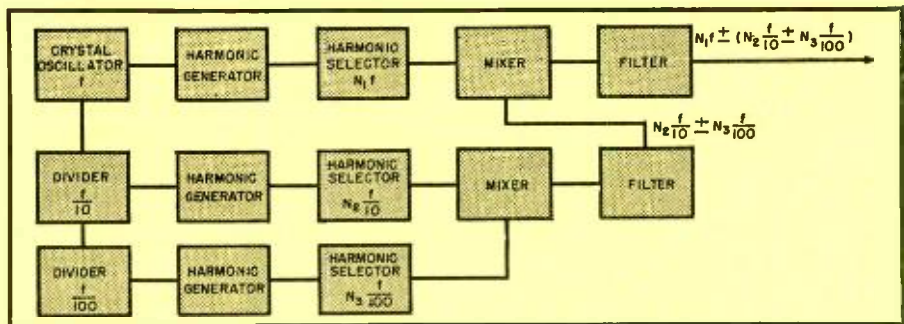


Fig. 2. Block diagram of a basic frequency synthesizer.

to extremes. For limited applications, however, relatively simple and straightforward designs are possible. The basic circuit is illustrated in Fig. 2. A single crystal oscillator is used, from which various harmonics and sub-harmonics are derived. Usually the sub-harmonics are one-tenth, one-hundredth, etc., of the basic frequency. The output of each divider is distorted and followed by a harmonic selector. The signal selected from the lowest frequency chain is mixed with that selected from the next higher chain, etc., until the final mixing is accomplished with the selected harmonic of the basic oscillator. The number of channels is limited by the number of divisions and harmonics thereof, and by the practicability of using the lower frequency derivations. It is not impossible to set up channels spaced by one kilocycle by this means. At high frequencies this may represent a large number of channels. In any event, all channels set up are derived from the basic oscillator and consequently have its stability and accuracy. Since it may be compared with the standard frequency transmissions from WWV, very high accuracy may be obtained.

The principal objections to this type

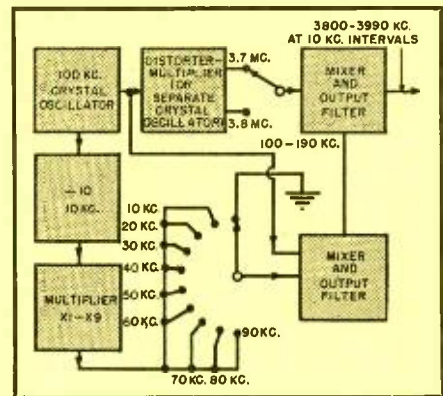
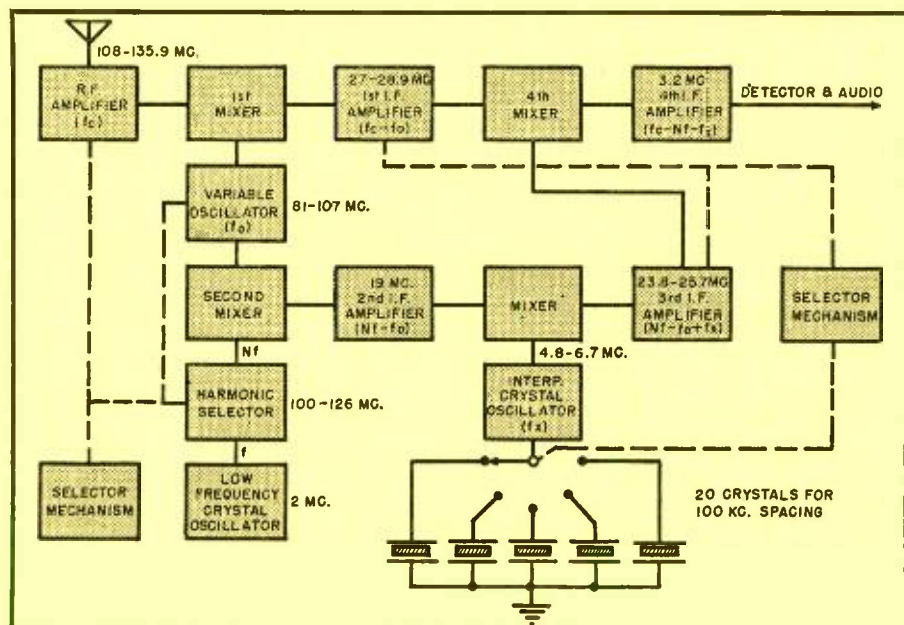


Fig. 3. Synthesizer producing channels at 10 kc. spacing from 3800 to 3990 kc.

of circuit are to the large numbers of tuned circuits required and the initial setting-up complications. Otherwise the method provides very reliable and satisfactory operation. Due to the physical bulk involved, these synthesizers have generally taken a back seat to the comparison methods when large numbers of channels are required, except in laboratory measuring equipment, in which the greater stability of the frequency standard is desired.

(Continued on page 27)

Fig. 4. Drift-cancelled oscillator in 108-136 mc. receiver; 280 channels spaced 100 kc.



\* "The Drift Cancelled Oscillator"—The Collins Signal (Collins Radio Company)—April, 1947.



# MICROWAVE TRANSMISSION LINES

By **J. RACKER**

Federal Telecommunication Laboratories

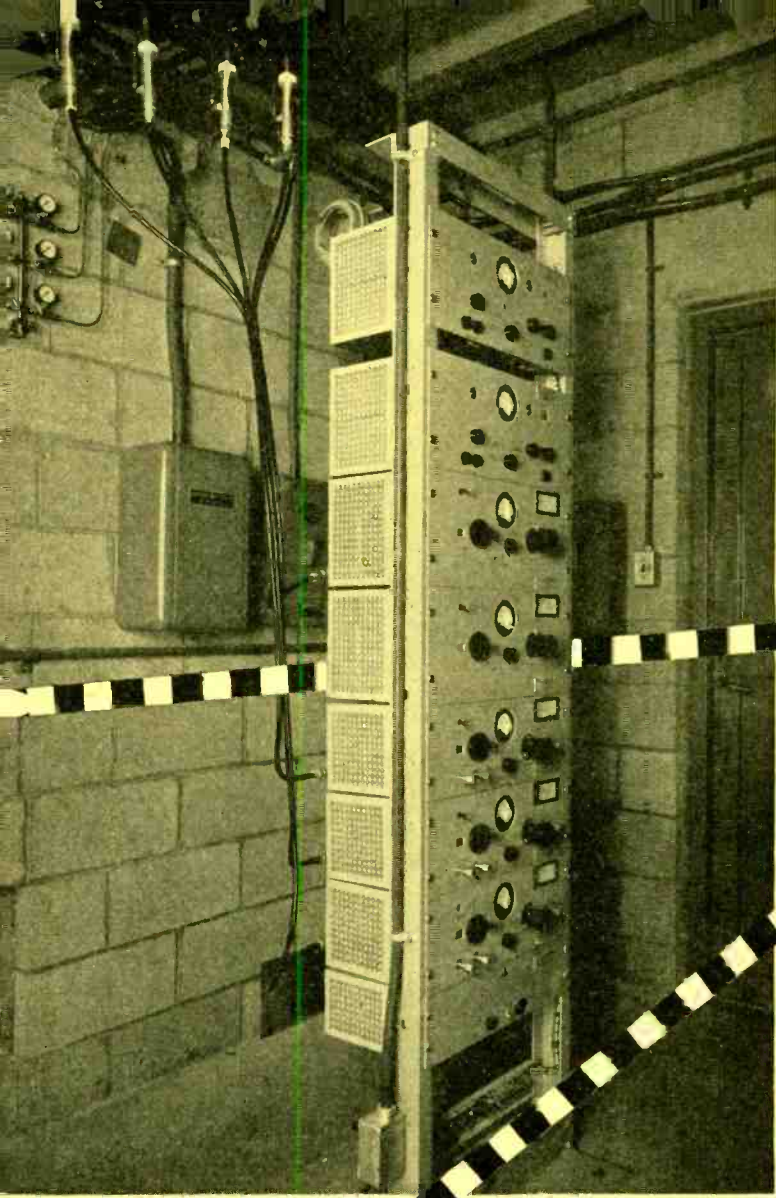


Fig. 1. Typical r.f. terminal of microwave link showing transmission line connections. Outputs of individual units are connected to a flexible, dielectric coaxial cable, which in turn is connected to air-dielectric lines.

At microwaves, transmission lines may be used for one of two functions. The first is the one normally associated with transmission lines and that is for the transfer of energy from one point to another. Sections of these lines can be used to obtain inductive and capacitive reactances, transformers, and filters. This aspect will be considered separately in the next article. This article will cover the use of lines for the point-to-point transmission of microwave power such as would be required to connect transmitter to antenna, or antenna to receiver.

## Coaxial Lines

Coaxial lines are familiar to most engineers since they have been used extensively in FM and television as well as other u.h.f. applications. Since they are used extensively, a large number of standard type cables is available at reasonable cost. Consequently coaxial cable is used whenever possible. It is important to understand the relationship between size, attenuation, power ratings, characteristic impedance, etc., of these cables, since in many cases the information supplied by the manufacturer will cover the u.h.f. range only (up to about 500 mc.) and it will be necessary for the microwave engineer to estimate the line characteristics at higher frequencies.

There are two sources of power loss in a microwave line. One is due to the line attenuation and the other to mismatch either between line and load or as a result of impedance variation within the line. The attenuation of a coaxial line is given by<sup>2</sup>:

$$\alpha_r = \alpha_c + \alpha_d = \frac{0.435}{Z_0} \left( \frac{R_1}{d} + \frac{R_2}{D} \right) \sqrt{f} + 2.78 \sqrt{k} pf \quad (1)$$

where  $\alpha_r$  is the total attenuation

$\alpha_c$  is the attenuation due to the high frequency resistance of the conductors

$\alpha_d$  is the attenuation due to the dielectric losses

## *A discussion of methods of transmitting microwave energy, with particular emphasis on wave guides.*

**T**RANSMISSION of energy at microwave frequencies is effected through the propagation of electromagnetic waves. Transmission lines, used at these frequencies, therefore function primarily to guide these electromagnetic waves and the study of these lines is closely linked with wave theory. As a matter of fact, at the higher frequencies (about 7000 mc. and above) it is possible to confine microwaves to such a narrow beam that transmission of energy from one point to another can be achieved efficiently without the use of physical lines. This article will be concerned with the practical problem of how to select the optimum transmission line system for any given application. Sufficient theory will be introduced to enable the engineer to understand the reason for the choices involved.

As indicated in the introductory article to this series, "Microwave Techniques", two basic types of transmission lines are used, i.e., coaxial lines and wave guides. Coaxial lines are normally used for frequencies up to about 2500 mc. This figure is based upon a number of factors including size, attenuation, and cost of the lines. It will be shown that the size of the wave guides (such as those shown in Fig. 4) varies inversely with frequency (hence they are employed almost universally for frequencies above 2500 mc.) while the size of a coaxial line increases with frequency for constant attenuation, all other factors remaining equal. At about 2500 mc. the size of the coaxial line is increased to the point that it becomes comparable to a wave guide designed for this frequency, for equivalent line attenuation.



- $R_1$  &  $R_2$  are equal to the ratios of the d.c. resistance of conductor used to the d.c. resistance of copper
- $Z_0$  is the characteristic impedance of the line
- $d$  is the diameter of the inner conductor
- $D$  is the diameter of the outer conductor
- $f$  is the frequency in mc.
- $p$  is the power factor of the dielectric
- $k$  is the dielectric constant

The first part of Eq. (1) is the attenuation of the line caused by the high frequency resistance of the conductors, and as indicated in this equation, the conductor attenuation increases as the diameters  $d$  and  $D$  decrease, and as the square root of frequency. In order to keep the attenuation constant as the frequency increases, it is therefore necessary to increase the conductors' diameters. It should be noted that the ratio of  $D/d$  must be kept constant for a given characteristic impedance, and that the inner conductor, having the smaller diameter, contributes a major part of the conductor losses.

The second part of Eq. (1) represents losses due to the dielectric. In the u.h.f. region the conductor losses are the major part of the total line attenuation. However, since the dielectric losses increase directly as the frequency, instead of as the square root of frequency, a point will be reached in the microwave band where the dielectric losses become comparable and then exceed the conductor attenuation. To reduce the dielectric loss, the dielectric constant,  $k$ , can be decreased. This is done by using air, rather than the usual polyethylene, as the dielectric. Air dielectric lines should be used only when absolutely necessary since they are more expensive, more difficult to handle (most are rigid instead of flexible), introduce mismatch losses due to discontinuities, and require special dehydrating and constant pressure apparatus to maintain uniform operation for all ambient conditions.

The power rating of a polyethylene dielectric cable is a function of the maximum temperature which the insulation can safely withstand. The power-handling capability of the cable is limited by the rate at which the cable can dissipate the heat generated by conductor and dielectric losses and is therefore inversely proportional to the line attenuation. For the purposes of this article, the following relation between power rating and attenuation is sufficient:

$$P = K_c / \alpha_T \dots \dots \dots (2)$$

where  $K_c$  is a constant for any given cable.

Knowing the power rating and attenuation of a cable for any u.h.f. fre-

quency, it is readily possible through the use of Eqts. (1) and (2) to estimate its power rating at any desired microwave frequency.

**Losses Due to Mismatch**

It has been shown in the previous article that when a line is terminated in its characteristic impedance, no reflections occur, and all the power transmitted down the line is absorbed by the load. (Of course loss in power will result if the generator is not matched to the load, but this factor is not due to the transmission line. The assumption will be made that the generator is matched to the line.) However if the load is not equal to the characteristic impedance, reflections occur—setting up standing waves—and losses due to mismatch result.

The ratio of reflected to incident waves for any arbitrary load  $Z_L$  is given by:

$$\frac{V_2}{V_1} = \frac{Z_L/Z_0 - 1}{Z_L/Z_0 + 1} \dots \dots \dots (3)$$

where  $V_2$  is reflected wave voltage, and  $V_1$  incident wave voltage. Since the load may be complex, this equation may contain complex quantities and the ratio of  $V_2/V_1$  will not only give the relative magnitude but also the relative phase between the two quantities.

As power varies with the square of voltage, the impedance being held constant, the per-cent power reflected from an arbitrary load is:

$$\% \text{ power reflected} = \left( \frac{V_2}{V_1} \right)^2 \times 100 \dots (4)$$

Two special cases of this equation can be considered. The first is for a load impedance which is purely resistive but not equal to  $Z_0$ . The per-cent power reflected in this case is plotted in Fig. 2 for various ratios of  $R/Z_0$ . The other special case is for the load impedance to be equal to a resistive plus a reactive

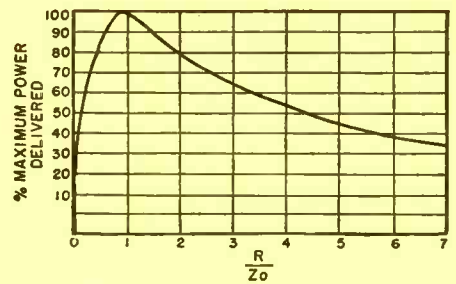


Fig. 2. Variation of power transfer with ratio  $R/Z_0$  when the load impedance has no reactive component.

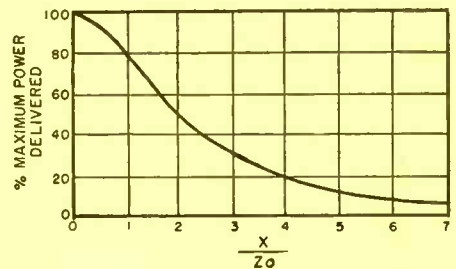


Fig. 3. Loss in power due to load reactance when the resistive component of the load is equal to  $Z_0$ .

component, but the resistive component is equal to  $Z_0$ . In this case, Eq. (4) becomes:

$$\% \text{ power reflected} = \left( \frac{V_2}{V_1} \right)^2 = \left[ \frac{jX_0 / Z_0}{1 + jX_0 / Z_0} \right]^2 \dots \dots \dots (5)$$

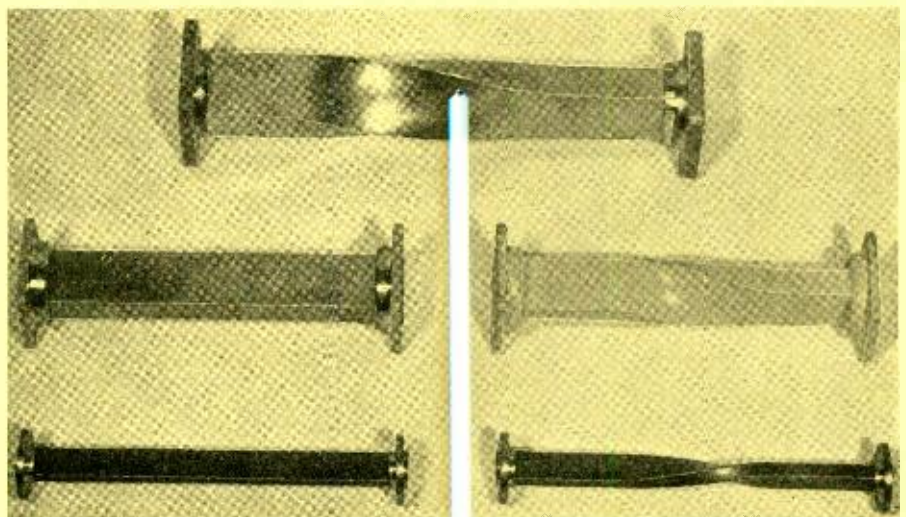
This relationship is plotted in Fig. 3 for various values of  $X/Z_0$ .

The most direct method of determining power reflection due to mismatch is to measure the standing wave ratio of the line. The power standing wave where  $\eta_v =$  voltage standing wave ratio,

$$\eta_p = \left( \frac{V_{max}}{V_{min}} \right)^2 = (\eta_v)^2 \dots \dots (6)$$

where  $\eta_v =$  voltage standing wave ratio,

Fig. 4. Several typical manufactured wave guide sections.





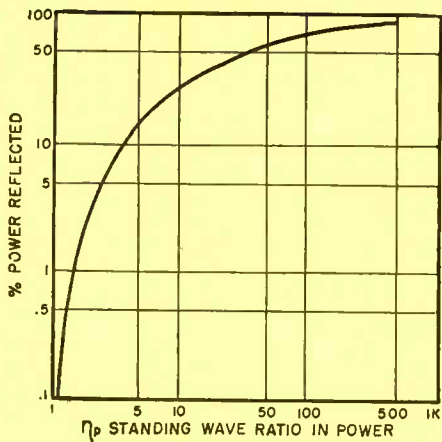


Fig. 5. Per-cent power reflected vs. standing wave ratio in power.

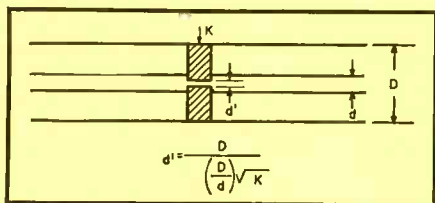


Fig. 6. Undercutting center conductor where bead support is inserted to maintain constant characteristic impedance.

and the percentage power reflected from the line is given as:

$$\% \text{ power reflected} = \frac{\sqrt{\eta_p} - 1}{\sqrt{\eta_p} + 1} \quad (7)$$

This equation is plotted in Fig. 5.

The equations given above assume that the line used is uniform and that no mismatch occurs within it due to discontinuities. However, in air dielectric lines where some insulating supports such as beads or quarter-wave stubs must be used to separate the inner and outer conductors, discontinuities do ex-

ist at the points where the supports are inserted. In this case, standing waves will exist on the line even though it is properly terminated. It is possible to minimize this effect by spacing the beads so as to cancel reflections and by adjusting the  $D/d$  ratio at the bead so as to hold constant characteristic impedance.

This is illustrated in Fig. 6. Manufacturers of air dielectric lines specify the standing-wave ratio at the frequency desired and this factor should be considered in determining whether a solid dielectric or air dielectric line should be used.

When a line is terminated in a load which has both a resistive and a reactive component it is possible to effect matching by tuning out the reactive component and "transforming" the resistive to the desired value. To do this the input impedance must be calculated to a transmission line with arbitrary load  $Z_i$ . This has been derived and is equal to:

$$Z_{in} = \frac{Z_i + jZ_o \tan \beta l}{1 + j \frac{Z_i}{Z_o} \tan \beta l} \quad (8)$$

When  $Z_i$  is a complex number this equation becomes difficult to solve. A transmission line calculator<sup>8</sup> (Emeloid Co. Inc., Arlington, N. J.) based upon this equation is available which greatly simplifies impedance calculations. Using Eq. (8) a point must be determined at which the impedance is purely resistive, i.e.,  $j$  term equal to zero. Then a quarter-wave transformer is used to match this impedance to that of the line.

To illustrate this procedure let us consider an actual problem. A transmitter with a 50 ohm output impedance is to be coupled to an antenna whose impedance at the transmitter frequency

is  $75 + j25$  ohms, a 50 ohm line is to be used.

Solution: Determine value of  $\tan \beta l$  which will make the  $j$  term of Eq. (8) equal to zero. There are a number of such points, the first is for  $\tan \beta l$  approximately equal to  $17.5^\circ$  or for  $l$  about 0.036 wavelengths from the antenna. At this point the input impedance is:

$$Z_{in} \approx 1.75 Z_o \text{ for } \tan \beta l = 17.5^\circ \quad (9)$$

To match this impedance with the 50 ohm line, a quarter wave transformer with the following characteristic impedance must be used:

$$Z_{ot} = \sqrt{Z_o Z_{in}} = \sqrt{50 \times 87.5} = 64 \text{ ohms} \quad (10)$$

Fig. 9 depicts the matching section of this system. It should be noted that matching is effected at one frequency only though mismatch for nearby frequencies is small. It is possible to increase the bandwidth of such a system by using two quarter-wave transformers and matching in steps. For example, one transformer would bring the 50 ohm impedance up to 68 ohms, the second to 87.5 ohms. The smaller the impedance steps, the broader the bandwidth.

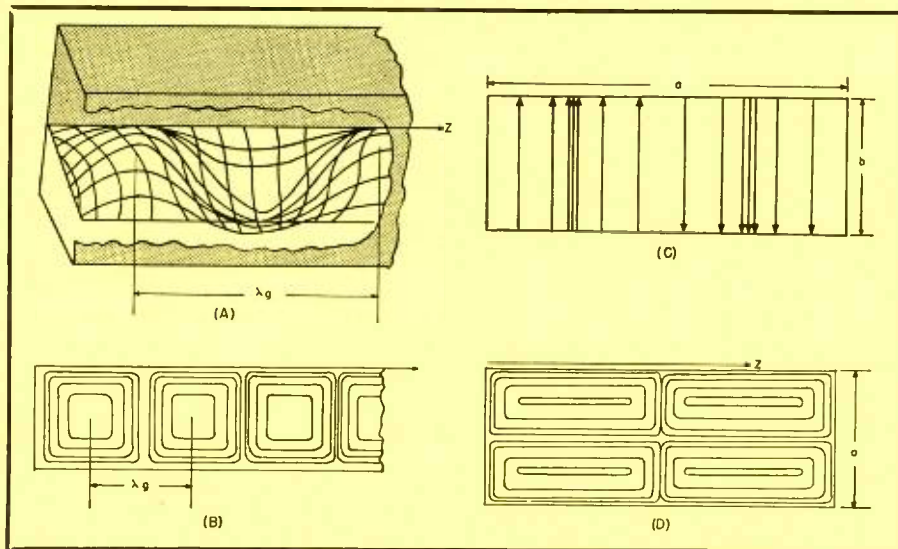
### Wave Guides

In a coaxial line the current flowing through the center conductor creates the electromagnetic field which is propagated down the line. In a wave guide, with no inner conductor, the electromagnetic wave configuration is set up by an input probe (which acts as an antenna) and the dimensions of the guide. If the dimensions of the guide are not correct, the wave generated by the probe will not be propagated down the line. A wave guide is a high pass filter which attenuates all energy below its cut-off frequency.

The fields evolved in a wave guide can be derived through the use of Maxwell's equations by a procedure similar to that used for determining the radiation pattern of an antenna; in this case the walls of the wave guide provide the boundary conditions. It is beyond the scope of this article to present this derivation, but a simple explanation of how waves are set up in certain patterns within the wave guide will help the reader to understand wave-guide calculations.

Consider the electric field that exists between a pair of parallel plates due to a potential difference,  $V$ , generated across them. It is known from electromagnetic theory that the electric field lines terminating on a perfect conductor must be normal to the conductor surface. The resultant electric field is therefore oriented as shown in Fig. 10A. If  $V$  is a sinusoidal function, the strength of the electric field will vary as  $V$  and

Fig. 7. (A) Electric field configuration in rectangular wave guide (TE<sub>0,1</sub> mode). (B) Magnetic field configuration (top view) in rectangular wave guide (TE<sub>0,1</sub> mode). (C) Electric field (side view) for TE<sub>2,0</sub> mode. (D) Magnetic field (top view) for TE<sub>2,0</sub> mode.





traveling waves will be sent down the plates in the  $z$  direction.

When another pair of parallel plates is placed at the sides of the former two—to form a wave guide—a reorientation of the electric field must take place since no tangential component of the electric field can exist parallel to the surface of a perfect conductor. Therefore the electric field at the sides of the guide must be equal to zero. One resulting pattern, shown in Fig. 10B, is in the form of a sine wave with maximum amplitude at the center of the guide (in the  $XY$  plane) and dropping to zero at both sides. This pattern must be maintained at any point along the guide in the  $XY$  plane. A picture (Fig. 7A) of the instantaneous electric field in the guide would then be a series of sine-wave hills.

This arrangement of the electric field cannot be produced by any single wave but requires two waves properly phased, just as was described for the short-circuited transmission line in the previous article. In this case, the problem is three dimensional and the waves involved are plane waves. This field can be achieved by two plane waves traveling within the guide at the same time as shown in Fig. 10C. For the purpose of this illustration, the angle between the wave guide walls and traveling waves can be considered to be:

$$\sin \alpha = \frac{\lambda}{2a} \dots \dots \dots (11)$$

It is readily seen that when  $\lambda = 2a$ ,  $\alpha = 90^\circ$ , or the waves are not propagated down the guide but bounce back and forth between the walls. For  $\lambda > 2a$ ,  $\sin \alpha$  does not exist which indicates that unless the wavelength of the wave is smaller than  $2a$ , it cannot be propagated down the guide.

From electromagnetic theory it is known that the existence of an electric field in the guide which varies with time develops a magnetic field which is transverse at the center of the guide but bends and becomes axial at the sides. A top view of the wave guide showing the magnetic field created by the previously described electric field is shown in Fig. 7B.

The original boundary condition requiring the electric field to drop to zero at the side walls could also be met by a full sine wave configuration, rather than a half wave. This pattern can also be achieved by two plane waves, but, in this case, the angle of the waves with the walls can be considered to be:

$$\sin \alpha = \frac{\lambda}{a} \dots \dots \dots (12)$$

and the cut-off wavelength,  $\lambda_c$ , is equal to  $a$ . The field configuration for these waves is shown in Fig. 7B.

Another possible configuration con-

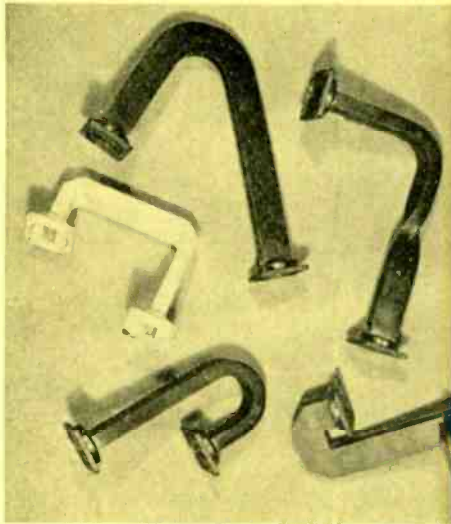


Fig. 8. Some of the many waveguide shapes available to meet the mechanical requirements of individual applications.



Fig. 9. Matching a 50 ohm line to an antenna having both reactance and resistance.

sists of the existence of an electric field which is normal to the side walls. A wave of this type will exist if the  $b$  dimension of the guide is large enough to permit propagation. To describe the various field configurations possible in a wave guide, a system of modes and subscripts has been evolved. Two basic types of waves can exist in wave guides, TE and TM waves. A TE wave indicates that there is no component of the electric field along the  $z$ -axis, while a TM wave indicates that there is no component of the magnetic field along the  $z$ -axis. A TEM mode is a wave in which both electric and magnetic fields have no  $z$  component. This latter mode exists only in free space and in a coaxial cable.

TE and TM waves are given numeral subscripts which represent the configuration of the electric or magnetic fields along the "a" and "b" dimensions of the guide.  $TE_{1,0}$  represents a wave with a half sine waveform (1) of the electric field along the "a" dimension, and no (0) electric field along the "b" dimension. This wave is shown in Fig. 7A. The configuration shown in Fig. 7B is that of a  $TE_{2,0}$ , i.e. a full sine wave along the "a" dimension (2), no (0) electric field along the "b" dimension. A  $TE_{1,1}$  wave is one which has an electric field in both "a" and "b" dimensions, in each case in the form of a half sine wave.

A wave guide acts as a high pass filter. The cut-off wavelength varies with the dimensions of the guide and the different modes. The generalized equation for the cut-off frequency of a rectangular guide is:

$$f_c = \frac{c}{\lambda_c} = \frac{c}{2} \sqrt{\left(\frac{m}{a}\right)^2 + \left(\frac{n}{b}\right)^2} \quad (13)$$

It has been shown that the electromagnetic waves traveling down the

wave guide do not follow a straight line but are reflected between the sides of the guide at some angle  $\alpha$ . The wavelength of the resulting field configuration, such as the one shown in Fig. 7A, is not the same as the free space wave-

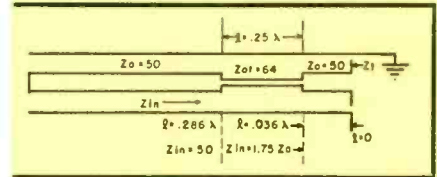
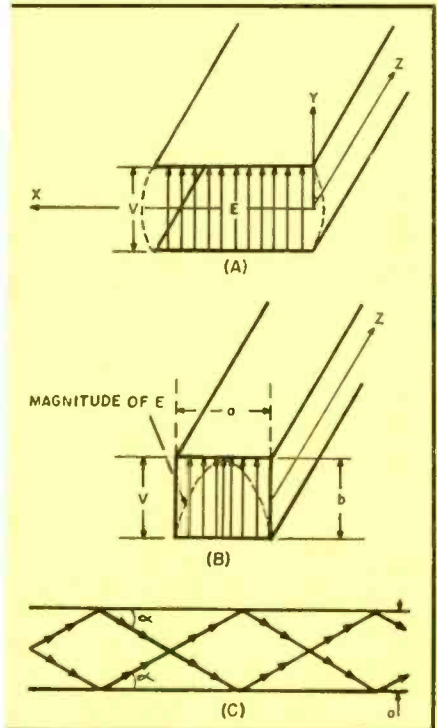


Fig. 10. (A) E field in pair of parallel plates. (B) E in rectangular wave guides. (C) Plane waves in guide.





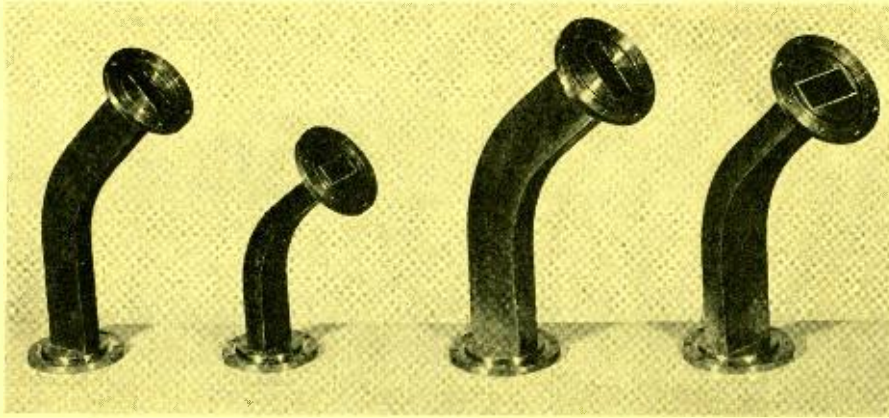


Fig. 11. Typical forty-five degree wave guide sections.

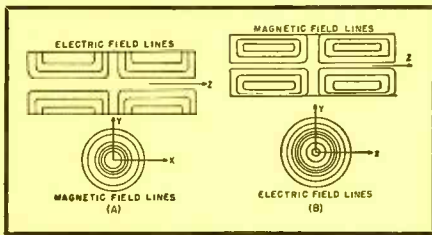


Fig. 12. Field configuration for (A)  $TM_{1,0}$  mode and (B)  $TE_{1,0}$  mode of a circular wave guide.

length  $\lambda$  of the original wave, but varies in accordance with the following equation:

$$\lambda_g = \frac{\lambda}{\sqrt{1 - \left(\frac{\lambda}{\lambda_c}\right)^2}} \dots (14)$$

where  $\lambda_g$  is guide wavelength.

The velocity of propagation down the guide, equal to the frequency times the guide wavelength, is:

$$v_g = f \lambda_g = \frac{c}{\sqrt{1 - \left(\frac{\lambda}{\lambda_c}\right)^2}} \dots (15)$$

These parameters can be determined for  $TE_{1,0}$  mode from the nomograph on page 32.

### Power Carrying Capacity and Attenuation of a Rectangular Wave Guide

The maximum power that can be transmitted through an air-dielectric

wave guide will depend upon the maximum electric field strength that can exist without breakdown. For the  $TE_{1,0}$  mode the theoretical maximum power that a wave guide can carry is:

$$P = (E_{max})^2 \times 6.63 \times 10^{-4} \times ab \left(\frac{\lambda}{\lambda_g}\right) (16)$$

where  $P$  is maximum power in watts and  $E_{max}$  is maximum permissible voltage gradient. This equation gives the theoretical power and assumes that no standing waves, due to mismatch, exist in the guide.

A value of 15,000 volts per centimeter  $E_{max}$  is usually used. This value has been arrived at empirically and is used by the Army and Navy in applying power ratings to wave guides. Figs. 13A and B show theoretical power rating curves for two typical wave guides.

The attenuation of a copper wave guide with air dielectric and for  $TE_{1,0}$  mode is:

$$\alpha_{copper} = \frac{0.001107}{a^{3/2}} \times \left[ \frac{\frac{a}{2b} \left(\frac{f}{f_c}\right)^{3/2} + \left(\frac{f}{f_c}\right)^{-1/2}}{\sqrt{\left(\frac{f}{f_c}\right)^2 - 1}} \right] \dots (17)$$

For metals other than copper, this equation must be multiplied by  $\sqrt{R_r}$ , where  $R_r$  is the resistivity ratio of the conductor used to that of copper. Curves of attenuation versus frequency are also

given in Figs. 13A and B. These curves indicate that it is not desirable to operate a wave guide at frequencies close to cut-off. The attenuation is high in this region and decreases rapidly to the point where it is fairly constant.

### Circular Wave Guides

It is also possible to utilize wave guides of circular form for transmission of microwaves. In practice this type of wave guide is rarely used because it is very difficult—due entirely to physical reasons—to maintain proper mode orientation. However in some specialized applications, such as when a rotating antenna is used, it is advantageous to use this type of guide. In these latter applications, it is necessary to utilize a "circular" type pattern such as the  $TE_{0,1}$  or  $TM_{0,1}$  modes shown in Fig. 12. The following relations describe the characteristics of the circular guide:

a) Cut-off frequency (TE modes):

$$f_c = \frac{cu'_{n,m}}{\pi D} \dots (18a)$$

where  $D$  is the guide diameter and the constant  $u'_{n,m}$  is the  $m$ th root of the Bessel equation  $J'_n(u) = 0$ .

b) Cut-off frequency (TM modes):

$$f_c = \frac{cu_{n,m}}{\pi D} \dots (18b)$$

where  $u_{n,m}$  is the  $m$ th root of the Bessel equation  $J_n(u) = 0$ .

c) Wavelength and velocity of propagation (same as for rectangular guide)

d) Power Carrying Capacity ( $TM_{0,1}$  mode):

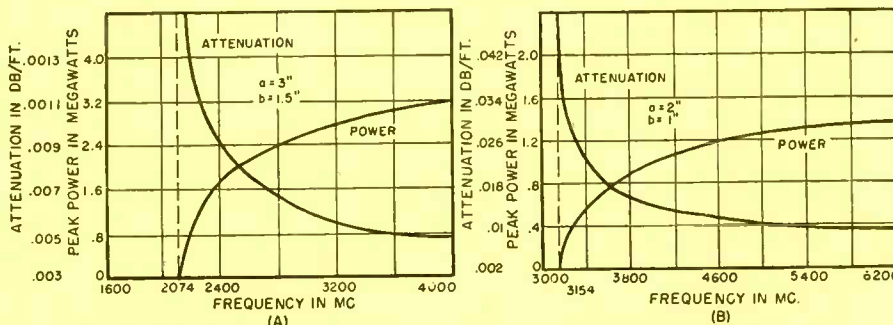
$$\text{For } D/2\lambda < 0.761, P = (E_{max})^2 \times 0.5 \times 10^{-3} \times \frac{D^4}{\lambda^2} \left(\frac{\lambda}{\lambda_g}\right) (19a)$$

$$\text{For } D/2\lambda > 0.761, P = (E_{max})^2 \times 0.75 \times 10^{-3} \times D^2 \left(\frac{\lambda_g}{\lambda}\right) \dots (19b)$$

e) Attenuation ( $TM_{0,1}$  Mode):

$$\alpha_{copper} = \frac{.00485}{D/2} \frac{\left(\frac{f}{f_c}\right)^{3/2}}{\sqrt{\left(\frac{f}{f_c}\right)^2 - 1}} \text{ db./ft.} \dots (20)$$

Fig. 13. Peak power and attenuation vs. frequency of  $TE_{1,0}$  mode in (A) 3" x 1½" wave guide and (B) 2" x 1" guide. Dotted lines represent the cut-off frequency.



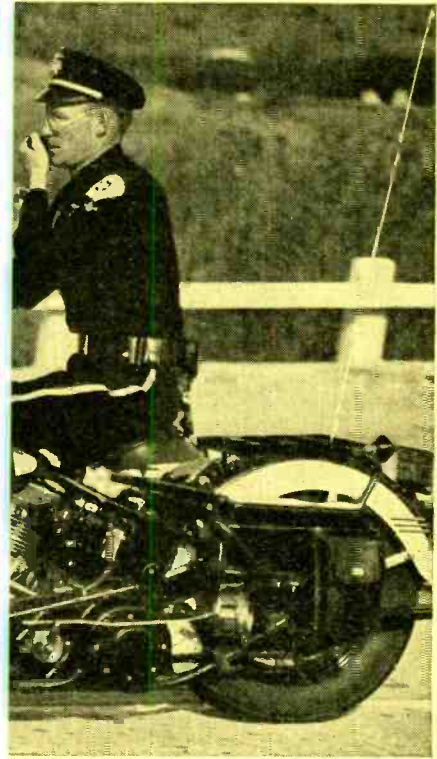
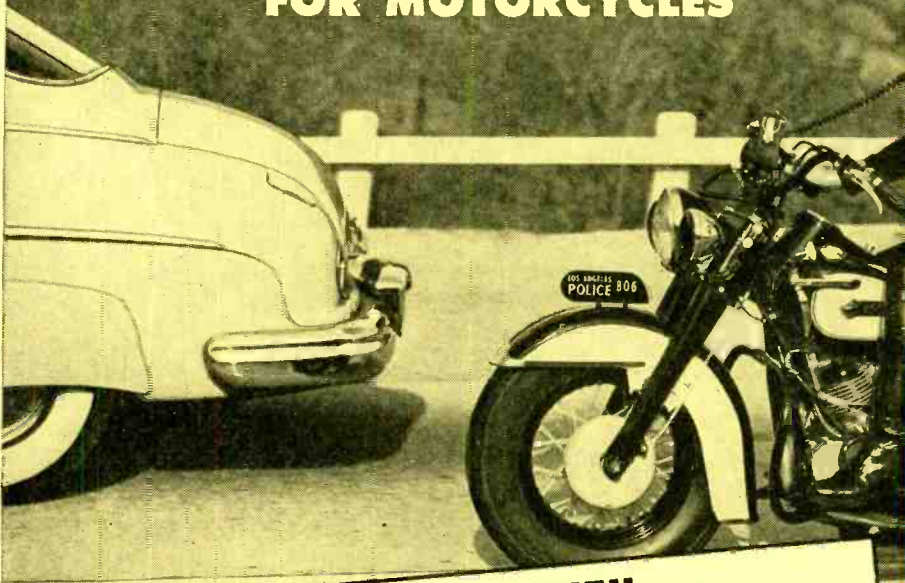
### Choosing a Wave Guide

In order to operate a wave guide at its optimum efficiency the dominant mode is usually used. The dominant mode is the lowest frequency mode that will propagate down the wave guide. In a rectangular guide, which is virtually always employed, this mode is  $TE_{1,0}$ .

The propagation of more than one  
(Continued on page 27)



# TWO-WAY RADIO COMMUNICATION FOR MOTORCYCLES



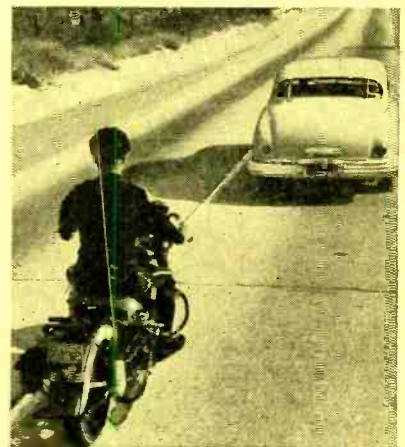
MADE POSSIBLE WITH . . .  
Equipment by Tubes by



Link Radio and VETTRIC SYLVANIA-ELECTRIC

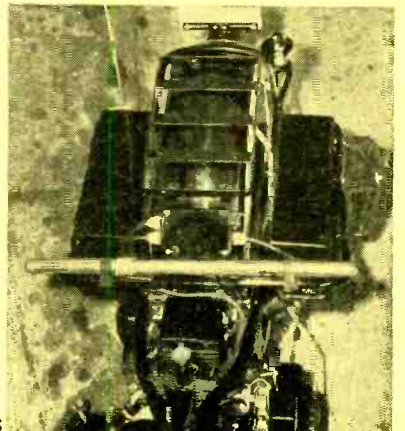
The long arm of the Law is just that much longer through the combined skill of Link-Vetric and Sylvania. In designing this compact two-way radio for the Los Angeles Motorcycle Police, one quality was paramount . . . faultless performance under the toughest conditions. Nothing must fail when the call comes through!

Link-Vetric uses Sylvania low-drain miniature tubes because every step in their manufacture is quality controlled, ensuring longer life under the most adverse conditions. From Regular Glass Tubes to the famous Lock-ins . . . from Miniatures to tiny Sub-Miniatures, Sylvania tubes give the perfection that can really take punishment. Sylvania Electric Products Inc., Emporium, Pa.



Highway bumps and rutted by-ways often have to be taken at high-speed. Sylvania tubes defy sudden shock, constant vibration. Maintenance work cut to a minimum.

Neatly installed either side of the rear fender, the two-way radio keeps patrolmen in constant touch with headquarters. All police calls are urgent calls . . . absolute reliability is essential. Sylvania tubes are chosen wherever necessity demands the highest standards.



# SYLVANIA ELECTRIC

RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTODIODES; PHOTOCATHODES; PHOTOMULTIPLIER TUBES; PHOTODIODES; PHOTOCATHODES; PHOTOMULTIPLIER TUBES; PHOTODIODES; PHOTOCATHODES; PHOTOMULTIPLIER TUBES



# MAGNETIC FLUX COMPARATOR

By EDWIN N. KAUFMAN

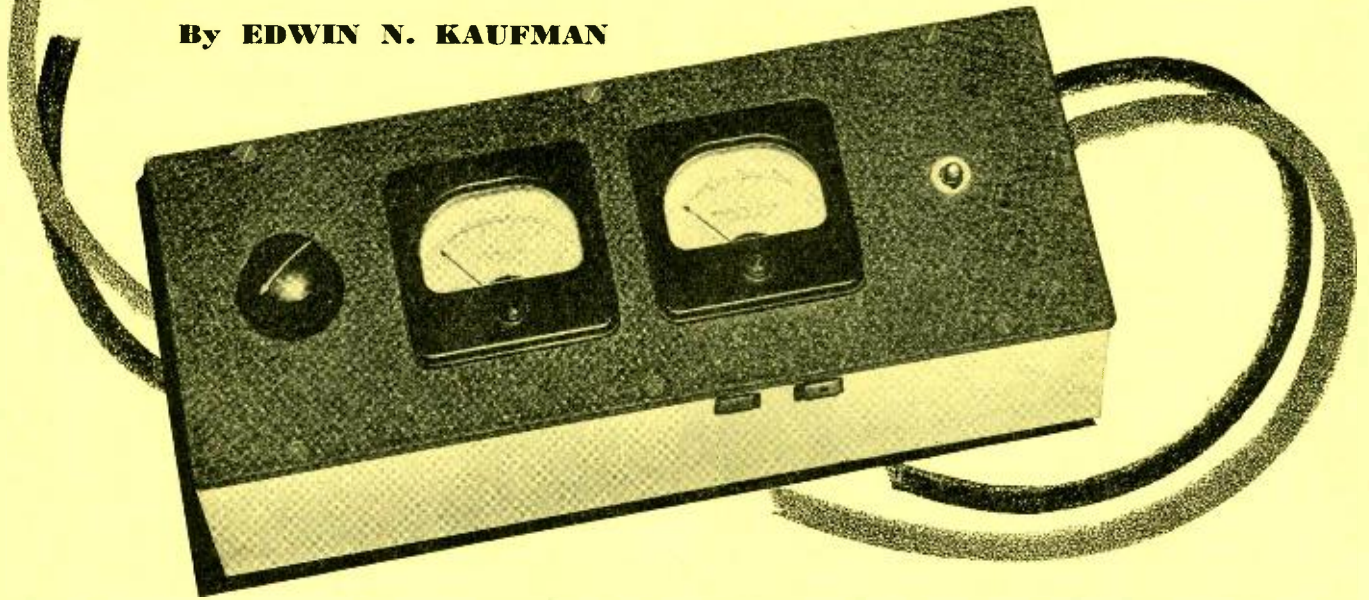


Fig. 1. The completed flux comparator. The two comparator bars may be seen protruding from the bottom of the case.

## A simple device for comparing the flux in an unknown magnet with that in a standard.

FOR a number of years instruments have existed which will permit magnetic flux densities to be read on a direct reading meter. This means that it is possible to check generators and motors for residual magnetism and for many other magnetic flux determinations to be made. One very practical use for a flux meter is determining to what extent a "charge" has been placed on a magnet after attempting to magnetize it. Applications also include flux measurements of electric instrument magnets, arc blowing chutes, contactor blow-outs, d.c. relays, iron of rotating machinery, voltage regulators, air gaps under pole pieces of rotating machinery, and studies of flux patterns about irregular shaped magnets.

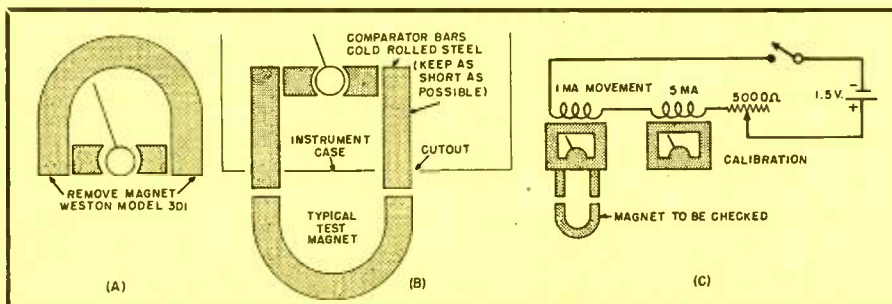
Depending upon the type of instrument, direct readings in Maxwells and

Gausses may be obtained or, as in the inexpensive instrument to be discussed here, only magnetic comparison can be made easily.

Three main types of instruments are in use today for measuring flux. The first is the ballistic galvanometer—which today is out of favor, almost completely, as it is very essential that the discharge from the test or search coil be completed before the galvanometer coil begins to move, as well as the necessity of quickly observing the deflection before the galvanometer coil begins to return to zero. The second method—the Sensitive Research Flux Meter—is infinitely better as the search coil may be moved slowly or rapidly through the test area and the pointer will remain at its final deflection. It is essentially a galvanometer movement

which has no return springs whatsoever. Naturally when the search coil is removed from the magnetic field the meter is deflected to a certain scale position, due to the electromotive force set up in the search coil. The speed of moving the search coil from the magnetic field has no effect on the scale reading because there is negligible restoring torque. This instrument will measure as low as FIVE lines per square centimeter and as high as 50 MILLION lines per square centimeter with an accuracy of  $\frac{1}{2}$  of 1%. This type of instrument operates on the principle that if a closed coil (the exploring search coil) is rotated or moved in a magnetic field, current flows in it owing to the electromotive force produced by the change in magnetic flux linked by the coil. This instrument can be used for many special purposes such as obtaining *BH* curves, determining permeability, measuring flux in a bar or horseshoe magnet, determining the number of turns in an unknown coil, and many other unusual purposes. Another type of instrument, the *General Electric Gauss Meter*, consists of an instrument very similar in appearance to a small D'Arsonval meter. The meter has a probe coming out of the back varying in length from one and a quarter inches to five inches. The probe diameter varies between .052 to .090 inches. The meter is directly calibrated in Gausses from 100 to 5000 Gausses for full scale depending on the meter selected. It is a very useful instrument for production testing of magnets and small magnetic gaps as its tiny probe with small area of sensitivity enables the flux to be

Fig. 2. Steps to follow in rebuilding the 0-1 ma. meter for a flux comparator. (A) The old magnet is removed. (B) Comparator bars are inserted to replace the old magnet. (C) Circuit diagram of the complete comparator.





measured at a single point in the air gap or iron structure. This makes possible a detailed analysis of flux distribution in any magnetic system. It also has the desirable feature of being relatively inexpensive compared to the other instruments mentioned previously. Any one desiring to purchase such an instrument would be wise to bear in mind the use to which it will be put rather than placing the dollar sign as the mark as to which instrument is best. This *General Electric* Gauss Meter is considered an instrument for high level flux measurements. Its operation and design are simple. The instrument consists of a tiny magnet at the end of a probe, which is mechanically connected to a pointer and restraining spring. When the probe is placed in a magnetic field the tiny magnet attempts to align itself with that field and so moves the pointer against the spring action. The amount of the deflection at that point when the magnet is turned to give maximum deflection is a measure of the field being explored. Although the accuracy of this instrument is probably plus or minus 5% it has considerable use for exploring small high intensity fields.

The instrument that the author believes is of possible use to industrial as well as amateur personnel is the Magnetic Flux Comparator. It may be purchased but it is so simple in construction and use that for many applications the instrument diagrammed herein will prove to be more than adequate. Magnetic comparison provides a quick, easy, non-destructive method of inspecting ferrous parts for quality control. Rods, bolts, springs, and small fabricated parts can be compared with pre-selected standards of the same size and shape to detect a difference in composition, heat treating, or other characteristics which alter the magnetic properties. Quality built instruments using a different method than shown here will distinguish between steels whose hardness differs by as little as two points of Rockwell. One very excellent application for this magnetic comparator is determining the magnetic charge of various magnets. It was for this purpose that the author constructed the model shown. In this case the magnets to be used were for Aluminum Drag Cup tachometers. The assembly and disassembly of these tachometers were expensive of time and quite a nuisance. But without a magnetic comparator this was necessary as some magnets took a very high charge and some none at all. Besides this, artificial ageing was desirable to maintain reasonable calibration. With the magnetic comparator as a check numerous uncharged magnets were charged and then discharged by a strong alternating field

to a predetermined point. Following this procedure the tachometer assembly was a fast running job with no rejections and consequent disassemblies. The unit described herein consists of a one milliamperere D'Arsonval meter and a five milliamperere meter. The one milliamperere meter had its horseshoe magnet removed and two straight steel bars, replacing the magnet, run out through the instrument case. The bar material should fit snugly against the remaining pole faces. These two meters are installed in an aluminum or wooden case with the two "comparator" bars extending through the case (see photograph). The two meter coils are connected in series and are supplied power thru a 5000 ohm potentiometer, a flashlight cell acting as the power supply. A known magnet is placed against the comparator pole pieces—thus supplying this meter's field strength. The calibration meter's (5.0 milliamperere) current is noted when half scale reading is obtained on the Flux Comparator Meter. Substituting the "unknown" magnet will give a deflection in proportion to its magnetic strength, either above or below this point. If full scale occurs the "unknown" magnet has twice the magnetic strength of the known magnet. Other readings can be calculated as easily. If it is desired, a double pole double throw switch can be applied to

the Flux Meter to eliminate turning the magnet if it is incorrectly polarized. Another feature is to raise the zero set position of the Flux Meter so that downscale movement can easily be seen when incorrect magnetic polarization occurs. Photographs and diagrams appear in the text of the article. ~⊗~

## U. H. F. TV Converter

*Continued from page 11)*

When the antenna tuner is loosened at the set screw allowing the oscillator tuner to remain stationary while the antenna tuner is allowed to rotate. A well shielded generator should be used in making measurements. To reduce radiation, a trimming condenser is inserted at the mixer output lead. If the leads are not short or making poor contact on both edges of the plate connection, spurious oscillations are apt to occur. The range covered by this unit is 520-550 mc. with a 55 megacycle i.f. A N21A is used as mixer.

A circuit diagram for the experimental unit is that shown in Fig. 3A.

A tuner covering the frequency from 60 to 750 mc. (calculated) is now in process. These tuners show a great deal of promise for the high band. It appears at present that gaps of 0.010" and .050" will be available at low production costs. ~⊗~

How **PRECISION**  
**PAPER TUBES** protect  
your coil windings

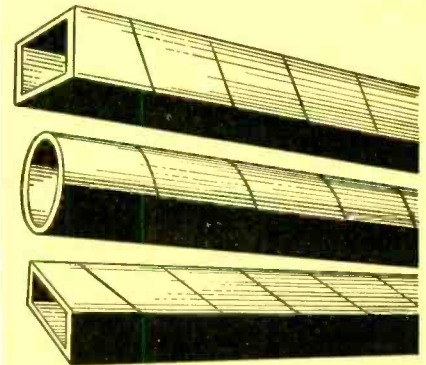
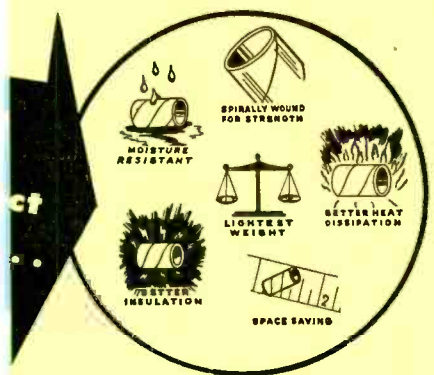
How far do these  
characteristics of your  
**COIL BASES** affect coil quality?

Every engineer knows the answer.

Precision coil bases have long proved their reliability in these factors . . . with light weight and space saving. Made to your specifications of finest dielectric Kraft, Fish Paper, Cellulose Acetate or combinations. Any length, any ID or OD, round, oval, square, rectangular.

Ask for new Mandrel list, over 1000 sizes.

Send for sample and **LOW PRICES.**



**PRECISION PAPER TUBE CO.**

2063 West Charleston St.  
Chicago 47, Ill.  
Plant No. 2, 79 Chapel St.  
Hartford, Conn.



# NEWS BRIEFS

## TV USED IN MEDICAL EDUCATION

A new method of applying television to medical teaching developed by William L. Norvell, manager of *Remington Rand's* television department, was re-



cently demonstrated during the Third Annual Clinical Session of the American Medical Association in Washington, D. C.

With Vericon, a system of closed-circuit television, the visual images of various internal organs of the body can now be televised for group study without resorting to surgery. The system incorporates a special optical link devised by Mr. Norvell and interposed between the eyepiece of a standard gastroscope and the pickup tube of the television camera.

## IRE SPRING CONFERENCE

Saturday, April 29th is the date set for the Cincinnati Section of the Institute of Radio Engineers Fourth Annual Spring Technical Conference at the Engineering Society Headquarters in Cincinnati.

The theme of the conference will be "Television" and sessions will be held morning and afternoon and exhibits will be on display. The day's proceedings will be climaxed by a banquet featuring a prominent speaker.

## TELREX APPOINTS ENGINEERS

*Telrex, Inc.*, of Asbury Park, New Jersey, has announced three recent appointments to its Engineering Staff. Those appointed are: Dr. H. Giuliani as Chief Chemical and Mechanical Engineer, Mr. Irvin Guttman as Chief Electronics Project Engineer and Sales Engineer, and Mr. Joseph P. Stephanile as Associate Electronics Engineer.

Dr. Giuliani formerly conducted research and development work at the Sheffield Engineering School, Yale Uni-

versity, and will direct many phases of plant development at *Telrex*.

Mr. Guttman was formerly associated with several prominent Electronics engineering firms as well as the U. S. Signal Corps Laboratories in Eatontown and Belmar in various engineering capacities.

Previously engaged in technical and engineering work with several Government installations, Mr. Stephanile joined *Telrex* in June and is conducting experimental work on new equipment.

## DR. ULREY RETIRES

Dr. Dayton Ulrey, an early researcher into vacuum tube design and well-known as an administrator and teacher, has



retired as Chief Engineer of the Lancaster, Pa., plant of the *RCA Tube Department*.

Dr. Ulrey's contributions to radio and television research include the development of processes for creating vacuum-tight metal-to-glass seals, the vital principle used in today's metal-coned television picture tubes. He was also responsible for important studies in the production of high vacuum, particularly the absorption and evolution of gases by glass and metals. Dr. Ulrey is shown examining one of the many intricate electron tubes which is the result of his development work.

*RCA* has announced that Dr. Ulrey will be retained as consultant to the company.

## REVISE WWV SERVICES

A new series of technical radio broadcast services over radio stations WWV, Beltsville, Md., and WWVH, Maui, Ter-

ritory of Hawaii, has been inaugurated by the National Bureau of Standards.

Revised services will not differ greatly from those given in the past, and include: (1) standard radio frequencies of 2.5, 5, 10, 15, 20, 25, 30, and 35 megacycles, (2) time announcements at 5-minute intervals by voice and International Morse code, (3) standard time intervals of 1 second, 4, and 5 minutes, (4) standard audio frequencies of 440 cycles and 600 cycles, (5) radio propagation disturbance warnings by International Morse code consisting of the letters W, U, or N, indicating warning, unstable conditions, or normal, respectively.

Radio station WWVH, recently established in Hawaii, broadcasts on an experimental basis on 5, 10, and 15 megacycles. The program of broadcasts on the three frequencies is essentially the same as that of station WWV.

Reports on reception are welcomed, and further information on these services, as well as forms on which to submit such reports, may be obtained on request from the National Bureau of Standards, Washington 25, D. C.

## 10th ANNIVERSARY FOR WRGB

*General Electric's* television station WRGB at Schenectady, N. Y., recently celebrated its 10th anniversary which marked the beginning of a new, completely modernized station containing the latest *General Electric* equipment throughout.

The studio has been enlarged to make room for a new master control room which acts as a control center for the entire system and is the distribution point for programs from the local studio, network programs which are brought from New York via the *GE* microwave relay and from the WRGB mobile pickup equipment.

At WRGB's master control panel, Stanley Godell is shown controlling the



quality of the photo being transmitted. This control panel is part of the station's new equipment, including cameras, control and transmitting equipment made at the *General Electric Company's* Electronics Park plant in



Syracuse, N. Y. Installation of the new facilities was completed on the eve of WRGB's 10th anniversary.

### TV TUBE PRODUCTION INCREASES

*Sylvania Electric Products Inc.*, New York, is expecting to set a new record in television tube production in 1950. With six television picture tubes per minute now coming off conveyORIZED production lines, production is now running 3½ times last year's rate.

Photograph shows a cleaning and inside-coating station under a conveyor



in the Ottawa, Ohio, picture-tube plant where both metal and glass tubes are processed side-by-side.

*Sylvania's* second new plant in Seneca Falls, N. Y., is reported to be near completion and both plants will produce standard and "gray-face" tubes and the new "short" and rectangular-face types.

### I.R.E. AWARDS

Announcement has been made of the I.R.E. awards which will be presented at the annual I.R.E. Convention in New York. The awards and recipients are as follows:

Browder J. Thompson Memorial Prize, Joseph F. Hull and Arthur W. Randals.

Editor's Award, E. J. Barlow.

Morris Liebmann Memorial Prize, Otto H. Schade.

Harry Diamond Memorial Award, Andrew V. Haeff.

Medal of Honor, Frederick E. Terman.

In addition to the above, thirty Fellow awards will be presented.

### REFLECTION OF RADIO WAVES

A system whereby radio waves are being reflected around a mountain in Pennsylvania has been reported by A. A. Johnson, manager of central station engineering for the *Westinghouse Electric Corporation*.

A microwave communication system recently installed between a sub-station and generating plant of the *Pennsyl-*

*vania Electric Company* at Johnstown has shown the reflection principle to be both efficient and economical.

Since the sub-station and generating plant were 12 miles apart with a large hill between, microwaves were reflected around it. In operation the microwaves are beamed at a large aluminum reflector sheet placed some two miles from the sub-station. This sheet, which measures 20 ft. square, is mounted on a 50-foot tower and is in the "line of sight" of both the sub-station and the generating plant. Microwaves striking this mirror-like reflector are deflected around the side of the mountain to the receiving apparatus.

### ELECTRON DIFFRACTION INSTRUMENT

An electron diffraction instrument which can "see" film surfaces as thin as two millionths of an inch is being used in the development of new and improved lubricants and catalysts at the *California Research Corporation* (subsidiary of *Standard Oil Company of California*) at Richmond, California.

The instrument, developed by *General Electric*, is said to be the most sensitive device yet developed for observing chemical and physical changes in extremely thin films. Before development of this equipment, the only means of studying these very thin films was by x-ray dif-

fraction or chemical analysis, which show only one chemical composition. Electron diffraction photographs will reveal a very thin surface layer of another material.



Shown is the *GE* electron diffraction instrument in use. According to *California Research* engineers, the electron diffraction method permits a truer evaluation of surface-active materials, and may lead to the discovery of new lubricants or lubricant additives. Another important advantage of this method is the speed with which the analysis of surfaces and thin films can be made.

### SAFEGUARD FOR ATOMIC LABS

An instrument which measures simultaneously the extent of beta and gamma contamination on hands and feet of those engaged in handling radioactive material, while compensating automat-

(Continued on page 29)

# Over 1000 Sizes

## PARAMOUNT SPIRAL WOUND PAPER TUBES

Square • Rectangular • Triangular  
Round and Half-Round

With a wide range of stock arbors... plus the specialized ability to engineer special tubes... PARAMOUNT can produce the exact shape and size you need for coil forms or other uses. *Hi-Dielectric*, *Hi-Strength*, *Kraft*, *Fish Paper*, *Red Rope*, or any combination, wound on automatic machines. Tolerances plus or minus .002". Made to your specifications or engineered for YOU.

Inside Perimeters from .592" to 19.0"

SEND FOR ARBOR LIST  
OF OVER 1000 SIZES

Convenient, helpful listing of over 1000 stock arbors. Includes many additional sizes of square and rectangular tubes. Write for Arbor List today. No obligation.

## PARAMOUNT PAPER TUBE CORP.

613 LAFAYETTE ST., FORT WAYNE 2, IND.

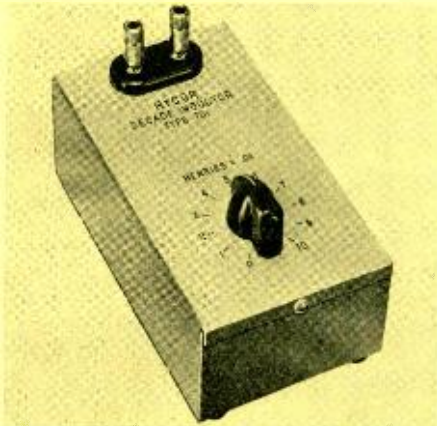
Manufacturers of Paper Tubing for the Electrical Industry



# NEW PRODUCTS

## DECADE-INDUCTOR UNITS

The Hycor Company, 11423 Vanowen St., North Hollywood, California has announced four individual high "Q"



Decade-Inductor units to cover .001, .01, 0.1 and 1 henry steps.

The four units may be connected in series to form a four dial unit covering 11.11 henries in .001 henry steps. High "Q" toroid coils are used throughout to provide the features of high "Q" and low pickup from external fields.

Full information is covered in Bulletin "D" which may be obtained upon request from the manufacturer.

## PREDETERMINED ELECTRONIC COUNTER

A high-speed predetermined electronic counter which will count at rates up to 60,000 per minute with absolute accuracy and will reset instantaneously without missing a count is now avail-



able from the Potter Instrument Co. Inc., 136-56 Roosevelt Ave., Flushing, N. Y.

The Model 133 Three-Decade Predetermined Electronic Counter shown will predetermine any count from 1 to 999

continuously and provide a high-speed relay action each time the selected predetermined count is reached. Other models having capacities of 2, 3, 4, 5 and 6 digits are available.

## I.F. COMPONENTS

Seven new picture i.f. components giving improved sensitivity, selectivity, and response have been announced by RCA's Tube Department, Harrison, N. J.

These new components are: Converter Transformer, Type 202K5; 1st Picture I.F. Transformer, Type 202K6; 2nd Picture I.F. Transformer, Type 202K7; 3rd Picture I.F. Transformer, Type 202K8; 4th Picture I.F. Transformer, Type 202K9; 5th Picture I. F. Transformer, Type 202K10; and cathode-circuit trap, Type 202K11.

The use of a link-coupled, double-tuned circuit between the converter

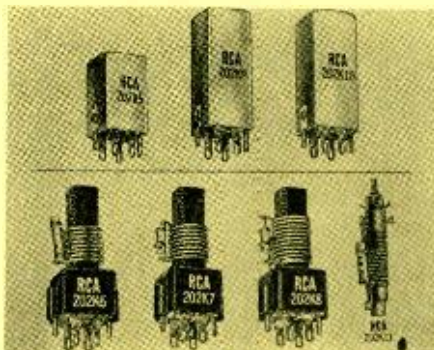


plate and the grid of the 1st i.f. tube increases the sensitivity of the system. These compact components are designed for a sound i.f. carrier of 21.25 megacycles and a picture i.f. carrier of 25.75 megacycles.

## DETECTOR RECORDS MINUTE CURRENTS

The Brown Instruments division of the Minneapolis-Honeywell Regulator Company, Minneapolis, Minnesota, has designed the Brown electrometer to measure and record very small currents like those developed in an ionization chamber as a result of radiation.

According to reports, the instrument has great possibilities for helping diagnosticians in the medical profession. When isotopes are injected into a person, this measuring instrument could be used to trace the course of the isotopes by detecting the location of

the isotope rays. It is capable of measuring to 100 millionths of a millionth of an ampere.

A single instrument without any alteration has a hundred-fold variation in currents which it will measure by means of a range-changing switch.

## RADIOACTIVITY DEMONSTRATOR

A radioactivity demonstrator for science instruction which is safe and simple to operate for use in high schools



and colleges, has been produced by the Nuclear Instrument and Chemical Corporation, 223 West Erie St., Chicago 10, Illinois.

The Model 1613 Demonstrator consists of the basic counting instrument which gives a visible, neon tube flash and an audible "click" indicating each disintegration, and an easy-to-read meter shows the amount of radioactivity. A twenty-eight page manual which describes and explains graphically how to use the accessories in the complete setup is included.

## PANEL INSTRUMENTS

The Marion Electrical Instrument Co., of Manchester, N. H. is announcing their new Ruggedized line of electrical meters said to meet performance requirements heretofore unattainable by conventional panel instruments.

Included in these performance requirements are high shock testing with



the Ruggedized meter mounted firmly to panels and subjected to 2,000 foot pound blows in each of three orientations with respect to direction of ap-



plied blows; extremely severe vibration for six hour periods; and tumble testing in a large compartmented tumbling barrel for one hour.

Detailed information regarding the meter and its performance may be obtained in a new booklet by writing direct to the manufacturer.

#### HIGH-SPEED D.C. RELAY

Stevens-Arnold Inc., 22 Elkins St., South Boston 27, Mass., is now offering its Millisec Relay in 6-pole, double-throw construction. Previously these relays had been made in two sizes only.

The advance from two poles to six poles was made possible by the availability of a 20-pin, hermetically sealed header and a 20-pin octal socket. This relay is claimed to have an operating time as short as 1/3 millisecond.

Contact rating is 110 volts d.c., 1/2



ampere. The life expectancy varies from 22 million operations at 1/2 ampere to 100 million operations at 1/4 ampere. Coils are wound for d.c. only.

#### KIT FOR BROADCASTERS

RCA Engineering Products Department, Camden, N. J., has designed a convenient kit which permits easy conversion from a.c. to battery operation for their Type BN-2A remote amplifier and eliminates carrying standard "A" and "B" batteries in a separate battery case.

This new battery-container and cover,



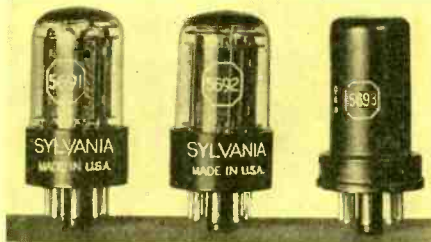
which can be mounted on the unit in place of the usual top cover, contains an a.c. receptacle, a switch to select

a.c. or battery operation, and a clamp for holding two 6-volt "A" batteries and four 67 1/2-volt "B" batteries.

This battery pack will supply power for the remote amplifier for 1 1/2 to 2 hours of continuous operation.

#### ELECTRON TUBES

Available now for distribution by Sylvania Electric Products Inc., New



York, N. Y. are three new electron tubes suitable for a wide range of industrial services where dependable operation and a service life up to 10,000 hours is required.

The three types include 5691, a high-mu twin triode recommended for voltage amplifier use and supplied with series-unit heaters; 5692, a medium-mu twin triode with series-unit heaters suitable for balanced d.c. amplifier, multivibrator, blocking oscillator and resistance coupled amplifier applications; and 5693, a sharp cut-off pentode designed particularly for high-gain resistance coupled amplifier service. The 5693 may be operated with number 1 grid resistance values up to 40 megohms.

#### DIELECTRIC HEATER

A pre-form heater which is automatic, portable, and built for long and



dependable service in pre-heating, drying, sealing and processing plastics, rubbers, and other dielectric materials has been announced by the High Frequency Heating Company, 143 Glen Park Avenue, Gary, Indiana.

The new HFH 1.5 AH Dielectric Heater is a bench machine operated by a pushbutton or foot switch. For preforming, one or several large or small "pills" are placed on a loading

(Continued on page 30)

**NOT JUST A PRODUCT\***

**FREQUENCY RANGE**  
1-100 MC

WITHOUT TEMPERATURE CONTROL, B1G CRYSTAL UNITS (SHOWN IN PHANTOM) CAN BE BUILT TO STABILIZE WITHIN ±.0025% FROM -55°C TO +90°C. WITH TEMPERATURE CONTROL, INSTALLED IN TYPE TCO-1 QVENS, STABILITY CAN BE ±.0001% IF DESIRED. IT PAYS TO CONSIDER THE RATIO OF COST TO IMPROVED STABILITY.

**BUT... A COMPLETE APPRECIATION OF END USE COST FACTORS AS APPLIED TO FREQUENCY STABILITY.**

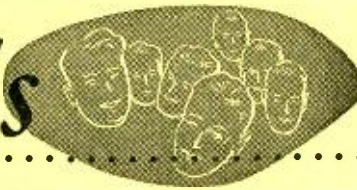
Always Specify Bliley!

**Bliley CRYSTALS**

BILEY ELECTRIC COMPANY  
UNION STATION BUILDING  
ERIE, PA.



# Personals



**CLARENCE G. FELIX** has been appointed Assistant to the General Manager of the *Crosley Division, Avco Manufacturing Corporation*, Cincinnati, Ohio. Beginning in the engineering department 22 years ago, Mr. Felix was named product manager of Government radio during *Crosley's* full-time war production in 1941 and later became manager of all Government products. He is a native Cincinnati and attended the University of Cincinnati.



**NORMAN L. HARVEY**, formerly head of the Applied Research Branch of the Physics Laboratory of *Sylvania Electric Products Inc.*, Bayside, N. Y., has been appointed director of engineering at *Colonial Radio Corporation*. During the war, Mr. Harvey served actively in research and development on proximity fuzes, airborne electronics, and advanced types of radar equipment. He is a senior member of the IRE and associate member of the AIEE.



**DR. CUTHBERT C. HURD** has been appointed director of *International Business Machines Corporation's* Applied Science Department. Prior to joining *IBM* in March, 1949, Dr. Hurd was a research head at Oak Ridge, Tenn. Dr. Hurd, author of two books and several papers on mathematics and on educational philosophy, holds degrees from Drake University, Iowa State College, and the University of Illinois.



**REAR ADMIRAL WALTER S. MACAULAY** has been appointed assistant executive engineer in the Knolls Atomic Power Laboratory being operated for the Atomic Energy Commission as part of *General Electric's* Research Laboratory. Admiral Macaulay was formerly on the assistant General Manager's staff of the Nucleonics Department. He is a graduate from the U. S. Naval Academy and received his M.S.E.E. at Columbia University.



**J. E. PAYNE** has been appointed Manager of the *Westinghouse Electric Corporation's* Central District and will supervise their apparatus business in Cleveland, Detroit, and Cincinnati and will make his headquarters in Pittsburgh. A graduate from the Alabama Polytechnic Institute as an honor student with a degree of Bachelor of Science in electrical engineering, Mr. Payne has been with *Westinghouse* since 1925.



**C. A. PUTNAM**, president of the *Markem Machine Company* of Keene, N. H., is now President of the National Association of Manufacturers. Several years ago, Mr. Putnam joined the *Markem Company*, makers of the power-driven marking and identifying devices used by radio, television and electronic equipment manufacturers, as the company's sales engineer, traveling in the United States and Europe. In 1929 he became the company's president.

## Strain Gauge Link

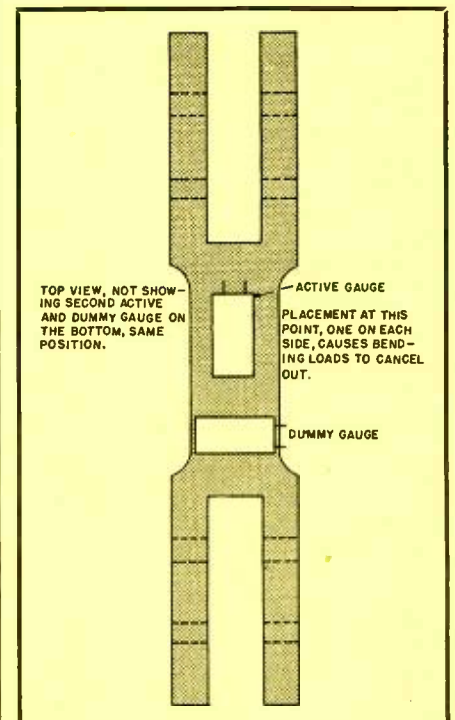
(Continued from page 9)

The two active strain gauges should be mounted as indicated on the photograph and drawing, on the sides subjected to any bending load. The dummy gauges are then mounted crosswise, 90 degrees from the bending plane. With the active gauges wired as indicated, any bending load will cancel out. The installation of these gauges is made per the instructions and bulletins issued by the *Baldwin Locomotive Company*. Bulletin 279B in particular gives complete step by step instructions for applying strain gauges. Roughly, the gauges are cemented in place with special glue after the surface has been degreased.

Voltage regulated power supplies may be used with such equipment. If so there will be no need for the bridge voltage regulating rheostat. The bridge accuracy will, however, be directly proportional to the regulation of the power supply.

The description of the above equipment stems from the design and use of similar equipment at a prominent west coast aircraft plant for the measurements of loads on special devices. Hydraulic loads were being used, but it was felt that the pressure gauges used in conjunction with the hydraulic cylinders were not always indicating true loads, especially when the fluid movement was at a high rate. Where the gauge could have been tapped directly into the cylinder this doubt would not

Fig. 6. Drawing showing location of active and inactive gauges.





have occurred. Calibration tests of a special jig, using the strain gauge link, did show up serious errors in the hydraulic load computations, but only as suspected at high flow rates. A restriction existed between the gauge and the cylinder through the smallest of the cylinder outlet connections and the connecting hose. This back pressure on the cylinder became much higher than the line pressure could indicate, as the cylinder piston was forced down rapidly.

The strain gauge link operating directly from the mover can indicate true load, whereas other devices such as hydraulic cylinders and gauges may not indicate binding loads in the cylinder, jig, or other associated equipment.

## Crystal Savers

(Continued from page 13)

A circuit of the direct synthesis type, adapted to the 75 meter amateur band, is illustrated in Fig. 3. A 100 kilocycle crystal oscillator is used to develop the primary signal. This is applied to a frequency divider, the output of which is at 10 kilocycles. The latter is in turn multiplied so that harmonics at 10, 20, 30, 40, 50, 60, 70, 80, and 90 kilocycles may be obtained at will. These harmonics are selected by means of a switch and mixed with the original 100 kilocycle signal, producing an output every 10 kilocycles from 100 to 190 kilocycles.

The 100-190 kilocycle signal is then mixed with another signal at either 3700 or 3800 kilocycles to produce an output every 10 kilocycles from 3800 to 3990 kilocycles. The 3.7 and 3.8 megacycle signals may be obtained from harmonics of the basic oscillator or by means of auxiliary crystal oscillators. The latter is probably the most economical method for the amateur or experimenter since a distorter, an amplifier and associated tuned circuits will be required to derive them from the 100 kilocycle oscillator.

By increasing the complexity of the circuit somewhat, outputs may be obtained every 10 kilocycles starting at 3805 kilocycles instead of 3800. Adaptations can also readily be made for other frequencies and other amateur bands. The main thing to watch in any of these crystal savers is the production of spurious signals. Since several mixers and harmonic amplifiers are used in any of them, such unwanted responses are easy to obtain and sometimes difficult to eliminate.

Frequency synthesis should be welcomed by those amateurs who demand the stability of crystal oscillators but at the same time wish a certain degree of flexibility not economically attainable with the usual methods of crystal control.

## Standing Wave Det.

(Continued from page 6)

phase of the reflection coefficient in a wave guide transmission line system, in practice it has such additional uses as:

1. To measure effect of discontinuities in any wave guide equipment.
2. To determine rectification characteristics of a crystal, bolometer or other type of detector or rectifier.
3. To measure directivity of directional couplers.
4. To calibrate fixed and variable attenuators.
5. For simple rapid quantity testing of standard wave guide component production.
6. For measurement of normalized impedances.
7. To predetermine and experimentally check position and dimensions of matching irises and stubs. This may be expanded to include any constriction existing or developing in a wave guide.

Measurements are obtained in terms of reflection coefficient  $K$  or Voltage Standing Wave Ratio (VSWR). The relationship between these values is as follows:

$$K = \frac{\text{VSWR} - 1}{\text{VSWR} + 1}$$

In the case of interpretations of the results in terms of normalized impedance, reference is made to a standard impedance chart such as the Smith chart used in advanced research and development.

In measuring reflection coefficients, the signal generator should be as stable as possible and the probe should disturb the fields in the wave guide the least possible amount. The use of an attenuator of not less than 20 db. prevents the tube (signal generator) from being affected by changes of the impedance for a component under test. The probe will least disturb the fields in the slotted wave guide if minimum probe depth consistent with the sensitivity of the output measuring equipment is employed. This is the reason for tuning the coaxial structure connected with the probe. It can thus be kept small without decreasing the sensitivity.

Since little power is available at the output terminal (coaxial cable connection), particularly with the use of an attenuator in the test setup, it necessitates sensitive measuring equipment. This may be provided in the form of either:

1. Use of an audio frequency amplifier and modulating the signal generator by means of a square wave separately generated. A square wave should be used instead of a sine wave in order to avoid FM behavior.
2. The use of a sensitive galvanometer (not over .001 microampere/mm

of scale deflection on a 10 cm. scale) and c.w. conditions in the oscillator.

## Microwave Trans.

(Continued from page 18)

mode in a wave guide is undesirable as it results in impedance mismatches for the various modes; reflection and generation of spurious frequencies; and an over-all loss in power. It is therefore necessary to select the physical dimensions of the guide so that only the desired mode can be propagated.

For the propagation of a  $TE_{1,0}$  mode the "a" dimension of the guide should be such as to fall between  $\lambda/2$  and  $\lambda$ . This can best be understood by working out a simple problem. A wave guide must be designed for the propagation of a  $TE_{1,0}$  mode at 3000 mc. ( $\lambda = 10$  cm.) with maximum efficiency. The dimension of the guide at the cut-off frequency of 3000 mc. would be:

$$3 \times 10^9 = \frac{3 \times 10^{10}}{2x}; x = 5 \text{ cm.} \quad (21)$$

However, we do not want to use a guide

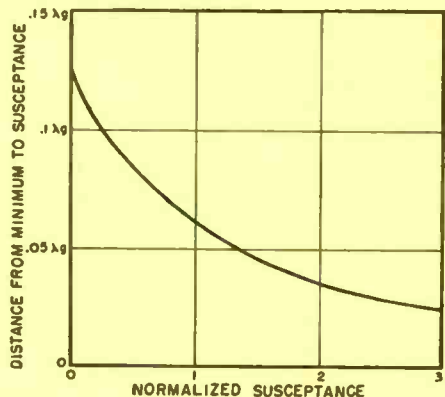


Fig. 14. Plot of the distance from minimum to susceptance (d) vs. the normalized susceptance (B).

with this dimension since the attenuation is high. With  $a = 5$  cm., the cut-off frequency of the next highest mode,  $TE_{2,0}$  is:

$$f_c = \frac{3 \times 10^{10}}{5} = 6000 \text{ mc.} \quad (22)$$

### C.T.I. TRAINED MEN ARE AVAILABLE!

Each month C.T.I. graduates ambitious young men who have completed an intensive course in Radio and Television maintenance and repairing. Their training has been practical. They've learned by working on modern equipment under personal, expert supervision.

If you need a trained technician, we invite you to write for an outline of our course, and for a prospectus of the graduate. (No fees, of course). Address:

Placement Manager, Dept. P106-3

**COMMERCIAL TRADES INSTITUTE**

1400 Greenleaf • Chicago 26



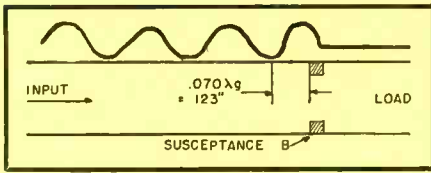


Fig. 15. Use of susceptance B to match load to wave guide.

and this mode will therefore not be propagated for  $a = 5$  cm. and  $f = 3000$  mc. However, if we increase the "a" dimension to 10 cm., then the cut-off frequency of the TE<sub>2,0</sub> mode would be 3000 mc., and this mode could propagate. We therefore choose a width which is some point between  $a = 5$  cm. and  $a = 10$  cm. For minimum attenuation this point should be as close to 10 cm. as possible, consistent with bandwidth requirements and allowing a safe margin.

The "b" dimension is subject to a compromise on many points. It must be small enough to eliminate the propagation of "n" modes. It is made as large as possible to minimize attenuation and increase power handling capability. In practice the ratio of b to a is kept to about 0.5.

Standard sized wave guides are available to meet virtually every application. Table I lists the standard sizes together with their wavelength range, attenuation factors, and Army-Navy type numbers.

### Impedance Matching in Wave Guides

The principles outlined previously for matching coaxial lines apply also to wave guides. Any obstruction placed in the guide will cause reflection of some of the energy, setting up standing waves. Thus in effect such an obstruction can be considered to be an impedance and since, in general, it cannot absorb energy, it will be in the form of an inductive or capacitive reactance. The impedance of such an obstruction can be determined by measuring the magnitude and phase of the incident

and reflected waves and introducing these values in Eq. (3).

In order to do this it is necessary to know the characteristic impedance of the guide. The characteristic impedance of wave guides has been variously defined, and the parameter used in matching problems is frequently called the "specific wave impedance." This impedance is:

$$Z_{TM} = \sqrt{\frac{\mu_1}{\epsilon_1}} \times 377 \frac{\lambda_g}{\lambda} = 377 \frac{\lambda_g}{\lambda} \text{ for air (TE waves). . . (23a)}$$

$$Z_{TE} = \sqrt{\frac{\mu_1}{\epsilon_1}} \times 377 \frac{\lambda}{\lambda_g} = 377 \frac{\lambda}{\lambda_g} \text{ for air (TM waves). . . (23b)}$$

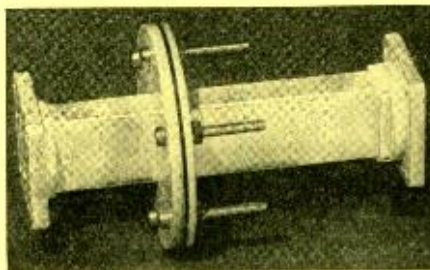


Fig. 16. One method of connecting two wave guides together.

The value of  $Z_0$  obtained from these equations is used for normalizing load equations. (An equation is "normalized" by dividing through by  $Z_0$ , for example, the normalized version of  $R + jX$  is  $R/Z_0 + jX/Z_0$ ). In wave guide matching it is more convenient to use admittances, rather than impedances, and the normalized input admittance,  $Y$ , to a matched line is represented by  $Y = 1 + jB$ , where  $B$  is the normalized susceptance of the reflecting element. This element may be the load or a matching element simulating an inductance or capacitance.

The following procedure is used to match wave guides. Consider the system

illustrated in Fig. 15. The wave guide is connected to the load and it is found that a certain standing wave ratio (voltage) exists. A susceptance  $B$  must be placed in the guide which is equal to:

$$B = \frac{\eta_0^{1/2} - 1}{\eta_0^{1/4}} \text{ . . . . . (24)}$$

Then to match the load to the line impedance, it should be placed at a position determined by:

$$d_1 = \frac{90 - \tan^{-1} \left| \frac{B}{2} \right|}{720} \lambda_g \text{ . . . . . (25)}$$

where  $d_1$  is the distance between the reflecting element and a voltage minimum. If the reflecting element is inductive ( $B$  is negative) it should be placed at a distance  $d_1$  on the load side of a minimum, while if capacitive it should be placed at a distance  $d_1$  on the generator side of a minimum. The distance  $d_1$  is plotted against  $B$  in Fig. 14.

As a typical example of impedance matching with a reflecting element, consider a 1" x 1/2" rectangular guide with  $\lambda = 3.2$  cm. feeding a load that gives a standing wave ratio of 5 to 1 in the guide. With the chosen wave guide and wavelength, the wavelength in the guide is  $\lambda_g = 1.764$ " and  $\lambda_g/a = .96$ . It is desired to correct this mismatch with a reflecting element.

1. From Eq. (24) the susceptance  $B$  must be equal to 0.82.

2. From Fig. 14 this susceptance should be located at a distance  $d_1 = .070 \lambda_g = .123$ " toward the load ( $B$  is negative) from a voltage minimum. For minimum frequency sensitivity the susceptance (usually in the form of a window) should be placed as near the load as possible, yet not so near that there will be interaction of the higher modes.

In this latter section as well as in the section dealing with matching of coaxial lines, the use of matching elements has been discussed, but the details of how to design such elements have not been covered. This subject will be covered in the next article in this series entitled "Microwave Components" which has been tentatively scheduled for the April issue of RADIO-ELECTRONIC ENGINEERING.

### BIBLIOGRAPHY

1. Racker, Joseph, "Microwave Techniques", RADIO-ELECTRONIC ENGINEERING, February, 1950.
2. Zimmerman, Karl, "High Frequency Cable Design", Electronics, February, 1948.
3. Smith, Philip, H., "An Improved Transmission Line Calculator", Electronics, January, 1944.
4. Sherbin, Leonard, E., "Wave Guide Data", Electronics, January, 1947.

Table I. List of standard wave guides and connectors.

Dimensions inches	Army-Navy type number	Cutoff wavelength cm.	Usable wavelength range for TE <sub>1,0</sub> (cm.)	Connectors		Attenuation in brass db./ft.
				choke	flange	
1 1/2 x 3 x 0.081 wall	RG-48/U	14.4	7.6-11.8	UG-54/U	UG-53/U	0.012 @ 10 cm.
1 x 2 x 0.064 wall	RG-49/U	9.5	5.15-7.6	UG-148/U	UG-149/U	0.021 @ 6 cm.
3/4 x 1 1/2 x 0.064 wall	RG-50/U	6.97	3.66-5.15	UG-150/U	contact type	0.036 @ 5 cm.
5/8 x 1 1/4 x 0.064 wall	RG-51/U	5.7	3.0-4.26	UG-52/U	UG-51/U	0.50 @ 3.6 cm.
1/2 x 1 x 0.050 wall	RG-52/U	4.57	2.4-3.66	UG-40/U	UG-39/U	0.076 @ 3.2 cm.



# TECHNICAL BOOKS

**"RADIO-FREQUENCY HEATING EQUIPMENT"** by L. L. Langton. Published by *Pitman Publishing Corp.*, 2 West 45th Street, New York, N. Y. 196 pages. \$3.75.

This volume deals mainly with the generation and transfer of radio-frequency power in a manner suited to the needs of those having interest in radio-frequency heating. The design of equipment for radio-frequency heating is also presented with some applications of the technique. Reasons underlying the advantages gained by using the technique in these applications are fully discussed.

It is not intended that this volume should be regarded as a handbook, and the application of the technique is treated in only a broad manner in Chapters 9 and 10.

Equations of a somewhat unfamiliar nature will be found in the book as the author has not given a full derivation of such expressions. However, the reader should have little difficulty in developing these expressions from a study of the earlier mathematics in the relevant chapters and with the assistance of Appendix 1.

Of special interest to readers having a second or third year knowledge of electrical or radio engineering, is the Design Section. Users as well as designers of such equipment will find this book of valuable assistance.

The author has suggested that this entire volume be read thoroughly before the reader returns to those particular chapters which are of interest to him.

**"TERRESTRIAL RADIO WAVES"** by H. Bremmer. Published by *Elsevier Publishing Co. Inc.*, 215 Fourth Avenue, New York 3, N. Y.

The initial form of this book was written during the war years as a continuation of the work initiated by Professor Van der Pol and the author on the propagation of radio waves. The considerable amount of work in this field published since then made a revision of this work desirable.

It presents the treatment of mathematical-physical methods for the computation of transmitter fields and describes how the electromagnetic field of a radio transmitter can be computed taking into account the curvature of the earth's surface.

The first part of this book deals with the theory relating to a homogenous atmosphere which concerns only that

part of the field which is independent of the ionosphere. The theory is then extended for an inhomogenous atmosphere in the second part.

## News Briefs

(Continued from page 23)

ically for background radiation, has been developed by the *RCA Engineering Products Department*.

Designed by *RCA* under the Atomic Energy Commission's program to safeguard those engaged in atomic work, the instrument is designated the *EMA-2B Hand and Foot Monitor*. It consists of a platform flanked by two posts designed for installation in a passageway where workers leaving the radioactive area must pass through the aperture, and a control cabinet which may be installed in any out-of-the-way space that is free from contamination and excessive vibration.

## SYNTHETIC MICA

As part of a broad program of fundamental research on fluorine-type artificial minerals carried on by the National Bureau of Standards, Dr. Herbert Insley, Alvin Van Valkenburg, and Robert Pike have successfully crystallized synthetic mica. Under the spon-



sorship of the Office of Naval Research, the synthetic mica phase of the program has been carried out in cooperation with the U. S. Bureau of Mines and the Colorado School of Mines.

Because of the extremely high pressures as well as high temperatures involved in duplicating the conditions under which mica is formed in nature, the Bureau's scientists are using fluorine as a crystallizing agent to grow crystals of mica without using high pressure. Although natural fluorine is a gas, poisonous and difficult to control, a group of synthetic fluorine compounds, the fluorosilicates, provides a convenient way of introducing fluorine into mica synthesis.

Photograph shows flakes of the synthetic mica being examined under a binocular microscope to locate any structural defects. Impurities, gas bubbles, faulty orientation, and incomplete crystallization are revealed by this method.

Clear crystals are selected for further analysis.

## ATOMIC WASTE RESEARCH

New York University College of Engineering, through its Research Division, is currently actively engaged in a project sponsored by the Atomic Energy



Commission which seeks to find solutions for problems concerned with atomic energy wastes.

Research assistant, Werner N. Grune, is shown removing a radioactive specimen from its lead container with a set of tongs in Carpenter Sanitary Engineering Laboratory at University Heights.

## MEASURING DEVICE

A new measuring machine which will select in sequence the quantities to be measured, make the measurement, transmit these readings as far as desired, and record them in numerical form properly tabulated was recently described at the Winter General Meeting of the AIEE.

The machine was described in a technical paper entitled "The Metrotype System of Digital Recording and Telemetering" presented by G. E. Foster of the *Metrotype Corporation*. In describing *Metrotype* recording, Mr. Foster stated that the machine combines the electronic computer technique with that of the printing telegraph and records data by means of "log sheets."

## DAYTON IRE PICKS COMMITTEE

The board of directors of the Dayton Section of the Institute of Radio Engineers has announced the members of the executive committee in charge of the 1950 Dayton IRE Technical Conference to be held May 3, 4, and 5.

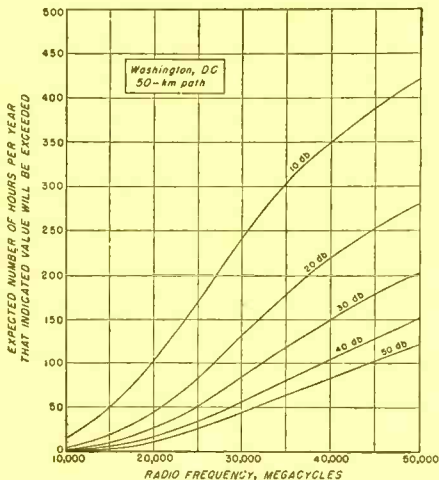
George Rappaport was named President, Harold V. Noble, Vice President, Gerald C. Schutz, Secretary, and Gilbert H. Arenstien, Treasurer. Chairmen appointed are as follows: Edward P. Spandau, Arrangements Committee, Paul G. Weigert, Exhibits Committee, Emanuel A. Blasi, Program Committee,



Albert O. Behnke, Publicity Committee, and Mary Wheeler, Ladies Program Committee. Chairmen for the publications and registration Committees have not yet been announced.

### ATTENUATION STATISTICS

Annual probability curves for the expected duration and magnitude of atmospheric attenuation at microwave frequencies for both one-kilometer and 50-kilometer path lengths have now been obtained by Howard E. Bussey at the National Bureau of Standards.



These attenuation statistics have been derived from meteorological records, using accepted theoretical and experimental coefficients for converting rainfall values into radio attenuation values.

Microwave radio signals decrease in intensity as they travel through the earth's atmosphere because of absorption and scattering by oxygen, water vapor, or precipitation. The attenuation increases sharply for microwave frequencies above 10,000 megacycles, and quantitative information on this effect is important in the selection and allocation of microwave radio frequencies.

The curves shown here give the expected number of hours per year that microwaves propagated over a 50-kilometer path near Washington, D.C., will experience rainfall resulting in attenuation values of 10, 20, 30, 40, or 50 decibels in the microwave frequency range from 10,000 to 50,000 megacycles.

### DIGITAL COMPUTER MANUFACTURING

Dr. Samuel Lubkin, formerly consultant to the National Bureau of Standards on mathematical, logical and engineering phases of electronic digital computers, has announced the formation of *The Electronic Computer Corporation* with offices and plant at 265

Butler St., Brooklyn, New York.

Headed by Dr. Lubkin, the new company is prepared to build electronic digital computers capable of multiplying two thirteen decimal digit numbers and obtaining an answer correct to twenty-six digits in three one-thousandths of a second.

The first practical machine of this type was the ENIAC completed at the Moore School of Electrical Engineering and now engaged in the solution of problems at the Ballistics Research Laboratories. The most recent one is the Mark III Computer built at Harvard University and unveiled a few months ago.

### New Products

(Continued from page 25)

tray that slides into the heater. Heating is automatically started and continues for the pre-set time cycle.

The basic heater (less tray) also supplies high frequency energy to bar sealers, electronic ovens, special fixtures, and laboratory apparatus.

### 16" PICTURE TUBE

RCA's Tube Department, Harrison, N. J., has announced the 16GP4, a short, directly viewed, 16" picture tube of



the metal-cone type for use in television receivers designed for it. A rounded-end picture 11" x 14 5/8" is obtained by utilizing the full-screen diameter.

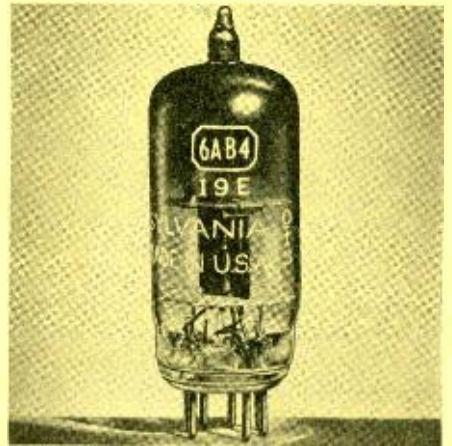
Having a maximum over-all length essentially 5 inches shorter than the 16AP4, the new wide-angle 16GP4 offers designers of television receivers greater flexibility in chassis design and cabinet styling, and makes possible greater compactness. In addition, the 16GP4 permits economies in tube stocking.

The comparatively flat face of the 16GP4 is made of "filterglass" to provide increased picture contrast particularly in a lighted room. The new design of cone-to-neck section makes possible the design of a longer and more efficient yoke than would otherwise be practical. Other outstanding features include an ion-trap gun which requires

only a single-field magnet, and a duodecal 5-pin base which permits the use of a lower-cost segment socket.

### MINIATURE TRIODE

A miniature triode, Type 6AB4, suitable for use as a grounded-grid r.f. amplifier, frequency converter, or oscil-



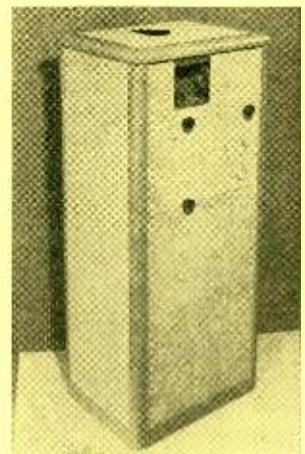
lator at frequencies below 300 megacycles is now available through distributors for *Sylvania Electric Products, Inc.*, 500 Fifth Avenue, New York 18, N. Y.

Frequency range of the 6AB4 makes it applicable for use in currently allocated television bands. High frequency performance is comparable to that of types 6C4, 6J6 and 7F8. It is supplied with a 6.3 volt, 150 milliamperere heater.

### VIEWER FOR STYLUS POINT

*Tape Recording Apparatus Company*, Box 221, Caldwell, N. J., has developed the Shadowgraph which will give a 500 times magnified view of the two cross-sectional profiles of the stylus point.

Other features include a perfect reproducing stylus curve as a comparison, a shaded screen for viewing, and a simple straight-forward focusing system



which allows movement of the stylus in three planes. The instrument is en-



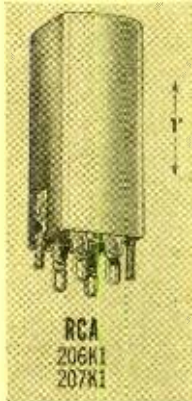
closed in a leather-finished tempered masonite case and occupies only 12½" x 15" of floor space.

Additional information may be obtained by writing the company direct.

### TV COMPONENTS

Two new components for television receivers have recently been offered to equipment manufacturers by the Tube Department of the *Radio Corporation of America*, Harrison, N. J.

The first of these new components is a sound-i.f. transformer Type 206K1 designed to operate at 21.25 megacycles per second with the miniature sharp-cutoff pentode 6AU6 as sound-i.f. amplifier tube. It is capable of providing a voltage gain of about 35 times between the grid of one sound-i.f. tube and the grid of the following sound-i.f. tube.



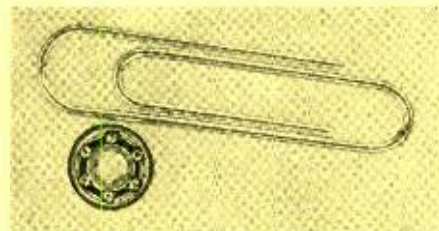
The second component, a sound-discriminator transformer Type 207K1, is designed for use between the last sound-i.f. stage utilizing a 6AU6 tube and the sound-discriminator stage employing the miniature twin diode 6AL5.

This transformer can provide 0.08 volt of audio output for each kilocycle of frequency deviation from its operating frequency of 21.25 megacycles per second, when a 1-volt signal is applied to the grid of the last sound-i.f. amplifier tube.

With these two components, a sound-i.f. amplifier and discriminator can be designed to give an audio-voltage output which is linear up to a bandwidth of 150 kilocycles and usable up to 300 kilocycles.

### BALL BEARING

A Micro Ball Bearing reported to represent a 33% reduction in size from the smallest of its type previously avail-



able in this country has been developed by *New Hampshire Ball Bearings, Inc.*, of Peterborough, N. H.

The bearing is fully ground, consistent with precision bearing practice,

measuring ¼" outside diameter by 3/32" wide, with a bore diameter of 5/64", both diameters being held to tolerances plus zero, minus .0002" from the nominal.

Immediate uses of this bearing are reported to be chiefly in the fields of instrumentation and control, particularly in widely used "Synchro" and "Servo" devices.

### HIGH VACUUM CHAMBER

*Pacific Universal Products Corporation*, 168 Vista Avenue, Pasadena 8, California is now offering a new and larger high vacuum chamber for the



vacuum evaporation of metals and dielectrics.

Front surface mirrors, one of the products of the new equipment, are in increasing demand in nuclear work as periscopes, for viewing radioactive processing, in television projection systems, for viewing large screen picture tubes mounted vertically, and for countless mirror applications in electrical and optical instruments.

Bob Frazer, Chief Engineer of *Pacific Universal Products*, is shown supervising the equipment's initial tests. Engineers confronted with problems which lend themselves to high vacuum treatment are invited to communicate with the company.

### CASTING RESIN

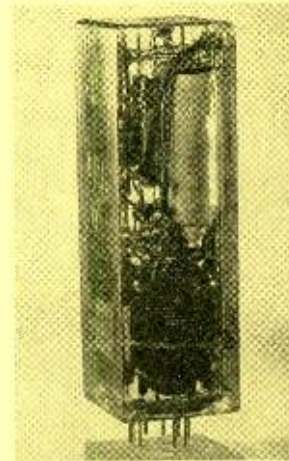
A casting resin designed specifically for encapsulating subminiature electronic circuits has been developed by

### PHOTO CREDITS

Page  
3, 5, 6.....DeMornay Budd, Inc.  
14.....Federal Telecommunication Laboratories, Inc.  
15, 17, 18, 28..Carl W. Schutter Co.

*Melpar, Inc.*, 452 Swann Ave., Alexandria, Virginia.

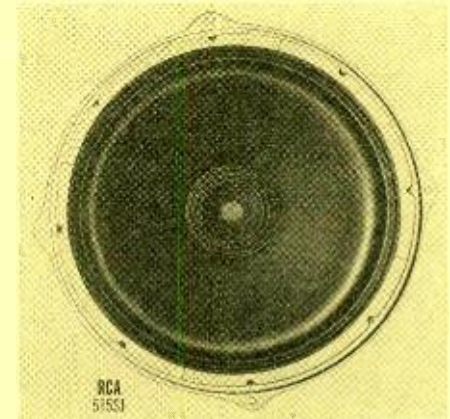
Melpak IV is recommended by the



manufacturers for audio or video applications where size, weight, temperature, moisture, or rough handling is a problem. Especially noteworthy is the wide temperature range of the resin which is -85°F (ambient) to +320°F (hotspot). Further information on this and other Melpak resins will be supplied upon request.

### HIGH-FIDELITY SPEAKER

The Tube Department of the *Radio Corporation of America*, Harrison, N. J. has announced the 15-inch, duo-cone,



high-fidelity speaker, RCA-515S1, designed to provide exceptionally fine tonal reproduction. It is particularly suited for high-quality radio and television receivers, low-distortion reproducing systems, and broadcast station monitoring applications.

The 515S1 speaker employs a unique magnet structure and vibrating system consisting of a dual cone, each section of which is driven by its own voice coil operating within its own air gap. The two cone-sections are mounted in a single housing and vibrate as a single cone over the range of cross-over frequencies centered at 2000 cycles per second.



# TE<sub>0,1</sub> WAVES IN RECTANGULAR WAVE GUIDES

**Nomograph for determining wavelength and group velocity in a guide, knowing free-space wavelength and guide width.**

In a rectangular wave guide for a TE<sub>0,1</sub> wave (transverse electric), the electric vectors are parallel to one side of the guide; the width dimension is measured at right angles to the electric vector. The wavelength within the guide and the group velocity are determined by the following equations:

$$\frac{\text{Group Velocity}}{\text{Velocity of Light}} = \sqrt{1 - (\lambda/2b)^2}$$

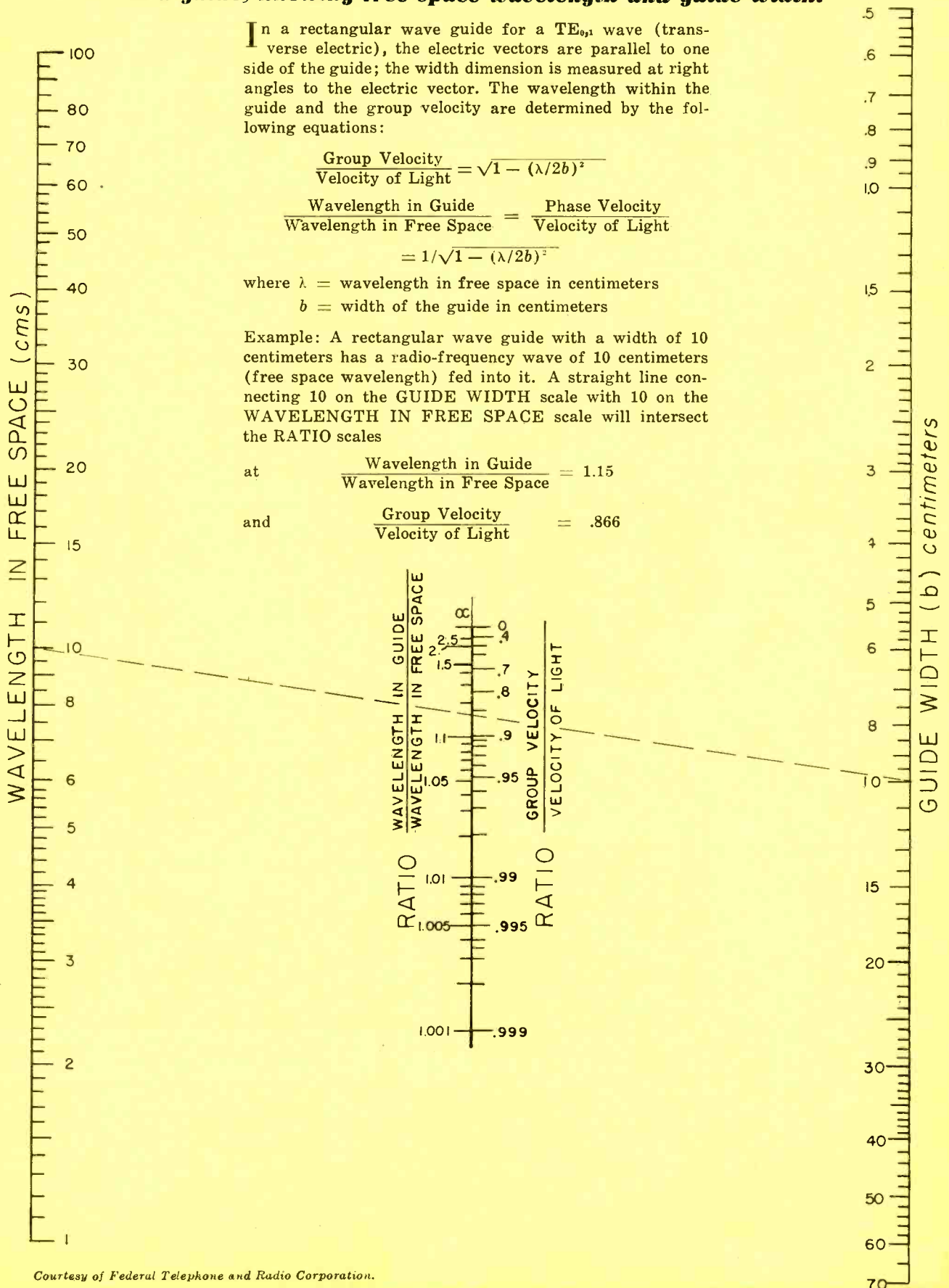
$$\frac{\text{Wavelength in Guide}}{\text{Wavelength in Free Space}} = \frac{\text{Phase Velocity}}{\text{Velocity of Light}} = 1/\sqrt{1 - (\lambda/2b)^2}$$

where  $\lambda$  = wavelength in free space in centimeters  
 $b$  = width of the guide in centimeters

Example: A rectangular wave guide with a width of 10 centimeters has a radio-frequency wave of 10 centimeters (free space wavelength) fed into it. A straight line connecting 10 on the GUIDE WIDTH scale with 10 on the WAVELENGTH IN FREE SPACE scale will intersect the RATIO scales

at  $\frac{\text{Wavelength in Guide}}{\text{Wavelength in Free Space}} = 1.15$

and  $\frac{\text{Group Velocity}}{\text{Velocity of Light}} = .866$



Courtesy of Federal Telephone and Radio Corporation.



**YOU** Need My PRACTICAL Training to Make Money in

# TELEVISION- RADIO and ELECTRONICS!



*I'll Send You*  
**8 BIG KITS of**  
Radio Parts and Equipment . . .

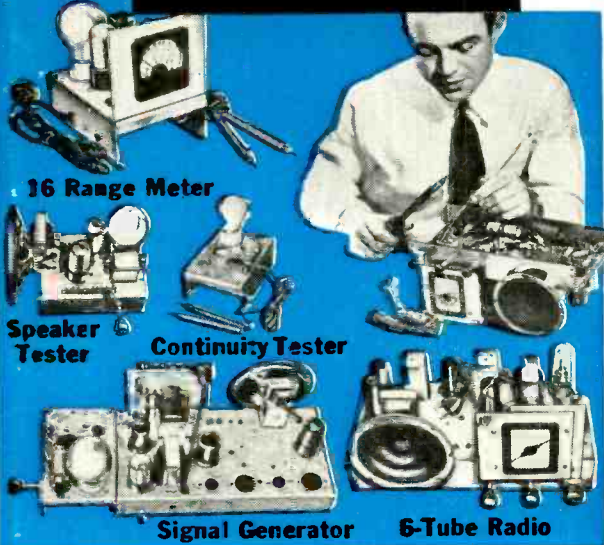
Learn at  
**HOME**  
IN YOUR  
SPARE TIME

**NOW IS THE TIME To Get Into This Fast Growing Industry—Prepare For A Fine Paying Job Or Your Own Business!**

If you want to get into Radio-Television and Electronics . . . you owe it to yourself to get the facts about my training. I have trained hundreds of men to become outstanding service technicians—and I'm ready to do the same for you. Whether your goal is a fine paying job in one of Radio's many branches—or a successful Radio and Television business of your own—you need the kind of training I offer! My training is practical and down to earth. **YOU NEED NO PREVIOUS EXPERIENCE.** You'll be astonished at your rapid progress. I start you with basic fundamentals and give you plenty of practical shop-bench training with many kits of parts I send you. This is the training that sticks with you and makes money for you on the job!

## Get Paid For Spare Time While Learning

Soon after you start training I send you my famous **BUSINESS BUILDERS** that show you how to make money in spare time doing interesting Radio jobs. Look at the useful and valuable equipment you get while training with me (illustrated at left)—I send you these 8 big kits of Radio parts and equipment and help you build step-by-step a powerful 6-tube superhet radio, a 16-range test meter, plus other mighty-useful equipment for Radio and Television servicing. You will perform over 175 fascinating experiments while training. You will learn about Television—so that you will be qualified to step into this fast growing, profitable field. I also send you many valuable service manuals, diagrams and my book telling exactly how to set up your own Television and Radio shop. *I want you to learn all about my training*—and that is why I urge you to clip and mail the coupon below for my two big FREE Radio books. I employ no salesmen—and nobody will call on you. The important thing is to act now and get the facts.



**16 Range Meter**

**Speaker Tester**

**Continuity Tester**

**Signal Generator**

**6-Tube Radio**



## HAVE A BUSINESS OF YOUR OWN

A profitable Radio and Television Service Shop may be started with little capital. I will show you how to get started and how to build your small business. At left is pictured one of my graduates, Mr. Merrit C. Sperry of Fairmont, Minnesota in his own shop. The way is also open for you to build a good **SERVICE BUSINESS FOR YOURSELF.**

## ALL KITS ARE YOURS TO KEEP

Each of the hundreds of Radio parts and other items I send my students is their "for keeps." You may use this equipment in your Radio and Television service work and save many dollars by not having to buy expensive "ready-made" test equipment. Each of my 8 kits will help you advance and learn important steps in Radio and Television servicing.



**CALVIN SKINNER** of New Orleans, La., tells us he makes \$5 to \$10 in spare time repairing radios. He is now also working with his own Television set.



**LOREN D. SAUCIER** of Coloma, Mich., reports that my training has made it possible for him to repair large numbers of Radio and Television receivers.

## RADIO AND TELEVISION INDUSTRY BOOMING

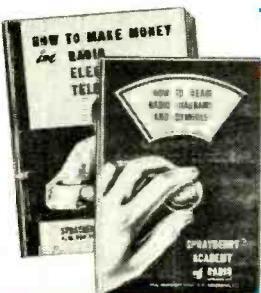
You couldn't pick a better time to get into Radio-Television and Electronics. New Television stations are going on the air to serve every major city—hundreds of new AM and FM Radio broadcasting stations are also on the air to serve practically every community in America. All this creates new and bigger opportunities for the trained man who knows Radio-Television and Electronics. Good Radio and Television service men are needed NOW!

## VETERANS

**THIS TRAINING AVAILABLE TO YOU UNDER THE G.I. BILL**

My Training Includes:

- Radio Servicing**
- Television**
- FM Frequency Modulation**
- Public Address and High Frequency Applications**



These Two Big **FREE!** Radio Books

Just mail coupon for a FREE sample Sprayberry Lesson and my big FREE book, "How To Make Money In Radio-Television and Electronics." Learn why my really practical training is best of all for you. Discover what's ahead for you in the fast moving Radio-Television and Electronics Industry. No obligation. Don't delay—the future is too important to you. Mail the coupon now—and count on me for fast action.

**RUSH COUPON Today!**

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

Please rush my FREE copies of "How To Make Money In Radio-Television and Electronics" and "How To Read Radio Diagrams and Symbols."

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

Address . . . . .

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

( ) Check here if you are a Veteran.





*MR. DEALER:  
Sell the Line that Builds  
CUSTOMER CONFIDENCE*

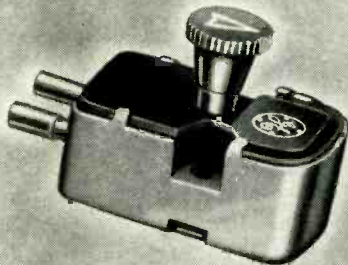
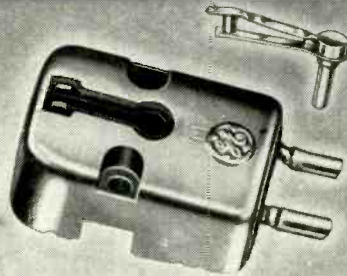
# VARIABLE RELUCTANCE CARTRIDGES

★ FOR QUALITY   ★ FOR PRICE   ★ FOR TURNOVER

Compare These General Electric Variable Reluctance Cartridges With Anything On The Market!

## NEW "BATON" STYLUS →

provides unexcelled delicacy of tone for critical ears. Dual-twist stylus assembly (inset) permits higher lateral compliance and improved tracking. Double damping blocks filter out needle talk and mechanical resonance. This new assembly now included in all types of G-E Cartridges. RPX-040 and RPX-041.



## ← TRIPLE PLAY CARTRIDGE

Ride the sales boom of this sensational new G-E model! Plays all three types of records without a change of position in the tone arm! A flick of the knob selects stylus. Requires no adjustment of tone arm weight. Costs 25% less than the 2 cartridges it replaces! A hit with manufacturers and listeners alike! Model RPX-050.

## PROFESSIONAL VARIABLE → RELUCTANCE CARTRIDGE—

One of the most popular cartridges of the G-E Line. Preferred by broadcast station engineers for its smooth, wide-range frequency response designed to match broadcast equalizers. Operates with any G-E stylus. Model RPX-046.



**Y**OU can't beat these General Electric Variable Reluctance Cartridges for superb reproduction, sturdy construction, and low cost. That's why manufacturers, radio stations and the listening public everywhere continue to select the G-E Cartridge that fits their needs best.

You can get a bigger share of the valuable replacement business by stocking the models shown here. Don't delay—place your orders today!

## PLENTY OF PROMOTION!

Ask your distributor for complete 1950 G-E Parts Promotion Kit! Counter displays, ad reprints, full line sheets and folders, everything you need to sell more G-E speakers, cartridges, parts and accessories! Get it today!

General Electric Company  
Section 930  
Electronics Park  
Syracuse, N. Y.



Send me latest information on stylus wear plus FREE folder on the new G-E Baton stylus.

NAME.....

ADDRESS.....

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

*You can put your confidence in—*

**GENERAL  ELECTRIC**



For *"Better-than-New"* Performance

..sell **RAULAND** replacements!

Here are the two greatest improvements in picture tubes since the war—both available from Rauland for your replacement business. Leading jobbers and dealers prefer and rec-

ommend them because they actually give customers better pictures than when their sets were new—assuring customer satisfaction that pays off in extra profits.

**Rauland Luxide Screen Tubes**

The public is clamoring for new Television sets featuring this new Rauland-developed tube. Now the Luxide Screen is available for replacement use in two tube types—metal-coned 16AP4-A, and all-glass 12LP4-A. The face of this new "black" tube contains a metallic oxide which gives the glass desirable light-absorbing characteristics. Both the reflection of ambient light and halation within the tube face are materially reduced. The result is a sharp, clear picture with such greatly increased contrast and clarity that it can be viewed in lighted rooms without "washing out" and without annoying glare.

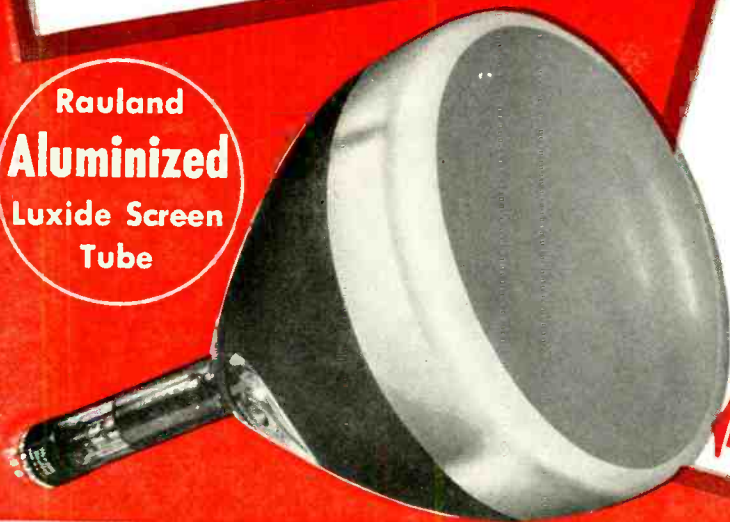


Rauland  
**LUXIDE**  
Screen Tube

**Rauland Aluminized Luxide Screen Tube**

This Rauland-developed replacement tube has brought thousands of owners clearer, brighter pictures than they enjoyed before. The Rauland aluminized screen gives pictures up to 80% brighter than conventional tubes—with better contrast and sharper definition. The Rauland aluminized tube does not require any ion trap magnet—the adjustment of which, on ordinary tubes, is critical and if improperly made, will result in damaging the tube. The Luxide Screen feature is now available in the aluminized tube as type 12KP4-A.

Rauland  
**Aluminized**  
Luxide Screen  
Tube



**THE RAULAND CORPORATION**



*Perfection Through Research*

4245 N. KNOX AVENUE • CHICAGO 41, ILLINOIS





the New  
**PYRAMID**  
**"Humidi-Seal"**

(TUBULAR PAPER CAPACITOR)



**Repels Moisture!**

Ruggedly built to withstand undue vibration and rough handling

Outer tube plastic impregnated to prevent moisture-absorption

Light outer coat of high-temp wax provides double protection

Each end plastic sealed against moisture

Leads anchored securely in solid plastic end



Type 85TOC "Humidi-Seal" capacitors are specially designed for 85° C. operation, even in the most humid atmospheres, and will meet the severe present-day demands of endurance in television receivers, auto radios, etc.

WRITE FOR COMPLETE LITERATURE

Representatives and Distributors throughout the U.S.A. and Canada



**PYRAMID**

**PYRAMID ELECTRIC COMPANY**

155 Oxford Street  
Paterson, N. J., U.S.A.

TELEGRAMS: WUX Paterson, N. J.  
CABLE ADDRESS: Pyramidusa

*Within the*  
**INDUSTRY**

**ALFRED C. VIEBRANZ** is the new general sales manager of the Electronics Division of *Sylvania Electric Products Inc.*, succeeding George C. Conner who is GSM of the Photoflash Division.



Mr. Viebranz was formerly government sales representative for the Electronics Division at Washington. He joined the *Sylvania* staff as sales engineer in 1946 and during the war served as a lieutenant, USNR in submarine service.

He holds a B.S. in Physics from St. Lawrence University and later took graduate work at the U. S. Naval Academy and was graduated as a communications engineer. He is a member of the IRE, the Radio Technical Commission for Marine Services, and the Radio Technical Commission for Aeronautics.

**AMERICAN STRUCTURAL PRODUCTS COMPANY**, a subsidiary of *Owens-Illinois Glass Company*, has announced that seventy-five per-cent of its television bulb production capacity will be devoted to the new all-glass rectangular bulb.

The increased production rate for the new all-glass rectangular bulb has been necessitated by the increased demand for this type of television tube. Approximately 33 per-cent of the company's capacity was devoted to production of the 16 inch tube during January and 50 per-cent devoted to 14 and 16 inch production in February.

The company developed and introduced the rectangular bulb late in 1949.

**J. J. CLANCY** of Fort Wayne, Indiana has been named sales representative of the northeastern Indiana and southern Michigan territory for *Webster Electric Company*. He recently took over representation of the *Radio Merchandise Sales, Inc.* line in Michigan while continuing to serve *R.M.S.* customers in Ohio, Indiana, and Kentucky. . . . **ALLEGHENY HOME APPLIANCE COMPANY** of Huntington, West Virginia will handle the *Du Mont* line in the Huntington and Charleston areas. . . . **W. BERT KNIGHT CO.** has been named manufacturer's representatives for *The House of Television, Inc.*, New York. Working out of Los Angeles, the *Knigh* outfit will cover southern California and Arizona. . . . *Raytheon Manufacturing Company*

has appointed **LAY AND NORD** of Yakima, Washington and **TROJAN RADIO COMPANY** of Troy, New York as distributors for the company's line of receiving, television, and special purpose tubes. . . . **SOUTHWEST DISTRIBUTING COMPANY** has been appointed distributor of *Stewart-Warner Corporation's* radio and television products in the Kansas City territory. . . . **WALLACE SCHNITZER** has joined the *Gerald B. Miller Co.* of Hollywood as an engineer in the company's industrial instrument division. . . . **Jobbers** in Ohio, western Pennsylvania, West Virginia, and eastern Kentucky will have **J. R. DANNEMILLER ASSOCIATES** as their new jobber representatives for the *Utah, Inc.* line. . . . *John Meck Industries, Inc.* has named **TURNQUIST BROTHERS COMPANY** of Los Angeles as franchise distributor for its line of television and radio receivers.

**EDWARD A. MALLING** has been appointed to the post of sales manager for component parts in the *General Electric Receiver Division* at Syracuse.



He will be responsible for the sale of parts to initial equipment and distribution accounts. This includes the sale of such items as loudspeakers, television receiver components, antennas, phonograph tone arms, and the variable reluctance cartridge.

Mr. Malling has been associated with *General Electric* since 1935 when he joined the Electric Refrigeration Department at Nela Park, Cleveland. Since that time he has served in the Appliance and Merchandise Department and the Electronics Department. He has held several positions in the latter department since being assigned in 1945.

**MARTIN L. SCHER** has been named general sales manager of *Motorola-New York, Inc.*, New York distributor for *Motorola, Inc.* of Chicago.

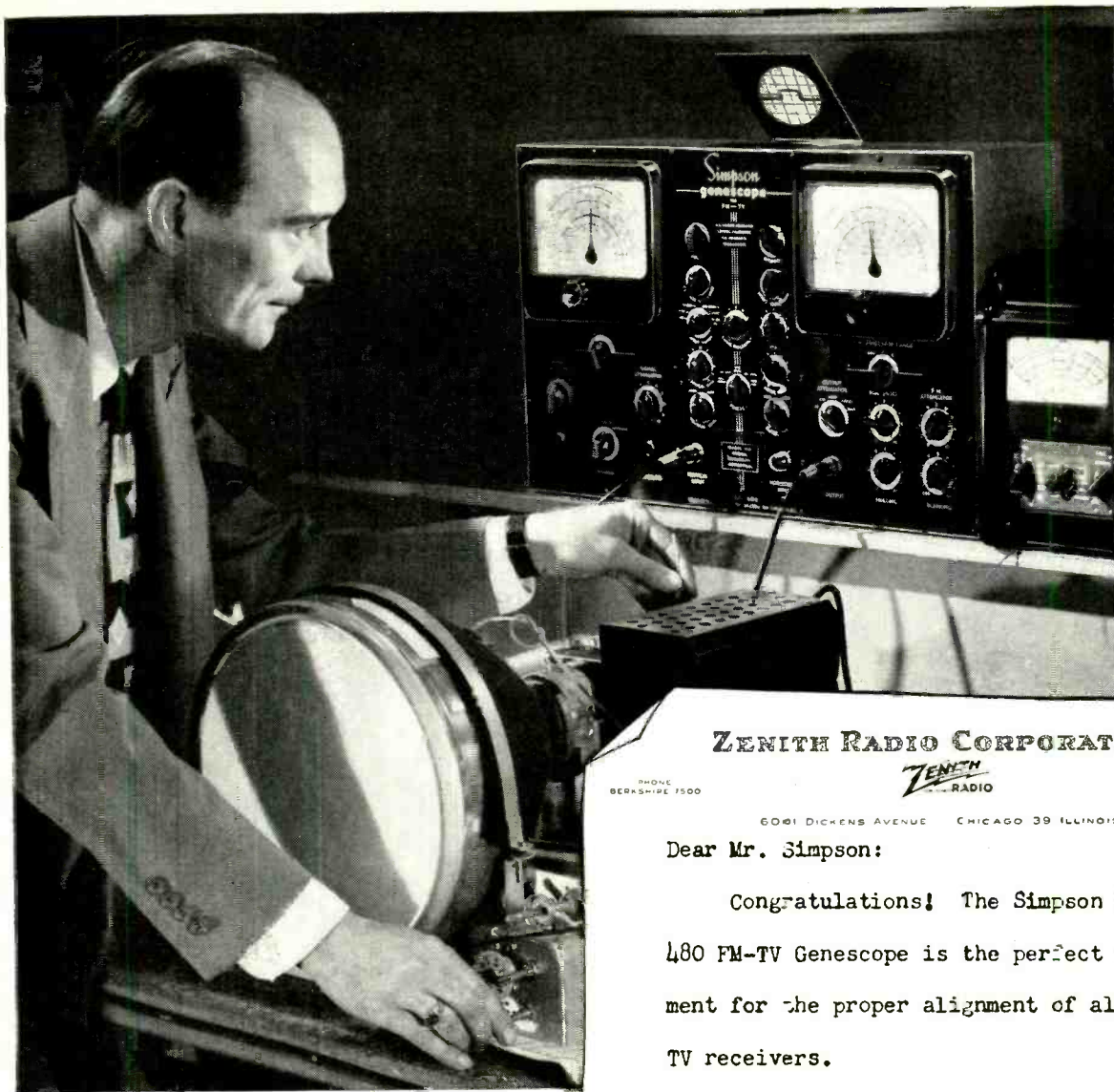


Prior to joining *Motorola*, Mr. Scher was for four years general sales manager for *Admiral Corporation's* New York distributing division and for the *Dale Distributing Company*, predecessor to the *Admiral Division*.

During the war he served as sales

**RADIO & TELEVISION NEWS**





says **FRANK SMOLEK,**

General Service Manager of Zenith

In addition to providing all necessary signal sources, the new Simpson Genescope includes a high sensitivity oscilloscope of unique advanced design, complete in every detail. Sensitivity 25 millivolts per inch. Wide band response to 3 megacycles or more. Equipped with a high frequency crystal probe for signal tracing. AM and FM oscillator sections provided with large, easy to read dials with 20-1 vernier control and 1000 division logging scale. *Revolutionary, Ingenious, Exclusive* output termination provides for various receiver impedances, either direct or through an isolating condenser.

Step attenuator for control of output.

Size: 22"x14"x7½". Weight 45 lbs. Shipping Weight 54 lbs.

DEALER'S NET PRICE complete with Test Leads and Operator's Manual \$375.00

Modern FM and TV development and servicing requires the use of test equipment made to exacting standards. With this in mind Simpson offers you the Genescope with the assurance that everything possible has been done to make it the most accurate, flexible and convenient instrument available. The Genescope will render many years of uninterrupted service and always produce accurate results.

**Simpson**  
INSTRUMENTS THAT STAY ACCURATE

**ZENITH RADIO CORPORATION**

PHONE  
BERNARDINE 1500



CABLE ADDRESS  
"ZENITHRAD"  
ALL CODES

6001 DICKENS AVENUE CHICAGO 39 ILLINOIS

Dear Mr. Simpson:

Congratulations! The Simpson Model 480 FM-TV Genescope is the perfect instrument for the proper alignment of all FM and TV receivers.

In addition to providing all necessary

**CHECK THESE RANGES AND YOU WILL SEE HOW MUCH THE SIMPSON GENESCOPE CAN DO FOR YOU**

**RANGES  
FREQUENCY MODULATED OSCILLATOR**

Band A—2-120 megacycles  
Band B—140-260 megacycles  
Sweep width variable from zero to 15 megacycles  
Sweep rate 60 cycles per second  
Specially designed frequency sweep motor  
Continuously variable attenuator  
Crystal calibrator—5 megacycles ± .05%  
Audio Oscillator 400 cycles

**AMPLITUDE MODULATED  
OSCILLATOR**

Band A—3.2-16 megacycles  
Band B—15-75 megacycles  
Band C—7.5-250 megacycles  
30% modulation at 400 cycles or unmodulated  
Continuously variable attenuator  
Visual method of beat frequency indication

**HERE'S THE SIMPSON—MODEL 479  
TV-FM SIGNAL GENERATOR**

Exactly the same circuits, ranges and functions as the Model 480, described above, with the exception of the oscilloscope.

Size 17"x14"x7½". Weight 34 lbs.  
Shipping Weight 40 lbs.

DEALER'S NET PRICE with Test Leads and Operator's Manual . . . . . \$245.00



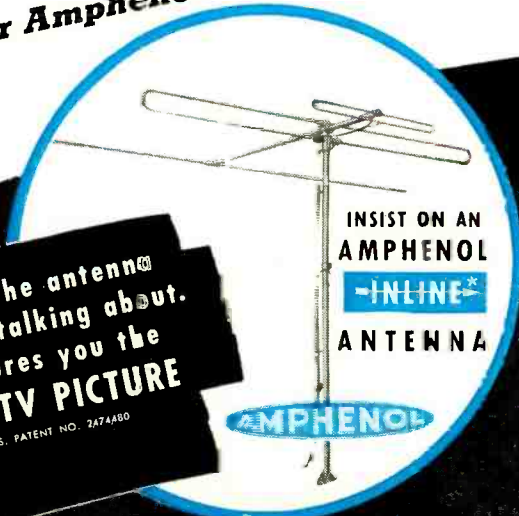
**SIMPSON ELECTRIC COMPANY**

5200-5218 WEST KINZIE STREET • CHICAGO 44, ILLINOIS  
In Canada: Bach-Simpson, Ltd., London, Ont.





**"We have a much better picture than the neighbors. I think the serviceman was right when he said it's all because of our Amphenol INLINE\* Antenna."**



INSIST ON AN  
**AMPHENOL**  
**-INLINE\***  
**ANTENNA**

**This is the antenna they are talking about. It assures you the Best TV PICTURE**

\*U. S. PATENT NO. 247480

**AMERICAN PHENOLIC CORPORATION**  
1830 SO. 54TH AVENUE · CHICAGO 50, ILLINOIS

director for the Electronic Research Supply Agency of the RFC where he was in charge of stockpiling critical electronic components.

\* \* \*

**H. JAMES TAIT** was recently appointed Eastern States regional sales manager for the receiver sales division of *Allen B. Du Mont Laboratories, Inc.*

Mr. Tait, who has been with the *Du Mont* organization for some time, has been working out of the New York Regional Sales Office, handling the Bronx-Long Island territory. In his new post, he will head receiver sales activities in the states along the eastern seaboard from Maine to South Carolina.



He will make his headquarters at the company's offices at 515 Madison Avenue, New York City.

\* \* \*

**RADIO MANUFACTURERS ASSOCIATION**, in cooperation with the Institute of Radio Engineers and the American Institute of Electrical Engineers, is sponsoring a "Conference on Improved Quality Electronic Components" to be held in Washington May 9-11. Military and government representatives will confer with the representatives of the industry organizations.

New techniques for producing longer-life components, especially for military, aircraft, and industrial electronic equipment, will be discussed at the symposium to be held in the new Department of Interior auditorium.

The symposium will give emphasis to the following topics; improved quality of circuit elements for greater dependability of electronic equipment, unitized packaging as a means for greater dependability through simplified maintenance, miniaturization, particularly as applied to the unit package, and circuit elements compatible with design requirements of the unit package.

\* \* \*

**PAUL B. H. SMITH** was elected to the post of vice-president and director of *Zenith Radio Corporation of Canada, Ltd.* at a recent meeting of the directors of that company.

The Canadian corporation is a subsidiary of *Zenith Radio Corporation* of Chicago and has headquarters in Windsor, Ontario.

In addition to his new duties, Mr. Smith will continue as general sales manager of the company's hearing aid division, with headquarters in Chicago. Previously, he was manager of the Canadian subsidiary for a two year period. From 1935-1944 he was affiliated with the sales, sales promotion, and public relations departments of the *Ford Motor Company* of Canada in Toronto and Windsor.



\* \* \*

**CHARLES A. GARDINER** has been named treasurer of the *Hudson Wire Company* of Ossining, New York. He joined the company 20 years ago, and has been serving as controller . . .

**JAMES M. SCALES** is the new district sales manager for the northwestern territory of *Zenith Radio Corporation* . . .

**W. H. SALEE** has taken over the post of general sales manager of *Janette Manufacturing Company*, Chicago manufacturers of rotary converters and gear-motors. He succeeds Harvey Klunder who resigned . . .

*General Electric Company* has made three new appointments in the Tube Division. **E. F. PETERSON** has been named manager of sales, **L. B. DAVIS** is the new manager of the receiving tube division at Owensboro, Ky., and **K. C. DEWALT** has been appointed manager of the cathode-ray tube division at Syracuse . . .

**JOHN D. SMALL** was elected vice-president of *Emerson Radio and Phonograph Corporation* while **ABRAHAM ROSEN** was promoted from controller to assistant treasurer. **A. A. VOGEL**, assistant controller, takes over Mr. Rosen's former post . . .

**HUGO SUNDBERG** has been upped to the post of vice-president and manager of *Oxford Electric Corporation*, Chicago manufacturers of loudspeakers . . . *Gertsch Products, Inc.*

(Continued on page 96)



# Sylvania's NEW

## Tube Testers

### are one jump ahead of tomorrow!



MODEL 220

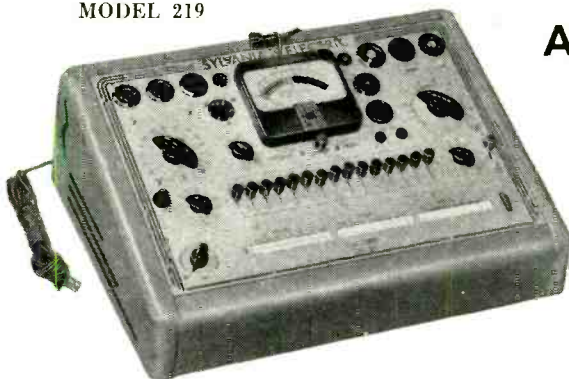
Once again Sylvania has anticipated radio and television developments. Sylvania's new tube testers, both counter and portable models, are not only capable of testing every modern receiving tube . . . they are calibrated to Sylvania's latest tube production standards.

Experts in tube-testing have built this new instrument . . . but you don't have to be an expert to operate it. Counter clerks, uninitiated in radio technicalities, can use it after a few minutes'

instruction. For the benefit of the customer, the illuminated meter reads "GOOD" or "REPLACE" for all tubes, including diodes. Gas tests can be made easily. It is the first tester with both circular and linear subminiature sockets. The new fast, smooth-running roll-chart is easily removable from the front panel.

Modern styling of both models tells even the layman that your up-to-the-minute service is one jump ahead of tomorrow!

MODEL 219



## A few more facts on what's NEW

In Tube Testers 219 (Counter) and 220 (Portable)

- Novel voltage controls prevent tube damage
- Switch-numbers correspond to tube pin-numbers
- Switching arranged for easiest operation
- Exclusive ohmmeter-type indicator for shorts and leakage
- Shorted tube reads "REPLACE"—no neon lamp
- Double-size power transformer

### NOTE ON "KNOW-HOW"

A comprehensive explanation of tube characteristics and tube tester applications comes free in each Operating Manual.

# SYLVANIA ELECTRIC

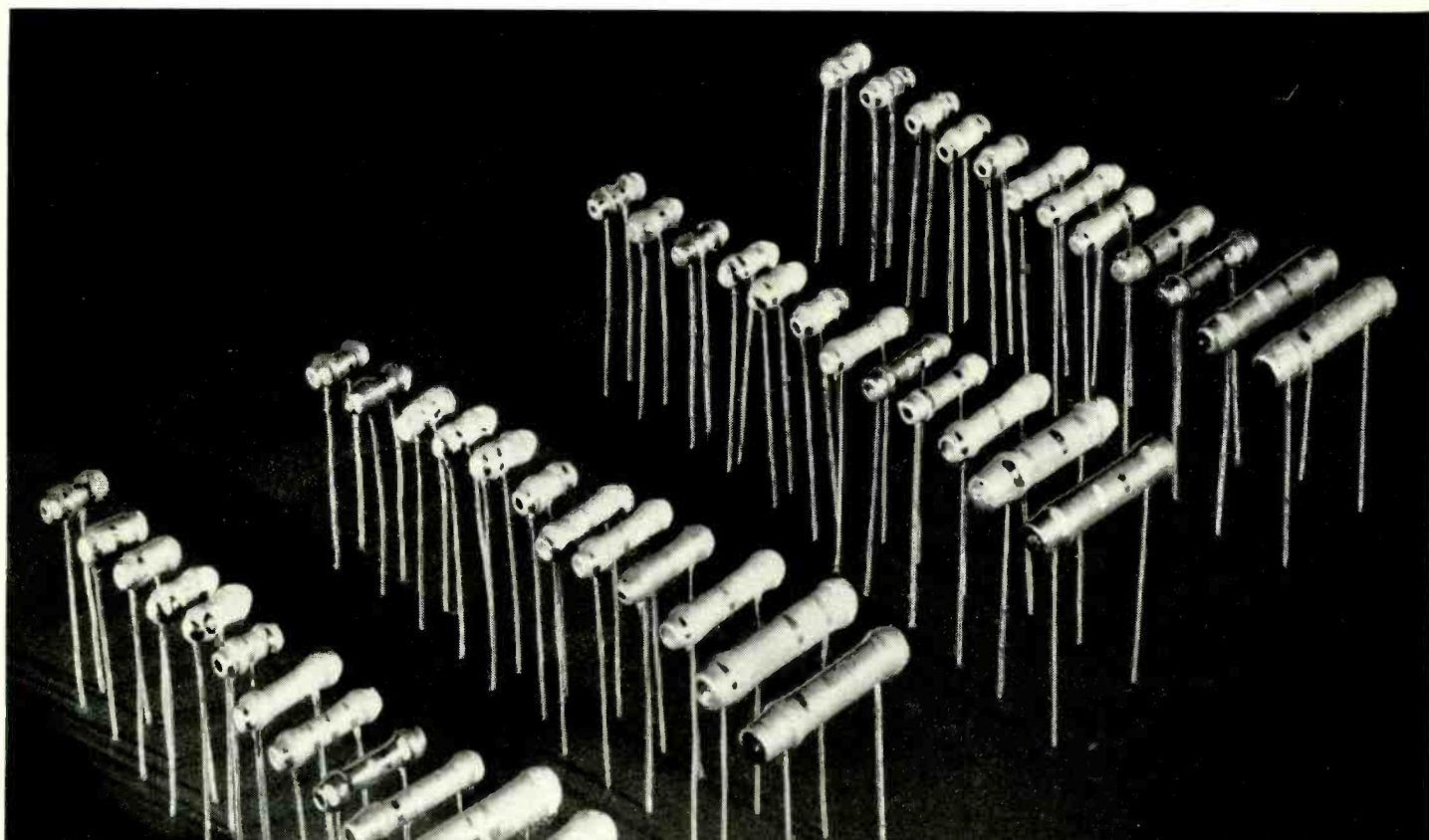
RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS

March, 1950

25



# NOW..A NEW, WIDER LINE



## Choose from this Complete Ceramic Capacitor Line

Your radio parts distributor can supply you with these BC HI-KAP Tubular Ceramic By-pass and Coupling Capacitors in the following values — all rated at 600 WVDC, flash tested, 1000 VDC. Packaged in cellophane envelopes, 5 of one value per envelope.

Capacity	CRL Cat. No.	Capacity	CRL Cat. No.	Capacity	CRL Cat. No.
10MMF	D6-100	120MMF	D6-121	1,000MMF	D6-102
12MMF	D6-120	150MMF	D6-151	1,200MMF	D6-122
15MMF	D6-150	180MMF	D6-181	1,500MMF	D6-152
18MMF	D6-180	200MMF	D6-201	1,800MMF	D6-182
20MMF	D6-200	220MMF	D6-221	2,000MMF	D6-202
25MMF	D6-250	250MMF	D6-251	2,200MMF	D6-222
27MMF	D6-270	270MMF	D6-271	2,500MMF	D6-252
33MMF	D6-330	300MMF	D6-301	2,700MMF	D6-272
39MMF	D6-390	330MMF	D6-331	3,000MMF	D6-302
40MMF	D6-400	390MMF	D6-391	3,300MMF	D6-332
47MMF	D6-470	400MMF	D6-401	4,700MMF	D6-472
50MMF	D6-500	470MMF	D6-471	5,000MMF	D6-502
56MMF	D6-560	500MMF	D6-501	5,600MMF	D6-562
68MMF	D6-680	560MMF	D6-561	6,800MMF	D6-682
75MMF	D6-750	680MMF	D6-681	7,500MMF	D6-752
100MMF	D6-101	750MMF	D6-751	10,000MMF	D6-103

For other ceramic capacitor replacement needs, use CENTRALAB's line of TV HI-VO-KAPS, KOLORDISKS and TC capacitors.



# OF TUBULAR BC HI-KAPS!

*Mr. Service Engineer . . . If your profits and reputation depend on guaranteed repairs, then this message is for You! Centralab . . . the First name in ceramic components . . . gives you famous ceramic tubular BC Hi-Kaps in 48 different and many new values. Check their advantages . . . see why CRL BC Hi-Kaps are absolutely safest for guaranteed repairs.*

The present trend to *guaranteed service policies* demands that service engineers take no profit-risking chances with replacement parts of doubtful performance and durability.

Chart below gives you the facts. Read them. See why we say *no other tubular by-pass and coupling capacitors made will outperform or outlast CRL Tubular Ceramic BC Hi-Kaps!*



DIVISION OF GLOBE-UNION INC., MILWAUKEE, WIS.

*Check these Features . . . See for Yourself why CRL BC Hi-Kaps are "safest"*

"HI-KAP" FEATURES	DESCRIPTION			WHAT IT MEANS TO YOU
1. Impervious to moisture	Ceramic-X is non-hygroscopic. Moisture absorption is .007% or less.			No deterioration, no shorting. Longer life even under the most adverse conditions of humidity.
2. Low mass weight	AV. WT.	DIMENSIONS	VALUES	For unit size and weight, Centralab BC "Hi-KAPS", made with Ceramic-X, are the only capacitors on the market which provide these voltage ratings.
3. Small Size	.029 oz.	D— .260" L— .530"	10—390 mmf.	
	.044 oz.	D— .260" L— .810"	400—3000 mmf.	
4. High capacity	.050 oz.	D— .280" L— .900"	3300—5000 mmf.	
	.082 oz.	D— .330" L— 1.200"	5600—10,000 mmf.	
Ratings: 600 WVDC — 1000 flash test.				
5. Special insulation	Low power factor resin and high temperature wax coatings, with an additional special phenolic jacket.			Prevents any possibility of shorting to adjacent leads, chassis or components.
6. Convenient side leads	Heavy No. 22 gauge tinned copper, silver soldered to electrodes.			Permit rapid, close-coupled connections. No tricky bending or fitting required.
7. Low power factor	Initial — .6%. After 100 hours, 95% humidity test — 3.0%.			More efficient circuit operation, fewer failures.
8. High leakage resistance	Initial — 5000 megohms. After humidity — 500 megohms.			Long life, more efficient performance.
9. Maximum dependability	Pure silver electrodes, electro-bonded to Ceramic-X dielectric. Protected against oxidation or mechanical damage by coatings of electrolytic copper and solder.			Moisture and puncture proof. Will not short or become intermittent.
10. Factory tested	For your protection, all units 100% factory tested before packaging and shipping.			Your guarantee to your customers of reliable service and performance.





## WE'RE STILL IN THE *RADIO* BUSINESS

Seems as though everything nowadays is TV . . . TV . . . TV. We've had so much TV news for you! Hytron's new 16RP4 rectangular picture tube. Hytron's new low-cost deflection-circuit tubes: 1x2, 6BQ6GT, 6U4GT, 6W4GT, 25BQ6GT, and 25W4GT. And many more Hytron designed-for-TV tubes coming.

But we're still in the *radio* business — both of us. Radio still is king. We realize that. Also that most service problems are still radio — not TV. You can depend on Hytron *radio* tubes. Whether it is the original Hytron GT . . . miniature . . . G . . . metal . . . or loctal. For a-c/d-c, portable, f-m, phono, or auto radio. Hytron will strive to give you the most dependable *radio* (as well as TV) replacement tubes.



OLDEST MANUFACTURER OF RECEIVING TUBES  
**HYTRON**  
RADIO AND ELECTRONICS CORP.



MAIN OFFICE: SALEM, MASSACHUSETTS

**Relax! LET HYTRON TOOLS  
EASE YOUR WORK**

**SOLDERING AID 49c net**

This Soldering Aid is a special alloy of silver, copper, and zinc. It is designed to melt at a low temperature and to flow easily. It is ideal for use in the repair of radio and television sets. It is also ideal for use in the repair of other electrical equipment. It is available in a convenient, easy-to-use form. It is sold in a small, handy container. It is sold at a special low price. It is sold by Hytron Radio and Electronics Corp. It is sold in Salem, Massachusetts.

**TUBE LIFTER 15c net**

This Tube Lifter is a special tool designed for the removal of vacuum tubes. It is made of high quality steel and is easy to use. It is ideal for use in the repair of radio and television sets. It is also ideal for use in the repair of other electrical equipment. It is available in a convenient, easy-to-use form. It is sold in a small, handy container. It is sold at a special low price. It is sold by Hytron Radio and Electronics Corp. It is sold in Salem, Massachusetts.

**TUBE TAPPER 5c net**

This Tube Tapper is a special tool designed for the tapping of vacuum tubes. It is made of high quality steel and is easy to use. It is ideal for use in the repair of radio and television sets. It is also ideal for use in the repair of other electrical equipment. It is available in a convenient, easy-to-use form. It is sold in a small, handy container. It is sold at a special low price. It is sold by Hytron Radio and Electronics Corp. It is sold in Salem, Massachusetts.

BY THE MAKERS OF  
**HYTRON TUBES**

**FREE**

New Hytron Tool Catalogue. Describes all the famous Hytron service-shop tools to date: Soldering Aid, Tube Lifter, 7-Pin and 9-Pin Straighteners, Tube Tapper, and Auto Radio Tool. Find out how these Hytron tools can ease your work. Mail the coupon today.

**HYTRON RADIO & ELECTRONICS CORP.,  
Salem, Massachusetts**

I want to know how the Hytron tools can help me make more money. Please send me the free Hytron Tool Catalogue at once.

(PLEASE PRINT)

NAME.....  
STREET.....  
CITY.....  
STATE..... R.N.



Unit switch construction houses precision resistors in insulated recesses.

Easy-to-change standard batteries. Double spiral springs give permanent connection.

Direct connections—no harness cabling—no shorts.

Molded selector switch fully enclosed. Spiral spring index control—over 150,000 cycles without breaking.

## Here's why top engineers and technicians use Model 630

Features like those shown above are what make this popular V.O.M. so outstandingly dependable in the field. The enclosed switch, for instance, keeps the silvered contacts *permanently clean*. That's rugged construction that means stronger performance, longer life. And tests show that the spiral spring index control, after more than 150,000 cycles of switch rotation, has no disruption or appreciable wear! Investigate this history-making Volt-Ohm-Mil-Ammeter today: 33 ranges, large 5½" meter.

ONLY  
\$37.50  
AT YOUR DISTRIBUTOR

FOR THE MAN WHO TAKES PRIDE IN HIS WORK

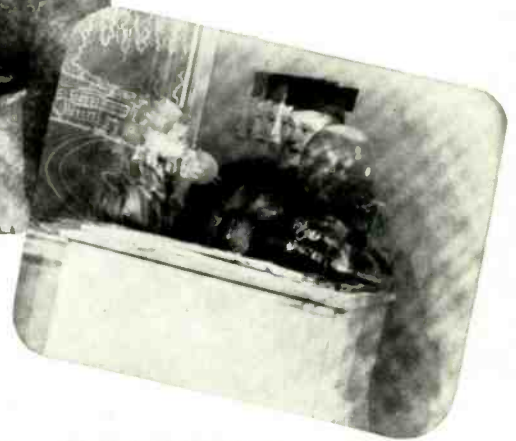
# Triplett

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





*If your  
Pictures  
look like this* →



# YOUR TELEVISION WILL BE IMPROVED WITH A **WARD** OUTDOOR AERIAL

*to give you  
Pictures like this* →

*The modern miracle of pictures by air can be a most satisfying means of entertainment. But be satisfied only with a picture comparable to a class "A" motion picture—on every station in your area. It is unnecessary to compromise!*

**HERE'S WHY:** Television waves are like light beams — solid objects reflect and refract them, making it impractical to pick up all stations from an indoor aerial. That is why you get double images on some stations.

In addition, indoor aerials have poor signal pickup making it difficult to get good pictures on all stations.

**FURTHERMORE:** Your indoor antenna may have a high noise level which increases the amount of interference as you advance the contrast control to bring up a weak picture. All of these technical difficulties are eliminated by a WARD outdoor aerial installed by a competent radio serviceman. In every case, a Ward outdoor antenna will improve reception over an indoor aerial. Also, Ward aerials are so well designed, they are attractive on a house. *It is unnecessary to compromise!*



*WARD is the largest and oldest exclusive maker of television and auto radio aerials.*



Does the antenna on your automobile need repair? Replace it with  
WARDS'S 8-BALL — world's largest selling auto aerial.

**WARD PRODUCTS CORPORATION**  
1523 E. 45TH STREET, CLEVELAND, OHIO  
*Division of the Gabriel Company*





# The ANTENNA RESEARCH LABORATORY



Fig. 1. Tiny crystal receiver, shown in engineer's right hand, is used to detect signals from model antenna. Place on side of model plane is removable to permit receivers to be installed within the hollow fuselage of plane.

By

**JOSEPH M. BOYER**

Consulting Engineer

***Douglas Aircraft's laboratory eliminates costly full-scale experiments by using tiny replicas in solving complicated antenna design problems.***

**N**EVER before in the history of radio has interest in the antenna beam been at such a feverish pitch! No longer are "aerials" merely required to transfer electromagnetic energy into space. Experts today, working with surrealistic shapes of metal and plastic, are molding radiated energy into the precisely shaped beams needed for the varied classes of radar—for highly eavesdrop-proof communication links, or even changing the beam's contour from instant-to-instant, automatically following the boiling vagaries of the Heaviside layer.

The center of all such investigation is the *antenna research laboratory*. Here antenna engineers work with worlds in miniature. Out on the model antenna range of one such laboratory it is not uncommon to see a complete scale replica of a television station: the tiny buildings, the accurately-made antenna towers, even the green rolling hills of the surrounding country. This Lilliputian model slowly revolves on a turntable, a large horn-type radiator some distance away "illuminating" it with microwave signals. The miniature antennas of the model station detect such energy and feed it back to high gain amplifiers in the laboratory. Thus, as the model turns,

automatic plotting instruments draw an accurate trace of the radiation pattern of the station for later study. Such model tests save costly cut-and-try procedures previously made on full scale installations.

Even more important, in view of our National Preparedness Program, is the investigation of aircraft antennas. With aircraft now operating both near and beyond the speed of sound, no object of any kind is permitted to project from the sleek, polished metal skin to add parasitic drag. This requirement is a death warrant for the numerous masts and wires which once were draped lavishly over aircraft exteriors. In the high-pressure search for distinctly new antenna types which may be faired flush into the skin of a high speed airplane, several of the large airframe manufacturers have aided the radio art immeasurably by taking the lead in such research. In order to see, at first hand, the evolution of a new antenna, a visit was made to the El Segundo, California antenna laboratory of the *Douglas Aircraft Company* which pioneered in this field. Here, work begins with the presentation of the Navy specifications to the aircraft antenna designer.

<sup>1</sup>Military frequencies are classified. Those given are only representative.

Such specifications call for a v.h.f. communications antenna. This unit is to be mounted flush within the skin of a high speed carrier type fighter, yet provide full 360-degree coverage about the horizon. When used for transmitting, the antenna must produce most of its signal in a zone approximately twenty degrees above and below the airplane. Efficiency must be equal to the older type protruding antenna because airborne power requirements are stringent. Finally, as if to complete the designer's frustration, such an antenna must be capable of operating from 300 to 590<sup>1</sup> megacycles while remaining matched to the coaxial transmission line feeding it. Specifically, it must not exceed a *voltage standing wave ratio* of 2 to 1.

The resourceful engineer begins a strenuous period of reading the available technical literature, making rough preliminary calculations, and weighing and discarding a number of configurations which come to mind. In this process the crude pencil sketches which litter his desk would be unrecognizable to prewar engineers. There is not a sign of wires or porcelain insulators. One sketch may show a small square portion of the metal skin isolated from the surrounding surface and fed by a tapered funnel section of coaxial line. Or perhaps a flat disc of polystyrene a foot or so in diameter is shown, excited at its center by a sphere of silver designed to function as a wide-band dipole.

Finally, the antenna designer may feel he has what is needed. Before he makes a preliminary shop drawing he must refine his design. This step involves extremely complex calculations. For some such problems he must discard his slide rule, set up the equations he wishes solved, and pass them on to electronic or mechanical



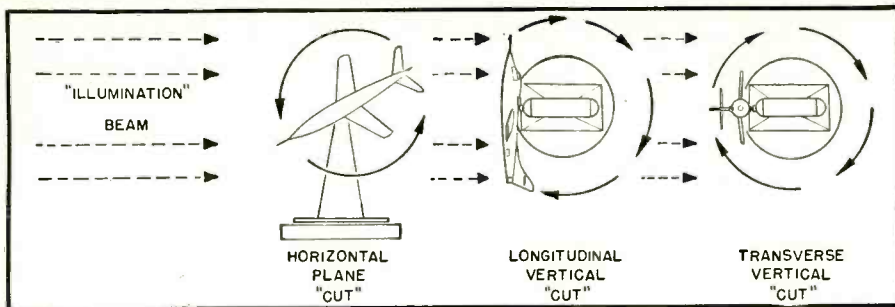


Fig. 2. Diagram shows position of model aircraft and rotation axis for each of the three principal radiation pattern "cuts" made during pattern study.

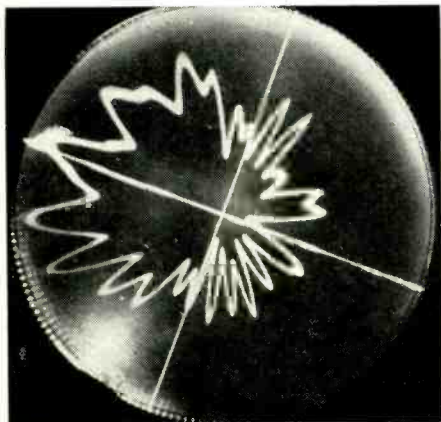


Fig. 3. Typical aircraft antenna radiation pattern. The pattern shown was photographed on the screen of antenna range cathode-ray "pattern painter." Magnetic deflection coils move in synchronization with rotation of model under study, tracing out an accurate polar diagram of antenna signal variation around the plane model.

computing machines. Satisfied that his "brain child" has a good chance of success, the engineer authorizes the experimental shop to fabricate a full size antenna and pass it on to the antenna laboratory for measurements.

#### Impedance Measurements

The antenna laboratory technician, highly-trained and experienced in this

specialized field, first may mount the prototype antenna upon a large *ground plane*. This usually is a metal wall forming one side or the roof of the laboratory building. In some cases the antenna may actually be mounted into a full scale wire cloth *mock-up* of the aircraft itself. A precision section of slotted coaxial transmission line (Fig. 5) is connected in series with the antenna and a laboratory v.h.f. oscillator. Beginning at one end of the frequency range to be covered by the antenna, the technician makes measurements of the voltage standing wave ratio in the transmission line. If the antenna is a perfect match there will be no change in the measured voltage from one end of the transmission line to the other. Such "flat" lines, however, are rarely encountered. There usually is a small v.s.w.r. but it must be under the called-for 2:1 ratio. If the designer has done his job properly this condition will be met over the entire frequency range desired. So far so good, but more hurdles remain to be cleared.

Once more an order goes to the experimental model shop: "Fabricate one 1/20th scale model of the antenna for range pattern tests." The men who receive this assignment are not ordinary machinists or metalsmiths. They are, for the most part, former instrument makers used to working with tiny precision parts under a pow-

erful lens. They are fantastically ingenious in devising ways of soldering and welding parts the size of a pin head into place within complex assemblies, of bending and twisting metal into shape while it is glowing in the flame of an alcohol lamp. An idea of the difficulty of their job can be obtained when it is realized that ordinary RG 8/U coaxial cable reduced to 1/20th scale is the size of store string. The inner conductor of such cable is the diameter of a human hair, yet must be soldered to the minute antenna without melting an extremely thin, easily-destroyed polyethylene sheath which insulates the assembly. Upon completing his exacting task, the model shop craftsman places the tiny antenna into the metal skin of a previously prepared 1/20th scale model of the aircraft in which it is intended to see service.

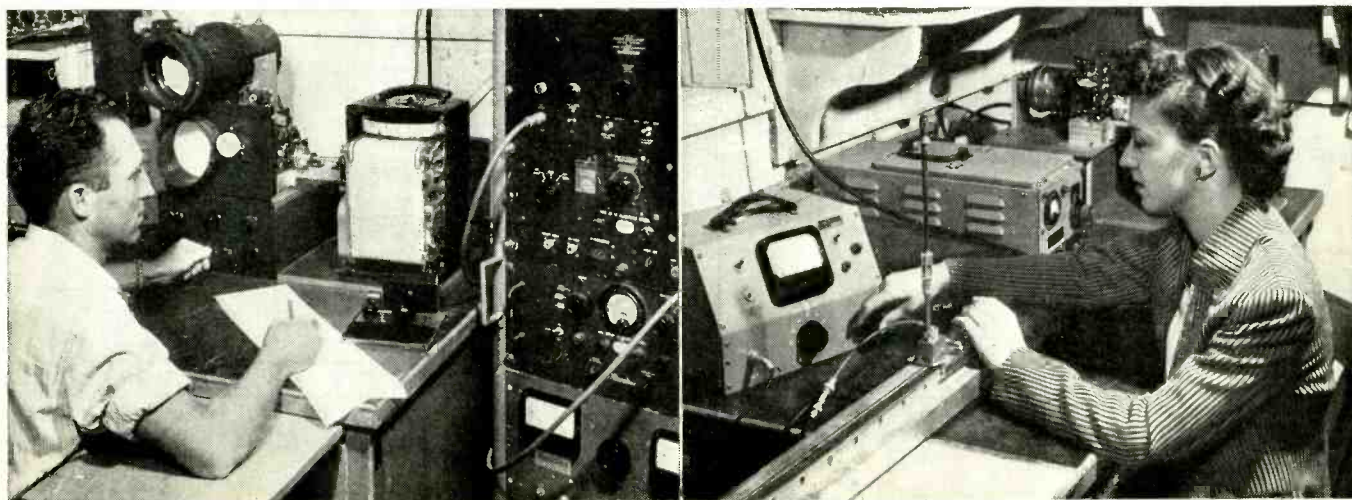
#### Radiation Pattern Measurements

Briefly, the basic idea behind the use of the model antenna pattern range is this: an aircraft operates far from the earth. The only environment which affects the antenna on the airplane is the configuration of the craft itself. Any attempts to measure radiation patterns on a full size aircraft resting on the earth would be futile. Patterns taken by means of flight tests are not only prohibitively expensive, difficult to measure and interpret, but usually end in doubtful results. However, by reducing the aircraft to 1/20th or 1/40th of the full scale dimensions it is possible to mount it from 40 to 60 wavelengths from the ground. This can be done because the operating frequencies must also be multiplied by 20 or 40 to keep in step with the model dimension change. That such theory is correct, when suitable precautions are taken, has been demonstrated conclusively.

The scaled-down model aircraft, complete with its test antenna, is mounted upon a special dielectric

Fig. 4. Operating and recording position. Shown are the v.h.f. and microwave transmitters, power supplies, and switching panel. In front of operator is a pen recorder and the Douglas cathode-ray "pattern painter." The "full moon" labeling device is seen as the white window below the cathode-ray tube.

Fig. 5. A coaxial slotted line in use. The slotted coaxial line is used to measure the voltage standing wave ratio of the prototype antenna. The radiator under test is mounted on the outside metal surface of the wall, directly behind the Hewlett Packard Voltage Standing Wave Ratio meter shown in photo.





tower, the base of which rests on a motor-driven turntable. Within the hollow belly of the little plane is a simple receiver usually consisting of an impedance matching transformer and a silicon crystal detector or hot wire bolometer.

With the tower placed as many as 100 wavelengths from the laboratory building, technicians energize a tunable Klystron transmitter which excites a large horn type antenna projecting toward the model through the wall of the laboratory. The transmitter's signal is amplitude modulated by a square wave with a repetition rate of 1000 cycles. A square wave is needed to avoid frequency modulation of the Klystron. Operating frequency is carefully adjusted to be 20 or 40 times the full scale point in the spectrum where the antenna is intended to function.

Reference to Fig. 2 will make clear the patterns to be described. The antenna specialist refers to such patterns as "cuts." The first "cut" is made by slowly rotating the model so that every portion of the plane's horizontal axis is exposed to the radio beam from the laboratory transmitting horn antenna. The model on the tower is then turned 90 degrees and again rotated by means of the turntable, exposing its nose, belly, topside surface, and tail to the beam. Finally, a "cut" is made presenting the wing-tips, belly, and topside surface of the model. This triad of cuts—the horizontal, longitudinal vertical, and transverse vertical, are fundamental in any pattern investigation and quickly tell if the radiation pattern of a new antenna is going to meet specifications. At least the three patterns just described must be made at frequent intervals over the simulated radio spectrum in which the antenna is going to operate. An antenna may frequently have the desired radiation pattern at one end of its frequency range and fail miserably at the opposite extreme.

Leaving the antenna designer for the moment with his problem let us enter the laboratory building proper and investigate the equipment used to study the radiation characteristics of antennas. Several racks of audio amplifiers are the first instruments seen. These are quite special items. There are preamplifiers capable of boosting the few millivolts or so of signal received from the model to about 10 or 20 volts. This piece of equipment is linear in response and features a tuned feedback network which permits the amplifier to operate with full gain only at 1000 cycles. All other signals of random frequency and noise are sharply attenuated. The output of the linear preamplifier drives a logarithmic amplifier which is also sharply tuned to 1000 cycles. Logarithmic response is desired so as to properly record variations in the model signal which may extend over 50 decibels or more. To graphically present the radiation pattern several different types of recorders are used.

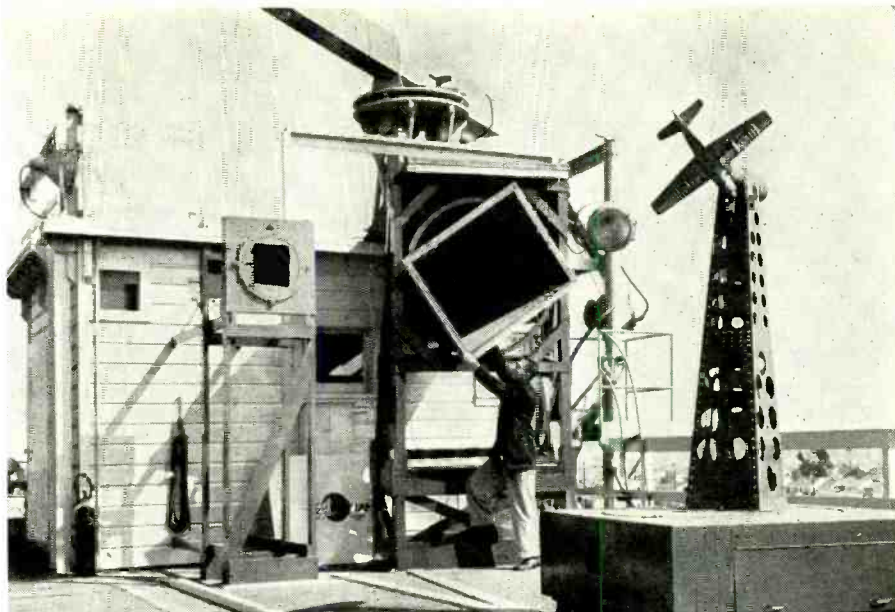


Fig. 6. General view of antenna model pattern range. A scale model of the Douglas "Skyraider" is shown mounted on the motor driven dielectric tower. The large electromagnetic horn antenna to the right is being turned to change electric polarization of signal to model. Smaller horn to the left of the picture covers the three centimeter frequency range.

The most common is a so-called polar recorder in which a pen is driven by signal variations from the model through the use of a servomechanism. In appearance this unit may resemble an automatic phonograph record changer. A circular piece of polar graph paper is placed upon its turntable and centered by means of a pinpoint of light at the center. The paper edges are clamped down by means of small Alnico magnets. Rotation of the recorder turntable is synchronized by means of selsyns to turn in step with the model out on the pattern range. When the model is rotated the servo-driven pen moves back and forth on a radius, tracing out the pattern.

Also used is a cathode-ray pattern

painter illustrated in Fig. 4. This instrument has several important advantages over the pen type recorders. One of the most valuable is lack of mechanical inertia. There are occasions when a radiation pattern being recorded varies from a deep null to maximum signal intensity within a fraction of a degree of rotation. Even for the slow speeds at which the model turns ( $\frac{1}{4}$  to 1 r.p.m.) this condition requires the pen to whip over the graph paper at an exceptionally fast rate. The consequent lack of response and "overshooting" of the pen distort such patterns.

This difficulty is absent in the cathode-ray "pattern painter." Here the magnetic deflection coils actually rotate about the neck of the cathode-

Fig. 7. Scale model aircraft and antenna shown in process of construction. Craftsman in foreground solders a connection in minute cavity type slot antenna. The 1/20th scale aircraft model shown is of wood.







Fig. 8. Closeup of 1 cm. transmitter and horn antenna. A complete 30,000 mc. Klystron transmitter, cavity wavemeter, and high gain horn radiator makes only a light handful of microwave equipment.

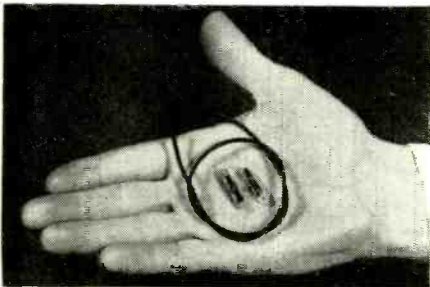
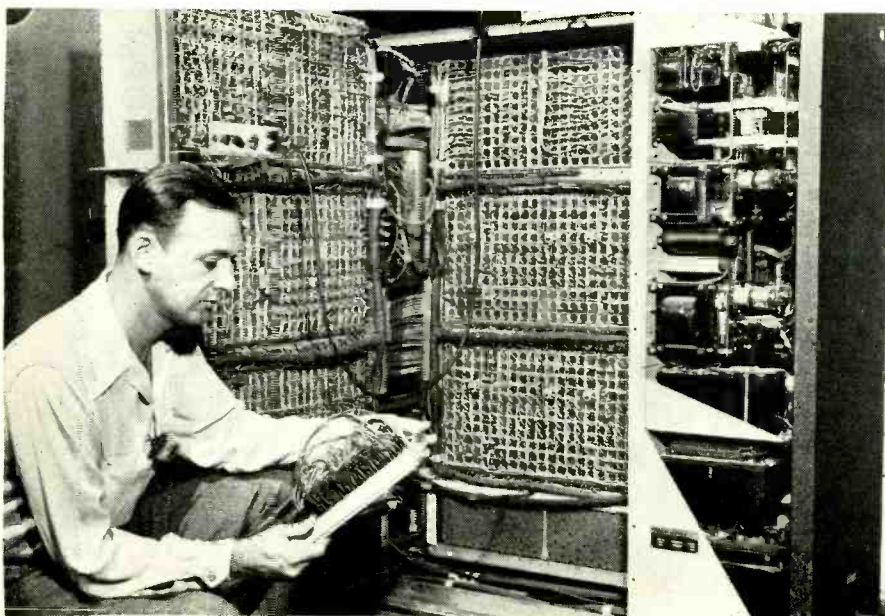


Fig. 9. Slot antenna and cable. The size of a pair of 1/20th scale slot-antennas and miniature coaxial cable may be judged by comparison with hand holding them.

ray tube in synchronism with the model. Thus, as the signal intensity changes the electron beam can follow the speediest variation with no time lag, no error. When used for radiation pattern plotting the screen (long persistence) of the tube is photo-

Fig. 10. View of computer showing vacuum tube bays. Mathematician inspects plug board which inserts problem into the 1285 vacuum tube electronic computer used to solve complex antenna equations. Such machines are now routine tools in the search for new antenna designs and antenna improvements.



graphed on 35 mm. film for a permanent record (Fig. 3). Another fine feature of the particular model developed at the Douglas laboratory is an edge-lighted *Lucite* disc seen in the illustration mounted below the cathode-ray tube. This disc is called the "full moon" because of its characteristic of glowing with evenly distributed white light. All pertinent data such as frequency, aircraft type, and description of the "cut," is typed on transparent gummed paper and this is then fixed over the face of the "full moon." Easily photographed on the same film as the pattern, such a screen label feature permits the laboratory to obtain a very complete, foolproof record of work in progress.

#### Frequency Coverage

Antenna laboratories must have transmitters available to cover enormous ranges of frequencies. To see the reason why, let us assume that the full scale frequencies of three antennas to be tested span the region 80 to 1600 megacycles. Not only must oscillators be on hand for these exact frequencies but, in addition, if the model range measurements are to be made at 1/20th scale, r.f. generators are required for the simulated range 1600 to 32,000 megacycles. Spanning such an expanse of radio territory calls for an imposing collection of coaxial cavity, and "butterfly" type oscillators, many, many Klystron tuners as well as elaborate high-voltage regulated power supplies and frequency measuring equipment of great accuracy. It is no wonder that antenna engineers always ask for bargains in frequency coverage when shopping for transmitters; otherwise such equipment would overflow the laboratory.

To cover the multitude of problems

which trouble an antenna specialist's slumber would be beyond the scope of this article. Some of the especially serious ones, however, may be of interest. The first and worst of these is spurious reflected signals. Exactly the same problem is faced by television service technicians in the form of "ghosts." The aircraft model itself is, of course, placed carefully "in the clear." Any posts, buildings, fences, or personnel in its vicinity would reflect signals into the model as if they were secondary transmitters. Such reflections, depending upon their instantaneous phase, either add or subtract in certain directions from the true magnitude pattern of the model.

The real villain of this story, however, is the ground or platform upon which the antenna laboratory rests. "Splash" from this source is almost impossible to eliminate completely. Great care is exercised in designing the large sectorial horn antennas which "illuminate" the models so that just enough beam width with uniform phase front is produced to cover the model with r.f. energy. Even though this precaution lowers the magnitude of floor "splash" it does not completely remove it. Sometimes low metal fences properly called *defraction edges* are placed on the model range to deflect the "splash" signal into a harmless area. Placing these fences for each frequency used (and sometimes as many as 200 "cuts" are made on a single model) is more of an art than a science.

Another troublemaker is the small coaxial cable which conveys the detected signal from the model down the tower to the laboratory. This is, of course, a metallic conductor of many wavelengths projecting from the model. Pattern distortion will be introduced by this cable, and only highly experienced personnel can minimize this difficulty by judicious placement of the cable when setting the model up for a "cut." To overcome this hazard some researchers have actually placed midjet transmitters *inside* the model aircraft. Battery power or an air-driven generator energized by a high pressure hose are used, but the attendant cooling problems and frequency drift due to lack of power supply regulation makes this technique a last resort measure.

The problem of distance in wavelengths at the operating frequency between the model under test and the "illuminating" horn antenna poses, at times, a nightmarish enigma for the antenna worker. In order that an accurate radiation pattern be secured, the model aircraft must sometimes be placed as many as 100 wavelengths from the laboratory antenna, otherwise true "free space" conditions are not realized. Even at the microwave frequencies 100 wavelengths may be a sizable distance physically. Unfortunately, the power output of laboratory type Klystron tubes is only about 200 milliwatts for the region up to

(Continued on page 108)



# The Batwing FM RECEIVING ANTENNA

**A single element will provide high-gain reception over entire FM band. In some areas its bi-directional pickup pattern is a desirable feature.**

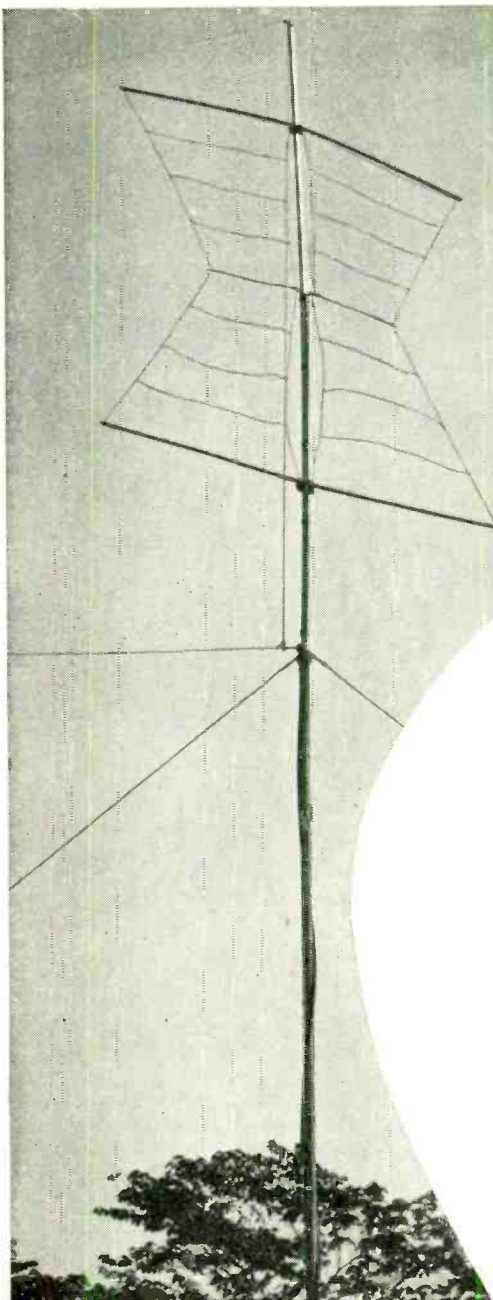


Fig. 1. Test model of the batwing FM receiving antenna installed on author's home.

By  
**R. CAMERON BARRITT**

**T**HE batwing antenna is an extremely wide-band radiator developed by RCA for television transmitting. In its omni-directional form, it is known as the "supertturnstile" and is used by nearly all television stations. This "current sheet" antenna has been employed for FM transmitting, but so far has been given little attention as an FM receiving antenna. In our opinion, it has many advantages and is worthy of consideration. A single element used as an FM receiving antenna results in bi-directional high gain over the whole FM band. For those who, like the writer,

are situated so that desired stations are in two opposed directions (Fig. 2), the figure 8 pickup pattern may be best utilized. The pattern in the vertical plane is similar to that of two vertically stacked dipoles  $\frac{1}{2}$  wavelength apart; however two dipoles so situated present their highest impedance at only one frequency because the natural resonance of a dipole is sharpened in stacked arrays. The wide-band batwing does not exhibit this undesirable single-frequency effect, and has almost unchanging impedance over the whole FM spectrum while still retaining its bi-directional high-gain feature.

Important dimensions of the antenna are shown in Fig. 3. These are not critical. The two edges of the wings are grounded and are fed at the center. The area within the wing may be filled in at the discretion of the constructor, however, to eliminate the dangerous wind resistance, this area should not be solid. Copper screening or chicken fence wire may be used. If horizontal members are utilized, there should be at least seven between top and bottom.

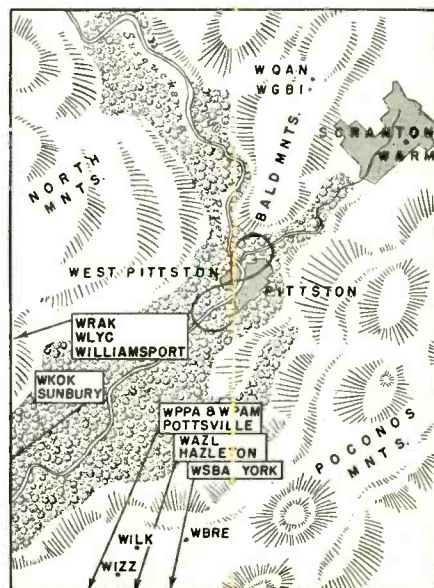
Fig. 1 is a test model constructed quite inexpensively of two  $\frac{1}{2}$ " diameter aluminum tubes and some 7/22 copper antenna wire. The antenna is mounted on the roof of the writer's home, 50 feet above street level, and is affixed to a 25-foot mast made of  $\frac{1}{2}$ " and 1" conduit and  $\frac{3}{4}$ " diameter aluminum tubing. A hundred feet of RG-8/U cable (available at five cents a foot) runs to the first floor from the roof. Since the batwing is a completely grounded type of antenna, the sheath of the cable may be grounded somewhere near the end, affording complete lightning protection. The output impedance of the antenna is not exactly the impedance of the cable (52 ohms), but is close enough for all practical purposes, as the wide-band radiator yields an unvarying standing wave ratio.

Our experimental batwing has performed extremely well, considering the fact that it is situated approximately 100 feet above the Susquehanna River, which is only 500 feet above sea-level at West Pittston. In spite of the poor location, we have managed to pick up WSBA, York, Pennsylvania, which is 110 miles distant. WKOK—Sunbury (60 miles), WRAK—Williamsport (65 miles), and WPPA—Pottsville (60 miles) are all received at limiter level.

The antenna shown in Fig. 1 was merely a test model, and although it has withstood the fierce March winds of Wyoming Valley, it is not expected to have a long life. It will be replaced with one fabricated entirely of aluminum tubing welded together. It is con-

(Continued on page 90)

Fig. 2. Map of a typical locale requiring a bi-directional antenna. All stations that can be received are either to the northeast or southwest, with the mountains blocking reception from either the east or west.





**Square-wave testing with the simplest of all clipper circuits. It provides an extremely sharp square wave over a frequency range of 20 to 20,000 c.p.s.**



Single tube, square-wave clipper. Only 5 components are used in its construction—3 resistors, a battery, and a dual diode.

# Wide Frequency Range Square-Wave Clipper

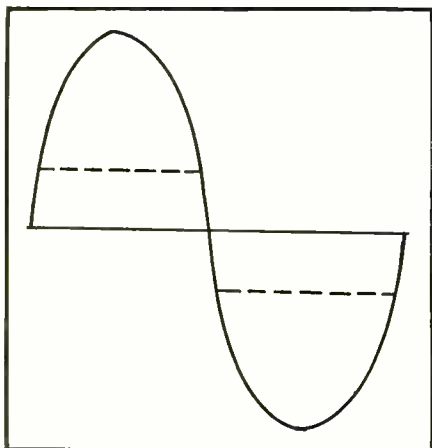
By  
**LOUIS E. GARNER, JR.**

**C**HECKING the response of an amplifier to a square-wave signal provides the fastest and easiest method for testing frequency response, phase shift, transient response and similar characteristics. Unfortunately, commercial square-wave generators, particularly those covering a wide frequency range, are comparatively expensive and hence not easily available to the average service technician or experimenter.

However, a close approach to a square wave may be obtained by "clipping" the peaks of a sine-wave signal as illustrated in Fig. 1. A number of clipper circuits may be used to do this, the most popular being illustrated in Fig. 4A.

In operation, whenever the voltage of the input sine-wave signal exceeds the d.c. voltage applied to the diodes by means of small cells, the diodes conduct. Diode  $V_1$  conducts on positive peaks and diode  $V_2$  conducts on negative peaks. When either diode conducts, it acts practically as a short circuit and the input signal is dropped across series resistor  $R_1$ .

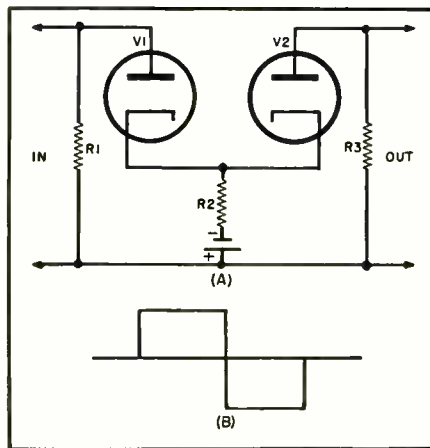
Fig. 1. Principle of clipper circuit. Peaks of sine wave are clipped to get square wave.



The effectiveness of clipping in this manner depends on the combined value of the diode resistance (when conducting) and the battery resistance in comparison with the value of  $R_1$ . If  $R_1$  is very large compared to the combined diode and battery resistance, reasonably good clipping is obtained.

This circuit, though widely used, does not give a really close approach to a "perfect" square wave, and hence is not suitable where more exacting tests are required. First, regardless of how large  $R_1$  is made, the diode and battery still have some resistance and a small voltage will appear across them. This voltage will vary with the changing resistance of the diode. Thus, a "rounded" square wave is obtained,

Fig. 2. Clipper circuit designed by the author. See text for values of components.



with both trailing and leading edges rounded somewhat and with a slight bow instead of a perfectly flat top, as illustrated in Fig. 4B.

In addition to this disadvantage, the circuit also has a limited frequency range, for as  $R_1$  is made larger, distributed capacities become important and limit the frequency at which even a close approach to a square wave can be obtained.

By using a different arrangement, the clipper circuit shown in Fig. 2A can be obtained. This circuit, when properly driven, will provide almost perfect square waves, with sharp corners and a flat top, over an extremely wide frequency range.

In operation, diodes  $V_1$  and  $V_2$  are normally conducting and thus act as resistors, passing any signal applied to the input. However, when the peak of the input signal exceeds the battery voltage, then one of the diodes stops conducting and acts as an open circuit, preventing further passage of the signal and effectively clipping the peaks.

On negative peaks, the plate of  $V_1$  is made negative with respect to its cathode and hence it stops conducting and acts to open the circuit. On positive peaks, diode  $V_1$  continues to conduct, but the cathode of  $V_2$  is made positive with respect to its plate and this tube acts to open the circuit.

A practical circuit can be built using a 6AL5 dual diode, a 1.5 volt single penlight or flashlight cell, and half-watt carbon resistors.  $R_1$  and  $R_3$  have a value of 18,000 ohms, and  $R_2$  has a value of 2200 ohms. Filament voltage



can be obtained from the amplifier under test, or a small filament transformer can be provided.

In the clipper circuit built by the author, using these values, an almost perfect square wave was obtained with a constant amplitude of 1.5 volts peak-to-peak over the range 20-20,000 c.p.s., when driven with a sine wave having an amplitude of approximately 90 volts peak-to-peak. It could not be determined how high in frequency this clipper would continue to produce a square-wave signal since no sine-wave source supplying a signal of sufficient amplitude was available. However, since the resistor values are low, minimizing the effects of distributed capacities, and since no "frequency-conscious" components are used, the maximum frequency at which a good square wave could be obtained should be comparatively high.

As in any clipper circuit, the square wave can be improved by increasing the amplitude of the input sine-wave signal, and, by using a signal of sufficient amplitude, a square-wave with an extremely short rise time can be obtained. Normally, the amplitude of the input signal should be from 50 to 100 times the amplitude of the output square wave.

In this circuit, the level of the output signal remains constant at the battery voltage. If a higher output voltage is desired, additional cells can be connected in series to increase the d.c. voltage and the level at which clipping starts. In this case, however, it is necessary to increase the amplitude of the input sine signal still further if a good square wave with a short rise time is to be maintained.

#### Application

When testing either a single stage or a complete amplifier, the equipment is arranged as shown in block diagram form in Fig. 5. A good oscilloscope and a sine-wave signal source are required in addition to the clipper. The square-wave signal at the output of the clipper is first observed on the oscilloscope. Next, the output signal from the amplifier is observed and any departures from a perfect square wave noted.

It is best to adjust the horizontal sweep of the oscilloscope so that at least two complete cycles can be observed on the screen.

An input square wave and distorted square waves showing the effect of different amplifier characteristics are shown in Fig. 3. The perfect input square wave is shown in Fig. 3A.

A drop-off in high frequency response in the amplifier causes "rounding" of the leading edges of the square-wave signal as shown in Fig. 3B. Usually, the rounding off will be easily noticeable if there is a decided drop in amplifier gain by the tenth harmonic (or less) of the square-wave fundamental frequency. Thus, if a 1000 c.p.s. square wave is passed without appreciable rounding, you can be reasonably sure that the amplifier is

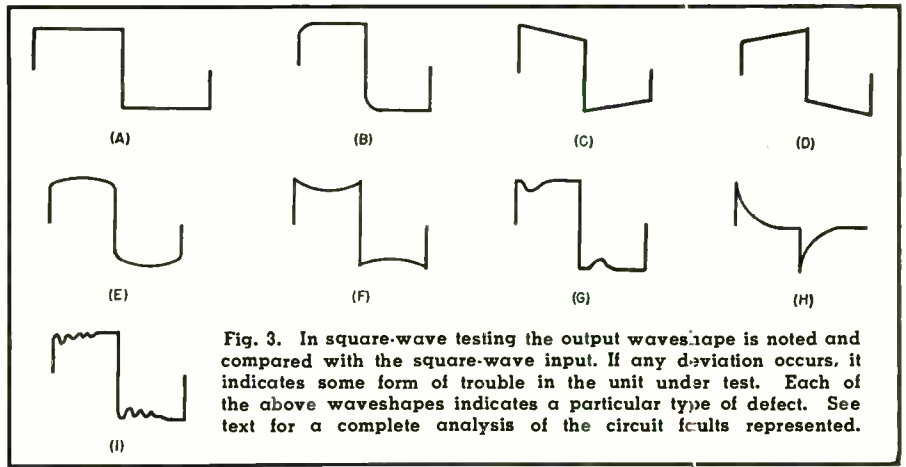


Fig. 3. In square-wave testing the output waveshape is noted and compared with the square-wave input. If any deviation occurs, it indicates some form of trouble in the unit under test. Each of the above waveshapes indicates a particular type of defect. See text for a complete analysis of the circuit faults represented.

"flat" to 10 kc. But this gives no indication of the response below the fundamental frequency of the square wave. To do this, a lower frequency square wave is required.

Since this clipper, when properly driven, can easily supply a 20 kc. square wave, it can be used for checking the response of wide-band amplifiers (up to 200,000 c.p.s.) as well as audio amplifiers.

If there is phase shift in the amplifier so that phase leads at low frequencies, the top of the square wave is tilted as shown in Fig. 3C. If phase lags, the tilt is as shown in Fig. 3D. The amount of "tilt" depends on the degree of phase shift. Phase shift is usually not too important in audio amplifiers, as the ear is unable to detect it. However, in video and oscilloscope amplifiers no phase shift should be present.

The effect of accentuated gain at low frequencies is shown in Fig. 3E, while the effect of a drop in gain is shown in Fig. 3F. The drop in gain (Fig. 3F) is at the fundamental frequency of the square wave. It is assumed that there is no phase shift in both cases.

(Continued on page 152)

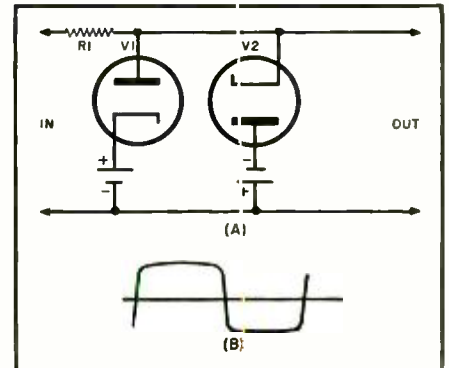


Fig. 4. Diagram of square-wave clipper tested by the author. Its waveshape is not as sharp as that of the final circuit shown in Fig. 2.

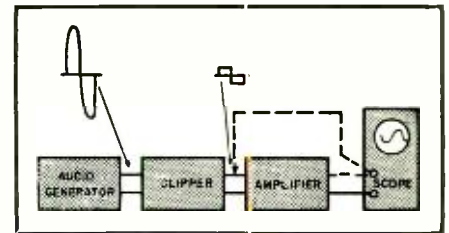
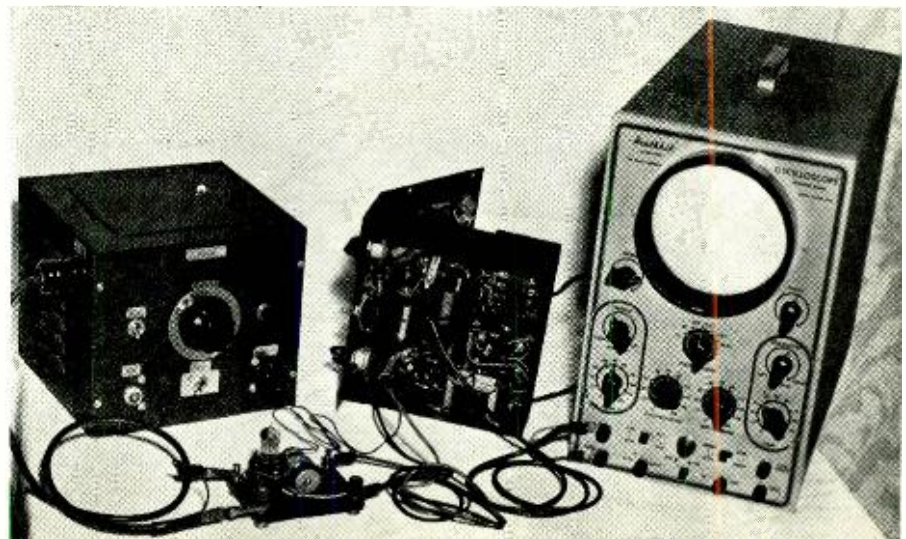


Fig. 5. Test setup used for checking audio amplifiers. It is pictured in photo below.

Clipper connected for checking the characteristics of an audio amplifier. The sine-wave audio oscillator is to the left, the test amplifier is in the middle, and the oscilloscope appears at right. The clipper itself is in the foreground.



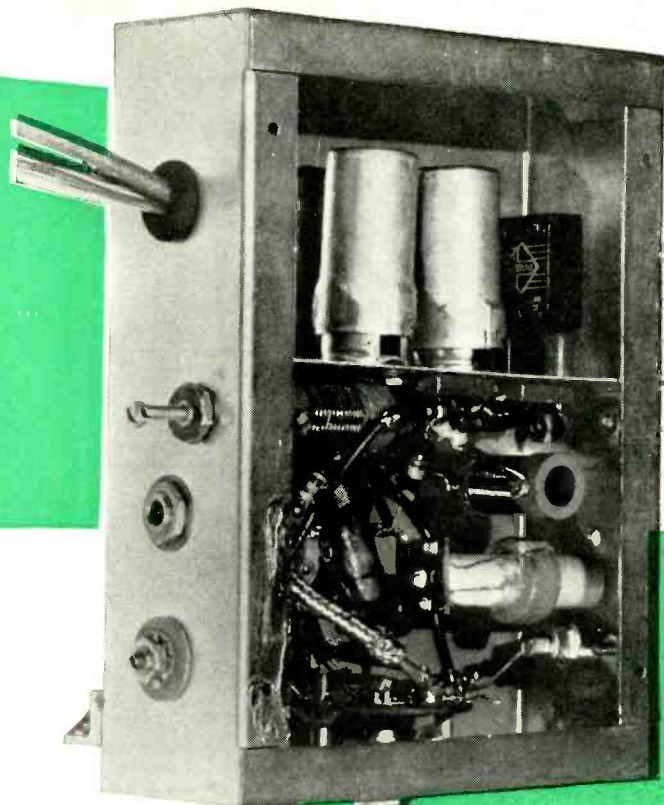


# BROADBAND CONVERTERS

By

ALVIN B. KAUFMAN, W6YOV

**Construction details for several types of short-wave converters for use on the 75, 40, 20, and 10-meter amateur bands.**



Bottom view of converter. The power cable and antenna RG 29/U wire to the receiver are at top left, while the r.f. trimmer, mike jack, and antenna padder are directly below.

**A**N EXAMINATION of the short-wave converters available commercially reveals several deficiencies both from the financial angle and because of technical imperfections.

The amateur or SWL, either with limited finances or with the desire to build a really simple though excellent 75, 40, 20, or 10 meter converter without any of the bugs and complications attendant with most such units, will be pleased by the simplicity and straightforward design of this converter.

In general, there are two types of converters presently in use. By far the most common is the tunable converter wherein the receiver is tuned to a fixed point and the converter

oscillator frequency is varied so as to produce a conversion or mixed frequency, always at the same frequency to which the receiver is tuned. The other type of converter, not commonly in use, employs a wide-band r.f. input and output and a fixed frequency oscillator. This is the "broadband converter." Its output frequency varies with the frequency of the incoming signal and must be detected by tuning the receiver rather than the converter. The converters to be described are of the "broadband" variety with another important innovation added, crystal control, in some cases of a very unusual type.

One common complaint with practically all high frequency converters is frequency drift, and for the builder without a signal generator this presents difficulties in securing proper operation. Crystal control eliminates both of these troubles. There are no tricky adjustments or trouble encountered in tuning or finding the frequency range that this converter covers. With the proper crystal frequency your car or house radio tunes the ham band as a perfect "bandspread" unit. Transmitting or receiving type crystals are used in the converter; the crystal frequency and type of converter to use for the different bands will be indicated during a discussion of the three converters shown schematically. The crystals used are not expensive as an accurate frequency is not required. No special frequency is required for the ten meter band.

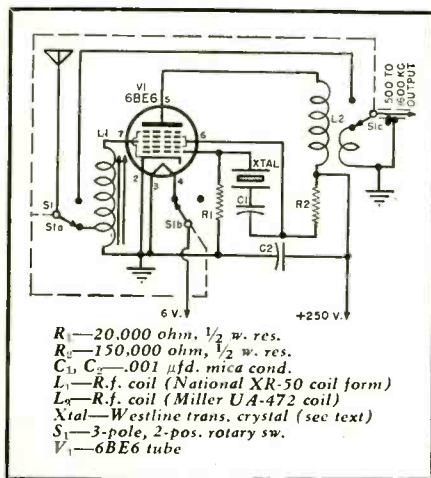
A one- or two-tube converter of this type admittedly does not have the gain of a four- or five-tube unit, but neither

does it cost as much. In its field of use its good points certainly outweigh any objections to lowered sensitivity or a little loss of bandwidth when used on the ten meter band. On the ten meter band the author has received signals from all over the country (2-tube unit) and considers the sensitivity satisfactory.

There is one prerequisite that *must* be met if a broadband converter is used. The broadcast receiver tunes in the converted signal as if it were on the broadcast band. This means that the BC receiver must be completely "dead" with close to full volume when its antenna is not connected. Car radios being well shielded generally have no pickup, but the average inexpensive a.c.-d.c. may have excessive pickup in which case it would interfere with the short-wave signal. In any case a shielded cable must be used from the converter into the broadcast receiver. This cable should be of the low loss coaxial type such as the RG 29/U, etc. With the converter connected to the receiver a small amount of broadcast signal may come through until the converter warms up and supplies a signal and background noise to operate the a.v.c. in the receiver.

Three converters were designed by the author. The 6BE6 converter was designed primarily for 75 and 40, while the dual 6AG5 unit was designed pri-

Fig. 1. Schematic diagram of 75- and 40-meter converter. It can also be used, though not desirable, for 20- and 10-meter operation.





marily for 20 and 10. Although either unit may be employed for any band there are reasons which make each better suited for a different range of frequencies.

The 6BE6 converter (Fig. 1) employs a pentagrid tube with a crystal controlled oscillator section. Starting at the antenna, the r.f. signal may be tapped into the r.f. coil a few turns from the bottom or fed in through the all impedance matching network as shown in Fig. 3. This coil is of the high "Q" type. A *National XR-50* coil is wound according to the specifications given in the coil table accompanying Fig. 3. This variable iron core coil is wound according to the specifications given in the coil table accompanying Fig. 3. This variable iron core coil and the tube's input capacity permit tuning throughout the band. The coil shows high "Q" over a wide frequency range, falling off rapidly outside this range. Rather than lower the "Q" by loading the coil with a resistor, which would "broaden the response" at a loss of the center frequency gain, no loading devices were used. Summed up in simpler words, the unit will be "hottest" near the peaked frequency of the coil. This coil's iron core should be adjusted after it is connected to the antenna so that it will resonate close to the frequency at which the transmissions are taking place or to any section of the band where peak performance is desired. In actual practice the per-

of the antenna coil are connected and are common on one post. These leads must be unsoldered and one wire shifted to the unused lug available on the Micarta strip. The associated aluminum shield can may be discarded to provide a more compact converter.

The use of a broadband broadcast frequency coil in the plate circuit of the converter makes special shielding unnecessary. Where both the plate and grid circuits are tuned to the same frequencies (some converters) careful shielding is required or the circuit may "take off" into tuned-plate, tuned-grid oscillator action.

As the crystal oscillator is of the Pierce type, no tuning is required in its circuits. Thus it can be seen that with the proper crystal, only the antenna input coil requires tuning to make the converter operative. This coil is tuned by operating the converter into a receiver without a.v.c. or into a short-wave receiver with an "S" meter. The receiver is tuned until a signal is received and then the coil is peaked by screwing the iron core in or out, as required. The windings for  $L_1$ , the input coil, are the same for all three units and are indicated on the schematic.

The 6BE6 converter, as can be seen, is a choice converter for 75 and 40 meters; only two coils, two resistors, two condensers, a crystal, and a tube

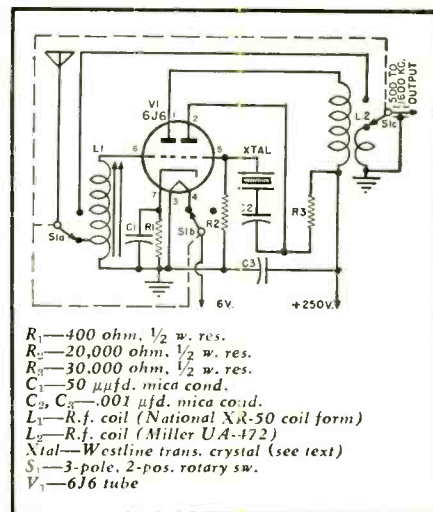
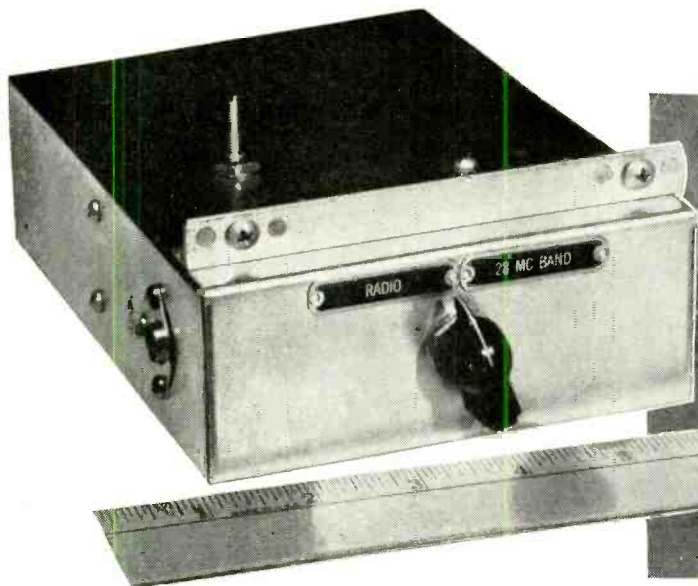


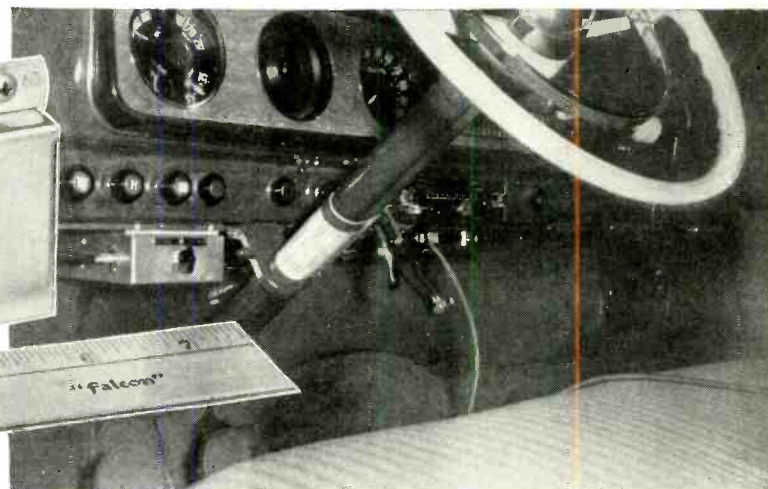
Fig. 2. Ideal, single tube, 10-meter converter.

ful 40 and 20 meter signals produced an undesirable signal in the receiver. The converter can be used for all bands by switching crystals and r.f. input coils, but, as indicated, is best suited for 75 and 40 meters.

The crystals used in any of the converters may be of either the transmitting or receiving type. *Westline* transmitting crystals were used by the author. The crystal frequency selected should preferably be at the low fre-



(Left) Over-all view of the home-built dual 6AG5 converter. The car antenna plugs into receptacle on the left side of unit. (Below) View of converter installed under the dash of author's Studebaker.



formance over the complete band is quite satisfactory.

The plate of the 6BE6 is connected to a *Miller UA-472* r.f. coil. This coil is a broadband broadcast coil designed to couple an antenna to the grid of the first r.f. tube, which is untuned. Here it is used in reverse. The grid winding is used as the plate winding in the converter, while the antenna coil feeds the converter output into the broadcast receiver's antenna input. This coil must be modified slightly from the manufacturer's configuration to fit this circuit. The grid return and bottom

being required. And it works excellently. It can be used on 20 or 10 meters, but as crystals with a fundamental mode of oscillation are made only down to 40 meters, it becomes necessary, when using a 40 meter crystal in the circuit, to employ its second or fourth harmonic, as developed in the tube circuit, to beat with the incoming 20 or 10 meter signal. The author has used this converter with a 40 meter crystal on the ten meter band. Its sensitivity is fair but not as good as the dual 6AG5 circuit where a 10 or 20 meter signal is injected into the mixer tube. Although the input coil was tuned to 10 meters, certain power-

frequency end of the band. This is so that as the incoming short-wave signals increase in frequency the resultant conversion frequency is also higher and thus the receiver is tuned to a higher frequency. On certain bands this permits adding a factor to the broadcast receiver dial and reading it directly in short-wave frequency! The crystals should be of the following frequencies. A 3000 kc. crystal should be used for the 75 meter band. Here the low frequency end of the band, 3500 kc., will appear at 500 kc. on the broadcast receiver while 4000 kc., the high frequency end of the band, will appear at 1000 kc. on the dial, etc. Thus for



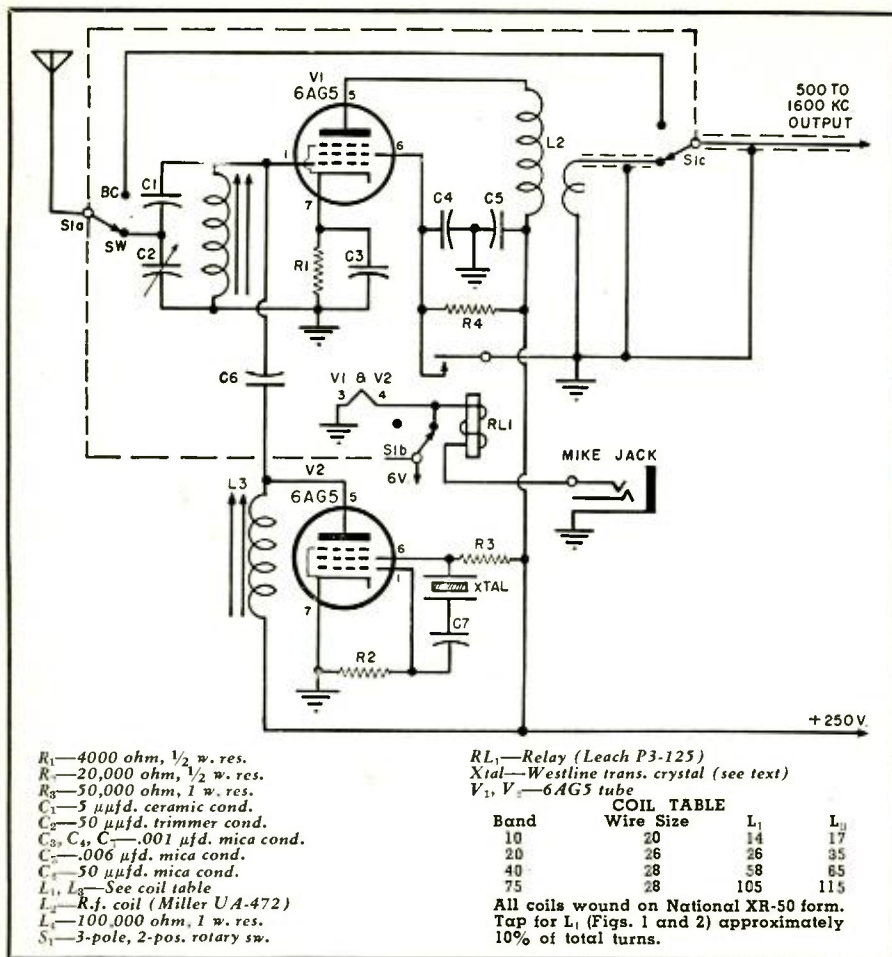


Fig. 3. Ideal, two-tube 20 and 10-meter converter. Winding data for r.f. coil, L<sub>1</sub>, covering 10, 20, 40, and 75-meter operation, also applies to r.f. coil L<sub>2</sub>, shown in Figs. 1 and 2.

the 75 meter band a factor of 3000 would simply be added to the dial indication. Any crystal frequency close to 3000 kc. would be satisfactory and such crystals may be found in surplus stores or can be ground on special order for a few extra dollars. A 2500 kc. crystal could be used, in which case the 75 meter band would fall between 1000 and 1500 kc. on the receiver. The crystal frequency selected depends, to a large degree, on how accurately you wish the broadcast dial to reflect the short-wave frequency! For the 40 meter band a crystal frequency of 5800 to 6500 kc. can be used. However, 6000 kc. is preferable as the low frequency end of the band would appear at 1000 kc. on the receiver and the broadcast dial would be read directly in short-wave frequency by adding a factor of 6000. The 20 meter band would be covered by a crystal frequency of 6450 to 6750. Again 13,000 kc. would be best, the low frequency end of the band appearing at 1000 kc. on the receiver. A factor of 13,000 would be added to make this band track on the receiver. In this case a 6500 kc. crystal would be used in the separate oscillator circuit, Fig. 3, and its second harmonic of 13,000 kc. injected into the mixer tube. These lower frequency bands present no problem of frequency coverage as they are only 300-500 kc. wide and thus the radio receiver gives more than ade-

quate coverage and sufficient band-spread to be satisfactory. The 10 meter band being 1700 kc. wide means that it cannot be completely covered by a broadcast receiver, but that the band-spread action would be excellent as the band covers more of the dial. Actually, for a given increment of dial movement, the receiver would tune the same frequency difference on any band and there would be no difference in selectivity on any of these bands. The proper crystal frequency for 10 meter coverage depends upon which section of the band you wish to receive. My choice is from 28.5 megacycles to 29.6 megacycles. This calls for a 7000 kc. crystal. Its fourth harmonic falls at 28 megacycles and thus by adding 28 to the receiver dial a 28.5 mc. signal appearing at 500 on the dial would be read 28,500. The factor would be 28 or 28,000. An advantage here is that 7000 to 7010 kc. crystals are easily obtainable as they are 40 meter crystals. To cover from 28,000 kc. up, a 6875 kc. crystal would be required. To cover from 29,700 kc. down, a 7050 kc. crystal is necessary.

The 6J6 converter (Fig. 2) is satisfactory for any frequency of operation, but has the same limitations as the 6BE6 unit for the two high frequency bands. It was determined that a triode mixer of this type does not have a lower noise level at these frequencies

than the pentagrid or grid injected converter. The oscillator mixing action takes place in the common cathode resistor and the bypass condenser is critical, 50 μfd. being the correct value for the 10 meter band. This unit compares favorably with the 6BE6 unit, but if the builder is starting from scratch, the latter is a better unit to build.

The dual 6AG5 converter (Fig. 3) is very satisfactory for 20 and 10 meter operation. This unit was designed and found suitable for these bands. It is needlessly complicated for the 75 and 40 meter band, the 6BE6 unit being comparable in performance and requiring less material. A 10 meter version was constructed and installed in the author's car to complete a mobile station. Although the previously mentioned points regarding crystals, coils, etc. also apply to this unit, there are additional features requiring explanation. During experimental development of this converter it was determined that the popular 6AK5 tube was not satisfactory for converter service for two reasons. This tube has a rated 180 volts maximum plate supply and the tubes tested were gassy enough to ionize at the admittedly high supply voltage of 250 volts d.c. The worst feature was the wide change in trans-conductance when the tube was subjected to vibration. The 6AG5 possesses neither of these objectionable features. Of course, this does not condemn 6AK5 tubes for other uses.

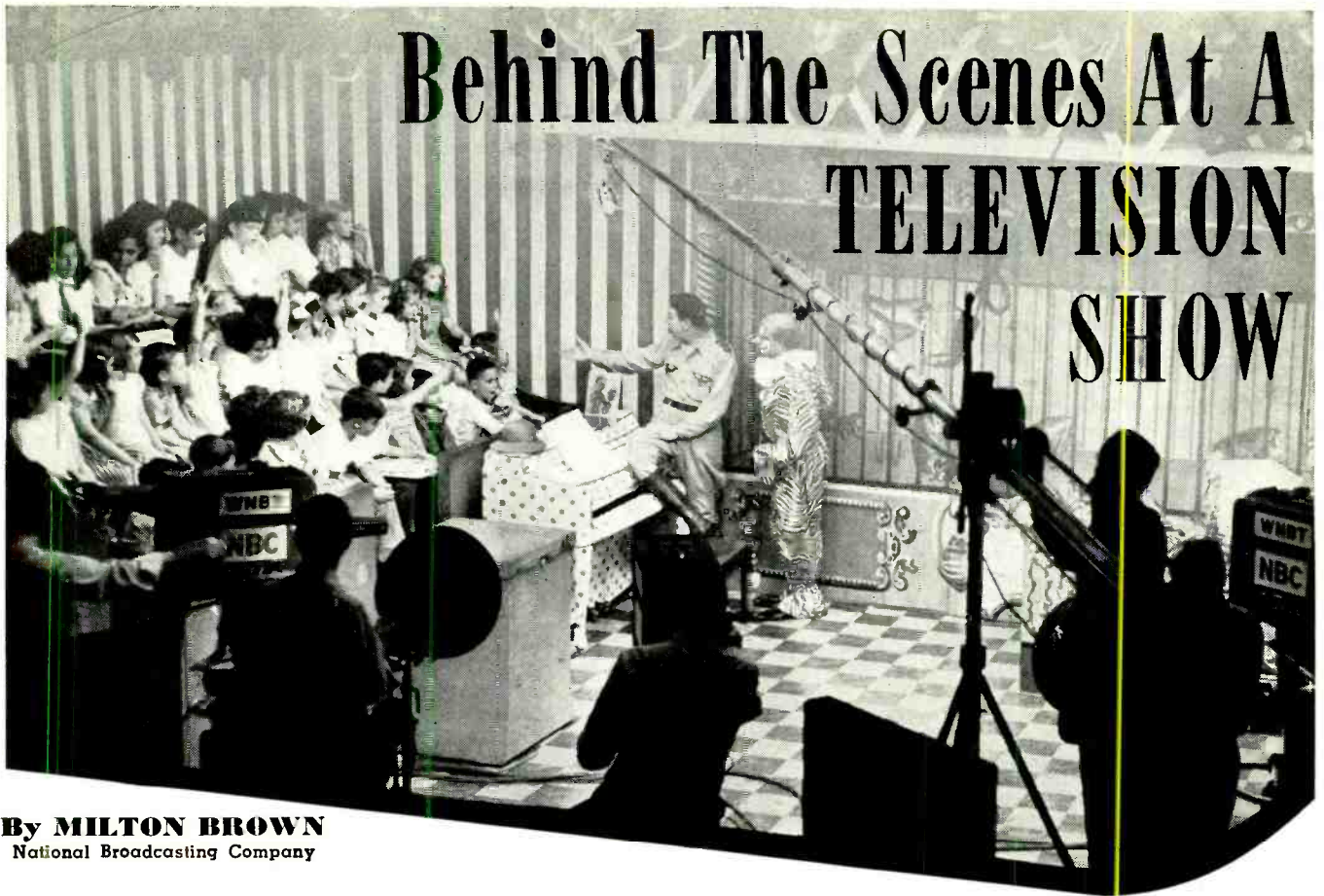
The oscillator section of the 6AG5 converter consists of a single 6AG5 tube whose screen grid circuit is wired as a Pierce oscillator and whose plate circuit is resonated (in this case) to the 10 meter band. A low frequency crystal is used, as outlined previously, and the plate circuit of the oscillator tuned to a multiple of the crystal frequency. Both the oscillator coil and r.f. input coil are tuned while operating the converter into a receiver. The receiver must have either an "S" meter, no a.v.c., or a very weak input signal applied to it. If a signal generator is not available any signal may be tuned in by the receiver on the ham band. Even without alignment there will be enough signals coming through for this purpose. After a signal or carrier is tuned in, the r.f. and oscillator coils are tuned by their iron cores for maximum receiver output. It is advisable to make the a.v.c. circuit in the receiver inert if it does not have an "S" meter, otherwise peak tuning is almost impossible. Where a high gain ham receiver is used for this tuning operation, a certain amount of broadcast leakage may be expected which will not appear with car or other radios.

The antenna may be coupled into any of the three converters by direct tapping into the coil or by the variable impedance antenna coupler as shown in the dual 6AG5 converter schematic. The variable impedance antenna coupling has been used on many other sig-

(Continued on page 145)



# Behind The Scenes At A TELEVISION SHOW



By **MILTON BROWN**  
National Broadcasting Company

***Back of the smooth and seemingly effortless show appearing on your video screen is a complex and highly trained organization of video technicians.***

**T**ELEVISION is a complex scientific operation, combining the action of light and optics, electricity and radio, physics and chemistry, electronics and photography.

One of the most complicated mechanisms in television is the camera—the instrument which is the basis of all television production.

Although the television camera resembles the motion picture camera, it practically begins where the movie camera leaves off. In regular photography, the scene to be photographed is picked up by a lens and focused on a strip of celluloid coated with a photosensitized emulsion and the action of the camera stops there.

On the other hand, the television camera is an electronic device which contains a tube, called the image orthicon, which translates the image transmitted from a lens onto a photosensitized surface into electrical impulses. These impulses are amplified and travel as such until they reach the television receiver in the home, where they are again translated into the image of the originally photographed scene. In greater detail, this is the route taken by a bit of action during a telecast:

The scene is picked up by the tele-

vision camera, the signal is amplified in the camera, sent through the camera cable to the studio control room, where it is adjusted and amplified, then sent through cable to master control, where it is amplified again, and from there to NBC's antenna atop the Empire State Building. At the same time that the telecast is sent to the Empire State Building from master control, it is also sent from there to the telephone company's network terminal point for transmission through the coaxial cable to stations connected to the network.

WNBT's television signal in New York is radiated from an antenna, located on the Empire State Building tower, to be picked up by home receivers. The video signals are brought into the set inside the house and appear on the screen. The sound portion of the program is picked up in the television studio simultaneously with the video, is amplified and transmitted in the same manner as any regular radio broadcast.

The technicians immediately concerned with pickup and transmission of any television show are specialists in many fields; some of the equipment they use is standard to radio and motion picture but most of it represents

Putting on NBC's "Howdy Doody" show at the WNBT studios requires the services of many highly trained technicians and engineers.

the best and latest in electronic achievement, a large portion of it designed by RCA and NBC engineers.

The following is to indicate the relationship of technician to equipment during the actual pickup of a video program:

## **In the Studio**

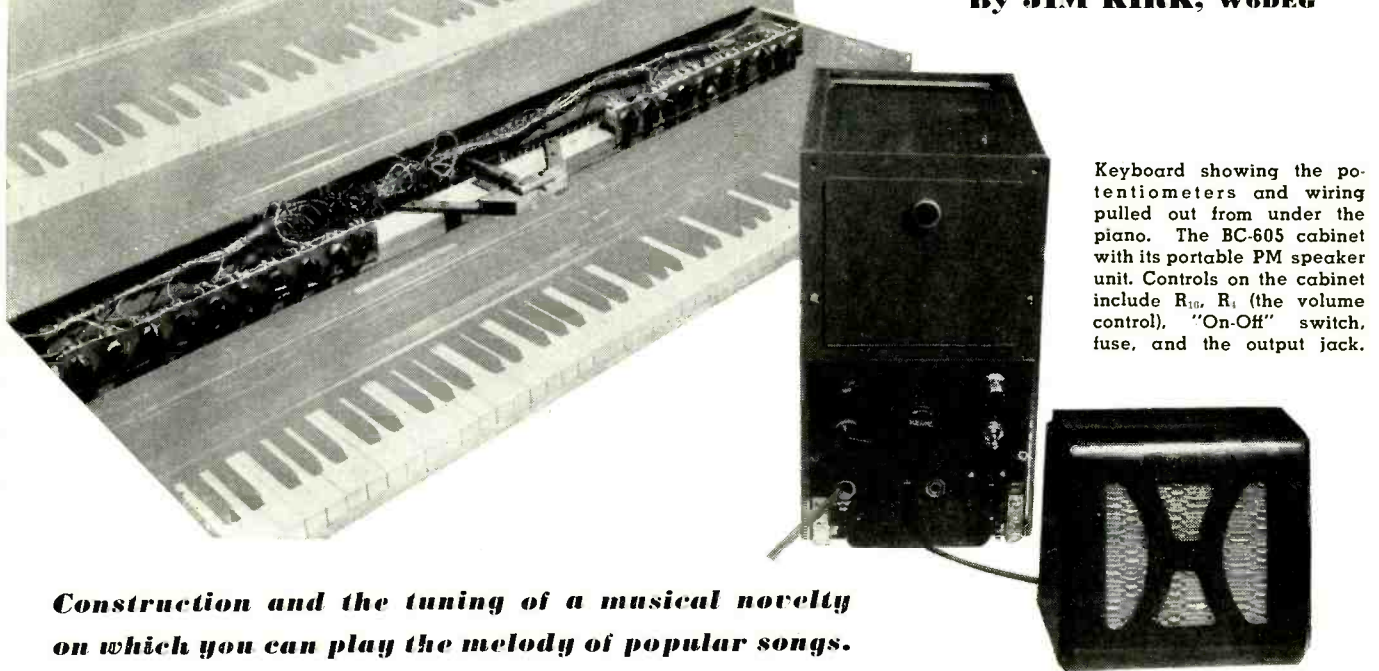
**Cameramen—Cameras:** Usually, three cameras are used. Camera #1 is mounted on a dolly and is the only camera which is moved to produce moving shots—called dolly or truck shots—during the program. It is used for wide-angle shots. Cameras #2 and #3 are mounted on mobile pedestals, and while they can be moved, they do so only between shots. Each camera has a lens turret with a complement of four lenses of various focal lengths. In general, on camera #1, the lenses have 35, 50, 75 and 135 mm. focal lengths, while #2 and #3 have 50, 75, 135 mm. and 7½-inch focal lengths. For extreme closeups, lenses of longer focal lengths are available and are used when necessary. All lens changes are accomplished by means of a remote control handle in the rear of the camera. Changes in optical focus are made by means of either a focusing handle or a knob on the right side of the camera. While motion picture cameras are focused by moving the lens itself, in a television camera, cor-

*(Continued on page 148)*



# A Home-Built ELECTRONIC ORGAN

By JIM KIRK, W6DEG



Keyboard showing the potentiometers and wiring pulled out from under the piano. The BC-605 cabinet with its portable PM speaker unit. Controls on the cabinet include  $R_{10}$ ,  $R_1$  (the volume control), "On-Off" switch, fuse, and the output jack.

## Construction and the tuning of a musical novelty on which you can play the melody of popular songs.

I HAD taken the pledge and sworn off. Yes sir—from now on—no more surplus. Then our local junk dealer demoralized me by offering, right in his window, a stack of brand new BC 605's for \$5 per copy. That was too much of a bargain to pass up. Besides, I told myself, I need a cabinet and chassis for the experimental electronic organ I am building. A cabinet that I'd be proud to set on top of my piano. Furthermore, the parts I did not use would be worth much more than the price of the whole BC 605 with tubes. Just try and buy those leftover parts new and see what they cost. Just one more little purchase of surplus—the reader can guess what happened.

### Search for a Keyboard

Then I needed a keyboard for my electronic organ. If I could get a keyboard that I could mount near or under my piano, I could use the electronic organ to play the melody and play chords on the piano to accompany it. I shopped at local toy stores for toy pianos. All they had were little plastic toy grand pianos. They would not do. They could not be taken apart without wrecking them. One shop did have a handsome little wooden toy piano. It wasn't so little, at that, and beautiful tunes could be played on it. It had 25 keys. That would suit my purpose fine but the price was \$24.50. With tax, that was five times what the BC 605 cost.

### Silent Practice Keyboards

A canvass of the piano stores for practice keyboards revealed several

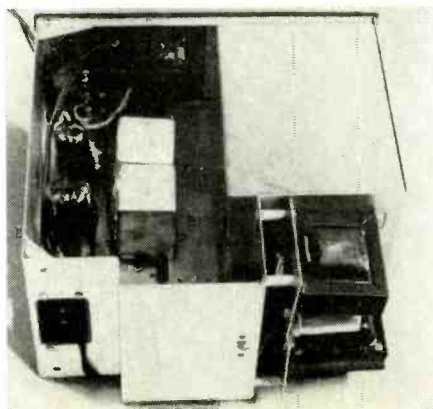
for \$49.50. Very beautiful—more keys than I needed and too costly. The last company had two Virgil "Claviers" for sale at ten dollars each. They were full size piano keyboards for soft or

*Editor's Note: The author has used a surplus BC 605 unit to obtain a cabinet, miscellaneous parts, and a chassis. This is not necessary as any new or junk box parts and cabinet may be substituted.*

*Since only 21 notes are required to play the melody of most popular pieces a full piano keyboard is not required. The author used a "Clavier" with a standard-sized keyboard simply because it was available at low cost. The entire keyboard may be utilized by adding additional octaves to the circuit as presented.*

hard keying or for silent or click keying. It would be too simple to install a copper strip back of the moving metal fingers. The whole thing could be cut down and moved right under

Chassis view of the unit. The choke, condenser, and power transformer are shown mounted on a strip of aluminum. The 5Y3GT tube, not visible, is behind the choke and condenser.



the piano with the keyboard protruding. Just what I wanted. I bought the best looking one. Inside was some printing showing when the manufacturer's guarantee expired—the year I was born—1895!

### Converting the BC 605

All the inside parts of the BC 605, including wiring, were removed, except the two tube sockets and two condensers. The front panel was left intact for appearance sake and because we are going to use the volume control, the switch, the fuses and the telephone jacks. A little strip of aluminum was mounted on the posts in the dynamotor well—identical to the method I use to power the popular BC 604 receivers. From the diagram it will be noted that two oscillator tubes in the one 6SN7 envelope are used. The reason being that the condenser and the resistance in the circuit control the frequency of the audio oscillation. If only one tube is used to cover the wide range wanted, a high resistance would be in the circuit by the time the low notes are wanted. The tube did not sound well on the low notes with a small grid condenser and a high grid leak. Better use one tube for the top half and another tube for the lower half. Since the 6SN7 tube is two tubes in one and since it takes up no more room than one tube and since surplus audio transformers are plentiful—two oscillators are employed.

### Cutting Down Howls

The volume control is invaluable for playing and especially for tuning

RADIO & TELEVISION NEWS



up, if you have any regard for the neighbors. I did not want to further antagonize my neighbors—what with them already up in arms and threatening to chop down my transmitting antenna because of BCI. That was before I installed NBFM, I hasten to explain.

When I first got the electronic organ all connected up and ready to try out, I struck a low note and received the Bronx cheer. That was all right. I had always wanted to know how to duplicate the Bronx cheer electronically. Now I knew.

### Tuning Up

You really need three hands for tuning up but if you are not so fortunate, there are two stunts you can employ. You can strike the piano note and remember what it sounded like, then hold down the organ key and try to tune the potentiometer to the same sound. You could put a roll of solder on the organ key and strike the piano note and tune—but it isn't much better than remembering. Start with the highest note and try to make it sound like high "F". Then try matching about four other keys. At this point, try playing some simple tune. If your experience matches mine, the tune will sound sick-like. However, if you have an ear for music, you can correct the sound better this way than by trying to match all the piano notes one by one.

Audio transformers will not oscillate unless the polarity is right. The method I employ is to go ahead and permanently hook the grid to "G" post and the "F" to the chassis. Then hook the plate to "B plus" and the power to the "P" post with flexible wires. If no oscillation, just reverse these flexible wires.

### Using the Organ

The reason for wanting 21 notes on my electronic organ was so I could play the melody for all popular ballads. These notes—from high "F" to a low "A"—cover every note used in one hundred popular ballads I have on hand and am fond of playing on the piano. At first glance, the 21 potentiometers (22 with the volume control) look like the most expensive part of the outfit—but you do not reckon with my Scotch blood. I could have saved money by discovering the exact resistance needed in each case and using cheap one half watt fixed resistances, but that would not hold for every piano and it would not hold if the piano changes tune with age. With potentiometers one can keep the organ in tune, just like tuning up a violin. (My organ sounds like a violin, I insist.) Just because the potentiometers scratch a little when used as volume controls, does not impair their usefulness in this application except the volume control on the 605 panel. Being a radio serviceman, I had a flock of used volume controls on hand and I only had to use a value larger than the resistance I needed.

The audio transformers are surplus transformers from the GF 11 transmitter, but any inexpensive 3 to 1 audio transformers from the junk box will do as well because I have tried several in the experimental stages. You compensate with the potentiometers, anyway, so a difference in the transformers is not noticed. The only reason why I wound up with these surplus transformers is that they look neat and are handy to mount and wire in this application. Placement of parts and wiring is definitely not critical so the builder may easily deviate from this arrangement without harmful results.

It may be noticed that several of the potentiometers have switches. This is because some of the used potentiometers that I had on hand were

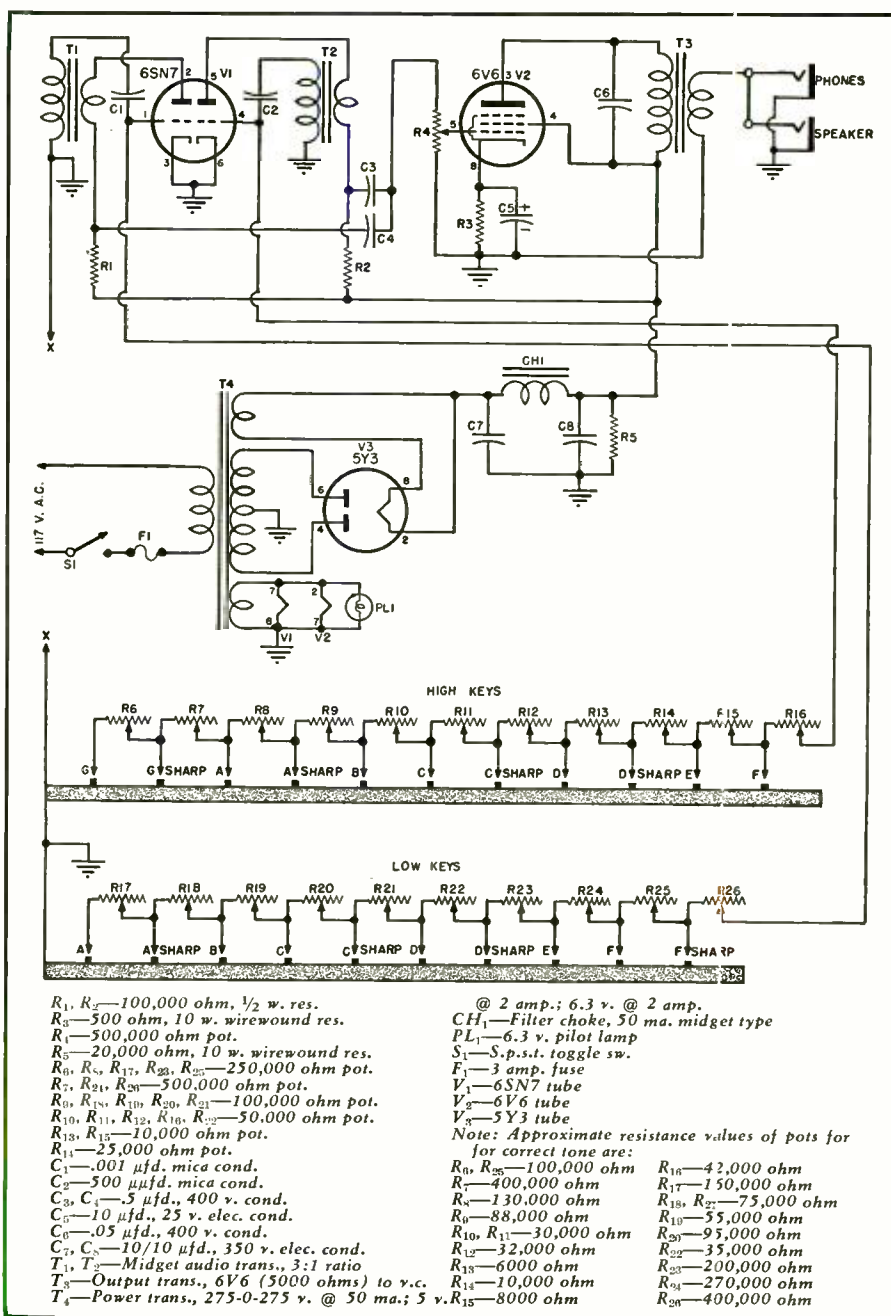
equipped with switches and I saw no reason for removing them in this application. The switch cover performs the function of keeping the dust out.

I must explain that this "organ" is tuned an octave lower than the melody for which the music is written. This is because it brought it in range of my singing voice and I can accompany my "music" with my rich baritone voice, if my guest insists. If you want to tune it to the melody that the music is written in, every key will be an octave higher and every potentiometer will have less resistance in the circuit. No change will have to be made in the components, however.

I built this organ five times before it reached its present form. I tried a neon oscillator first. Then I tried dif-

(Continued on page 111)

Circuit diagram and parts list covering the electronic organ. The approximate resistance values for the various potentiometers are given below the parts list.





# An Effective SYNC "Lock-in" CIRCUIT

By  
**DAVID GNESSIN**

**Details of a new circuit for television receivers developed by Transvision and available in kit form.**

**D**OES your television horizontal hold control act skittish, requiring adjustment to a single sensitive position, otherwise the picture tears? You can lock-in the horizontal hold with the circuit described in this article so that once set a deliberate rotation of the control (up to 30 degrees of rotation) will not throw the horizontal sync out of hold.

Despite its efficiency this device is simple. Comprising a single dual-diode tube with its coupling circuit, this automatic frequency device leans over backwards to hold the sync locked even when the hold control is moved off oscillator frequency. This article will discuss the theory of operation fully.

Fig. 1A shows a simple sync amplifier. This could be an amplifier common to both horizontal and vertical sync, or it might be the horizontal sync amplifier alone. Note the phase

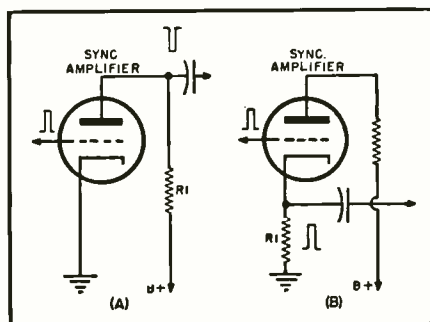


Fig. 1. Two versions of simple sync amplifier.

reversal of the sync pulse. Due to inherent plate amplifier action the positive sync pulse applied to the grid results in a negative sync pulse developed in the output.

Next examine Fig. 1B. By placing  $R_1$  in the cathode circuit the sync pulse now developed in the circuit has the

same polarity as that applied to the grid input.

This leads to Fig. 2 where  $R_1$  and  $R_2$  are placed in the plate and cathode circuits respectively. Thus, a voltage of the same potential but of opposite polarity is developed in the two outputs. This charges condensers  $C_1$  and  $C_2$  in opposite polarities. (Condenser  $C$  can be considered an extension of the plate-cathode tube capacity. It is part of the inherent phase-shifting network).

The filament circuit of the phase converter is omitted for simplicity. It may be readily seen, however, that while conducting, the diode is an effective low-resistance path from  $C_1$  to  $C_2$ . Thus, while the sync amplifier is passing a horizontal sync pulse the condensers  $C_1$  and  $C_2$  charge, right through the diode. Resistors  $R_3$  and  $R_4$  act as bleeding control returns to ground.

Due to the time constant of circuit components, condensers  $C_1$  and  $C_2$  are not fully discharged before the next sync pulse is applied to the input of the sync amplifier. Thus an effective d.c. is established within the circuit which may be measured say, at point "X." Since this is a balanced circuit, if incoming sync pulses are of equal amplitude, the voltage at reference point "X" would be zero.

A short digression is in order to explain the "phase converter" whose real work is yet to begin. The horizontal sync pulse has been rectified and it is ready to be mixed with the horizontal sweep pulse tapped off of the horizontal yoke (not shown). This latter pulse is the one developed by the local horizontal oscillator which is not shown.

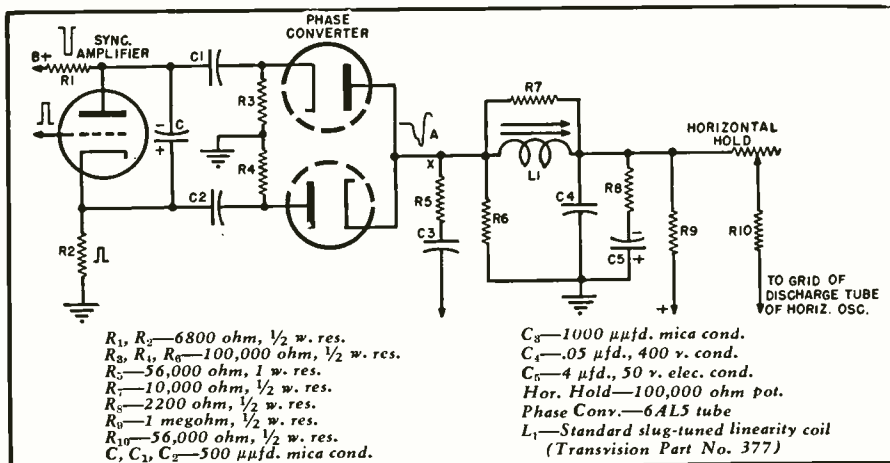
The essence of the mixing within the phase converter tube lies in the following reasoning. The horizontal oscillator circuit of the TV receiver is triggered by the horizontal sync pulse in normal operation. This "trigger" pulse rides on the modified saw-tooth sweep which leaves the horizontal output circuit and is impressed on the horizontal yoke. Naturally the question arises—Is it really doing all this?

The phase converter circuit is a checking and correcting device which answers that question. It examines the pure sync pulses stripped from the composite video signal and simultaneously examines the sweep pulses already corrected by that same sync, checking them against each other for accuracy.

Since these two pulses pass through the phase converter tube together to be rectified, conversion will take place, just like the converter in the common superheterodyne. Only it won't be a conversion to change frequencies. (The frequency difference will be in the order of a fraction of a cycle.) The comparison will be one of phase difference. Thus the name, phase converter.

No matter how sharply the circuits are tuned in superheterodyne converter stages, the resulting conversion (Continued on page 88)

Fig. 2. Schematic and parts list of Transvision's lock-in circuit for TV receivers.





# The MINI-RACK TRANSMITTER

Complete 100-watt, all-band c.w. transmitter which is housed in a miniature relay rack, 19" x 10". The front panel is aluminum, finished in grey crackle. The rack frame is made of 5/8" aluminum angle stock and self-tapping screws. The three decks, from top to bottom, are: final amplifier, the v.f.o. exciter unit, and the final amplifier power supply assembly.

By  
**JOHN F. CLEMENS,  
W9ERN**

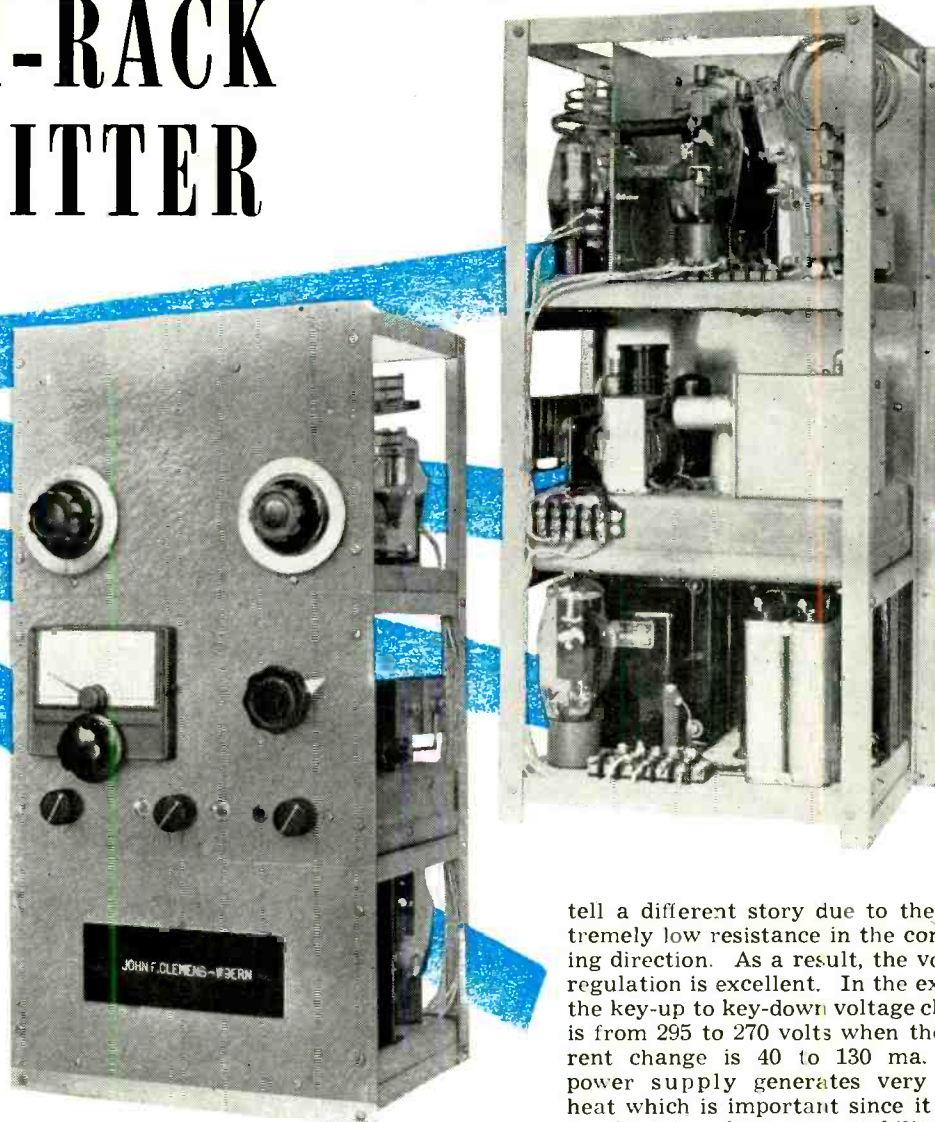
***Designed for clickless and chirpless keying, this compact, home-built transmitter is smaller than most of the present-day communications receivers.***

**T**HE modern amateur station invariably uses some form of variable frequency control. The current trend in transmitter design accents speed and flexibility of control but these advantages are usually obtained at an increase in complexity and bulk. After several attempts at transmitter layout along conventional lines, the author concluded that a standard relay rack occupied too much operating table space. Finally, the pictured layout evolved and proved quite satisfactory from the standpoint of operating convenience. The transmitter is constructed in miniature relay rack style. The front panels are ten inches wide and the three decks, final power supply, v.f.o. exciter, and final amplifier, total 19 inches high. The rack is eight inches deep. Thus the complete 100 watt, all-

band transmitter occupies only 8x10 inches on the operating table.

The absence of a transformer-type exciter power supply greatly facilitates compact construction. The voltage doubler power supply for the exciter uses selenium rectifiers and makes the exciter a completely self-powered, all-band, 15-watt transmitter. The voltage doubler power supply using vacuum rectifiers has never gained wide popularity among amateurs due to its notoriously poor voltage regulation. Selenium rectifiers

*Coming Next Month*  
**"THE MINI-RACK MODULATOR"**  
A 50-watt modulator designed as a companion unit to this transmitter.

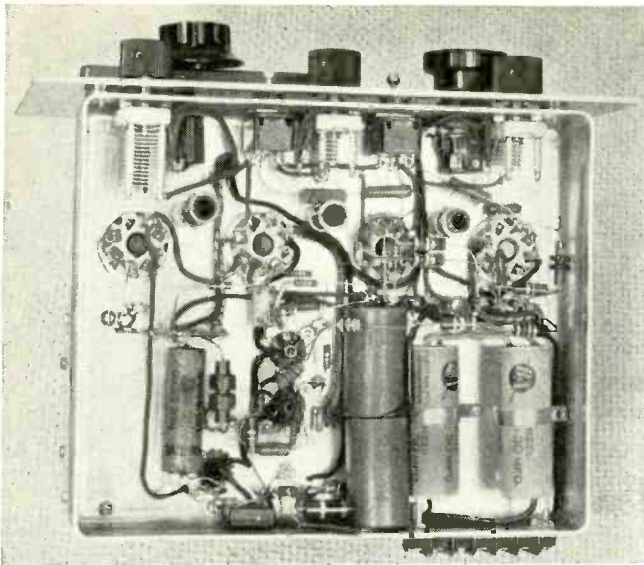


tell a different story due to their extremely low resistance in the conducting direction. As a result, the voltage regulation is excellent. In the exciter, the key-up to key-down voltage change is from 295 to 270 volts when the current change is 40 to 130 ma. The power supply generates very little heat which is important since it helps in obtaining frequency stability.

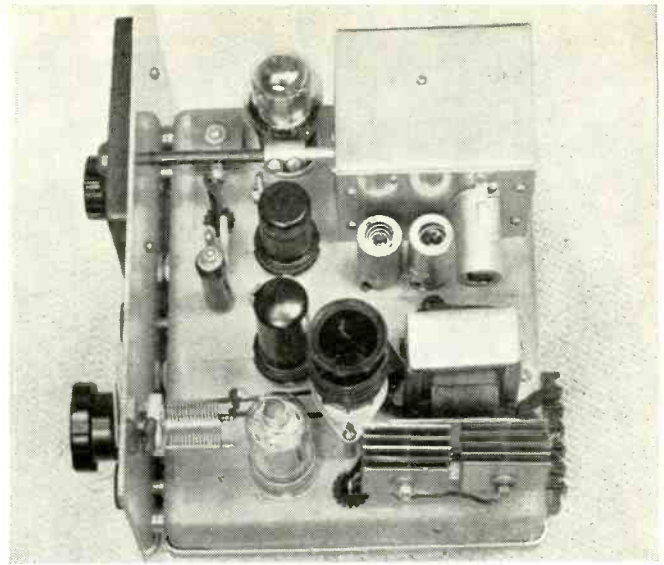
One objection to the transformerless power supply remains: the fact that one side of the power line is connected to the chassis. This need cause no difficulty if the operator is careful to insert the wall plug with the grounded side of the line connected to the chassis. If the transmitter is located some distance from any grounded object, e.g., on the second floor and not near a radiator, the grounded line needs little consideration since neither plug position can cause a shock. Of course, the safest procedure is to provide a good ground lead from the chassis to a water pipe and to be careful to insert the plug correctly. The single wire plug system with the ground lead may also be used.

The variable frequency oscillator uses a 6C4 or 9002 in the now-famous Clapp circuit. The tuning range is 1.7 to 2.0 mc. so that all the amateur frequencies from 3.5 to 29.7 mc. are covered. A great deal has been written recently about the advantages of the Clapp circuit so there is no need to review it here. One point should be mentioned in connection with the stability of the oscillator. If maximum dynamic stability is to be ob-





Bottom view of exciter. The exciter chassis is provided with a cover which has been removed to show wiring. The three variable condensers tune 80, 40, and 20 m. doubler tank circuits.



Top view of exciter. The unit is a self-powered, 15-watt transmitter. The rectifiers are mounted with the fins vertical to aid cooling. The 2E26 plate coil socket is mounted on spacers.

tained it is essential that the oscillator coil have maximum "Q." This requirement necessarily imposes a limitation on the construction since a coil must have a diameter of at least two inches at this frequency if high "Q" is to be obtained. In addition, the shield around the coil should clear it everywhere by at least the coil diameter. It is apparent that the oscillator will become a bulky unit if these conditions are realized. The keying ability of the oscillator depends on the frequency-change versus plate voltage characteristic which we have referred to as the "dynamic stability." Dynamic stability is of only secondary importance if the oscillator is not keyed and is supplied from a voltage stabilized power source. The oscillator still retains the stability which accrues by virtue of the large capacities between grid and cathode, and ground and cathode so that thermal variations in tube constants and changes in load cause little effect on the frequency. It should be emphasized that where dynamic conditions are maintained constant by voltage regulation and by continuous, rather than keyed operation, the Clapp oscillator will be stable even though the coil does not have the highest possible "Q." This is the basis for the compact construction of the exciter. It was reasoned that the best oscillator keying would do no better than approach buffer keying and if back-wave effects could be eliminated the latter would be superior.

In order to provide a constant load for the oscillator the second stage is not keyed. It is coupled to the oscillator through a  $1 \mu\text{fd.}$  condenser. This loose coupling prevents reaction of subsequent stages on the oscillator.

A second 6AK5 is keyed by the blocked-grid system. The network of resistors and condensers in the keying circuit has been carefully proportioned to give excellent keying. From

the diagram it can be seen that resistors  $R_6$ ,  $R_7$ , and  $R_8$  set the key-up bias. The voltage at this point, used to block the grid, should be no greater than necessary to completely cut off the tube or the stage will generate clicks by acting as a pulse-sharpening amplifier. This same rule applies to all the succeeding stages. Next,  $R_9$  and  $C_{24}$  form a time-constant circuit to round off the keyed characters with a slight lag and filter r.f. from the key leads. Third, the value of  $R_7$  is made as low as possible to reduce phase modulation of the wave at high keying speeds which could cause a keying chirp or thump. Phase modulation might result from the variation of the impedance represented by  $R_7$  in parallel with the input capacity of the 6AK5 as this capacity varies with the bias due to Miller effect. Since  $R_7$  is quite low, the impedance of the combination is virtually unaffected by the changing capacitive component.

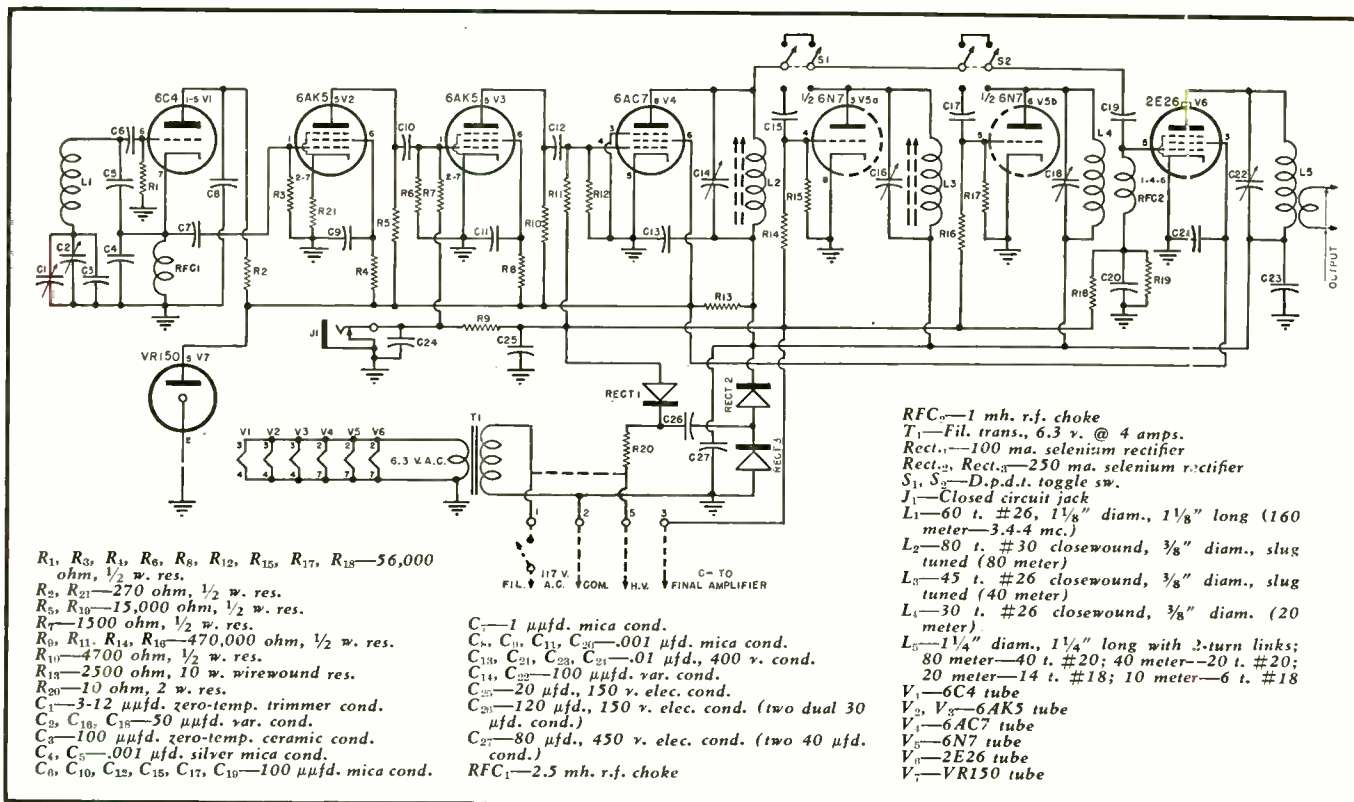
The second 6AK5 produces sufficient output to excite a 6AC7 80 meter doubler. Like all the following stages of the transmitter, this tube has cut-off bias applied from the bias supply. The method in which the bias is applied varies from the usual series fed system. The selenium rectifier bias supply furnishes 125 volts across the  $20 \mu\text{fd.}$  filter condenser. Since this voltage is considerably higher than is required by the exciter stages, voltage dividers are used to introduce the bias to each stage. In the 6AC7 stage, resistors  $R_{11}$  and  $R_{12}$  comprise this bleeder. When the key is up the cut-off bias is determined by the ratio of  $R_{11}$  to  $R_{12}$ . When the key is down the bias is almost entirely determined by  $R_{12}$  alone, since the impedance of the path through  $R_{11}$  and the bias supply is infinite by comparison. This method of applying bias has two advantages: (1) No high current bleeder is necessary, and (2) the self-regulatory character of grid leak bias is obtained. Al-

though an extra resistor is used in each stage, cathode bias resistors and bypass condensers have been eliminated. The final amplifier bias is applied in the more conventional manner from the VR tube with the exciter bias supply furnishing ignition potential. The five milliamperes drained from the exciter bias supply keeps the VR tube lighted when the key is up. Because of the extremely small current drawn from the bias supply, a single filter condenser is adequate.

It has already been mentioned that key click prevention demands low bias. A second requirement is that the bias on each stage be sufficient to completely cut off each tube when the key is up. This conflicting requirement is necessary if backwave radiation is to be prevented. While reasonable care in shielding the transmitter will reduce the radiation in the key-up position, the tube cut-off measure will give the final touch so that break-in operation may be used on the oscillator frequency. A vestigial signal may be heard in the receiver on the 80 and 40 meter bands but it is too weak to mask any other signal. This is a small price to pay for 100% clickless keying. It is possible to monitor the 40 meter band with the transmitter being operated on the same operating table and same band without trouble from clicks. An auxiliary lag circuit is used at the bug, consisting of a small "a.c.-d.c." type filter choke in series with the key and a  $.1 \mu\text{fd.}$  condenser across the key.

The 80 meter tank circuit of the 6AC7 is tuned by the knob on the left below the v.f.o. dial. Ordinarily this control need only be touched if a frequency change is made from one end of the 80 meter band to the other. All three doubler tank circuits are low capacity, low "Q" circuits so that the tuning is not critical. Much simpler than ganged tuning, this system is just as satisfactory and the trans-





Circuit diagram and parts list covering the 15-watt, all-band exciter unit used in the Mini-Rack transmitter.

mitter is always ready to be peaked to the limit of its last ounce of output for a bit of choice DX.

Although the coil forms used in the exciter unit were home-built from bakelite tubing, an almost identical coil form is available from the Cambridge Thermionic Corp. It is the Type LS-3 and is supplied complete with a tuning slug. Since slug-tuning is used only on coils  $L_2$  and  $L_3$ , if the coil form for  $L_4$  (20 meters) has slug-tuning, this must be removed before the coil is wound for this circuit.

Next to the 80 meter tuning control is the 80 to 40 meter bandswitch, an ordinary d.p.d.t. toggle switch. This method of doubler switching is not at all new but was revived after considerable experimenting with wafer and other types of bandswitches. It has the advantage that it is not necessary to backtrack in the wiring since the wiring progresses logically from stage to stage with a bandswitch occurring between the doublers. If possible, toggle switches of the molded bakelite type should be selected in preference to the laminated type. The r.f. losses in either type are quite small but the molded type has a more convenient terminal arrangement with all the lugs on the rear.

Functionally, this switch determines which tube receives the 80 meter signal; in the "up" position the 80 meter output is applied to the doubler stage while in the "down" position the 80 meter signal may be applied to the 2E26 grid. No power supply switching is necessary because of the cut-off bias on the unused tubes.

For 40 and 20 meter doubling, the

two halves of a 6N7 are used with a similar toggle bandswitch between them. Thus it is possible to drive the 2E26 grid with 80, 40, or 20 meter excitation merely by flipping the toggle switches. Due to the high  $\mu$  of the 6N7, very little bias is required to cut off the stages and it is a very efficient doubler. It is operated well below its rating in driving the 2E26.

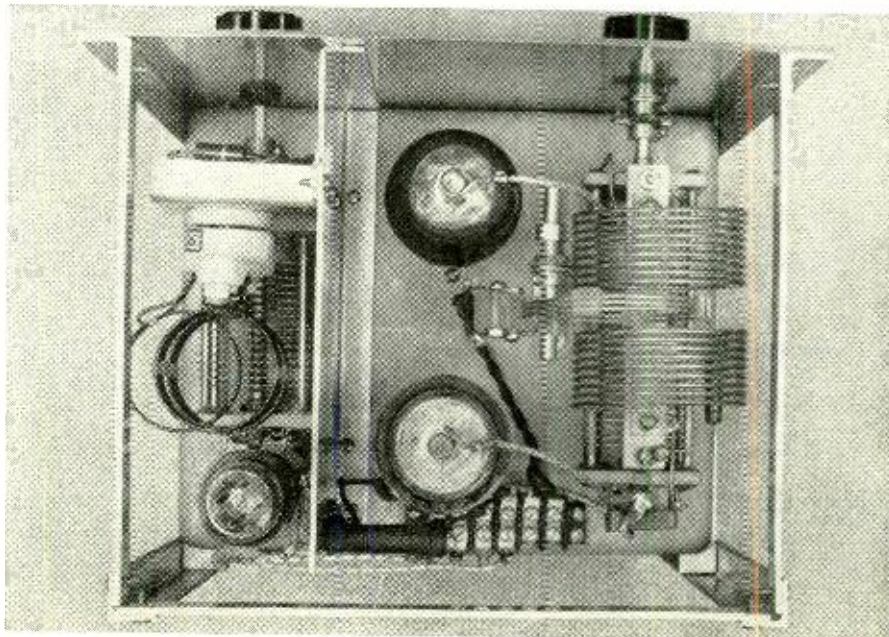
The 40 meter tuning knob is in the center of the lower row with the 20 meter tuning knob on the right. Be-

tween the 40/20 meter bandswitch and the 20 meter tuning knob is the key jack with the 2E26 plate tuning knob above it.

The principal design features of the 2E26 are wasted in the buffer application since the tube is designed for higher frequency operation. The double-ended construction keeps all the plate circuit components above the chassis but since the stage doubles on all bands except 80 meters, there

(Continued on page 114)

Top view of the final amplifier section used in the Mini-Rack transmitter. Push-pull 807's are used. The grid coil is mounted at right angles to the unit's plate coil in order to prevent self-oscillation which might be caused by magnetic coupling.









# SIMULATING TV INTERFERENCE PATTERNS

By  
E. G. LOUIS

**The ability to recognize trouble by the type of pattern is an asset in servicing video receivers.**

**W**HEN television "comes" to a town or city, practically every local radio technician who has not already been studying television will try to get all the information possible within a few short days or weeks. By reading articles, studying manufacturers' service manuals, and, in many cases by actual experimentation (building sets from kits, etc.), he will try to acquaint himself with the principles and practices of the new (to him) field.

It is one thing, however, to read about a condition or circuit, and quite another to actually work on the circuit, or to work on a set with a given defective condition.

One of the most valuable assets that a TV technician can acquire is the ability to recognize trouble by the type of pattern (or lack of pattern) obtained on the screen of the TV receiver. Such an ability enables the technician to reduce servicing time by making his diagnosis much more rapidly, and enables him to isolate the defective section of the TV set much more quickly.

Therefore, for a radio technician or student first learning television, or even for the man with some experience, it is often desirable for him to spend a few days experimenting with a TV receiver known to be in good operating condition. Common defects can be introduced, and their effect on set operation noted. A leaky coupling condenser might be simulated by shunting a condenser with a high value resistance. An open condenser may be simulated by either opening the lead, or by substituting a much smaller condenser. Low emission tubes may be simulated by placing a small resistor in series with the filament lead in order to drop the filament current.

By carrying out this program, the technician can soon learn what symptoms to expect from the more common defects, and is thus in a better position to go right to the source of a complaint.

Some complaints are not too easy to simulate. Interference, for example, apparently cannot be duplicated un-

der test conditions unless an actual interference condition exists. However, a simple technique has been worked out by which the effects of certain types of interference on the screen may be easily shown. By actually demonstrating the patterns obtained, the technician will be in a better position to recognize the cause and so take corrective steps.

The only item, besides a television set, needed for demonstrating some of the more common TV interference test patterns is an ordinary AM signal generator . . . preferably one that can supply either an audio tone, an unmodulated r.f. signal, or a modulated r.f. signal, and in which the operating frequency can be easily varied; in other words, the type of signal generator found in the majority of service shops in the nation.

The signal generator is simply connected across the video second detector load resistor as illustrated in Fig. 1E. It is assumed that the signal generator has a built-in d.c. blocking condenser in series with the "hot" lead. If not, or if there is any doubt, then a .01  $\mu$ fd, 600 v. paper condenser should be connected in series with the "hot" lead.

Both the signal generator and the TV receiver are now turned on. If a station is on the air at the time the experiments are to be carried out, then a program can be tuned in so that the "interference" pattern will appear superimposed on the program picture . . . such as would be the case if actual interference trouble were encountered. But even if a program is not available, the basic patterns can still be shown to advantage.

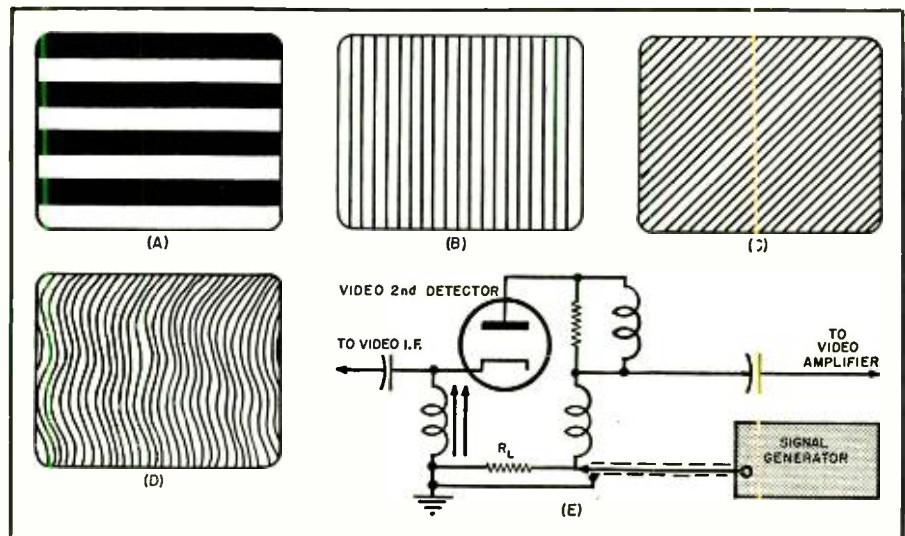
If a program is not being received, adjust the brilliancy and contrast controls on the TV set so that a raster appears on the screen. Then adjust the signal generator to deliver an audio signal.

Since the frequency of the audio signal will be far below that of the horizontal sweep, several lines at a time will be made brighter and darker by the audio signal, resulting in "bars" horizontally across the TV screen as shown in Fig. 1A. If a program is being received, these bars will be superimposed on the picture.

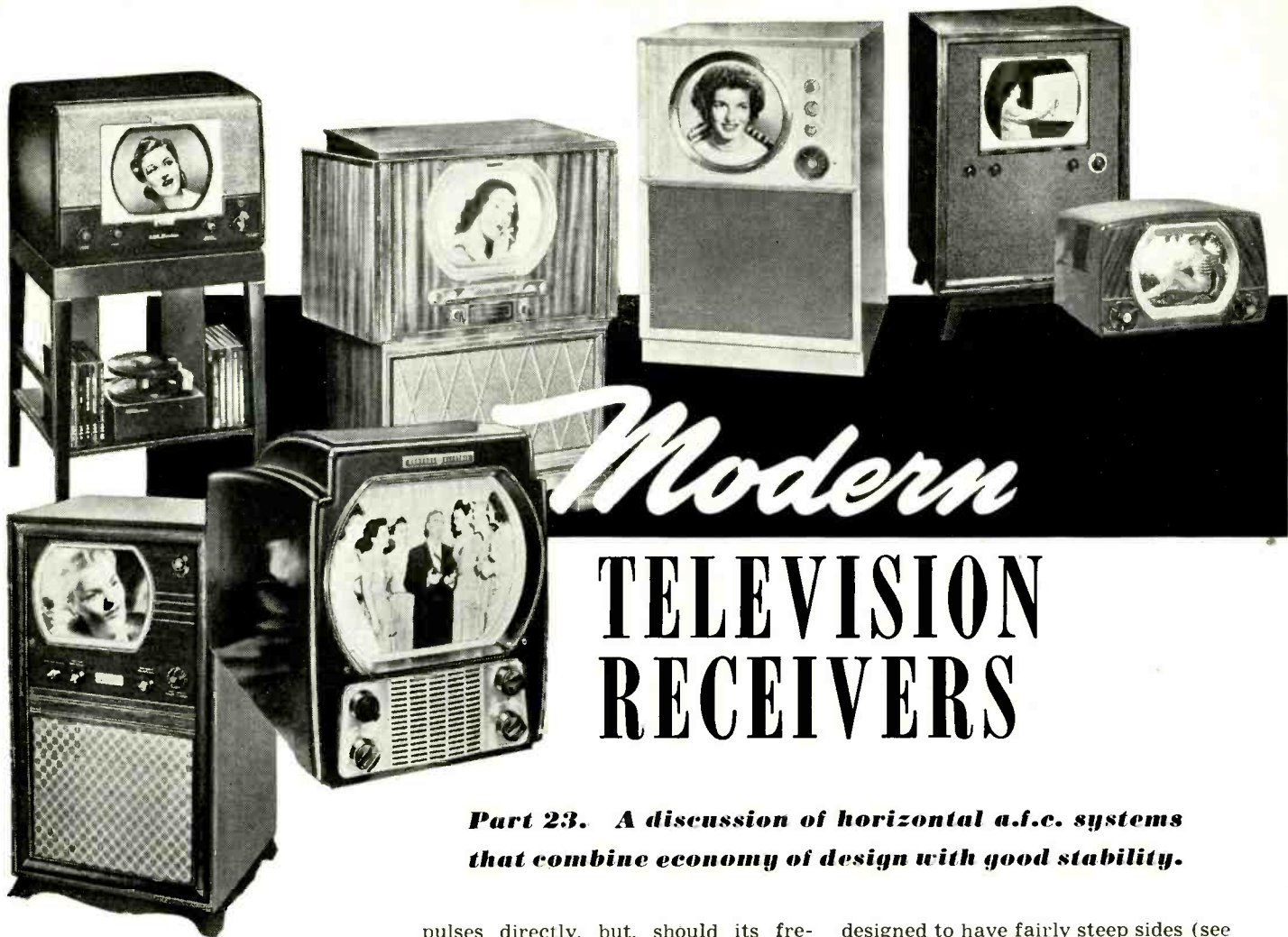
These are the well known "sound bars" that may result from misadjustment of the fine tuning control or local oscillator in a TV set, or from misalignment in the video i.f. stages. Whenever bars of this type (horizontal) appear on a TV screen, you can be pretty sure that an audio signal is get-

*(Continued on page 144)*

Fig. 1.







# Modern TELEVISION RECEIVERS

**Part 23. A discussion of horizontal a.f.c. systems that combine economy of design with good stability.**

1950 TV models—(counter-clockwise) Arvin Model 4080 TV (8½"); RCA Model TC-124 (12½"); Stromberg-Carlson Model TC 125-LA4 (12½"); G.E. Model 12C109 (12½"); RCA Model T-100 (10"); Starrett "Sam Houston" (12½"); and G.E. Model 10T6 (10") in plastic cabinet.

By  
**MILTON S. KIVER**

**T**HE television industry, although very young in years and experience, is already fiercely competitive. Any economy in design which will permit the cost of a set to be lowered without appreciably lowering the standards of set operation is highly desirable. The previously discussed sine wave and saw-tooth wave a.f.c. systems required three and two tubes respectively. The pulse width a.f.c. system, about to be examined, requires only one tube, a relatively inexpensive 6SN7.

The circuit schematic, shown in Fig. 1, consists of a single control tube, a long time-constant filter, and a blocking oscillator. The 6BG6G horizontal output tube is added to the diagram because part of its output voltage is fed back to the control tube. Basically, the horizontal oscillator is a free-running oscillator and discharge circuit. It does not receive the incoming

pulses directly, but, should its frequency differ from that of the pulses, the control tube,  $V_1$ , will alter the negative bias on the grid of the blocking oscillator and thereby change its frequency. It can accomplish this because the cathode resistor  $R_1$  of the control tube is common to the grid of the blocking oscillator. The incoming sync pulses, positive in polarity, are received by the grid of  $V_1$  through a 120- $\mu$ fd. condenser. This same grid also receives a pulse from the horizontal output transformer, plus a parabolic wave from the output of the horizontal oscillator ( $V_2$ ) itself. The pulse from the output transformer and the parabolic wave from the horizontal oscillator form a combined wave, which then reacts with the incoming sync pulses to maintain the blocking oscillator on frequency.

Fig. 1 illustrates the shape of the various voltages reaching  $V_1$ . The wave obtained from the output of  $V_2$  is originally a saw-tooth wave, but it is converted into a parabolic wave by the 150,000 ohm resistor and condenser  $C_1$  before reaching  $V_1$ . The pulse which appears at the secondary of the horizontal output transformer is modified somewhat in form by an integrating network consisting of a 560,000 ohm resistor, a 5  $\mu$ fd. condenser, and  $C_2$ . The shape this pulse finally assumes is shown in Fig. 1.

The combined wave is specifically

designed to have fairly steep sides (see Fig. 2) in order that any difference in frequency between the blocking oscillator and the incoming sync pulses will have a marked effect on the circuit. Here is how this occurs.

A portion of the bias from the blocking oscillator is applied to the grid of the control tube and is sufficient to keep the control tube cut off except when the incoming sync pulse is high on the slope of the grid waveform (the combined wave mentioned previously) as shown in Fig. 2A. If the blocking oscillator changes phase so that the pulse arrives at a time when it is down the slope, the length of time that  $V_1$  conducts will diminish. This is indicated in Fig. 2B by the narrow width of the waveform extending above the cut-off point of the tube  $V_1$ . On the other hand, if the blocking oscillator frequency changes so that the sync pulse arrives at a time when it is closer to the top of the combined wave (Fig. 2C), then the plate conduction time of  $V_1$  will increase. When the control tube conducts,  $C_1$  and  $C_2$  in its cathode circuit will charge to a d.c. potential proportional to the length of time that current flows through the tube. This d.c. potential is applied as a bias to the grid of the blocking oscillator, thereby altering its frequency and tending to bring it back into line.

A long time-constant filter to



achieve an averaging effect is placed in the cathode leg of  $V_1$  and consists of  $R_1$ ,  $R_4$ , and  $C_1$ . Note, however, that these are not the only components in this portion of the circuit.  $C_1$  (a .02  $\mu$ f. condenser) and  $R_5$  (an 8200 ohm resistor) are also present and their purpose is to provide better sync control of the oscillator by permitting a small component of the sync pulse to reach the grid of the oscillator tube,  $V_2$ . The combination of the long time-constant filter with the short time-constant filter thus presents to the oscillator a large d.c. component (due to the averaging effect of  $R_1$ ,  $R_4$ , and  $C_2$ ) plus a much smaller a.c. component (due to  $C_1$  and  $R_5$ ).

There are five controls associated with this circuit and they function as follows: The blocking oscillator transformer,  $L_1$ , is slug-tuned to permit coarse adjustments in oscillator frequency.  $C_3$ , connected across the resistor common to the control tube and blocking oscillator, can provide fine adjustments in frequency. The horizontal hold control will affect the plate voltage of the control tube and, in this manner, the amount of voltage developed across  $R_1$ . This is the only front-panel control of the group.  $C_4$  is part of a voltage divider network that controls the amplitude of the waveform on the grid of the control tube.  $C_4$  will therefore control the point at which  $V_1$  starts to conduct. Finally,  $C_5$  is part of a capacitance voltage divider and regulates the amount of voltage reaching  $V_2$ . It partially controls the width of the picture and partially the linearity of the left-hand side of this image. An additional linearity control located at a subsequent point in the horizontal sweep system regulates the over-all horizontal linearity.

Several components of the oscillator and control circuits have special coefficients or characteristics and, in case of failure, should be replaced only by an exact duplicate.  $R_2$  is a special resistor capable of stability of 1 per-cent or better.  $R_3$  is a high negative coefficient resistor to compensate for warm-up drift. It is mounted within about  $\frac{1}{4}$  inch of the power transformer and chassis for good heat transfer.

**Adjustment of Pulse-Width A.F.C. System.** When the pulse-width a.f.c. system is operating properly, it should be possible to perform the following test on it. Permit the set to warm up for about 5 minutes and then tune in a station with the station selector control. The picture should be locked-in. Now, rotate the horizontal hold control,  $R_6$ , over its entire range. It should be possible to hold the picture in sync throughout three-fourths of this range. Next, place the control at mid-position, switch to another channel and back again. The picture should immediately lock into synchronization. It will be found when switching stations, that the picture will lock in throughout more than half the range of  $R_6$ , although generally

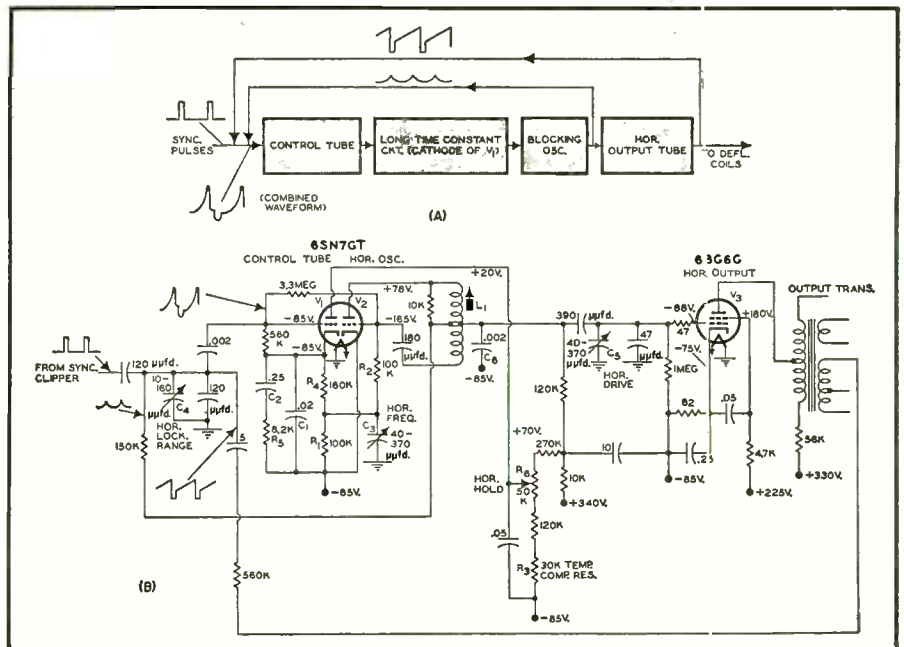


Fig. 1. Schematic diagram of the pulse-width a.f.c. system. The waveforms are shown as to shape only and are not indicative of their relative size.

not when this control is set at either extreme position.

If it is found that the picture tends to slip out of synchronization or that after switching stations, the picture does not immediately lock-in, the following adjustments should be made.

Adjust the iron core of  $L_1$  for a steady picture, with the front panel horizontal hold control at mid-position. Note whether the picture remains locked-in as  $R_6$  is rotated through half its range. Set the hold control to its mid-position, switch to another channel and then back again. If the picture does not remain in sync, back off the horizontal locking trimmer,  $C_4$ , to 2 to 2½ turns from tight. Next, turn the horizontal hold control to the extreme counter-clockwise position and back off on the horizontal frequency trimmer,  $C_3$ , until the picture tends to slip to the right, then turn the hold control clockwise until the picture locks in. When this has been done, it should be possible to switch stations or turn the set on and off without losing synchronization.

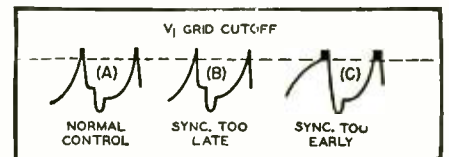
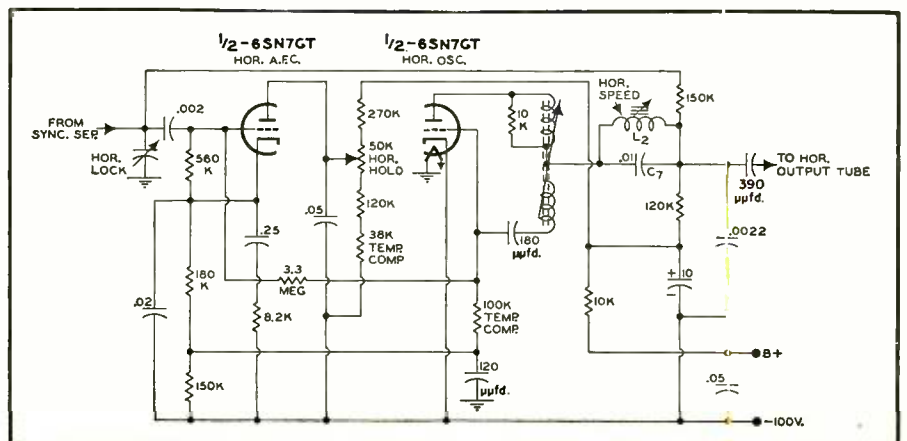


Fig. 2. Horizontal control waveforms. Area above dotted line is portion of waveform effective in controlling oscillator.

A slight modification of the circuit of Fig. 1, which is frequently seen, is the circuit shown in Fig. 3. The horizontal frequency trimmer condenser,  $C_3$ , has been replaced by a fixed condenser and a parallel resonant circuit consisting of  $C_7$  and  $L_2$  has been placed in series with the charge and discharge condenser,  $C_6$ . This is a stabilizing circuit, designed to improve the stability of the oscillator and control circuits. With these additional components in the circuit, the adjustment procedure is as follows:

1. Set the horizontal hold control to the full clockwise position.
2. Adjust the horizontal lock

Fig. 3. Schematic diagram of a variation of the pulse-width a.f.c. system.





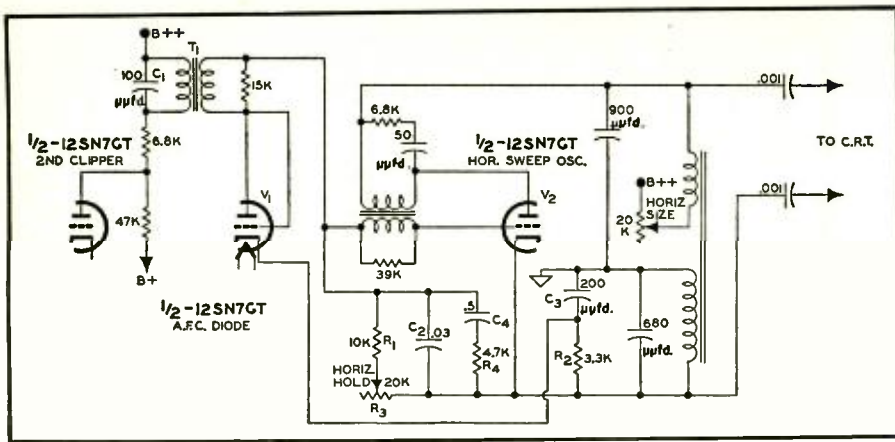


Fig. 4. A simple a.f.c. system employed by Motorola in their 7-inch TV sets.

trimmer to at least two turns from maximum tightness.

3. Short circuit  $L_2$ .

4. With a signal being received, and with the horizontal hold control in the full clockwise position, set the iron core adjustment of  $L_1$  to frame the picture.

5. Remove the short from  $L_2$  and adjust the iron core of  $L_2$  until the picture remains in sync over the greatest range of the horizontal hold control.

#### Additional A.F.C. Systems

Continuing in the same vein of economy and simplicity of construction, *Motorola* has devised two a.f.c. circuits which are currently being used in many of their television receivers. The first circuit, employed principally in their 7-inch television sets, is shown in Fig. 4. It consists of a triode connected as a diode and obtained from the same envelope as the horizontal blocking oscillator. (The operation of this particular oscillator was described previously.)\* In common with all other a.f.c. systems, the incoming sync pulses do not directly affect the sweep oscillator, but rather influence its operation by varying the plate current flowing through the a.f.c. diode ( $V_1$ ). Note that the plate of the diode connects directly to the grid of the sweep oscillator. Further, the cathode of the a.f.c. diode is attached to  $R_2$  which is part of a differentiating network receiving the output sawtooth deflection voltage that  $V_2$  applies to one deflection plate in the 7JP4 cathode-ray tube. During retrace, a sharp negative pulse develops across  $R_2$  and it is the frequency of these pulses which is compared with the frequency of the incoming sync pulses. If the two are not identical, the plate

current of the a.f.c. diode is altered, altering the negative bias on the grid of the horizontal sweep oscillator and thereby producing a frequency change.

In detail, the circuit functions as follows: Condenser  $C_1$  and the primary winding of  $T_1$  form a parallel resonant circuit which receives the incoming horizontal sync pulses and converts them to an a.c. wave. See Fig. 5A. (Actually, this tuned circuit is self-resonant to a frequency close to 15,750 cycles and the incoming sync pulses merely maintain oscillations in this network by continuous triggering. Resonant circuits used in conjunction with class C amplifiers operate in the same manner.) At some time during this a.c. cycle, the cathode of  $V_1$  receives a sharp negative pulse from  $R_2$ . The negative retrace pulse on the cathode of  $V_1$  is equivalent to a positive pulse on the plate. The combined sync wave and firing pulse on the plate of  $V_1$ , with respect to the cathode, is shown in Fig. 5B. This particular position of the retrace pulse along the slope of the sync wave represents the desired operation, i.e., when the two are in frequency step with each other.

If the horizontal oscillator tends to run fast, its triggering pulse will appear sooner and its position would then be higher up on the slope of the sync wave. See Fig. 5C. With this condition, the positive plate voltage of the diode will be greater, causing more plate current to flow. The current, flowing through  $R_1$  and  $R_3$ , will raise the negative voltage developed across these resistors and across  $C_2$ . This will bias  $V_1$  more negatively,

causing the tube to remain non-conductive for a longer period of time and thereby lowering the sweep frequency.

By the same token, if the horizontal sweep frequency should decrease below the desired value, the triggering pulse from  $R_2$  will appear later than usual, or farther down on the slope of the sync wave. See Fig. 5D. The plate voltage of the diode will now be less positive, resulting in decreased current flow. Less current through  $R_1$  and  $R_3$  will lower the negative voltage here (and across  $C_2$ , also) and permit the blocking oscillator to come out of the cutoff sooner. The result: an increase in frequency. Thus, any tendency on the part of the sweep oscillator to change frequency will be compensated by the diode drawing more or less current.

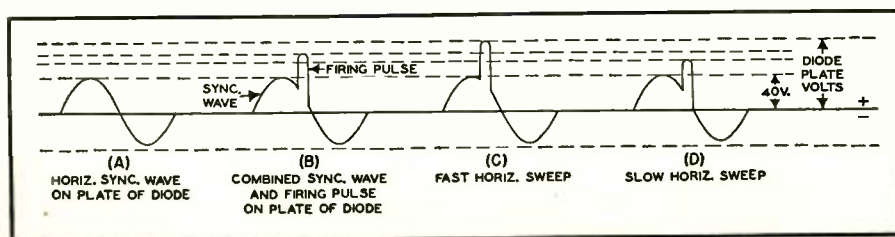
Condenser  $C_4$  and resistor  $R_4$  form a long time-constant filter to hold the horizontal sweep oscillator in synchronization for approximately 50 lines.

A second a.f.c. circuit that *Motorola* has begun to use is shown in Fig. 6. (Strictly speaking, this is not an a.f.c. circuit in the same sense as the previous a.f.c. circuits. It does not, for example, compare the horizontal sweep frequency with the frequency of the incoming pulses. What it does is to synchronize the horizontal oscillator through an intermediate locked-in oscillator. However, it does represent another approach to automatic frequency control and hence can justly be included under a.f.c. systems.) The circuit consists of a diode sync clipper ( $V_1$ , 6AL5), a Colpitts oscillator ( $V_2$ ), and a horizontal blocking oscillator,  $V_3$ . The incoming sync pulses lock-in the frequency of the Colpitts oscillator and the positive pulses obtained from the Colpitts trigger the following horizontal blocking oscillator. When no sync pulses are reaching the receiver, the Colpitts still continues to oscillate and trigger the blocking oscillator.

In operation, negative sync pulses from the cathode of the sync separator tube (not shown here) are differentiated by  $C_1$  (.002  $\mu\text{fd.}$ ) and  $R_1$  (10,000 ohms). This provides a negative pulse at the leading edge of all sync pulses and a positive pulse at the trailing edge of all sync pulses. Since  $V_1$  is a diode, it will conduct only when its plate is positive with respect to its cathode and this occurs only at the leading edge of all sync pulses. The positive pulse that appears at the trailing edge is unable to pass through the diode and is effectively suppressed. The negative pulses that do cause diode conduction produce the same effect as though the cathode were grounded and the plate of the tube had received a positive pulse. The diode plate current, flowing through  $R_3$ , develops a triggering pulse here which controls the frequency of the Colpitts oscillator tank circuit ( $R_2$ ,  $L_1$ ,  $C_2$ , and  $C_3$ ). The result of this lock-in is the generation of a 15,750 cycle sine

(Continued on page 110)

Fig. 5. Waveforms in the a.f.c. circuit shown in the schematic of Fig. 4.



\* Kiver, Milton S.: "Modern Television Receivers," Part 19, RADIO & TELEVISION NEWS, October, 1949.



By  
**SAMUEL FREEDMAN**

# Elimination of RADIO INTERFERENCE By OFF-FREQUENCY INVERSION

*Improvement in receiver selectivity  
may be obtained with this new circuit.*

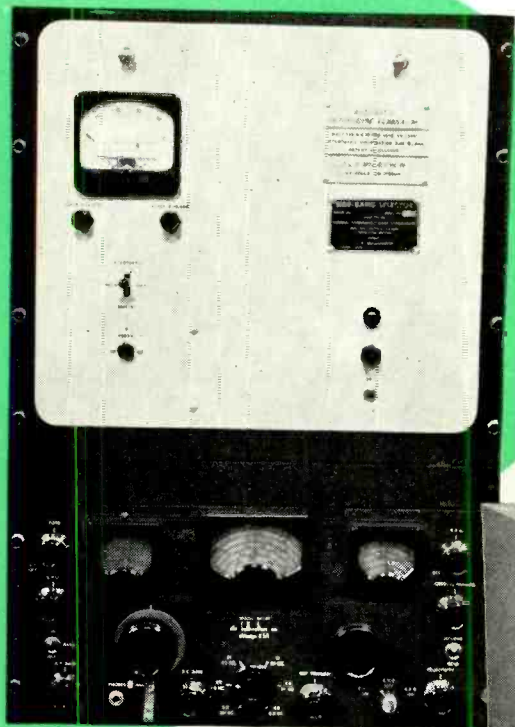


Fig. 1. First heterodyne eliminator using off-frequency inversion. Originally built for the FCC, it is now in the Commission's Instrument Museum.

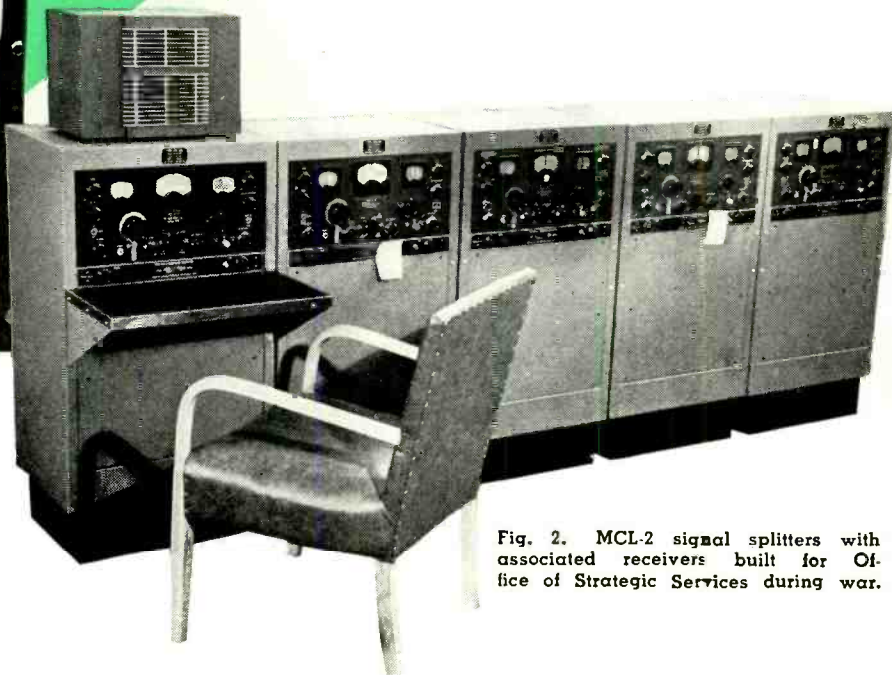


Fig. 2. MCL-2 signal splitters with associated receivers built for Office of Strategic Services during war.

**T**HE first improvement in radio receiver selectivity in twenty years—since James Lamb's invention of phasing control to permit the use of crystal filters—is the asymmetrical off-frequency inverter type of heterodyne eliminator developed by James L. A. McLaughlin of LaJolla, California. It is an outgrowth of wartime developments undertaken in his laboratory for the Radio Intelligence Division of the Federal Communications Commission and for the Office of Strategic Services (OSS).

At the outbreak of World War II, the Federal Communications Commission had the problem of monitoring and receiving Japanese signals. Spoken Japanese contains very high frequencies not encountered in spoken English. The sibilants of the Japanese language are as much a part of the meaning or interpretation of the word as are the syllables themselves. Where English, as spoken by Americans, can be quite intelligible with a maximum

modulating frequency of 3000 c.p.s., our translators might require as much as 5000 c.p.s. to get the gist of material in Japanese.

During the search for more suitable radio receiving apparatus to cope with this problem, an FCC engineer obtained Mr. McLaughlin's original model of the heterodyne eliminator as shown in Fig. 1. This signal splitter, or heterodyne eliminator, was designated the Type MC-1. This was later modified to become the first automatic heterodyne eliminator. The instrument is now in the Instrument Museum of the Federal Communications Commission in Washington and represents the first unit of its type ever constructed.

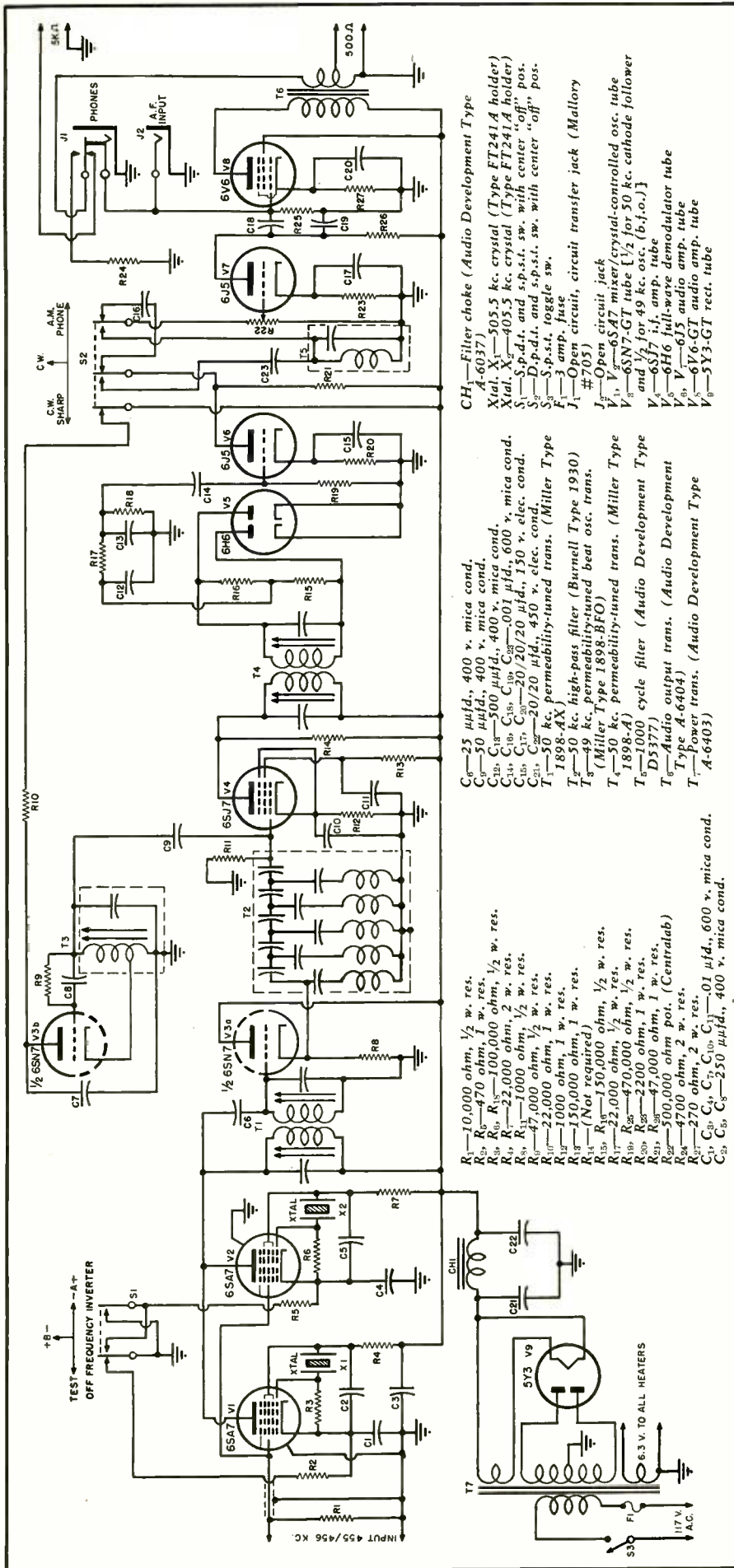
This early model was used in conjunction with a standard *Hallcrafters* Model SX-28 receiver. On the basis of

extensive tests these units were ordered for all of the primary monitoring stations of the Radio Intelligence Division.

When the Communication Branch of the Office of Strategic Services was established in 1942, it was faced with the task of copying signals through terrific jamming. Similar apparatus for anti-jamming purposes was ordered and evolved as the MCL-2 shown in Fig. 2. These units were used extensively during the war wherever the jamming problem was encountered.

By the end of the war a third type of heterodyne eliminator had been developed. Known as the MCL-3 this apparatus did not require any modification of the receiver. An internal view of this model is shown in Fig. 4. With this unit if interference was encountered on one side of a mean fre-





- R<sub>1</sub>—10,000 ohm, 1/2 w. res.
- R<sub>2</sub>—470 ohm, 1 w. res.
- R<sub>3</sub>—R<sub>15</sub>—100,000 ohm, 1/2 w. res.
- R<sub>16</sub>—22,000 ohm, 2 w. res.
- R<sub>17</sub>—1,000 ohm, 1/2 w. res.
- R<sub>18</sub>—47,000 ohm, 1/2 w. res.
- R<sub>19</sub>—22,000 ohm, 1 w. res.
- R<sub>20</sub>—1,000 ohm, 1 w. res.
- R<sub>21</sub>—150,000 ohm, 1 w. res.
- R<sub>22</sub>—(Not required)
- R<sub>23</sub>—R<sub>25</sub>—100,000 ohm, 1/2 w. res.
- R<sub>26</sub>—470,000 ohm, 1/2 w. res.
- R<sub>27</sub>—R<sub>28</sub>—22,000 ohm, 1 w. res.
- R<sub>29</sub>—R<sub>30</sub>—47,000 ohm, 1 w. res.
- R<sub>31</sub>—500,000 ohm pot. (Centralab)
- R<sub>32</sub>—4700 ohm, 2 w. res.
- R<sub>33</sub>—270 ohm, 2 w. res.
- C<sub>1</sub>—C<sub>5</sub>—C<sub>7</sub>—C<sub>10</sub>—C<sub>11</sub>—0.01 μfd., 600 v. mica cond.
- C<sub>6</sub>—C<sub>9</sub>—C<sub>12</sub>—C<sub>13</sub>—250 μfd., 400 v. mica cond.
- C<sub>14</sub>—25 μfd., 400 v. mica cond.
- C<sub>15</sub>—50 μfd., 400 v. mica cond.
- C<sub>16</sub>—500 μfd., 400 v. mica cond.
- C<sub>17</sub>—C<sub>18</sub>—C<sub>19</sub>—C<sub>20</sub>—0.01 μfd., 600 v. mica cond.
- C<sub>21</sub>—C<sub>22</sub>—20/20 μfd., 150 v. elec. cond.
- C<sub>23</sub>—C<sub>24</sub>—20/20 μfd., 450 v. elec. cond.
- C<sub>25</sub>—50 kc. permeability-tuned trans. (Miller Type 1898-AX)
- C<sub>26</sub>—50 kc. high-pass filter (Burrill Type 1930)
- C<sub>27</sub>—49 kc. permeability-tuned beat osc. trans. (Miller Type 1898-BFO)
- C<sub>28</sub>—50 kc. permeability-tuned trans. (Miller Type 1898-A)
- C<sub>29</sub>—1000 cycle filter (Audio Development Type D5377)
- C<sub>30</sub>—Audio output trans. (Audio Development Type A-6404)
- C<sub>31</sub>—Power trans. (Audio Development Type A-6403)
- CH<sub>1</sub>—Filter choke (Audio Development Type A-6037)
- Xtal. X<sub>1</sub>—505.5 kc. crystal (Type FT241A holder)
- Xtal. X<sub>2</sub>—405.5 kc. crystal (Type FT241A holder)
- S<sub>1</sub>—S.p.d.t. and s.p.s.t. sw. with center "off" pos.
- S<sub>2</sub>—D.p.d.t. and s.p.s.t. sw. with center "off" pos.
- S<sub>3</sub>—S.p.s.t. toggle sw.
- F<sub>1</sub>—3 amp. fuse
- J<sub>1</sub>—Open circuit, circuit transfer jack (Mallory #705)
- J<sub>2</sub>—Open circuit jack
- V<sub>1</sub>—V<sub>9</sub>—6SA7 mixer/crystal-controlled osc. tube
- V<sub>2</sub>—6SN7-GT tube [1/2 for 50 kc. cathode follower and 1/2 for 49 kc. osc. (b.t.o.)]
- V<sub>3</sub>—6SJ7 i.t. amp. tube
- V<sub>4</sub>—6H6 full-wave demodulator tube
- V<sub>5</sub>—V<sub>8</sub>—6J5 audio amp. tube
- V<sub>6</sub>—6V6-GT audio amp. tube
- V<sub>9</sub>—5Y3-GT rect. tube

quency it could be manually switched to invert the frequency and select the side which was free or freer of interference. Some of the units were constructed so that this operation could be performed automatically.

The result of all this development work was the standardization on the Type MCL-4 shown in Fig. 6. This unit contains an important improvement over the MCL-3 which has been described previously.<sup>1,2</sup> High-pass filters replaced the tuned permeability type of transformers, which required critical alignment, used in the earlier models. Fig. 11 shows the internal view with the cabinet opened for servicing or inspection. Fig. 9 shows the easy accessibility of all tubes in the MCL-4 when the dust cover is removed. The largest can (marked T<sub>1</sub>) in Fig. 9 is the compact high-pass filter which is made up of five toroidal coils and nine fixed condensers. Over 10% of the total cost of the MCL-4 is represented by this single unit.

This new model takes care of all the previous requirements of the FCC and OSS as well as the general receiving problem of virtually every type of radio communications service. The latter may include problems associated with adjacent channel interference, stations in close proximity irrespective of the amount of frequency separation, accidental or malicious interference, simultaneous usage of a common communications band by more than one station, etc. In this connection, this type of equipment is suitable for such users as airways radio networks, mobile radio systems, common carrier radiotelephone systems, marine radiotelegraph stations ashore and afloat, or wherever dependable radiotelephony and radiotelegraphy must be maintained irrespective of interference or heterodyning.

Four patents, with variations, have been applied for and two have already been granted on the principles of off-frequency inverters. It will be used more and more often to afford relief during S.O.S. emergency situations, interference, the presence of uncooperative signals, variations in receiver selectivity, and wherever the radio spectrum is congested or overcrowded.

Development work is now being expanded with newly filed patents on a heterodyne elimination system for single sideband transmission which will automatically remove the beat of a carrier lying in the band of intelligence. It is a well-known fact that most radio and electronic equipment is obsolescent by the time it reaches the user and obsolete within about five years. The common receiver basic selectivity, or signal separating ability, is twenty years old. Nothing of real importance has been done in the past two decades to improve signal separation since the first receivers were built incorporating a crystal filter. This new development seems to be the first

Fig. 3. Complete schematic diagram of the McLaughlin Type MCL-4 signal splitter.



worthwhile improvement along this line.

Fig. 3 is the circuit diagram of the MCL-4 heterodyne eliminator or signal splitter together with a complete parts list. Fig. 5 is an elementary block diagram of a heterodyne suppressor of a heterodyne inverter type suitable for unmodulated reception.

Let us assume that a desired signal of 455 kc. is present, for example a code signal from the i.f. of a receiver, and that an interfering signal of 455.8 kc. is also present. As shown, two fixed oscillators are used, separated from the desired signal by 1 kc. Thus, if the 456 kc. oscillator is used, the desired signal will be converted to a frequency of 1 kc. and the undesired signal to 200 cycles. This mixed signal is sent through an asymmetrical off-frequency filter with a center frequency of 1000 cycles. This filter will permit a 1000 cycle signal to pass through but attenuates all signals below 1000 cycles very sharply. Thus, in this case, the desired 1 kc. signal would pass through while the undesired 200 cycle interfering signal would be attenuated 60 db.

If the 454 kc. oscillator is used, the desired signal again becomes 1 kc. and the undesired signal 1.8 kc., which will be attenuated 25 db. in the filter. Thus, either oscillator may be switched on, the one giving the highest attenuation of the undesired signal being the most satisfactory operating position in most cases. This is true whether the unwanted signal is higher or lower in frequency than the desired carrier.

Fig. 7 is a simplified block diagram of the heterodyne eliminator for either voice or code reception. It will be noted that two off-frequency inverters are used, one feeding the 50 kc. asymmetrical off-frequency filter and the other the 1 kc. filter previously described. The 50 kc. filter is of the high-pass type, cutting off very sharply below 50 kc. The off-frequency inverter is switched so that the undesired signal is below 50 kc., and is thus highly attenuated. For example, a carrier 1.5 kc. off center may be down as much as 100 db. on phone-type signals. Even greater attenuation is possible with code signals due to the action of the second off-frequency inverter and filter.

Normally, the MCL-4 signal splitter is intended for use with any communications receiver having an intermediate frequency of approximately 455 kc. If the i.f. is other than 455 kc., it is only necessary to change the two local oscillator crystals to 50 kc. above and 50 kc. below the appropriate i.f. setting. No realignment or circuit changes are required in the associated receiver. The unit connects to the receiver through a small coaxial cable, the end of which has an insulated loop. This loop is placed over the plate pin of the first i.f. amplifier tube and the tube is replaced in its socket. The signal splitter has been designed for con-

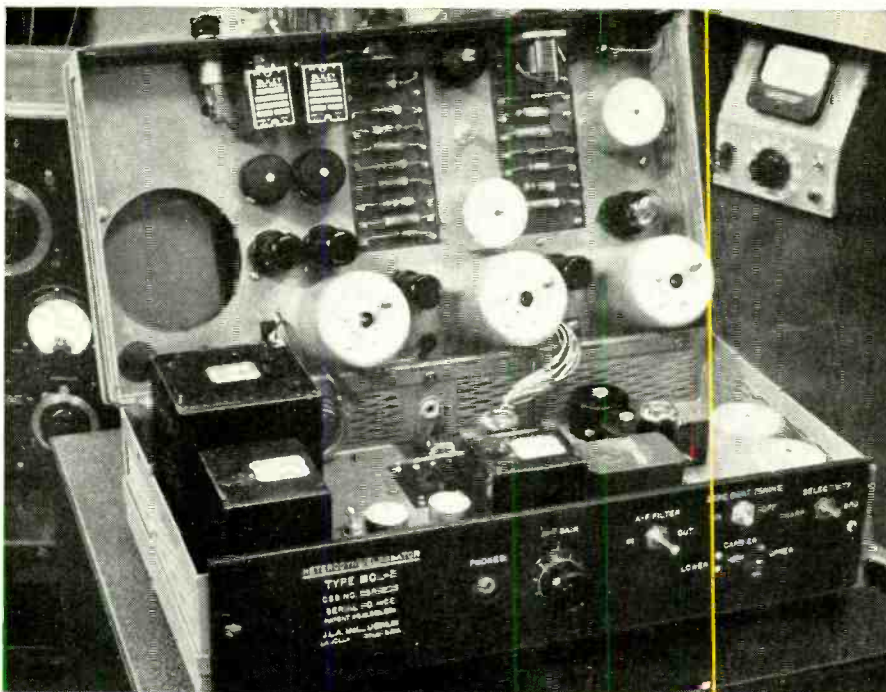


Fig. 4. Type MCL-3 heterodyne eliminator using tuned transformers instead of filters. This eliminator may be used without modification of the associated receiver unit.

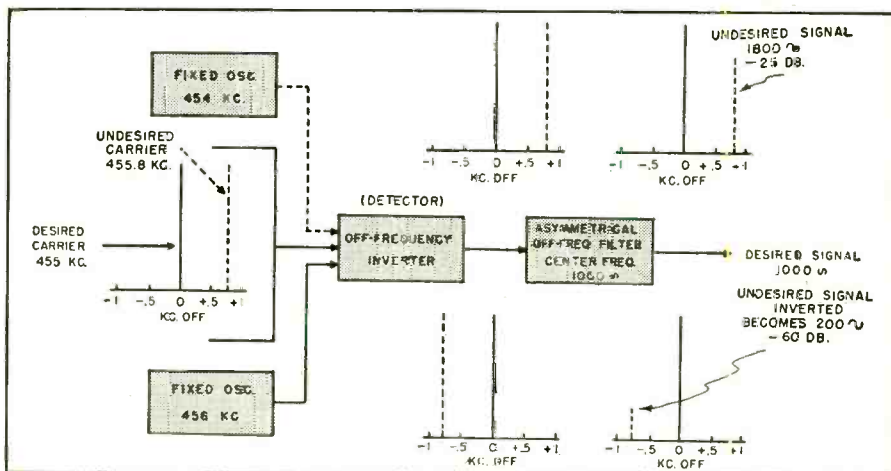


Fig. 5. Elementary block diagram of a heterodyne suppressor of the off-frequency inverter type which is suitable for the reception of continuous wave signals.

Fig. 6. Type MCL-4 signal splitter built for U. S. Coast Guard radio stations.





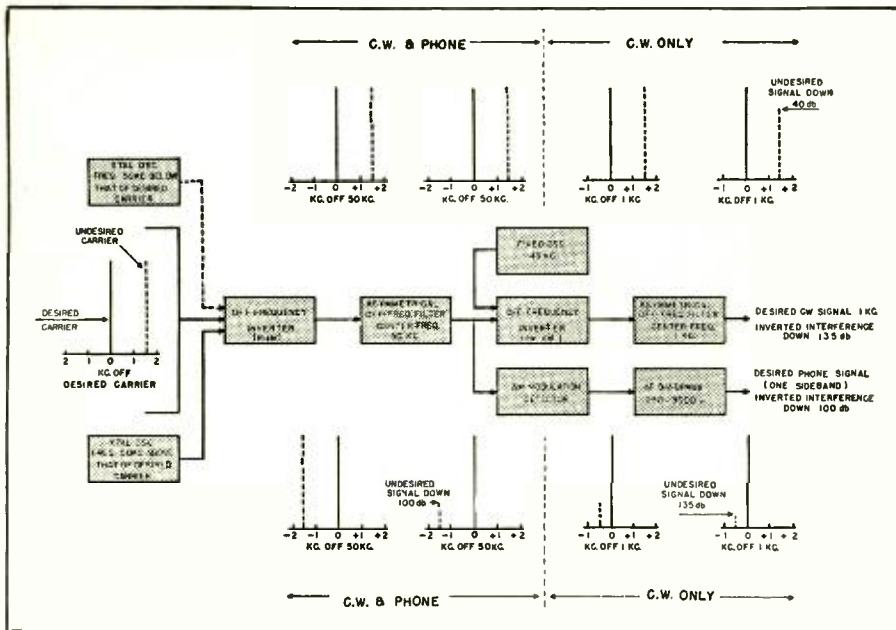
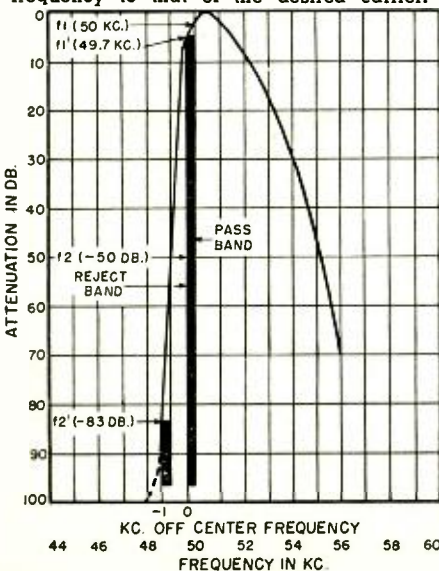


Fig. 7. A simplified block diagram of the Type MCL-4 signal splitter.

tinuous operation and has a power drain of 70 watts from a 105/125 volt, 60-cycle, single-phase source. The audio output of the instrument at 5% harmonic distortion is approximately

Fig. 8. Asymmetrical selectivity curve of the MCL-4 signal splitter. As illustrated, the desired signal will be at 50 kc. Should an undesired signal lie 1 kc. removed (51 kc.) there would exist a heterodyne beat note of 1000 cycles which would be disagreeable. By using the frequency inverter feature, 51 kc. will be changed to 49 kc., while the desired signal remains at 50 kc. The undesired signal will be attenuated 50 db. Should an unusually strong signal and greater attenuation be required, a shift of but a few hundred cycles in tuning will provide an increase in attenuation of the desired signal. The solid line at 50 kc. is 300 cycles wide. Should greater attenuation be desired, the operator shifts his tuning. The desired signal is now 49.7 kc. ( $f_1'$ ) instead of 50 kc. ( $f_1$ ). The interfering signal,  $f_2$  (49 kc.) has now been shifted 300 cycles to position  $f_2'$  showing an increase of 33 db. attenuation (-83 db.) thus affording extreme selectivity to heterodyne interference lying very close in frequency to that of the desired carrier.



two watts. On c.w. reception 4 to 5 watts output power can be achieved without noticeable distortion.

A signal that will drive the receiver to full output will develop a voltage across the primary of the i.f. transformer (connected to the plate of the first i.f. tube) sufficient, when coupled through the capacity loop, to drive the signal splitter to approximately full output. If this capacity loop is placed around the pin of the second i.f. tube instead of the first, serious overloading of the signal splitter will result. This overloading could seriously impair the instrument's ability to reject heterodynes. For this reason, it is necessary that the capacity loop be coupled to the plate of the first i.f. tube.

With regards to phone-type signals, this system takes advantage of normal double sideband modulation. The fact that intelligence is duplicated on both sides and a carrier which can produce a beat note lies within one band, the system permits cutting off that whole band without losing the demodulated intelligence since it is also present on the other sideband. In such cases where the interference is of excessive magnitude in both bands, no further improvement can be made. This has led to investigations and further development of an improved communications system. This development now forms the basis of new patent applications which are as yet not ready for release to the public. It involves improved forms of modulation which permit an interfering carrier lying within a single sideband of intelligence to be handled with as much ease as the present systems requiring two sidebands.

In the case of professional c.w. code reception, the desired c.w. signal becomes a beat note of 1000 cycles due to the sharply tuned 1000 cycle bandpass filter in the audio circuit and the fact that the b.f.o. is fixed at 49 kc. In Fig.

8 it may be noted that the image frequency will be 48 kc. (derived by 49 kc. minus 1 kc. beat note) while the desired signal will be 50 kc. (49 kc. plus 1 kc.). In this example, it means that the undesired signal will be over 100 db. down. Fig. 8 shows the increase in attenuation to low frequencies that a slight detuning of the desired carrier achieves (50 kc.) toward the cut-off side. The left hand edge of the solid line at 50 kc. indicates a frequency shift of the carrier of approximately 300 cycles. At this point the carrier will be down 5 db. The bottom of the curve illustrates the increase in attenuation this small frequency shift gives a signal 1 kc. removed from the desired carrier, 33 db. greater attenuation has been realized. Frequencies closer to the carrier than 1 kc. will receive proportionate improvement in attenuation. Frequencies below the voice range are satisfactorily attenuated in the a.f. amplifier.

Even though the undesired signal is over 100 db. down it does not mean that the beat produced will be of this value since it is necessary to take into account the peculiar action of detectors. The detector is working as a square law detector on a weak signal and a linear detector on a strong signal. In this instance, the beat is proportional to the b.f.o. and the weak signal where in the case of the linear detection the signal is proportional to the weaker of the two mixed. In practice, it has been found that the beat note's actual measured attenuation is in the order of 80 db. This is sufficient attenuation for good reception of the desired signal. The theory of detection also applies to a crystal filter. For example, there might be many curves which show an attenuation of 60 db. whereas the beat note attenuation actually may not be more than about 40 db. This explains the disparity between theoretical crystal filter selectivity curves and those encountered in practice.

Fig. 10 is a block diagram of the automatic version of the anti-jamming or heterodyne eliminator which is similar to the apparatus shown in Fig. 1. A frequency discriminator "senses" the interference and operates the heterodyne (heterodyne automatic) switch to cut out the malicious interference automatically. It can perform this function automatically at any required rate even where FM jamming is taking place. It was developed during the war for use by radio intelligence groups which encountered this type of interference.

The effect of a drift in frequency of the receiver's local oscillator is not important. The operator, in practice, is fighting interference all the time and adjusting controls. The amount of drift present in any brief period is not too great.

The i.f. mean frequency of 455.5 kc. normally employed is supposed to take care of the fact that most receivers use either 455 or 456 kc. The i.f. is un-



important because 455 or 456 kc. is actually wide-band amplification compared to the selectivity of the signal splitter. Radio receivers are considered good when their i.f. stability is  $\pm 2\%$ . The same holds true for crystal filters when they are  $\pm 10$  kc.

Unlike most accessory items, the MCL-4 signal splitter reduces rather than increases the complexity of operation. For example, in the case of c.w. reception without this accessory, an operator trying to receive through interference may have to adjust the volume control, tuning control, crystal phasing control, b.f.o., etc. When the MCL-4 unit is employed, the entire process of shifting from the interfering side to the clear side of the mean frequency is automatically and instantly achieved by means of one off-frequency inverter toggle switch. The operator does not have to fuss with controls and lose time as well as signals. He quickly determines which side has the minimum interference and concentrates on that side. When a heterodyne is picked up, it is tuned in for maximum on the receiver. Then, by throwing the toggle switch, it is automatically cut out. It is actually easier to tune with a heterodyne than without. When no heterodyne is present the procedure is to tune by ear to the best response and throw the off-frequency inverter switch to the cut-off side.

Referring to Fig. 6, the front panel controls from left to right are: pilot light which comes on when adjacent toggle switch is in the "on" position; the off-frequency inverter triple-throw toggle switch with the top position "-A+" to invert with middle position, the middle position "+B-" to invert with top position, while the down position is labeled "Test" for precise tuning. In the "Test" position, both oscillators are employed which produces two signals moving in opposite directions as the receiver is tuned. The difference between the two signals is heard as a beat note. The correct position will be indicated at zero-beat; the audio gain control out of the unit; a triple-throw toggle switch with the top position for "AM Phone" reception the middle "CW" position is broad c.w. without the 1000 c.p.s. filter, and the bottom "Sharp" position for sharp c.w. with the 1000 c.p.s. filter; and phone jacks. If it is desired to feed both audio output of the receiver and the signal splitter to a common speaker or line, a patch cord should connect from the "Phones" jack of the receiver to the "AF Input" jack on the signal splitter. By turning down the audio gain on the signal splitter and bringing the gain up on the receiver, normal operation of the receiver is permitted. When the audio gain of the receiver is turned off as far as it will go and the gain of the signal splitter is brought up to operation level, the heterodyne elimination action of the signal splitter becomes possible.

There has been a tendency for per-

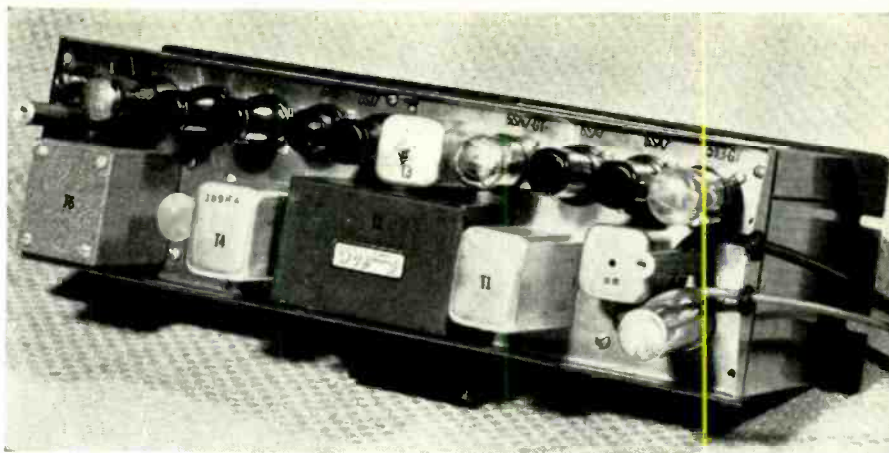


Fig. 9. The tube and transformer layout of the MCL-4 signal splitter.

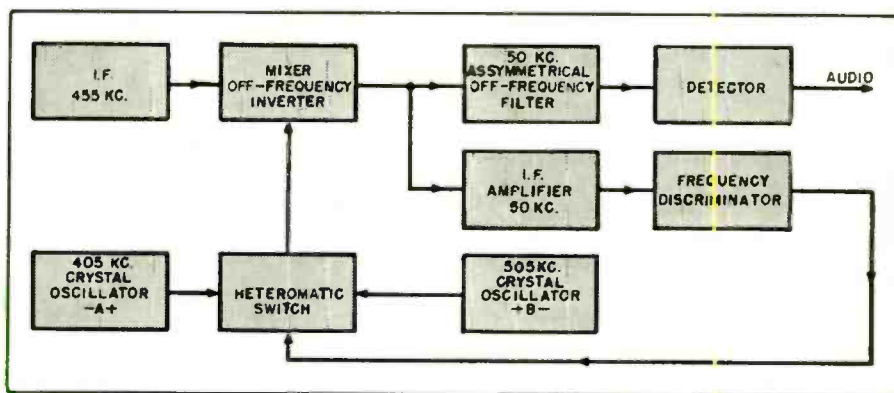


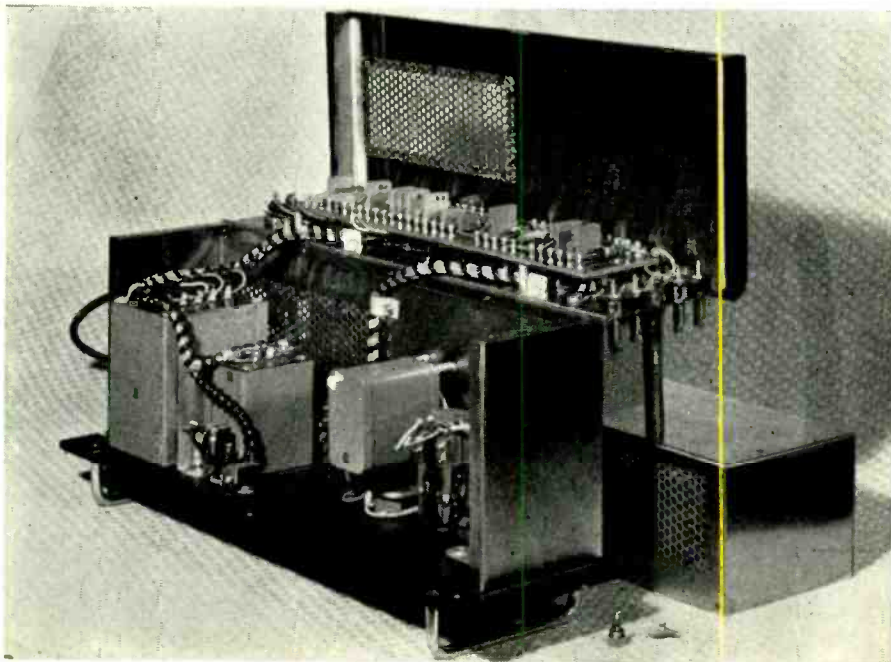
Fig. 10. Automatic version of anti-jamming or heterodyne eliminator.

sons operating this unit for the first time to confuse it with single sideband transmission even though recognized as an off-frequency inverter. They reach this conclusion because the inverter selects the best sideband. It is actually a sideband selector functioning with either single or double side-

band receivers. When used with a single sideband receiver, it performs no useful function other than its inherent selectivity. In the case of c.w., which has no sidebands, the asymmetrical (i.e., unsymmetrical) response of the system permits the off-frequency in-

(Continued on page 154)

Fig. 11. Interior view of MCL-4 signal splitter opened for inspection.



## AROUND THE CLOCK WITH SHORT-WAVE ENGLISH NEWSCASTS

EST	LOCATION	CALL	FREQ.	EST	LOCATION	CALL	FREQ.	EST	LOCATION	CALL	FREQ.
0000 (NS)	Manila	DZH2	9.640		London (ES)	GRO	6.180	0320 (SO)	Melbourne (ABC)	VLR2	6.150
	Johannesburg (SABC)	IV	4.800			GSX	6.060		Wellington (To Pacific)	ZL4	15.280
(1-NS)	Cape Town (SABC)	III	5.880 A	0120 (SO)	Melbourne (ABC)	VLR2	6.150	0330 (SO)	Salisbury	ZEA	6.000
(1-NS)	Pretoria (SABC Relay)	ZRE	9.110	0130 (SO)	Wellington (BBC Delayed Relay)	ZL4	15.280	0345 (SO)	Montreal (CBC-To Pacific)	CHOL	11.720
	Buenos Aires (SRI-To NA)	LRY	9.455 V	(NM)	Rangoon	ZL7	6.080	0355 (NS)	Melbourne (ABC)	CKLO	9.630
	Los Angeles (AFRS-To Pacific)	KCBF	15.310				9.543		Melbourne (ABC)	VLH3	9.580
	Edmonton	KWIX	9.570		London (Radio Newsreel-To Pacific)	GSN	11.820		Brisbane (ABC)	VLO3	9.660
	Calgary	KCBA	6.120			GRH	9.825	0400	Melbourne (ABC)	VLM	4.917.5
(SO)	Vancouver	VE9AI	9.540			GRX	9.690		Perth (ABC)	VLH3	9.580
	Toronto	CFVP	6.030	0145	Wellington (BBC Relay, Radio Newsreel)	GSW	7.230			VLR2	6.150
0015 (NSAT)	Melbourne (RA-To W. NA)	CFRX	6.070			ZL4	15.280			VLW3	11.830
(NSAT)	(To W. NA)	VE9AI	9.540	0200	London (GOS)	ZL3	11.780			VX3	9.610
	(To Africa)	VLC9	17.840			GSH	21.470		Brisbane (ABC)	VLX2	6.1301
	(To W. NA)	VLC6	15.320			GSV	17.810			VLQ3	9.660
	Hong Kong	VLA6	15.200			GRA	17.715		Sydney (ABC) (Via Pt. Moresby-ABC)	VLI2	6.090
0030	Brazzaville (To Europe)	ZBW3	9.525 V			GS1	15.260			VLT5	7.280
	(To Africa)		11.972			GSO	15.180		Kure (BFOS from ABC)	WLKS	6.105
	(To Middle East)		9.973			GSF	15.140		Melbourne (RA-To Forces, Japan, Asia, N. Pacific)	VLA6	15.200
	(To Africa)		9.440		Malta (FBS-BBC Relay)	GSW	15.110			VLC4	15.310
(NS)	Salzburg (BDN)	CFRX	9.533 V			GSL	6.110			VLB4	11.860
	Toronto	LRY	6.070				6.140			VLG10	11.760
0052	Buenos Aires (SRI-To NA)	LRY	9.455 V		Los Angeles (AFRS-To Pacific)	KNBX	15.250		Cebu	DYH2	6.140
0100	London (GOS)	GRA	17.715			KWID	11.900		Los Angeles (AFRS-To Pacific)	KWIX	11.860
	(To Pacific)	GSO	15.180			KCBF	11.810			KCBF	9.700
	(To Pacific)	GSF	15.140			KGEX	11.730			KGEI	9.670
	(To Pacific)	GSN	11.820			KWEI	9.670			KWID	9.570
	(To Pacific)	GSD	11.760		Edmonton	KWIX	9.570			KCBA	6.120
	(To Pacific)	GRH	9.825		Vancouver	KCBA	6.120		New York (VOA-To Far East)	KGEX	11.730
	(To Pacific)	GRX	9.690		Melbourne (ABC)	VE9AI	9.540			KNBX	9.600
	(To Pacific)	GRY	9.600			CFKX	6.080			KCBA	6.185
	(To Pacific)	GSC	9.580	0210	Lahore (Karachi Relay)	VLR	9.540			KNBI	6.080
	(To Pacific)	GSE	9.510				6.075		(Via Honolulu)	KRHK	11.790
	(To Pacific)	GSW	7.230	0215	London (ES)	GWT	9.675			KRHO	9.650
(NS)	Singapore (Radio Malaya, Blue Network)		7.220 V			GWJ	9.525		(Via Manila)	III	17.760
	(Via Kuala Lumpur)		6.135			GWN	9.280			II	15.330
(SO)	Malta (FBS-BBC Relay)		6.025			GSU	7.260		Tokyo (AFRS)	I	11.890
	Vancouver	CBRX	4.965	0220	Berne (To Pacific, Far East)	HER6	15.305	0405	Berne (To Pacific)	JKK	6.015
	Edmonton	CKFX	6.160			HER5	11.865	0440 (NS)		JKL	4.860
	Melbourne (CBC Relay)	VED	6.080	0230 (NM)	Lake Success (UN via VOA)	HEIS	11.715	0455	Salisbury	HER6	15.305
	Perth (ABC-BBC Relay)	VLR	8.265			KNBA	9.700	0500	Manila	HER5	11.865
	London (ABC-BBC Relay)	VLW3	11.830			KNBI	6.060		Saigon (Radio France Asia)	HEIS	11.715
	Brisbane (ABC-BBC Relay)	VX3	9.610	0245	Honolulu (Via Manila)	KRHO	17.800	(NW-S)	Manila	ZEA	6.000
	Sydney (ABC-BBC Relay)	VLM	4.917.5	0300 (SO)	Colombo	ZOI	4.897 V	(NS)	Manila	ZEA	6.000
(I)	Via Pt. Moresby-ABC)	VLT7	9.520		Vancouver	CKFX	6.080		Manila	DZH3	9.505 A
	Johannesburg (SAEC-BBC Relay)	III	4.895		Salzburg (BDN)		9.533 V		Saigon (Radio France Asia)	FZS4	11.780
	Cape Town (SABC-BBC Relay)	IV	4.800		Delhi (AIR-To W. Europe)	VUD5	21.510			DZH3	9.505 A
	Pietermaritzburg (SABC-BBC Relay)	II	4.878			VUD7	17.830			DZH6	6.030
	Los Angeles (AFRS)	KNBX	15.250			VUD10	17.780		Salzburg (BDN)	DZH7	9.748
		KWID	11.900			VUD3	17.760		Hilversum (To Pacific)	PHI	21.480
		KGEI	9.670			VUD9	15.290			PHI	17.775
		KWIX	9.570			VUD11	15.190			PCJ	15.220
		KCBA	6.120			VUD2	9.660			PGD	6.026
	Tokyo (AFRS)	JKL2	9.605		Bombay (Delhi Relay)	VUD4	9.630	0515 (NSS-M)	Bangkok	KWIX	11.860
		JKK	6.015			VUB3	7.240	(Daily)		KCBF	9.700
0110	Edmonton	VE9AI	9.540	(NS)	Calcutta (Delhi Relay)	VUC3	7.210	(NS)	Manila	KGEI	9.670
	Melbourne (ABC)	VLR	9.540			VUC2	6.010		Port-of-Spain	KWID	9.570
	Brisbane (ABC)	VLO3	9.660		Madras (Delhi Relay)	VUM3	7.260	0520 V	Rome (To Pacific, Far East)	KCBA	6.120
	Dacca (Karachi Relay)	VLM	4.917.5			VUM2	6.085	0530	London (ES—Dictation Speed)	GRG	11.680
			7.635		Los Angeles (AFRS-To Pacific)	VUM2	6.085			GWT	9.675
0115	Belgrade	GSU	7.260	0315 (NS)		KNBX	15.250			GSW	7.230
	London (ES)	GWL	7.210			KWID	11.900			GSY	6.040
						KCBF	11.810		Damascus		11.750
						KGEX	11.730				6.000
						KWEI	9.670				5.005 A
						KWIX	9.570				4.897
						KCBA	6.120				9.712
						KNBA	9.700		Perth (ABC)	VLX2	6.120
						KNBI	6.060		Singapore (Radio Malaya, Blue Network)		7.200 V
						KRHO	17.800		St. Johns	CBNX	5.970
						II	15.330		Accra	ZOY	9.640
						II	15.330	0545	London (ES)	GRG	11.680
						JKL2	9.605			GWT	9.675
						VLR	9.540		Port-of-Spain	VP4RD	9.625
						VLO3	9.660	0550 V	Copenhagen	OZH	15.165
						VLM	4.917.5	(T-Th-Sat)	(To Far East)		

(Continued on page 98)

NOTES: GMT is equal to EST plus 5 hours. Winter schedules are given; in many cases during summer, schedules will be one hour earlier than listed herein. In a few instances, stations temporarily off the air—but scheduled to return this spring—have been included. Frequencies are listed in megacycles; to convert to meters, divide 300 by the frequency in megacycles. In some cases, frequencies are "measured;" in others are "announced" or "listed" channels.

"A" means "approximately." "I" means "irregularly." "V" means "may vary." NS—Not Sunday. SO—Sunday only. NSAT—Not Saturday. SATO—Saturday only. NM—Not Monday. WO—Wednesday only. NF—Not Friday. TO—Tuesday only. FO—Friday only. MO—Monday only. FSATO—Friday, Saturday only. NFSAT—Not Friday, Saturday. SSO—Saturday, Sunday only. NSS—Not Saturday, Sunday.

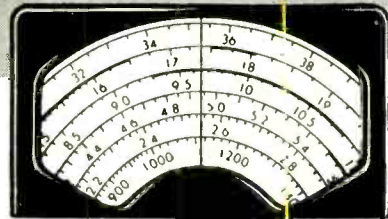
ABC—Australian Broadcasting Commission. AFRS—Armed Forces Radio Service. AIR—All India Radio. BBC—British Broadcasting Corporation. BDN—Blue Danube Network. BFES—British Far Eastern Broadcasting Service. BFOS—British Forces of Occupation Station. CBC—Canadian Broadcasting Corporation. ES—European Service. FBS—Forces Broadcasting Service. Middle East. GOS—General Overseas Service. NA—North America. RA—Radio Australia. RDF—Radiodiffusion Francaise. RNE—Radio Nacional de Espana. SAEC—South African Broadcasting Corporation. SRI—Servicio Radiofonico Internacional (International Service). UN—United Nations. VOA—Voice of America. WWBC—World Wide Broadcasting Corporation.





# International SHORT-WAVE

Compiled by **KENNETH R. BOORD**



**D**IRECT from Djakarta (formerly Batavia), Ir. M. P. Breedveld, Chief Engineer of *Djakarta Radio*, sends me this data:

The broadcasting organizations in Indonesia have been consolidated into a government broadcasting service called *Radio Republik Indonesia Serikat* ("Serikat" means "United"); address is Sambir Selatan 17, Djakarta, Indonesia.

The new 100 kw. transmitter is now in regular service as YDF on 6.045 with Indonesian programs 1700-1900, 2300-0130, 0400-1000 weekdays, and 1800-0130, 0400-1000 Sundays; a new *English* period follows at 1000-1100 for South East Asia and the West Coast of North America. The 100 kw. transmitter is used as YDF3 on 11.795 for programs in Arabic 1115-1200, French 1200-1300, and Dutch 1300-1400, beamed to India, the Near East, and Europe; the *English* period for Europe has not been put into effect yet, but in the spring when propagation conditions improve, it may be added for around 1400-1500. The *English* program for Australia and Malaya is on YDC, 15.150, and YDB2, 4.910, the former with antenna radiating the power of YDC in a narrow beam to Australia only. The French program 1000-1100 for South East Asia and Africa is radiated on YDC, 15.150, to South Africa; YDE, 11.770, to Indo-China; YDB3, 7.270, to India, and YDD2, 4.865, omnidirectional.

These transmitters at Djakarta were listed as active:

YDB, 2.240, 300 watts; YDB2, 4.910, 1 kw.; YDB3, 7.270, 3 kw.; YDC, 15.150, 3 kw.; YDD, 2.600, 300 watts; YDD2, 4.865, 3 kw.; YDE, 11.770, 3 kw.; YDF, 6.045, and YDF3, 11.795, 100 kw.

### Radio Club Notes

**England**—Roy Patrick is now vice-president of the *Sweden DX Fan Club* and is starting a monthly bulletin for that organization. It will contain broadcast, s.w. and amateur band news, as well as club news. The club is arranging several special DX broadcasts for 1950. Membership fees in this club are now 4 IRC's a year. Headquarters is 5, Aldred Street, Worksop, England.

**New Zealand**—The *New Zealand Radio DX League* recently chose these officers for the year: President, Jack F. Fox; vice-presidents, Arthur T. Cushen and Jim I. Martin; secretary-

treasurer, Des L. Lynn; board members, Lynn M. Gerrie, Peter Thorn, Lloyd E. Warburton, Bill March, Alex J. Allan, and A. Mervyn Branks, in addition to the officers. Officials of the club's monthly house organ, *The New Zealand DX Times*, include A. Mervyn Branks, editor; Arthur T. Cushen, short-wave editor and publicity agent; Ron Gray, amateur editor; Alex Allan, circulation manager and assistant editor; Lloyd Warburton, competitions editor; George Goodsir, printer; Bill Marsh, secretary, and Dudley Carter, treasurer.

**Sweden**—The *Radio Club of Sweden* (SRK) has started a novel service for its *English*-speaking members; each month a digest of the more important items of its house organ—*DX-Radio*—are translated into *English* and are airmailed to *English*-speaking members, while the house organ then follows by regular mail.

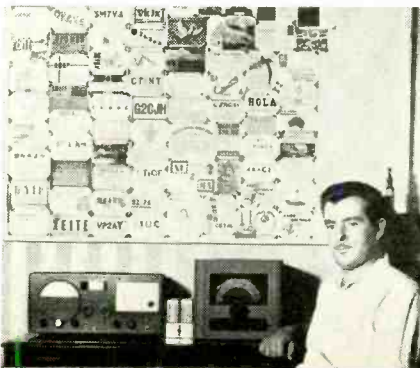
\* \* \*

### This Month's Schedules

**Algeria**—Mesquita e Sousa, Portugal, reports *Radio Alger* on 9.570 at 1400-1500 with Arabic music.

**Angola**—Widely reported in CR6RG, approximately 9.240, "*Radio Club de Huambo*," Nova Lisboa, afternoons to 1500 or later. Peddle, Newfoundland, says he hears an outlet on 11.945 in parallel around 1415-1500 or later; announced as operating in the 32- and 25-m. bands. Laubscher, South Africa, airmails that this is a powerful outlet on approximately 9.240, compared to other Angolan outlets, probably at least 1 kw. in power.

Galen Balfé, Massachusetts DX-er, collects both ISW and ham QSL cards. He is using a Hallicrafter's S-40A, a RME DB-22A preselector, and a Silver sideband selector. More recently he has rigged up a 100 kc. frequency standard to round out his post.



**Australia**—VLA6, 15.220, is now in use to Eastern North America 1643-1815; fine level.

**Austria**—The Blue Danube Network, Salzburg, reported off the air sometime ago, is now being heard on 9.532, operating under heavy QRM. (Radio Sweden)

**Burma**—A Forces Station reported heard in Israel, Australia, New Zealand, and India on approximately 7.375 around 0800-0830, in *English*, is reported to be *Radio Mandalay*; another report lists it as "*Ka-en Radio*." (Radio Australia)

**Canada**—A letter verification from CKFX, Vancouver, British Columbia, stated that this is the s.w. counterpart of medium-wave CKWX and is used "to serve the mountainous areas of British Columbia which cannot be reached by CKWX." Operates on 6.080 with 10 watts, using a quarter-wave vertical antenna; output tube is a single 807 at 400 volts; closes down 0305; is privately-owned. (Cox, Dela., Lytle, Ontario)

CJXC, 6.010, Sydney, Nova Scotia, 1 kw., relaying CJCB, 1270 kc., 5 kw., is scheduled weekdays 0600-2315, Sundays 0800-2315.

**Cape Verde Islands**—CR4AA, 5.920, heard in Chicago 1640 with good signal; news in Portuguese. (Whitman)

**Costa Rica**—TIFC, San Jose, informed Lytle, Ontario, it is operating with 350 watts from a home-built transmitter; frequency is 9.645; is owned by the Latin American Mission, Inc., Ridgefield Park, New Jersey; usually has *English* 2230-0005; good signal in Ontario.

**Cuba**—COBZ, 9.026, Havana, noted with *English Lesson* (recorded by BBC) at 1800-1815. (Selman, Texas, others)

**Ethiopia**—Bluman, Israel, lists schedule of *Radio Addis Ababa*, "Voice of Ethiopia," as ETA, 9.620, 0600-0645, 0845-1100, with *English* 1010-1100; and ETB, 15.032, which is being used experimentally. He states further that on Tuesdays an additional schedule of 1230-1400 is in effect, with programs  
(Continued on page 139)

(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.



# Mac's RADIO SERVICE SHOP

By JOHN T. FRYE



**A** SUDDEN extra-strong gust of wind jerked the opening door from Barney's fingers and slammed it back against the wall. Before he could step inside the service shop and close the door, the same mischievous whirlwind scooped a bunch of papers from the desk at which Mac and the office girl, Miss Perkins, were sitting and sent the sheets sailing wildly about the office.

"That's our boy, Barney," Mac observed resignedly as he recovered the scattered papers. "He and March both come in like lions."

"Man! The wind out there is twenty db. over S9," Barney said as he perched himself on a corner of the desk. "What are you two in a huddle about?"

"We were just talking about letting you go and getting an intelligent monkey to take your place," Mac explained blandly. "I was pointing out that with all the climbing that has to be done putting up these TV antennas, a good, reliable, sure-grip tail would be worth more to a service technician than any amount of brains; and as far as there being any great difference in brains, if the monkey is only reasonably intelligent—"

"He's just teasing you, Barney," Miss Perkins broke in quickly as she saw a look of genuine concern cross the boy's freckled face. "We were just working out a parts order in preparation for the April portable-special Mac is planning."

"The whatable special?"

"Portable-special," Mac replied. "During the last two weeks of April we are going to run an offer to check the batteries, tubes, and general operating condition of any portable re-

ceiver brought to the shop for only one buck. Newspaper ads and radio spot announcements will urge the good people to dig their portable sets out of the closets and bring them to us so that we can put them in top-notch shape for the picnic-beach-party-and-baseball-game season."

"A single George Washington doesn't seem like much money for the kind of check you will give them—or rather make me give them," Barney said dubiously.

"True, but a high percentage of those sets are bound to need new tubes or batteries or both. Quite a few of them will take some further work to put them into shape. As our advertising will make crystal-clear, that 'George Washington' as you call it simply pays for testing the tubes and batteries and calling attention to any defects that need remedying. Any further service will be charged for at our usual rates."

Before Barney could pursue the subject, the door opened to admit a pretty young woman who was all the prettier with her hair slightly tousled by the wind.

"Hello, Gay," Mac greeted her. "What can we do for you?"

"My big radio has gone dead, Mr. McGregor, and I was wondering when you could fix it."

"Hm-m-m-m," Mac said as he took a quick look at the call-list beside the telephone, "it will probably be two or three days. We are really snowed under this week."

She made a little face of disappointment, but she said, "Well, it will just have to wait until then, for my husband told me never to let anyone touch it but you. Just stop by and

pick it up when you get the chance."

"Wait a minute, Gay," Mac said as she started for the door. "I can't run your set around others in the shop during regular working hours; but I guess I can work on it on my own time if I please. I know what that set means to you, and I also know that my wife is having a bridge party at our house tonight. I'll pick up your set right after supper and bring it down here and see what is the matter with it. I'd much rather be here working than sitting at home in the basement re-reading old magazines and wondering if those gals are *never* going home."

"You are trying awfully hard to make it sound as though I were doing *you* a favor, but I think you know how much I appreciate this," Gay said with a dazzling smile that seemed to hang in the air long after she had closed the door behind her—or at least it seemed so to Barney, who was more than somewhat susceptible to feminine charm.

"Not that I blame you, Boss," Barney said softly, "but weren't you the one who gave me a lecture last week about not letting a pretty face wheedle special favors out of me? And she's a married woman, too!"

"The pretty face has nothing to do with it," Mac answered gruffly. "I happen to know the circumstances. That set is an all-wave job that she uses to listen for her G.I. husband in Germany who gets a chance to talk over a ham station from there every now and then. Since she actually talked to him over Herb Thorne's ten-meter rig, she spends half her time listening to the ham bands on the off chance she will hear her husband's voice."

"And while we are talking, Fireball, I may as well take up another little matter. I realize I told you the only fair way was to repair sets exactly in the order in which they came in and that you were not to run one radio around another just to keep from losing a service job; but do you *have* to sound so coldly impersonal when you tell a poor guy that you can't get on his receiver immediately, even though it is the only one he has in the house?"

"Try to keep in mind that it is not just a radio he has brought you. That dead set he holds in his hands represents a worrisome *trouble* that he hopes you can help him get rid of. If you can't do that immediately, the least you can do is be properly sympathetic and show that you actually would like to help him."

"I get it: you want me to put on the old I-wish-I-could-but-I-can't act."

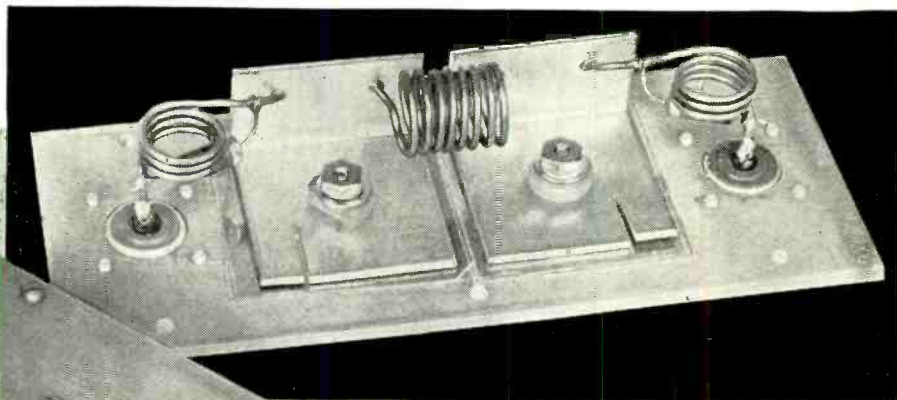
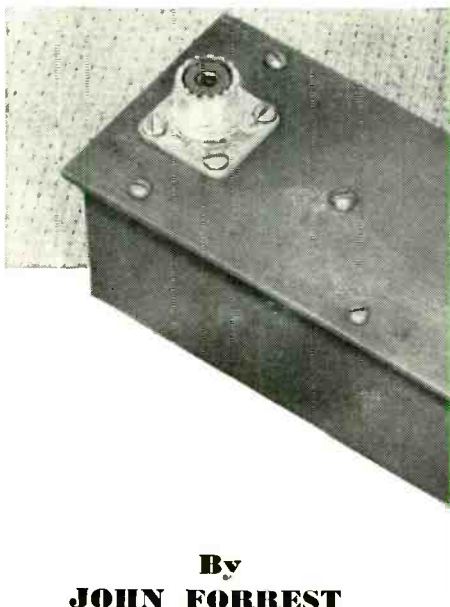
"No you *don't* get it," Mac said with a thoughtful frown. "I don't want you just to pretend you are sorry; I want you to *be* sorry. It's part of being a real service technician. This wacky business we are in is called 'radio service'; and we never want to concentrate so hard on the 'radio' end of it that we forget the 'service' part. People depend upon us to do a par-

(Continued on page 84)



# A TVI Filter for Coaxial TRANSMISSION LINES

Two views of the TVI filter. Internal view shows method of mounting airwound coils.



By  
**JOHN FORREST**

**Complete details for an antenna feedline filter which reduces radiation of harmonics falling in the TV band.**

**T**HE increasing number of television receivers is a source of concern to all amateurs. In urban areas the amateur is likely to be completely surrounded by television receivers, each a potential threat to the ham version of "pursuit of happiness." In small communities, remote from television stations, TVI is also a serious problem since the use of high gain boosters and antennas compounds the difficulty. The amateur who wishes to be free of TVI must begin immediately to rid his equipment of spurious radiations. The task of "delousing" the average amateur transmitter is formidable but successful techniques are being developed which may be applied to all transmitters, e.g., shielding, power line filters, class B operation of r.f. stages, use of FM, and finally, antenna feedline filters.

The antenna feedline filter should be considered standard equipment by the amateur who has many television receivers nearby. Excellent filters are available from several manufacturers. These filters are usually designed for coax for several reasons: It is easier to construct a filter for coax than for

balanced lines; the excellent shielding of coax reduces the probability of TVI to begin with; and surplus coax such as RG-8/U is cheap and plentiful and has lower loss than any of the other commonly used amateur feedlines. The difficulty of feeding a balanced load with coax is ordinarily sufficient to deter many from using it, but there are several excellent methods of accomplishing the job. For instance, a substantial advance in this respect appears to have been made by W3MTE with the "Gamma match."<sup>1</sup>

The filter shown in the photographs is intended primarily for use in RG-8/U cable feeding a 10 meter beam antenna. It is suitable for use in any 50 ohm coaxial cable on any band between 160 and 10 meters. Transmission characteristics of the filter are plotted from 2 mc. to 200 mc. The measurements were made with a *Measurements Corp.* Model 80 laboratory signal generator and an r.f. voltmeter across a 50 ohm termination. The minimum attenuation in the stop band is 30 db., near 60 mc. This should be adequate

<sup>1</sup> Washburn, H. H.; "The 'Gamma' Match," QST, Sept., 1949.

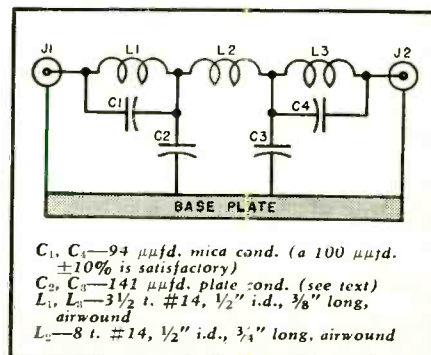
to eliminate TVI but there is no reason why any number of similar filters may not be connected in cascade. The filter is merely inserted in the transmission line between the final amplifier and antenna.

Electrically, the filter is described as a single pi-section  $m$ -derived, low-pass filter with terminating half sections. The design equations are contained in *Terman's "Radio Engineer's Handbook"* on page 228. A filter to meet a particular requirement may be designed from these equations. The construction technique used in this model is recommended for similar devices operating in the television frequency ranges.

All components are assembled on a  $\frac{1}{8}$ " brass plate. This thick material is used for rigidity so that the bypass capacities will be constant once adjusted. Each condenser top plate is secured by a single screw with a shoulder washer for insulation. The top plates are  $\frac{1}{16}$ " material. Each top plate has a right angle bend in it with holes through which the ends of the coils are passed for soldering. This style of condenser has high break-down voltage, high current-carrying capacity, and most im-

(Continued on page 128)

Diagram and parts list for TVI filter.



# A Versatile Recording and Playback Amplifier



By **GLEN SOUTHWORTH**

Panel view of the recording and playback amplifier. Author used his unit in conjunction with the tape recorder shown.

## *Construction details for building an amplifier which can be used for either tape, wire, or disc.*

**A**N IMPORTANT branch of the audio art is that which deals with transforming sounds into a form in which they may be kept more or less permanently and reproduced at will. Prior to the recent war, disc and film were the two principal recording techniques. Since then magnetic recording on wire, and particularly tape, has experienced a phenomenal growth.

Each system has its own advantages and disadvantages. Disc records are subject to noise, surface wear, warpage, and may often require expensive, high quality recording equipment for good results. On the credit side they may be kept indefinitely, if well treated, and are convenient in that it is easy to find a particular passage on the record quickly. The merits of sound on film recording may be noted at your neighborhood theater, but, in general, this technique is too expensive and complicated for widespread general use.

Magnetic recording has several advantages over other types of systems, one of the chief ones being that no mechanical linkage is used in either recording or playback. This results in considerably lowered distortion, particularly of transients, and the ability to be replayed indefinitely without deterioration of quality. Although good results may be obtained on either wire or tape, tape recording seems preferable from the standpoint of better mechanical properties, ease of editing, and generally greater advancement in the art.

The amplifier described in this article was designed for use in recording or playback of disc, wire, or tape, and may be used for re-recording from any of these media to another. Push-pull 6L6's are used in the output stage to give ample power to drive either a loudspeaker or magnetic disc recording head, while a high frequency oscillator is included to provide bias and erase voltage for either wire or tape.

The high gain required for the playback of tape recordings gives rise to several problems. One of these is reducing the hum level to a low value. Other than inadequate filtering, ground loops are a common source of disturbance and it is recommended that an isolated ground system, connected to the chassis at only one point, be used. Another problem arises when the high frequency energy from the bias oscillator gets into the amplifier stages and creates distortion and lack of sensitivity. A wide range oscilloscope is very useful in tracking down this difficulty and eliminating the trouble through use of proper shielding or bypassing.

Another serious problem occurs when energy from the output of the amplifier gets back into the input, causing oscillation or instability. The simplest way to reduce this effect is to separate the input and output circuits physically, and manually change the position of the recording-playback head connection from output to input. If it seems desirable to have a more convenient switching arrange-

ment, a multiple section switch, such as shown in the accompanying diagram, may be used. In this case, sections of the switch are used as conductors in one position and shields in the other, making good electrical separation possible.

For single track recording the author has found that a small permanent magnet makes a good, yet simple erase mechanism and has the advantage that an entire reel of tape may be cleared in the short period of time during rewind or fast speed forward, while electronic means do not usually work satisfactorily at such high speeds. When using permanent magnet erase, a quieter recording appears to result by placing the magnet on the side of the tape away from the magnetic coating. Using one of the small Alnico magnets, the field is usually intense enough to penetrate the tape and provide complete erasure, while the more uniform field produced tends to lower the amount of noise recorded on the tape during the erase process.

When recording two independent sound tracks on standard tape, electronic erase becomes desirable due to the fact that the erase area may be carefully controlled so as not to overlap and attenuate the adjacent recording. For this reason the bias oscillator in the recording amplifier is designed to supply several watts of high frequency power, sufficient to operate an erase head for either tape or wire.

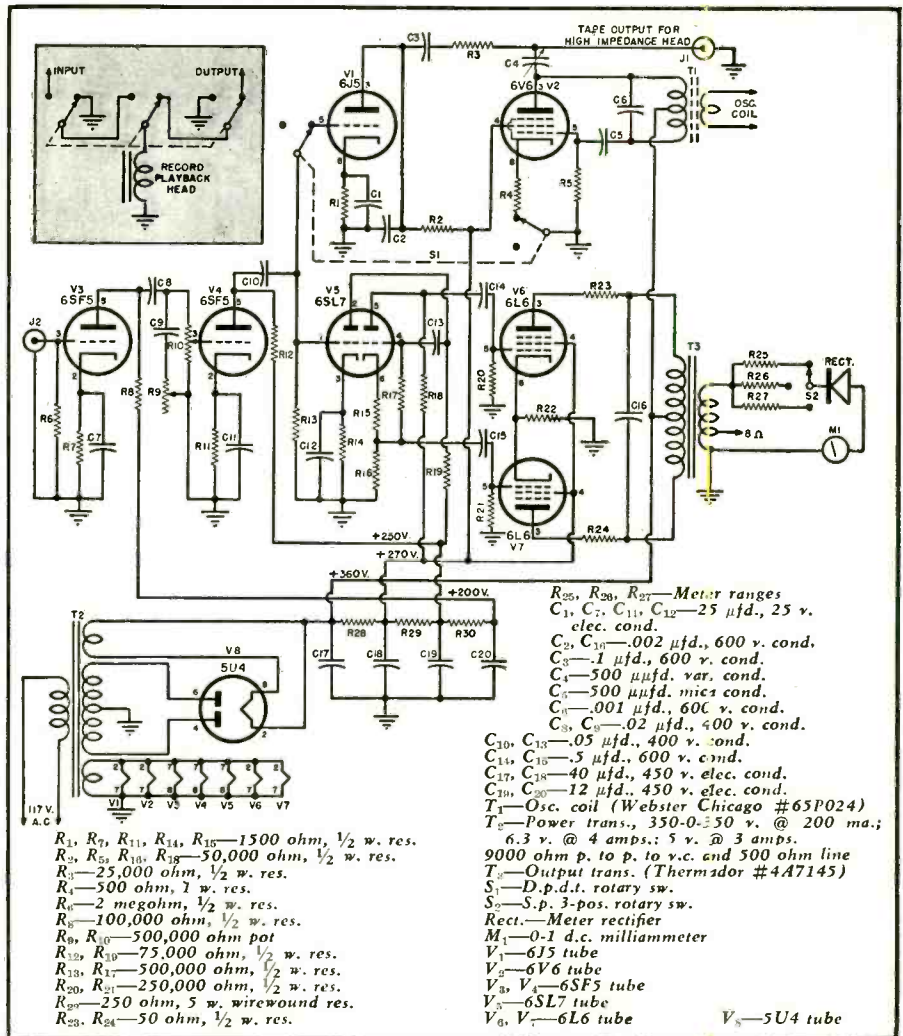
A considerable variety of recording-playback heads is now on the market. Probably the easiest of these to use is the high impedance head which may be driven by a simple triode voltage amplifier stage. As



power requirements are very low, high quality recordings may be made with light, compact equipment. As shown in the amplifier schematic, a separate triode stage is used to drive a high impedance recording head, thus bypassing any distortion that might occur in the power output stages. In the event that a low impedance head is used, the taps on the output transformer may be connected for proper match and the push-pull 6L6's used to drive the recording head. Similarly, the oscillator coil specified has a low impedance winding for use with low impedance erase heads.

As mentioned previously, an oscilloscope is an excellent aid in testing a magnetic recording system. The high frequency bias should be as nearly a perfect sine wave shape as possible and any serious departures from this standard may be observed on the scope. Likewise, the scope provides a simple means of observing hum, regeneration, or bias frequency in the amplifier stage. If a stable audio oscillator is available it may be used as a "wow" meter by recording a constant tone, and during playback applying the output of the recording to one set of deflection plates and the output of the oscillator to the other. Periodic variations in the pattern will indicate wow, while a gradual change will indicate tape slippage or oscillator drift. Meter calibration for recording level may be determined by recording a tone of gradually increasing intensity and observing on the playback the point at which distortion starts to occur. Breaking in at certain levels with voice announcements may make it easier to locate the exact point at which distortion begins.

Assuming a perfectly functioning amplifier, the quality of the recording will depend on a number of factors. Type of recording head, tape, bias frequency, bias amplitude, tape speed, and quality of the original signal should be considered. If using a well matched recording head of good design, the quality of the recording may vary according to the type of tape used with a particular system. This is due to the varying characteristics of different magnetic coatings and the fact that recording level and bias conditions may differ considerably for optimum results. The author's preference is for the brown oxide-coated tape which gives wider range, greater sensitivity, lower distortion and noise, and higher output levels than that obtainable with the less expensive tapes. However, with any tape, if the bias is not correct serious distortion may result, giving either harsh reproduction due to strong third harmonic production or mushiness due to the suppression of low level components, the latter effect apparently being increasingly noticeable at slow tape speeds even though the same frequency range is reproduced.

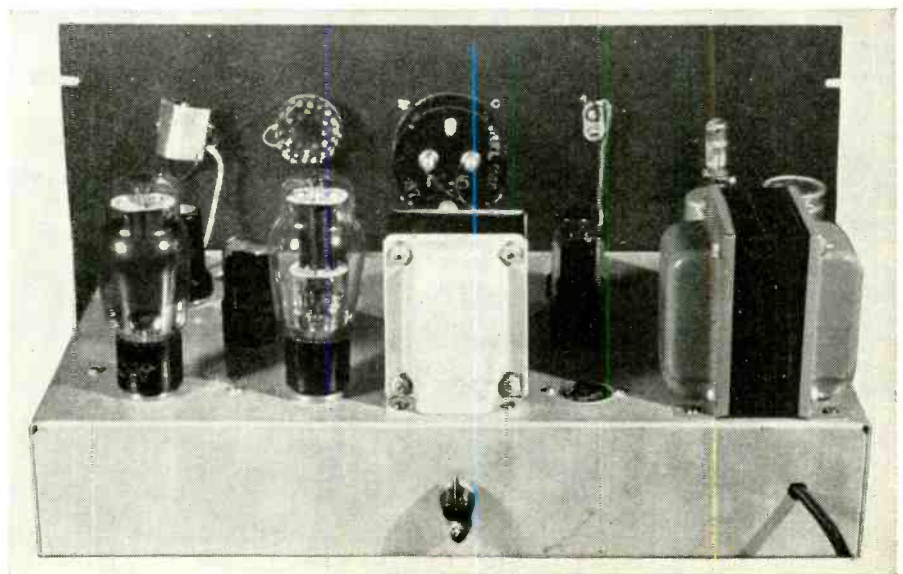


Schematic of the high gain amplifier for tape, wire, or disc recording and playback. Shaded inset shows simple method for switching magnetic record-playback head from input of amplifier to output of recorder. Three-section switch mini-mizes coupling.

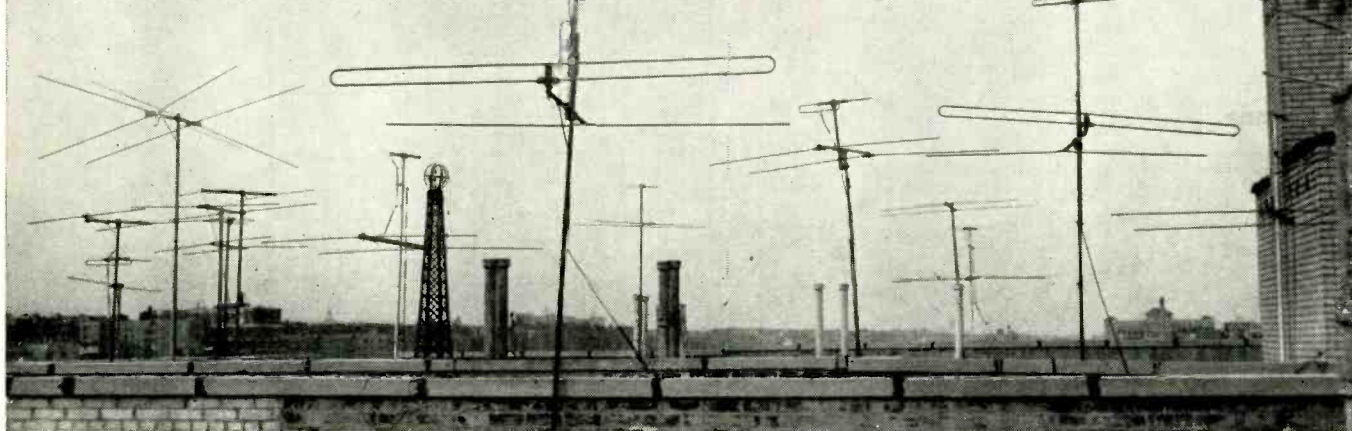
The photograph (see page 62) illustrates an interesting tape pulling mechanism used by the author and available to experimenters. Of primary interest is the fact that it is a

three-speed unit, capable of tape speeds of 3.75, 7.5, or 15 inches per second, thus providing three combinations of quality and playing time. (Continued on page 112)

Rear view of record-playback amplifier showing general layout of component parts.



# TELEVISION TROUBLESHOOTING Without Instruments



By **WALTER H. BUCHSBAUM**

Chief Eng., Tech-Master Products Co.

***Not all defects can be located—but the procedure outlined describes a method whereby a great number of circuit faults can be found without instruments.***

**T**HE title of this article appears to offer a long-awaited panacea to the service industry and the evolution of a nemesis to the test instrument manufacturers. Actually, we do not recommend that you throw out all your instruments, or delay purchasing new ones—not even *after* you have read this article. The method outlined herein is merely a convenient procedure for locating certain defects when instruments are not available. While most service technicians carry a voltohmmeter on all service calls, few can take a signal generator and an oscilloscope along; and in those instances where the defect would normally be found by signal tracing or signal injection, this method is often of great help. It should be understood clearly that we are not trying to suggest a complete system for troubleshooting *all* defects, but merely showing how in some cases, some defects can be found without the use of any instruments.

The principle of this new method of troubleshooting is the utilization of one functioning section of the receiver to locate the defect in another section. A study of any TV circuit diagram reveals that the audio amplifier section resembles the circuit of most AM signal tracers. The video section and the sweep circuits, on the other hand, have some similarity to

an oscilloscope. Before showing how these sections of the receiver can be used to locate trouble, it is important that the function of each stage and each section is clearly understood. Lacking this basic knowledge, troubleshooting with or without instruments is only a hit and miss proposition.

#### Function of Each Stage

Referring to Fig. 1, and starting at the upper left hand corner we find the r.f. amplifier, mixer, and oscillator. These three stages are usually located on a small subchassis and comprise the r.f. tuner or "front end." Because these tubes operate on the television r.f. frequencies and at a relatively low signal level, signal tracing is not practical. If either sound or picture are being received it is safe to assume that the r.f. tuner is operating properly. Even if only static noise is either seen or heard the defect may not be in the tuner. Realignment the local oscillator slightly may be sufficient to bring in either sound or picture, or both. In any event, troubleshooting the r.f. front end is usually a tedious and difficult job, and most service technicians are content with trying out new tubes and measuring the operating voltages until the set can be brought into the shop for a thorough check-up.

The picture i.f. amplifier consists of a chain of three or four tubes, either types 6AG5 or 6AU6 are the most popular in present day sets, and in most cases a system of stagger tuning is used. This means that each stage is tuned to a different frequency and the relatively high gain of each stage at that frequency adds up to the overall, broadband response curve. One of the drawbacks of this system is that in the event two subsequent tuned circuits are close to each others' resonant frequency, a tendency toward regeneration and oscillation exists. The transformer-coupled system where each stage is broadly tuned over the entire bandwidth is more stable, but more costly and more difficult to align. In either system a broad band of frequencies is being amplified and it is possible to signal trace this section of the receiver. How this is accomplished is described in detail in a later paragraph.

After the i.f. signal is amplified sufficiently it reaches the second detector where the picture signal is removed from the i.f. carrier and amplified further. This signal has three main components: the actual picture part which determines the light and dark on the screen, the horizontal sync pulses, and the vertical sync pulses. The horizontal sync pulses and most of the picture consist of frequencies too high to be audible, or to be reproduced by conventional loudspeakers. The 60-cycle pulse which forms the vertical sync signal, however, is audible as a low rasping noise. Where a pair of earphones is connected to the output of the last video amplifier this rasping noise can be heard clearly, but for our new method of troubleshooting the audio amplifier of the set will be utilized to trace the path of the picture signal.

**RADIO & TELEVISION NEWS**



The sound signal is separated from the picture signal in two different ways. In the block diagram of Fig. 1, the Intercarrier System is shown, because this system is becoming more and more popular, especially among lower priced sets. The sound and picture i.f. signals are amplified together through the chain of i.f. stages and at the second detector the sound i.f. carrier beats with the picture i.f. carrier. Since their difference frequency is 4.5 mc., a second sound i.f. of that frequency is created which is then amplified, along with the picture signal, through the video amplifiers. This 4.5 mc. signal is trapped out at the plate of the last video stage and fed to the sound limiter-amplifier. The 4.5 mc. carrier is frequency modulated and the sound is detected by a ratio detector type circuit.

After passing through a de-emphasizing filter the audio signal is then applied to a conventional two-stage audio amplifier. This two-stage amplifier is very useful as a signal tracer for troubleshooting either video stages or the vertical sweep and synchronizing section.

Many older type sets and most of the more expensive models use a separate sound i.f. channel, usually tuned to 21.25 mc., and a discriminator type of detector circuit. The sound i.f. carrier is removed from the picture i.f. signal either through a tuned trap at the mixer plate or in one of the first two i.f. stages. In this system the picture i.f. amplifiers, following the point of sound i.f. removal, will always have at least one more trap to eliminate the sound signal. A conventional audio amplifier circuit is used after the detector, just as in the Intercarrier System.

In addition to the sound and picture signals, a television system also requires synchronizing pulses for both the vertical 60-cycle sweep and the horizontal scanning which has a frequency of 15,750 c.p.s. Both pulses are present in the final picture signal as it reaches the picture tube, and usually a portion of this picture signal is applied to the synchronizing circuits. Depending on the method of generating the sweep voltages, different amplitude and phase of sync pulses may be required. In all cases, however, both vertical and horizontal pulses are passed through at least one clipper-limiter stage as shown in Fig. 1. If this stage is functioning properly, both pulse frequencies will be present at its output, and while the 15,750 c.p.s. signal is nearly inaudible the 60-cycle pulse is clearly distinguished as a low rasping hum, when the signal is run through the audio amplifier. Sync pulse separation is achieved by using an integrating network to pass only the 60-cycle pulses and a small coupling condenser to pass only the 15,750 c.p.s. horizontal sync pulses.

The vertical sweep section shown in Fig. 1 is one of the simplest in use, requiring only a single 6SN7 tube of

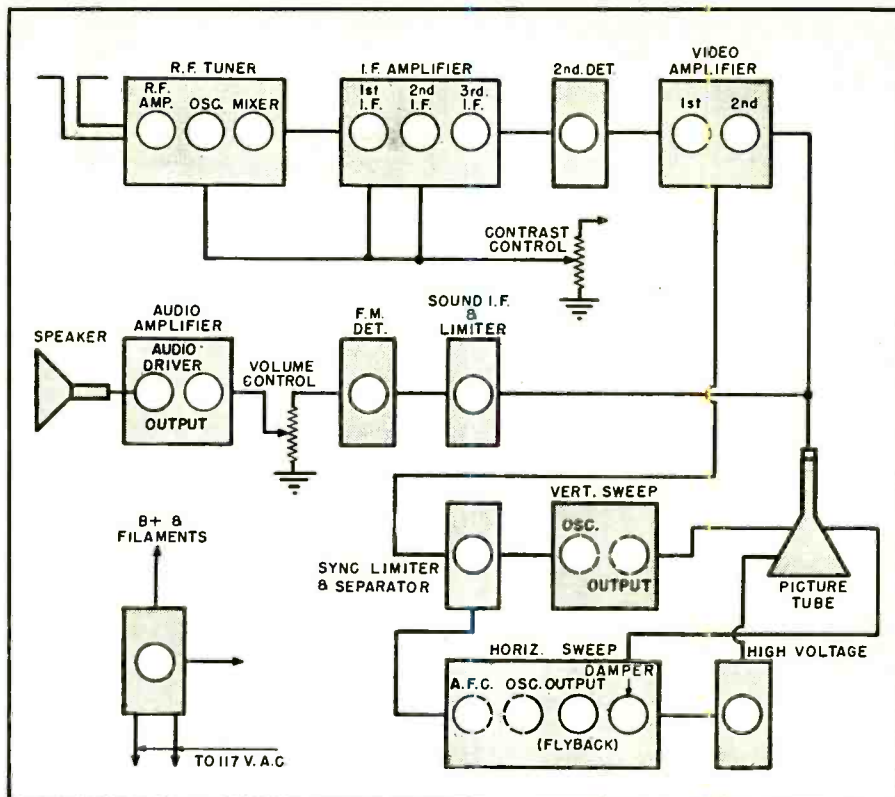


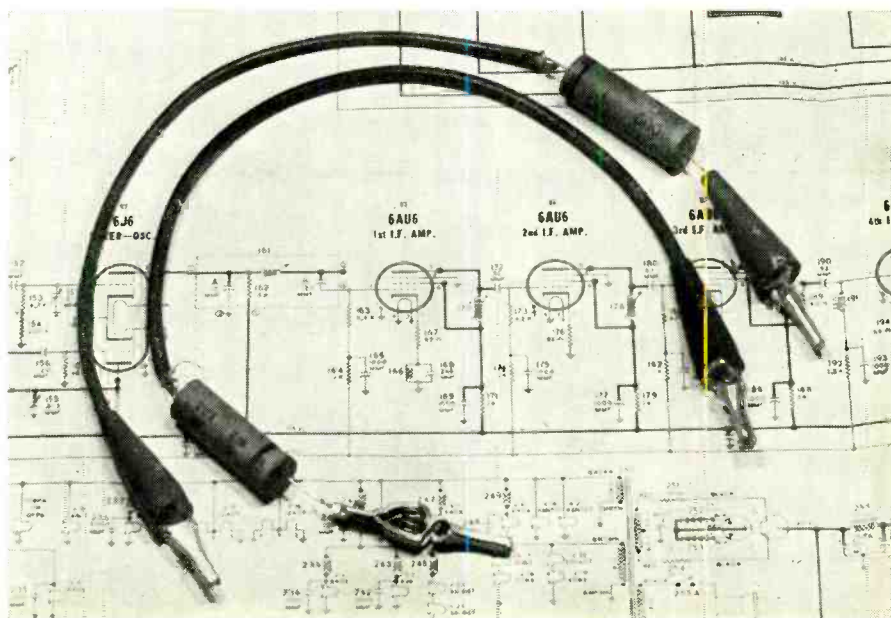
Fig. 1. Block diagram shows functional operation of a conventional television receiver.

which one triode section is used as the oscillator and discharge tube and the other as the output amplifier. Some receivers may use two or even three tubes for this purpose, but the principles are the same and signal tracing can be done in a manner similar to that outlined in a later paragraph.

Fig. 1 shows a frequently used system of a.f.c. (automatic frequency control) used to hold the horizontal sweep steady. The actual functions of each stage in the horizontal sweep circuit and high voltage section will

not be discussed here because this part of the receiver does not lend itself directly to troubleshooting without instruments. Unless an obvious short or broken part is apparent in the horizontal sweep and high voltage section, the fastest method of locating the defect is by signal tracing with an oscilloscope. The only way in which the method described in this article can be applied to this section is by tracing the sync pulses to the output of the sync separator stage and assuming that since the vertical output is observed there, the hori-

Fig. 2. The only "tools" required to make the troubleshooting tests outlined in article.



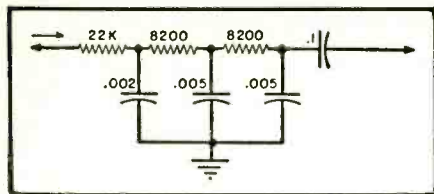


Fig. 3. Vertical sync pulse integrator network used almost universally for removing the horizontal sync pulses permitting only the vertical sync pulses to pass through.

zontal output must also be present and any loss of sync pulse must, therefore, take place in a subsequent stage.

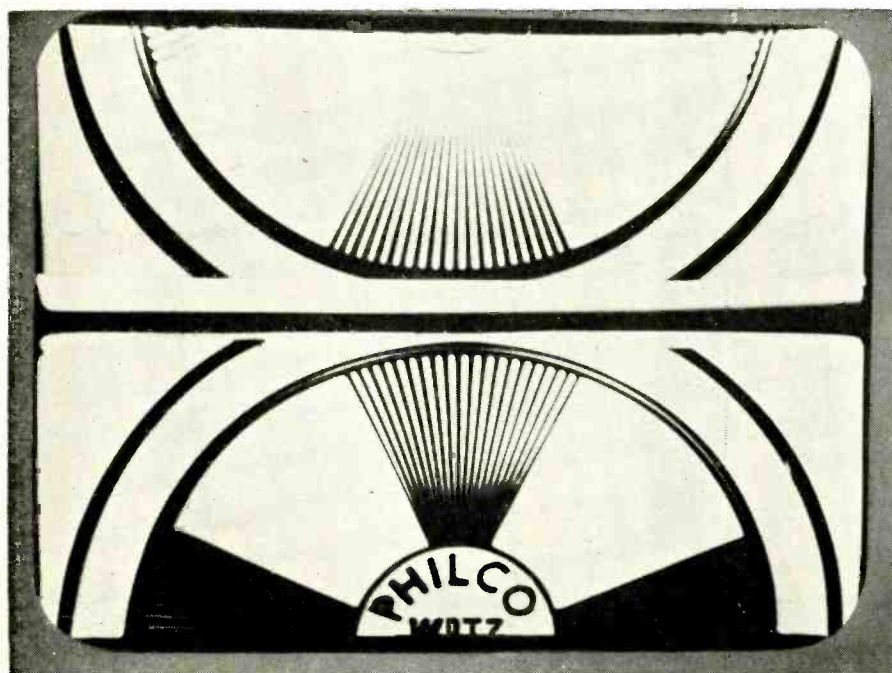
The filament and "B plus" circuits can usually be checked easily by the old radio technician's standby, the spark test. In the event an open filament choke or transformer winding is suspected the audio amplifiers can be used to trace this defect. In general, these circuits can be serviced more efficiently with any conventional volt-ohmmeter.

### Practical Applications

If the exact function and the nature of each stage in the modern television receiver is thoroughly understood, the actual application of the method outlined in this article will present no difficulties. A little practice is helpful, especially in those parts where the audio section is used as a signal tracer. Once the technician learns to recognize the different sounds, locating the defective part is usually only a matter of minutes. Among the most frequent applications of the instrument-less method are the following major symptoms which are discussed in detail:

1. No sound, no picture.
2. No sound or weak sound with good picture.

Fig. 4. A double-image pattern of this type indicates loss of vertical synchronization.



3. No picture or weak picture with good sound.

4. No vertical sweep or very little sweep.

5. Loss of vertical or horizontal sync or both.

Other defects, such as intermittent front end tuners, no high voltage, burned or shorted components, etc., do not lend themselves readily to troubleshooting without instruments and it will be found that they can be serviced more efficiently with conventional equipment.

1. *No sound, no picture.* This condition can be due either to the loss of the signal in the r.f. stages because of a power supply failure or, especially in sets using the Intercarrier System, because of a defect in the picture i.f. or video amplifiers. To ascertain whether a picture signal is present in the video amplifiers connect a .05  $\mu$ fd. condenser, through a clip or test lead, to the "high" side of the volume control. Touch the free end of the condenser to a filament pin anywhere in the set. This will produce a loud 60-cycle hum in the speaker, proving that the audio amplifiers are working properly. Next touch the free or "probe" end of the condenser to the plate of the last picture amplifier. If a picture signal is present, a loud rasping hum is heard. If no signal is found, move the "probe" back to the preceding grid, and so on until it is connected to the second detector load resistor. The absence of a picture signal there indicates that the defect must be in either the i.f. or r.f. stages preceding the detector.

To check the i.f. amplifiers would require the insertion of a signal from a generator or at least a multivibrator generating harmonics in the i.f. frequency range. We find, however, that

the set itself contains such a multivibrator in the form of the vertical sweep generator. To utilize the vertical sweep connect a .1  $\mu$ fd. condenser to the plate of the vertical sweep output tube and attach a clip or test lead on the free end. As indicated, the audio system is used again and since we know that the defect is not in the video amplifiers it is usually best to connect the "probe" end of the .05  $\mu$ fd. condenser from the volume control to the plate of the last video amplifier for best indication. Next touch the free end of the .1  $\mu$ fd. condenser to the detector load resistor. A loud buzzing will be heard, showing that the signal passes from there to the last video amplifier.

To check the i.f. stages touch the "probe" end of the .1  $\mu$ fd. condenser in turn to the plate and grid of each i.f. stage, going from the second detector back to the mixer grid. Receivers using transformer coupled i.f.'s may give only a weak indication which is hard to recognize if some inherent hum is present. To definitely identify the signal from the vertical sweep, rotate the vertical hold control a few times and observe the change in pitch as this is done. This method is, in effect, signal substitution with the vertical sweep circuits providing the signal and the audio amplifiers the detecting device. The vertical sweep voltage used in this method cannot be observed on the picture tube because the pulses occur only in the flyback period during which the tube is usually blanked out. If it is not convenient to use the vertical pulses as a signal, it is often possible to connect a .1  $\mu$ fd. condenser from any filament point to the different i.f. grids and then the 60-cycle hum is visible as well as audible. In many sets this works only on the last i.f. stage, because the attenuation at 60-cycles is too great in each stage, but if a .1  $\mu$ fd., 600 volt condenser is connected from the cathode of the "B plus" rectifier to the different grid circuits, enough signal is usually passed to cause a dark horizontal bar on the picture tube.

2. *No sound or weak sound but good picture.* Since in this condition a picture is present, the .05  $\mu$ fd. condenser is connected to the plate of the last video amplifier and the free end touched first to the grid of the audio tube. A distinct rasping hum should be heard if this stage is functioning. Next we move the free end to the plate of the audio voltage amplifier. The same hum should be heard. If nothing or a weak sound is heard the coupling network between the plate of the voltage amplifier and the grid of the output tube is defective. Moving the free end of the .05  $\mu$ fd. condenser back until it is connected to the load resistance of the sound detector will locate any trouble present in the audio amplifiers.

To check the sound i.f. stage in sets using the Intercarrier System just

(Continued on page 155)





## "MY **BIG SALES ASSET!**"

**W**HAT helps me sell tubes, and the radio-TV service that goes with them, is buyers' preference for the G-E brand." You hear this from pleased servicemen . . . everywhere . . . who are cashing in on the strong trend to General Electric. Good tubes and popular—available in all the types you need, including latest designs—backed by advertising and promotion aids that really pull business *your way* . . . these form a bright sales picture when you feature the G-E line. Build a fast-growing income on your public's faith in the General Electric monogram! Your G-E tube distributor will be glad to help. Phone or write him today! *Electronics Department, General Electric Co., Schenectady 5, N. Y.*

*You can put your confidence in—*

**GENERAL  ELECTRIC**



181-JA3

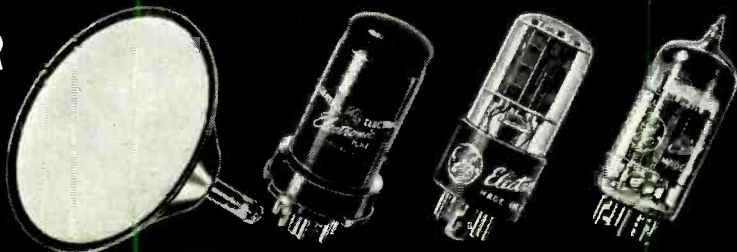
**ONE SOURCE FOR  
ALL YOUR TUBE  
REQUIREMENTS!**

TV PICTURE TUBES

METAL TUBES

GLASS TYPES

MINIATURES



—also GERMANIUM DIODES and SELENIUM RECTIFIERS. Stock G-E 100-percent, to save time and routine in ordering—to have the benefit of bulk deliveries from your distributor—to profit from General Electric tube quality and product popularity.



**RADIO  
TROUBLESHOOTER'S  
HANDBOOK**

Eliminates  
useless testing  
on 4 jobs out of 5



**...YOUR  
COMPLETE  
PRACTICAL RADIO  
SERVICE LIBRARY**

**...in two  
giant books**



**MODERN RADIO  
SERVICING**

A complete guide to trou-  
ble-shooting, instruments,  
circuit analysis, repair.

**LEARN TO WORK BY MODERN,  
PROFESSIONAL METHODS**

**1 Train for the big pay jobs!**

Ghirardi's MODERN RADIO SERVICING is a complete, 1 vol. course in all phases of professional radio-electronic repair. Tells how to make preliminary trouble checks on difficult jobs; how to analyze any circuit and its components; how, when and where to use all types of test instruments and interpret their readings to track down the trouble—even how to start a service business of your own. Everything is explained simply and thoroughly. 706 clear illustrations and 723 self-test review questions make study easy. Complete 1300-page book only \$5—or see special combination price offer below.

**CUT TIME IN HALF ON  
COMMON SERVICE JOBS**

**2 Work faster—make more money**

Almost 4 out of 5 radio repair jobs can be handled as easily as falling off a log! Just look up the model of the set to be fixed. Chances are Ghirardi's RADIO TROUBLESHOOTER'S HANDBOOK tells exactly what the trouble is, exactly how to fix it. Gives common troubles, their symptoms and remedies for over 4800 radios by 202 manufacturers. Hundreds of additional pages contain tube data; transformer trouble listings, alignment charts, and dozens of diagrams, etc., for faster, better service on any radio ever made. Only \$5—or see special combination offer.

**MONEY-SAVING OFFER!**

Let Ghirardi's RADIO TROUBLESHOOTER'S HANDBOOK save time, help you make more money on common service jobs. Let MODERN RADIO SERVICING train you in truly scientific servicing that can pave your way to the big money jobs. Get BOTH big books at the special price of only \$9.50 for the two (\$10.50 foreign). Use coupon today—at our risk!

**NOW!  
READ THESE  
GIANT  
BOOKS  
FOR 10 DAYS  
at our risk!**

**10-DAY MONEY-BACK GUARANTEE**

Dept. RN-30, MURRAY HILL BOOKS, Inc.,  
232 Madison Ave., New York 16, N. Y.

Enclosed find \$..... for books checked; or  
 send C.O.D. (in U.S.A. only) for this amount and  
I will pay postman. If books are not satisfactory, it  
is understood I may return them in 10 days and  
you guarantee to refund my purchase price. (Cash  
only outside U.S.A., same return privilege.)

MODERN RADIO SERVICING \$5 (\$5.50 outside  
U.S.A.)

RADIO TROUBLESHOOTER'S HANDBOOK  
\$5 (\$5.50 outside U.S.A.)

SPECIAL MONEY-SAVING OFFER—Both of  
above big books only \$9.50 (\$10.50 outside U.S.A.)

Name.....  
Address.....  
City, Zone, State.....

**MARS** Station  
**of the Month**

**MARS BEAMS WEEKLY BROADCASTS**

MARS—Army Headquarters station, WAR, located at the Pentagon Building, Washington, D. C., broadcasts a weekly message each Tuesday at 0100Z and at 0400Z. (This is Monday at 8 p.m. and 11 p.m., Eastern Standard Time; Monday at 7 p.m. and 10 p.m., Central Standard Time; Monday at 6 p.m. and 9 p.m., Mountain Standard Time; and Monday at 5 p.m. and 8 p.m., Pacific Standard Time.)

Simultaneous broadcasts are made on frequencies 6997.5 kc., 14,405 kc., and 20,994 kc. Each message is sent three times, once at 10 words per minute, once at 15 words per minute, and once at 20 words per minute.

Designed especially to transmit quasi-official traffic and training information to MARS members, the broadcast offers an excellent opportunity to all amateurs in building up their code proficiency.

**S**TATION A6ZQL has been designated the Military Amateur Radio Station-Of-The-Month by Captain E. L. Nielsen, Chief of MARS—Army.

The station is licensed to Major Clifford A. Frink, Signal Corps, who is Chief of Technical Production Section, Armed Forces Radio Service, Armed Forces Information and Education Division, Los Angeles Branch Office, Office of the Secretary of Defense. The station address of A6ZQL is 2109 Dymond Street, Burbank, California.

In the ZQL shack are HT-9 and BC-459 transmitters, an R-9er, an RCA 88 A receiver and a BC-342 receiver with an LS-3 speaker. The Major says, "Just give a call and I'll help you chew your fat... hand key or bug... makes no difference to me 'cause they both make dots and dashes!"

Frink's service extends over a period of 23 years as both an enlisted man and an officer. His entire military service has been directly related with some form of radio, but he did not take out a ham ticket until 1939 when he was

licensed as W5JJE at Fort Bliss, Texas, where he was a non-com with the 1st Cavalry Division.

Major Frink was commissioned a Second Lieutenant in the Signal Corps in 1942 and assigned duty with the Western Signal Corps Replacement Training Center at Camp Kohler, California. He was assigned as Officer-in-Charge of the Radio School, and later became Executive Officer of the Signal Communications Branch of this school.

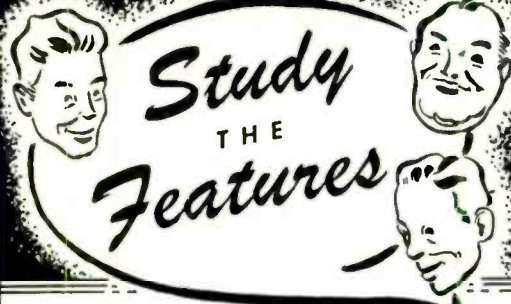
He was assigned duty with the Armed Forces Radio Service in Los Angeles in October of 1943. That same year he went overseas as Engineering Officer for AFRS in the South Pacific and three years later was Chief, AFRS, SOPAC. Still later he served as Chief, AFRS, Middle Pacific and Pacific Ocean Area. He has been assigned in the Los Angeles office, Secretary of Defense, since February, 1947. He went there first as Assistant Chief of the Program Section, then served as Officer-In-Charge, Short-wave Operations Section, before taking over his present duties.

-30-

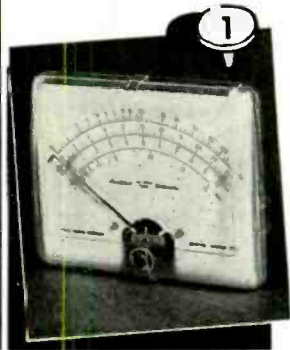
Twenty-three years of radio have developed a sweet fist and a ham's patience in Major Clifford A. Frink. Here he is shown in QSO at his home station A6ZQL/W6ZQL.







# Heathkits ARE THE QUALITY LINE OF TEST EQUIPMENT KITS



1

## MODERN STYLING

Heathkits have brought a new conception of beauty to laboratories and service benches.

Many organizations have standardized on Heathkits to make their shops appear attractive and uniform.

The panels are produced in grey and maroon and the modern streamline aluminum handles give the instruments a pleasant, professional appearance.

There is no waste space or false effort to appear large in Heathkits—space on service benches is at a premium and the size of Heathkit instruments is kept as small as is consistent with good engineering design.



5

## COMPLETE KITS

When you receive your Heathkit, you are assured of every necessary part for the proper operation of the instrument.

Beautiful cabinets, handles, two-color panels,  $\phi$  tubes, test leads where they are a necessary part of the instrument, quality rubber line cords and plugs, rubber feet for each instrument, all scales and dials ready printed and calibrated. Every Heathkit is 110V 60 cy. power transformer operated by a husky transformer especially designed for the job.

## BEST OF PARTS

You will find many famous names on the parts in your Heathkit. Mallory switches and filter condensers, Chicago Transformer Corporation and Electrical Assembly Transformers, Centralab Potentiometers, Belden Cable, IRC and Allen Bradley resistors, G.E. tubes, Cinch and Amphenol sockets with silver plated contacts, Defiance variable condensers, Eby binding post and many other quality parts. The finest of parts are used to assure long trouble-free service from Heathkits.



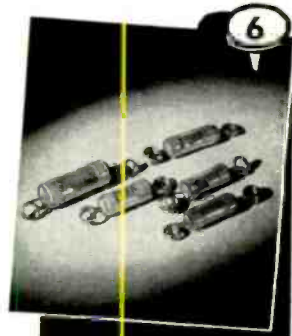
2

## PRECISION PARTS

Wherever required, the finest quality 1% ceramic resistors are supplied. These require no aging and do not shift. No matching of common resistors is required. You find in Heathkit the same quality voltage divider resistors as in the most expensive equipment.

The transformers are designed especially for the Heathkit unit. The scope transformer has two electrostatic shields to prevent interaction of AC fields.

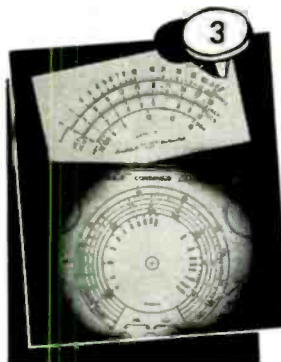
These transformers are built by several of the finest transformer companies in the United States.



6

## COMPLETE INSTRUCTION MANUALS

Everyone is pleased at the thorough instructions covering the assembly of each Heathkit instrument. Every detail of the assembly is covered, together with sections on the use of the instrument and trouble shooting instructions in case of difficulty. Actual photos of the assembled instrument enable fast and accurate assembly, clear schematics and pictorial diagrams of the confusing parts such as rotary switches, enable the wiring to be completed quickly.



3

## LARGE EASILY READ CALIBRATIONS

No charts or calculations are necessary to use any Heathkit properly. All scales are simply and plainly marked.

The operator instantly knows the proper use of the instrument and can proceed confidently. No multiplication is required as each scale is calibrated independently of the others.



7

## KITS THAT FIT

Heathkit chassis are precision punched to fit the quality parts supplied. The grey crackle aluminum cabinet and the two-color panels are die punched to assure proper fitting.

Many builders have written marveling at the ease with which assembly can be accomplished.

The chassis are specially engineered for easy assembly and wiring—there are no small, tight corners which cannot be reached—the ends of the chassis are left open in order that installation of parts and soldering can be done with both hands.

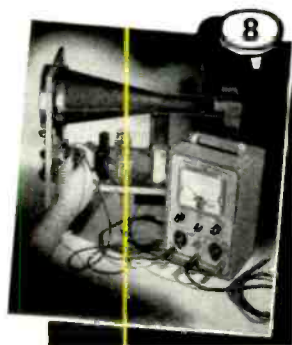


4

## IDEAL FOR SCHOOLS

Heathkits have been adopted as standard equipment of many of the largest universities and colleges. The low cost plus the fact that the students learn by actual assembly make them ideal training mediums. Many high schools and small colleges are finding that they too can have a modern physics and electronics laboratory by using Heathkits.

Some of the largest technical schools recommend Heathkits to their students as the best means of securing the necessary equipment to start their own shops.



8

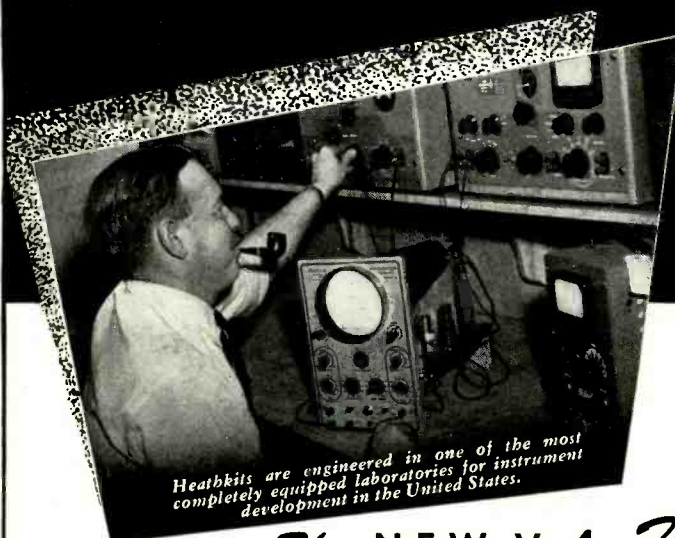
EXPORT DEPT.  
13 East 40th St.  
NEW YORK CITY (16)  
CABLE: ARLAB-N.Y.

The **HEATH COMPANY**

... BENTON HARBOR 15, MICHIGAN



# Heathkits ARE LABORATORY ENGINEERED . . .



Heathkits are engineered in one of the most completely equipped laboratories for instrument development in the United States.

## The NEW V-4 Heathkit VACUUM TUBE VOLTMETER KIT

### Features

- Meter scale 17% longer than average 4 1/2" meter.
- Modern streamline 200 ua meter.
- New modern streamline styling.
- Burn-out proof meter circuit.
- 24 Complete ranges.
- Isolated probe for dynamic testing.
- Most beautiful VTVM in America.
- Accessory probes (extra) extend ranges to 10,000 Volts and 100 Megacycles.
- Uses 1% precision ceramic divider resistors.
- Modern push-pull electronic voltmeter circuit.
- Electronic AC circuit. No current drawing rectifiers.
- Shatterproof plastic meter face.

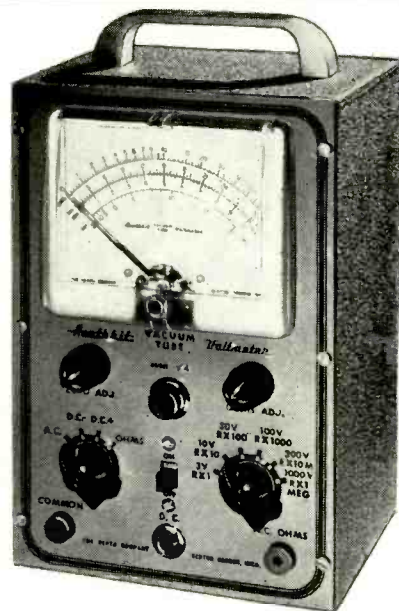
The new Heathkit Model V-4 Vacuum Tube Voltmeter has dozens of improvements. A new modern streamlined 200 microampere meter has Alnico V magnet for fast, accurate readings. The new electronic AC voltmeter circuit incorporates an entire new balance control which eliminates contact potential and provides greater accuracy. New simplified switches for quicker assembly. New snap-in battery mounting is on the chassis for easy replacement.

The Heathkit VTVM is the only kit giving all the ranges. Check them — DC and AC full scale linear ranges of 0-3V, 0-10V, 0-30V, 0-100V, 0-300V, 0-1000V and can be extended to 0-3000V and 0-10,000V DC with accessory probe at slight extra cost. Electronic ohmmeter has six ranges measuring resistance accurately from .1 ohm to one billion ohms. Meter pointer can be offset to zero center for FM alignment.

The DC probe is isolated for dynamic measurements. Has db scale for making gain and other audio measurements.

The new instruction manual features pictorial diagrams and step-by-step instructions for easy assembly. The Heathkit VTVM is complete with every part — 110V transformer operated with test leads, tubes, light aluminum cabinet for portability, giant 4 1/2" 200 microamp meter and complete instruction manual.

Order now and enjoy it this entire season. Shipping weight 8 lbs., Model V-4



# \$24.50

THE FINEST VTVM KIT AVAILABLE  
FOR THIS PRICE.

Accessory: 10,000V high voltage probe, No. 310, \$4.50.  
Accessory: RF crystal diode probe kit extends RF range  
to 100 Mc., No. 309, \$6.50.

## New Heathkit HANDITESTER KIT

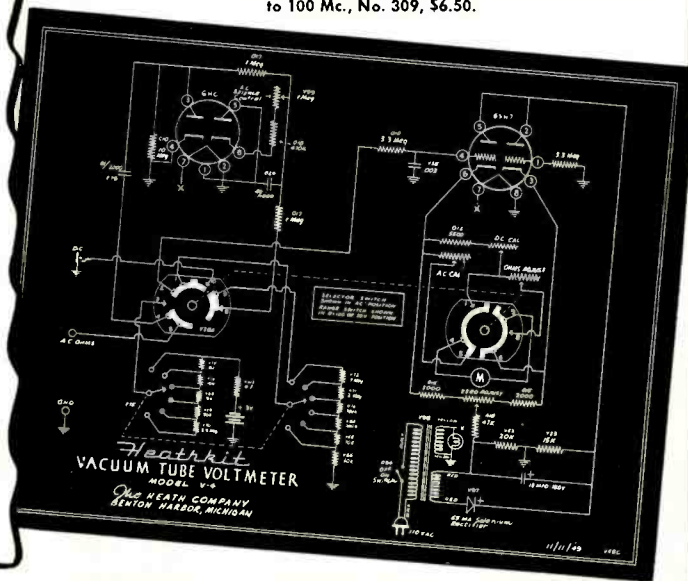
### Features

- Beautiful streamline Bakelite case.
- AC and DC ranges to 5,000 Volts.
- 1% Precision ceramic resistors.
- Convenient thumb type adjust control.
- 400 Microampere meter movement.
- Quality Bradley AC rectifier.
- Multiplying type ohms ranges.
- All the convenient ranges 10-30-300-1,000-5,000 Volts.
- Large quality 3" built-in meter.

A precision portable volt-ohm-milliammeter. An ideal instrument for students, radio service, experimenters, hobbyists, electricians, mechanics, etc. Rugged 400 ua meter movement. Twelve complete ranges, precision dividers for accuracy. Easily assembled from complete instructions and pictorial diagrams. An hour of assembly saves one-half the cost. Order today. Model M-1. Shipping wgt., 2 lbs.



# \$13.50



EXPORT DEPT.  
13 East 40th St.  
NEW YORK CITY (16)  
CABLE: ARLAB-N.Y.

# The HEATH COMPANY

... BENTON HARBOR 15, MICHIGAN



# TEST INSTRUMENT KITS



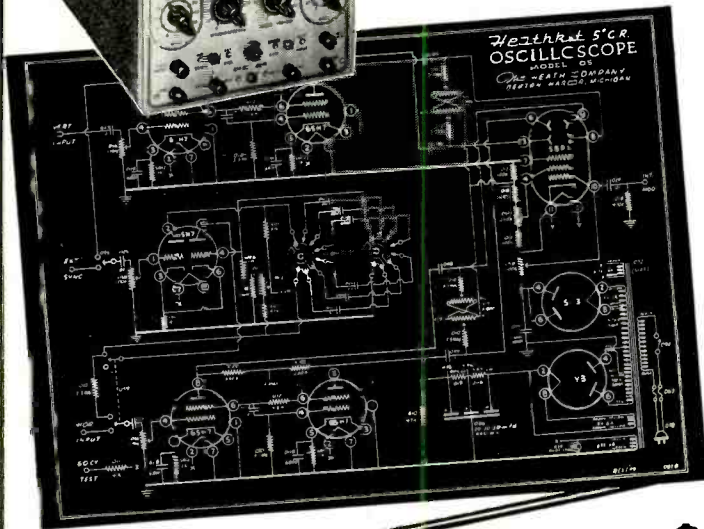
Only  
**\$39<sup>50</sup>**

## Heathkit PUSH-PULL EXTENDED RANGE 5" OSCILLOSCOPE KIT

### Features

- The first truly television oscilloscope.
- Tremendous sensitivity .06 Volt RMS per inch deflection.
- Push-pull vertical and horizontal amplifiers.
- Useful frequency range to 2 1/2 Megacycles.
- Extended sweep range 15 cycles to 70,000 cycles.
- New television type multivibrator sweep generator.
- New magnetic alloy shield included.
- Still the amazing price of \$39.50.

The new 1950 Push-Pull 5" Oscilloscope has features that seem impossible in a \$39.50 oscilloscope. Think of it—push-pull vertical and horizontal amplifiers with tremendous sensitivity only six one-hundredths of a volt required for full inch of deflection. The weak impulses of television can be boosted to full size on the five-inch screen. Traces you couldn't see before. Amazing frequency range, clear, useful response to 2 1/2 Megacycles made possible by improved push-pull amplifiers. Only Heathkit Oscilloscopes have the frequency range required for television. New type multivibrator sweep generator with more than twice the frequency range. 15 cycles to 70,000 cycles will actually synchronize with 250,000 cycle signal. Dual positioning controls will move trace over any section of the screen for observation of any part. New magnetic alloy CR tube shield protects the instrument from outside fields. All the same high quality parts, case, electrostatically shielded power transformer, aluminum cabinet, all tubes and parts. New instruction manual now has complete step-by-step pictorials for easiest assembly. Shipping weight, 25 lbs. Model O-5



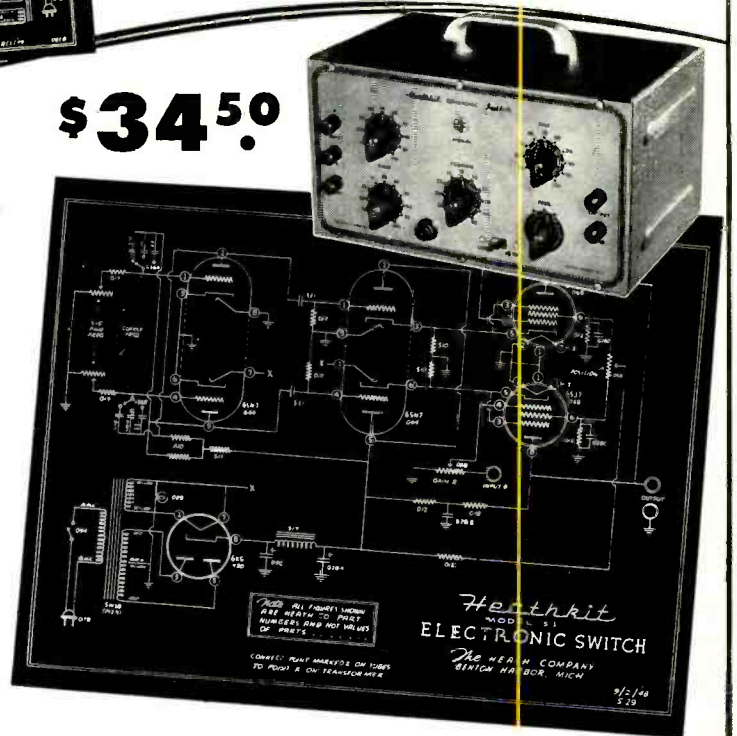
## Heathkit

## ELECTRONIC SWITCH KIT

DOUBLE THE UTILITY OF ANY SCOPE

An electronic switch used with any oscilloscope provides two separately controllable traces on the screen. Each trace is controlled independently and the position of the traces may be varied. The input and output traces of an amplifier may be observed one above the other or one directly over the other illustrating perfectly any change occurring in the amplifier. Distortion-phase shift and other defects show up instantly. 110V, 60 cycle transformer operated. Uses 5 tubes (1 6X5, 2 6SN7's, 2 6SJ7's). Has individual gain controls, positioning control and coarse and fine switching rate controls. The cabinet and panel match all other Heathkits. Every part supplied including detailed instructions for assembly and use. Shipping weight 11 lbs. Model S-1

**\$34<sup>50</sup>**



EXPORT DEPT.  
13 East 40th St.  
NEW YORK CITY (16)  
CABLE: ARLAB-N.Y.

The **HEATH COMPANY**

... BENTON HARBOR 15, MICHIGAN

# Heathkits ENABLE THE BUILDER



By assembling your own laboratory equipment, you control the quality of workmanship and learn the entire story of the instrument.

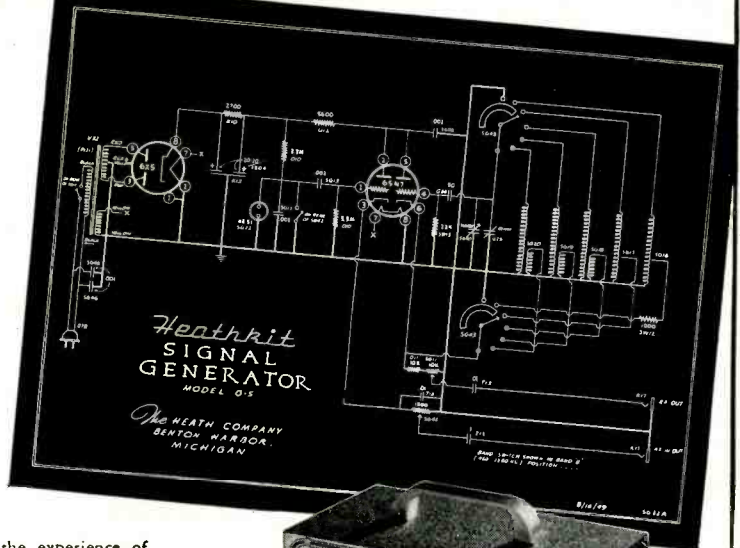
## New 1950 VERNIER TUNING RF Heathkit SIGNAL GENERATOR KIT

### Features

- New 5-to-1 ratio vernier tuning for ease and accuracy.
- New external modulation switch — use it for fidelity testing.
- Covers 150 Kc. to 34 Mc. on fundamentals and calibrated strong harmonics to 102 Mc.
- 400 cycle audio available for audio testing.
- Most modern type R.F. oscillator.
- New precision coils for greater output.
- Cathode follower output for greatest stability.

The most popular signal generator kit has been vastly improved — the experience of thousands combined to give you the best. Check the features in this fine generator and consider the low price \$19.50. A best buy for any shop, yet inexpensive enough for hobbyists. Everyone can have an accurate controlled source of R.F. signal voltage.

The new features double the value — think of being able to make fidelity checks on receivers by inserting a variable audio signal. Internal 400 cycle saw-tooth audio oscillator modulates R.F. signal and is available externally for audio testing. The new 5-to-1 ratio vernier drive gives hairline tuning for maximum accuracy in scale settings. The coils are already precision wound and calibrated. Uses turret type coil and switch assembly for ease of construction. The generator is 110V. 60 cycle transformer operated and comes complete in every detail — cabinet, tubes, beautiful two color calibrated panel and all small parts — new step-by-step pictorial diagrams and complete instruction manual make assembly a cinch even for novices. Why try to get along without a signal generator when you can have the best for less than a twenty-dollar bill. Better order it now. Shipping weight, 7 lbs. Model G-5.



**\$19.50**



**\$34.50**

### Heathkit

## SINE AND SQUARE WAVE AUDIO GENERATOR KIT

Experimenters and servicemen working with a square wave for the first time invariably wonder why it was not introduced before. The characteristics of an amplifier can be determined in seconds compared to several hours of tedious plotting using older methods. Stage by stage, amplifier testing is as easy as signal tracing. The low distortion (less than 1%) and linear output ( $\pm$  one db) make this Heathkit equal or superior to factory built equipment selling for three or four times its price. The circuit is the popular RC tuning circuit using a four gang variable condenser. Three ranges 20-200, 200-2,000, 2,000-20,000 cycles are provided by selector switch. Either sine or square waves instantly available at slide switch. All components are of highest quality, cased 110V. 60 cycle power transformer. Mallory F.P. filter condensers, 5 tubes, calibrated two-color panel, grey crackle aluminum cabinet. The detailed instructions make assembly an interesting and instructive few hours. Shipping weight, 12 lbs. Model G-2.

*Nothing ELSE TO BUY*

EXPORT DEPT.  
13 East 40th St.  
NEW YORK CITY (16)  
CABLE: ARLAB-N.Y.

**The HEATH COMPANY**

**... BENTON HARBOR 15, MICHIGAN**



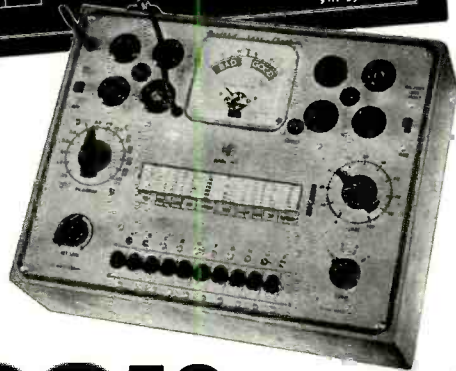
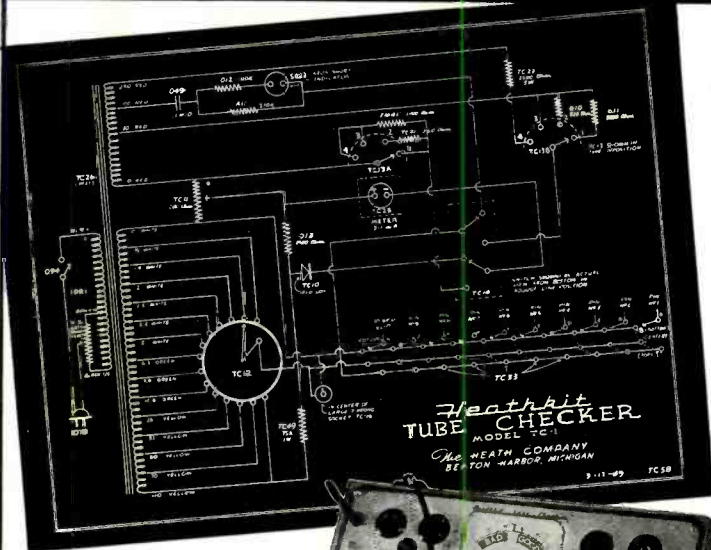
# TO USE THE *Best* OF WORKMANSHIP

## *Heathkit* TUBE CHECKER KIT *Features*

1. Measures each element individually.
2. Has gear driven roller chart.
3. Has lever switching for speed.
4. Complete range of filament voltages.
5. Uses latest type lever switches.
7. Uses beautiful shatterproof full view meter.
8. Large size 11" x 14" x 4" complete.
9. Checks new 9 pin miniatures.

Check the features and you will realize that this Heathkit has all the features you want. Speed, simplicity, beauty, protection against obsolescence. The most modern type of tester — measures each element — beautiful Bad-Good scale, high quality meter — the best of parts — rugged oversize 110V, 60 cycle power transformer — finest of Mallory switches — Centralab controls — quality wood cabinet — complete set of sockets for all type tubes including blank spare for future types — fast action gear driven roller chart uses brass gears to quickly locate and set up any type tube. Simplified switching cuts necessary time to minimum and saves valuable service time. Short and open element check. No matter what arrangement of tube elements, the Heathkit flexible switching arrangement easily handles it. Order your Heathkit Tube Checker today. See for yourself that Heath again saves you two-thirds and yet retains all the quality — this tube checker will pay for itself in a few weeks — better build it now.

Complete with detailed instructions, all parts, cabinet, roller chart, ready to wire up and operate. Shipping weight, 12 lbs. Model TC-1.



*Nothing*  
ELSE  
TO BUY

Only \$29<sup>50</sup>

## *Heathkit* BATTERY ELIMINATOR KIT

Now a bench 6 Volt power supply kit for all auto radio testing. Supplies 5 - 7½ Volts at 10 Amperes continuous or 15 Amperes intermittent. A well filtered rugged power supply, uses heavy duty selenium rectifier, choke input filter with 4,000 MFD of electrolytic filter, 0 - 15 Volt meter indicates output. Output variable in eight steps. Excellent for demonstrating auto radios. Ideal for servicing — can be lowered to find sticky vibrators or stepped up to equivalent of generator overload — easily constructed in less than two hours. Complete in every respect. Shipping wgt., 19 lbs.

Model BE-1

*Nothing* ELSE TO BUY



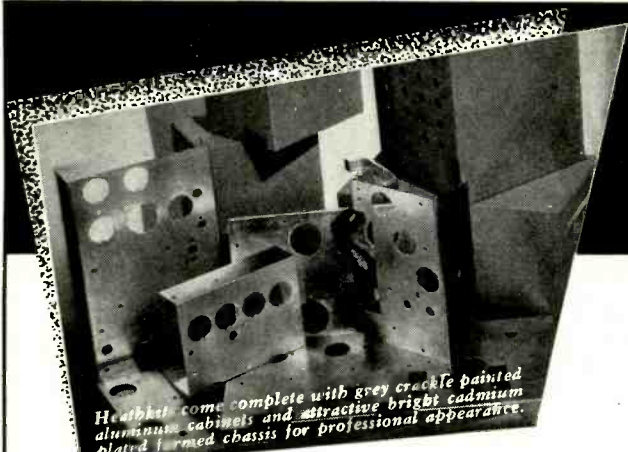
\$22<sup>50</sup>

EXPORT DEPT.  
13 East 40th St.  
NEW YORK CITY (16)  
CABLE: ARLAB-N.Y.

*The* **HEATH COMPANY**

... BENTON HARBOR 15, MICHIGAN

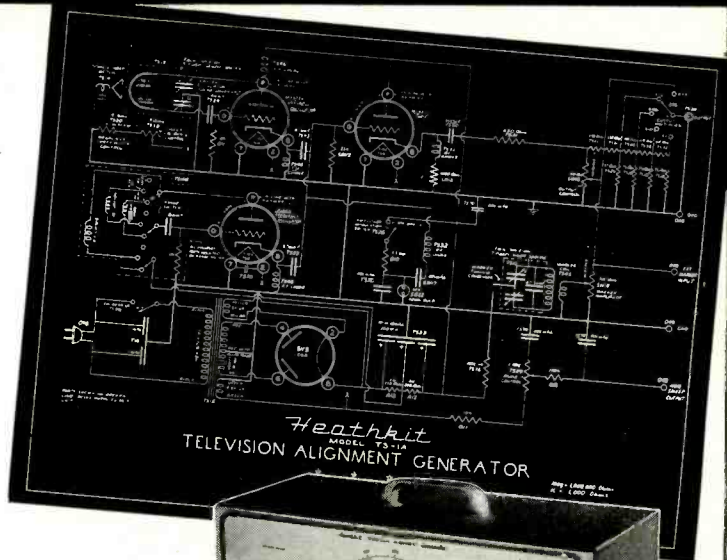
# Heathkits ELIMINATE



Heathkits come complete with grey crackle painted aluminum cabinets and attractive bright cadmium plated formed chassis for professional appearance.

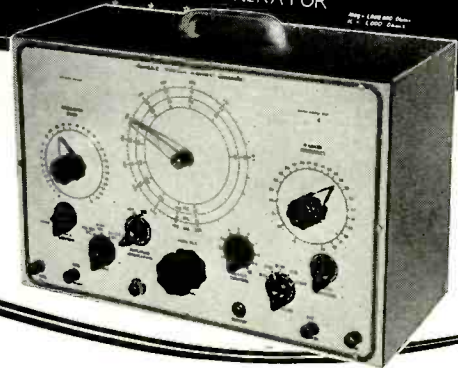
## Heathkit TELEVISION ALIGNMENT GENERATOR KIT

Everything you want in a television alignment generator. A wide band sweep generator covering all TV frequencies 0 to 46 — 54 to 100 — 174 to 220 Megacycles, a marker indicator covering 19 to 42 Megacycles, AM modulation for RF alignment — variable calibrated sweep width 0-30 Mc. — mechanical driven inductive sweep. Husky 110V. 60 cycle power transformer operated — step type output attenuator with 10,000 to 1 range — high output on all ranges — band switching for each range — vernier driven main calibrated dial with over 45 inches of calibration — vernier driven calibrated indicator marker tuning. Large grey crackle cabinet 16 1/8" x 10 3/8" x 7-3/16". Phase control for single trace adjustment. Uses three high frequency triodes plus 5Y3 rectifier — split stator tuning condensers for greater efficiency and accuracy at high frequencies — this Heathkit is complete and adequate for every alignment need and is supplied with every part — cabinet, calibrated panel, all coils and condensers wound, calibrated and adjusted, tubes, transformer, test leads — every part with instruction manual for assembly and use. Actually three instruments in one — TV sweep generator — TV AM generator and TV marker indicator.



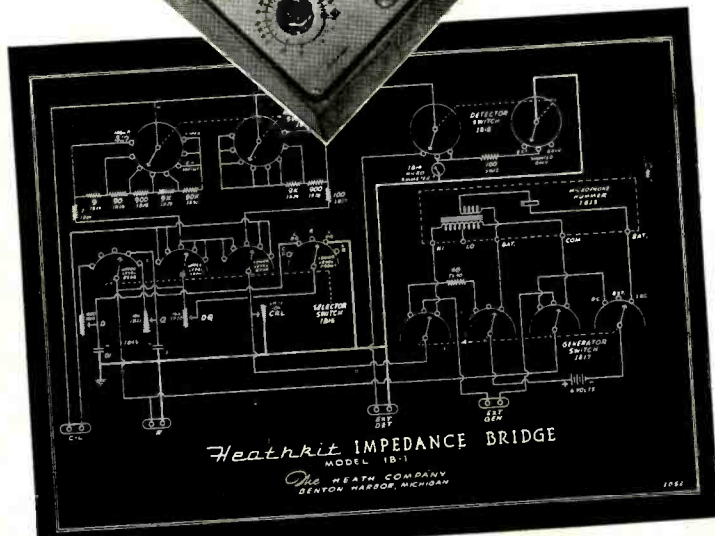
**\$39<sup>50</sup>**

Shipping weight 20 lbs.  
Model TS-1A



**\$69<sup>50</sup>**

Shipping weight 15 lbs.  
Model IB-1



*New Heathkit*

## IMPEDANCE BRIDGE KIT

A LABORATORY INSTRUMENT NOW WITHIN  
THE PRICE RANGE OF ALL

Measures inductance from 10 microhenries to 100 henries capacitance from .00001 MFD to 100 MFD. Resistance from .01 ohms to 10 megohms. Dissipation factor from .001 to 1. "Q" from 1 to 1000.

Ideal for schools, laboratories, service shops, serious experimenters.

An impedance bridge for everyone — the most useful instrument of all, which heretofore has been out of the price range of serious experimenters and service shops. Now at the lowest price possible. All highest quality parts. General Radio main calibrated control. General Radio 1000 cycle hummer. Mallory ceramic switches with 60 degree indexing — 200 microamp zero center galvanometer — 1/2 of 1% ceramic non-inductive decade resistors. Professional type binding posts with standard 3/4" centers. Beautiful birch cabinet. Directly calibrated "Q" and dissipation factor scales. Ready calibrated capacity and inductance standards of Silver Mica, accurate to 1/2 of 1% and with dissipation factors of less than 30 parts in one million. Provisions on panel for external generator and detector. Measure all your unknowns the way laboratories do — with a bridge for accuracy and speed.

Internal 6 Volt battery for resistance and hummer operation. Circuit utilizes Wheatstone, Hay and Maxwell circuits for different measurements. Supplied complete with every quality part — all calibrations completed and instruction manual for assembly and use. Deliveries are limited.

EXPORT DEPT.  
13 East 40th St.  
NEW YORK CITY (16)  
CABLE: ARLAB-N.Y.

**The HEATH COMPANY**

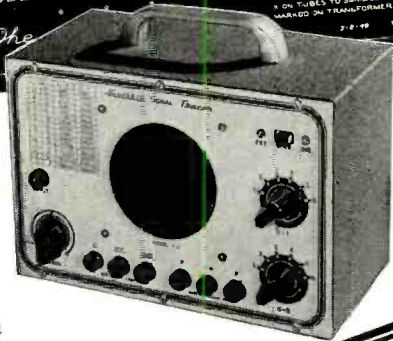
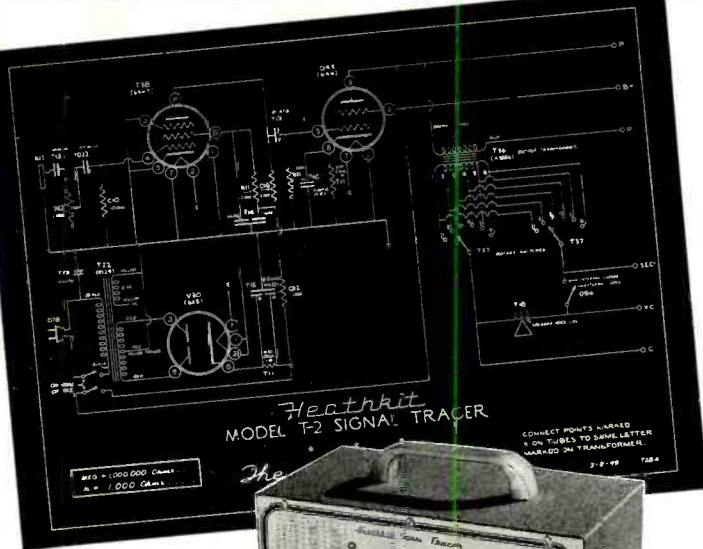
... BENTON HARBOR 15, MICHIGAN



# DIFFICULT METAL FABRICATION....

## NEW *Heathkit* SIGNAL TRACER AND UNIVERSAL TEST SPEAKER KIT

The popular Heathkit Signal Tracer has now been combined with a universal test speaker at no increase in price. The same high quality tracer follows signal from antenna to speaker, locates intermittents, defective parts quicker, saves valuable service time, gives greater income per service hour. Works equally well on broadcast, FM or TV receivers. The test speaker has assortment of switching ranges to match push-pull or single output impedance. Also tests microphones, pickups, PA systems; comes complete—cabinet, 110V. 60 cycle power transformer, tubes, test probe—all parts and detailed instructions for assembly and use. Shipping Wt., 8 lbs. Model T-2.



**\$19.50**

*Nothing ELSE TO BUY*

**\$19.50**

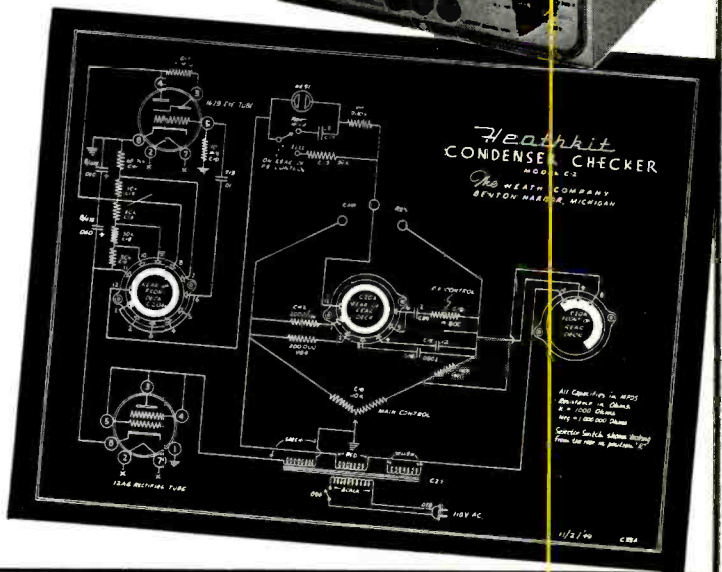


## Heathkit CONDENSER CHECKER KIT

### Features

- Power factor scale
- Measures resistance
- Measures leakage
- Checks paper-mica-electrolytics
- Bridge type circuit
- Magic eye indicator
- 110V. transformer operated
- All scales on panel

Checks all types of condensers, paper-mica-electrolytic-ceramic over a range of .00001 MFD. to 1000 MFD. All on readable scales that are read direct from the panel. NO CHARTS OR MULTIPLIERS NECESSARY. A condenser checker anyone can read without a college education. A leakage test and polarizing voltage for 20 to 500 volts provided. Measures power factor of electrolytics between 0% and 50%. 110V. 60 cycle transformer operated complete with rectifier and magic eye tubes, cabinet, calibrated panel, test leads and all other parts. Clear detailed instruction for assembly and use. Why guess at the quality and capacity of a condenser when you can know for less than a twenty dollar bill. Shipping weight, 7 lbs. Model C-2.



EXPORT DEPT.  
13 East 40th St.  
NEW YORK CITY (16)  
CABLE: ARLAB-N.Y.

**The HEATH COMPANY**

... BENTON HARBOR 15, MICHIGAN





# The GREATEST TELEVISION *Buy!*

## Complete TV RECEIVER KIT

A 18 TUBE  
WITH 12 CHANNEL TUNER  
*Actually* LESS THAN COST  
OF TUNER ALONE

# \$34.50

less  
TUBES  
AND  
CABINET



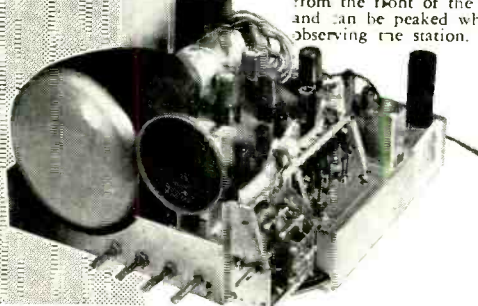
Think of it. A beautiful factory engineered 18 tube television receiver with all parts (less tubes and cabinet) for the cost of the tuner alone, \$34.50. Now you can afford to learn the fascinating secret of this new industry by actually assembling a high quality receiver. This TV receiver kit has everything, 12 channel Defiance tuner using 6BH6 RF stage and 6J6 as oscillator and mixer, all assembled and adjusted. Completely assembled 5000 Volt high voltage power supply ready to operate. A circuit incorporating the latest developments. The panel controls are station selector, volume, vertical and horizontal hold and contrast. At the rear are brightness, vertical and horizontal size, focus, vertical and horizontal centering. The circuit uses three stages of high gain I.F. with 6AG5 tubes, 12AU6 limiter 6AL5 second detector, 12AU6 syn. separator, 12AU6 video amplifier, 12SN7 horizontal multivibrator, 50L6 horizontal output, 12SN7 vertical multivibrator, 12SN7 vertical output, 50L6 high voltage oscillator, 1B3 high voltage rectifier, 19T8 as FM detector and audio amplifier, 25L6 audio output.



**COMPLETELY ASSEMBLED 5000 VOLT PICTURE TUBE POWER SUPPLY**  
This husky 5000 volt supply provides adequate voltage for the picture tube and gives perfect black and white reproduction. It is of the E.F. type and comes complete with the 50L6 R.F. oscillator and the 1B3 rectifier tubes installed.



**COMPLETELY ASSEMBLED 12 CHANNEL TUNER**  
One of the finest tuners available is supplied completely assembled. The tuner has three permeability tuned circuits for both the high and low bands. A 6BH6 is used as R.F. amplifier while a 6J6 twin triode operates as mixer and oscillator.  
The tuner is adjustable from the front of the set and can be peaked while observing the station.



This quality TV receiver uses latest type miniature television tubes 6AG5 - 6BH6, etc. The chassis comes complete with all brackets, CR tube mounting, I.F. coils, speaker — everything to build a powerful factory quality television receiver.

The cadmium plated chassis is punched and formed ready to assemble — every coil, condenser, resistor supplied. Comes complete with large (18 x 24) pictorial and manufacturer's instruction manual.

### BEAUTIFUL STYLING

This modern beautifully styled TV receiver will bring untold pleasure and entertainment to the entire family. The pleasant appearance compliments any living room while the steadily improving programs will please the entire family. There are excellent vaudeville programs to entertain your friends, excellent children's programs, Arthur Godfrey, United Nations programs for serious thinkers. A television set aids in the education of the family and by building its vast technical knowledge of this new profitable field is obtained.

Remember we have a limited quantity. Order now while still available.

- |   |                |
|---|----------------|
| Complete 7" Television Receiver Kit<br>(less tubes and cabinet).....  | <b>\$34.50</b> |
| Complete set of tubes as outlined above with RCA 7JP4 picture tube (18 tubes for less than price of picture tube) | <b>20.00</b>   |
| Beautiful piano finish mahogany cabinet for above TV set  | <b>20.00</b>   |
| Buy all at one time and save. Complete Receiver Kit with tubes and cabinet .....                                  | <b>69.50</b>   |

EXPORT DEPT.  
13 East 40th St.  
NEW YORK CITY (16)  
CABLE: ARLAB-N.Y.

## The HEATH COMPANY

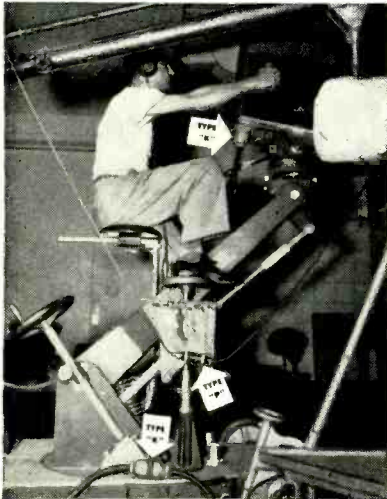
BENTON HARBOR 15, MICHIGAN





## KEEP UP WITH CANNON

... get on the gratis subscription list of "The Cannon Electric Cannonade" bi-monthly, eight-page, technical house organ and preview of Cannon Plugs, news and information about all Cannon Electric products.



## PLUGS ON VIDEO CAMERA

... be assured of "good connections." That's why television stations, for instance, use Cannon Electric Type K, P, and other series for cameras, microphones and transmission equipment that *must not fail*. Shown above is a camera at KTLA—Hollywood.

Cannon Plugs are available through a network of radio parts dealers all over the U.S.A. Buy them from Rochester Radio Supply, *Rochester, N. Y.*; Warren Radio, *Sioux Falls, N. D.*; Electra Dist., *Nashville, Tenn.*; Radio Specialties, *Detroit*; The Hargis Co., *Austin, Tex.*; Radio & Electronic Parts, *Cleveland*; and more than 400 other radio parts distributors. Write for new C-48 Condensed General Catalog.

Cannon Electric Development Company, Division of Cannon Manufacturing Corporation, 3209 Humboldt Street, Los Angeles 31, California. Canadian factory: Toronto. World Export: Frazer & Hansen, San Francisco, New York, Los Angeles.

SINCE 1915  
**CANNON ELECTRIC**

78

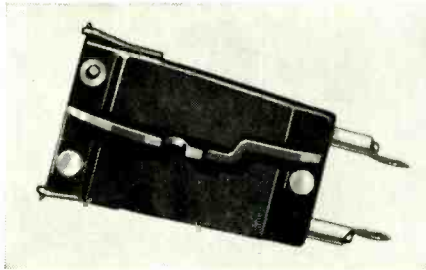
# What's New in Radio

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.

## UNIVERSAL CARTRIDGE

A new universal cartridge, the "Featheride" Type A1, which will fit almost all record changer arms and play any combination of record speeds has been announced by *Webster Electric Company* of Racine, Wisconsin.

The cartridge measures 19/32" wide



by 1" long which makes it suitable for most of the modern designed tone arms. Tracking pressure is 7 grams, meeting the requirements of 33 1/3 and 45 r.p.m. record speeds and providing unusually light tracking in the playing of standard 78 r.p.m. records.

Needles are held firmly in position by specially designed friction chucks.

## CROSSOVER NETWORK

*University Loudspeakers, Inc.* of 80 South Kensico Avenue, White Plains, New York has announced a new filter network of the LC type for use with coaxial or duplex loudspeaker systems.

Designated the Model 4410 filter, this high fidelity accessory provides a proper attenuation rate at a crossover of 600 cycles. The new unit is housed in a cast aluminum container which is compact and carefully finished throughout. A high frequency attenu-



ator is supplied with this network for properly balancing the low and high frequencies.

## SPRAGUE CONDENSERS

A line of electrolytic condensers for 115-volt continuous duty alternating current service is a new development of the *Sprague Electric Company* of North Adams, Massachusetts.

Known as the *Sprague Type 11A*, these units are suited for across-the-line power factor improvement at low voltages, particularly with appliances and light industrial equipment. They may be used in applications where starting voltage surges across condensers may exceed rated voltages by as much as 50 per-cent for a maximum of two seconds.

They may also be used in applications where a voltage drop is required without power dissipation. An engineering bulletin (No. 301) is available on this line when requests are made on company letterhead.

## EMC "VOLOMETER"

*Electronic Measurements Corporation*, 423 Broome Street, New York 13, New York, has developed a new com-



compact and lightweight multimeter, the Model 104 "Volometer."

Although inexpensively priced, the new unit has such features as 4 1/2" square, 50 microampere meter with Alnico magnet, three a.c. current ranges to 3 amperes, three resistance ranges to 20 megohms, five d.c. voltage ranges at 20,000 ohms/volt to 3000 volts, and five a.c. voltage ranges to 3000 volts.

The instrument, which is housed in a high-impact, round-cornered Bakelite case with carrying strap, measures 5 1/4" x 6 3/4" x 2 7/8" and weighs only 2 pounds and 5 ounces.

## 3-INCH CR TUBE

A new three-inch cathode-ray tube, said to be the shortest electrostatic tube of its classification made in the United States, has been announced by the Tube Divisions of the *General Electric Company*.

Designated the 3MP1, it was originally designed for use in small indus-

**RADIO & TELEVISION NEWS**





# FREE!

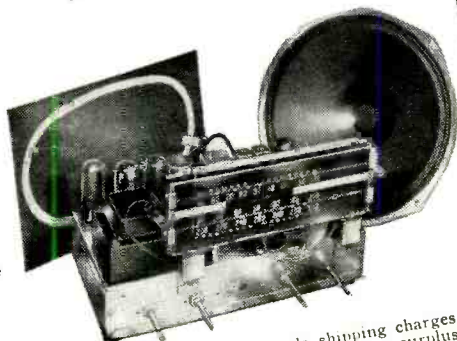
THE GREATEST CATALOG  
FROM LAFAYETTE IN  
29 YEARS

164 large-size pages filled with  
Parts • Tools • Public Address  
High-Fidelity Components  
Radio & Television Sets and Chassis  
Test Equipment • Ham Gear  
Record Changers

Everything in Radio  
and Television at the  
Lowest "Net" Prices!

Check these specs—  
then look at the price!  
**LAFAYETTE-ENGINEERED  
FM-AM CHASSIS**

- 11 tubes plus rectifier
- Pre-amplifier for variable reluctance pick-up
- 10-watt push-pull beam-power output



only **\$59.50**

INCLUDING THE MATCHED 12" PM SPEAKER!

(When ordering, include shipping charges based on weight and zone—any surplus will be refunded.)

This is, without question, Lafayette's greatest chassis value in 10 years. For \$59.50 you get a chassis that compares favorably in performance with sets that have been selling as high as \$300 or more. Look at these excellent features: Latest 11-tube circuit, plus rectifier. Push-pull beam power output. Rated at 10 watts, undistorted. Built-in pre-amplifier for variable reluctance pick-up. Automatic volume control. Equipped with

phono input jacks for low and high impedance inputs. Full-range tone control. Slide rule dial, indirectly illuminated. Receives 88-108 MC FM band, 550 to 1700 KC broadcast band. 105-125 volts, 60 cycles. AC only. Chassis dimensions: 13x9x9 1/2". Shipping weight: 25 lbs. Complete with tubes, dial escutcheon, two in-door antennas (folded dipole for FM, loop for AM), and matching 12" PM speaker. \$59.50.

**DON'T** just take our word for it. Invest a penny postcard and send for your copy of the great new 1950 Lafayette Catalog. Then sit down with a pencil and paper and make a price comparison test yourself. Check the famous-make equipment, model for model, and see if Lafayette doesn't save you anywhere from a few pennies to a few dollars on most every item.

And remember—Lafayette gives you the service of a *national organization*, with 2 great centrally-located mail order centers and 6 strategic outlets for personal shopping. That means you save more money on postage, and get the parts you need a couple of days sooner.

So if you're a service man, experimenter, ham, hi-fi bug, engineer, or set-builder—send for your new 1950 Lafayette Catalog now. It's one of the biggest things in America you can get "for free"!

# Lafayette

RADIO

2 Great Mail Order Centers:  
NEW YORK: 100 Sixth Avenue, New York 13  
CHICAGO: 901 W. Jackson Blvd., Chicago 7



6 Outlets for Shopping in Person:

- NEW YORK: 100 Sixth Ave. and 542 E. Fordham Road (Bronx)
- ATLANTA: 265 Peachtree St.
- BOSTON: 110 Federal St.
- CHICAGO: 901 W. Jackson Blvd.
- NEWARK: 24 Central Ave.

**RUSH COUPON**

LAFAYETTE RADIO, DEPT. RC-50

901 W. Jackson Blvd., Chicago 7, Ill.  
or 100 Sixth Avenue, New York 13, N. Y.

- Check here for FREE 1950 Catalog. (Please don't check if you have already received your catalog.)
- Please rush the Lafayette FM-AM chassis (including speaker) at \$59.50. I enclose \$..... in postal note, money order or check. (Please include shipping charges based on weight and zone. Any surplus will be refunded.)

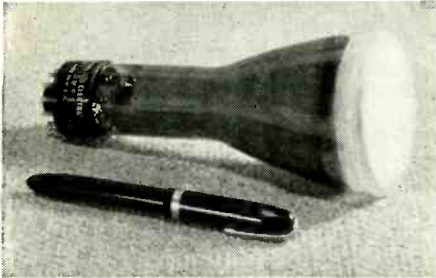
Name.....

Address.....

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

-PASTE COUPON ON PENNY POSTCARD-

trial oscilloscopes. The new tube is expected to find numerous applications for television servicing and for



testing industrial apparatus such as welders, amplifiers, and electronic timing devices.

Special processing of the screen gives a brighter trace than normal tubes of the same electrical ratings, according to the company. The new tube is an electrostatic focus and deflection type with a bulb diameter of 3 3/8 inches and a useful screen diameter of 2 3/4 inches. It is equipped with a small-shell, duodecal base which has been set as the standard base on all television tube types.

Maximum ratings for the new tube are available from the company's Tube Divisions at Schenectady, New York, along with other pertinent data on the 3MP1.

#### PLYWOOD MAST

A new sectional mast which is capable of supporting a television re-

ceiver antenna up to 90 feet above the ground has been introduced by *Special Purpose Products Co.*, 155 Perry Street, New York 14, New York.

Available in kit form, these masts are of a special plywood tubing, Woundwood, which has been designed especially for such purposes. Parts for a 60-foot antenna mast include Woundwood sections for mast and erection boom, guy lines, block and fall, base, boom socket and stakes.

The lead wires are protected inside of the hollow core of the mast, which is weather-resistant and non-rusting.

#### GROUND CLAMPS

Of interest to service technicians and amateurs is the new adjustable ground clamp recently announced by *Blackburn Specialty Co.*, 6541 Euclid Ave., Cleveland 3, Ohio.

The clamp is now available in two sizes, one to fit 3/8" to 1 1/4" pipe and the other to fit 3/8" to 3" pipe. A tightening screw chafes the pipe, draws up slack, cuts through rust and dirt and at the same time contracts the band around the pipe surface, assuring a perfect ground.

Solder or solderless terminal types are available for various applications. The clamp itself consists of a flexible, perforated pure copper band which encircles the pipe. A boss raised on the flat end of a removable copper alloy terminal lug fits into band holes and is machined to give a clean and

smooth contact surface. The tightening screw with a lock nut is threaded through the boss. The clamp carries *Underwriters' Laboratories* approval.

#### NEW-TYPE TAPE RECORDER

A new tape recorder, which is being marketed under the trade name "Reelest," has been introduced by *Universal Moulded Products Corporation* of 1500 Walnut Street, Philadelphia 2, Pennsylvania.

Some of the unit's exclusive new features include twin-track recording without interruption for rewinding; no "flip-flop" of reels as a patented "Revers-A-Matic" plays or records in two directions for one hour without

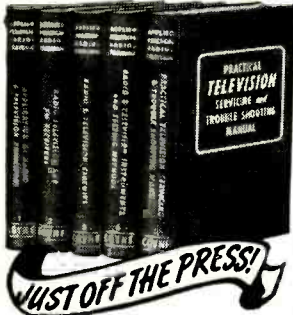


attention; a new "Thred-A-Matic" feature which simplifies threading of tape; and a volume indicator (an elec-  
(Continued on page 134)

# BIG MONEY IN RADIO and TELEVISION NOW!

See **COYNE'S Brand New 5 Volume Set**

**"APPLIED PRACTICAL RADIO-TELEVISION" FREE!**



Here is a **BRAND NEW** Set of books written for men who want to "go places" in **TELEVISION** and **RADIO** . . . men who know how much a **PRACTICAL** working knowledge helps to get the **BIG MONEY**. Over 1500 pages, 5000 subjects of the latest Radio and Television "know how" . . . easy to understand with hundreds of crystal-clear illustrations. It's **ALL** here! **EVEN COLOR TELEVISION AND UHF**. How to install, service, align, balance **ALL** radio and TV sets . . . how to use new and old testing instruments for TV service . . . latest data on adapters, converters and more, more, **MORE**. You name it and **COYNE'S GOT IT**, in this amazing new money-making 5-Volume Radio-Television Library.

**PRACTICAL!  
CLEAR!  
COMPLETE!**

5 fact-packed volumes - 1000 illustrations and diagrams with step-by-step photographs which "break down" the equipment to show what makes it "tick". Up-to-the-minute, complete, easy to follow.

#### Color Television Is Here!

Set contains most complete section ever published on Color Television and UHF, adapters and converters. **FULLY ILLUSTRATED AND PRINTED IN 4 COLORS.**

#### Act Now and Get FREE Book

Now you can see these new Coyne books for 7 days without cost and get Coyne's remarkable new 4-color book, "The Complete Story of Color Television" **FREE**. It's free just for examining the new 5-Volume Set. Full details of this sensational Coyne "prove it" offer are given below. Mail the coupon at once.

**SEND COUPON—SEE SET FREE FOR 7 DAYS**

You must **SEE** these new books to know how easy it is to prepare for the big jobs in radio and television. Here's our special offer:—we'll send the complete 5-volume set for your 7-Day **FREE** Examination. And with it, we'll include our sensational, new 50-page book, "The Complete Story of Color Television", absolutely **FREE!** If you keep the 5-volume Set all you pay is \$3.00 within 7 days after the books arrive and \$3.00 per month until \$16.50 is paid—or you can pay \$15.00 cash price. If you don't want the set, return it and you **OWE NOTHING**. But either way you keep "The Complete Story of Color Television" as a gift. That book is **ABSOLUTELY FREE**.

**SEND NO MONEY** Coupon is just a request to see Set free and get **FREE BOOK**. Offer limited—act now.

**COYNE Electrical and Radio-Television School**

500 S. Paulina St., Dept. 30-T3, Chicago 12, Ill.

#### Mail This Coupon NOW

Educational Book Publishing Division  
**COYNE ELECTRICAL & RADIO-TELEVISION SCHOOL**  
500 S. Paulina St., Dept. 30-T3, Chicago 12, Ill.

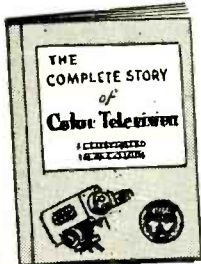
O.K. Send me postpaid, your new 5-volume set, "Applied Practical Radio-Television", on 7 days Free Trial per your offer. Be sure to include as a gift the book on Color Television absolutely **FREE**.

NAME \_\_\_\_\_ AGE \_\_\_\_\_

ADDRESS \_\_\_\_\_

TOWN \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

Where employed \_\_\_\_\_





# McGEE'S BIG SCOOP SALE ON "WEBSTER-RACINE" AMPLIFIERS

McGee makes another terrific purchase. A solid truck load of brand new factory cartoned public address equipment. The following advertisement prices you the material at less than the original jobbers' cost. As you experienced sound-men know, the Webster Electric Co. of Racine, Wisconsin, is a renowned builder of the finest in audio equipment. All amplifiers are conservatively rated and can be counted on to give the terrific by high retail list price originally placed on these articles is indicative of their No. 1 quality. To the best of our knowledge, these are the best amplifier values in the U. S. today. These prices will be good only as long as our inventory lasts.

## WEBSTER MODEL 41-12

12-WATT AMPLIFIER

ORIGINAL LIST \$126.50

SALE PRICE **\$33.90**

Has Automatic Volume Control

Webster Racine 12 watt amplifier Model 41-12, housed in a 13 3/4" x 7" wide and 8" high metal cabinet. Input for one crystal or dynamic mike and crystal phono pickup. One dual type tone control. Wide range frequency response, 40 to 10,000 CPS, plus or minus 3 db. Output taps, 2-4-250 and 500 ohms. With tubes: 6J7, 6K7, 6Z7, 6H6, 2-6V6G and 80. Has automatic volume control circuit and selector switch. Ship. weight 19 lbs. Original list price on this unit was \$126.50. McGee's scoop price \$33.90.



## WEBSTER MODEL 12-TN COMPLETE 12-WATT PORTABLE PUBLIC ADDRESS SYSTEM

SALE PRICE **\$59.95**

Complete portable public address system, Webster Racine Model 12TN-1 consists of one Model 41-12 amplifier, one carrying case, two S6025 heavy duty PM speakers and 50 feet of rubber cord with plug. All equipment is contained in the split type amplifier case. A small American crystal mike and desk stand is included. This PA system is conservatively rated at 12 watts. Input for one mike and one phono player. Ship. weight 41 lbs. Less than 50 of these portable PA systems are available at the ridiculous price of \$59.95.



6-TUBE RADIO PHONO COMBINATION SALE PRICE **\$39.95**

Another red hot McGee Scoop. An attractive blond finish console cabinet with 78 RPM record changer and a full 6 tube super-net broadcast chassis wired in the nationally known factory. Has R.F. stage, loop antenna, 6 tubes: 2-12SK7, 12SA7, 12AQ7, 35L6, and 35Z5, variable tone control and built-in radio phono switch. In order to offer this set at the low price of \$39.95, we ship the chassis and changer unmounted. Cabinet has cut to fit radio panel. However it's easy to install the set as an etchupon plate is furnished. About one hour's time is needed to mount the set and changer. Shipping weight 50 lbs. Stock No. AK-10, sale price \$39.95.



## WEBSTER MODEL 16A20

McGEE'S SALE PRICE **\$42.95**

Webster Electric Model 16A20, conservatively rated at 20 watts. (Original retail price was \$187.00. Housed in a heavy metal case, 16" long, 7" wide and 9" high. Two inputs for microphones (crystal or hi Z dynamic), 1 phono input for crystal pickup, 1 volt required for added amplifier output. Two mike volume or fader controls. One phono control and one dual type tone control. Wide range frequency response, plus or minus 1 db, from 50 to 10,000 CPS. Output transformer taps, 2-4-8-250 and 500 ohms. Electron-ray eye tube indicates rated power output when eye is closed, in order to prevent overload distortion. Complete with tubes, 2-6J7, 6N7, 6SN7, 2-6L6, 5V4, 6H6 and 6E5. Shipping weight 33 lbs. This is one of the finest public address amplifiers that we have ever seen. We have only 25 to sell, at the ridiculous price of only \$42.95. Remember this amplifier's original retail list was \$187.00. Amp. are new and in factory cartons. Better order now.

## 50 WATT WEBSTER MODEL 18-50 SALE PRICE **\$79.95**

Webster Racine Model 18-50, 50 watt amplifier. Similar in appearance to Model 16A20. Original list price was \$248.00. Housed in an attractive metal case, 18" long, 9" wide and 9" high. Two inputs for crystal or dynamic mike and one input for phono. Dual type tone control. Frequency response, plus or minus 1 db, from 50 to 10,000 CPS. Output transformer taps, 2-4-8-125-166-250 and 500 ohms. Electronray tube indicates maximum power output when closed. This is one of the finest public address amplifiers we know of. Only 50 of these 50 watt amplifiers are available. Regular \$248.00 list. McGee's sale price, \$79.95. Shipping weight 49 lbs.

## ST. GEORGE Wire Recorder MECHANISM SALE PRICE **\$12.95**

St. George wire recorder mechanism, size 1 1/2 x 3 1/2". Crystal pickup for recording from 78 RPM records may be attached, however it is not furnished at the \$12.95 price. The units are complete with wire recording head and suggested amplifier diagram. They are new, but need minor adjustments. No broken or missing parts. Only a few to sell at the scoop price of \$12.95. Shipping weight 15 lbs. Stock No. SG-74. Net \$12.95.

**SALE ON RECORDING WIRE**  
Top quality magnetic recording wire on metal spools. Red hot prices.  
15 minute spool, Net \$1.19, 10 for \$11.00.  
30 minute spool, Net \$1.79, 10 for \$16.90.  
1 hour spool, Net \$2.79, 10 for \$25.00.

## VM-406 Tri-O-Matic 3-Speed Changer **\$33.21**

The new VM model 406 Tri-O-Matic automatically plays all records, all sizes and all speeds now on the market. Protective features: records are lowered, not dropped, no wobbling down the spindle, no slip or scrape, no possibility of the tiny micro-grooves on the new type records being damaged. Plays 12 1/2", 33 1/3" or 78 RPM, 3 1/2", 33 1/3" or 78 RPM any 10 or 12 records of the same type intermixed, 12 7/8" 33 1/3" RPM and 12 7/8" 45 RPM records. Automatically shuts off on the last record. coil Jensen PM speaker, 6 ohm voice coil. General Electric Variable Reluctance Cartridge and Twin Needles. Model 406GE. New 1950 Model VM-406 with All-in-one General Electric Variable Reluctance Cartridge and Twin Needles. Model 406GE. Specify VM406-GE. Add \$2.85 to above cost.

## WEBSTER MODEL 50B-12 12-Watt Paging Amplifier Made for 24 Hour Service **\$132.00 LIST PRICE \$33.90**

Webster Racine Model 50B-12, 12 watt paging amplifier. Original retail list \$132.00. Designed for continuous operation, 24 hours a day, 7 days a week. Plate voltage is applied to all tubes only during actual speech or sound operation. Amplifier is housed in a metal case 13 3/4" long, 7" wide and 8" high. One input for crystal or dynamic mike and one input for crystal phono pickup. Mike line has screwdriver adjustment and tamper-proof cap. Dual type tone control. Frequency response 60 to 8,000 CPS, plus or minus 1 db. Automatic volume control, limiter type, provides reasonably constant amplifier output from signals louder than normal. Output taps, 5-7-10-14-20-80 and 417 ohms. With tubes: 6J7, 6L7, 6C8, 6H6, 80 and 2-6V6. Original retail list, \$132.00. McGee scoop price only \$33.90. Shipping weight 19 lbs.

## WEBSTER Model DS 12-50HN comp. Price **\$44.95**

Model DS 12-50HN comp. Price \$44.95. \$41.00 list heavy duty Jensen PM speakers, housed in a split leatherette carrying case. The original retail list on these speakers and case was \$150.00. McGee's scoop price, \$44.95. Shipping weight 49 lbs. Only 50 pieces to sell. 10" x 7" watt permanent magnet speaker, Webster Racine Stock No. S6026, 6 ohm voice coil. Net price, each, \$3.95. 12" Jensen PM speaker Model PM-12C, 6 ohm voice coil, Webster Racine Stock No. S-4482. The original retail list on this speaker was \$22.95. McGee's sale price, \$7.95. 8 ohm voice coil, Webster Racine Stock No. S-4626. Original list price was \$41.00. Ship. w., 19 lbs. McGee offers them to you, while stock lasts. \$13.95 each.

## Our Leader Changer Scoop **\$11.95, 2 for \$22.95**



Our leader, automatic changer scoop. Base size 13 x 13". Plays 10 1/2" or 12 1/2" 78 RPM records automatically. Has static L-70 cartridge. Priced complete with a metal base, which can be used in slide away compartment or as a shelf-top base, or changer can be lifted off base to fit your needs. Stock No. AD-12, Shipping weight 11 lbs. Scoop price \$11.95 each, 2 for \$22.95. General Instrument 78 RPM changer with crystal cartridge for 10 1/2" or 12 1/2" records. Base size 11 x 12". Weight 11 lbs. Net \$12.95, 2 for \$25.00. VM-400, 78 RPM changer with crystal cartridge. Base size 12 1/2 x 13". Plays 10 1/2" or 12" records. A super duper value. Weight 12 lbs. Scoop price \$12.95, 2 for \$25.00.

## RED HOT VALUES IN COMPLETE RADIO KITS 6 TUBE AC SUPERHET KIT BROADCAST AND SHORTWAVE MATCHED PARTS **\$9.95**



MODEL 6-ACX5 2 BAND CHASSIS KIT

A complete kit of parts, tubes and ready punched chassis to build a fine 6 tube, 2 band AC power transformer type radio chassis. (No cabinet.) We furnish all pieces as well as a printed diagram and photograph. Chassis size, 14 1/2" x 7". Receives standard broadcast and 6 to 18 MC shortwave. 3 gang tuning condenser used on both bands. 90 mill power transformer and 6V6 output tube. The chassis dial mechanism, gang and coils used in this kit were manufactured for use in a high quality Detroit radio. The heavy plate glass dial has etched-in numerals. This is a complete 2 band AC chassis kit. Former is furnished but the speaker is not. Use any standard PM speaker, 8" Heavy duty PM speaker, \$2.95 extra. 10" Heavy duty PM speaker, 3.95 extra.

## NEW 1950 MODEL 5-TUBE SUPERHET RADIO KIT MODEL NS-5 **\$9.95**

McGee's new 1950 Model 5 tube AC-DC superheterodyne radio kit. Has loop antenna and 2 gang condenser, with lighted slide rule dial and attractive plastic cabinet. Receiver broadcast, 550 to 1650 kc. Full size dynamic speaker, matched 456 I.F. automatic volume control. This is a complete radio kit. Everything furnished, including diagram, photos and tubes: 12BE6, 12BA6, 12AT6, 50B5 and 35W4. Shipping weight, 7 lbs. Stock No. NS-5. Net price, \$9.95.

## BUILD YOUR OWN MINIATURE RADIO STATION KIT MODEL DE-6X **\$6.95**



Kit Model DE-6X. With this simple kit you can build your own radio station in miniature. Has 4 tubes. Broadcast on frequency from 800 to 1500 KC. from either a crystal microphone or phono-graph record. (Warning: this transmitter must be used with only a short aerial. Otherwise you will broadcast 3 or 3 miles.) One control fades from mike to record. Price includes parts, diagram, instructions, photo and tubes. Every one will enjoy your miniature broadcast station. Kit Model DE-6X. Shipping weight 4 lbs. Net price, \$6.95. Model DE-6XWT, miniature transmitter, wired and tested. Net price, \$8.95. Crystal mike and desk stand, pictured with transmitter, \$4.95 extra. Dynamic mike, small palm-of-your-hand type, \$5.95 extra. Stock No. NK-T, small aluminum cased crystal microphone, response 40 to 9000 CPS. About the size of an overcoat button. Furnished less cable. Just solder on connections for concealed use, \$3.95 extra.

## 100 CARTONED RADIO TUBES **\$29.95**

McGee carries a tremendous inventory of individually cartoned and branded Hy-Vac tubes. These are made by a nationally advertised tube manufacturer. These tubes are available at this low price because they do not fall within the rigid testing limits of this factory. However, every tube is guaranteed by us.

1R5	12AB6	12A7	6A05	6W4	9T8
1T4	12BE6	12BA7	6B06	6AG5	6BJ6
12A10	12AU6	12AU7	6A10	6AT6	6B7G
3A4	35W4	12BF6	6S07	12SH	6BA7
155	35B5	6BA6	6A05	9001	6BJ6
157	6X4	6X5	6X6	6X7	35C5
3Q4	12AT7	6AT8	6C4	6BN6	
354	12AU7	6A15	6X4	11723	

## Popular Hyvac GT Tubes All Guaranteed and Cartoned 39c

184	6C8	6K7	6S17	6S07	1258	25L6
5Y3	6F6	6P5	6SK7	6V6	125A7	32L7
5Y4G	6J5	6SR	6SL7	6X5	125F7	35Z5
6B05	6E7	6T7	6T8	6X6	125G7	70L7
6BG6	6K5	6SD7	6SR7	12BF7	125J7	70L7
6C5	6K6	6SF5	6S57	12K8	125N7	80

## STANDARD BRAND TUBES AND CARTONED 49c

Standard brand radio tubes. Some are cartoned individually, some are not. We acquire these tubes from manufacturers over-run, radio receiver over-stock, JAN, etc. We cannot give you a choice of brands, but we will give you a good quality standard brand tube. Every tube guaranteed.

024	1G4	354	6D6	6L7	6SK7	7A5	7E7	12A6	12Q7	14A7	30	45Z5	50Y6
1A4	1G6	5T4	6D8	6N7	6SL7	7A6	7E7	12A8	12SC7	14B6	32	50B5	41
1A6	1H6	5V4	6F5	6R7	6S07	7A7	7H7	12A7	12FC7	14C7	33	56	35B5
184	1J6	5Y3	6F7	6S7	6SR7	7B4	7L7	12A7	12F7	14H7	34	57	30A
185	1L4	6A3	6H6	6SA7	6S57	7B5	7N7	12A6	12S7	14Q7	35	58	14A4
1C6	1R5	6A87	6J5	6C7	6T7	7B6	7Q7	12B6	12SH7	14R7	35W4	70L7	12T7
1C7	1S5	6A07	6J5	6D07	6V6	7C4	7S7	12B6	12SJ7	19	35Y4	75	6A76
1D5	1T4	6A07	6K5	6SF5	6X5	7C4	7S7	12B6	12SL7	25L6	35Z4	76	6BA6
1D7	1V	6B8	6K6	6SF7	6Y6	7C5	7V7	12F5	12SN7	25Z5	35Z5	77	
1D8	2A5	6C4	6K7	6SG7	6Z7	7C6	7Y4	12H6	12SQ7	25Z6	38	78	
1F4	2A6	6C5	6K8	6SH7	6Z7	7C7	7Z4	12I5	12SR7	26	39	80	
1F5	2A7	6C6	6L5	6S17	7A4	7E5	10Y	12K8	12Z3	27	43	6BE6	

## STANDARD BRAND TUBES LOCTALS etc. **\$0.69 EA.**

G.E. RPX010 V.R. CART. \$2.95  
G.E. RPX010, with permanent needle, \$2.95 each; 10 for \$24.95.  
Kit of parts to build 6S07 type preamp. A lucky purchase by us enables this terrific General Electric cartridge value.

HYVAC 49c BRACKET 6B6 6J6 6A65  
STANDARD BRAND 59c  
Every Day Numbers  
125A7GT 125K7GT 35L6GT 50L6GT

# 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 SPEAKERS ARE LATEST 1950 PRODUCTION — FULLY GUARANTEED

**MODEL CU-13X  
12-INCH "COAXIAL"  
WIDE RANGE SPEAKER**  
★ **NEW 1950 MODEL \$9.95**  
★ **Regular \$32.50 List**  
On Sale at McGee's for

McGee announces its new 1950 Model 12" coaxial PM speaker. A regular \$32.50 list speaker, but mass production enables a new low price of \$9.95. Made especially for McGee's by a famous speaker manufacturer, to our own specifications. It's a speaker you can't get anywhere else. The speaker consists of a 12" Alnico V magnet with 1" voice coil and heavy one piece ribbed cone. This responds to the frequency from register of the audio spectrum. The tweeter has its own separate 2.15 oz. Alnico V magnet. A high pass filter is concealed under the pot cover. This prevents low frequency from reaching the tweeter. With all this the speaker is still just as simple to connect as any ordinary PM. Only two wires to connect. Input impedance is 8 ohms. Designed especially for the critical music listener with a keen ear for the higher audio register. Response is from 40 to 17,000 cps. This speaker is ideal for the home music system. Generally used in only \$400 to \$800 radio installations. The high piano, violin and violin notes will reproduce clearly with our new 12" coaxial speaker Model CU-13X. Shipping weight 8 lbs. Net price \$9.95 2 for \$19.00

**MODEL P15-8  
15-INCH "COAXIAL"  
WIDE RANGE SPEAKER**  
★ **NEW 1950 MODEL**  
★ **Regular \$62.50 List \$19.95**  
On Sale at McGee's for  
"IT WOOFAS AS IT TWEETS"

This 15", 35 watt peak coaxial PM speaker is not surplus. It is manufactured by a leading speaker company, to our own specifications. We buy them by the hundreds in order to offer them to you at this low \$19.95 price. They are comparable to any \$62.50 list speaker on the market. The 15" woofer will reproduce down to 20 cycles. It has a 22 oz. Alnico V magnet and molded cone with 1 1/2" voice coil. The high frequency tweeter is coaxially built in, with a special cone that will produce notes up to 17,500 cycles. The input impedance of both reproducers combined, is 8 ohms. Matching network is concealed under the pot cover. Just hook this up like any other 8 ohm speaker and hear the difference. Shipping Wt. 16 lbs. Stock No. P15-8 Sale price \$19.95. Two for \$38.00

## SUPER QUALITY 12" AND 15" ALNICO V P. M. SPEAKERS — LOWEST PRICES

**15-Inch 50 Watt  
WIDE RANGE SPEAKER  
20 TO 12,000 CPS.  
MODEL 25-LS. . . . \$15.95**  
Regular \$45.00 List with wide range molded cone. Model 25-LS. 15" 2 1/2" dia. Alnico V Magnet P.M. Speaker. Will take 35 watts with ease. Thousands of dollars were spent in building the fine tools to produce this speaker. The 8 ohm voice coil is 1 1/2" in diameter and has been heat treated and plastic coated. Constructed to eliminate loose voice coils, wires and warping. Made by a renowned builder of high fidelity loud box speakers. Shipping weight 14 lbs. Net Price \$15.95. Two for \$30.00

**15 INCH JUKE BOX P.M. \$9.95**  
Stock No. 15KR. 15 inch 12 ohm 8 ohm voice coil PM. Shlp. wt. 10 lbs. Scoop price \$9.95. Two for \$19.00

**50-Watt 12" Super  
Heavy Duty P.M. \$13.95**  
Model A-50-12". 50 watt super heavy duty permanent magnet speaker. Has 1 1/2" 8 ohm treated voice coil and one piece molded cone. Heavy half inch machined pot with bolt secured. 12" Alnico V magnet. Frame is of heavy construction with metal pot cover. Finished in silver-grey enamel. This speaker is the best value possible today. Efficiency is two to three times that of ordinary speaker. Especially recommended for all public address systems and high quality home audio systems. Will handle 35 watts with ease and 50 watts peak or short lengths of time. Its retail value is \$50. But, by our large purchase, we are able to offer it to you for only \$13.95. Do not confuse this speaker with surplus merchandise. It is the latest production. Model A-50. Shipping wt. 13 lbs.

**12-Inch 25 Watt  
WIDE RANGE SPEAKER  
35 TO 12,500 CPS.  
MODEL 1202-X. . . . \$9.95**

McGee's model 1202-X, 12" 25 watt 1 1/2" voice coil Alnico V PM speaker. Model 1202-X has 1 1/2" oz. Alnico V ring magnet and full 1 1/2" 8 ohm voice coil. One piece molded cone. The speaker forms a trumpet for high note distribution. Ideal for high fidelity home music systems and public address systems. Made especially for us, to our own specifications by a famous builder of speakers. Frequency response is from 35 to 12,500 cps. Lustré grey finish with metal pot cover. Shipping weight 7 lbs. Why pay twice as much for some other brand? Every speaker guaranteed. Regular \$24.00 list. Model 1202-X. Net price \$9.95. 2 for \$19.00

**McGEE'S SUPER  
High Fidelity  
OUTPUT  
TRANS.  
20-20,000  
CPS. . . . \$6.95**  
Best Value In U.S.A.

A-403-6600 ohms. Plate to Plate. Why pay \$30.00 or \$40.00 for an output? Supreme quality and high fidelity output transformer. Designed to match push-pull plates (2-6L6, 2-6V6, or 2-6AQ5) class AB, to 4-8-15-250 and 500 ohm; with 100% feedback winding. Housed in a compound filled and plastic coated. 3". Actual net weight, 6 lbs. If you want the best quality from your audio system, order this transformer. Response is from 20 to 20,000 cycles. We have tried several high fidelity outputs in our lab and find this to be the best value. Even the King of amplifier only puts out 10 or 15 watts. This 34 watt job is what you should have. Connecting instructions are furnished. Stock No. A-403, shipping weight 8 lbs. Net price \$6.95

**ALUMINUM VOICE COIL  
REPLACEMENT SPEAKERS—FACTORY PRICES**  
McGee's Aluminum Voice Coil Double X Line. McGee offers you our Double X line of replacement P.M. Speakers. Made by a pioneer of the aluminum voice coil speakers. All of the Double X speakers have Alnico V magnets. All aluminum voice coils with RMA standard 3.2 ohm impedance. Why pay twice as much for a replacement speaker? McGee buys them by the carload and sells them for half price. Every speaker is unconditionally guaranteed.

**Double X Aluminum Voice Coil, Alnico V Magnet, RMA 3.2 ohm V.C.**

4XX 4" square	1 Oz. Mag.	\$1.09 ea.	10 for \$10.00
5XX 5" round	1 Oz. Mag.	1.09 ea.	10 for 10.00
6XX 6" pincushion	1.47 Oz. Mag.	1.49 ea.	10 for 14.95
6XX 6" pincushion	2.15 Oz. Mag.	1.95 ea.	10 for 17.95
46XX 4x6"	1 Oz. Mag.	1.49 ea.	10 for 13.95
57XX 5x7" oval	1.47 Oz. Mag.	1.95 ea.	10 for 17.95
7XX 7" pincushion (Auto set)	3.15 Oz. Mag.	2.79 ea.	10 for 24.95
8XX 8" pincushion	3.15 Oz. Mag.	2.79 ea.	10 for 27.95
69XX 6x9" oval	3.16 Oz. Mag.	2.95 ea.	10 for 27.95
12XX 12"	6.8 Oz. Mag.	4.95 ea.	5 for 22.50

Universal replacement output transformers for any push-pull or single plate 2500 to 13,000 ohms from 2 to 18 ohm voice coil. Standard size, strap mounting with long leads and lugs for voice coil connections.

U-5 5 watt universal output	\$ .79 each, 10 for \$ 7.50
U-8 8 watt universal output	.99 each, 10 for 9.50
U-15 15 watt universal output	1.19 each, 10 for 11.00
U-20 20 watt universal output	1.49 each, 10 for 13.95

Any single plate (4-watt) to 3.20 Hy VC. Stock No. JJ-4. 49c each, 10 for \$4.50

**40-Watt Capehart High Fidelity  
Output Worth \$795**  
Specially built Capehart for this finest combination. 40-watt capacity all windings interwound to increase high frequency response and decrease capacity losses. High inductance coils makes for best efficiency at low audio frequency. This high fidelity output transformer is fully shielded and has a net weight of 15 lbs. Made to match push pull 6L6 tubes 5,000 ohm plate to plate. Has tertiary winding for 100% feed back and voice coil windings 4 and 8 ohms. Frequency response plus or minus 2 dB from 30 to 15,000 cycles. Down 60dB below 20 cycles and above 20,000 cycles. Furnished with connecting instructions. Size 3 1/2"x4 1/2"x4 1/2" tall. Shipping weight 8 lbs. Stock No. SX-55, net \$79.50. Stock No. SX-54. Same as SX-55 only 25 watt capacity. Same winding. Shipping weight 5 lbs. net \$49.95

**12-WATT MUSICAL  
P.A. AMP. \$129.50  
KIT**  
This amplifier kit, when wired, may be used as a musical amplifier, paging system or for any other low power P.A. use. It is a complete kit with diagram, neatly punched chassis and matched parts to build an AC transformer type amplifier with push-pull output tubes. (12AX7) Has heavy duty 8" 7 oz. Alnico V PM speaker, with tubes 2-12AX7, 2-6X4, 6V4 and 6X4 instruments or mike and phono pickup. Leatherette covered case. Stock No. MN-12RC. Shipping weight 18 lbs. Net price \$129.50. Crystal mike and desk stand \$4.95 extra.

**BUILD A BETTER AMPLIFIER WITH A McGEE MATCHED PARTS KIT**

**WIDE RANGE  
THEATRE QUALITY  
20-20,000 CPS  
AMP. \$299.50  
KIT**  
Mike, Crystal, and V.R. Inputs

It's the newest thing in audio amplifiers. McGee's wide range, 34 watt amplifier kit with inputs for crystal or dynamic mikes and any crystal phono cartridge, as well as the new G.E. variable reluctance cartridge. Output transformer has 100% feedback winding. Push-pull 6L6 output tubes. Separate electronic base and treble boost. Inverse feedback winding to be heated to reduce hum level to nil. Frequency response from 20 to 20,000 cps. Easy to follow diagram and photos for easy assembly of this kit. Ready punched chassis. Every part furnished, including tubes, 2-6L6, 2-6X4, 6V4, 6X4. Shipping weight 25 lbs. Stock No. XX-34, net. \$299.50. XX-34 WT (wired and tested) \$110.00 extra.

**COMMERCIAL QUALITY  
PUBLIC ADDRESS  
AMP KIT \$149.50  
20 WATTS**  
30 WATT MODEL \$19.95

Here are the two best amplifier kit values in the United States. 20 and 30 watt models that will look like a manufactured job when wired. Everything fits. Ready punched chassis and cover. Inputs for 2 mikes (crystal or dynamic) and crystal phono pickup. Compact chassis size, 5 1/2" x 12". Universal output transformer. Schematic diagram and photo for easy wiring. Frequency response, 20 to 12,500 CPS. Dealers, you can build your own amplifier for less.

ZR-20, 20 watt amplifier kit, with tubes: 2-6L6G, 6SN7, 2-12AX7 and 5U4, 160 mill power transformer, output 4-8-16 and 250 ohms. A complete kit. Shipping weight 25 lbs. Net price \$19.95.

ZR-30, 30 watt amplifier kit, with tubes: 2-6L6G, 6SN7, 2-12AX7, 5U4 and 6SN7, 200 mill power transformer. Output 4-8-16-250 and 500 ohms. Complete kit. Shipping weight 25 lbs. Net price \$19.95.

Either the ZR-20 or ZR-30 may be had with our high fidelity output transformer for \$5.00 extra. (Specify when ordering, with high fidelity output transformer at \$5.00 extra, 4-8-16-250 and 500 ohms. Response, 20 to 20,000 CPS.

**CONSOLE BASS REFLEX  
SPEAKER BAFFLE \$14.95**  
6 cubic foot utility base reflex speaker baffle. 3 1/2" high x 22" x 16". It is a complete kit with construction, brown leatherette covering and instructions. Can be used with any speaker up to 15". This is not a piece of furniture, but a heavy baffle made for utility use. Shipping weight 40 lbs. Stock No. NA-16. Close out price \$14.95.

**12 inch slanting front wall baffle with tri-color plastic front. Stock No. 12-11, \$3.95 each, 4 for \$14.95.**

**12 inch corner baffle with tri-color plastic front. Stock No. 12-C, net \$3.49, 4 for \$12.95.**

**12-WATT AMP. KIT HAS INPUT FOR G.E. PICK UP \$99.50**

Kit Model TM-12. 12 watt amplifier kit. Ideal for a high quality recording player, a P.A. system or recording amplifier. Matched component parts, ready punched chassis. One control fades from phono to mike. Input compensation for G.E. variable reluctance pickup. Output matches 8 ohm voice coil. 100 mill power transformer. Complete with tubes, photos and diagram. 2-6V6, 2-6AX6 and rectifier. Variable tone control. Model TM-12. Weight 10 lbs. Net. \$99.50. Crystal utility mike and desk stand \$4.95 extra.

**McGEE'S MIKE SALE**

Our leader High Z Dynamic Mike with 12 feet of cable. Stock No. D-4. Sale price \$9.95. Shure CX-50 Crystal Mike with 20 feet of cable. Sale price \$8.95. Table Top Adjustable Banquet Mike Stand \$2.95. Floor Mike Stand adjustable 2 section chrome stem—cast base \$4.95.

**OUR LEADER CRYSTAL MIKE AND DESK STAND SHIP. WT. 2 LBS. SALE PRICE \$4.95**

**JUKE BOX OPERATORS SPECIAL**

**8 Inch Heavy Duty Speaker \$295**

8" super heavy duty, 7 oz. Alnico V PM speaker, with 8 ohm voice coil. Made by a nationally known speaker builder, expressly for juke box remote use and general P.A. work. This speaker will take just as much kick as most 12" speakers. It's the best value in the U. S. today. A regular \$7.00 value. Shipping weight, 4 lbs. Stock No. SE-8X. Net price \$2.95. each, 10 for \$27.50, 25 for \$62.50 and 100 for \$225.00.

**8 Inch Plastic Front Wall Baffle \$195**

Attractive wood baffle with curved tri-color plastic front, for 8" speaker. Very attractive design, well built economical to use. Hundreds have been sold to juke box operators for extra kick. Shipping weight 6 lbs. Stock No. 8-RCM. Net price \$1.95 each. 10 for \$17.50, 100 for \$150.00.

**McGEE RADIO COMPANY** PRICES F.O.B. K.C. Send 25% Deposit with order. Bal. Sent C.O.D. With parcel post orders include postage. **TELEPHONE VICTOR 9045. Write for Flyer 1422 GRAND AVE., KANSAS CITY, MISSOURI**







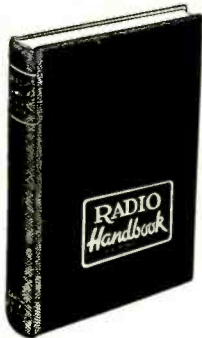
Keeping up with radio



**Mac's Service Shop**  
(Continued from page 60)

## TWO GREAT RADIO HANDBOOKS

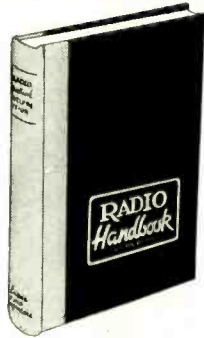
11TH EDITION—Theoretical—Reference—Constructional



The STANDARD work on practical and theoretical aspects of all radio communication, both amateur and commercial. Constructional and reference material on: converters, exciters, complete transmitters, test equipment, modulators, etc.—ALL NEW; none repeated from prior editions. Six full chapters on antennas and transmission.

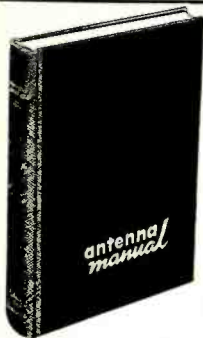
### 12TH EDITION All-Constructional

Detailed constructional information on a wealth of radio communication equipment—ALL BRAND NEW; all different from prior editions. More than ever before shown in a single book.



BOTH these top-notch books should be in the hands of every person interested in radio communication. Each is a perfect companion to the other. For a complete list of chapter heads and equipment descriptions, see ad in February 1950 "Radio News."

**\$3.00** FOR EITHER EDITION AT YOUR DEALER. By mail: \$3.25 in U.S.A. (plus any tax); elsewhere, \$3.50.



## antenna manual

Do you know why it is sometimes important not to get a TV receiving antenna **too high** for best reception of high channel signals? A working knowledge of radio wave propagation is a useful, easily acquired tool, whether your interest is TV, Standard Broadcast, FM Broadcast, Amateur or HF, VHF or UHF Communication. The ANTENNA MANUAL gives you the "how" and "why" of radio wave propagation, with a comprehensive coverage of transmission lines and antennas for all frequency ranges. Simply written; easily understood.

**\$3.50** AT YOUR DEALER. By mail: \$3.65 in U.S.A. (plus any tax); elsewhere, \$3.75.

## SURPLUS RADIO CONVERSION MANUAL IN TWO VOLUMES

Here are the books which have become standard for most commonly used items of surplus electronic equipment. All conversions shown are practical and useful; all have been proven by testing on several units.

### VOLUME 1

BC-221 Freq. Meter BC-342, BC-348 and BC-312 Revrs. BC-412 as a test scope or TV Revr. BC-645 420Mc. Xmtr./Revr. BC-453A Series Revrs. BC-457A Series Xmtrs. SRC-522 144Mc. Xmtr./Revr. TBY Transceiver with Xtal Control PE-103A Dynamotor BC-1068A V-h-f Revr. Electronics Surplus Index. Cross Index of VT-Number Tubes.

### VOLUME 2

ARC-5 & BC-454 Revrs. for 28-Mc. ARC-5 & BC-457 Tx for 28-Mc. Mobile ART-13 & ATC Xmtr. Surplus Beam Rotating Mechanisms Selenium-Rect. Power Units Hi-Fi Tuner from BC-946B Revr. ARC-5 V-h-f Xmtr. GO-9 & TBW Xmtrs. AVT-112A Aircraft Xmtr. BC-375 & BC-191 Xmtrs. LM Freq. Meter Primary Power Requirements Chart ARB Revr. Diagram Only.



**\$2.50** FOR EITHER VOLUME AT YOUR DEALER. By mail: \$2.60 (plus any tax).

GET YOUR COMMERCIAL LICENSE  
WITH THESE BRAND NEW BOOKS



### RADIO- TELEVISION

Questions  
and  
Answers

A SEPARATE BOOK for each element of the study-guide questions pertaining to the various classes of commercial U.S.A. radio operators licenses. NOW READY: Element 2—BASIC THEORY AND PRACTICE; Element 3—RADIOTELEPHONY; Element 4—ADVANCED RADIOTELEPHONY. Please do not order elements not yet announced.

**85¢** PER ELEMENT AT YOUR DEALER. By mail: \$1.00 (plus any tax) for one. Two or more copies or elements, 90¢ each (plus any tax).

THE MOST COMPREHENSIVE  
RADIO BOOK FOR BEGINNERS

### THE RADIO AMATEUR NEWCOMER

You Need No Other Book to Get  
Your License and Get on the Air



Ideal for those just getting started, or interested in amateur radio. How-to-build simple equipment for a complete station on all newcomer bands; operating instructions; simple theory; study questions; U.S.A. Amateur radio regulations.

**\$1.00** AT YOUR DEALER. By mail \$1.10 (plus any tax).

ticular job for them that they cannot do for themselves, just as they depend on their doctor, dentist, auto mechanic, or jeweler. In short, we have elected to *serve* the people, with all that big word implies.

"If we are going to serve them well, we have to have a genuine interest in them and their problems. If we have no such interest, we had better get into some other more impersonal business; for while the average person is a very poor judge of radio service work, he is not nearly so dumb about human nature. He may not notice the improvement that your realignment job produced in his set, but he can spot the old brushoff a mile away."

"Then you don't hold with the idea that if you are a super-duper technician the world will seek you out and overwhelm you with business."

"Not by a long shot. I doubt that a man can make a continued success of radio servicing unless he is a good technician; but I know that a good technician can be a flat failure unless he has the knack of making people like and trust him.

"The main idea in the radio service business is the same as that in the famous recipe for rabbit stew that starts out: 'First, catch a rabbit.' The first thing we have to do is to catch and keep customers; yet, being the technical-minded nuts we are, a lot of us get so wrapped up in actually fixing sets and in trying to keep up with the new developments in this galloping field of ours that we neglect our 'customer-relations.' In fact, we go so far as to feel and show actual annoyance when a customer comes in and makes us leave the bench just when we are hot on the trail of an elusive intermittent.

"But I am just wasting my breath. I doubt that you have even the foggiest idea of what I am trying to tell you."

"I resent that—bitterly!" Barney replied as he drew his lanky figure to its full height and looked disdainfully down at Mac. "Just to show you what a grave injustice you have done me, I shall point out that you have spent the greater part of the last quarter of an hour explaining in needless detail What Every Girl Should Know."

"What Every Girl Should Know!" Mac repeated in blank amazement. "How on earth did you ever get that crackpot idea?"

"What Every Girl Should Know: How to say, 'No,'" Barney explained as he started sidling toward the service department door.

Only his youthful agility enabled him to dart through the opening and slam the door behind him before the copy of Turner's "Radio Test Instruments," the first weapon that came to Mac's hand, crashed against the jamb.

-30-

RADIO & TELEVISION NEWS

Editors and Engineers

1302 KENWOOD ROAD

Santa Barbara

CALIFORNIA

www.americanradiohistory.com



**YOU BUILD 'EM  
IN ONE EVENING  
BUT...**

**THEY LAST A LIFETIME!**

**SAVE 50% WITH**

**LABORATORY  
PRECISION**



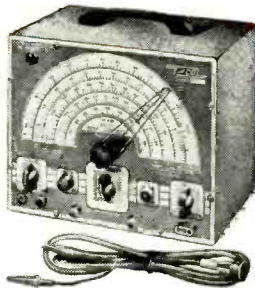
**INSTRUMENTS  
& KITS**

**SENSATIONAL NEW**

**EICO Model 360-K TV-FM SWEEP  
SIGNAL GENERATOR**

• Crystal marker oscillator with variable amplitude. • Covers all TV and FM alignment frequencies between 500 kc. and 228 mc. • Sweep width variable from 0-30 mc. with mechanical inductive sweep. • Extremely wide sweepwidth allows gain comparison of adjacent RF TV Channels. • Provides for injection of external signal generator marker. • Phasing control included. • Large, easy-to-read dial is directly calibrated in frequencies. Vernier tuning condenser. Comes complete with all tubes (including new, high-frequency miniature types): 6X5GT, 12AU7, two 6C4's. Crystal not included. 10"x8"x6 3/4". 5 Mc. Crystals available for above, each \$3.95.

**\$29.95**



**FACTORY-WIRED AND TESTED \$39.95**  
Model 360. Ready to use Sweep Signal Generator. See it at your local jobber!

**ANYONE  
CAN BUILD  
THEM!**



**\$19.95**

**NEW! MODEL 320-K  
SIGNAL GENERATOR**

For FM, AM alignment and to provide TV marker frequencies. Highly stable Hartley oscillator has range of 150 kc. to 102 mc. with fundamentals to 34 mc. Colpitts audio oscillator supplies pure 400 cycle sine wave voltage for modulation. Vernier tuning condenser. Use audio oscillator voltage to test distortion in audio equipment, bridge measurements, etc.

**FACTORY-WIRED AND TESTED \$29.95**  
Model 320. Ready to use....



**\$18.95**

**VERSATILE MULTI-  
SIGNAL TRACER**

Model 145-K. High gain—high frequency. Self-contained test speaker permits audible signal tracing of RF, IF, FM, audio and video circuits. Provision for visual tracing with VTVM. Response is well over 200 mc. 3-color hammettone panel. 110-125 V. AC. Size: 10"x8"x4 3/4". Comes complete with tubes and diode probe in kit form.

**FACTORY-WIRED AND TESTED \$28.95**  
Model 145. Ready to operate....

**NEW PUSH-PULL  
5" TV  
OSCILLOSCOPE  
Model 425-K Kit**

**\$39.95**

ALL-NEW laboratory precision scope has Push-Pull deflection and .05 to .1 volts per inch sensitivity. Wide range, flat from 5 cps to 500 kc. with full gain setting, useful to 2 1/2 mc. Wide-range, multi-vibrator, sweep circuit from 15 cps to 75,000 cps. Direct connection to plates of CRT available at rear of cabinet. Z axis intensity modulation feature included. Size: 8 1/2"x17"x13" high. Complete with 3-6SN7s, 2-6J6s, 2-5Y3s, and 5BP1 CRT.

**FACTORY-BUILT OSCILLOSCOPE \$69.95**  
Model 425. Fully wired and tested

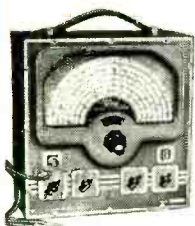


**HIGH PRECISION  
VACUUM TUBE  
VOLTMETER  
Model 221-K**

**\$23.95**

Tops in workbench versatility—15 different ranges! AC and DC ranges: 0.5/10/100/500/1000 volts. Electronic ohmmeter ranges from 2 ohms to 1000 megohms in 5 steps. New features include Zero Center for TV discriminator alignment, 26 Meg. DC input impedance. Accurate, 4 1/2" meter cannot burn out. Double triode balanced bridge circuit assures guaranteed performance. Sturdy portable steel base with etched rubberproof panel. 110-130 V. AC 50-60 cycle. Size: 9 7/16"x6"x5".

**FACTORY-WIRED AND TESTED \$49.95**  
Model 221. Same, but completely wired, calibrated, and tested....



**DELUXE SIGNAL  
GENERATOR**

**MODEL 315**

Completely wired, ready-to-use Signal Generator with 1% accuracy! A wonderful instrument with dozens of expensive features. Frequency range: 75 kc to 150 mc. Has microcycle band-spread vernier tuning for FM, AM, and TV. Voltage regulator. Write for full details. **\$59.95**

Model 511-K. A "Must" for every serviceman! Small, handy instrument used a thousand times a day. Large 3" meter, beautifully etched panel. A perfect kit for beginners. Simple to assemble. (Ranges: DC-0.5/50/250/500/2500 volts. AC-0.10/100/500/2000 volts. Output-0.1/10/100/500/1000 v. DC 3A-0.1/10. Ohm meter 0.5/500/100,000 ohms. 0.1 meg. DB 0.1 meter -8 to +55 Db.) **\$14.95**

**ASSEMBLED-READY TO USE \$17.95**  
Model 511 - Completely wired, tested, and assembled at the factory. Rugged built for heavy duty....

**VOLT-OHM  
MILLIAMMETER  
Complete Pocket Kit**



**\$14.95**



**Model  
HVP-1**

**HIGH VOLTAGE PROBE**

Complete top-quality Voltage Test Probe Measures up to 30,000 Volts. Special Helical-Wound Ceramic HV Multiplier Resistor adaptable to most VTVM's and all 20,000 ohms per volt meters with 1000 or 5000 volt scales. Lucite head, plywood bakelite handle, large flashguards for additional safety. Specify your instrument. Complete, ready to use. **\$6.95**

**SEE THEM—TRY THEM—  
AT YOUR LOCAL JOBBER!**

EICO Instruments and Kits are on display at your local jobber—the nationally advertised kits which you can see and use before you buy. You take no chances with EICO!

**Write For New Catalog "N"  
Prices Higher on West Coast**

**HIGH FREQUENCY RF PROBE**

Model P-75K germanium crystal probe for visual RF signal tracing and measurements to over 200 megacycles. Can be used with models 221 or 113A EICO instrument (state which when ordering). 6 1/2" long, 1/2" O.D., with wire, plugs, and all components. **\$3.75**

**IN KIT FORM \$3.75**  
Model P75K same as above, but for oscilloscopes; in kit form. **\$3.75**  
Models P75 or P76 similar to above but factory wired, ready to operate. Each. **\$7.50**

**EASY-TO-FOLLOW SCHEMATIC & PICTORIAL DIAGRAMS**

Come complete with every EICO instrument Kit. Each kit fully guaranteed to operate perfectly when assembled according to our simple instructions! **EXCLUSIVE LIFE-TIME REPAIR SERVICE:** For a nominal charge, we will repair and service your EICO instrument, regardless of its age!



**ELECTRONIC INSTRUMENT CO., INC.**  
276 Newport Street, Brooklyn 12, N. Y.



first time in RHS history!  
Special Purchase

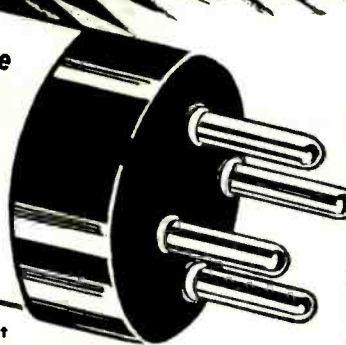
**SALE!**

while quantities last!

Transmitting—Cathode Ray—Special Purpose  
**TUBES**

Brand New! Standard Brands! No Seconds!

We made a once-in-a-lifetime purchase—and now you can benefit by the terrific savings! No need to tell you these are the most sensational values in our history! Just look at the listing below . . . compare the prices . . . you'll know what we mean when we say that you may never again come across a real savings opportunity like this!



RECEIVING TUBES

0A2	\$1.29	6B8G	\$.69	12AT6	\$.44
0A4G	.89	6BA6	.52	12AT7	.79
0B2	1.67	6BE6	.55	12AU6	.57
024	.57	6BF6	.57	12AU7	.57
01A	.39	6BG6G	1.17	12AV6	.54
1A3	.44	6BH6	.59	12BA6	.55
1A4	1.09	6BJ6	.57	12BE6	.49
1A4P	.97	6C4	.19	12C8	.34
1A5GT	.49	6C5	.47	12F5GT	.28
1A6	.69	6C6	.57	12H6	.57
1A7GT	.67	6CG	.69	12J5GT	.34
1AB5	.59	6D6	.44	12J7GT	.52
1B3/8016	1.15	6D8Q	.79	12K7GT	.54
1B4	1.19	6E5	.69	12K8	.59
1B5/25S	.89	6F5	.47	12Q7	.49
1C5GT	.59	6F6	.57	12SA7	.57
1C6	.89	6FGGT	.57	12SC7	.54
1C7G	.89	6F7	.69	12SC9	.59
1D5GP	.97	6F8Q	.87	12SF7	.54
1D7G	.89	6GG6	.69	12SG7	.52
1D8GT	.95	6H6	.39	12SH7	.35
1F4	.75	6H6GT	.37	12SJ7	.47
1F5G	.75	6J5	.47	12SK7	.57
1G4GT	.69	6J5GT	.39	12SL7	.59
1G6GT	.65	6J6	.77	12SN7	.52
1E7G	1.15	6J7	.67	12SQ7	.49
1H4G	.55	6J7GT	.65	12SR7	.49
1H5GT	.54	6K5GT	.79	12T3	.69
1H6GT	.87	6K6GT	.44	14A4	.79
1H6G	.75	6L6	.49	14A7	.52
1L4	.48	6K8	.79	14B6	.67
1L4A	.79	6L5GT	.79	14F7	.69
1L6A	.89	6L6	1.05	14F8	.79
1L8A	.89	6L6G	.99	14H7	.59
1LCS	.69	6L6GA	.85	14J7	.87
1LCS	.69	6L6GT	.69	14J7	.85
1LD5	.79	6L7G	.87	14Q7	.53
1LE3	.69	6N7	.75	14R7	.67
1L5	.79	6Q7	.64	19	.69
1LH4	.79	6R7	.79	24A	.49
1LH5	.67	6S7G	.79	25L6GT	.53
1N5GT	.49	6S8GT	.77	25V5	.44
1P5GT	.67	6SA7	.44	25Z6GT	.43
1Q5GT	.67	6SC7	.59	26	.49
1R4	.59	6SD7GT	.44	27	.42
1R5	.69	6SFT	.49	28D7	.35
1S4	.59	6SF7	.59	30	.37
1S5	.49	6SG7	.59	31	.59
1T4	.53	6SH7	.57	37	.85
1T5GT	.69	6SJ7	.47	32L7GT	.89
1U4	.59	6SK7GT	.44	33	.69
1V	.57	6SL7GT	.59	34	.37
2A3	.87	6SN6GT	.97	35/51	.57
2A4G	1.07	6SWGT	.54	35A5	.63
2A5	.69	6SQ7	.45	35B5	.55
2A6	.79	6SR7GT	.52	35C5	.59
2A7	.79	6SS7	.49	35L6	.52
2V3G	.69	6ST7	.72	35W4	.39
2X2	.37	6SU7GT	1.25	35Y4	.49
2X2A	.65	6SV7	.79	35Z5	.57
2X4	.34	6T7G	.89	35Z4	.44
3A5	.79	6U5G	.65	35Z5	.39
3A8	1.59	6U6GT	.63	36	.67
3B7/1291	.29	6U7G	.49	37	.35
3D6/1299	.29	6V6	.89	38	.37
3F4	.69	6V6GT	.57	39/44	.27
3Q4	.47	6W4	.63	41	.49
3Q5GT	.67	6W7G	.77	42	.49
3S4	.57	6X4	.57	43	.49
3V4	.67	6X5GT	.47	45	.52
5R4GY	1.09	6Y6G	.67	45Z3	.57
5T4	.87	6Z6	.89	45Z5	.55
5U4G	.49	6ZV5G	.59	46	.62
5V4G	.87	7A4/XXL	.49	47	.69
5W4	.67	7A6	.59	49	.85
5X4G	.57	7A7	.53	50	1.39
5Y3GT	.39	7AG7	.72	50A5	.69
5Y4G	.49	7B4	.59	50B5	.53
5Z3	.52	7B5	.52	50L6GT	.52
5Z4	.77	7B6	.56	50V6	.57
6A3	.92	7B7	.59	53	.87
6A4LA	1.09	7C4	.34	56	.45
6A6	.79	7C5	.46	57	.45
6A7	.69	7C7	.59	58	.49
6A8	.75	7E5	.67	59	.89
6A8T	.79	7E6	.54	70L7	.99
6A7C	.74	7E7	.62	71A	.59
6A07G	1.09	7F7	.59	75	.53
6A07G	.79	7H7	.59	76	.44
6A05	.69	7H4	.67	78	.43
6A07	.98	7L7	.69	78	.44
6A06	1.29	7N7	.67	80	.37
6A15	.79	7Q7	.59	81	1.25
6A15	.59	7R7	.69	82	.84
6A05	.49	7W7	.79	83V	.89
6A06	.59	7Y4	.47	84/62A	.56
6A05	.52	7Z4	.57	89V	.59
6A16	.44	12A	.57	117L7/M7	1.19
6A06	.59	12A6	.17	117N7	1.19
6A06	.89	12A7	.89	117P7	1.19
6B6G	.79	12A8GT	.49	117Z3	.49
6B7	.87	12AHTGT	.80	117Z6	.65

**DIODE GAS RECTIFIERS**

4R26	\$.33	866A	\$1.05	RX21	\$2.39
249C	1.49	866JR	.98	RX120	8.95
575A	11.95	869D	26.50		
816	.99	872A	1.12		

**PENTODES**

307A/RK75	\$.33	804	\$7.95	1619	\$.15
713A	.79	807	1.09	1851	.69
717A	.49	837	1.19	EF50	.39
803	2.95	1613	.49	HY115/145	.59

**UHF TRIODES**

2C40	\$2.95	703A/368AS	\$1.89
2C43	7.95	708A	3.59
2C44	.98	826	.39
2C46	6.95	8012	.89
3C24/24G	.35	GL434A	2.69
388A	.47	HY615	.19
527	5.95	VT127A/100TS	1.95

**THRATRODS**

2D21	\$.89	2051	\$.39
3C23	2.19	CGJ	3.65
3C31/C1B	1.69	FG17	2.69
3C45	12.95	FG27A	6.95
884	1.19	FG81A	3.29
885	1.19	FG105	8.95
2050	1.19	FG172	13.95

**VOLTAGE REGULATORS**

OA3/VR75	\$.93	OC3/VR105	\$.69
OB3/VR90	.65	OD3/VR150	.49
	874		\$.39

**ACORNS**

954	\$.16	957	\$.22	9004	\$.24
955	.25	958	.22	9005	1.39
956	.25	959	.35		

**MINIATURES**

9001	\$.32	9003	\$.33
9002	.25	9006	.15

**TRIODES**

2C22/7193	\$.15	710A	\$.25	845	\$.38
2C28A	.15	800	1.49	851	12.95
3C22	39.50	801A	.19	1626	.25
6J4	4.49	805	3.65	8005	4.75
10Y	.19	808	.99	8011/WL538	.25
45 spec.	.19	809/3C30	1.89	8014	22.50
75T	1.89	810	7.95	8025	3.69
100TH	10.49	812	1.98	F123A	7.95
211	.25	814	2.45	F127A	15.95
250TH	18.75	833A	33.95	F128A	69.50
304TH	3.49	838	1.98	F862A	397.50
304TL	1.29	841	.29	HYE1148	.29
316A	.79	843	.29	ML101/	
450TH	16.95			GL605	49.50
				WL530	12.95

**DIODE VACUUM RECTIFIERS**

3B24	\$.149	371B	\$.49	VU111	\$.49
3B26	1.49	705A	.69	WL531	4.75
15R	.49	1616	.49	WL616	37.50
100R/8020	.89	8013	1.39	KC4	37.50
GL451	.89	F660/WL562	49.50	ML100	37.50
250R	5.95	RK72	.59	F606	37.50
371A	.39	RK73	.59		

**CATHODE RAY TUBES**

2AP1	\$.389	4AP10	\$.295	5JP1	\$29.95
3AP1	4.59	5AP1	2.95	5JP2	8.95
3SP1	2.39	5AP4	2.95	5LP1	12.95
3CP1	1.39	61P1	1.85	7B7	3.49
3DP1	1.79	5CP1	1.29	91P7	1.98
3DP1-82A	.29	5CP7	2.95	902	3.39
3FP7	1.79	5FP7	1.19	905	2.49
3GP1	5.95	5GP1	2.98	908/3AP1	4.95

**CRYSTAL RECTIFIERS**

1N21	\$.49	1N23	\$.59	1N27	\$.89
1N21A	.89	1N23A	.79	1N34	.82
1N21B	.89	1N23B	1.89		

**KLYSTRONS**

2K25/		417A	\$.895	726A	\$.675
723AB	\$22.50	707B	14.95	726B	29.50
2K28	24.95	723A/B	12.95	726C	49.50

**TWIN PENTODES**

3E20		58.95	820 UHF	57.45
815 HF		1.59	832A	4.89

**TETRODES**

3D21A	\$.98	5D21	\$24.45	813	\$.685
4-65A	14.21	350B	1.39	860	14.95
4-125A	26.05	715A	5.49	861	9.49
4-250A	36.25	715B	6.59	865	.79
4E27	12.45	715C	19.95	1614	1.35
257B	12.45				

**GAS SWITCHING TUBES**

1B24 TR	54.59	532A	\$1.89
1B26 TR	2.79	1B36 anti Tit.	3.95
1B27 TR	7.95	721A anti TR	1.98
1B29	.79	721B anti TR	2.43
1B32	1.89	1960/SB36 diode	.89

**PHOTOTUBES**

1P24	\$.53	930	\$.98
1P36	2.95	931A	2.39

**TWIN TRIODES**

2C21/RK33	\$.24	2C34/RK34	\$.22
1642	.24	RK59	1.69

**MAGNETRONS**

2J21A	\$.795	2J31	\$.849	5J29	\$11.95
2J22	7.95	2J32	12.95	5J30	47.50
2J26	6.95	2J48	12.75	714A V	3.59
2J27	12.75	2J54B	22.50	725A	6.45

**DUO-DIODE GAS RECTIFIERS**

3B22/ELIC	\$.198	CK1005	\$.09
4B24/EL3C	1.98	CK1006	.85

**SPECIALS**

23D4 ballast	\$.29	1625 beam amp.	\$.19
28D7 beam amp.	.29	1629 tuning eye	.19
559 UHF diode	.98	1631 beam amp.	.98
876 ballast	.29	1636 beam amp.	.98
1624 beam amp.	.67	REL21 spark gap	.98
1630 orbital beam hexode			\$.49
RK60/1641 duodiode vac rect.			.42

**RADIO HAM SHACK Inc.**  
189 GREENWICH STREET . NEW YORK, N. Y.

PHONE DIGBY 9-0347  
Write for quantity price.  
PRICES SUBJECT TO  
CHANGE WITHOUT NOTICE  
All Merchandise Guaranteed.  
F.O.B. N.Y.C. Minimum Order \$10  
Write for Quantity Prices  
20% Deposit Required



# RHS Warehouse Clearance

Profit by these spectacular values! We're clearing our warehouse to make room for incoming stock! Everything goes!

# SALE!

## OIL CONDENSERS—DC RATINGS

3x.1	mfd 600v	\$.49	15	mfd 2000v	\$.95
.25	mfd 600v	.25	.1	mfd 2500v	1.09
1	mfd 600v	.25	.25	mfd 2500v	1.19
2	mfd 600v	.28	5	mfd 2500v	1.29
2x2	mfd 600v	.28	.5	mfd 2500v	1.98
4	mfd 600v	.57	.01	mfd 3000v	1.07
6	mfd 600v	.57	.05	mfd 3000v	1.19
8	mfd 600v	.97	.1	mfd 3000v	1.39
10	mfd 600v	1.05	.25	mfd 3000v	1.49
3x.1	mfd 1000v	1.15	.5	mfd 3000v	1.69
.25	mfd 1000v	.59	2	mfd 3000v	2.19
.5	mfd 1000v	.39	4	mfd 3000v	3.47
1	mfd 1000v	.49	12	mfd 3000v	6.95
2	mfd 1000v	.69	1	mfd 3600v	2.39
4	mfd 1000v	1.29	.25	mfd 4000v	1.98
8	mfd 1000v	1.89	.5	mfd 4000v	2.49
10	mfd 1000v	2.07	1	mfd 4000v	2.79
20	mfd 1000v	3.29	2	mfd 4000v	3.10
.5	mfd 1500v	.77	3	mfd 4000v	4.95
1	mfd 1500v	.97	.1	mfd 5000v	1.98
2	mfd 1500v	1.19	.25	mfd 5000v	2.29
4	mfd 1500v	1.98	1	mfd 5000v	2.98
.24	mfd 1500v	4.98	1	mfd 7500v	1.79
1	mfd 2000v	.69	.01	mfd 7500v	1.79
.25	mfd 2000v	.89	.02	mfd 7500v	1.79
.5	mfd 2000v	.97	.03	mfd 7500v	1.79
1	mfd 2000v	1.29	.05	mfd 7500v	1.79
2	mfd 2000v	1.98	.1	mfd 7500v	1.79
4	mfd 2000v	3.89	2x.1	mfd 7500v	4.95
8	mfd 2000v	4.95	.02	mfd 12000v	9.95

## HIGH CAPACITY CONDENSERS

2x3500	mfd 25v	\$.37	200	mfd 35v	\$.57
2500	mfd 3v	.35	100	mfd 50v	.45
3000	mfd 25v	2.45	4000	mfd 18v	1.95
650	mfd 80v	1.29	2350	mfd 24v	2.25
1000	mfd 15v	.98	10000	mfd 25v	4.57

1000KC crystal BT cut ..... \$3.95  
 3" scope shield ..... 1.29  
 2 speed dial drive for 1/8" shaft ratios 5 to 1 1 to 1 ..... .49

## SOCKETS

Angle octal	\$.19	Ceramic for 5D21, 705A	\$.89
Magnal	.59	Ceramic for 832, 826, 829	.69
Dihedral	.59	Mycalex for T127A	.59
Safety recessed for 2X2	.39	Ceramic acorn	.29
Mycalex for 813	.59	Ceramic for 866A	.59

## TRANSFORMERS—115v 60 cyc

HS	Herm. sealed	FS	Full shell	Wgt.	Ht.	W.	D.	Price
OF	Open frame	FE	Fully enclosed					
Secondaries								
HS	6350v @ .025 arms (16kV ins)			33 1/2	3	7 1/2	6	\$11.95
OF	6250v or 3850v or 2600v @ .056 arms			37	12	8	5 1/2	13.95
HS	2500v @ 15 ma			13 1/2	5 1/2	4 1/2	4 1/2	3.49
HS	1600v @ 4 ma; 350-0-350v @ 150 ma; 6.3v @ 9A			9	5 1/2	4	3 1/2	4.45
HS	1540v @ 5 ma; 340-0-340v @ 300 ma			16	5 1/2	5 1/2	4 1/2	4.35
FS	1120-0-1120v @ 500 ma; 12v CT @ 14A; 2.5v @ 10A; 17v @ 2.5A; 32v @ 25 ma; 115/230 pri			45	9 1/2	10	7 1/2	27.00
HS	925v @ 10 ma; 525-0-525v @ 60 ma; 2x5v @ 3A; 6.3v CT @ 3.6A; 6.3v @ 2A; 6.3v 1A			14 1/2	6 1/2	4 1/2	4 1/2	5.55
FE	700-0-700v @ 300 ma			34	5 1/2	11 1/2	4 1/2	7.55
FE	500-0-500v @ 175 ma			14 1/2	5 1/2	4 1/2	4 1/2	4.55
FS	430-0-430v @ 340 ma; 6.3v CT @ 6.3A; 5v @ 6A			8 1/2	5 1/2	3 1/2	3 1/2	4.85
HS	425-0-425v @ 75 ma; 6.3v @ 1.5A; 5v @ 3A			7 1/2	5 1/2	3 1/2	3 1/2	3.65
FE	415-0-415v @ 60 ma; 5v CT @ 2A; 115/230 dual pri.			7 1/2	5 1/2	3 1/2	3 1/2	4.97
HS	405-0-405v @ 150 ma; 6.3v CT @ 2.5A; 5v @ 3A; 2.5v CT @ 5A			7 1/2	4 1/2	3 1/2	3 1/2	4.35
HS	400-315-0-100-315v @ 200 ma; 2x6.3v @ 9A; 5v @ 3A; 2.5v @ 2A			18	5 1/2	4 1/2	4 1/2	5.35
HS	500-385-0-385v @ 200 ma; 3x6.3v @ 6A; 5v @ 3A; 2.5v @ 2A			18	5 1/2	4 1/2	4 1/2	4.75
FE	325-0-325v @ 12 ma; 255-0-255v @ 240 ma			15 1/2	5 1/2	4 1/2	3 1/2	4.25
HS	300-0-300v @ 65 ma; 6.3v @ 2.5A; 6.3v @ 1A; 2x5v @ 2A			6 1/2	3 1/2	3 1/2	3 1/2	3.25
HS	120-0-120v @ 50 ma			6 1/2	4 1/2	2 1/2	2 1/2	.95
HS	80-0-80v @ 225 ma; 5v @ 2A; 5v @ 4A			6 1/2	4 1/2	3 1/2	3 1/2	2.97
FE	0-17.4/21.6/25.8v @ 400 ma; 6.4v @ 5A; 2.6v CT @ 2.5A pri 115/230			7	5	5	3 1/2	3.85

OF	18 or 36v @ 15A	Wgt.	Ht.	W.	D.	Price	HS	6.3v @ 1A; 2.5v @ 2A	Wgt.	Ht.	W.	D.	Price
FS	12.6v CT @ 10A; 11v CT @ 6.5A	16	6 1/2	6 1/2	3 1/2	3.87	OF	6.3v @ 1A	8	5 1/2	4 1/2	3 1/2	\$2.29
FE	3x10.3v CT @ 7A	12 1/2	6 1/2	5 1/2	3 1/2	6.35	FE	6.3v CT @ 3.5A; 2x2.5v @ 2A	7	3 1/2	3 1/2	3 1/2	2.97
HS	6.5v @ 12A; 6.3v @ 2A; 1.15v @ 1A	9 1/2	5 1/2	4 1/2	3 1/2	3.50	HS	5v CT @ 20A; 10KV ins	22	6 1/2	7 1/2	4 1/2	8.95
HS	6.4v @ 10A; 6.3v @ 6A; 2.5v @ 8A; 6.5v @ 6A	7 1/2	5 1/2	4 1/2	2 1/2	2.77	HS	4-0-4v @ 1A	1 1/2	2 1/2	2 1/2	2 1/2	.87
OF	6.5v @ 1.75A	9	4 1/2	4 1/2	3 1/2	4.17	HS	6v @ 15A rms	3 1/2	3 1/2	3 1/2	2 1/2	1.47

## TRANSFORMERS—220v 60 cyc

FE	512.5-0-512.5v @ 427 ma	24 1/2	6 1/2	6 1/2	4 1/2	5.35	FE	Step up/down 110/220 500 watt	25	6	11	5	10.95
FE	3x5v @ 6A; 4v @ 25A	10	5 1/2	4	4	2.95	FE	Step up/down 110/220 220/440 600 watt	39	5 1/2	7 1/2	7	14.95
FE	3x6.3v CT @ 3A; 6.3v CT @ 1.6A	9 1/2	5 1/2	4	3 1/2	2.95							
FE	10v CT @ 6.5A; 6.3v CT @ 2.5A; 6.3v CT @ 1.8A 220/440 pri.	13	5 1/2	5 1/2	4 1/2	3.95							

## FILTER CHOKES—HI V INS

HS	600 hy @ 1 ma/500 ohms	1	2 1/2	2 1/2	dia.	3.15	FE	14/3.5 hy @ 40/400 ma	17	4 1/2	6 1/2	6 1/2	6.95
HS	325 hy @ 2 ma/450 ohms	1	2 1/2	2 1/2	dia.	3.37	FE	3 hy @ 50 ma/300 ohms	1 1/2	1 1/2	1 1/2	dia.	.33
HS	200 hy @ 10 ma/520 ohms	1 1/2	3 1/2	2 1/2	dia.	3.37	HS	2 hy @ 175 ma/60 ohms	1 1/2	2 1/2	1 1/2	1 1/2	1.49
FE	30 hy @ 60 ma/240 ohms	6	4	4 1/2	3	1.57	FE	5 hy @ 70 ma/100 ohms	2	2 1/2	1 1/2	1 1/2	
HS	30 hy @ 25 ma/870 ohms	1 1/2	2 1/2	2	2	.97		2 hy @ 350 ma/6 ohms dual	5	3 1/2	4 1/2	3	2.39
HS	15 hy @ 70 ma/500 ohms	3	3 1/2	2 1/2	2 1/2	1.15	HS	1 hy @ 5A	12	6	4 1/2	3 1/2	6.97
HS	10 hy @ 80 ma/85 ohms	3 1/2	3 1/2	3	3	2.17	FE	.065 hy @ 2.5A	11	4	4 1/2	3 1/2	2.49
FS	3/30 hy @ 250 ma/70 ohms	6 1/2	4 1/2	3 1/2	dia.	3.65	HS	.05 hy @ 15A	9	6	4 1/2	3 1/2	7.97
FS	10/20 hy @ 85 ma/2000 ohms	2 1/2	3	2 1/2	2 1/2	1.55							

## SELENIUM RECTIFIERS—FULL WAVE BRIDGE TYPE

Input: 0-18v AC				Output: 0-14.5v DC				
Type	Max. DC Current	Price	Type	Max. DC Current	Price	Type	Max. DC Current	Price
18D1	1.2	\$ 2.59	18K2	26.0	\$17.95			
18E1	2.4	3.49	18K3	39.0	24.95			
18F1	6.4	4.95	18K4	52.0	29.95			
18K1	13.0	8.95	18K5	65.0	35.95			
18J1	17.5	11.95						

Input: 0-40v AC				Output: 0-34v DC				
Type	Current	Price	Type	Current	Price	Type	Current	Price
40D1	0.6	\$ 2.95	40K2	12.0	\$18.95			
40E1	1.2	3.89	40J2	18.0	22.45			
40F1	3.2	5.79	40K4	24.0	32.50			
40K1	6.0	9.95	40K5	30.0	37.95			
40J1	9.0	12.95	40J4	36.0	42.50			

Input: 0-120v AC				Output: 0-100v DC				
Type	Max. DC Current	Price	Type	Max. DC Current	Price	Type	Max. DC Current	Price
40D1	.6	\$ 7.85	40K1	6.0	\$27.47			
40E1	1.2	10.76	40J1	9.0	34.35			
40F1	3.2	16.65						

## SINGLE PHASE FULL WAVE CENTER TAPPED

Input: 10-0-10v AC				Output: 8v DC				
Type	Max. DC Current	Price	Type	Max. DC Current	Price	Type	Max. DC Current	Price
20D1	1.2	\$ 1.89	20K4	48.0	\$17.95			
20E1	2.4	2.25	20K5	60.0	22.49			
20F1	6.4	3.87	20K6	72.0	25.57			
20K1	12.0	4.95	20K7	84.0	27.95			
20J1	16.0	7.95	20K8	96.0	32.50			
20K2	24.0	11.95	20K10	120.0	36.50			
20K3	36.0	14.95						

## THREE PHASE FULL WAVE—BRIDGE RECTIFIERS

Input: 120v AC				Output: 150v DC				
Type	Max. DC Current	Price	Type	Max. DC Current	Price	Type	Max. DC Current	Price
40D31	.9	\$16.52	40K31	9.0	\$32.50			
40E31	1.8	19.87	40J31	12.0	54.69			
40F31	4.75	27.95						

Current ratings can be increased 2 to 2 1/2 times by fan cooling.

## COMPONENTS

50 mmfd ceramic condensers	\$.59
50 mmfd button condensers	.07
55 mmfd ceramic feed thru	.08
4-30 mmfd ceramic trimmers	.29
25, 50 mmfd air trimmers screwdriver	.39
100, 140 mmfd air trimmers screwdriver	.29
50 mmfd 5KV GE vacuum condenser	1.49
1 mfd 600v donut condenser (152 in box)	per box 1.98
TMC-300 National variable 300 mmfd	1.29
Single gang variable 33-435 mmfd	.69
Five gang variable 11.5-30 mmfd per section	.98
Three megacycle 1F coil double slug	.29
Thirty megacycle 1F coil	.19
80 meter osc. coil for ARC5	.29
80 meter PA final coil for ARC5	.29
0-1 na meter Weston 506	2.95
—10+5 decibel meter Weston 301	9.95
2v, 6v, 12v vibrators	.98
Circuit breaker 15 amp.	.98
J37 key	.69
200 watt power supply kit, complete	17.95
400 watt modulation xformer 803, 813, 100TH	19.95
Output xformer UTC pri: 8500 ohms, sec: 0-8-125-500	.69
500 watt 12.5 ohm rheostat	3.49
Driver unit WE 35 watt	4.95
Horn throat for above	.39
Rotary switch GE mycalex, 2 deck SP3T	.49
Plate caps ceramic, 2X2, 807, etc.	.19
Plate caps ceramic, 866A, 813, etc.	.19
Couplings ceramic 1/2" to 1/4"	.29
Couplings ceramic 1/2" to 3/8"	.29
Couplings ceramic 3/8" to 1/2"	.29
Crystal socket ceramic 2 prong 1/2"	.14

## EQUIPMENT

APN-1 altimeter transceiver	New \$ 7.95
ATR inverter 12v DC in 110v AC 100v out	New 16.95
AN/CRW-2 UHF receiver	New 5.95
BC 1016 tape recorder	New 139.50
BC 950A-121 xmitter 100-156 mc, modulated	New 49.50
BC 778 Gibson Girl	Shelfworn 3.95
BC375E xmitter, 7 tuning units, dynamotor	Like new 69.50
BC-A1229 receiver	Used 2.95
BC 733 receiver	New 6.95
BC 433 receiver	Used 24.95
BC 456 modulator	New 1.98
BC 434A control box/SCR269	Used 2.45
BC 996T1 interphone amplifier	Like new 6.95
BC 602A control box/SCR522	Used .49
BK-22 relay for SCR269	New 2.95
BK-22 relay for SCR269	Used 1.95
CFI Navy unit w/200 KC crystal	New 14.9



# WOW! LOOK AT THIS SAVING!



quantities are limited so get in your order TODAY

**NATIONALLY FAMOUS!**  
15 in. (130 Sq. In. Picture)

## TV CHASSIS

\$259.50 Value **\$169.95**

Complete with Picture Tube

**THIS IS NOT A KIT!**

But a Factory Custom Engineered, Factory Wired and Tested, Factory Aligned TV Chassis THATS READY TO USE—JUST PLUG IT IN AND IT WORKS!

We agreed not to mention the name but you've seen it Nationally Advertised—a name you respect for "know how" and quality. You get the identical Chassis regularly priced at \$259.50 for only \$169.95! Big Picture Television at a cost as low as usually quoted for pictures half as large plus the convenience of a custom installation.

Mount it in a cabinet of your own choosing—in a wall—in any location that meets your own requirements.

130 sq. in. picture on a 15" direct view tube. All channel selector switch provides instant tuning. Fine tuning control on front

YOU SAVE \$90.00



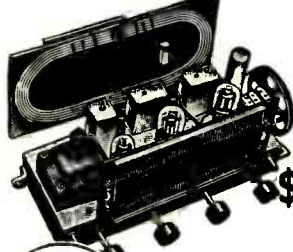
panel. 8" electro-dynamic speaker provides rich tone.

Supplied mounted on reinforced wood frame ready to be slipped in cabinet, wall installations etc. Dimensions: 19 1/2-in. high, 23-in. wide, 21 1/4-in. deep. Factory wired and tested, complete with 19 tubes, plus 3 rectifiers and 15DP4 Dumont picture tube. For 110-120 V 60 cycle AC. Shipping Wt. 80 lbs.

Quantities are limited—all orders subject to prior sale Order Now!

No. 39A18X NET EACH..... **\$169.95**

## hallicrafters S-59



\$49.50 VALUE

Only

**\$32.95**

### 8-TUBE CUSTOM FM-AM CHASSIS

High fidelity. Receives broadcast 540 to 1700 kc and FM 88 to 108 mc. Excellently engineered—ideal for custom installations. Size 13 1/4 x 6 x 5 1/2" high. Complete with tubes and broadcast loop antenna. 8 ohm output transformer matches most speakers. Limited quantity still available. Order Now! With or without speaker. Complete description on page 137 in our catalog No. 501. Write us if you do not have this catalog. Wt. 18 1/2 lbs.

No. 34A19—Hallicrafters **\$32.95**  
S-59 Chassis  
No. 31B8—12" Coaxial **\$ 9.95**  
Speaker. Wt. 6 lbs.

Prices FOB Kansas City. Remit with order or send 25% deposit when COD.



## BURSTEIN-APPLEBEE CO.

1012-14 MCGEE ST. KANSAS CITY 6, MO.

### "Lock-in" Circuit

(Continued from page 44)

takes place over quite a few cycles on either side of the frequency to which the circuits are tuned. In this particular case it is significant to note that the "tank circuit" is aperiodic. Since this means that there are no tuned circuits, the conversion takes place over one complete cycle, which is essential to proper operation in the type of comparator circuit required.

Next, examine the complete circuit of Fig. 2. Note that a negative scan pulse (actually a whole line) is drawn from the horizontal yoke. After passing through the phase-shifting network,  $R_2C_3$ , it assumes the shape shown at "A." (Note the pip of the original sync is still riding the pulse.) For an enlarged drawing of "A," see Fig. 3.

This distorted pulse is injected into the diode at point "X." Mixing with the incoming sync pulse, a d.c. voltage is developed, the value of which is a function of the difference in phase between the pulses of these two sources. This voltage, varying with phase difference (brought about by the various factors which cause loss of sync in normal TV receivers), is used to control the frequency of the horizontal oscillator.

Consider point "X" in Fig. 2. The dual-diode with equal resistors  $R_3$  and  $R_4$  comprise a bridge circuit. Normally the voltage at "X" would be equal to voltage at ground, or zero. The distorted negative pulse entering the circuit has an a.c. waveform, due to the distorting network. However, the major lobe is still clearly negative as shown at "A."

Thus the injection at "X" is essentially negative. This causes the upper diode to conduct less heavily and the lower one more heavily, producing a net increase of positive voltage across the load (to right of point "X.") A positive voltage applied to the grid of the discharge tube of the horizontal oscillator will tend to unblock the oscillator, increasing its speed. Conversely, reducing this positive voltage will slow up the oscillator.

Now, with the hold control remaining fairly fixed, the control voltage will have to be practically instantaneous becoming more positive when the oscillator is slow and less positive (negative going) when the oscillator is fast. How is this accomplished?

Consider Fig. 3. Study the picture of one horizontal line scan. This shows a normally locked raster line with the sync pulse riding at point "Z." It could actually ride anywhere between points "M" and "N" without upsetting the oscillator, but it will tend toward point "Z" because that is the maximum (negative) point. If it rode between points "Z" and "O" it would give wrong polarity, kicking the oscillator off frequency. (Once the oscillator goes off frequency for the major part of a cycle the pulse would meet the line in a

**LEARN DAY and EVENING CLASSES**  
**TELEVISION**  
ELECTRONICS-RADIO  
Modern Laboratory Instruction In

- SERVICING
- BROADCAST OPERATING
- ELECTRONIC and TV ENGINEERING

WRITE FOR CATALOG  
ILLUSTRATED  
**ELECTRONICS INSTITUTE, Inc.**  
21 HENRY, DETROIT 1, MICH.

**G.I. APPROVED**

CHOICE OF ENGINEERS EVERYWHERE

### TWIN-TRAX TAPE RECORDER

Available to you direct from the factory at savings that make TWIN-TRAX the only professional-type recorder in the popular-price field. More than a dozen model variations for portability, long-play, continuous operation, etc. For a better tape recorder that combines professional quality with operating ease and trouble-free construction, it's TWIN-TRAX. Write today for complete literature. \*Trade Mark Registered

**AMPLIFIER CORP. OF AMERICA**  
398-2 Broadway • New York 13, N. Y.





# ORDER from ARROW!

## BC-605 INTERPHONE AMPLIFIER

Easily converted to an ideal intercommunication set for office—home—or factory. **\$4.95**  
Original—New .....  
Like ..... **3.95**  
New .....  
(With schematic)



All necessary parts and instructions to convert the above to AC operation with one remote station. \$8.25 additional.

### Miscellaneous SPECIALS

	Used	New
ID 6/APN 4 Scope, Excellent	\$29.50	
ID 2/APS-5FP7 Assembly		\$6.95
R 7/APS 2 Receiver-Indicator		79.50
R 76/APS-15 Receiver-Indicator	34.50	
BC 1287 A Scope	75.00	
ASE 7 Indicator Scope	12.95	
ARB Receiver, 200 to 9000 KC	19.95	
SCR 522 Transceiver 100 to 150MC	34.95	75.00
EC 1206 Receiver, 200 to 400 KC	3.95	5.95
MN 26 C or Y Receiver	17.50	24.95
KA 10 DA Receiver	17.50	24.95
T 85/APT 5 Transmitter		69.50
T 39/APQ 9 Transmitter	7.95	
T 26/APT 2 Transmitter	8.95	
BC 457 Transmitter—as is—fair condition—as they come, some with, some less tubes and Xtal	1.95	
EC 458 Transmitter—as is—fair condition—as they come, some with—some less tubes and Xtal	1.95	
R 89 Receiver chassis less tubes and side covers	1.95	
RT 7/APN 1 Transceiver	7.95	9.95
APN 1 Complete		34.50
ED 71 6 Pos. Switchboard	9.95	12.95
EE 8 Field Phones	7.95	
BC 347 Interphone Amplifier		2.95
I-70 Tuning Meter		.89
AM 61 Indicator Amplifier		9.50
SCR 625 Mine Detector		39.50
PE 237 Power Supply		12.95
BC 461 Veeder Root Counter		.59
BC 442 Less Condenser	1.49	1.95
BC 306 Antenna TU for BC 375		1.50
A 27 Phantom Antenna		.98
APS 13 UHF Antenna, Pair		.98
Manual for BC 312 & 342 J		1.00
Manual for SCR 269 G		2.50
FL 8 Filter		2.95
I-97 Bias Meter	2.95	3.95
RM 29 Remote Telephone Control	7.95	9.95
BC 602 Control Box		.98
BC 639 Receiver with RA 42 Rectifier		
RTA 1B Transceiver		
TA 2J24 Transmitter and MP 10G Power Pack		
SCR 269 Compass Installation		
R 5/ARN 7 Compass Installation		
MN 26 Compass Installation		
I. L. S. Installation (R 89-BC 733)		
SCR 584 Components		

Information and prices on request

### HERMETICALLY SEALED CHOKES

10 H. 100 M.A.	59c
59 H. 100 M.A.	95c
3.7 H. 145 M.A.	59c
10 H. 20 M.A.	39c

### RECEIVER

Easily Converted for Use in Citizens Band

Crystal Controlled Local Oscillator. Broad Band Pass—20.7 MC IF's. Complete with 7-6AJ5, 1-12SR7, 2-12SN7, 1-28D7, relays, crystals. Schematic furnished. Used **\$7.95**

### CONDENSERS

	Each
2 mid 4000 VDC. OIL-FILLED	\$2.95
2 mid 5000 VDC. OIL-FILLED	4 for 10.00
	3 for 10.00
1 mid 6000 VDC	1.98
.25 mid 15000 VDC	4.95
00025 mid 25000 VDC	2.95
.4 mid 1500 VDC	.29
	10 for 2.49

### TUBES

Nationally Advertised Brands—All Brand New

Type	Net Price	Type	Net Price	Type	Net Price
1A4P	\$0.49	6L5G	\$0.49	38	\$0.29
1A6	.49	6L7G	.49	39/44	.24
1B5/265	.49	6R7	.39	49	.39
1B22	1.95	6SF5GT	.39	50	.59
1B26	2.96	6S8GT	.59	56	.29
1B29	.59	6S7F	.49	57	.29
1B32-532A	2.95	6S7J	.69	76	.29
1C6	.49	6T7G	.59	77	.39
1C7G	.49	6U7G	.39	216 V4L	.75
1D5GP	.49	6Z7G	.69	316A	.39
1D7G	.49	6ZY5G	.39	371B	.39
1F4	.49	7C4/1203A	.29	703A	1.95
1F5G	.49	7E5/1201	.59	7C5A	.98
1H4G	.39	10Y/VT25A	.19	714AV	5.95
1J6G	.49	12A6	.39	724B	4.95
1J6GT	.49	12A6GT	.39	801A	.69
1N5GT	.49	12A7	.39	836	.96
1P5GT	.49	12A8GT	.39	837	1.95
1V	.49	12C8Y	.39	841	.39
2A6	.39	12F5GT	.39	864	.39
2A7	.49	12H6	.39	872A	1.29
2C26A	.19	12J5GT	.39	954	.19
2V3G	.39	12J7GT	.39	958	.39
2X2/379	.39	12K8GT	.39	957	.39
3B7/1291	.39	12O7GT	.39	1625	.19
3O6/1299	.39	12S5F	.39	1626	.29
5P7	.98	12S5FGT	.39	1629	.29
4AP10	.98	12S7H	.29	1F30	.59
FBP1	1.96	12S7J	.29	1636	2.95
5BP4	2.95	12S7R7	.29	1638	.69
5CP1	2.95	12S7GT	.29	1642	.69
5D21	19.95	15R	.19	2051	.79
5J23	7.95	19	.59	719	.19
5T4	.69	2J22	3.96	9007	.39
5W4	.59	28D7	.39	9008	.49
6Z4	.59	30S5EC	.39	9009	.29
6B8	.59	Vt67	.59	GL4A21	.29
6C4	.29	30	.29	Amperite	
6D2	.59	32L7GT	.59	10T1	1.29
6F5GT	.39	33	.29	Jan CRP72	2.49
6H6	.29	34	.29	WE 331A	.89
6J6	.89	35/51	.29	REL 36	.89
6J7GT	.39	36	.29	VR 150	.39
6K6G	.69	37	.29	VR 106	.69

### WRITE FOR QUANTITY PRICES

### BEAM INDICATORS

I 82—5"	New	\$4.95
Transmitter Selsyn for above		2.45
	both for	7.00
I 81—3"	New	3.45
Transmitter Selsyn for above		2.45
	both for	5.25
I 81	Used	2.45

### SURPRISE PACKAGE

20 lbs. Ass't radio parts. A \$25.00 value for only **\$1.95**

### PP 12A/APS-3 RECTIFIER POWER SUPPLY

110 VAC—800 to 2400 CPS input. Used to supply many voltages for APS 3 equipment. Contains four VR105; Three 5U4G; 2x2; 6AC7; 6Y6-G; VR 150; 6X5GT-G condensers, chokes, etc. Parts **\$6.95** alone worth more than

### OUTPUT TRANSFORMER

Hi-Fil used in Scott Manufactured Navy receiver. Fully potted. 1r. 5000 ohms; output secondary 60 ohms C.T.—Inverse feedback secondary CT-60 ohms. New **\$1.45**

### NEW CATALOG

listing many surplus values, write for your **FREE** copy TODAY.

All shipments FOB Chicago. 20% Deposit required on all orders. Minimum order accepted—\$5.00. Illinois residents, please add regular sales tax to your remittance.

## ARROW SALES, Inc.

Dept. N

1712-14 S. Michigan Ave., Chicago 16, Ill.

PHONE: HARRISON 7-9374

### BC-604 TRANSMITTER FM 20-28 MC

11 and 15 meters. Can be operated on 10 meters—10 channel push button crystal. With all tubes and meter but less dynamotor.

Excellent Condition **\$12.95**  
Crystals—Set o' 80..... **14.95**

### COMMAND (SCR 274 N) EQUIPMENT

	Used	New
FC-453	\$12.95	
BC-454	4.95	\$6.95
EC-455	7.95	
BC-456	1.95	2.95
BC-457	5.95	
BC-458	5.95	7.95
BC-459 (or T22)	9.95	
EC-696 (or T19)	14.95	24.95
ARCS Transm. 2.1-3MC	9.95	
EC-450—3 Receiver Remote Control	.89	1.95
EC-442		2.95
3 Receiver Rack	1.95	
2 Transmitter Rack	1.50	

Complete Command set as removed from aircraft—3 receivers—2 transmitters—relay unit—control boxes—mounting racks—plugs—modulator and dynamotors—creted. Set **\$34.50**

### DYNAMOTORS

DM-28—For BC-348 with Mount and Filter	New	\$6.95
	Used	3.95
DY-12—For ART-13 less filter and base	New	6.95
DM-36	Used	.95
	New	1.95
BD-77	New	5.95
PE-206	New	6.95
	Used	2.75
PE-101	New	2.75
PE-73	New	3.95
DM-53	New	3.95
	Used 1.95	(3 for \$2.00)
DM-32	New	1.95
	Used .95	(3 for \$2.00)

### MIKES—HEADSETS

HS-23 Hi Imp.	New	\$2.95
HS-33 Lo Imp.	New	2.95
HS-30 Hi Imp.	New	1.50
	Used	.79
T-17D Carbon Mike	New	2.75
T-24 Hi Imp. Carbon Mike	New	1.19
T-30 Throat Mike	New	.98
T-45 (or Navy) Lip Mike	New	.98
CD-307 Extension Cord for Headsets	New	.59

### BC 620

Receiver-Transmitter—2 crystal channels—20 to 27.8 MC FM—13 tubes. Metered, Plate and Filament. New **\$14.95**  
Used 9.95  
PE 97 Power Supply for above 6-12 volt vibrator type.  
Used—complete..... **\$6.95**  
Used less tubes, vib. & cond..... **2.95**  
FT 250 Mount for both BC 620 and PE 97 New **\$1.50**

### BC 223

Brand new Transmitter with all three tuning units, two tuning unit cases, spare tube carrying case, shock Mount and brace, but less tubes at new low price of **\$19.95**  
Tuning units are available separately at . Ea. **\$2.50**  
Cases at ..... Ea. **.95**  
PE 125—12-volt Vibrator Pack ..... New **\$12.95**  
Used **8.95**



## These Men are Getting PRACTICAL TRAINING



# IN RADIO-TELEVISION

ON REAL TELEVISION SETS RADIO RECEIVERS F.M. RECEIVERS

## IN THE GREAT SHOPS OF COYNE

Big opportunities are waiting for men who know the practical and technical end of Radio and Television. That's what you get at COYNE—besides practical Shop Training in F.M., Electronics and other branches of this giant field. Remember, Television is the fastest growing opportunity held today, and Radio is one of the biggest.

### NOT "HOME STUDY" COURSES

All Coyne Training is given in our mammoth Chicago training shops. We do not teach by mail. You train on actual equipment, under friendly instructors. Previous experience unnecessary. Hundreds of firms employ Coyne trained men.

### OLDEST, LARGEST, BEST EQUIPPED SCHOOL OF ITS KIND IN AMERICA

Come to the Great Shops of Coyne in Chicago. Established 1899—now in our 51st Year. Fully approved for G.I. training. Finance plan for non-veterans.

### MAIL COUPON FOR FREE BOOK

Send today for big new book packed with large pictures taken in Coyne Shops. No obligation. No salesman will call. Get the facts now!

**COYNE** B. W. COOKE, Pres.  
ELECTRICAL, RADIO & TELEVISION SCHOOL  
500 S. Paulina St., Dept. 30-1K  
Chicago 12, Illinois



B. W. COOKE, Pres.  
COYNE Electrical, Radio & Television School,  
500 S. Paulina Street, Dept. 30-1K, Chicago 12, Ill.

Send FREE BOOK and full details on Radio-Television Course.

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

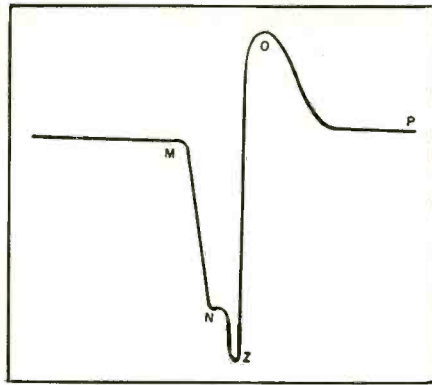


Fig. 3. Enlarged view of "A" in Fig. 2.

more favorable position since the sync pulse is rigidly controlled at the transmitter while the local horizontal oscillator is designed to lock-in when triggered by the sync pulse.)

It could ride between points "O" and "P" but that slope is too broad for sensitivity of control, and the oscillator would vary, permitting sync to strike the more favorable region "M" to "N."

Suppose the oscillator starts to speed up. If it runs away from the sync the sync pulse will start to move toward "M." This would shorten the negative peak, lowering the output voltage at point "X," slowing up the oscillator. If the action were such as to make the oscillator go too slowly, the sync would move forward to the maximum negative point at "Z," increasing the output voltage at "X," increasing the speed of the oscillator. Since the correction takes place within the cycle, the sync correction takes place within one line, causing no visible change from the standpoint of the observer.

The horizontal oscillator (not shown) is a conventional blocking oscillator in which the frequency is controlled by the time constant of the grid resistor and the grid blocking condenser. Variation of either of these two elements will control the frequency of the oscillator. (Examine the horizontal oscillator of the TV receiver it is desired to control. Any Sams Photofact Standard Notation Schematic of a TV receiver will clearly indicate this circuit.)

To the normal means of control of the horizontal oscillator frequency may now be added a third means of applying an automatic variable d.c. voltage to the cold end of the grid resistor. (Simply open the ground end of the resistor already in the grid circuit of the horizontal oscillator. Now connect the opened end to the output of the circuit shown in Fig. 2. The rest is automatic.)

The control voltage is derived from the reference point "X" described earlier. It passes through a filter network containing  $L_1$ , with its damping resistor,  $R_1$ . This offers a low impedance to d.c., and a high impedance to the pulses which appear at "X." Condenser  $C_1$  further removes any pulses which might come through  $L_1$ . Since  $L_1$  and  $C_1$  comprise a series-tuned cir-

cuit, further damping is necessary. This is achieved by  $C_2$ , a large value condenser, and its damping resistor  $R_2$ .

Because the horizontal blocking oscillator tends to develop a high negative voltage in its grid circuit, it may be seen that this negative voltage could be reflected back to point "X", upsetting the action of the diode, if it is not balanced out.

To take care of this, resistor  $R_3$  supplies a positive voltage to counter the negative voltage developed by the blocking oscillator. This maintains the d.c. voltage at point "X" near zero, or slightly negative. Further stabilizing may be achieved by the use of  $R_4$  to prevent the blocking oscillator from departing too far from its normal frequency in case the synchronizing pulses from the transmitter are not present.

The author has operated the horizontal hold control on receivers using this circuit and can testify it really holds 'em!

All elements for this lock-in circuit are available in kit form from *Transvision, Inc.*, originators of this circuit. Full instructions for assembly accompany the kit. The circuit may be used with any TV receiver utilizing a horizontal blocking oscillator circuit.

-50-

### Batwing FM Antenna

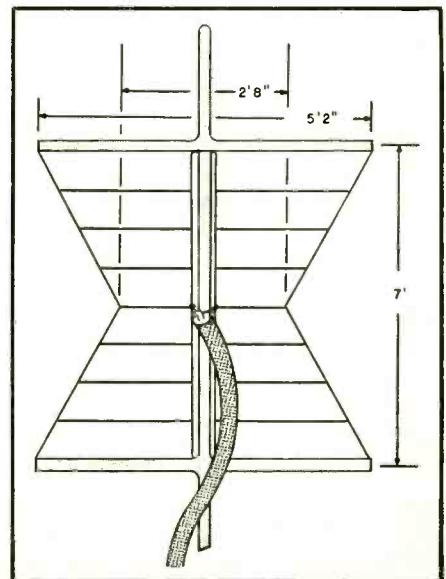
(Continued from page 35)

templated using  $\frac{3}{4}$ " diameter tubing for the top and bottom members,  $\frac{1}{2}$ " for the vertical members, and  $\frac{3}{8}$ " for the inner horizontals—all mounted on a  $\frac{3}{4}$ " mast. An antenna constructed in this manner, we believe, will yield optimum, dependable, weather-proof performance for a lifetime.

If bolted construction is used instead of the welded construction, it is advisable to use tubing and bolts of the same material to reduce the effects of electrolysis.

-50-

Fig. 3. Dimensions of a typical batwing unit.





It's Rotor-ific!

The RADIART

# TELE-ROTOR

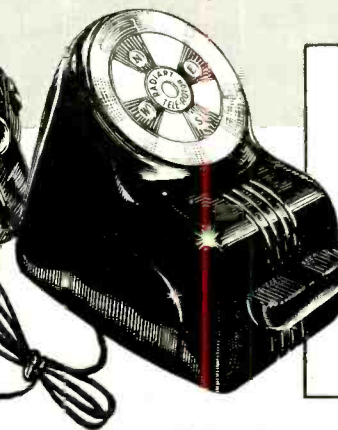
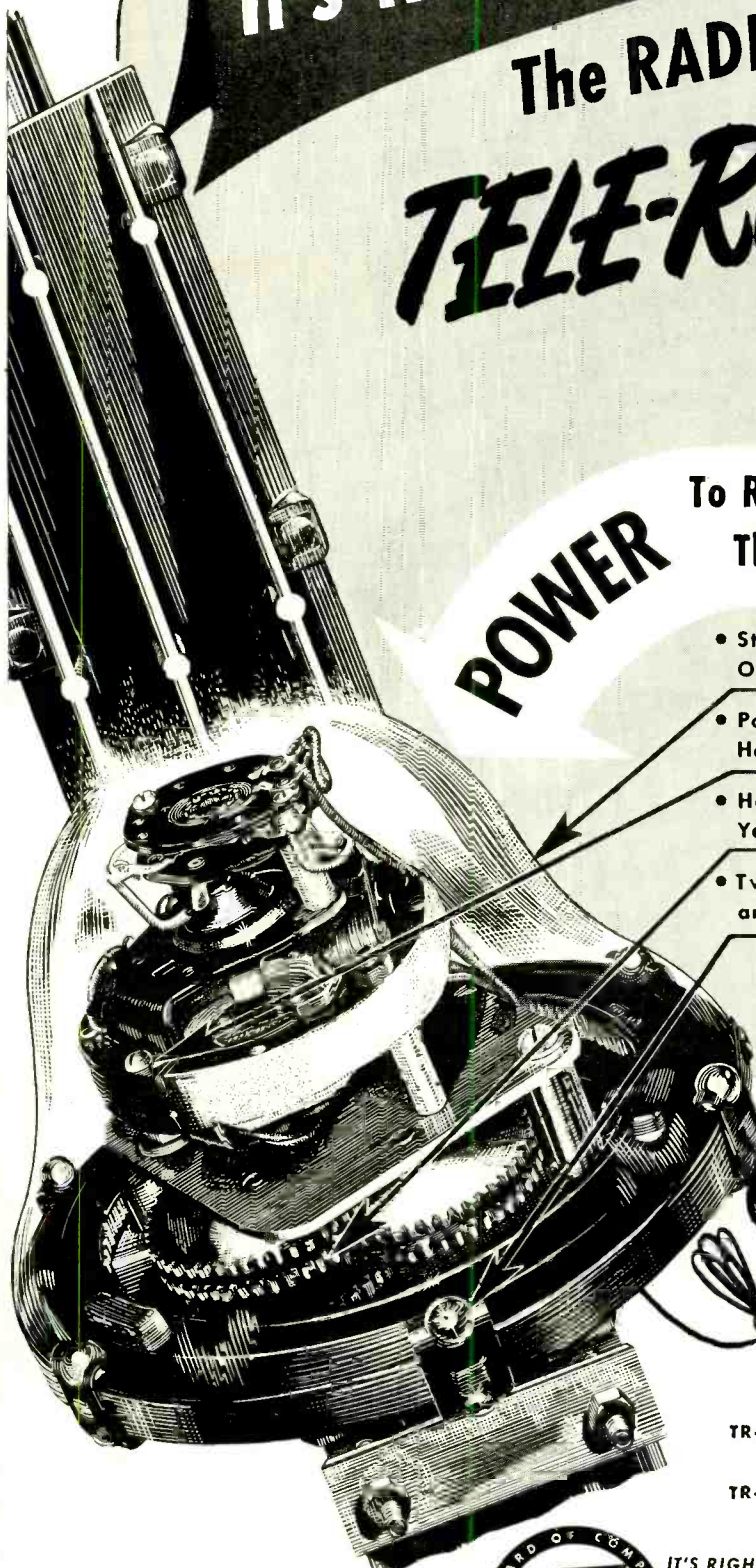


Makes the MOST of Television Reception  
By Making Possible CLEAR, SHARP PICTURES  
and PERFECT, TROUBLE-FREE PERFORMANCE

To Rotate TV Antennas Under Even  
The Most Adverse Conditions!

POWER

- Streamlined WEATHER-PROOF Housing! Keeps Out Water, Snow and Ice.
- Powerful Heavy-Duty Motor that Reverses Instantly! Handles 150-Pound Loads Easily.
- Heavy-Duty Precision STEEL Gears for Years and Years of Wear.
- Twelve Heavy-Duty Ball Bearings in Two 6½" diameter Races for Smooth, Easy Rotation.



THE RADIART  
**TELE-ROTOR**  
CONTROL

... With the "PERFECT PATTERN" Dial... Fingertip Control with Instant Indication of Antenna Position shown on the Illuminated Two-Tone Face.

Available in These Models:

- TR-1... Rotator and control unit with end of rotation light (uses 4 wire cable) . . . . . \$39.95
- TR-2... Compass Control Rotator with illuminated "Perfect Pattern" dial (uses 8 wire cable) . . . . . \$44.95

\* You Can't Beat a RADIART ANTENNA on a TELE-ROTOR... It's TOPS!



IT'S RIGHT WHEN IT'S RADIART

THE **RADIART** CORPORATION  
CLEVELAND 2, OHIO



- ROTATORS
- VIBRATORS
- TV ANTENNAS
- AUTO AERIALS
- POWER SUPPLIES



# Cletron

## Loudspeakers are gaining

# preference BECAUSE of



Model PM-10G

1. Finer tone amplification with better aluminum voice coils that dissipate heat faster.
2. Stronger construction—(a 3" speaker supports 300 lbs.).
3. Non-fluttering because of vulcanized cones and spiders.
4. Fully weather-proof—(will even play when fully submerged in water).
5. Millions are chosen each year by the most expert radio technicians.
6. The Cletron line is complete with an Alnico 5 or E.M. speaker for every need.
7. Beautiful blue-grey Hammerloid finish, infra-red baked.
8. Individually packed in sturdy corrugated cartons.

# Cletron

Radio and TV loudspeakers handle greater power without distortion or overheating. No warping. No buckling. No corrosion.

Write or wire now for your best buy in Speakers. It's CLETRON.

## CLEVELAND ELECTRONICS, INC.

6616 EUCLID AVENUE • CLEVELAND, OHIO

MORGAN EXPORTING CORP. • 458 Broadway Avenue • New York, New York

*Cletron The Choice of Expert Radio Technicians*

## Technical BOOKS

"THE OSCILLOGRAPH" by Walter Weiss. Published by *The Hickok Electrical Instrument Co.*, Cleveland, Ohio. 47 pages. Price \$1.00 (paper).

This is a thoroughly practical handbook that the radio technician can use daily in servicing radio, FM, and television receivers.

It should be emphasized that this manual is not concerned with the operation of the cathode-ray oscillograph but rather with the types of patterns that result from various service faults.

The first six sections are devoted to the subject of superheterodyne troubleshooting. For convenience sake, the author has divided the receiver into six sections; the power supply, the oscillator section, the first detector, the i.f. amplifier, the second detector and first audio section, and the final amplifier. He then outlines and illustrates the oscillograph patterns that should be obtained in a correctly functioning receiver and then the patterns which appear when the receiver is operating incorrectly.

The seventh section of the book is concerned with proper FM receiver alignment procedures to be followed when using an oscillograph for the operation and finally, a section on the proper use of an oscillograph in television receiver alignment.

A separate "Oscillograph Control Settings vs. Positions" chart is attached to the inside of the back cover where it can be easily removed for use above the oscillograph position on the service bench.

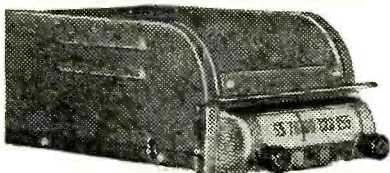
"16 MM. SOUND MOTION PICTURES" by William H. Offenhausser, Jr. Published by *Interscience Publishers, Inc.*, New York. 565 pages. Price \$10.00.

This is a definitive work on the subject of 16 mm. films and one of the first comprehensive texts in the literature. Prior to its appearance both amateur and professional film-makers had to search many sources to find the answers to their questions and solutions to their problems.

As to the value of the photographic discussion, this reviewer is not qualified to state but the sections on sound, sound recording, sound recording characteristics and sound recording equipment and its arrangement are valuable additions to the growing library of sound and audio texts.

Although the author has more or less confined his discussion to the photographic recording and reproduction of sound, he does touch on the subject of magnetic tape and its associated recording techniques. The author discusses the general requirements as to frequency range, the influence of noise, theoretical considerations in speech and music reproduction,

### AUTOMATIC M-90 AUTO RADIO



- Six Tube Superheterodyne • Three Gang Condenser • Powerful, Long-Distance Reception • Fits All Cars, Easy Installation
- Mounting Brackets Included Net \$29.97
- 6 Tube model M90 ..... \$29.97
- 5 Tube model X50 ..... \$24.95

MAIL US YOUR ORDERS

All orders filled within 24 hours. Illustrated parts list on request. Sylvania and Cunningham tubes 50% off list

*Bill Sutton's*  
Fifth at Commerce

Wholesale  
Electronics  
Fort Worth, Texas

## RCA DETENT EXCHANGE

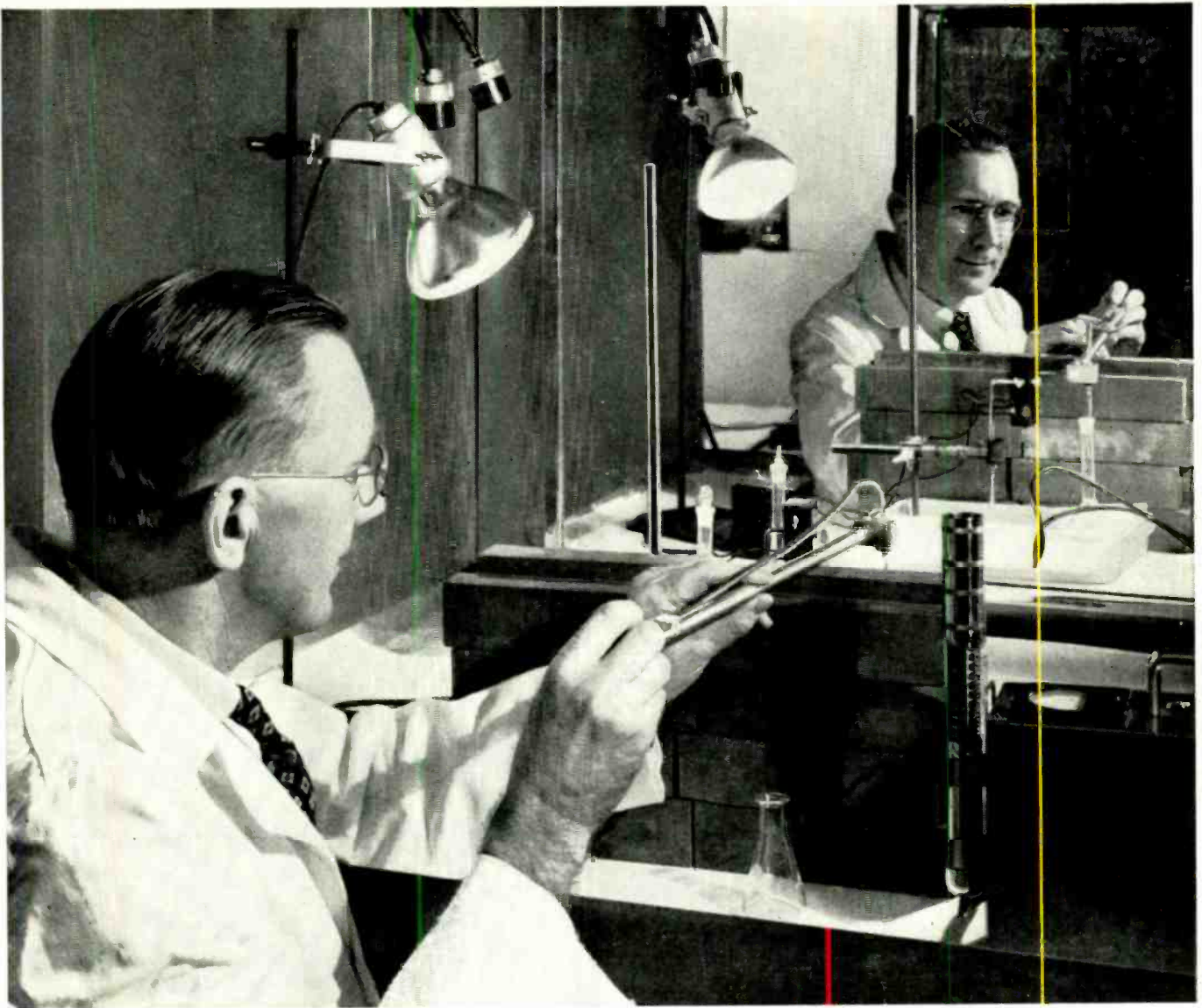
We will exchange your defective RCA TV Tuner Switch Detent Assembly for a factory rebuilt one. \*59¢ Prepaid. No C.O.D.

Unconditionally Guaranteed for 3 months \*You must mail us your defective detent.

## TECHNICAL RADIO PARTS CO.

557 McDonald Ave., Brooklyn 18, N. Y.





## IT'S **DONE WITH MIRRORS!**

Protected by a wall of lead bricks and using a mirror to guide his instruments, this Bell Laboratories scientist is preparing a solution of a radioactive isotope, for use as a tracer to study materials for your telephone system.

Bombardment by neutrons turns some atoms of many chemical elements into their "radioactive isotopes"; these are unstable and give off radiation which can be detected by a Geiger counter. Chemically a "radioactive isotope" behaves exactly like the original element. Mix the two in a solution or an alloy and they will stay together; when the Geiger counter shows up an isotope, its inactive brother will be there too. Minute amounts beyond the reach of ordinary chemical methods can be detected—often as little as one part in a billion.

The method is used to study the effect of composition on the performance of newly developed germanium transistors—tiny amplifiers which may one day perform many functions which now require vacuum tubes.

It enables Bell scientists to observe the behavior of microscopic impurities which affect the emission of electrons from vacuum tube cathodes. It is of great help in observing wear on relay contacts. And it may develop into a useful tool for measuring the distribution and penetration of preservatives in wood.

Thus, one of science's newest techniques is adopted by Bell Laboratories to make your telephone serve you better today and better still tomorrow.



**BELL TELEPHONE LABORATORIES**

EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.





# HENRY HAS THE NEW hallicrafters MODEL SX-71 NOW!



This new type of receiver—the first of its kind on the market—has extra sensitivity, selectivity, and definitely superior image rejection. Continuous AM reception from 538 kc to 35 Mc, and 46 to 56 Mc. One RF, 2 conversion, and 3 IF stages. 105-125 volts AC. 11 tubes plus voltage regulator and rectifier. Only \$179.50.



**MEDIUM PRICED HALLICRAFTERS MODEL S-40A**  
540 kc. to 43 Mc. Temperature compensated. One RF, 2 IF, 3-watt output, 4 bands. 115 V. AC. 8 tubes plus rectifier. Internal speaker. Only \$79.95. Other popular Hallicrafters models: S38-A, only \$39.95; S-72, only \$89.95; SX-43, only \$159.50; SX-62, only \$269.50.

I have a complete stock of Hallicrafters receivers and transmitters. I'll make you the best deal on a trade-in for your communications receiver. I give you prompt delivery, and 90-day FREE service. Nobody can beat Bob Henry on a trade-in, and I offer you the world's lowest credit terms. Write, wire, phone, or visit either store today for the best deal.

*Bob Henry*  
WPARA

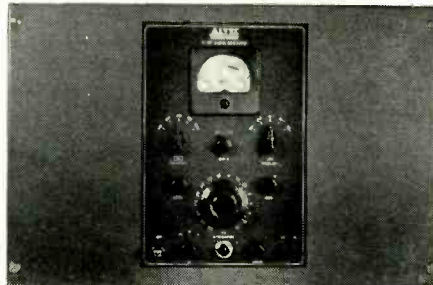
Butler 2, Missouri

## HENRY RADIO STORES

11240 Olympic Blvd.  
LOS ANGELES 25  
CALIF.

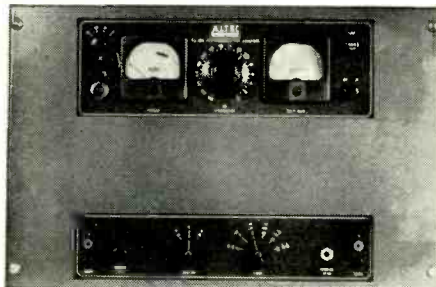
"WORLD'S LARGEST DISTRIBUTORS OF SHORT WAVE RECEIVERS"

TI 401  
Signal Generator



## INTERMODULATION TESTS

MADE EASY!



TI 402—Intermodulation Analyzer

An ideal tool for the design, maintenance and testing of audio devices, Altec's intermodulation Analyzer offers distinct advantages over single-frequency "harmonic" methods of distortion measurement. Distortion products resulting from the interaction of double test frequencies are measured and read directly for any given power level. Analyzer includes VTVM, making residual noise and signal-to-noise ratio determinations possible without extra equipment. Instrument is a reliable performance index for FM and AM transmitters and receivers, all audio amplifier, disc, tape and film recording equipment.

1161 N. VINE ST., HOLLYWOOD 38, CALIF.

161 SIXTH AVE., NEW YORK 13, NEW YORK



practical considerations affecting the low frequency cut-off of a system, practical considerations concerning frequency range and volume range of reproduced sound, production implications of performance range requirements, factors influencing response frequency characteristics in 16 mm. sound recording, transfer steps, process of making release prints and effect on sound, general recording procedures, and practical suggestions for recording.

The chapter covering the equipment used in recording on film lists the general requirements for such equipment, transfer losses and their correction, recommended ranges of response frequency over-all characteristic, pre- and post-equalizing, details of recording equipment, and the physical placement of the various recording components.

For the amateur 16 mm. enthusiast as well as personnel of commercial film outfits, this book is a must on the reference shelf.

\* \* \*

"FACSIMILE" by Charles R. Jones. Published by *Murray Hill Books, Inc.*, New York. 411 pages. Price \$6.00.

This is a comprehensive work on the subject of facsimile written for the user as well as the technician who services the equipment.

The book is divided into four parts covering the nature of facsimile; its operation, present-day facsimile systems, and servicing. The first part deals with the historical and technical background of the medium, modern facsimile equipment, the type and scope of facsimile services (both projected and actual), facsimile broadcasting, and other facsimile devices.

The second part covers transmitters and transmission facilities, facsimile reception, synchronization and phasing, tape facsimile, and facsimile standards. The third part deals with the various facsimile systems now available and covers the products of such manufacturers as *Acme Teletronics*, *Alden Products Company, A.T. & T.*, *Finch Telecommunications, Inc.*, *Radio Inventions, Inc.*, *Times Facsimile Corporation*, and *Western Union*.

The fourth part is for the service technician and deals with such subjects as exciter lamp replacement, replacing the recording element, printer blade adjustment, cleaning and lubrication, mechanical repairs, electronic maintenance, photofacsimile units, and troubleshooting the set. Detailed service notes are provided on the *Finch* Type FRS 140-C, and the *General Electric* Types FR-1 and RX23.

Both technically and non-technically trained persons will find this book of interest. Although the author is a development engineer with *Finch Telecommunications, Inc.*, he has not fallen into the trap which so often ensnares engineer-authors and used highly technical terminology in his text. The book is thoroughly readable and informative.

-30-

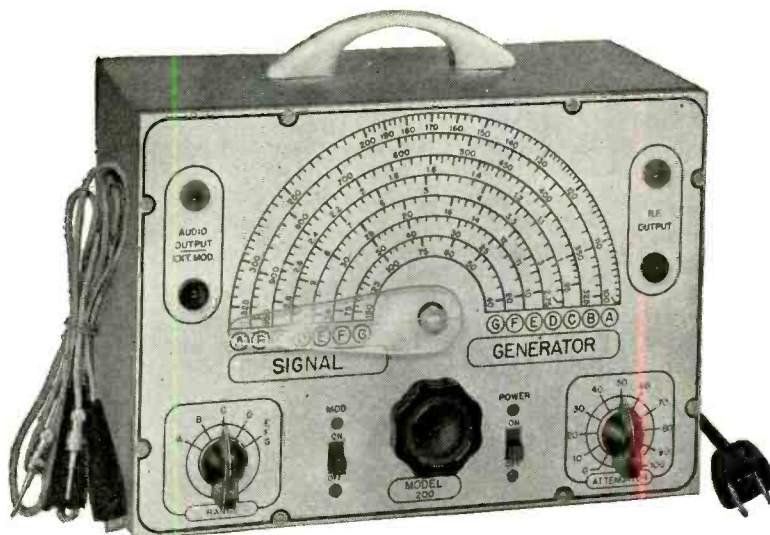


## WE KNOW THE PRICE IS UNBELIEVABLY LOW,

but that's not all! In addition, this finely engineered instrument provides a degree of accuracy never before attained in a unit selling for even double this price. Furthermore in designing this unit, we took advantage of every recent improvement in components. For example, by using slug-tuned coils, we are able to efficiently adjust each instrument

for perfect accuracy. This feature will also enable you to recalibrate the model 200 periodically without having to return it to the factory. The use of a Noval tube (the 12AU7) with its extremely low inter-electrode capacity enabled us to reach a higher frequency range than was heretofore possible in a unit of this type.

# THE NEW MODEL 200 **AM and FM** **SIGNAL GENERATOR**



### SPECIFICATIONS

- ★ **R.F. FREQUENCY RANGES:** 100 Kilocycles to 150 Megacycles.
- ★ **MODULATING FREQUENCY:** 400 Cycles. May be used for modulating the R. F. signal. Also available separately.
- ★ **ATTENUATION:** The constant impedance attenuator is isolated from the oscillating circuit by the buffer tube. Output impedance of this model is only 100 ohms. This low impedance reduces losses in the output cable.
- ★ **OSCILLATORY CIRCUIT:** Hartley oscillator with cathode follower buffer tube. Frequency stability is assured by modulating the buffer tube.
- ★ **ACCURACY:** Use of high-Q permeability tuned coils adjusted against 1/10th of 1% standards assures an accuracy of 1% on all ranges from 100 Kilocycles to 10 Megacycles and an accuracy of 2% on the higher frequencies.
- ★ **TUBES USED:** 12AU7—One section is used as oscillator and the second is modulated cathode follower. T-2 is used as modulator. 6C4 is used as rectifier.

The Model 200 operates on 110 volts A.C. Comes complete with output cable and operating instructions

**\$18<sup>85</sup>**  
**NET**

—20% DEPOSIT REQUIRED ON ALL C.O.D. ORDERS (Sold on a "MONEY-BACK-IF-NOT-SATISFIED" Guarantee)—  
**GENERAL ELECTRONIC DISTRIBUTING CO.**

Dept. RN-3, 98 PARK PLACE  
NEW YORK 7, N. Y.



**Within the Industry**

(Continued from page 24)

of Los Angeles has named **HENRY BECKER** to be in complete charge of mechanical engineering for the firm . . . **WILLIAM R. SPITAL** has recently formed a new company, known as *The Highland Engineering Company*, which will manufacture transformers, inductors, rectifiers, power supplies, and related items at a new plant in Hicksville, Long Island. **CHARLES W. GUTNEY** is the production manager of the new firm . . . **SAMUEL OLCHAK** has been promoted to the post of advertising and sales promotion manager for *Air King Products Company, Inc.* He will continue his duties as commercial service manager . . . **J. W. LAMARQUE** heads *Graybar Electric Company's* new communications sales department with **R. W. GRIFFITHS** serving as manager of electronics sales . . . **PAUL W. TANNER** will serve as merchandising manager for radio and TV activities at *Noblitt-Sparks Industries, Inc.* while **GLENN MILLS** will act as sales promotion manager for the company's *Arvin* line . . . **FREDERIC C. YOUNG**, formerly vice-president in charge of research and engineering and a director of *Stromberg-Carlson Company*, has joined the staff of *Designers for Industry, Inc.* as vice-president . . . Two of *General Electric Company's* outstanding scientists retired recently from active business; **DR. ALBERT W. HULL**, assistant director of the Research Laboratory and inventor of the magnetron, and **DR. GORTON R. FONDA**, research chemist who, with his associates, developed the American version of the radar screen 14 days after the problem had been assigned to the laboratory . . . **CLARENCE H. ENDRESS** has been named chief engineer of *Willard Storage Battery Company*. He has been with the firm since 1920 . . . **J. D. HEIBEL** heads the new Research and Development Department recently created by *Erie Resistor Corporation*.

\* \* \*

**HYTRON RADIO & ELECTRONIC CORP'S** new television picture tube plant at Newburyport, Mass., was recently the scene of cornerstone laying ceremonies. The ultra-modern new plant will produce approximately 3000 tubes a day, ranging in size up to 20 inches. Both round and rectangular tubes will be produced . . . **TRANS-VUE CORPORATION** of Chicago has added 12,000 square feet of floor space to its manufacturing facilities to handle the increased demand for the company's television receivers . . . **MOTOROLA, INC.** is doubling the capacity of its Locust Avenue radio plant in Quincy, Illinois in order to free its Chicago plant for greater television production . . . **ADMIRAL CORPORATION** has purchased the 64,000 square foot *General Mills* plant in Bloomington, Illinois.

# HICKOK Television LINEARITY-PATTERN GENERATOR

**MODEL 620**

## SERVICE MAN'S INCOME BUILDER . . .

**Provides Stable Pattern for Aligning TV Anytime . . . Anywhere HOME OR SHOP**



● Here is the instrument for television trouble-shooting that is completely independent of station operation.

A new portable instrument especially designed to make TV Warranty Servicing simpler and more profitable.

Now you can prove to any customer in his home, by an electronic instrument that his set is properly aligned. Then, if reception is still faulty, you are able to show the receiver is not at fault. Perhaps a better antenna installation is needed. Model 620 is a compact, portable instrument built to the high HICKOK standard. Technicians who seriously considered dropping warranty servicing now use the 620 and profit by it. Ask any technician who owns one. See your jobber for complete information.

### Features

- High output to 5,000 microvolts.
- Checks relative receiver sensitivity; horizontal and vertical deflection circuits.
- Permits alignment of linearity, drive, width, height, hold and horizontal AFC controls.
- Connects to receiver antenna.
- Blue hammertex portable steel case.

## THE HICKOK ELECTRICAL INSTRUMENT CO.

10524 Dupont Avenue · Cleveland 8, Ohio

Please send me complete details on the new HICKOK 620 Television Linearity Pattern Generator

NAME \_\_\_\_\_  
 ADDRESS \_\_\_\_\_  
 CITY \_\_\_\_\_ STATE \_\_\_\_\_

### BC-1068 RECEIVER

110V 60 cycle power supply. 5 stages I.F. 2 stages R.F. 2 stages audio amplifier, separately tuned converter and oscillator, tuning indicator. Frequency range: 150-210 Mcs. Makes good 2 meter or FM broadcast receiver. With 14 tubes, instructions and schematic, in excellent condition . . . **\$19.95**

### G.E. TRANSFORMERS

110 V. 60 Cy. AC

850V CT. 6.3V @ 5A. 6.3V @ 3A. 5V @ 3A. Conservatively rated @ 148 Mil. tested @ 250 mil and will handle more. A bargain at . . . **\$2.95**



### HS-33 HEADSETS

With Cord and Plug. Good. Used. .89c (\$1.00 Postpaid in U. S.)

### G.E. 12 HENRY CHOKE

Made as companion to G.E. Transformer . . . **\$1.95**

F.O.B. Oakland, 25% cash with order. Bal. C.O.D.

### EMMONS RADIO SUPPLY

405-10th St. Oakland, Calif.

## 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. Modern laboratory. Low tuition. Also 27-month courses in Aeronautical, Chemical, Civil, Electrical and Mechanical Engineering. Approved for G.I.'s. Enter March, June, September, December. You can earn part of your expenses right here in Fort Wayne while you are studying.

### INDIANA TECHNICAL COLLEGE

930 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 \_\_\_\_\_



# SPECTACULAR "Surprise" ALLOWANCES ON YOUR USED TEST and COMMUNICATION EQUIPMENT....



**COLLINS  
75-A 1  
RECEIVER**

Complete with Speaker. Shpg. wt. 53 lbs. ....Only **\$375<sup>00</sup>**

Buy it at a substantial saving with a Walter Ashe "Surprise" Trade-in decl. What do you have to trade?



**NATIONAL  
HRO-50**  
Shpg. wt. 80 lbs.  
Only

**\$349<sup>00</sup>**

Slash the above price by trading in your used equipment!



**AMAZING NEW HALLICRAFTERS SX-71**

Shpg. wt. 33 lbs. ....Only **\$179<sup>50</sup>**

But buy it for less by applying our liberal trade-in allowance against the purchase price!

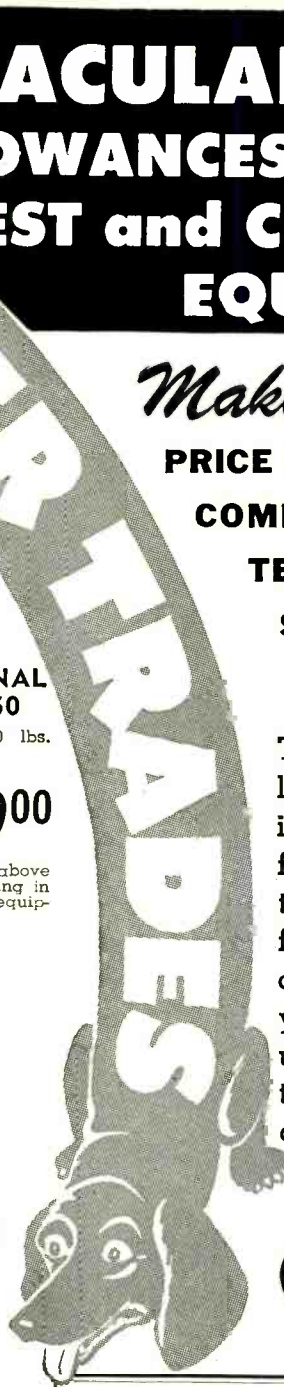


**ELDICO TR-1 KIT**

300 watt's Input Transmitter kit, Phone & CW. 813 final, PP class B 811 modulators. Complete with meter, antenna relay, microphone, tubes and final coil for one band. ....Only **\$179<sup>50</sup>**

For amazing savings apply our "Surprise" Trade-in allowance against this price.

**Walter Ashe  
RADIO CO.**  
THE HOUSE OF "SURPRISE" TRADE-INS  
1125 PINE ST. • ST. LOUIS 1, MO.



*Makes possible:* — **DRASTIC PRICE REDUCTIONS IN BRAND NEW COMMUNICATION EQUIPMENT, TEST INSTRUMENTS, TELEVISION SETS AND TV CUSTOM CHASSIS.**

Trades that are longer . . . much longer . . . that's the big money saving reason why bargain-conscious folks everywhere are taking advantage of sensational savings afforded by "Surprise" allowances on used equipment. Here's how you, too, can profitably dispose of used (factory-built) equipment by trading for the brand new merchandise of your choice. Simply tell us



what you have to trade. Indicate your preference in new equipment. Back will come our extra-liberal offer. Don't delay! Wire, write, phone or use the handy coupon — today!

Easy Terms on Your New Equipment Purchases  
• All prices F.O.B. St. Louis  
• Phone: CHestnut 1125

**FREE  
NEW 1950  
CATALOG**

WALTER ASHE RADIO CO.  
1125 Pine St., St. Louis 1, Mo. RN-50-3

Rush Special "Surprise" Trade-in offer on my \_\_\_\_\_  
(describe used equipment)

for \_\_\_\_\_  
(show make and model No. new equipment desired)

Send new Free 1950 Catalog.

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

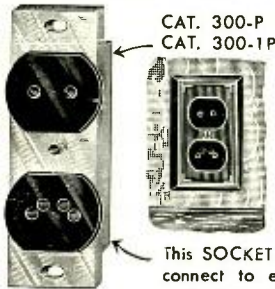


# NEW!

## MOSLEY FLUSH SOCKETS

1. For TV-FM-RADIO antennas and rotator controls.
2. Conceals unsightly lead-ins within walls.
3. Fits standard metal outlet boxes and single and double receptacle plates.
4. Fabricated of plastic of high dielectric and non-ferrous metals.
5. Installs as neatly as any electrical outlet.
6. Because of small entrance holes for pins of PLUGS, SOCKETS cannot be mistaken for electrical outlets.

This SOCKET designed to connect to any antenna lead-in and to receive any of MOSLEY PLUGS such as:



This SOCKET designed to connect to either 4-wire or 5-wire cable to rotator and to receive MOSLEY

POLARIZED PLUGS such as CAT. 300-2P (plug portion only) and CAT. 300-5P.

### FURNISHED IN 3 DESIGNS

- CAT. F-1—Single SOCKET for lead-in only.  
 CAT. F-14—Single SOCKET for antenna lead-in and 4-wire SOCKET for rotator control.  
 CAT. F-15—Single SOCKET for antenna lead-in and 5-wire SOCKET for rotator control.



CAT. 300P  
Mosley Transmission Line Plug



CAT. 300-1P  
For Federal Shielded K-111 Cable

- CAT. 2P—4-wire Plug (Not Shown)  
 CAT. 5P—5-wire Plug (Not Shown)

FOR SALE AT YOUR JOBBER

**MOSLEY ELECTRONIC SPECIALTIES**  
 (WØFQY) 2125 LACKLAND ROAD  
 OVERLAND (14) MISSOURI.

## Around the Clock (Continued from page 58)

		(NS)	Sydney	CJCX	6.010
		(NS)	Halifax	CHNX	6.130
			Toronto	CFRX	6.070
			Los Angeles	KWIX	11.860
			(AFRS-To Pacific)	KCBF	9.700
				KGEI	9.670
				KCBA	6.120
			Tokyo (AFRS)	JKK	6.015
				JKL	4.860
			Port-of-Spain	VP4RD	9.625
			London (To Far East)	GSQ	25.750
				GVT	21.750
				GSH	21.470
				GSN	11.820
		0715 (NS)	Helsinki	OIX5	17.800
			(To NA)	OIX4	15.190
				OIX2	9.555
				OIX1	6.120
			Melbourne (RA-To E. NA)	VLC7	11.810
			London (ES- Dictation Speed)	GVX	11.930
				GVU	11.770
				GWT	9.675
				GWO	9.625
				GRI	9.410
				GRJ	7.320
				GSW	7.230
				GWL	7.210
		0730	Delhi (AIR)	VUD9	15.290
				VUD3	11.830
				VUD9	9.630
				VUD2	7.290
				VUD8	7.275
			Bombay (Delhi Relay)	VUB3	9.550
			Calcutta (Delhi Relay)	VUC3	9.530
			Madras (Delhi Relay)	VUM3	7.260
			Akashvani (AIR Relay)	VUM2	4.920
			Georgetown (Caribbean News)	VU7MC	6.026
				ZFY	5.984A
			Cebu	DYH2	6.140
			Toronto	CFRX	6.070
		0745 (NS)	Manila	DUH5	11.840
				DUH4	9.620
				DUH2	6.173
			London (ES)	GVX	11.930
				GVU	11.770
				GRG	11.680
				GWT	9.675
				GWO	9.625
				GRI	9.410
				GRJ	7.323
				GSW	7.230
				GWL	7.210
		0750	Berne (To S.E. Asia)	HER8	21.520
				HER6	15.305
				HER5	11.865
		0800	London (GOS) (To NA)	GSK	26.100
				GST	21.550
				GSH	21.470
				GSV	17.810
				GSO	15.180
				GWG	15.110
				GVW	11.700
			Halifax	CHNX	6.130
			Sydney	CJCX	6.010
			Toronto	CFRX	6.070
			Melbourne	VLC6	15.323
			(RA-To Forces, Asia, North Pacific)	VLA6	15.203
				VLB4	11.850
			Melbourne (ABC-BBC Relay)	VLH3	9.580
			Sydney (ABC)	VL12	6.093
			Brisbane	VLQ3	9.660
			(ABC)	VLM	4.917.5
			Perth (ABC)	VLW5	9.610
				VLX2	6.130
			(Via Pt. Moresby-ABC)	VLTS	4.897I
				VLTS	7.280
			Koeta Radja, Sumatra (To S.E. Asia)		11.640
			Los Angeles (AFRS)	KWIX	11.860
				KCBF	9.700
				KGEI	9.670
				KCBA	6.120
			Toungoo, Burma		7.380A
			Malta (BFS)		11.782
		(NS)	Manila	DZH3	9.505A
			Colombo (Radio Ceylon-BBC Relay to Far East)		21.620
					17.730
		(I)	Jodhpur, Rajputana		3.775
		0810	Melbourne	VLH3	9.580
			Brisbane (ABC)	VLQ3	9.660
				VLM	4.917.5
		0815	Melbourne	VLC7	11.810
			(RA-To E. NA)		
			New York (VOA)		17.830
					15.350
			Davao, Mindanao	DYB2	4.985A
			Hong Kong (Delayed BBC Relay, Radio Newsreel)	ZBW3	9.525V
			Rangoon (?) (Forces Station)		7.170A
			Colon (Delayed HP5K Relay of VOA)		6.005
		0820 (NS)	Edmonton	VE9A1	9.540
					(Continued on page 100)
0600	London (GOS)	GSK	26.100		
		GVS	21.710		
		GSH	21.470		
		GSJ	21.530		
		GSV	17.810		
		GSI	15.260		
		GSO	15.180		
		GSF	15.140		
		GSW	15.110		
		GVU	11.770		
		GVD	11.700		
		YDC	15.150		
		YDB2	4.910		
	Djakarta (To Asia, Australia, NA)				
	Cebu	DYH2	6.140		
	Colombo (Radio Ceylon-BBC Relay to Far East)		21.620		
			17.730		
	Colombo (BBC Relay)	ZOI	4.897V		
	Melbourne (RA-BBC Relay)	VLC4	15.320		
		VLA6	15.200		
		VLG10	11.760		
	Melbourne (ABC)	VLH3	9.580		
	Perth (ABC)	VLW5	9.610		
		VLX2	6.130		
			4.897I		
	Sydney (ABC)	VL12	6.090		
	Brisbane (ABC)	VLQ3	9.660		
	(Via Pt. Moresby-ABC)	VLM	4.917.		
		VLT5	7.280		
	Wellington (BBC Relay)	ZL4	15.280		
	Singapore (Radio Malaya, Blue Network)	ZL7	6.080		
		ZL7	9.712		
	Georgetown (BBC Relay)	ZFY	5.984A		
	Port-of-Spain (BBC Relay)	VP4RD	9.625		
(SATO)	Halifax	CHNX	6.130		
	Nairobi (BBC Relay)	VQ7LO	6.057		
	Hong Kong (BBC Relay)	ZBW3	9.525V		
	Kure (BPOS-BBC Relay)	WLKS	6.105		
	Salisbury (BDN)	ZEA	5.933V		
	Salisbury (BBC Relay)	ZEA	6.000		
	Los Angeles (AFRS-To Pacific)	KWIX	11.860		
		KCBF	9.700		
		KGEI	9.670		
		KWID	6.570		
		KCBA	6.120		
0600A	Colon	HP5K	6.005		
0610	Melbourne (RA)	VLC4	15.320		
		VLA6	15.200		
		VLG10	11.760		
0615 (NSS-M)	Bangkok	HSG3	9.796A		
(Daily)		HSPD	6.240A		
	Mafeking	ZNB	5.900		
	Johannesburg (SABC)	IV	9.870		
		V	4.373		
(SATO)	Hong Kong	ZBW3	9.525V		
	London (ES- Dictation Speed)	GWR	15.300		
		GSE	11.860		
		GWJ	9.525		
0630	Singapore (Radio Malaya, Blue Network to Borneo and Sarawak)		9.712		
			7.200V		
			4.825I		
			4.778I		
	(Via Kuala Lumpur)		6.025		
(NS)	Georgetown	ZFY	5.984A		
(SO)	Salzburg (BDN)		9.533V		
	Davao, Mindanao	DYB2	4.985A		
(NS)	Sydney	CJCX	6.010		
(NS)	Toronto	CFRX	6.070		
0645 (I)	Makassar (Comment)	YDO	9.554		
		YDO2	5.030		
0655A	Djakarta (To Asia, Australia, NA)	YDC	15.150		
		YDB2	4.910		
0700	Karachi		11.770A		
	Dacca (Karachi Relay)		7.635A		
	Lahore (Karachi Relay)		6.075		
	Tel-Aviv (Kol-Israel)		6.830A		
			8.900A		
	(Via Haifa)		8.170		
	Singapore (BFES-BBC Relay to Far East)		15.300		
			11.880		
			9.690		
			6.175		
	Colombo (Radio Ceylon-BBC Relay to Far East)		21.620		
			17.730		
	Jogjakarta	SBT	5.058		
(I)	Stockholm	SBP	15.155		
	(Sweden To day-To Europe)	SBP	11.705		
(NS)	Montreal	CBLX	15.090		



# RADIO TUBES

AM Largest Tube Stock in the Country

FM ORDER TODAY for

TV Immediate Delivery

At LOWEST Prices!

**29c**  
ea.

1U4  
2C26  
2C34  
3A4  
6S8GT  
01A  
4A6G

6A3  
10  
12A  
39/44  
47  
50  
71A

112A  
182B  
183  
25S  
482B  
483

1A4  
1A4P  
1A6  
1B5  
1D5GT  
1D7

1D8GT  
1F4  
1F5G  
1G4GT  
1G6GT  
1H4G

1H6GT  
1J6G  
1619  
1626  
E1148  
7193

**FREE!** \$20.00 List Value  
Cornell-Dubilier,  
Mallory, Aerovox,  
Sprague, Solar. Filter Condensers  
—ten fast moving filters FREE  
with each 100 tubes.

**79c**  
each

1B3GT  
2A3  
2A4  
3DZ4  
3Q5  
6A7  
6B6G  
6E5  
6G5  
6U5  
19B6G  
RK-34  
RK-39

50A5  
307A  
350B  
371B  
446A  
615  
707B  
807  
813  
837  
864  
117L7GT  
117N7GT  
117P7GT

**39c**  
ea.

1T4  
35W4  
35Z5GT

6C4  
6F8GT  
6SD7GT

6X5GT  
14X7  
25Z6GT

30  
31  
32

33  
34  
35

35Z4GT  
36  
37

38  
39  
46

VT-52  
56  
57

58  
76  
80

89  
HY-615

**49c**  
ea.

3Q4  
3S4  
3V4

6AG5  
6AK5  
6AL6

6BA6  
6BD6  
6BE6

6H6  
6H6GT  
6J5

6SA7GT  
6SC7GT  
6S7

6U6G  
6U7G  
6U7GT

12A6  
12A7  
12A7GT

12K8GT  
12S8GT  
12SA7GT

12X6  
12Y6  
12Z6GT

25X6  
35B5  
35C5

35Z6GT  
50B5  
50C5

50Y6  
51  
77

1C5  
1C6  
1L4  
1R5  
1S5  
1U5  
2A5  
2A7

5W4GT  
5X4G  
5Y3GT  
5Y4G  
6A4  
6A4G  
6AC5  
6AC5GT

6AG5  
6AK5  
6AL6  
6AQ5  
6AR5  
6AS5  
6AT6  
6AU6  
6A8G  
6A8GT  
6B6

6BA6  
6BD6  
6BE6  
6BH6  
6BJ6  
6C5  
6C5G  
6C8G  
6D6  
6F5GT  
6F6GT  
6G6

6H6  
6H6GT  
6J5  
6J5GT  
6J6  
6J7G  
6J7GT  
6K6GT  
6K7GT  
6K8GT  
6P5GT

6SA7GT  
6SC7GT  
6S7  
6S7GT  
6S8  
6S8GT  
6S9GT  
6S9GT

6U6G  
6U7G  
6U7GT  
6V6GT  
6W4  
6X4  
6Y5GT  
6Z4  
12A8GT  
12A7G

12A6  
12A7  
12A7GT  
12A8GT  
12A9GT  
12B6  
12B6GT  
12B7GT  
12C6  
12C8  
12J5  
12Q7GT

12K8GT  
12S8GT  
12SA7GT  
12SB6  
12SB7  
12SB7GT  
12SB8  
12SB8GT  
12SB9  
12SB9GT  
12SB9GT

12X6  
12Y6  
12Z6GT  
25X6  
35B5  
35C5  
35Z6GT  
50B5  
50C5  
50Y6  
51  
77  
24A  
25L6GT

25X6  
35B5  
35C5  
35Z6GT  
50B5  
50C5  
50Y6  
51  
77  
24A  
25L6GT

25X6  
35B5  
35C5  
35Z6GT  
50B5  
50C5  
50Y6  
51  
77  
24A  
25L6GT

25X6  
35B5  
35C5  
35Z6GT  
50B5  
50C5  
50Y6  
51  
77  
24A  
25L6GT

**59c**  
ea.

1LA4  
1LE3  
1Q5GT  
1T5GT  
1V  
1C5GT

5V4  
5Z3  
5Z4  
6A8  
6AC7  
6AJ5  
6AK6  
6AL5

6AR5  
6AS5  
6AV6  
6B4G  
6BA7  
6B8  
6C6  
6D8

6D8G  
6F5  
6F8G  
6K7G  
6R7  
6S8  
6S5GT  
6S7GT

6S7  
6T4  
6T4G  
6T7  
6T7G  
6T8  
6T8G  
6T9

6Z7G  
7A4  
7A6  
7A7  
7B5  
7B6  
7B8  
7C4

7C6  
7E5  
7E6  
7E7  
7F7  
7G7  
7H7  
7Y4

7L7  
7N7  
7Q7  
7S7  
7T7  
7V7  
7W7  
7Y4

10Y  
12A7  
12A7GT  
12AV6  
12B6  
12C8  
12J5  
12Q7GT

12S7  
12S7GT  
12SK7GT  
12SL7  
12SQ7GT  
12Z3  
19T8

20  
32L7GT  
35/51  
35L6GT  
36  
40  
41  
42

43  
50L6GT  
53  
75  
84/6Z4  
117Z3  
VR150  
XXL

**69c**  
ea.

1A3  
1AB5  
1AD5  
1H5GT  
1LA6

11B4  
11C5  
11C6  
11H4  
154

11N5  
1N5GT  
1P5GT  
2X2  
25Z5

2C34  
2V3G  
2X2  
25Z5

35Z3  
3LF4  
4A6G  
6B7  
6G6

6BF6  
6J8G  
6L6G  
6L6  
7C4

6S7G  
6S7GT  
7A8  
7C4  
14A4

7C5  
12A6  
12BF6  
14A7  
14B6  
14H7

14B8  
14A7  
14E7  
14Q7  
14W7

14J7  
14N7  
14Q7  
35Y4  
45

14X7  
14Y4  
35Y4  
45

2050  
2051  
50C6  
70L7GT  
9001  
XXB

Tube prices are for 50 tubes or more—may be assorted. Individually boxed—Standard factory guarantee.

50L6, 35Z5, 12SK7,  
12SQ7, 12SA7...5 tubes for **\$2.19**

1R5, 1S5, 1T4, 3V4 Battery  
Tube Special...4 tubes for **\$1.49**

10BP4TV  
Picture  
Tube. Each **\$17.95** | 12LP4  
each **\$24.95**

Miniature tubes 12AT6, 12BA6,  
12BE6, 35W4, 50B5...5 tubes for **\$1.89**

3-Way Portable Tube Kit, 117Z3,  
1U5, 3V4, 1R5, 1T4...all for **\$1.99**

3S4, 1T4, 1S5, 1R5  
...4 tubes for **\$1.49**

1U4, 3S4, 1S5, 1R5  
...4 tube kit **\$1.49**

3Q4, 1T4, 1R5, 1S5  
...4 tube kit **\$1.49**

50A5, 35Y4, 14A7, 4B6,  
14Q7...5 tubes for **\$2.95**

**Best Quality SPEAKERS** **Alnico 5 PM**

10 or more  
Each Price  
Each

**5" - 95c - \$1.05**

2 1/2", 3", 4" - 95c - \$1.05

6" ..... \$1.49 ..... \$1.59  
8" ..... 2.95 ..... 3.25

Utah Speaker Baffles—completely enclosed  
for 8" speakers and smaller...ea. \$2.00

10" ..... \$4.25 ..... \$4.50  
12" ..... 4.95 ..... 5.95

Jobbers: write for quantity prices.

**FILTER CONDENSERS**

Very best brands  
Fresh stock

10 or more  
assorted  
5% discount

30-450 V with 20-20-  
25 V ..... ea. 29c  
8-8-450 V ..... ea. 29c  
8-8-450 V-50-50 V ..... ea. 39c  
8-8-450 V ..... ea. 39c  
8-8-450 V-50-50 V ..... ea. 39c  
10-10-450 V ..... ea. 43c  
20-20-450 V ..... ea. 49c

**150 Working Volts**

10-10-150 V ..... ea. 24c  
15-15-150 V ..... ea. 29c  
15-150 V ..... ea. 21c  
16-150 V ..... ea. 23c  
20-150 V ..... ea. 25c  
30-150 V ..... ea. 29c  
40-150 V ..... ea. 29c  
15-15-150 V ..... ea. 29c  
30-150 V ..... ea. 29c  
20-20-150 V ..... ea. 29c  
20-20-150 V ..... ea. 39c

30-20-150 V ..... ea. 29c  
30-30-150 V ..... ea. 39c  
40-20-150 V ..... ea. 39c  
40-30-150 V-30-20-25 V ..... ea. 39c  
40-40-150 V ..... ea. 39c  
40-40-150 V 20-25 V ..... ea. 39c  
50-30-150 V ..... ea. 39c  
50-50-150 V ..... ea. 39c  
60-60-150 V ..... ea. 39c

20-16-16-350 V Sprague  
type ..... ea. 39c  
25-25-150 V-200-10 V ..... ea. 39c

Cathode Condensers

10-25 V ..... 16c ea.  
20-20-25 V .....  
20-20-20-25 V .....  
20-25 V .....  
25-25 V .....  
30-50 V .....  
100-25 V .....

**IF TRANSFORMERS**

Standard Replacement  
Regular size ..... ea. 29c  
Midjet ..... ea. 39c

Red Hot Vibrator Special. 4-prong, small  
size Universal, fits 80% of all jobs. ea. 89c  
Jobbers: Write for quantity price.

4 PRONG VIBRATORS—VERY BEST BRANDS

Standard replacement  
—Sensational Value **\$129** ea.

**WESTON DC VOLTMETER** 0-15, 0-600  
volts, 500 microamp move-  
ment **\$3.49**

Oscillator Coils for any 5 tube  
AC-DC **19c**

RF and Antenna Coils.  
Standard Broadcast Band **29c** ea.

**OUTPUT TRANSFORMERS**

For 50L6,  
etc. **39c** ea.

For 6V6, 6F6, 3Q5,  
etc. **45c** ea.

**BY-PASS CONDENSERS**

100 Condensers assorted  
in package **\$5.95**

.001 ea. 6c .0005  
.002 ea. 6c .00025  
.005 ea. 6c .0005  
.01 600 V ea. 7c 500 mmf  
.02 ea. 7c 250 mmf  
.05 ea. 8c 100 mmf  
.1 ca. 9c 50 mmf

600 V. 6C  
MICA 6C

**OCTAL SOCKETS** 10 for **49c**  
**MINIATURE TUBE SOCKETS** 10 for **49c**

Standard replacement crystal  
cartridge. Each **\$1.39**  
Nylon 1J CARTRIDGE \$2.59

**SPECIAL—CONDENSER KITS**

Kit of 25 BY-PASS CONDENSERS  
best assorted brands and sizes **\$1.75**

Kit of 50 BY-PASS CONDENSERS  
very best, assorted sizes **3.25**

Kit of 50 MICA CONDENSERS  
complete **2.79**

100 resistors—packed in a box IRC etc.  
Best values only—1/2 watt, 1 watt,  
2 watt **\$1.98**

**UNIVERSAL OUTPUT TRANSFORMER SPECIAL**  
Up to 12 watts to any speaker **98c** ea.  
(while they last)

**Special on No. 47 Pilot Lights Only—**  
100 Bulbs...\$3.95 Box of 10...49c  
PILOT LIGHTS—100 BULBS **\$4.90**

1 box of  
10 bulbs **54c**  
No. 40 6-8 V. 15 Amps. No. 44 6-8 V. 25 Amps.  
No. 41 2.5 V. 50 Amps. No. 46 6-8 V. 25 Amps.  
No. 51 6-8 V. 20 Amps.

**400-VOLT BY-PASS CONDENSERS**

.05 mfd. .... ea. 6c  
.2 mfd. .... ea. 6c  
.25 mfd. .... ea. 10c  
.5 mfd. .... ea. 15c

**BUFFER CONDENSERS**

.005 mfd. 1600 WV }  
.008 mfd. 1600 WV } **15c** ea.  
.01 mfd. 1600 WV }

**VARIABLE CONDENSERS**  
Two gang for superhet Star dard 1/4" shaft **69c**

**SELENIUM RECTIFIERS**  
Standard 100 mil.  
Each **79c**

**PUSH-BACK WIRE** 100-ft. rolls **39c** each

**VOLUME CONTROLS** 10 or more Price  
Each Each

VERY BEST BRANDS

1/2 meg. or 1 meg. or 1/10 meg.  
with switch—long shaft **29c 35c**

2 meg. for battery sets—  
switch, long shaft **29c 35c**

1/2 meg., 1 meg., 1/10 meg. or 2  
meg., long shaft, less switch **16c 19c**

**6-FT. LINE CORDS**

Appliance Cord, up  
to 1,000 watts, 1  
rubber plug **99c**  
5 for

Good Rubber with  
plug. **\$1.25**  
10 for

Appliance Cord as  
above, with  
UL label 5 for **\$1.29**

Underwriters' Ap-  
proved. **\$1.69**  
10 for

**TV PARTS**

TV Antennas:  
Conical price leader with 8-ft. mast ..... \$5.75  
World's Best Deluxe Conical with 9-ft. mast  
and heavy cast fittings ..... 8.95  
Hi-Lo folded dipole array, 8-ft. mast ..... 6.95  
300-ohm line \$1.59 per 100 ft. \$14.95 per 1000 ft.  
Horizontal output, RCA Type Flyback ..... \$3.45 ea.  
Discriminator Transformers ..... 1.29 ea.  
TV Screen Filters with suction cups 10" ..... \$1.17  
—best quality IND. BOXED for 12" ..... 1.95  
Highest re-sale value ..... 1.29

Rated accounts—10 days—all others 20% deposit  
with order, balance COD.

50c handling charge for orders less than \$5.00  
All shipments FOB Chicago. Prompt attention paid  
to foreign orders. ORDER TODAY. Our parts and  
tubes are warranted to be 100% replacements for the  
prototypes in the listings above. Satisfaction Guar-  
anteed. To speed up delivery, sign your order and  
your remittance with the same name.  
**CURRENT ADVERTISED PRICES APPLY.**

**PREMIER RADIO TUBE COMPANY**

551 West Randolph St., Chicago 6, Ill.  
Phone: Andover 3-1590  
"Your Tube Source Since 1926"



**ATTENTION**

**AERONAUTICAL RADIO MEN!**

MG-149-H, brand new, orig. pack, 400 cy ADF inverter. While small quantity lasts... \$27.50  
 VICTORY GIRL AN/CRT-3, new, complete, dual freq., sea rescue... \$59.50

**ILS INSTALLATION PARTS**  
 RG-22 U, dpl-2 coax w/PL-24 each end, appx. 7' long... \$2.25  
 Same, appx. 20' long... \$4.50  
 Right angle adapters, dual coax, PL-293... \$6.00  
 R-89 Recr. Plug with 10 coded approved leads, 6' to 10' long... \$3.00  
 Same, appx. 47' long... \$15.50

**INSTALLATION BAGS** for J-box and I-101-C, includes hardware, barrier term. strip and 3DKR1250 non-polarized 1250 mfd. cond. to shunt indicator... \$3.50  
 R-89 RECR. less tubes & covers, buy for parts... \$2.95  
 INDICATOR I-101-C, new... \$7.50  
 NOTE: These are just a few of our aeronautical items. If you don't see it here, ask for it!

**ATTENTION, MARINE RADIOMEN!**

(1) G.L. "MARINER" XMTR. 100 to 125 V. RF to antenna, 90% modulated, 4 chan. xtal. cont., 12 or 24 V input (specify voltage & freq. when ordering) w/Dyna., connecting cord, xtal. tubes (12 1/2 ball) mike; all aligned & ready to operate. Controls are On-Off switch, chan. selector, antenna tuner to match any antenna. Built-in recr. break-in relay in addition to ant. switching relay. Panel has RF curr. meter & total curr. meter. This xmtr. built from \$1200 govt. cost surplus. We offer it at the astounding price of... \$225.00

(2) G.L. "MARINER" RECR., specify 12 or 24 V. DC. BFO ON-OFF, AVC-MVC. Long wave, Broadcast, Marine, Short Wave. A beautiful conversion of a doggone good Navy surplus recr., entirely new front panel. Vernier on-the-nose resetting tuner, all controls on front panel, no plugs needed, ready to go... \$49.50

(3) DU-1 Manual Direction Finder, specify 12 or 24 V. Converted for Marine hand, still retains half of Broadcast band and all the lighthouse and beacon band. 2-tube pre-amplifier. No. 180° ambiguity, true bearing immediately. Goes ahead of G.L. "Mariner" on any other receiver. NEW, converted... \$32.50

(4) BC-223 TRANSMITTER, 15 watts. Brand New. With used 12 V Dynamotor PE-55, connecting cable, 4 marine freq. xtal. mike. Specify freq. \$22.50 to BC-223

(5) 12 V. DYNAMOTOR FOR 100 watt xmtr, DM-42, two outputs, 1030 V @ 215 ma. for final, and 515 V @ 280 ma. NEW... \$9.95

(6) PE-55 DYNAMOTOR, 12 V for BC-223, 500 V @ 400 ma. w/relay, filter, etc., EXC. USED... \$9.95

(7) CONNECTING CORD with plugs, 10' long, PE-55 to BC-223... \$1.50

(8) TCS-7 XMTR DYNAMOTOR, 12 V input, output 440 V @ 200 ma. NEW... \$5.95

(9) DM-35 DYNAMOTOR, 12 V input, output 625 V @ 200 ma. EXCELLENT USED... \$9.95

(10) 24 V DYNAMOTOR FOR 100 watt xmtr, dynamotor of DY-147, 150 V @ 350 ma. plus 600 V @ 400 ma. NEW... \$7.50

MODULATOR BC-456. New, orig. pack... \$3.95  
 Excellent used... 2.95  
 Used, less tubes and top cover... 1.29  
 Add for DM-35 dyn., NEW... 2.75

**AN RF & AF SIGNAL TRACER FOR 79c!**  
 BZ-5. Tiny dual vibrator, 4 V DC in, 2 V AC out, at 1700 cps. Harmonics to 40 mc. Use as tubeless tone osc. for code or MCW. NEW...

**LOOK WHAT \$2.65 WILL BUY!**  
 6 V. DYNAMOTOR. Very low battery drain. Multiple windings: 250 V DC @ 100 ma to 350 V DC @ 50 ma. Second winding gives 190V DC @ 70 ma. No brushes to add or shift around! No mechanical work! Complete dope sheet furnished, connections, etc. BRAND SPANKING NEW! ONLY... \$2.65

**CITIZEN'S BAND ANTENNA** w/director, radiator, reflector, hardware. PAIR for... \$6.00

**COIL KIT**, 125 all new coils! Contains IF cans, tuning chokes, less than 2c per unit... \$2.19

**SCOTT HI-FI OUTPUT TRANSFORMER**. Essentially flat 20-20,000 cy, 25 w, hermetically sealed, impedance 3000 ohms pri., 2 CT secondaries 600 and 60 ohms, this providing 150 and 15 ohm secondaries also. NEW... \$1.89

**METALLIC MINE DETECTOR SCR-625** with BA-38 battery. For non-ferrous or ferrous metals. Also operates under water. Brand new, export packed... \$39.50

**3-DIGIT** resettable Veeder-Root counter with pilot lamp assembly, wafer switch, nice case. NEW... \$79c  
 Willard 2-V wet cell battery, new, 20AH... 98c  
 RG-8/U NEW. Cut to order at \$4.95 per 100 ft.

**ATTENTION, EXPORTERS!**

BC-375-E. NEW. ORIG. EXPORT PACKED. COMPLETE... \$75.00  
 RA-34 RECTIFIER for BC-191 or modified BC-375. Input 115 or 230v at 60 cy. Filtered DC outputs: 1000 V 350 ma and 12 V 3.2 ma. AC output: 12 V 14.5 amps. All of these units have been completely checked out, guaranteed operative, with spares, cables and tech manual... \$105.00  
 BC-191 XMTR UNIT, EXCELLENT USED... \$29.95  
 BC-375 XMTR UNIT, EXCELLENT USED... \$19.95  
 Will check out and guarantee the units at \$10 extra. Tuning Units & Antenna Loading Coil for BC-191 or B-375. EXCELLENT USED... \$1.95  
 USED, AS IS... 98c

**WANTED!** Your Spare Surplus Equipment and Tubes! Dynamotors, Recrs, Smt's, Test Equipment. Send list, stating condition and your rock bottom price.

**G.L. ELECTRONICS**

1260 S. Alvarado St. Los Angeles 6, Cal.  
 All Prices F.O.B. L. A. Calif. Buyers add Sales Tax.  
 SEND FOR OUR LATEST CATALOGUE!

**SCHEMATICS—CONVERSIONS FOR SURPLUS GEAR**

**PARTIAL LIST:**

NEW BC-433-G Conversion... \$2.00  
 R-45/ARM-7 Conversion... \$2.00  
 ARC-4 schematic, parts, cabling... \$1.00  
 Another \$2.00 for 2-meter AC conversion with all specs, tune-up, color-coded wiring diagrams.  
 BC-375-E original schematic, tuning units, complete parts list, values, characteristics, circuit functions, plate and ant. currents... \$4.00  
 BC-645 original and conversion... \$2.00  
 ARC-5 schematics, all us... \$2.00  
 SCR-522-A, AM, and C schematics, parts lists with circuit functions, explanation of differences, chart for xtal selection... \$2.00  
 Please remit with order. We pay postage, send 25c and stamped addressed envelope for comprehensive list, cross-indexed for BC and SCR. Includes chart explaining code used in Army-Navy nomenclature.

R. E. GOODHEART 345 1/2 N. PALM DRIVE BEVERLY HILLS, CALIF.

(Continued from page 98)

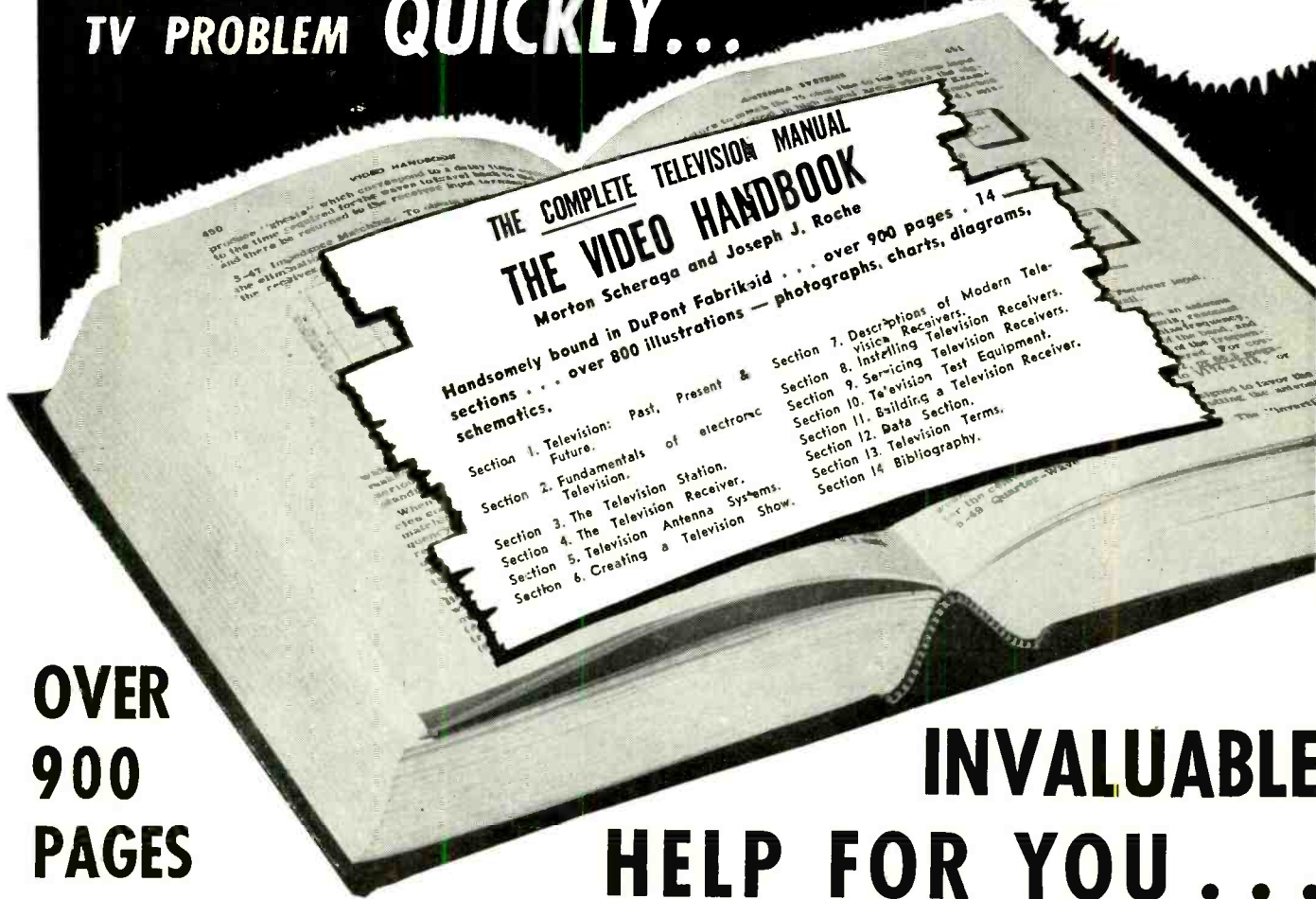
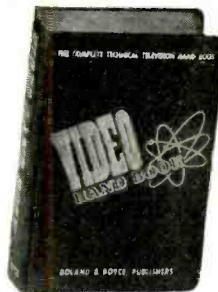
0830	London	GVT	21.750		Lahore (Karachi)	6.075
		GWC	15.070	(NM or Th)	Beirut (Radio Liban)	8.030 V
		GRH	9.825	1020V	Addis Ababa	ETB 15.032 V
	Peking		10.260		ETA	9.620
	Hankow		9.740	1025	Edmonton	VED 8.265
	(Peking Relay)				(CBX Relay)	
	Nanking		9.730	1030	Delhi (AIR-To W. Europe)	VUD5 15.290
	(Peking Relay)				VUD11	11.850
	North Shensi		9.040 V		Delhi (AIR)	VUD9 11.790
	(Peking Relay)				VUD4	9.630
	North Shensi		7.500 A		VUD8	7.275
	(Peking Relay)				VUD10	7.225
	Harbin, Manchuria		7.100		VUD7	6.190
	(Peking Relay)				VUD3	6.010
	Chungking (?)		6.100 A		VUD2	3.495
	(Peking Relay)				Bombay(Delhi Relay)	VUB3 7.240
(NS)	Toronto	CFRX	6.070		VUB2	4.840
	Delhi (AIR)	VUD5	17.840		VUC3	4.880
		VUD11	15.190		VUC2	3.305
(I)	Vienna via VOA Relay Station, Munich	DTSP	15.280		Madras (Delhi Relay)	VUM3 7.260
	London	GST	21.550		VUM2	4.920
	(To NA)				Srinagar, Kashmir (AIR Relay)	4.865
0835	Colombo	ZOI	4.897 V	(TO)	Vatican City	HVJ 17.445
0900	London (Radio Newsreel)	GSK	26.100		(To S. Asia and South Africa)	
		GSH	21.470		Melbourne	VLG11 15.200
		GSV	17.810		(RA-to Africa)	VLA4 11.850
		GSO	15.180		(To W. NA)	VLC7 11.810
		GWG	15.110			VLB9 9.615
		GSB	9.510		Vancouver	CKFX 6.080
(NS)	Hong Kong	ZBW3	9.525 V	(NSS)	Athens	15.345
	(BBC Relay, Radio Newsreel)			(I)	Munich (VOA)	15.280
	Saigon (Radio France Asie)	FZS4	11.780	(NS-I)	Addis Ababa	ETB 15.032 V
					ETA	9.620
	Singapore (Radio Malaya, Blue Network)		9.712		Brazzaville	
	(Via Kuala Lumpur)		7.200 V		(To Far East)	11.972
(M-F)	Lake Success	CKRP	21.600		(To Africa)	9.973
	(UN-Via CBC-Montreal)	CKNC	17.820	1053A	(To Near East)	9.440
	Toronto	CFRX	6.070		(To Africa)	6.024
	Edmonton	VE9AI	9.540	1055 (NM)	Djakarta	VDF 6.045
	Edmonton	VED	8.265		(To Asia, W. NA)	
(NS)	Calgary	CFVP	6.030		Edmonton	VE9AI 9.540
(NS)	Montreal	CBLX	15.090	1100	Manila	DZH4 6.000
	(CBC-Regional)				London (GOS)	GVS 21.710
(NS)	Manila	DUH5	11.840		(To NA)	GST 21.550
		DUH4	9.620		GSH	21.470
(SMWF)	Manila	DZH2	6.170		GRA	17.715
	New York	KGEX	11.730		GSI	15.260
		KNBX	9.600		GSO	15.180
		KWID	9.570		CGW	15.110
		CKBR	9.530		GSN	11.820
		KNBZ	6.185		GSC	9.580
		KNBI	6.060		Colombo (Radio Ceylon-BBC Relay to Far East)	ZOI 4.897 V
	(Via Honolulu)	KRHK	11.790		Colombo	
	(Via Manila)	KRHO	9.650		(BBC Relay)	
		III	17.760		Singapore	
		II	15.330		(BFEB-BBC Relay to Far East)	
		I	11.890		Georgetown	ZFY 5.984 A
	Los Angeles	KWIX	11.860		(BBC Relay)	
	(AFRS)	KCBF	9.700		Port-of-Spain	VP4RD 9.625
		KGEI	9.670		(BBC Relay)	
		CKBA	6.120		Johannesburg	IV 9.870
		GRZ	21.640		(SABC-BBC V Relay)	4.373
		GSF	15.140		Moscow (To Asia)	
	Hong Kong	ZBW3	9.525 V			11.765
	(China News)					9.689
0930	Melbourne	VLG6	15.320	(NS)	(Via Ashkabad)	6.179
	(RA-To Britain, Europe)	VLA6	15.200		Lusaka	ZOP 7.290
	(To Central NA)	VLB4	11.850		ZOP	3.914
	Singapore (BFEB-Delayed BBC Relay, Radio Newsreel-To Far East)	VLC7	11.810		Salzburg (BDN)	9.833 V
			15.300		Vancouver	CKFX 6.080
			11.880		Manila	DZH3 9.505 A
			9.690		Cebu	DYH3 6.100
			6.175		Hilversum (To S. Asia)	PHI 15.220
			6.175		Nairobi (BBC Relay)	VQG1 4.855 V
(TO)	Halifax	CHNX	6.130	1115	Belgrade	6.100 A
	Akashvani	VU7MC	6.026		Port-of-Spain	VP4RD 9.625
	Manila (UN News)	DUH5	11.840		Sydney	CJXC 6.010
		DUH4	9.620		New York	WNRX 21.730
		DUH2	6.170		(VOA-To Europe)	WLWS1 21.650
0945 (M, Th Only)	Beirut (Radio Liban)		8.030 V		WLGW	17.765
0950	Berne (To S. Asia)	HER7	17.784		WLWR1	15.250
		HER5	11.865		IV	7.250
1000	Vatican City	HVJ	15.095		(Via Munich)	
			11.740		(Via BBC, London-ES)	GRU 11.770
			9.643 V		GRI	9.410
	Rangoon		6.035	1130 (SO)	GWL	7.210
			6.070 A		Georgetown (Caribbean Review)	ZFY 5.984 A
(Tue)	Lusaka	ZOP	7.290	(NS)	Halifax	CHNX 6.130
		ZOP	3.914	1145 (I)	Vancouver	CKFX 6.080
	Edmonton	VE9AI	9.540	(T, Sat)	Forest Side	V3USE 15.055 A
	Edmonton	VED	8.265		Lusaka	ZOP 7.290
(NS)	Calgary	CFVP	6.030		ZOP	3.914
(NS)	Vancouver	CKFX	6.080	1150	Berne (To Middle East)	HER5 11.865
(SO)	Montreal	CBLX	15.090	(NSAT-S)	Toronto	CFRX 6.070
	(CBC-Regional)			1200	St. Johns	CBNX 5.970
1003A	Djakarta	YDF	6.045		Sydney	CJXC 6.010
	(To Asia, W. NA)				Halifax	CHNX 6.130
1005V	Stockholm	SBT	15.155		Edmonton	VED 8.265
		SDB2	10.780		(BBC Relay)	
1015	Karachi		11.770 A	(NS)	Calgary	CFVP 6.030
	Dacca		7.635	(NS)	Vancouver	CKFX 6.080
	(Karachi Relay)		9.645			

(Continued on page 102)



**GET AHEAD IN TELEVISION . . .  
INCREASE YOUR INCOME . . .**

**FIND THE ANSWERS TO ANY  
TV PROBLEM QUICKLY . . .**



**THE COMPLETE TELEVISION MANUAL  
THE VIDEO HANDBOOK**  
Morton Scheraga and Joseph J. Roche  
Handsome bound in DuPont Fabriksid . . . over 900 pages . 14  
sections . . . over 800 illustrations — photographs, charts, diagrams,  
schematics.

Section 1. Television: Past, Present & Future.  
Section 2. Fundamentals of electronic Television.  
Section 3. The Television Station.  
Section 4. The Television Receiver.  
Section 5. Television Antenna Systems.  
Section 6. Creating a Television Show.  
Section 7. Descriptions of Modern Tele-  
visicn Receivers.  
Section 8. Installing Television Receivers.  
Section 9. Servicing Television Receivers.  
Section 10. Building a Television Receiver.  
Section 11. Data Section.  
Section 12. Bibliography.  
Section 13. Television Terms.  
Section 14. Bibliography.

**OVER  
900  
PAGES**

**INVALUABLE  
HELP FOR YOU . . .**

*Fully illustrated with  
charts and diagrams*

*If you are an engineer, technician, student,  
or in television work of any kind*

**COMPLETE  
AUTHORITY**

**ONLY \$5.00**

**14 BOOKS COMPLETE IN ONE  
VOLUME . . . SAVES YOU TIME**

When trouble shooting, testing, installing, constructing, either receivers or transmitters, you can use the data and basic knowledge found in this one handy book. It can help you solve basic problems quickly in your shop, drafting room, studio, or in the field. You have just one source to find the answers quickly to all problems. If your income depends on any one of the many phases of television you cannot afford to be without this reference book.

**TWO VALUABLE REFERENCE BOOKS**

**RADIO DATA BOOK**

Over 900  
pages, 12 sections,  
completely illustrated . . .

**ONLY \$5.00**

**VIDEO  
HAND BOOK**

Over 900  
pages, 860 illustrations, 14  
sections . . .

**ONLY \$5.00**

**COMPLETE RADIO  
& TV LIBRARY**

Both Radio and Video Hand-  
book in attractive slip case.  
Buy both books and save  
money.

**ONLY \$9.00**

Get them at your favorite  
dealer's. If he cannot supply  
you, order direct, using the  
coupon.



**MAIL ORDER  
COUPON NOW**

**BOYCE-ROCHE BOOK CO.  
MONTCLAIR, NEW JERSEY**

RTV3

Please send me the following, postpaid:

- Radio and Video Library — \$9.00
- Radio Data Book — \$5.00
- Video Data Book — \$5.00

Check or M. O. enclosed in amount of \$ \_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_

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

March, 1950

101







# OUTSTANDING VALUES NOW AVAILABLE

## 6-TUBE TWO BAND RADIO CHASSIS Completely Wired

Broadcast and shortwave with phono input. Dimensions: Length 10", Width 6", Overall Height 5 1/4". 4 push-button operation. Tone control, volume control. Tubes: 2—14A7, 14Q7, 7C6, 35Y4, 50A5.

The perfect chassis for amateurs, experimenters, and for a fine performing set.

Complete—less tubes.....**\$5.95**  
Set of tubes for above..... **4.00**  
Alnico V 6" PM for above chassis..... **1.59**

## 4-TUBE AMPLIFIER

Uses 2—35L6, 1—35Z5, 1—12SL7 in AC-DC Circuit. Separate tone and volume controls. With universal output transformer.... **\$5.29**  
Less tubes..... **2.95**

## RADIO AND WIRE RECORDER COMBINATION IN CHASSIS FORM

Standard make wire recording mechanism, including phono playback. 8-tube AC operated radio chassis with power supply. Alnico V 6" PM Controls—tone control, volume control, band switch and tuning knob. Completely wired. Chassis includes recording and erasing and playback circuits to make complete wire recorder. Tubes: 1280, 14Q7, 7C6, 2—50A5, 2—35Y4. Dimensions: 11" long, 6 1/4" wide, 5 1/4" overall depth.

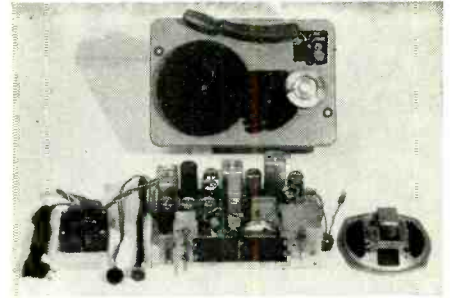
This is just the unit you have been looking for, for your custom-built installation. This chassis is and will give big set performance. The wire recorder renders excellent reproduction, directly from the radio, directly from the phono, or from the mike.

Easy to assemble. Complete instructions supplied with each unit. Price, complete—less tubes... **\$35.00**  
Set of tubes for above..... **5.50**

Limited Quantity Available—Order Now!

Above chassis less wire recording mechanism (can be purchased alone).

Price, less tubes, less power transformer..... **\$5.95**  
With power transformer..... **8.95**  
Complete set of tubes..... **5.50**



## 2-TUBE AMPLIFIER

Uses 1—50L6, 1—35Z5. Includes volume control. Comes with universal output transformer. Compact in size..... **\$3.61**  
Less tubes..... **2.29**

## TUBES

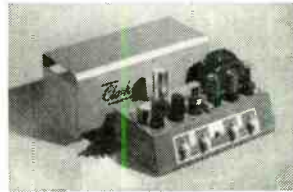
(All Standard Brands)

6SK7GT	1A3	
6H6	1L4	} 29c
12H6	1LN5	
39/44	3LF4	
	6F6G	
	6J7	
	6K7G	
	6V6G	
	6X5GT	} 49c
6C4	7A7	
6SA7GT	12A8GT	
6SH7	12SJ7GT	
6SQ7	14R7	} 39c
7B4	35B5	
12J5GT	35Z4	
12SR7	35Z5	
76	77	
12SH7		
	5U4G	} 59c
	12SK7GT	
	12SQ7GT	
	6AU6	
	6BA6	
	6SJ7	
	50L6	

## Famous CLARK AMPLIFIER KITS

### 18-Watt Kit

6 tubes: 1—6SQ7, 1—6SC7, 2—6V6, 1—6SN7, 1—5Y3GT. Mike and phono input. Separate Bass and Treble controls, Heavy steel chassis and cover.



Frequency response 50-17,000 CPS & 1DB. Output impedances 4-8-16-500. Hum level 65DB below rated output. Complete, with tubes..... **\$18.95**

### 25-Watt Kit

6 tubes: 2—6SJ7, 2—6L6, 1—6SC7, 1—5Y3. 2 mike, 1 phono input. Separate bass and treble controls.

Output impedance 2-4-8-16-500 ohms. Frequency response 30-17000 CPS & 1DB.

Attractive heavy steel chassis and cover. Push pull phase inverter driver for hum level. Complete, with tubes..... **\$24.95**

Each kit comes complete with instruction sheet, schematic and parts list.

## CONDENSER SPECIALS

Better Values Than Ever Before

20x30 mfd—150V	} 27c each
40 mfd/350V plug-in type	
20 mfd/150v 50 mfd/35v	10 for \$2.50
20 mfd/50V	} 19c each
20 mfd/25V	
10 mfd/10V	
25x25 mfd—	} 35c each
150V—200 mfd/10V	
30x30 mfd—	
150V—20 mfd/25V	} 35c each
40x20 mfd—	
450V common positive	
40x20 mfd—	} 10 for \$3.25
150V—200 mfd/35V	

All Standard Makes—Guaranteed

## SALES ITEMS—CHECK FOR TERRIFIC BUYS

JUST CUT OUT—FILL IN QUANTITIES—SEND TO US

- 2-gang, Superhet, variable condensers..... **49c** ea.
- 6" recording blanks, metal base, high quality.. **15c** ea. 10 for **\$1.25**
- SPST toggle switches..... **19c** ea. 10 for **\$1.75**
- Willard wet cell batteries 2 1/2 V for early G.E. portables.... **\$2.29** ea.
- Silk covered twin lead lamp cord..... **\$1.50** per 100 ft.
- AC rubber capped plugs screw terminals..... 10 for **55c**
- No. 47 pilot lites..... 10 for **45c** 100 for **\$3.85**
- 7JP4 sockets with leads..... **39c** ea.
- 150-watt soldering irons UL approved plug type tip. .... **\$1.99** ea.
- Rubber tape 1/8"..... **15c** per roll. 10 rolls for **\$1.25**
- Friction tape 1/8"..... **15c** per roll. 10 rolls for **\$1.25**
- Flashlites—plastic case with bulb and two cells..... **69c** ea.
- 5" 450-ohm speakers..... **\$1.98** ea.

SEND FOR OUR LATEST CATALOG

# Radio Parts Company, 614 RANDOLPH ST., CHICAGO 6, ILL.



# TELEVISION SCOPE

## SUPERIORITY AT A GLANCE!

The vertical response of this economy TV scope is usable to 5000 kc, not 50 kc. Response is flat to 750 kc, down 3 db at 1000 kc. Amplifier supplies a voltage gain of 20 at 5000 kc.



AR-3

Check this necessary feature before you buy any scope for TV use.

The R.S.E., AR-3 Scope has been built by Ross Armstrong to our rigid specifications. It's a complete unit that embodies standard horizontal amplifier and sweep circuits with normal sensitivity.

The case is 8" high x 5" wide x 14" long, attractively finished in "hammered" opalescent blue enamel. Operates on standard 110 volts—60 cycles—40 watts. Tubes, 3BP1-6AC7-6SJ7-6X5-5Y3-884. Instructions included. Complete specifications upon request. Satisfaction or your money back.

PRICE

**\$4995**

AVAILABLE TO JOBBERS IN QUANTITY

F. O. B. DETROIT

## INTERCOM & RADIO

AT A PRICE THAT CAN'T BE BEAT



6 tube superhet—3 tube intercom permits communication between radio-master and up to 4 sub-stations.

Original cost \$64.50

WHILE THEY LAST

**\$2995**

With 1 sub-station and 50 feet of cable Extra Sub-stations \$3.95 each

## PUSHBACK WIRE



25% BELOW MILL COST!

1st class, Essex or Lenz, ALL SOLID tinned copper, double cotton serve, waxed finish.

SIZE	COLORS	100 feet	1000 feet	Production Reel
22	BLACK-BROWN	.39	3.79	3.65M
20	RED-WHITE-BLUE	.49	4.49	3.95M
18	BROWN	.69	5.98	

## ORDER INSTRUCTIONS

Minimum order—\$2.00. 25% deposit with order required for all C.O.D. shipments. Be sure to include sufficient postage—excess will be refunded. Orders received without postage will be shipped express collect. All prices F.O.B. Detroit.

Demand This Seal of Quality

Quantity and Export Orders Solicited

**RADIO SUPPLY & ENGINEERING CO., Inc.**  
89 SELDEN AVE. DETROIT 1, MICH.

(Continued from page 102)

	Melbourne (RA-To Britain, Europe)	VLC9	17.800		1825A	Moscow (To NA)	9.716	
	(To E. NA)	VLA6	15.220			(To Siberia)	9.630	
	(To Forces- Japan, Asia, N. Pacific)	VLB11	15.160			(To Siberia)	7.360	
	(Via BFOS, Kure)	WLKS	6.105			(To Siberia)	7.310	
(NS)	Melbourne (ABC)	VLG6	15.230			(Via Komsomolsk)	15.230	
	Brisbane (ABC)	VLH4	11.880			(Via Kiev)	9.670	
	Perth (ABC)	VLM	9.810		1830	(Via Petropavlovsk)	11.885	
	Sydney (ABC)	VLW6	9.810			Buenos Aires (SRI-To Europe)	11.880	
	(Via Pt. Moresby-ABC)	VLX2	6.130			Sydney	CJCX 6.010	
(MO)	Colon	HOLA	9.505			Toronto	CFRX 6.070	
1700	Halifax	CHNX	6.130			Montreal	CHOL 11.720	
(SO)	Toronto	CFRX	6.070			(CBC-To Europe)	CKLO 9.630	
	Winnipeg	CKRX	11.720		1848	Saigon (Radio France Asie)	FZS4 11.780	
(NS)	Edmonton	VESA1	9.540			Caracas	YV5RU 4.880	
	Montreal	CHOL	11.720			Port-of-Spain	VP4RD 9.625	
	(CBC-To Europe)	CKLO	9.630		(M-Th)	Boston	WRUX 17.750	
(NSAT)	Melbourne (ABC)	VLH4	11.880			(WWBC-To Latin America)	WRUL 15.290	
	Sydney (ABC)	VLH4	11.880		1900	Brazzaville (To Sou. Afr.)	11.972	
1715	Brazzaville (To NA)	VLH4	11.880			(To Sou. America)	9.973	
	(To Africa)	VLH4	11.880			(To NA)	9.440	
	(To Sou. America)	VLH4	11.880			(To Africa)	6.024	
	(To Africa)	VLH4	11.880			Prague (To NA)	OLR4A 11.840	
	St. Johns	CBNX	5.970			Manila	DZH2 9.640	
	Sydney	CJCX	6.010		(NS)	London (Radio Newsreel)	GSD 11.750	
	Kingston	ZOI	4.950				GRH 9.825	
(WO)	Georgetown	ZFY	5.984 A				GSC 9.580	
(SO)	Athens (To NA)	ZOI	4.950				GSB 9.510	
	New York	WNBI	17.780				GRW 6.110	
	(VOA-To Europe)	WRUL	15.350				GSL 6.110	
		WCBA	15.270			Stockholm (To NA and Latin Amer.)	SDB2 10.780	
		WRUS	11.790			Vancouver	CKFX 6.080	
		WOOW	9.700			New York	II 15.330	
	(Via Munich)	IV	7.250			(VOA-De-layed Relay to Far East-Via Manila)	I 11.890	
		I	6.170				III 9.530	
	(Via Tangier)	III	6.080		1925 (NS)	Helsinki (To NA)	OIX5 17.800	
	New York	WOOC	7.220			Buenos Aires (SRI-To Europe)	LRS 11.880	
(I)		WNRI	11.710		1930	Delhi (AIR-To Far East and S. E. Asia)	VUD5 15.160	
(I)		WNRA	9.615			Kingston	ZOI 3.480	
(I)		ZOI	4.950			Paris (RDF-To NA)	9.680	
1725V (I)	Kingston	ZOI	15.345			Georgetown (Argosy Newsletter)	ZFY 5.984 A	
1730	Athens	ZOI	15.345			Edmonton	VED 8.265	
(Wkdays)						(CBC Relay)		
(NS)	St. Johns	CBNX	5.970		1945A	Saigon (Radio France Asie)	FZS4 11.780	
	Vancouver	CKFX	6.080			London (GOS)	GSD 11.750	
	New York	WGEX	17.765				GRH 9.825	
	(AFRS-To Europe)	WBOS	15.210				GSC 9.580	
		WNRX	11.890				GSB 9.510	
		WRCA	9.670				GRW 6.180	
	Moscow		7.340				GSL 6.110	
			6.090			Rome (To NA)	15.120	
			5.970 A			Port-of-Spain (BBC Relay)	VP4RD 9.625	
	London (ES-Press Review)	GRJ	7.320			Stockholm (To NA and Latin America)	SDB2 10.780	
	Colon	GSA	6.050			Vancouver	CKFX 6.080	
	Buenos Aires (SRI-To Europe)	HOLA	9.505			Melbourne (ABC)	VLH4 6.150	
1733		LRS	11.880			New York	WABC 21.570	
1735	Berne (To NA)	HEI7	15.320			(VOA-TO Latin America)	KNBA 21.460	
		HER5	11.865				WCXB 17.830	
		HER4	9.535				WLWK 17.800	
1745	Melbourne (RA-To Sou. America)	VLC9	17.840				WNBI 17.780	
	(To Britain, Europe)	VLG6	15.230				KWID 17.760	
	(To E. NA)	VLA6	15.220				WRUA 15.350	
	(To Forces- Japan, Asia, N. Pacific)	VLB11	15.160				WLWR2 15.330	
	(Via BFOS, Kure)	WLKS	6.105				WCBN 15.270	
(SATO)	Melbourne (ABC)	VLH4	11.880				WRCA 15.210	
	Manila	DZH2	9.640				KNBI 15.130	
	London (ES)	GRJ	7.320				WRUL 11.790	
	Halifax	GSA	6.050				KCBR 11.770	
1755	London (GOS-News)	CHNS	6.130				WLWR1 11.710	
1800		GWH	11.800				WLWS2 9.700	
		GSD	11.750				WNRX 9.670	
		GSC	9.580				WGEO 9.530	
	London (Radio Newsreel-To NA)	GRH	9.825				WLWO 6.080	
		GSB	9.510					
		GSL	6.110					
	Georgetown (BBC Relay)	ZFY	5.984 A			2005A	Moscow (To NA)	9.716
(SO)	Winnipeg	CKRX	11.720				(To Siberia)	9.630
	Vancouver	CKFX	6.080				(To Siberia)	7.360
	New York	KCBA	21.740				(To Siberia)	7.310
	(VOA-To Far East)	KCBF	17.770				(Via Komsomolsk)	15.230
	(Via Honolulu)	KNBX	15.240				(Via Kiev)	9.670
	(Via Manila)	KRHO	17.800				(Via Petropavlovsk)	11.885
		II	15.250				Buenos Aires (SRI-To Europe)	LRS 11.880
		I	11.890				Rangoon	9.543
		III	9.530				Colon (De-layed Relay of VOA)	HPSK 6.005
(NSAT)	Manila	DUH5	11.840			2022V		
		DUH4	9.620			2025 (NS)		
		DUH2	6.170			2030		
(NSAT)	Manila	DZH3	9.505 A			2035A		
1810A	Manila	DZH4	6.000				Berne (To NA)	HER5 11.865
	Madrid	DZH4	9.369 V					HER4 9.535
	(RNE-To Na)							HER3 6.165
1815 (I)	Edmonton	VED	8.265					

(Continued on page 106)



# When is a dot not a dot?

Look carefully at the pictures  
on this page, to see how television  
creates an image

No. 2 in a series outlining high  
points in television history

Photos from the historical collection of RCA

● As parlor magicians say: "The hand is quicker than the eye!" But modernize the statement so that it becomes: *Television magic is quicker than the eye*—and that's why you see a photographic image in motion . . . where actually there is only a series of moving dots!

To explain this to laymen, ask them to examine a newspaper picture through a magnifying glass.

Surprisingly, few people know that newspaper pictures are masses of tiny dots "mixed" by the eye to make an image. Even fewer know that the same principle creates a television picture . . . and, when picture after picture comes in rapid succession, the eye sees motion.

Devising a successful way to "scan" an image—to break it into dots which could be transmitted as electrical impulses—was one of television's first basic problems. Most of the methods dreamed up were *mechanical*, since electronics was then a baby science. You may remember some of the crude results transmitted mechanically.

Television as we now know it, brilliant images on home receivers, begins with the invention of the *iconoscope* tube by Dr. V. K. Zworykin of RCA Laboratories. First all-electronic "eye" of the television camera, this amazing tube scans an image—"sees" it even in very dim light—translates it into thousands of electrical impulses which are telecast, received,



Felix the Cat was the "stand-in" when this 60-line image was made *mechanically* in tests at NBC's first experimental television station.



Improved definition is obvious to anyone in this *all-electronic* 120-line image of Felix—transmitted in the early days of NBC television.



By increasing the number of scanning lines to 441 lines in each picture frame, RCA scientists gave us a sharper, clearer television image.



And here you see the deep blacks, clear whites, and subtle halftones as transmitted by NBC with our present 525-line scanning system.

and re-created as sharp, clear pictures in black-and-white—on the phosphorescent screens of today's home television receivers.

And, just as the first flickering "30-line" pictures—produced mechanically—eventually became our present sharp 525-line images, so the iconoscope itself was improved until it became today's super-sensitive RCA image orthicon television camera. All-electronic, the image orthicon peers deep into shadows, needs only the light of a candle to see and transmit dramatic action.

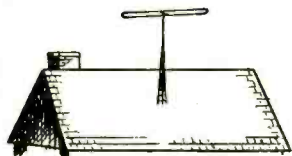
But every single television development made by scientists at RCA Laboratories depends, in the end, on a basic physiological fact: When the human eye sees a series of swift-moving dots on a television screen, it automatically "mixes" them into a moving photographic image!



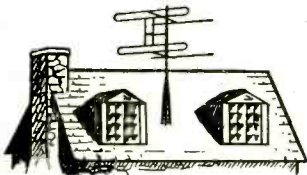
Radio Corporation of America

WORLD LEADER IN RADIO—FIRST IN TELEVISION

**PENN**  
*Thriftower*  
 Costs less than 75c...  
 Weighs less than 2 lbs...  
 ...per Foot!



**SELL THE BULK!** Low price sells lower and middle income groups.



**SELL THE CREAM!** Improved reception sells upper income brackets.

Right along, tripod-type towers of sectional construction have been the choice of the "cream" of television's market. Through elevating antennae, such towers extend fringe area and improve reception. Now — Penn offers a tripod tower priced within reach of the ever-expanding "bulk" market. Be among the first to profit — write today for details about the still-available Penn dealer propositions.

**Prices to Retailers**

**THRIFTOWER "30"** — Composed of 20' of tower welded as a single unit with 10' 1" O.D. adjustable pole, total approximately 30' overall .....\$24.75  
**THRIFTOWER "40"** — Composed of 20' of tower, same as Thriftower 30, with 20' 1" O.D. doubly reinforced adjustable pole giving a total overall extended height of approximately 40' .....\$29.75

**PENN Teletower**  
 Penn Boiler & Burner  
 Mfg. Corp.  
**Makers of Penn**  
*Packaged Heat*  
 ESTABLISHED SINCE 1932  
 LANCASTER, PA.

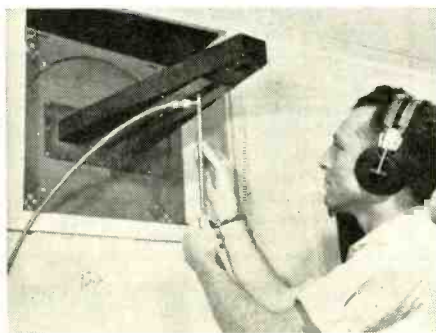
**Antenna Laboratory**  
 (Continued from page 34)

about 8000 mc. and 40 to 50 mw. for frequencies above this. Sensitivity of the simple receivers used in the models is quite low and, upon numerous occasions, the model simply cannot be placed at the required distance and still secure sufficient signal to record a pattern. The model tower must then be moved into the so-called "near zone" region and many hours spent in calculations and educated guesses in order to replot the pattern to some degree of accuracy. The uninitiated invariably suggest going to higher powered transmitters such as radar pulsed units. When such suggestor, however, ponders over the problem of building or purchasing the number of high power, room-size radars needed to cover the frequencies called for, he soon realizes that a fairly large warehouse would be needed to mount them for use.

Rejoining the antenna engineer it is found that his new antenna has successfully completed its preliminary radiation pattern tests. While mildly jubilant he must still subject his creation to an investigation to determine its response to cross-polarized signals. Also he must investigate what effect additional structures, such as wing mounted rockets or bombs, have on its pattern. The worried frown will remain on his brow for some time to come as he follows the antenna through the intricate maze of production decisions, cost analysis, and lastly the flight test which places the final stamp of approval on his work.

While emphasis has been placed on the aircraft antenna because of its present importance, it should be made clear that the laboratories of such institutions as Ohio State University are carrying on programs of investigation into many other aspects of the antenna problem. For example, in the study of land-based radio stations scientists must content themselves not only with dimensional perfection with regard to towers and buildings,

Fig. 11. View of "feed" end of large horn type antenna. Coaxial cable shown supplies v.h.f. energy to probe "feed" for the large horn type "illuminating" antenna. Microwatts are precious and technician carefully adjusts the matching stub for the maximum obtainable signal.



**2 BIG SPECIALS**

Plus 100's of other items too numerous to mention.

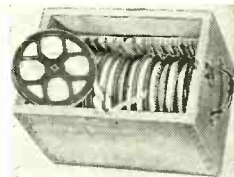
**PORTABLE PUBLIC ADDRESS SYSTEM**

Model CS-91-C made by Silman Mfg. Co. for the U.S. Army. Ideal for camps, boat races, ski races, loading platforms, etc., etc. It's a battery operated amplifier with 2 tubes, 1H4-1J6; hand microphone and trigger type switch microphone and loud speaker; 4 1/2' collapsible metal tripod, batteries and carrying case. Brand New. Shipping Weight 25 lbs. While they last . . . .



**\$39.95**

**AT LAST**



We have available **CODE PRACTICE TAPE**, which was used for code practice work by the Signal Corps—from slow to fast practice. 15 rolls on 16MM metal reels in heavy wooden slotted case, to be used with McElroy TG10 Keyers, Tone Keyers or any code practice unit using printed tape. **\$9.95** Special . . . .

Prompt Delivery—25% deposit required on C.O.D. order. Shipped F.O.B. New York. Write Dept. RN-3

**MICHAEL STAHL, INC.**  
 39 VESEY ST.  
 WO 4-2882 New York 7, N. Y.

when you use  
 the **Audax**  
**POLYPHASE...**  
**ONE** single unit  
 plays **ALL**  
 your records  
**SUPERBLY...**  
 and at less  
 than the cost  
 of ordinary  
 magnetic pick-ups

*"The Standard by which Others Are Judged and Valued"*

Microgroove, 78 r.p.m., etc.

Only **\$11.70** net cost to you—believe it or not!  
 See it at your local distributor or write us

**AUDAK COMPANY**  
 500 5th Ave., Dept. 66, New York 18  
 Fine Music Reproducers Since 1915



but must also actually design the soil of these scale models to have proper conductivity at the higher model frequencies in order that it simulate the soil found in the region under study. The "guess and by-gosh" methods of the past in making costly antenna installations are slowly giving way to exact knowledge.

Last but by no means least, Naval research centers are engaged in measuring the radiation patterns of antennas mounted within the complex maze produced by a ship's masts, cables, and other marine structure. As might be expected, Naval antenna designers must take the sea into account when making their scaled-down ships for range tests. To an electromagnetic wave a ship resting upon the sea appears to have an exact mirror image *directly beneath it*. This can be duplicated on the Naval antenna model range by cutting a ship model off at its water line and resting it upon a large sheet of metal. In lieu of this, two ship models are constructed, sawed off at the water line, and one fastened upside down to the waterline of the other. The technique of making the actual radiation pattern measurements is identical to that described for aircraft.

-30-

## ONE MA. METER

By MILTON KALSHIAN

A 1 ma. meter is a very handy item, but unfortunately it is rather expensive and therefore most of us don't have as many of them as we could conceivably use.

Fortunately, most of the units that utilize the 1 ma. meter are rarely in operation at the same time. For example, the v.o.m., the f.s. meter, grid dip meter, modulation monitor, and the absorption frequency meter are all popular pieces of ham equipment which generally incorporate a 1 ma. meter, but seldom are these units used simultaneously.

This being the case, it is a very simple matter to use one meter in all these instruments. The answer to the problem is to make the meter "plug in." This is easily done by purchasing banana plugs that are tapped to take a 10-32 machine screw. Most manufacturers have standardized on this size and thread for the terminal posts on the meters. Next screw these plugs onto the meter terminal posts.

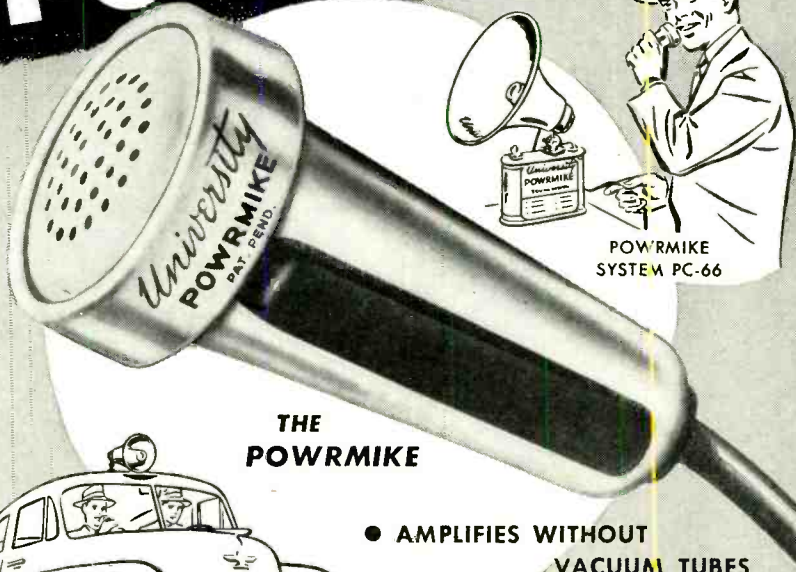
The equipment with which the meter is to be used should have a bracket installed several inches behind the front panel, the exact dimensions depending on the size of the meter used. The bracket should have two insulated banana jacks to match the banana plugs on the meter when the meter body is passed through the front panel meter cutout normally provided for mounting the meter. The mounting bracket should be placed behind the front panel in such a way that when the meter is plugged in the mounting flange of the meter case will be flush with the front panel.

The banana plugs provide enough tension to hold the meter securely in place, therefore mounting screws are unnecessary. Thus all one has to do is unplug the meter from one piece of equipment and plug it into another.

-30-

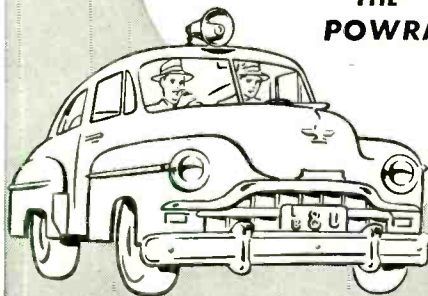
# Applications Unlimited!

# University POWRMIKE



POWRMIKE  
SYSTEM PC-66

## THE POWRMIKE



ALSO FOR MOBILE AND  
SPECIAL INSTALLATIONS

- AMPLIFIES WITHOUT VACUUM TUBES
- OPERATES FROM ANY 6 VOLT D.C. SOURCE
- INSTANTANEOUS OPERATION
- DEPENDABLE, FOOL-PROOF, ECONOMICAL

The new UNIVERSITY POWRMIKE opens a new field for sound distribution. Low in cost, requiring no amplifier, completely portable, POWRMIKE can be used in thousands of applications where power supply or high cost rule out sound amplification. POWRMIKE has a maximum output of 1.5 watts, reproduces speech with excellent fidelity and is instantaneously operated by handy press-to-talk switch. Additional speakers may be added for broader coverage and special switching arrangements.

POWRMIKE is the perfect answer for voice amplification in stores, carnivals, rallies, waiting rooms, auctions, outdoor markets, sight seeing buses and boats, school group activities, police and fire department work, etc. Get the complete story on sensational POWRMIKE, today.

MODEL PC-66 — For applications requiring portability. Includes: POWRMIKE microphone wired to loudspeaker, "Hot-Shot" type battery mounting bracket with volume control, and automobile current adapter.

MODEL PC-60 — For mobile operation and special installations. POWRMIKE microphone, loudspeaker, and automobile cigarette lighter adapter, supplied unwired.

WRITE DEPT. A FOR ILLUSTRATED CATALOG



# University LOUDSPEAKERS INC

80 SO. KENSICO AVE., WHITE PLAINS, N. Y.

Famous World-Wide for LOUDSPEAKERS • DRIVER UNITS • TWEETERS • PORTABLE POWRMIKES



## Nationally Famous Brands

### Precision Resistors

Types WW3, WW4, WWS

500,000	1%				\$ .65
100,000	1%				.55
Following sizes are \$0.35 each; \$27.50/100					
800,000	1%	220,000	2%	50,000	1%
700,000	1%	125,000	1%	25,000	1%
600,000	1%	109,000	1%		
Following sizes are \$0.25 each; \$19.50/100					
most sizes are 1% or better—others 2%:					
95,000	20,000	7,500	1,400		70
92,000	17,000	5,000	1,200		50
84,000	15,000	4,500	1,000		30
82,000	12,000	4,300	750		22
80,000	11,000	4,000	140		20
66,000	10,000	2,200	130		14
46,000	8,000	1,500	125		12
33,000					
Following sizes are \$0.15 each; \$12.50/100 odd					
types are 1% or better, round numbers are 3%					
or better:					
.399 meg.	50,000	2,230	110		35
.268 meg.	26,000	1,123	70		30
109,000	22,000	280	50		6
54,500	17,300	235	40		4
Following sizes are \$0.10 each; \$8.50/100 most					
sizes are 1% or better:					
53.96	13.52	4.3	2.14		.25
53.32	13.333	3.94	1.563		
33.22	10.2				
23.29	5.1	2.56	.256		

### New Surplus Relays

Following Types are \$.55 each

Any combination of 50 for \$25.00

- #1026—ISOLANTITE RELAY D.P.D.T. Heavy Contacts Coil 50 ohms, 12 volts. D.C. Excellent for antenna switchover.
- #1028—RBM RELAY S.P.S.T. Heavy Contacts Aircraft Starter—Type Coil 272 ohms, 32 volts.
- #1031—GM RELAY D.P.D.T. plus S.P.S.T. Coil 30 ohms, 6 volts D.C.
- #1045—ALLIED Control #D0X8. 4 Make 4 Break. Heavy Contacts Coil, 18 turns # 10 enameled wire.
- #1050—MINIATURE RELAY. RBM #55526. S.P.D.T. Plus S.P.S.T. Normally open. Coil 250 ohms, 12-24 volts, D.C.
- #2101—GE #D106F3 ANTENNA SWITCHOVER RELAY. D.P.D.T. Ceramic insulation Coil 24 volts.

Following types are \$.85 each

Any combination of 50 for \$40.00

- #1021—ALLIED B013D35. Two circuit. Heavy duty contacts, 24 volts, D.C., 250 ohms. Overall dimensions, 1 3/4" x 1 1/4" x 1 1/2".
- #1022—ALLIED CONTROL #B06D35 D.P.D.T. Coil 26 volts, D.C. Contacts 10 amps. A.C. at 115 volts.
- #1023—ALLIED CONTROL #BOY-X5. Coil 6 volts, D.C. Contacts D.P.D.T. plus S.P.S.T. N.C. Heavy contacts.
- #2105—ALLIED #ASX-8 Miniature relay S.P.D.T. operates from 12 volts D.C. Coil 150 ohms.
- #2106—OAK ROTARY RELAY—Shaft rotates standard rotary wafers switch. Coil 65 ohms tapped at 1 ohm.
- #1041—RBM 6 VOLT RELAY-HEAVY CONTACTS. D.P.D.T. Coil 18 ohms.
- #1049—TELEPHONE TYPE RELAY. S.P.D.T. plus S.P.S.T.—normally open. Coil 100 ohms, 10-12 volts, D.C.
- #1063—SENSITIVE MINIATURE RELAY. Operates on 2 volts, D.C. Resistance 5.3 ohms. Leach Type 221. Coil #780. Single screw mounting.

### SPECIAL RELAYS

- #3333—Struthers Dunn PTAH19. 110 volt DC relay. Contacts S.P.D.T. plus S.P.S.T.—N.O. Coil resistance 5000 ohms. Has built-in thermostatic switch with bimetallic element and 1000 ohm heating element for use as overload cutout or time delay action. Price \$1.45
- #1051—CLARE RELAY. Telephone Type. Heavy contacts D.P.D.T. Coil 6300 ohms, 110 volts, D.C. Available with or without wired octal plug in base. Price \$1.95
- #1059—110 VOLT D.C. RELAY. Leach type 2058-SMX. Coil 4200 ohms. Heavy contacts D.P.D.T. plus holding contact. Mounted on micalex base with mica and micalex insulation. Price \$1.45

### VACUUM RELAY

- #1035—RCA VACUUM RELAY. Relay contacts will break 3000 volts and carry 10 amperes. Solenoid resistance, 200 ohms, 24 volts, D.C. Excellent at R.F. antenna relay. Price \$3.95

### TIME DELAY RELAY

- #1052—THERMAL VACUUM TYPE. S.P.S.T. 100 ohm coil. 24 volts A.C./D.C. 90 second delay. Price \$3.95

### AC RELAYS

- #1055—STRUTHERS DUNN #CS2367. Coil 440 volts, 60 cycles, 31/ST Contacts, 110 volts, A.C. 30 amps. Price Only \$2.95
- #1057—CASED A.C. RELAY ALLIED #BJ11 6A115. Coil 115 volts, 50/60 cycles, D.P.D.T. Contacts. Housed in hermetically sealed can with feed-thru glass-wire terminals. Price \$1.95

### SPECIAL

- #2107—We have an assortment of miscellaneous relays. All guaranteed new.

Priced at only 6 for \$1.00

Write for Latest Catalog R-3 Listing Thousands of Relays, Resistors, Condensers, Switches, etc.

**EDLIE ELECTRONICS, INC.**

Telephone Digby 9-3143

154 Greenwich Street New York 6, N. Y.

## Modern TV Receivers

(Continued from page 52)

wave which is locked to the station's horizontal line frequency. The negative peaks of this sine wave drive the grid of  $V_2$  to cut-off, causing only a half-wave to appear in the plate circuit. This wave is differentiated by  $C_4$  and  $L_2$ , producing alternate positive and negative pulses which are applied to the grid of the blocking oscillator. These positive pulses trigger the blocking oscillator, keeping it in synchronism with the incoming pulses. The saw-tooth deflection waveform is then developed in the plate circuit of the blocking oscillator by components  $C_5$  and  $R_3$ .

The locked-in oscillator for television synchronization possesses one marked advantage over the a.f.c. systems previously discussed in that the synchronization actually becomes more stable as the signal becomes weaker. The stability of this circuit lies chiefly in the "Q" of the resonant circuit ( $R_2$ ,  $L_1$ ,  $C_2$ , and  $C_3$ ) of the locked-in oscillator. Now, every tuning circuit functions as a bandpass filter, accepting a small range of frequencies and rejecting all other frequencies. The higher the "Q" of the tuned circuit, the greater its power of discrimination—in this instance, against noise pulses other than the proper horizontal synchronizing pulses.

A logical assumption, then, would be to make the "Q" of the circuits as high as possible. There is one difficulty, however. The sync pulses transmitted by the broadcast station are not absolutely fixed in frequency but possess a certain frequency variation. If the resonant circuit selectivity is made too high, two things will happen. First, if the sync pulses should drift in frequency too far from that of the resonant circuit, sync control will be lost. Second, even if sync control is maintained, slight frequency variations in the sync pulses will cause a phase shift in the generated sine wave. Since the triggering pulses are derived from the generated sine waves, they, too, will shift, producing a horizontal shifting of the television picture.

As a compromise, the "Q" of the resonant circuit is kept somewhere be-

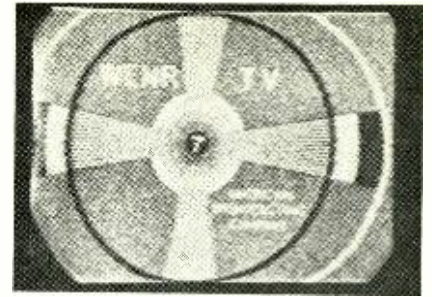


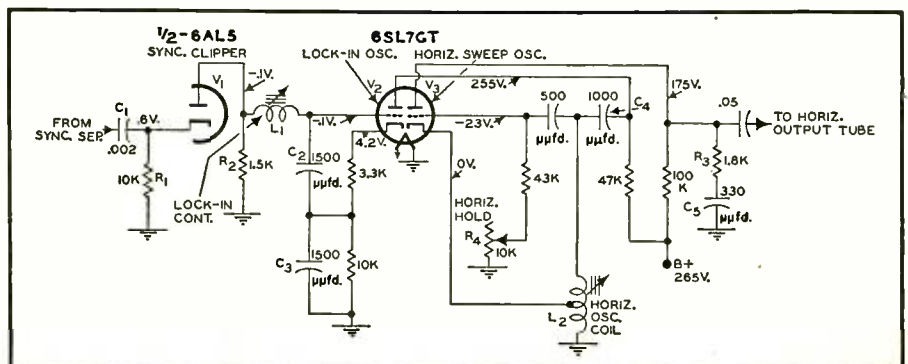
Fig. 7. Appearance of a picture under weak signal conditions in a set not possessing an automatic frequency control.

tween 10 and 30, depending upon the value of  $R_2$  in Fig. 6. Since the diode,  $V_1$ , shunts  $R_2$ , it, too, will affect the "Q" of the resonant tuning circuit. When the signal received is strong, the current through the diode is high, the diode resistance is low and the "Q" of the locked-in tank circuit is lowered. On the other hand, when the signal strength is low, the current passing through the diode is low and the diode plate resistance is high. This reduces the diode shunting effect, enabling the "Q" of the tuned circuit to be higher.

When the circuit was first designed,  $R_2$  was given a value of 470 ohms. This value was satisfactory whenever the station sync pulse frequency was maintained within the limits established by the FCC. In some areas, however, it was soon discovered that the station was not adhering to FCC regulations and a higher valued resistor (lowering the "Q" of the circuit) was required. Hence, the indicated value of 1500 ohms in Fig. 6.

There are three adjustments in this circuit: A lock-in control and two frequency controls. The iron core in  $L_2$  can be considered as a rough tuning adjustment whereas  $R_1$  is a fine tuning control. This is the horizontal hold control positioned on the front panel. The third control, labeled lock-in control, is a screwdriver adjustment on the rear of the chassis. It governs the lock-in range of the horizontal sync system and requires adjustment only if the picture does not remain locked in over the entire range of the horizontal hold control. With normal contrast and the hold control in mid-position, the lock-in coil at the rear of the chassis should be adjusted until the

Fig. 6. A locked-in oscillator circuit for television synchronization.





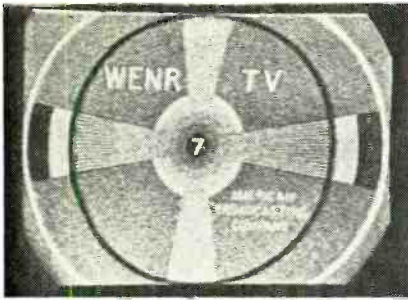


Fig. 8. Same picture as Fig. 7 only in a set using a locked-in oscillator circuit.

picture remains in sync throughout the entire range of the horizontal hold control. However, it is permissible for tearing of the picture to occur at the extreme end of the hold control.

Figs. 7 and 8 show the effect of the locked-in oscillator on a picture being received under weak signal conditions. Fig. 7 was obtained when the set used the incoming sync pulses to trigger the horizontal sweep oscillator directly. Note the improvement in Fig. 8 when the locked-in oscillator was employed. Sync jitter is gone and the readability of the small letters has improved markedly.

The author is indebted to Kurt Schlesinger, who developed this circuit, for an interesting discussion on the properties of this oscillator under various conditions. Figs. 7 and 8 were also furnished by Mr. Schlesinger and are being used with his permission.

(To be continued)

### Electronic Organ

(Continued from page 43)

ferent tubes and parts and circuits. Probably I have given the reader some ideas which he can combine with some of his own to produce something very different and better. I know I shall rebuild this entirely and immediately. I have drawn the plans of a complete organ that can be used independently of the piano. One on which you may play chords or any piece of music, using all the fingers of both hands. That will make a very expensive and elaborate instrument. I plan on cutting the cost a little by using surplus parts on hand. That is the way of the ham—always trying to make everything better. Very often we succeed by making it worse!

The best transformer to use is the one from the BC-456. Terminal No. 2 goes to grid, No. 1 to ground, No. 3 to plate, and No. 4 to "B plus."

The small single plate to push-pull grid transformer made by *Stancor*, as their type A-53C, will work just as well but is more expensive than the surplus units.

If the *Stancor* unit is used, the green lead goes to grid, the yellow to ground, the red to plate, and the blue to "B plus." This transformer is light and small and will make a small and neat assembly, reducing the over-all space required.

## ★ Chelsea is **FIRST AGAIN** with LIC. RCA CHASSIS FOR 16" OPERATION



AT **\$119<sup>95</sup>** less CRT  
Plus \$1.80 Fed. Tax

FOR 19" OPERATION **\$129**

less CRT, plus \$1.30 Fed. Tax

(19" picture tube **\$79.95**)

A NEW LOW PRICE for our superior receiver. The C-4 is quality-controlled engineered, with improved AGC and AFC, and Standard Coi Front End down to 45 microvolts. Completely wired, tested and **GUARANTEED!**

Just Off the Assembly Line  
for Custom-Built Installations

Same chassis for 12½" operation, less CRT, **\$109.95 plus \$1.80 Fed. Tax**

**JUST PLUG IT IN—IT WORKS BEAUTIFULLY!**

## ★ Chelsea is **FIRST AGAIN** with THE FAMOUS IMPROVED 630-TYPE CHASSIS

for 19" operation  
with voltage doubler

Less CRT plus \$2.25  
Fed. Tax

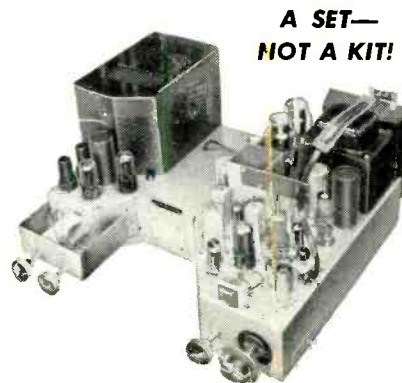
**\$155<sup>75</sup>**

A NEW LOW PRICE for this custom-made, completely wired, factory-engineered and **GUARANTEED** Chassis. Improved AGC and Improved High Gain Front End.

FOR 15" & 16" OPERATION,  
with voltage doubler less CRT **\$152.95**  
plus \$2.25 Fed. Tax

FOR 12½" OPERATION, less CRT **\$145.75**  
plus \$2.25 Fed. Tax

**JUST PLUG IT IN—IT WORKS BEAUTIFULLY!**



## ★ Chelsea is **FIRST AGAIN** with lowest-prices for TUBES, TUNERS, AMPLIFIERS, RECORD CHANGERS, ANTENNA

### BRAND NEW TV TUBES

10" CRT.....\$19.50  
12" CRT.....\$20.00  
12½" CRT.....\$26.00  
15" CRT.....\$41.50  
16" CRT.....\$41.50  
19" CRT.....\$79.95

Highly-sensitive No-Drift AM-FM TUNER  
**\$31.50**

Plus \$1.80 Fed. Tax

High and Low Frequency All-Channel ANTENNA . . . from \$6.71 to \$471.00

### RECORD CHANGERS

WEBSTER 256-1 . . . . . dual speed, 78 and 33½ RPM **\$28.44** inc. tax.  
WEBSTER 356-1 . . . . . three speed, 78, 45 and 33½ RPM. **\$29.70** inc. tax.

### WHY PAY MORE ELSEWHERE?

Write Dept. P for latest literature and prices—and **COMPARE!**

Phone and mail orders filled on receipt of certified check or money order for \$25 as deposit . . . balance C.O.D., F.O.B. N. Y.

For Free Demonstrations, visit our street-level showroom.

*The House of Bargains*

**CHELSEA TELEVISION CENTER, INC.**

187 Seventh Ave., New York 11, N. Y. CHelsea 3-4425-6-7

Prices subject to change without notice.

# NEW TELEKITS

NOW **49<sup>95</sup>**

**Jobbers: Write for Confidential Price Information**

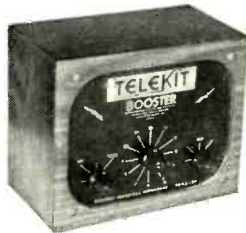
**NEW TELEKITS**  
**10-B \$69.95**  
**7-B \$49.95**  
**Less Tubes**



Sparkling new Telekit 10-B has 52-inch screen. Brand new compact lay-out has video tube mounted on chassis. Big illustrated easy-to-follow instruction book guides you step by step through easy assembly. No special knowledge of television is required. All you need is a soldering iron, pliers, and screw driver. 10-B kit can be used with 12 1/2, 15, 16 inch tubes. Telekit 10-B, \$69.95. 10-B Telekit cabinet \$15.95 and \$24.50. Satisfactory Telekit performance guaranteed by Factory Service Plan.

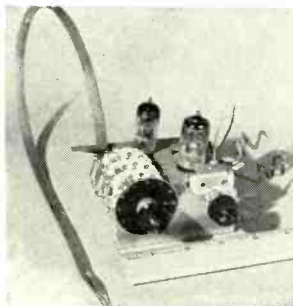
Write for catalog listing 10-B and 7-B Telekits. New 7-B Telekit for 7-inch tube, \$49.95. 7-B cabinet, \$15.95 and \$24.50

**TELEKIT BOOSTER**  
**12.95**



This Telekit booster will bring in TV signals bright and clear in the fringe areas. Has a 20 times boost on all TV channels. NOT A KIT. Completely assembled. With tubes. Works with Telekit or any TV receiver.

**13 CHANNEL TUNER**  
**12.95**



This compact front end has a stage of RF for extra distance. Made to conform with Telekit or any TV set having a video I.F. of 25.75 Mc. Complete with tubes, pre-wired, pre-assembled. Only four connections to make.

Write for catalog of Telekit antennas, boosters, television kits tuners, television parts and tubes.

# TELEKIT

**ELECTRO-TECHNICAL INDUSTRIES**  
 1432 NORTH BROAD STREET PHILADELPHIA 21, PA.

## Recording Amplifier

(Continued from page 63)

The three-inch speed is capable of handling a frequency range of up to four thousand cycles, approximately the equivalent of a small table model radio, and is useful for dictation or recording of non-musical radio programs. The seven-inch speed provides reproduction to about eight thousand c.p.s. and is useful for general purpose, medium quality recording, such as musical programs, dance bands, voice, and copying prized disc recordings to tape, as well as other applications. The fifteen-inch speed is useful for full-range reproduction up to 15 kc. and may be used in radio broadcast or master recording for copying onto 7" speed tape or disc.

A number of interesting opportunities are open to the constructor who builds his own system. One of these is the use of simultaneous, dual-track recording, either for binaural reproduction or with a second track for control purposes, such as volume expansion. A number of half-track heads are now on the market and may be adapted for this purpose by using two heads in conjunction with a permanent magnet erase system.

Another application is to use the playback mechanism as a signal generator by running a small, endless belt of tape through the machine. This has the advantage that a number of loops with sine or complex waves may be kept for convenient use. Likewise, a simple sweep frequency audio signal generator might be made in this fashion, the rate of sweep being determined by the tape speed and length of the loop.

For advertising, or other purposes, it may be possible to run a loop of tape the length of the room thus continually reproducing a message of a minute or two duration which could be turned on or off by some external mechanism, such as a photocell or capacity relay. A similar arrangement is to set the machine to "recording" and place a separate pickup head and amplifier some distance down the tape to allow the person talking to hear his own voice, as if an echo. It is possible that the same principle might be applied to difficult public address locations, either to reduce feedback or to synchronize widely separated loudspeakers acoustically.

For the professional or semi-professional recording engineer, a good tape recorder capable of fifteen-inch speed should provide a convenient means for making high quality recordings of bands, orchestras, vocal groups, and other events in which it would be inconvenient for the performing group to use a regular recording studio. In cases where only a limited number of individuals desire copies of a particular piece of music, the master tape may be re-

## SPOT SURPLUS! SPECIALS!

- MODULATION TRANSFORMER 1 KW  
Thermador or SOLA. Sig. Corp. 2Z9639.29 Pri. Imp. 6800 Ohm, C.T. 500 MA. Sec. 4600 Ohm 400 MA. **NEW!**  
Sec., 2300 Ohm 800 MA. **\$18.95**  
WEIGHT: 55 lbs.
- AMERTRAN TRANSFORMER  
5 VOLT, 190 Amp. Pri. 105-125 V. 25 KV. **\$15.95**  
Ins. Sig. Corp. 2C6383A/13.
- SELSYN MOTORS 110 V. 60 CYCLE  
Heavy brass jobs. Weight, 17 3/4 lbs. per pair. **NEW!**  
USED: \$9.95 pair. **\$19.95**
- SUPER PRO SECOND FILTER CHOKE  
50 Henry 110 MA 1150 Ohm DC Res. **\$2.45**  
**79c**
- SHIELD FOR 3" SCOPE TUBE.....
- BUD OSC-1 10-20-40-80-160 METER **NEW!**  
Oscillator and Buffer Band Switch Ass'y. **\$2.95**  
50 W.
- BUD JC-1560 DUAL TRANS. VAR. COND. **\$2.95**  
80-80 MMF Max. .078 Air Gap.
- BUD CE-2034 DUAL TRANS. CONDENSER **\$1.65**  
75 MMF per Section. .030 Air Gap.
- RELAY-SENSITIVE S.P.D.T. **\$1.95**  
10K Ohm Coil. Closes at 15V. 1 MA.

### Complete Kits • All New • Special!

- 100 INSULATED RESISTORS  
RMA color coded, 1/4, 1/2, 1, 2 watt. **\$1.75**  
Contains over 50 values. Complete Kit.
  - 100 CARBON NON-INS. RESISTORS  
RMA color coded. Well known makes, 1/4-2 watts. **95c**  
Contains over 25 values. Complete Kit.
  - 50 RF CHOKE COILS  
All sizes for plate, grid, filament circuits. Includes popular 2.5 MH chokes. For Trans., TV, Osc., etc. **\$1.45**  
Complete Kit.
  - 50 MICA CONDENSERS  
Over 20 values, incl. silver mica types. Complete. **\$1.75**
  - 25 PRECISION WIRE WOUND RESISTORS  
Well known brands. Incl. over 20 values. **\$1.95**  
Complete Kit.
  - VOLUME CONTROL KIT  
15 types, incl. carbon and wire wound S.D. and shaft types, some with switch. Complete Kit. **\$1.95**
  - 50 CERAMIC CONDENSERS  
Over 30 values. CODED. **\$1.95**
  - 50 BY-PASS CONDENSERS  
Tubular. Bakelite molded, etc. Popular values. **\$1.75**  
For all purposes. GUARANTEED.
  - 20 ELECTROLYTIC CONDENSERS **ONLY**  
Tubular with leads, FP types, upright mount. **\$2.25**  
All popular numbers. GUARANTEED.
- Check this terrific buy!!!

Prices F.O.B. Phila.—Check or M.O., no C.O.D.'s  
 Please include postage. Balance promptly refunded

## THE ELECTRIC SPOT

132 S. 11th St. PE 5-9146 Phila. 7, Pa.

## STAR SPECIAL!

### Genuine Polaroid Filters

Here's a buy you can't afford to miss! Genuine Polaroid filters are easy to install and fit every type of TV receiver. Provide greater enjoyment of television reception. Dissolve fuzzy grays, snap up blacks, sharpen detail, provide restful tinting to cut down eye strain. This is your chance to save over 60% on a genuine Polaroid filter. It will pay for itself over and over in greater enjoyment of TV programs.

**\$2.59**

10-inch Filter, (List \$10.00), now only...**\$2.59**  
 12-inch Filter, (List \$12.50), now only...**\$3.59**

COMPLETE STOCKS  
 All Standard Brands **Just off the press**  
**BIG BARGAIN BULLETIN**

**STAR ELECTRONIC DISTRIBUTORS, INC.**

Dept. RN 2-7736 S. Halsted, Chicago 20, Ill.

RADIO & TELEVISION NEWS



recorded as often as desired on conventional discs or seven-inch tape. The ability to obtain excellent results with a comparatively light weight tape recorder seems to indicate a much wider market for recordings among individual members of dance bands, high school and college groups, and other musical associations.

From a personal standpoint, tape is even cheaper than the new LP records if twin-track operation is used at seven-and-one-half inches per second. The long playing feature is retained and the additional advantages of low noise level, excellent transient response, and freedom from dust, needle wear, and turntable rumble, and eventual reuse, if desired, are included. In building up a tape library a number of factors may be considered. Reels which are to be kept should be clearly marked to avoid accidental erasure, while separate selections on the reel may be easily identified by means of colored crayon marks on the back of the tape. Reels should be stored where they will not be subjected to high temperatures.

Program material may be obtained by re-recording rare discs from your own collection or that of friends, or by recording radio, particularly live FM, broadcasts. First hand recordings of community musicians and concerts often provide an excellent source of material and in some instances are definitely preferred to conventional recordings of well-known artists. In addition, at least one company, the *Amplifier Corp. of America*, has released a catalogue of various selections on tape, with the likelihood that others may follow suit.

In conclusion, a few notes on microphone technique might be advisable. Due to the fact that there is no physical inertia in the tape recording mechanism and no adjacent grooves to overcut, it is possible to record percussion instruments with excellent brilliance and clarity. As a result it is not necessary to place the microphone away from these instruments and the experimenter may indulge his taste for good, heavy bass drum or crashing cymbals. In order to provide the excellent detail that a tape system is capable of recording, a crystal microphone is specifically recommended as an excellent means of picking up transients and low level sounds, and, with a good operating recording and playback system, provides a smooth, clear, approximation of the original sound.

However, as listening tastes may vary greatly with the individual, some constructors may prefer the less brilliant reproduction of a dynamic microphone. Similarly, no specific equalization circuits were included in the amplifier schematic, other than a simple tone control, as proper equalization will depend upon the associated equipment used as well as the constructors' tastes.

-30-



## CONICAL "V" BEAM ANTENNAS

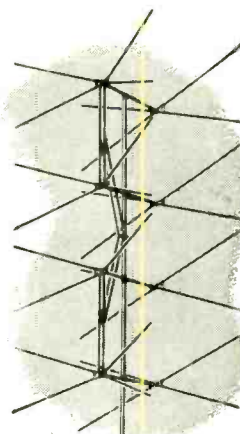
MODEL 1X-BD  
Bi-Directional Hi-Gain  
Conical "V" Beam



- TRUE CONICAL PERFORMANCE WITHOUT BULKY METAL CONES
  - THE ONE ANTENNA FOR ALL CHANNELS PLUS FM
  - NO HIGH FREQUENCY HEAD NEEDED
  - HIGHEST GAIN — CONSTANT CENTER IMPEDANCE ALL CHANNELS
  - BETTER THAN 12 DB FRONT TO BACK RATIO ALL FREQUENCIES
  - ALL ELEMENTS MADE OF HIGH STRENGTH DURAL
  - MODELS FOR HIGH BUILDING, CONGESTED AND FRINGE AREAS
- TO BE SURE IT'S A CONICAL "V" BEAM  
... LOOK FOR THE TELREX TRADEMARK

"These features are the reason we install TELREX antennas exclusively in our area"

We know from experience that genuine Telrex Conical Antennas will do the job right—every time. Whether it's a high signal or fringe area installation on roof, chimney, sidewall or apartment window, Telrex means a better picture and a lasting installation. Since we started using Telrex exclusively, our service callbacks due to antenna failure have been eliminated. Our selling area has been broadened, also. Many of our customers are getting excellent pictures with sets \*200 miles from the transmitter.



MODEL 8X-TV  
Super Hi-Gain  
4 Bay Stacked Array

\*TV paths over land. On all-water paths, TELREX antennas are performing satisfactorily over distances up to 300 miles.

QUALITY ACCESSORIES  
FOR CHIMNEY, ROOF  
SIDEWALL MOUNTING

Ask your distributor  
for complete data or write  
for illustrated catalog.

Telephone—ASBURY PARK 2-7252



AMERICA'S  
OUTSTANDING  
TELEVISION  
BEAM

ASBURY PARK 7, N. J.

# At last—a built-in booster!



CHASSIS FOR 16" OR 19" CRT  
25 TUBES PLUS 4 RECTIFIERS

... brings 'em in  
out of the snow



**FRINGE AREAS**  
now can enjoy excel-  
lent reception with-  
out cumbersome,

costly external boosters! Craftsmen Television alone gives you a built-in booster that literally brings a picture right out of the "snow"—gives a 10 db. video boost simply by shifting a knob! Unparalleled performance, and it will not interfere with audio reception.

**HIGH-FIDELITY SOUND** available through cathode-follower audio output. And RC-100 television—engineered from the mounting bolts up for big picture operation—is twice as sensitive as before! Automatic phase control of both vertical and horizontal synchronization guarantees perfect interlace. Keyed AGC, too. Will accommodate UHF channels.

**COMPLETE THE PICTURE** with Craftsmen high fidelity audio—RC-8 FM-AM tuner featuring automatic frequency control that entirely eliminates drift, and RC-2 high fidelity amplifier.

THE RADIO  
**craftsmen**  
INCORPORATED

Write for information—or send 50¢  
for instructions and schematics.

Dept. D, 1617 S. Michigan Ave., Chicago 16, Ill.

## Mini-Rack Transmitter

(Continued from page 47)

is no necessity for extreme isolation between the input and output circuits. For this reason, a less expensive 6V6GT may be substituted in the buffer stage without appreciable loss in efficiency. With either tube, plenty of output is obtained to drive the final amplifier for plate modulated phone operation on ten meters.

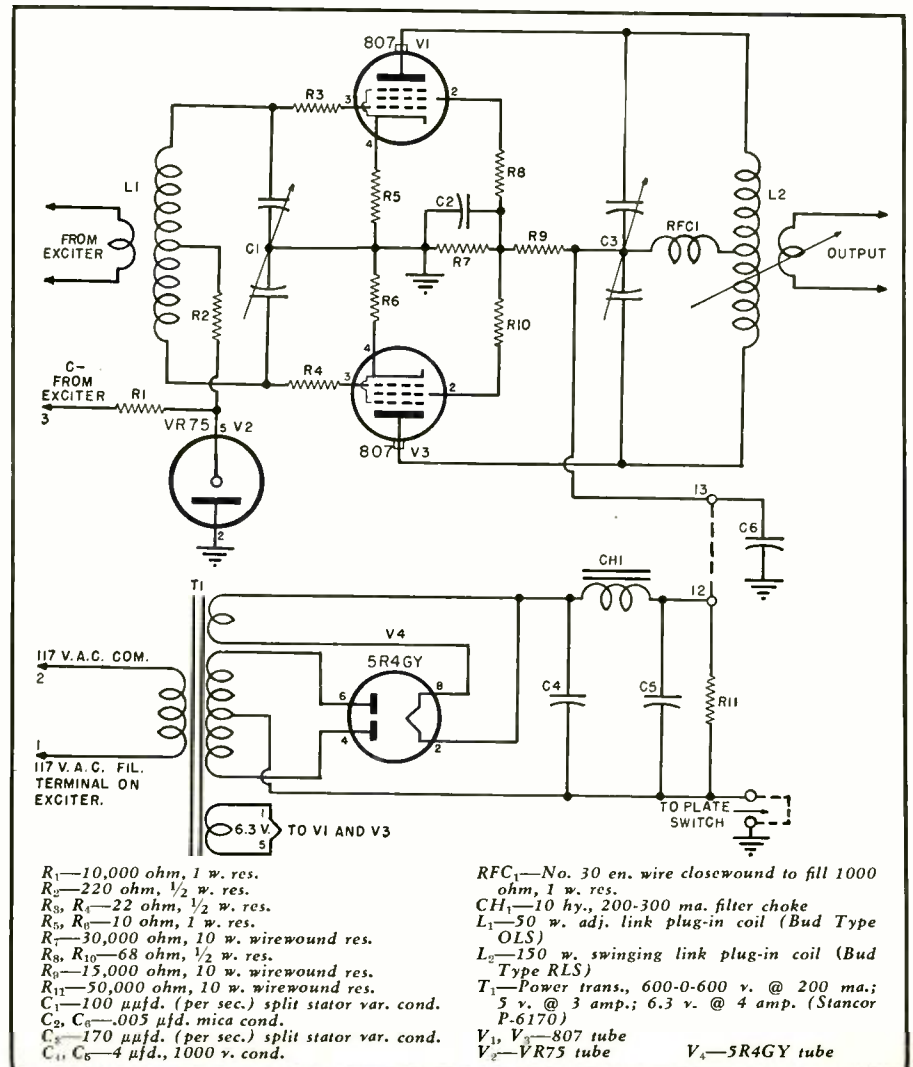
The construction of the push-pull 807 stage is evident from the photographs. Only a single baffle shield is used between the grid and plate circuits, but the axis of the grid coil is at right angles to the plate coil axis to minimize electromagnetic coupling between them.

Either a VR75 or a VR90 may be used for the bias voltage regulator although a VR90 adheres a little closer to the published recommended operating condition for phone. At either bias voltage the key-up plate current is zero. Following standard practice for 807's, parasitic suppressing resistors are used in grid, screen, and cathode leads.

It is sometimes found that it is impossible to load an amplifier up to rated power input with commercial "swinging link" coils, even with the link fully meshed with the tank coil. This condition indicates that the loaded tank circuit "Q" is too low. Since the loaded tank "Q" is directly proportional to tuning capacity, the remedy is a decrease in the L/C ratio. It was found necessary to short out two turns on each end of the Bud 40 meter plate coil to secure proper loading. A "Q"-meter test of the coil showed that the unloaded "Q" was only slightly reduced by the shorted turns so the tank efficiency is reduced by this measure by only a negligible amount.

The power supply for the final amplifier is inexpensive and constructed using a widely available power transformer. A single 5R4GY rectifier will deliver the 200 ma. output without difficulty. Mercury vapor rectifiers have been avoided because of the "hash" they usually radiate to the receiver. With a somewhat larger-than-necessary (300 ma.) filter choke which happened to be available, the power supply output voltage is 600 volts at a load of 200 ma. Switches were omitted from the power supply since a sepa-

Schematic diagram of the 100 watt final amplifier unit.





# MICROWAVE

Write for Flyers of Exceptional Microwave Plumbing Buy Just Received from Well Known Company

## 1.25 CENTIMETER

- "K" BAND MIXER ..... \$49.50
- "K" BAND FEEDBACK TO PARABOLA HORN with pressurized window ..... \$30.00
- MITRED ELBOW cover to cover ..... \$4.00
- TR/ATR SECTION choke to cover ..... \$4.00
- FLEXIBLE SECTION 1" choke to choke ..... \$5.00
- ADAPTER, rd. cover to sq. cover ..... \$5.00
- MITRED ELBOW and S sections choke to cover ..... \$4.50
- WAVE GUIDE 1/2 x 1/4 per ft. .... \$1.00
- "K" BAND CIRCULAR FLANGES ..... \$0.50
- 3J31 "K" BAND MAGNETRON ..... \$55.00

## TEST EQUIPMENT

### MODEL TS-268/U

Test set designed to provide a means of rapid checking of crystal diodes IN21, IN21A, IN21B, IN23, N23A, IN23B. Operates on 1/2 volt dry cell battery 3x6x7. New ..... \$35.00

## CRYSTAL DIODES

No.	Each	2 for	10 for
IN21	\$1.00	\$1.79	\$ 8.30
IN22	1.50	2.79	14.00
IN23	1.50	2.79	14.00
IN26	3.00	5.90	27.50

10CM ECHO BOX CABY 144BA-1 or OBU-3 2890 MC to 3170 MCS direct reading micrometer head. Ring prediction scale plus 9% to minus 9%. Type "N" input Resonance indicator meter. New and Comp. w/access. Box and 10 CM Directional Coupler. .... \$350.00

3 CM RECEIVER. SO-3 Complete with W.G. Mixer Assy. (723-A/B). Reg. Fil. Power Supply. 6 stages IF (6ACT) ..... \$99.50

10 cm. horn assembly consisting of two "N" dishes with dipoles feeding single type "N" output. Includes UG28/U type "N" "T" junction and type "N" pickup probe. Mfg. cable. .... \$15.50 New

10 cm. cavity type wavemeters 6" deep 6 1/2" in diameter. Coax. output. Silver plated. .... ea. \$64.50

10 cm. echo box. Part of SFI Radar W/115 volt DC tuning motor. Sub. Sig. 1118AO. .... \$47.50

THERMISTOR BRIDGE: Power meter I-203-A. 10 cm. mfg. W.E. Complete with meter, interpolation chart, portable carrying case. .... \$72.50

W.E. I 138. Signal generator. 2700 to 2900 MC. range. Lighthouse tube oscillator with attenuator & output meter. 115 VAC input reg. Pwr. supply. With circuit diagram. .... \$150.00

3 cm. wavemeter. Ordnance type micrometer head. New: Absorption type. .... \$85.00

9000-9500 MCS Transmission type. .... \$92.50

SL wavemeter. Type CW60ABM. .... \$125.00

TS 89/AP Voltage Divider. Ranges 100: 1/2 for 2000 to 2000v. 10:1 for 200 to 2000v. Input Z 2000 ohms. Output Z 4 meg. ohms. flat response 150 cy to 5 meg. cy. .... \$42.50

AS14A/AP—10 cm. Pickup Dipole with "N" Cables. .... \$4.50

TS235 UP Dummy Load. .... \$87.50

10 cm. Wavemeter. WE type B435490 Transmission type. Type N Fittings. Veeeder Root Micrometer dial, Gold Plated W/Calib. Chart. P/c Freq. Meter X66404A. New ..... \$99.50

## WAVEGUIDE

1/2" x 1/4" OD	\$1.00 per foot
1" x 1/2" OD	1.50 per foot
5/8" x 1/2" OD	1.65 per foot
5/8" x 3/4" OD Aluminum	.75 per foot
1 1/2" x 3" OD	3.00 per foot
2 1/2" x 3" OD	3.50 per foot
1" x 1/2" OD Flexible	4.00 per foot
7/8" rigid coax 1/4" IC	1.20 per foot

(Available in 10 ft. to 15 ft. lengths or smaller.)  
 UG 65/U 10CM flanges ..... \$6.75 each  
 UG 35/U Cover ..... 4.00 each  
 UG 54/U Choke ..... 4.50 each

Full Line of UG Connectors in Stock Immediate Delivery  
 AMPHENOL "AN" CONNECTORS Large Variety Available At Great Savings  
 Send Us Your Spe... Let Us Quote

**BC-929 SCOPE**  
 8 Tubes: 1-3BP, 1-6SN7, 2-6H6, 1-6CG, 1-2X4, 1-6X4. Good deal for conversion. For use as Test Scope. We tried it and it worked by using 50 watt bulb and the marker pipe went up. Excellent cond. .... \$21.50  
 Originally \$75.00

**SCR-522 VHF XMTR-RCVR**  
 10-tube, auto controlled revr. 7-tube Xmtr. Makes ideal 2-meter, 2-way mobile rig. 100-156 mc. w/ tubes. Price ..... \$34.95

**MINE DETECTOR**  
 AN/PRSI for locating metal, pipes, gold, treasure. .... \$12.74  
 With batteries ..... \$21.76

**BC-620 Mobile FM Transceiver—11.0.**  
 SCR-610. Includes 10 meter band. Excellent condition with tubes. \$15.95  
 PE-120 Power Supply with tubes—less Vibrator and Cond. .... \$5.50  
 Combination BC-620 and PE-120. Both packed in knapsack. .... \$20.95

**GIBSON GIRL**  
 The Emergency Radio Transmitter. Sends S O S signals automatically on 500KC. 150-mile range. No batteries required. Has hand-driven generator, tubes, w/ all packed in knapsack. New. It's only ..... \$4.95

**BC 223 XMTR**  
 30 Watt Transmitter with crystal oscillator control on four pre-selected channels—also master oscillator. Frequency coverage 2000 KC. to 5250 KC. by use of three plug-in coils. Five tube operation. 801 oscillator, 801 power amplifier two 46 modulators, and one 46 special amplifier. Price with TUI8 Tuning Unit. 3-4.5MC or 3.5-5.2 MC. .... \$23.95

**Birtcher Tube Clips**

926C	926-C15
926-16	926-C13
926-81	926B
926-88	13c ea.
926B-16	100 for
926B-18	100 for
926C-19	\$12.00 for
926C-21	1000 for
926-A11	10c ea.

**SCR 183 REC. TUNING UNITS**

D—Range 850-1330 Kc	
F—Range 1330-2040 Kc	
E—Range 2.04-3 Mc	
G—Range 3-5 Mc	
H—Range 4-6 Mc	
K—Range 9.05-13.5 Mc	
Dual Range 400-600 Kc	
6-9 Mc	

\$1.95 EACH

**SCR 183 TRANS TUNING UNITS**

1-1.2 Mc	\$1.49
1.2-1.5 Mc	1.49
3.2-4 Mc	1.49
5-6.2 Mc	1.49
4-5 Mc w/4895 Kc XTAL	2.95

Many Others

**TUNING UNIT FOR BC 223**

TU 18A 3-4.5 MC.	\$2.50
TU 25 3.5-5.2 MC.	\$2.50

Price

**MOUNTINGS**

FT 234A For 274N Trans	
FT 232A For 274N Trans	
FT 225A For 274N, BC45B	
NT 62 For ARC 75 ARR2	
MT 78/ARC5 Control Unit	
MT 85/ARC5 Junction Box	
FT 141 B3459	
MT 80/ARC5 Junction Box	
FT 282A P/c PEI 13VA	
FT 308A P/c PEI 13VA	
MT 167/U SAR	
FT 340 P/c SCR 540	
FT 263A P/c BC-011	
MT 171A/U SAR	
MT 7/ARR2 R4/ARR2	
MT 5/ARR2 684x1084	

Write for Many Others

**VARIABLE TRIMMER CONDENSERS**

C714 3.2-42Mmf.	19c
C713 2.8-27Mmf.	
C717 2.8-35Mmf.	ea.
A289 3-25Mmf.	
1741 3.0-50Mmf.	

Write for Other Values

**ARC 3 complete Audio Modulation XMTR**  
 jkK, T103 Carbon Mike to Grid. .... \$95  
 T102 615 to PP 616 Grids (Modulation) 1.15  
 T104 Mod. XFMR PP 616 to 832 or 828 Plates ..... 1.49

**COMPLETE KIT \$2.98 OF THREE**

**SUPER PRO EQUIPT.**

1st and 2nd RF 10-20 MC Coil PT-2A 11. — RF ANT OTPT 1. 2.5-5 MC Coil SA-116. — ANT INPT 200-400 KC Coil SA181. — ANT INPT 200-400 KC OSC 2.5-5MC Coil SA118. — ANT OTPT 10-20 MC Coil SA110. Price Each ..... 65c

**M.O. COIL**  
 1800-2250KC  
 1 1/2 Collins 32RA Plug In ..... 59c

**VARIABLE CERAMICONS**

MMF	Price
95-220	20c
400-520	20c
10-160	20c
5-50	20c
20-160	20c
200-350	20c
Set of 6	\$1.00

**T.V. Transformer, 7" or 9" 300V / 5 MA, 720 VET / 200 MA, 6.4 / 8.7A, 6.4 / 6.4 A, 1.25 / 3A.**  
 New. Pr. .... \$4.95

**BC605 INTERPHONE AMPLIFIER**  
 Easily converted to an ideal inter-communications set for office, home- or factory.

**Heineman Ckt Bkrs. For AC-DC Operation.** Add here a sig. Corp. ant. must 80, 100, 150, 180, 200, 250, 300, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 950, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 6000, 6100, 6200, 6300, 6400, 6500, 6600, 6700, 6800, 6900, 7000, 7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, 10000. .... \$1.45

**ANTENNA MAST**  
 Are you in a dead spot? If you can't get a good T. V. picture here is a sig. Corp. ant. mast 30" high of rugged plywood construction to solve your problem. It telescopes into 3" ten ft. set, for easy storage. Easy to Mt. Comp. with stakes & rods. Each ..... \$19.95

**MS49 and MS50 Dipole Antenna, 74" long. Both for \$4.95**  
 Cable Clamp Assortment  
 Tinnerman, etc. 50 for ..... \$1.00

**Remote Control CABLES**

2MC215	MC124	Mfd	Price
34"	65"	1	200V
190"	52"	1	50.15
260"	29"	5	400V
186"	13"	2	.18
77"	103"	4	.30
183"	63"	1	600V

Many Others

**METERS**

0-5MA Sq. 2" Metal Case	1	.20
0-500MA Sq. 3" Itake Case	2	\$.95

**TELEVISION TRANSDUCER**

2300V 4MA,	Mfg. Vol. Price
2.5/2A	\$6.49
1080VCT 55MA,	1000 3V .85
0.3 / 1.2, 6.3 / 1.2	500 6V 1.45
	2000 6V 1.45
	225 15 .30
	800 15 .98
	1000 15 .85
	500 50 .95
	6000 12 1.35
	9000 12 2.00

Write for Flyer of 100,000 New Electrolytics in Stock.

**Electric Motor 115V 60CY 3500 RPM 3/4"x2x1 1/2" 3/4" L Shaft**  
 Each ..... \$1.95

**SOUND POWERED PHONES**  
 Complete. No batteries required. Water proof brand new. Leather case. 1201 w/ r/ringing CK. operation more than 27 miles. Pair. .... \$37.50

**VFO CAPACITOR**  
 High Grade Unit. Consists of 3 Gang Capacitor. 20 mmf per sect. Ceramic ins. Low drift w/ Worm Gear (reduction) 1201 w/ r/ringing Shaft and Veeeder 4 digit Counter. .... \$3.95

**ROTARY BEAM COUPLER**  
 RF Coupler 360° rotation 1 turn coupling link. Easy to adjust to 300 MC. Plastic case mount on side. Price. .... \$2.95

**Hi Gain Dynamic Mike Xfmr**  
 Comb hi-gain DynMikeXfmr UTC/Super Elec 3wdg.600ohm CTx400ohms Tapped 250x150 ohms. Fully Shielded E'shd. Price Each ..... 49c

**VEEDER COUNTER**  
 Counts to 9999 and repeats. Many uses. 1/2" shaft front meas 1 x 1 1/2". Price 98c.

**Soldering Iron 200W**  
 121-130V iron 5/8" removable copper tip. Heats in a minute. Complete with cord & plug. New with stand ..... \$3.95

**LEARN OR TEACH CODE**  
 Uses 6-2 24-115V DC or 115-230V AC. Can use hookup of over 20 students. Contains 10 keys, speaker, blinker, freq control, etc. in fiber trunk 17"x13"x10 1/2". New. Price. .... \$29.50

**Solar Trimmer Condensers**  
 Asst. 100 Pcs. .... \$2.95

**XMR COILS AIR WOUND**

80 MTR Bar Prong 100 w 40 MTR. 5 Prong 50w plug in socket. .... \$1.19
160 MTR. 5 Prong 50w plug in socket. .... \$1.19
40 MTR 3 Prong Ea. .... \$1.19
C-538 2-3.5 MC. 30wv Fix. Link. .... \$1.19
2-1735 2-3.5 MC. .... \$1.19
Var. Link. .... \$1.19
C-390 5-7 MC. 30wv Fix. Link. .... \$1.19
160 MTR Bar Type ..... \$1.19

**UHF ANTENNA**  
 12"/30cm AT5/ARR1 Convertible Citizens Band Thrulead Coax Term Insulated Silly Pl Cont w/ waterproof gas. Range & hardware for MOBILE mtg. BRAND NEW 39c; 4 \$1.00 PE-59 for Above. 23c ANT AN1308 Spring Swivel Lead Whip, 33" lg. SPE. C13A. .... 95c

**SELSON MOTORS**  
 115V A.C. 60 cycle 1 No. C-78248. Can be used to turn small antennas or as indicators. Size 3 1/2" x 5 1/2" x 3". Price per pair. .... \$6.95

**MOSSMAN**  
 Switch. 4PST. N.O. and N.C. .... \$1.10

## CONDENSERS FAMOUS MAKES BRAND NEW

Mfd.	Volt	Price
15	250VAC	\$ 2.20
15	400	.50
1	600	.45
6	600	.98
7	600	1.05
5	750AC	1.69
7	800	1.20
5	1K	.75
2	1K	.99
4	1K	.98
10	1K	1.95
15	1K	2.20
25	1.5K	1.05
1	1.5K	.89
1.5	1.5K	.95
2	1.5K	1.05
6	1.5K	2.25
1	2K	.98
1	2.5K	1.20
15	4K	2.95
1.1	4.8K	2.95
4	5K	2.95
1	6K	2.79
15.15	6K	3.95
1.5	6K	9.75
1.1	7K	3.35
1	7.5K	2.95
1	7.5K	12.95
15.15	8K	4.95
1	10K	14.95
.0016	15K	7.95
15	15K	30.95
.05	15K	6.95
5	20K	16.95
.5	25K	36.95
1	25K	83.95
4	50	.29
1	100	.15
2.5	100	.23

## MICA CONDERS

.027	600VDC	\$0.92
.0015	1000VDC	.36
.00175		.55
.00095		.49
.00137		.98
	1200VDC	
.000075		.59
.0002		.59
	2000VDC	
.00003		.98
.01	2500VDC	1.64
	2500VDC	
.00025		.38
.005		1.00
.000047		.79
.0001		.39
.00051		.54
	3000VDC	
.0001		1.59
.0004		1.25
.002		1.60
	5000VDC	
.0035		.98
.006		1.95
.0015		.70
.0043		.98
.0002		2.70
.0008		2.70
.0004		2.70
.00075		2.70
.005		2.50

## RF CHOKES

1MHY	125MA	\$0.23
1.9-2MHY		.10
2.5MHY		.10
3.0MHY		.89
3.2MHY		.10
3.3MHY		.10
3.6MHY		.10
5.2MHY		.39
200MA		.39
5.5MHY		.98



# Easy on the Ears...



## TELEX Monoset\*—Under Chin Headset

Stethoscope design of the Telex *Monoset* eliminates tiresome pressure—instrument swings lightly under the chin. Wear it for hours without fatigue!

## TELEX Earset\*—Slips onto the Ear

Weighing only 1/2 oz., *Earset's* flat plastic frame slips onto the ear, holds the sensitive receiver securely in place. User's other ear is always free for phone calls or conversation.



## TELEX Twinset\*—Nothing Need Touch Ears!

Lightest twin-receiver headset made—weighs only 1.6 oz. Adjust to any head. Flexible, slips into pocket.



Write for Colorful FREE Specifications Folder Today!

# TELEX

DEPT. H-20-3, TELEX PARK  
MINNEAPOLIS, MINNESOTA

In Canada, Atlas Radio Corp., Toronto



rate switching panel is built into the operating table. The final power supply is switched on and off with the transmitter filaments. Since the bias voltage is applied instantly, the power supply remains unloaded (except for the bleeder) until the key is pressed. A switch should be used in either the "B plus" or "B minus" lead of the final power supply to turn the final amplifier off when zero-beating the exciter on another signal.

## CLAMP-ON HOLDER

By ARTHUR TRAUFFER

HERE is a handy and easily made accessory for your mike that allows the unit to be clamped onto an object, or held in your hand.

Buy a photolamp clamp (these can be bought separately in many photo shops and electrical supply houses) and saw off the ball, as shown in the sketch Fig. 1A. Now, remove the coil spring from the male half of a mike cord connector, and solder the connector securely to the top of the clamp, as shown

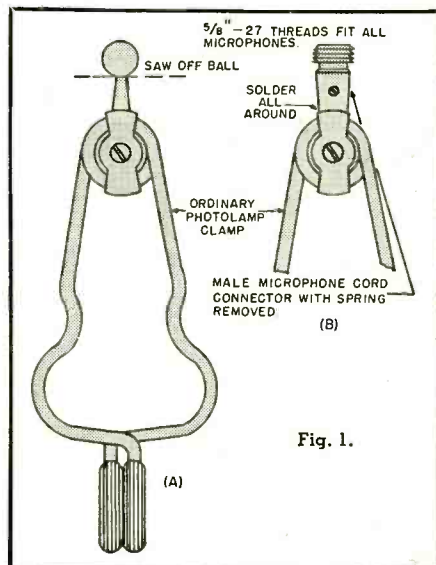


Fig. 1.

in the sketch of Fig. 1B. Now you can screw your mike head onto the clamp and clamp the mike most anywhere.

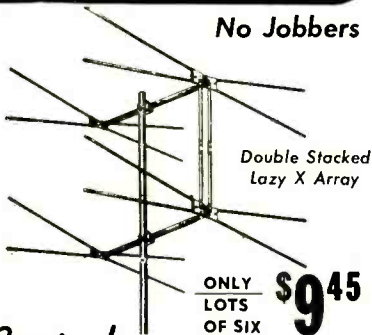
The clamp can also be held in the hand when desired, yet the clamp screws off easily when you want to put the mike head on a floor stand. Fortunately, the male mike cord connector has a standard 5/8-27 thread that fits all microphones.

Microphone "clipped" to chair back by means of the removable clamp-on holder assembly.



## TV Antennae Direct from Manufacturer

No Jobbers



Double Stacked  
Lazy X Array

ONLY  
LOTS OF SIX \$945

SINGLE  
ORDERS \$990

### Conical

### TV RECORD BREAKER

Users report up to 300 mile reception. Increases TV sales in fringe areas.

Matches any ohm wire.

Also all types of brackets, guy rings, U-bolts, masting, TV wire etc.

Write - Wire - Call

## WOODLAND MFG. CO.

416 Woodland Ave. • Toledo 2, Ohio

# ACORN

## BEACON RECEIVER

BC-1206-CM

Made by Setchell-Carlson

Frequency range—195 KC to 420 KC. IF Frequency—135 KC. Power supply 24-28 volts. Comes complete with 5 tubes. Includes instruction booklet.

**\$645**

BRAND NEW

### TRANSFORMERS

**Thordarson Power Transformer**

Pri. 115 v., 60 cy. Sec. 900 v. c.t. @ 100 mls. 5v. @ 3 amps. 6.3 V. @ 3 amps. Half shell mounting.

**\$249**

Only

**6L6 OUTPUT TRANS.**

Class AB, p.p., 20 w. output, 6000 ohms per plate. V.C. 4, 8, 15 ohms.

**\$169**

VERY SPECIAL

**STANCOR INTERSTAGE TRANS.**

P.P. plates to parallel or p.p. grids. Upright mount. Max. pri. DC 15 mls.

**\$119**

Special 3 for \$3.25

### 10" SPEAKER

Quam - Nichols. Alnico V, 6.8 oz. magnet. 13 w. output. 3.2 ohm v.c. List \$14.

**OUR PRICE \$399**

### TV COMPONENTS

for 630 or OTHERS

**VERTICAL OUTPUT TRANSFORMER**  
R.C.A. Type 204-T2  
for R.C.A. 201-D1 or 201-D2 Deflection.

**\$249**

Bargain

<p><b>HORIZONTAL BLOCKING OSCILLATOR TRANSFORMER</b></p> <p>R.C.A. 208-... <b>\$129</b></p>	<p><b>HORIZONTAL OUTPUT TRANSFORMER</b> Fly-Back Transformers</p> <p>10" - 211-T1..... <b>\$3.89</b> 12" - 211-T3..... <b>3.89</b> 16" - 211-T5..... <b>4.95</b></p>
---	--

TERMS: 20% cash with order. Balance C.O.D. All prices F.O.B. our warehouse in New York City. No orders under \$2.50.

Phone: WOrth 4-3270

## ACORN ELECTRONICS CORP.

76 Vesey Street, Dept. N-3, New York 7, N.Y.



# NEW TV PRODUCTS On The Market

## 19-INCH CONSOLE

Garod Electronics Corporation of 70 Washington Street, Brooklyn 1, New York is in production on a 19-inch



television console, "The Claridge," which provides a 203 square inch direct view screen.

Designated the Model 1900, the new console is housed in a hand-rubbed mahogany cabinet which measures 25 inches wide, 45 inches high, and 22 inches deep. The new Garod "Picture-Lock" tuner has been incorporated in this set.

## EMERSON CONSOLE

Delivery is under way on the new 12½ inch television console, Model 647, according to word received from Emerson Radio & Phonograph Corporation of 111 Eighth Ave., New York 11.

Among the new features of this set is the super-powered circuit for providing satisfactory reception even in fringe areas. The receiver is equipped with a built-in antenna designed for maximum performance in most localities without the use of outdoor or separate in-the-room antennas.

An acoustically constructed console cabinet of pin-striped mahogany veneer houses the new chassis and the 12 inch Alnico 5 dynamic speaker. The set has the new "Simplimatic Tuning" for minimum controls.

## TELEVISION TOWER

The Energy Farm Equipment Company of Monticello, Iowa has developed a telescopic hydraulic tower which is suitable for both television and amateur antennas.

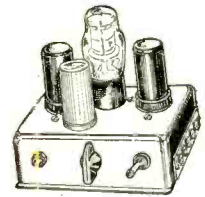
Available in either 3 or 4 section models, the 4 section unit is 68 feet fully extended and the 3 section model is 54 feet. Installation may be effected

## NARROW-BAND PHASE OR FREQUENCY MODULATION

**Sure-fire results! Top-dollar value!**

Here's an opportunity to provide yourself with an effective NFM or NPM unit at small cost. Use instead of AM during early evening hours and avoid BCI... also the most economical method for putting a good phone signal on the air... low-power or a full KW! Units come to you in complete kit form. Three tubes, all necessary components, fabricated aluminum chassis. Step-by-step assembly and wiring instructions... circuit and plan wiring diagrams. Tried and proved circuits assure positive results. FM-3 connects across frequency-controlling circuit of your ECO and is suitable for use on all phone bands. PM-3 connects to plate of ECO or buffer and used when stage is on or near 160. Suitable for 20, 10 and higher. Does not materially affect ECO calibration. Both units have VR-150 for voltage stability.

FM-3R—N.B.F.M., Frequency-modulated kit.....only \$8.45  
PM-3R—N.B.P.M., Phase-modulated kit.....only 8.45



### CLIP THOSE IGNITION PEAKS!

Use this effective, double-diode circuit between receiver output and headphones to maintain noise and signals to any desired level! Works on both positive and negative peaks. Has switch for IN-OUT and control for wide range of signal level... input and output jacks. Use with any receiver. Kit is complete—tube, all parts, complete assembly, testing and wiring instructions. Simple! Highly effective.

NL-6R for 6V fil.....complete \$4.20  
NL-24R for 24V fil.....complete 4.58

### SPEECH "CLIPPER" KIT

Same as above except high impedance for interstage use in speech amplifiers. Clipping level fully adjustable to permit higher average percentage without overmodulation.

SP-6R (6V fil.).....complete \$4.20



### INCREASED RECEIVER OUTPUT TO HEADPHONES!

Use these matching transformers to obtain big increase in output when using hi-imp. phones with the average receiver. (300-600 ohms.) Use also with FL-8 filters for greatly improved results. Hermetically sealed, plated brass case, good LF response. Imp. ratio approx. 10:1.

An excellent value at.....95c ea.  
Special hi-ratio for 75A receivers.....95c ea.

### Power Supply for Any 274-N Receiver

Here it is—at last! 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. All necessary parts for conversion of rest of receiver also included. ONLY \$7.95. TUNING KNOB for 274-N Receiver. 59c ea.



### 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 in rich black wrinkle. Felt facing protects handset. Provision to fasten directly to desk or to telephone equipment. An extremely useful, well-made item.....\$1.95 ea.



6L6 METAL..90c ea. Four for \$3.40

6L6 GLASS..79c ea. Four for \$3.00  
BRAND NEW...STANDARD BRANDS



### HANDSET HANGER

Accommodate all makes and models. (Kelllogg, W-E, American etc.) Beautiful, cast aluminum shell finished in rich black wrinkle. Felt facing protects handset. Provision to fasten directly to desk or to telephone equipment. An extremely useful, well-made item.....\$1.95 ea.

TS-10 Sound Powered Handsets

Brand New! \$16.95 per pair

RM-29A TELEPHONE: Brand New...\$12.95 ea.

EE-89A TELEPHONE REPEATER:.....\$9.95 ea.

### FL-8 FILTERS AND "FL-8 FILTER FACTS" BOOKLET

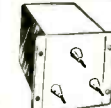
A sure bet for better reception, an FL-8. The low-down on the filter is given in "Filter Facts" booklet. See past issues RADIO NEWS for more complete dope on this fine duo.

FL-8 Filter and booklet—combo offer...\$2.98  
Booklet only. (Postpaid in U. S.).....50

### HOT SPECIAL ON OIL CAPACITORS

8 mfd., 1000V, oil-filled. Made by Aerovox. Rect. case grey finish, complete with mounting brackets.

4 mfd., 600V, oil-filled. Round case, upright single-hole mounting. With mtc. hardware.....95c ea.; 5 for \$3.75



### HEAVY-DUTY FILTER CHOKE

A hermetically sealed unit, conservatively rated at 50 henries @ 200 ma. Has hum-bucking tap. Steel cases—ONLY \$1.98 each.

### HI-LEVEL NEGATIVE PEAK CLIPPER! 836 RECTIFIER TUBES

Use an 836 high-vacuum, high-voltage rectifier tube. Ideal for "clippers"—no "hash" troubles. Same tubes also used to replace 866's in normal, high-voltage rectifier applications.

Rock-bottom price on a really "hot" tube 2 for \$1.10

High-voltage Filament Transformer for "Clipper" or Rectifier applications.

Phi. 110V. 60cy. AC. Sec. 2.5V @ 10A. 10,000V insulation.....\$2.76 ea.

### A SCOOP FOR A SCOPE!

Beautiful 5" cathode-ray tube, Type 5NP1. Green phosphor, medium persistence, standard type. 6.3V heater. Here is the heart of a good scope... at a scoop price. \$2.50 each



### OR... A SCOPE COMBO OFFER...

Use the following basic parts to make a good, simple scope suitable for checking modulation and dozens of other tests and measurements. Circuit is furnished.

1—5NP1, C/R tube  
1—40-volt transformer with heater windings for 5NP1 and 2X2 rectifier.  
1—2X2 hi-voltage rectifier tube.  
All three of the above items (with circuit) only...\$7.45

### TWO 810's... A FULL GALLON!

Opportunity knocks! Use two of these husky carbon-platers for a KW at a reasonable plate voltage. These triodes are easy to drive... simple to 2 for \$8.95 tame

### 805's... CLASS B AUDIO

The 805 is well-known as one of the few triodes that can be used zero bias for hi-power Class B modulators! Avoid those bias batteries and hi-drain bias supplies. Fit up with 805's..... 2 for \$6.50

### PROTECT COSTLY TUBES AND EQUIPMENT AGAINST OVERLOAD!

Here's a huy on a fast-acting, reset-type circuit breaker. Designed to trip at 220 ma; cinch to shut for higher currents. Excellent construction—panel or desk mount—use also as combo on-off sw. and bkr. Priced low because of quantity purchase.....89c ea.



### MOBILE MIKE

This mike leaves both hands free for mobile QSO's. Fastens to operator by simple snap strap. Western Electric button assures best quality obtainable from any carbon mike. Adjustable. Double action sw. operates push-to-talk or holds on. BRAND NEW only \$1.75 ea. POST-PAID IN U.S.A. and CANADA.

### BC-221 FREQUENCY METERS

Two models available. Metal case, used in good condition. With original crystal and calibration charts.....\$90.00 ea.  
BC-221 A-1. Brand new—new modulation. Original crystal and calibration charts.....\$125.00 ea.

### POWER SUPPLY KIT FOR BC-221

Contains all parts needed for BC-221 power supply including chassis and diagram.....only \$5.85

### SPECIAL PURCHASE—B6-624 RECEIVER

A few of these well-known UHF receivers from the SCR-522. Complete with tubes. Good, electrical and mechanical condition.....\$14.95 ea.

★ 4-HOUR MAIL-ORDER SERVICE. WE SHIP ANYWHERE.

20% DEPOSIT MUST ACCOMPANY ALL ORDERS. BALANCE C.O.D.

# OFFENBACH & REIMUS CO.

372 ELLIS ST. SAN FRANCISCO, CALIF.

'PHONE—ORdway 3-8551



**The NEW**  
**Automatic**  
**Radio**  
CUSTOM-BUILT  
AUTO RADIO

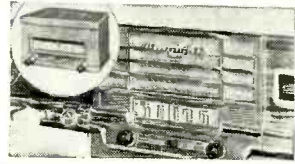
**RECORD SMASHING VALUES!**

**1949 and 1950  
CHEVROLET RADIOS**



List Price.....\$4995

**1949 and 1950  
PLYMOUTH-DODGE RADIOS**



List Price.....\$4995

**1949 and 1950  
FORD AUTO RADIOS**



List Price.....\$4995

**SPECIAL DISCOUNTS TO  
DEALERS**

**CUSTOM-BUILT  
BY**



Each auto radio is specifically designed to fit all 1949 and 1950 cars shown above and all incorporate the same outstanding features. . . Six-tube superheterodyne. Six-volt storage battery operation. Two dual purpose tubes. Eight-tube performance. Installation in a few minutes. Three-gang tuning condenser and tuned R.F. stage for extreme sensitivity. Permanent magnet dynamic speaker with Powerful Alnico #5 magnet. Low battery drain. Weight 10 lbs.

**SPECIALS**

**ATTENTION! BOAT OWNERS!**

- Famous Gibson Girl Distress Transmitter Complete With Flag and Parachute. NEW...\$9.85
- Gibson Girl Kit Includes 2 Balloons with Hydro Generators, Kite, Lamp, Wire. NEW \$8.95
- BC-433G Radio Compass Receiver with Tubes. Used. Excellent Cond. \$13.95
- 76 Feet Telescopic Aluminum Mast—Fully collapsed only 11 Feet. 7" Dia. @ Base. Tapers to 3 1/2" at Top. With Guy. Erection Poles and Lights. \$175.00

**CAPACITORS**

BATHUR	EA	TEN
40 mfd	25 VDC	\$0.30 \$0.25
50 mfd	50 VDC	.35 .30
50 mfd	50 VDC	.40 .35
4 mfd	100 VDC	.40 .35
2X.1 mfd	200 VDC	.15 .10
2X.1 mfd	400 VDC	.25 .20
2 mfd	400 VDC	.45 .40
.05 mfd	600 VDC	.20 .15
.25 mfd	600 VDC	.25 .20
1 mfd	600 VDC	.25 .20
2X.1 mfd	800 VDC	.35 .30
1 mfd	800 VDC	.45 .40
2 mfd	800 VDC	.45 .40
.05 mfd	1000 VDC	.50 .45
2X.1 mfd	1000 VDC	.55 .50
<b>OIL-FILLED AND GE PYRANOL</b>		
1 mfd	400 VDC	\$0.35 \$0.30
1 mfd	500 VDC	.40 .35
1 mfd	500 VDC	.30 .25
1 mfd	600 VDC	.35 .30
2 mfd	600 VDC	.35 .30
4 mfd	600 VDC	.55 .50
5 mfd	600 VDC	.60 .55
8 mfd	600 VDC	1.00 .90
1-8 mfd	600 VDC	1.00 .90
10 mfd	600 VDC	1.10 1.00
4 mfd	700 VDC	.65 .60
.5 mfd	1000 VDC	.45 .40
2 mfd	1000 VDC	.55 .50
.5 mfd	2000 VDC	1.10 .90
.5 mfd	3000 VDC	1.45 1.25
.5 mfd	3000 VDC	2.00 1.70
1 mfd	7500 VDC	2.60 2.30
1 mfd	15,000 VDC	4.25 3.75
.0045 mfd	15,000 VDC	6.95 6.50
.045 mfd	16,000 VDC	4.15 3.25

**PAPER**

2500 mfd	3 VDC	\$0.15 \$0.10
500 mfd	12 VDC	.50 .45
25 mfd	25 VDC	.25 .20
50 mfd	25 VDC	.25 .20
1000 mfd	25 VDC	.50 .45
150 mfd	50 VDC	.20 .15
2000 mfd	50 VDC	1.00 .90
500 mfd	200 VDC	1.00 .90

**TRANSMITTING-MICA**

.002 mfd	600 VDC	.15
.0005 mfd	2500 VDC	.20
.0009 mfd	2500 VDC	.20
.006 mfd	2000 VDC	.20
.00075 mfd	5000 VDC	.65
.000375 mfd	5000 VDC	.65
.007 mfd	5000 VDC	2.60
.008 mfd	6000 VDC	3.95
.002 mfd	8000 VDC	3.95
.005 mfd	8000 VDC	5.50
.0012 mfd	20,000 VDC	10.95

**SPECIALS**

- 80.86 KC Crystal with Holder. \$1.50
- CD-501 A Cord Connects BC-155 Transceiver to GN-45 GEN. 1.59
- Balloon with Hydrogen Generator. 2.50
- Gibson Girl Box Kite 17" x 17" x 38". 2.25
- 50 Watt Tube Socket 872, 211 NE-2 Neon Lamp. .05
- Anti-Capacity Lever Switch 8 PDP. .80
- 33-410 MMF Variable Condenser. .69
- 7-100 MMF Variable Condenser. .69
- 24-750 MMF Tapered Rotor Plates. .95

**CHECK THESE VALUES**

- BC-709 Interphone Amplifier. Ideal for Aircraft-Booster Telephone. NEW \$4.00
- MIN-2GY Radio Compass Receiver. 150-325KC, 325-695KC 3.4-7.0 MCS. 28 Volt BENDIX. NEW \$29.95
- RA-10DB Receiver. Bendix. NEW \$10.95
- Used With Dynamotor. \$6.95
- BC-224 Receiver. NEW. Less Mtg. \$90.00
- BC-412 Radar Oscilloscope. \$49.95

**TUBES**

2C34	.25	50	6.90
2X2A	.55	CEQ72	1.30
3C2/879	.38	CK-70	3.50
7C4/1203A	.35	CK-72	4.25
10Y	.45	E-1148	.35
15E	1.20	HY-615	.70
15R	.60	RR-72	.65
39/41	.25	RR-73	.75
45 SPEC.	.28	VP-127A	2.25
1000	1.65	31P1	2.50
211	.40	5CP1	1.95
713A	.90	51P4	2.90
717A	.55	5P7	1.00
801A	.25	11G7	.80
803	4.00	574	.75
804	8.50	6AC7	.50
805	3.65	6AJ5	.75
864	.45	6C4	.25
869B	25.00	6K6GT	.70
873A	1.45	6L8	.45
10005	.20	6L6	1.10
1026	.25	6SG7	.50
1629	.25	6SH7	.40
2025	.40	6SJ7	.55
7193	.20	6Y6G	.65
8011	2.00	12SN7GT	.50
9001	.30	251G7	.50
9003	.35	25Z5	.45
9006	.25	3Z	.65

**TRANSFORMERS**

- PRIMARYS 115V 60 CY
- 1. 9V @ 750 MA 6.3V @ 39A \$3.00
- 2. 0.6V @ 0.6 A. 3000 V INS. 2.60 V @ 1.75 A. 2700V \$3.00
- 3. 6.4V @ 10 A. 6.3 @ 0.6 A 1.75
- 4. 1000.500. .275/363 KVA. 5.50
- 5. 660.330V @ .08 A CT 5.0/2.5 @ 3A CT 3.45
- 6. 350.0-350 @ 120 MA .5V 82 @ .3A. 6.3V. ACPT 6.3V. 4.25

**LINEAR POTENTIOMETERS WW**

OHMS	WATTS	HTGR	EA	TEN
300	2	Chicago Tel	50	20
300	2	Chicago Tel	25	20
2000	Dual	2 Trelz	40	35
500	2	Wirt	30	25
200	3	Chicago Tel	25	20
7500	3	Trelz	25	20
20,000	3	Trelz	25	20
25,000	3	Wirt	30	25
15,000	4	Trelz	30	25
15	25	Dejur	45	40
20	25	Ohmite	45	40
25	25	Dejur	45	40
50	25	Dejur	50	45
100	25	IRC	55	45
200	25	Dejur	55	45
500	25	Dejur	55	45
1000	25	Dejur	55	45
2000	25	Dejur	65	55
5000	25	Dejur	65	55
15,000	25	Dejur	65	55
20,000	25	Dejur	85	70
6	50	Dejur	1.00	.90
50	50	AC	1.00	.90
80	50	Ohmite	1.10	.95
10,000	50	Dejur	1.50	1.25
15	60	Ohmite	1.50	1.25
75	75	IRC	1.50	1.25
95	150	Ohmite	2.45	2.10

**ROUND PANEL METERS**

0-4 RF Amps Gese.	2	\$3.95
0-5 RF Amps Westing.	3 1/2"	4.50
0-15 RF Amps Gese.	2 1/2"	3.75
0-300 MA DC Simpson	2 1/2"	3.75
0-300 MA DC Westing.	2 1/2"	3.75
50 MA Shunt.	3 1/2"	4.25
0-8 Amps DC McClin.	2 1/2"	1.95
0-50 Amps DC Weston.	3 1/2"	4.75
0-100 Amps DC Hoyt.	3	3.00
0-3 Volts DC Sun	2 1/2"	1.95
0-15 Volts AC Weston.	3 1/2"	4.95
0-2500 Volts DC Simpson.	3 1/2"	5.50
0-5KV DC 0-10 MA DC.	3 1/2"	5.50
0-150 Volts DC Hoyt.	3 1/2"	3.50
10-0-6 DB Weston	2 1/2"	4.50

**PORTABLE METERS**

0-10 Amps DC Weston	489	7.50
0-300 Volts DC Weston	280	17.50
0-100 Amps AC Weston	269	21.95
0-25 Amps AC Weston	433	23.95
0-300 Volts AC Weston	433	24.95
0-1.5-6 Volts AC Output Meter Weston	571	10.95

**SPECIAL VALUES**

- De-Ion Line Starter DPST 115V 60 CY 15A 1HP Rating Westinghouse. NEW \$3.25
- Hellipot 10,000 Ohms 5 Watt 0.5% Linear Gibbs. NEW ea. 4.50
- 1 Micro Second Time Delay Line 15KVA 400 CY. 50 Ohm. BRAND NEW. \$4.95

**TIME DELAY SWITCHES**

- 1 Minute 115 VAC 60 CY Enc. in Waterproof Metal Case. NEW \$2.95
- 3 Micro Switches Make Contact at 40-11-42 Sec. Time Delay 110 VAC Motor. NEW. 4.00
- 3 Micro Switches Make Contact at 2 Minute Time Delay 110 VAC Motor. NEW. 4.00
- Thermo Switch 50° to 300° F 115 VAC @ 6A. 230 VAC @ 5A Breaks Contact with Increase of Temperature. NEW .95
- 30-40 Second Mercury Time Delay Relay 110 VAC AD-LAKE. NEW. 6.50

**POWER EQUIPMENT**

- Voltage Regulator Raytheon 95/130 V 60 CY 1.25 Amp. Output 115V 60 Watts. NEW. \$9.50
- Inverter DE-151 Input 12VDC Output 110 VAC 150 W 60 CY. NEW. \$10.95
- Vibrapak VDG 360 12 VDC Output 250V @ 70 MA Synchronous Motor. NEW. \$3.45
- ATR Inverter and Regulator 12VDC to 110 VAC 50/60 CY 100 Watt. NEW. \$16.50
- Vibrator ATR 2410 24VDC Output 110V 100 W. NEW. \$2.95

**ROTARY SWITCHES**

- Pole Position Section Shaft. Price
| 2 | 3 | 6 | 1/8" | \$0.35 |
| 2 | 4 | 2 | 1/8" | .35 |
| 2 | 8 | 2 | 2 1/2" | .30 |
| 4 | 10 | 2 | 3/4" | .35 |
| 4 | 12 | 2 | 3/4" | .45 |
| 2 | 8 | 2 | 30 A OKVA Flash Over | 1.45 |
| 2 | 10 | 3 | 3" | .50 |
| 2 | 12 | 2 | 2 1/2" | .60 |
| 3 | 2 | 3 | 3" | .50 |
| 2 | Pole 2 | Circuit 6 | Cont w/KNOB | .30 |

**RELAYS**

- 6 VDC DPST Contacts 6A 12 VDC DPST Allied Control #Box 32 \$0.45
- 12 VDC DPST 64 Ohms. .85
- 24 VDC DPST Allied B16 D36. .60
- 24 VDC 3PDT 8 Amp. .95

by setting the tower in a concrete base or mounting it along the side of the home or building and using metal straps for bearings.

When the 4 section unit is mounted in an open area, either straight or Navy type guys can be used. The installation can be made without the use of a gin pole and the collapsed length over-all runs about 23 feet and the unit weighs 245 pounds.

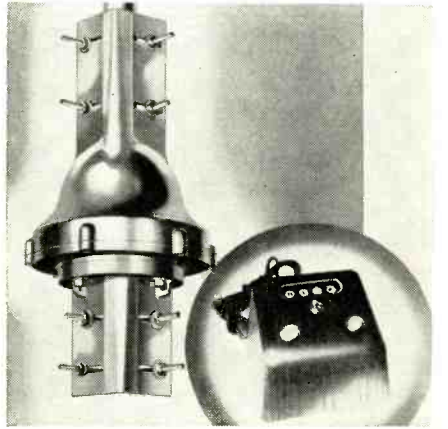
A hand hydraulic pump is used to elevate the tower. During erection the best reception height can be determined and the height held at that point. In case it is necessary to work on the antenna atop the tower, the tower can be lowered and then pumped back up when repairs have been completed.

**"TELE-ROTOR"**

Ability to take an unusual amount of wind stress and to carry TV and amateur antenna arrays without overloading the motor are among the features stressed by *Cornell-Dubilier Electric Corp.* of South Plainfield, New Jersey, in announcing the "Tele-rotor."

Tests show that the unit will take load stress up to 300 pounds. Not only can more units be built onto the antenna without overloading the motor, but the motor is weather-sealed and lubricated for life. It is instantly reversible and is operated by directional push-buttons.

The housing of the rotator is die cast and heavily reinforced, designed for mast or platform mounting and



equipped with three heavy-duty guy-wire lugs. It will accommodate 7/8 to 2 inch upper and lower masts.

**STACKED ARRAY**

The *LaPointe Plascomold Corporation* of Unionville, Connecticut, has developed and is marketing a new low-cost, four-bay stacked array which has been named the *Challenger Model HL*.

Designed to meet the requirements of viewers in areas where both high and low channel reception is desired, this unit comes custom cut to favor any particular high channel desired. Because of its broadband characteristics it also performs well on the low channel stations. The antenna matches

**TERMS:** Minimum order \$5.00—Mail orders promptly filled—All prices F.O.B. Boston, Mass. Sen J M.O. or check. Shipping charges sent C.O.D. 25% deposit required with all C.O.D. orders.

**SEND FOR OUR  
CATALOGUE NOW!**  
Inquiries from Dealers, Schools  
and Industrial Firms Invited

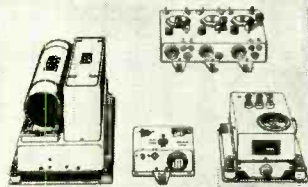
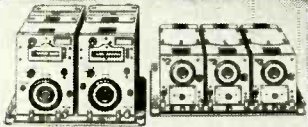
**COMET ELECTRONIC  
SALES CO.**  
22 Washington St. Brighton 35, Mass.  
Beacon 2-7863



# ... AND NOW A WORD FROM BUFFALO RADIO SUPPLY



## 274N COMMAND SET MADE BY WESTERN ELECTRIC



A mountain of valuable equipment that includes 3 separate Communications Receivers, covering up to 8.1 MC, 2 separate 10 watt Transmitters including crystals, 4-28 $\frac{1}{2}$  Dynamotors (easily converted to 110V. A.C. operation), Preamplifier and Modulator, 2 Tuning Control Boxes, and 1 Antenna Coupling Box complete with R.F. Ammeter, 28 tubes supplied in all. Receivers and Transmitters instantly detached from mounting racks for use in separate locations. Removed from unused aircraft and in guaranteed electrical condition. A super value at \$59.95 complete.

RT-1655 crystal controlled SUPERHET RECEIVER that covers the FM band. The ultra modern circuit uses the latest types of tubes. Beautiful chassis and aluminum cabinet. Eleven tubes and schematic supplied. \$14.95

## PORTABLE ELECTRIC DRILL TERRIFIC VALUE

Equipped with 1/4" Jacobs Geared Chuck and Key  
**\$19.95** (Sold at less than established factory price so we cannot mention brand name)

Not an intermittent duty drill, but a full size rugged tool. Most convenient type switch. Natural grip handle. Balance like a six shooter. Precision cut gears. Turbine type cooling blower. Extra long brushes. No stalling under heaviest pressure because of powerful 110 Volt AC or DC motor and multiple ball thrust bearing. Other bearings self-lubricating lifetime-lubricated Oilite type. Made for toughest year-in and year-out service in plant or on construction jobs. Amazing perpetual factory guarantee assures you of a lifetime of trouble-free use. Satisfaction guaranteed or money refunded if returned prepaid within 5 days.

3-Gang Broadcast Band Permeability Tuner. List Value \$7.00. Now \$1.50



## \$6.95 TAKES ALL THREE BIG BARGAINS "E"

- AUDIO AMPLIFIER**—Brand new push-pull output triode amplifiers having 2 of the valuable and scarce oncuer type audio transformers that sell for over \$10.00 apiece. Near aluminum case, fully enclosed (largest dimension 6 inches). Perfect for intercom systems, phone amplifiers, mike amplifier, or signal tracer amplifier for testing radio sets. A sensational bargain at only... \$3.40 each
- BANDSWITCHING TUNING TURRET** made by Western Electric. Covers 4 bands above 100 MC. All coils wound with #14 silver-plated wire. Complete with tuning condensers and powerful electric driving motor. ONE OF OUR MOST TERRIFIC VALUES... ONLY... \$2.95
- CARBON MIKE** with Push-To-Talk Switch and Gold Plated Carbon Lapel Mike. Combination offer on both mikes... \$1.75

## "DRILLMASTER" ELECTRIC DRILL

Low-priced electric drill, ideal for hobbyists. Complete with sander, buffers, grinding wheels, etc. This is bankrupt stock and only a few are available. A sensational bargain at \$9.95. Satisfaction guaranteed or money refunded if returned prepaid within 5 days.

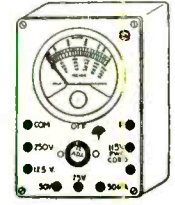
## THE BUFRAD SECTIONAL TOWER

This latest addition to the famous line of BUFRAD antenna products makes up to a hundred foot tower from any desired number of ten foot sections of extremely strong welded construction. The sections are shipped assembled so erection is a matter of minutes rather than hours. Finished in gray "TELECOTE," a new time and climate proof finish that will outlast the pyramids. Assembly is a one man job and is accomplished by climbing up the completed portion of the tower with the next 25 lb. section to be installed. Hand and footholds are provided to make the work safe and easy. Cap at top of tower provides bearing surface for rotating, and prevents water from entering tubes. Useful for police, or amateur transmitters, and in addition the tower will provide satisfactory TV reception where otherwise it would be impossible. Ideal for supporting permanent or temporary power lines, wind generators, stadium public address speakers, or spot lights for gas stations or parking lots. "B" and "C" sections together cost a total of \$12.75 and total 20 feet. "A" Sections, which make up the entire tower except for the top, are each ten feet long and cost but \$12.75 apiece. Those who wish a mast base will be able to obtain one (not shown) for only \$6.00. The base is especially useful when erecting the tower on a sloping roof.

## DELUXE AC-DC RADIO KIT

High quality standard production line RADIO in kit form with complete instructions. No other advertised kit regardless of price offers these features: 2 Iron Core I.F. transformers. Polyethylene insulated edge-wound antenna loop. 2 gang condenser. Tubes include 12AT6, 12BA6, 12BB6, 50B5, and 35W4. Receives Broadcast Band from 550 to 1700 KC. Kit is \$8.75 or 2 for \$17.00. Assembled, wired and tested, \$12.95 or 2 for \$25.00.

ANALYZER featuring a sensitive repulsion type meter housed in a bakelite case; represents the culmination of 15 years' achievement in the instrument field by a large company specializing in electronic test equipment. Specifications of the AC-DC Model Volt-Ohm-milliammeter; AC Volts—0-25, 50, 125, 250, DC Volts—0-25, 50, 125, 250, Milliampers AC—0 to 50, DC Milliampers—0 to 50, Ohms Full Scale—100,000, Ohms Center Scale—2400, Capacity—05 to 15 Mfd. Total Price, prepaid anywhere in the USA... \$7.90



## \$7.05 TAKES BARGAIN "C"

(All three items below)  
**ALUMINUM GEAR BOX** 1588X7 that contains two powerful electric motors and two matched gear trains. 62 gears in all varying in size from 3/4 to 4 inches in diameter. This unit is readily converted to rotate in beam antenna or any other similar use... \$5.00

## SIGNAL CORP INTER-CONNECTOR RELAY BOX 730A

This valuable unit, made by Bell, and more familiarly known by the U. S. Army designation BC616, is encased in a highly polished aluminum case 4 1/2 x 5 1/2 x 2 1/2, and contains 150 mfd. of condenser capacity, sensitive relays, resistors, and terminals. Order several at the giveaway price of only... \$1.95

## REMOTE CONTROL UNIT

Aluminum case 4 x 3 x 2 containing 2 potentiometers, triple pole switch, 4 knobs, phone jack, gear mechanism and revolution counter, including 8 prong JAN connector. Kit box... \$1.39

## COMPRESSED AIR INSTANTLY ANYWHERE

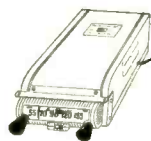
Portable Air Compressor and storage tank. Ruggedly built. Best Metered lifetime-lubricated ball-bearing on connecting rod and oil-impregnated main bearing on shaft. Unusual design forever eliminates valve trouble, the most common fault in air compressors. **PATENTED** unique air intake system increases efficiency tremendously so that air output is much greater than that from larger compressors powered by heavier motors. Delivers approximately 3500 cu. inches of air per minute at maintained pressure of 90 lbs., or will inflate 90 lb. truck tire in less than one minute. Complete with 100 lb. gauge. Finger-tip adjustment always setting of output pressure at any value, which will automatically be maintained. Works from any 1/4 HP. motor. Useful for spraying paint, heater, disinfectant, insecticide, annealing or brazing with natural gas, inflating tires, etc. Price \$14.50 postage prepaid anywhere in the U. S. Efficient, completely adjustable syphon type spray gun complete with 12 ft. of 100 lb. tested hose, only \$7.75 with pint container, also prepaid.

## CERAMIC INSULATED VARIABLE AIR CONDENSERS

- |                   |        |               |                |
|-------------------|--------|---------------|----------------|
| 10, 15 or 23 mmf. | \$3.10 | 10 for \$2.90 | 100 for \$2.25 |
| 35 mmf.           | \$3.40 | 10 for \$3.40 | 100 for \$2.80 |
| 50 mmf.           | \$4.50 | 10 for \$3.70 | 100 for \$3.30 |
| 75 mmf.           | \$5.10 | 10 for \$4.40 | 100 for \$3.80 |
| 100 mmf.          | \$5.70 | 10 for \$4.50 | 100 for \$3.99 |
| 140 mmf.          | \$8.10 | 10 for \$7.40 | 100 for \$6.75 |
| 160 mmf.          | \$1.00 | 10 for \$8.50 | 100 for \$7.64 |
- Butterfly condenser rotor has double ball bearings and 3/4" shaft.  
15 mmf. per section \$5.10, 10 for \$4.50, 100 for \$4.00  
30 mmf per section \$6.00, 10 for \$5.50, 100 for \$5.00  
50 mmf per section \$7.00, 10 for \$6.50, 100 for \$6.00  
**SUPER SPECIAL!**  
2 gang midjet superhet tuning condensers with 1/4" shaft and trimmers... 9 for \$2.50  
2 gang 140 mmf. \$1.60, 10 for \$12.50, 100 for \$10.00  
350 mmfd 5 gang—\$1.95  
3 gang—\$1.29  
Manufacturers and Distributors: Write for prices on larger quantities. WE HAVE OVER 250,000 VARIABLE CONDENSERS IN STOCK.

## AUTO RADIO DEALERS! ATTENTION!

Car radio specially made by famous American manufacturer of communications sets for export to South America. (Recently imposed currency restrictions make export impossible.) 6 tubes, 3 gang condenser, and unbelievable sensitivity and selectivity. Fungus proofed and tropicalized. Out of this world, compared to any radio built for the domestic market. A sensational value at \$28.00 net, or \$25.00 in lots of 3.



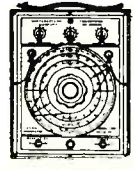
## MICROPHONES

Super Special—Highest quality all chrome bullet shaped C R Y S-TAL MIKE B of top-flight nationally known brand—\$5.95. Bullet D Y N A M I C MIKE J—\$7.95. MIKE J—60c. "EASH" TQ-TALK MIKE switch on handle—98c. L A P E L MIKE S—(Specify whether carbon or magnetic) 93c.



## SIGNAL GENERATOR

Genuine Laboratory-type precision signal generator. Manufactured and sold for \$68.00 each in large quantities during the war by Northeastern Engineering Corp., one of the top manufacturers of electronic equipment for the U.S. Govt. Five fundamental bands starting at 150 KC. Strong harmonics up to 120 MC. Five step ladder type attenuator as well as potentiometer output control. Regular 1000 cycle audio oscillator using vacuum tube, not a cheap neon sawtooth audio oscillator. Audio output separately available externally. Weight without packing material 16 lbs. which should show what a world of difference exists between this signal generator and the ordinary cheap oscillator used by the average serviceman. Complete with fused plug and coaxial output lead. Super Special \$38.75.



## NEW G. E. TRANSMITTER

Brand new General Electric BC-475 or BC-191 transmitters, export packed, complete set of spare tubes as well as 10 and 20 meter convertible sections \$100.00. BC-312, BC-345 or BC-224 receivers sold with the above transmitters \$125.00 (unit for unit).

SCR610 portable 6, 12 and 24V crystal controlled transmitter receiver with built-in loudspeaker. Complete with antenna. \$59.95

SCR522 Transmitter-receiver in guaranteed condition complete with remote controls, antenna and mike. No conversion necessary to license for tactical use. A natural for any 2 \$100.00 meter use.

## ISOLATION TRANSFORMERS \$2.95

Many adjustments on radio and TV sets require that the chassis be grounded for successful results. Using an isolation transformer this can be done as routine procedure on every set on the test bench, ending the hazard of shock. Connected as auto transformers these isolation transformers can also be used to change 110V to 220V or the reverse. We do not believe that 100 watt 110V isolation transformers have ever before been offered at less than double our price of \$2.95.

Push-Pull AUDIO AMPLIFIER with Hypersil core A.F. transformers—\$30.00 Value—NOW \$3.40.



## Phonograph Scratch Eliminator

Consists of 2 condensers and powdered iron core choke connected in a meter bridge. Same as used in most jukeboxes to improve low note response and eliminate scratch. Connects instantly between pickup and amplifier. A super bargain at... \$2.00

**BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. RN-3, BUFFALO 3, N. Y.**

March, 1950



# TRANSVISION

A MESSAGE TO

## Service-Dealers: WORRIED ABOUT COMPETITION? Become the TV SALES and SERVICE CENTER

IN YOUR COMMUNITY

- Beat competition at a profit.
- Stop being undersold — by anybody!

Here's a real opportunity to MAKE MONEY in Television. If you can qualify, you can become the Transvision Television Center in your community — and BUY TV and RADIO PARTS at JOBBER PRICES. Practically no investment required. This offer is open only to service-dealers in territories where we do not have an authorized distributor. CONTACT US today!

### Now . . . 16" WIRED TV CHASSIS

Completely wired and aligned by TRANSVISION. Specify: MODEL W16RS TV CHASSIS. List price, less C.R. Tube . . . . . \$139

Also available as a KIT which can be completed in ONE DAY. Specify: Model W16RS TV Kit. List price, less C.R. Tube . . . . . \$119

FILL OUT AND MAIL THIS COUPON NOW!

**TRANSVISION, INC.**  
NEW ROCHELLE, N. Y.

Please ship THROUGH YOUR NEAREST LOCAL OUTLET: RN 3-50

( ) . . . . .  
I am enclosing 10% DEPOSIT in the amount of \$ . . . . . balance C.O.D.  
( ) Send details of TV CENTER PLAN.

Name . . . . . (please print)  
Address . . . . .  
City & State . . . . .

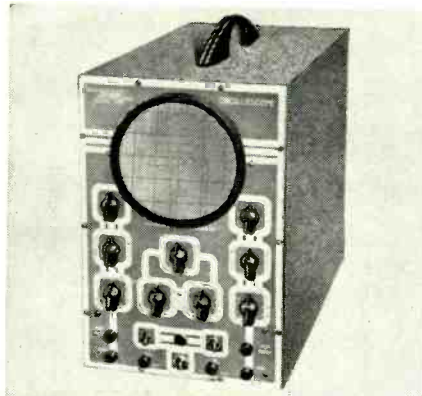
a 300 ohm line with negligible impedance variation throughout the television spectrum. It is constructed of duraluminum and is furnished with an integral 9 foot mast (1 1/2" o.d.) and will fit all rotators commercially available without the need of special adaptors. Half-wave spacing provides low vertical angle of radiation, thus affording maximum signal-to-noise ratio.

#### TELEVISION SCOPE

Of interest to television technicians is the new Model 425 oscilloscope which is currently being offered by *Electronic Instrument Company* of 276 Newport Street, Brooklyn, New York.

Probably the outstanding new feature of this instrument is a push-pull horizontal and vertical amplifier. Other features include extremely high sensitivity and wide bandwidth.

The new oscilloscope is available in

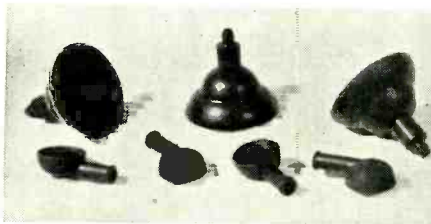


kit form (Model 425K) as well as completely assembled.

#### RUBBER ANODE CONNECTORS

An injection molding process for making anode connectors and other television parts has been developed by *Minnesota Rubber and Gasket Co.*, 3630-V Wooddale Ave., Minneapolis 16, Minnesota.

The manufacturer claims that this molding process enables him to hold to closer dimensions, tolerances, and provide greater uniformity in production than was hitherto possible. A special television rubber compound has been developed to provide heat resistance,

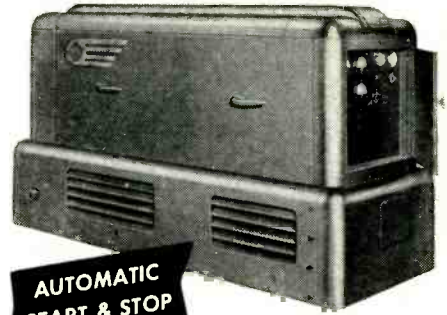


corona resistance, and high dielectric. Special aging chemicals provide good flexibility even after prolonged use.

#### MAJESTIC CONSOLE

A name long and favorably known in the radio industry has made its reappearance with the debut of the 1950 line of *Majestic* television receivers.

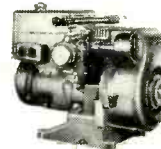
## STAY ON THE AIR WHEN POWER FAILS...with an ONAN Electric Plant



**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. Can be carried by hand or in trunk of car. Weigh as little as 80 pounds. A.C. models 350 to 35,000 watts.

Write for FREE Folder



**D. W. ONAN & SONS INC.**  
4806 Royalston Avenue  
Minneapolis 5, Minnesota

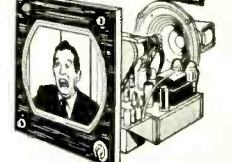
## New for 1950 FACTORY-TO-YOU MIDWEST TELEVISION

### NEW GIANT 16" PICTURE TUBE

Immense 151 square-inch screen on new 16" metal-glass tube . . . clear, steady, bright pictures . . . Synchronized sound and picture that a child can tune in perfectly . . . Long Distance FM Circuit . . . Big 12" Electro-Dynamic Panasonic Speaker . . . Available in beautiful consoles or in complete chassis (not a kit). Buy direct at Low Factory Prices, with Low Down Payment and Long Easy Terms . . . and on 30 Days Trial! Send for 32-page, 4 color catalog today



**30 DAYS TRIAL**



**EASY TERMS**

**BUY DIRECT FROM FACTORY and SAVE!**



Also a Complete New 1950 Line of  
**MIDWEST RADIOS**  
with new long distance FM Circuit and new 3-Speed Phonograph.

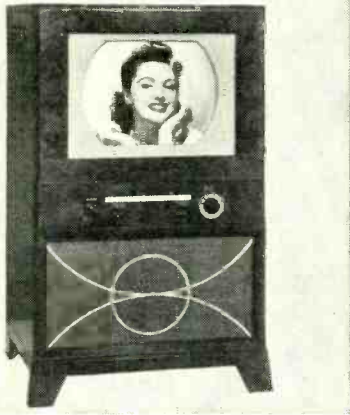
Send This COUPON on 1c Post Card for NEW 1950 FREE 4 Color 32 Page MIDWEST CATALOG

**MIDWEST RADIO & TELEVISION CORP.**  
Dept. X378, 909 Broadway, Cincinnati 2, Ohio  
Please send me your new FREE 1950 Catalog.

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_



One of the featured sets in the new line is the Model 16C4, a 16" unit with a black tube. Like all of the receivers in the line, this new model has a built-



in "Channelized" antenna which is said to operate satisfactorily in 8 out of 10 locations, and some recent electronic circuit innovations developed by the company.

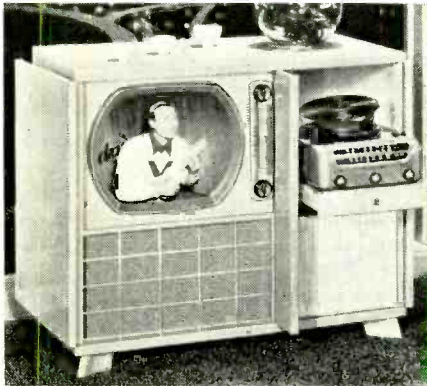
The Model 16C4 is housed in a hand-rubbed mahogany cabinet and is also available in blonde mahogany as the Model 16C5.

The new *Majestic Radio and Television Corporation*, headed by Leonard Ashbach, has headquarters at 743 N. La Salle Street in Chicago.

#### SIX-WAY CONSOLE

*Admiral Corporation* of Chicago is marketing a six-way console in its 1950 line of home radio instruments.

This unit, which uses a 19-inch picture tube, features a Dynamagic FM-AM radio with 12-inch speakers as well as the company's three-speed record changer which handles 33 1/3, 45, and 78 r.p.m. records on a single spindle. The changer will handle from 12 to 14 records at a time, depending on their size. Both the radio and record



player slide out from the cabinet when in use for easy accessibility.

The cabinet, of hand-rubbed wood, comes in either blonde or mahogany finishes.

#### INDOOR ANTENNA

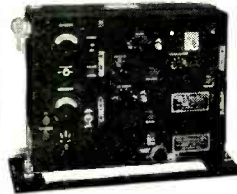
*Tricraft Products Company* of 1535 North Ashland Avenue, Chicago, Illinois, is currently in production on a new indoor television antenna, the "Vidiette" Model "700."

According to the company there is

### NEW LOW PRICES TRANSMITTERS AND RECEIVERS:

	USED:	NEW:
BC-453 Receiver—190-550 KC.	\$11.95	
BC-455 Receiver—6-9.1 MC.	6.95	
BC-454 Receiver—3-6 MC.	4.95	
Transformer f/Com. Rec. See NH-109 below		\$3.00
BC-696 Transmitter—3-4 MC.	\$12.95	
BC-459 Transmitter—7-9 MC.	9.95	\$14.95
BC-457 Transmitter—4-5.3 MC.	5.95	8.95
BC-458 Transmitter—5.3-7 MC.	5.95	8.95
BC-456 Transmitter Modulator.	1.95	2.95
Transformer f/Com. Trans. See NH-108 below		6.90
Choke—13 Hvy. 250 MA. No. NH-121		4.95

### BC-223 TRANSMITTER



30 Watt Transmitter with crystal or MO control on four pre-selected channels. 2000 to 3250 KC., by use of three plug-in coils. Five Tubes: 2-801 & 3-46. With TU-17 Tuning Unit 2000 to 3000 KC. and Cable. Less Mtg. Prices:  
NEW: \$24.95  
USED: \$19.95

TUNING UNITS: TU-18 3 to 4.5 MC. TU-25 4.5 to 5.2 MC. Either: NEW: \$3.50—USED: \$2.50

PE-125 VIBRATOR POWER SUPPLY f/BC-223 Transmitter. 12/24 volt input; output 500 V. 150 MA. Prices: NEW: \$9.95—USED: \$7.95  
CABLE only—Trans. to Power Supply.....\$1.75

### MARK II B-19 TRANSMITTER AND RECEIVING SET

15 TUBES 2-8 MC., 240 MC., AND INTERCOM.  
IDEAL FOR MOBILE OR STATIONARY USE



Set transmits and receives 2 to 8 MC. Phone. C W and M C W 25 Watt Master Oscillator Control. Transmits and receives 240 MC. Phone. Also an intercommunicating set. Comes complete with 15 Tubes, Headset, Micro. Antennas, Control Box, 12/24 Volt Power Supply, and instructions—ready to operate. Set size: 27"x10"x14 1/4". Prices: \$39.50 NEW.....\$59.50; USED (Tested).....\$29.50

Also Available—All Parts and Accessories for B19 Mark II Sets!

### NEW TRANSFORMERS And CHOKES

ALL FOLLOWING TRANSFORMERS—CASED  
115 V.A.C. 60 CYCLE INPUT:

OUTPUT: 750-0-750 V.A.C. (600 V.D.C. after choke input filter at 250 MA.) Includes 6.3 V.A.C. winding at 5 amps and 5.0 V.A.C. winding at 4 amps. NH-106.....\$7.95  
OUTPUT: 625-0-625 V.A.C. (500 V.D.C. after choke input filter at 250 MA.) Includes 6.3 V.A.C. winding at 5 amps and 5.0 V.A.C. winding at 4 amps. NH-107.....\$7.35  
OUTPUT: 600-0-600 V.A.C. at 250 MA. 12 V.A.C. at 3 amps; 12 V.A.C. at 3 amps and 5 V.A.C. at 3 amps. Designed for Army surplus transmitters. NH-108.....\$6.90  
OUTPUT: 250-0-250 V.A.C. at 60 MA. 24 V.A.C. at .6 amps; 6.3 V.A.C. at .6 amps. Designed for Army surplus Receivers. NH-109.....\$3.00  
OUTPUT: 6.3 V.A.C. at 8 amps. NH-110.....\$2.25  
OUTPUT: 2.5 V.A.C. at 10 amps, center tapped and shielded. Open frame mounting insulated for continuous operation at 5,000 volts. NH-113.....\$4.20

#### TRANSFORMERS

110 V. 60 CYCLE PRIMARIES:

SEC.	SEC.
12 V. 1 amp.....\$1.50	24 V. 2 amps...\$2.25
24 V. 1 amp.....1.95	24 V. .5 amp...1.50
Sec. 36 V.A.C. 2.5 amps.....2.95	
Sec. 14-14 or 28 V. 7 1/2 or 15 amps.....4.95	

#### CHOKES—CASED:

NH-115—8 Henries at 500 MA. filter choke. 5,000 volt insulation.....\$9.95  
NH-116—5-20 Henry 500 MA. swinging choke. 5,000 volt insulation.....\$9.95  
NH-117—8 Henries at 700 MA. filter choke. 7,500 volt insulation.....\$14.95  
NH-118—5-20 Henries at 700 MA. swinging choke. 7,500 volt insulation.....\$14.95  
NH-121—13 Henries at 250 MA. filter choke. 1,500 volt insulation.....\$4.95  
NH-412—4-12 Henries 81 ohm. Gov't conservative test voltage 2500 V.....\$4.95

PAE-1 Portable ELECTRIC MEGAPHONE EQUIP. Complete w/6 V. DC battery and 110 Volt AC charging rack. Price \$39.95

#### GEARED MOTOR

Ideal reversible motor for rotating antennas, displays, etc. Weight: 4 lbs. Overall size: 7" long, less shaft. Gear Box size: 3 1/4" x 3 1/4". Motor size: 4" x 2 1/2". Shaft size: 3/8" x 1 1/2" threaded. Operates from 24 volt DC, 2.9 A., 9 RPM or 36 volt AC at 75 lbs. per inch torque. Price.....\$5.95

TRANSFORMER—110 Volt 60 cycle primary; secondary 36 volt AC. Price.....\$2.95

Address DEPT. RN • Minimum Order \$2.00 • Prices F.O.B., Lima • 25% Deposit on C.O.D. Orders



### BLOWERS:



110 VOLT 60 CYCLE (Pictured), 4" intake, 2" outlet. Approx. 100 Cu. Ft. Dis. After size: 3"x3". 1750 RPM. Quiet running. Prices: NEW: \$6.95—Motor only \$3.95  
24 VOLT DC or 36 VOLT AC—6" intake, 3" outlet. Approx. 200 Cu. Ft. Dis. Also has adapter for Dual outlet. Chused. Price.....\$5.95

6 VOLT DC CAR DEFROSTER KIT—complete with hose, Blower, Hardware, and instructions for easy installation.....\$4.95

### BC-645-A TRANSCEIVER—ALSO

110 VOLT TRANSFORMER AND CHOKES

15 Tube Transceiver, ideal for conversion to 460 MC. Frequency coverage 435 to 500 MC. With conversion instructions.....\$14.95  
Price: New and Boxed.....\$14.95

TRANSFORMER for BC-645-A—110 Volt 60 cycle input; output 100 Volt 150 MA. after filter. 12, 9, and 6 V. A.C. 4 amps and 5 V. 3 amps. No. NH-645.....\$6.95

CHOKE—15 Hvy. 150 MA. Order No. NH-646.....2.95

PE-101 DYNAMOTOR—13/26 V. input.....2.95

SELSYN TRANSMITTER AND INDICATOR SYSTEM—ideal for antenna direction indicator to remote position. Complete with Autosyn Trans. 3" 1-81 Indicator, Transformer, and instructions.....\$6.75  
Autosyn Trans. only: \$2.95 Plug f/I-81: \$1.00

### CONDENSER ASSEMBLIES:

5 Gang with vernier tuning, 25 MMFD to 450 MMFD each section. Size: 7 1/2"x3 1/4"x3 3/4". Price.....\$2.95  
3 Gang Condenser, 25 MMFD to 450 MMFD each section. Size: 6"x3 1/4"x3 3/4". Price.....\$1.95

### WHIP ANTENNA EQUIPMENT

MAST BASES—INSULATED:

MP-132—1" heavy coil spring, 2" insulator, overall length: 1 1/2". Wt.: 2 1/2 lbs. Price.....\$3.95  
MP-22—Spring action direction of bracket, 4"x6" mounting. Price.....2.95  
MP-37—2" heavy coil spring, 5" insulator.....2.95  
MP-48—2" heavy coil spring, 3" insulator.....2.95  
MP-37—2" heavy coil spring, 8" insulator.....3.95  
MP-47—2" heavy coil spring, 9" insulator.....5.95

#### MAST SECTIONS FOR ABOVE BASES:

Tubular steel, copper coated, painted, 3 foot sections, screw-in type, MS-53 cap, used to make any length, with MS-52-51-50-49 for taper. Price—any section.....50c Ea.  
BAG BG-56 f/carrying 5 mast sections.....50c

#### DYNAMOTORS:

INPUT:	OUTPUT:	STOCK NO.:	PRICE:
12 V. DC	680 V. 210 MA.	DM-680	\$7.95
@ 6 V. DC	300 V. 150 MA.		
9 V. DC	450 V. 60 MA.	DM-9450	
@ 6 V. DC	275 V. 50 MA.	w/Blower	3.95
12/24 V. DC	440 V. 200 MA. & 220 V. 100 MA.	D-104	9.95
18 V. DC	450 V. 60 MA.	DM-175	7.95
12 V. DC	600 V. 300 MA.	BD-86	2.95

PERMANENT MAGNET FIELD DYNAMOTORS:  
12/24 V. DC 275 V. 110 MA. USA/0516 3.95  
12/24 V. DC 500 V. 50 MA. USA/0515 2.95

PM FIELD DYNAMOTOR POWER SUPPLY—Completely filtered. Has two PM Dynamotors as listed directly above.....\$5.00

#### INVERTERS:

28 V. DC 110 V. 400 Cy. 500 VA. MG-149F 26 V. 400 Cy. 250 VA. (Recond.) \$14.95  
28 V. DC 110 V. 400 Cy. 750 VA. 3 Phase 26 V. 400 Cy. 250 VA. MG-153F 42.50  
1 Phase (Recond.)

WRITE FOR QUOTATION ON OTHER INVERTER OR DYNAMOTOR NEEDS!

SCR-522 Transceiver 100-150 MC. USED.....\$34.50  
ET-237 MOUNTING BASE f/HC-604 & 603's, & f/HC-684 & 683's. Prices: NEW.....\$9.95 USED.....\$7.00  
BC-1206 REC 5 Tubes, 24-28 VDC. 200-400 KC. 6.95  
FL-8A FILTER—1200 CPS.....\$1.95  
SELSYN C-78248—110 V. 60 cycle & instr. Pair.....\$5.95  
Cable—4 conductor, shielded, 50 Ft. length.....2.00  
C-0-213 CABLE—Seven conductor No. 20 AWG., with 2 cond. separately shielded within the outer shield for all 7 conductors. Insulated, rubber covered, 35 ft. length.....\$1.25  
CABLE CD—280 one 2 6 wirs, shielded RC 15 ft. 1.00  
CABLE—2 #16 wire, rubber covered—20 ft. 1.00  
RG-34 U Coaxial Cable, 71 ohm, 140 ft. length. 10.00  
3-Conductor Cable—unshielded.....Per foot .10  
Cable f/BC-375 w/PL-59-61 or 64 Plugs.....Ea. 1.75  
Tuning Unit f/BC-375 TU-6-7-8-9-10-22-26.....Ea. 3.95  
GN-45 Generator.....5.00  
Leg & Seat Assy. f/hand generators.....2.75  
Crank for hand generators.....Each .75  
BC-1023 Marker Beacon Receiver, 4 Tubes.....4.50  
BC-357 Marker Beacon Receiver (used).....2.95  
HC-301 Marker Beacon Receiver, less tube.....1.95  
BC-347 Amplifier, Used, less tube......79

**FAIR RADIO SALES** 132 SOUTH MAIN ST. LIMA, OHIO



## WHY PAY MORE! Save on Surplus Buys

This is the New ALVARADIO! We've re-organized and are better than ever able to serve you and give you bigger and better surplus values. Look to ALVARADIO! NOTE NEW ADDRESS.

### SCR-522 WITH RA-62C

Save \$27.40 on Complete Unit

Everyone is clamoring for this unit. Consists of the following units: Transmitter/Receiver with plugs. 18 tubes, voice modulated, output 8-9 watts. PE-94 Dynamotor with voltage regulator and filter system and plugs. 24 VDC @ 12 amps inputs. 300 VDC @ 26 amps, minus 150 VDC @ .01 amps. 14.4 VDC @ 5 amps. RA-62C AC Rectifier Power Supply with input selector switch for AC input voltages of 115 to 250, output supplies transmitter/receiver voltage; size 17" x 11" x 11".  
**SAVE \$27.40 BY BUYING COMPLETE UNIT \$219.95**

#### SEPARATE PARTS PRICE LIST:

SCR-522 Xmitter/Recv. .... \$49.95  
PE-94 Dynamotor ..... 5.95  
RA-62C Pwr. Supply ..... 189.95  
SCR-522 Antenna ..... 1.50

\$247.35

### BC-929 INDICATOR SCOPE

Wonderful deal for cheap test scope. Contains 8 tubes: 1-3BP1, 2-6SN7, 2-6H6, 1-6G6, 1-2X2 and 6X5. Full instructions for use with light bulb.  
Excellent condition ..... **\$14.95**

### APS-13 TRANSCEIVER

While They Last—At This Low Price

Tail-end Charlie—kept the Japs off our tail. Now yours at a fraction of original gov't. cost. 5 stages of 30 Mcs. IF (6AG5), 2 stages of video amp. (6AC5) which feed into 2-D21 for relay warning. 56J6 in transmitter-receiver. Just the thing for citizens band, 420 mc ham band, or TV, or use for short range radar detection. Wonderful possibility for marine and small aircraft radar. Tubes alone are worth almost as much as our complete price to you. Good condition.  
**ONLY \$9.95**

### BC-906 FREQUENCY METER

A real laboratory instrument at a fraction of original cost. Can be modified for many other uses. Absorption-type. Range 150-225 MC. Power requirements: 2 batteries, 1.5V and 45V. Uses precision friction-type vernier dial for frequency variation. Black wrinkle-finish metal cabinet with door. Complete with tubes and frequency charts! NEW ..... **\$19.95**

### APN-1 ALTIMETER TRANSCEIVER

Here's a real buy! 418-462 MC FM. Can be modified for citizens band use. You get 14 tubes and a dynamotor for only ..... **\$6.95**

### COMMAND RECEIVERS

Used, Good Condition  
Complete with Tubes

BC-450 190-550 KC (Q-5er) ..... \$12.95  
BC-454 8-6 MC (75 M Revr.) ..... 5.85  
BC-455 6-9.1 MC (40 M Revr.) ..... 6.95

Hottest Value on the Market

**COMMAND XMITTERS—ARC-5 & ATA**  
Complete with Tubes & Xtals

BC-459 7-9.1 Mcs. (Excell. cond.) ..... \$12.95  
BC-457 4-5.3 Mcs. (Excell. cond.) ..... 3.95  
BC-458 5.3-7 Mcs. (Excell. cond.) ..... 3.95

### BC-221 FREQUENCY METER

Don't pass this up! They're all reconditioned and guaranteed in perfect operating condition. Crystal-calibrated in all ranges: 125-250 KC and 2000-4000 KC. These frequency meters are just the thing for use as signal generators and VFO. Remember, they've been electrically and physically inspected. Just 150 left—so hurry and order yours today—now! Complete with tubes, crystal and calibration book ..... **\$69.50**

**DELCO-REMY MARINE GENERATORS.** Model 110646. 12V 50 amp. Brand new ..... **\$17.95**  
**BC-1206 RCVR.** Beacon Revr. 200 to 400 KC. 28V plate and filament. Easily converted to broadcast band by adjusting of slug and tuned coils. A cheap Q-5er. Each **\$5.95**

### ORDER DIRECT FROM THIS AD!

Cash with order, 25% deposit on all C.O.D. orders. All orders shipped by truck or railroad express collect.

Prices subject to change. All merchandise subject to prior sale.

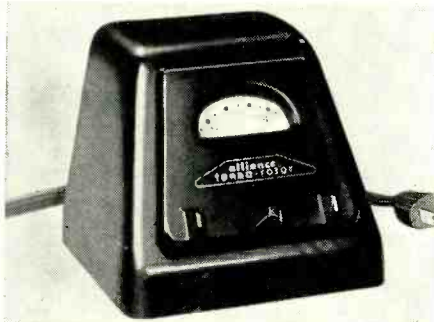
## ALVARADIO SUPPLY CO.

Dept. A-2, 341 S. Vermont  
Los Angeles 5, California

no pushing or pulling of rods with this unit, a simple movement of the knob to the desired channel is all that is required. The television receiver is then automatically electrically tuned in to the proper station. The unit is small and compact, making it suitable for installation in apartments and other limited-space locations.

### "TENNA-ROTOR"

Production is underway at the Alliance Manufacturing Company's Al-



liance, Ohio plant on a deluxe model of the company's "Tenna-Rotor," the Model DIR.

The new unit features a directional

indicator control case. An indicator dial on the control case panel enables the television viewer to select and know the actual compass direction to which the antenna is pointed.

Like the company's standard model, the new rotator is factory lubricated for life, has stainless steel bearing inserts, and is designed to operate in any weather.

Both the deluxe and standard models come with special 4-conductor cable. The cable has a special "zip" feature which facilitates installation.

### ANTENAPLEX SYSTEM

The Engineering Products Department of Radio Corporation of America has announced that the company's Television Antenaplex System is now available for installation in television areas throughout the nation.

Originally restricted to distribution on the Eastern Seaboard, the system is designed as a multiple-outlet antenna unit for apartment houses, hotels, stores, schools, hospitals, and office buildings. The system consists essentially of an individually tuned antenna for each transmitting channel in the given area, a master signal am-

## TV SERVICE CONTRACT PRICES CUT

By ROBERT HERTZBERG

IN line with the trend toward lower prices for television receivers in 1950, the RCA Service Co., a subsidiary of RCA-Victor, has announced a series of new low-cost TV service contracts. This move will undoubtedly establish a new price pattern for the entire television servicing industry.

The initial reaction of many TV technicians to the "cut" was dismay. "We're taking a licking now on many contracts," they said. "How will we make out if we charge less?" Study of the new RCA schedule reveals, however, that it will benefit the trade rather than hurt it. The outstanding feature is the restriction of the much-abused "unlimited service" privilege to 90 days, with a flat charge of \$5.75 for all calls after that period. The rates vary from \$22.95 for a 10-inch set with built-in aerial to \$69.95 for projection models with outdoor antennas. Unlimited service contracts at the higher prices heretofore in effect will still be available to customers willing to pay for them.

In announcing the new contract plans, Charles M. Odorizzi, vice-president of RCA in charge of service activities, disclosed that the RCA Service Co. is moving along various fronts to help all service organizations and technicians to keep pace with the rapidly expanding industry. Service notes are being distributed at no charge to recognized organizations, and at a very nominal charge to individual technicians. In addition, a series of six lectures on the practical aspects of TV servicing will be held in various parts of the country during the year, under the auspices of RCA dealers.

"We regard our activities as broader in scope than merely the installation and servicing of RCA and RCA-Victor products," says Mr. Odorizzi. "They are also designed to advance the whole industry, since whatever helps build

public acceptance for television will contribute to the sales of all manufacturers and build volume business for all servicing agencies. Our aim is to maintain friendly and cooperative relations with other servicing organizations."

-30-

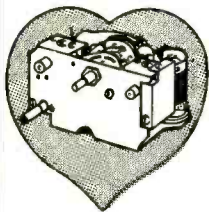
Newly revised factory service contract price list recently released by RCA Victor. This schedule applies to both commercial and residential installations. The adjustments made for various "zones" applies to distances from the transmitter. Thus, Zone A is normally a 22 to 25 mile radius around a TV station, established by 500 microvolt range of the station. Zone B is normally about 10 miles beyond Zone A, while Zone C is normally 10 miles beyond Zone B.

TELEVISION TYPE	PLAN I		PLAN II	
	With Built-in Antenna	With Standard Outdoor Antenna	With Built-in Antenna	With Standard Outdoor Antenna
<b>TELEVISION ONLY</b>				
All 10" Models	\$ 22.95	\$ 39.95	\$ 45.00	\$ 65.00
All 12½" Models	24.95	44.95	50.00	70.00
All 16" Models	29.95	49.95	60.00	80.00
Projection Models	39.95	59.95	75.00	95.00
<b>TELEVISION COMBINATIONS</b>				
All 10" Models	\$ 29.95	\$ 49.95	\$ 60.00	\$ 80.00
All 12½" Models	34.95	54.95	65.00	85.00
All 16" Models	39.95	59.95	75.00	95.00
Projection Models	49.95	69.95	90.00	110.00

Above prices apply for Zone A; for Zone B add \$7.50; for Zone C add \$15.00  
\*Built-in Antenna prices apply when existing antenna is used.  
†Portable Indoor Antenna Supplied on Request—\$3.50



# THERE'S ONLY ONE NIAGARA FOR GREAT RADIO VALUES



## HEART OF THE BC-221 FREQUENCY METER

This VFO Sub-Assembly, used in BC-221 Freq. Meter, is ideally suited for home construction of:

- 1—Amateur V.F.O.
- 2—Freq. Mtr. Foundation
- 3—Portable Transmitter
- 4—Replacement for BC-221

Unit contains two temperature & moisture compensating coils, wafer switch, 3 variable condensers, carbon resistors, & silver mica condensers. FULLY WIRED & mounted on sturdy aluminum sub-chassis, ready for installation. Brand new—in original packing.

N-276 Very special. **\$6.95**

For Complete List of Tube Prices See Feb. Issue of This Publication.

## TERRIFIC PRICE SLASH! BRAND NEW TUBES

TRANSMITTING		RECEIVING	
E1148	\$ .34	1H5GT	\$ .50
2C26	.28	3A4	.27
5B7P1	1.70	3B7	.29
1D1	.28	3D6	.29
211	.28	6C4	.20
803	3.63	6AR5	.54
805	3.63	6D6	.42
813	6.90	6K7GT	.43
815	1.37	6SH7	.27
843	.38	6S7	.53
954	.18	7C4	.28
955	.18	12A6	.19
957	.18	12H6	.22
958A	.18	12K7GT	.49
1619	.18	12SH7	.29
1625	.18	12SR7	.29
1626	.18	25D7	.29
1793	.47	356GT	.49
9004	.18	50B5	.49
9006	.18	50L6GT	.48

All Quantities Limited

## MORE BARGAINS IN SURPLUS EQUIPMENT

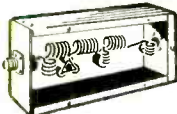
1—2 or 3 of each • Check every line!

- Wilcox CW-3-110V Superhet Revr. New... \$75.00
- Antenna Rotating Motor—RL—22A Reel Exc. 4.95
- W.E. XMTR MOD. Comp. w/controls spares—New 225.00
- MN26C Radio Compass—Used 32.00
- MN26C Radio Compass—New 26.95
- 733DD Localized Receiver Exc. 9.95
- AN-APN-1 Altimeter—L.N. 18.95
- APS-13 Receiver—Exc. 12.95
- TG-10 Code Keyer—L.N. 14.95
- Z74N Modulator BC456A w/tubes Exc. 2.65
- Z74N Modulator BC456A Fair less tubes 1.68
- SCR 522 Receiver BC624 Exc. less tubes 7.95
- SCR522 XMTR-BC625 Exc. less tubes 11.95
- BC 1000A Transceiver New 300.00
- BC 604 FM XMTR Exc. 14.95
- BC 603 FM RCVR. Exc. 14.95
- BC 642 Transceiver, Contr. Box, Dyn. In-struction book, New 17.95
- T-17 HandiMike 200 Ohm Imp. Exc. .69
- T-24 HandiMike—7 Ft. Cord—Noise Filter—Plug—New 1.19
- PE 94 24V. DYN. for SCR522 Used L.N. 2.95
- Surplus Radio Conv. Manual Vol. 1 or 2 2.50
- BC 610 Tank Coils—New 1.50
- BC 654 80 Meter XMTR & RCVR. w/tubes & XTAL. 29.95
- Collins 32 RA-7 XMTR VY GD. 125.00
- Teletex Code Machines (Less tapes) Exc. 18.95
- ASD Radar Set (Complete—New (Price on Request)
- ASD Parabolic Antenna—Rotable—L.N. (Price on Request)
- 2601A Parabolic Rot. Ant.—L.N. (Price on Request)
- R784 APS 15A Electronic Camera (Price on Request)
- Sig. Gen. Ferris #16C (Price on Request)
- BC221 Freq. Mtr. w/XTAL & Calib. Book L.N. \$75.00
- LM Freq. Mtr. w/XTAL. Book Mod. Exc. 90.00
- TEY Navy 6 & 10 Mtr. Bat. Transceiver. 39.95
- RM69 RCVR. w/SPKR. 69.00
- BC-375 Tuning Units New—cased 4.95
- BC-375 Tuning Units New—cased 3.95
- GE 25 Watt Phone XMTR Model GP4A Pow. Sup. Exc. 29.95
- ATD 50 Watt XMTR New 49.95
- JQ Navy 6V. Port. Audio Amp. w/VIB. Sup. VY. GD. 9.95
- Gibson Girl Emergency XMTR. New 2.89
- BC 614 Speech Amplifier for BC610 L.N. 55.00
- W1252 Electronic Wavemeter 25-30 Mcs. Exc. 44.95
- BC 939 Ant. Tuner for BC610 L.N. 59.90
- Nat'l 1-10A RCVR. w/coils less Pow. Sup. L.N. 39.95
- BC 342 3V. Comm. RCVR. Exc. 69.95
- McMurdo Silver RCVR. Mod. #01 6-80 Mtrs. w/tubes L.N. 29.95
- Gon-Set 50-54 Mc. Conv. L.N. 24.95
- Beach 80 Meter VFO New 19.95
- Handy 28.5-29.7 Mc. Conv. New 24.95
- BC-347C Interphone Amplif. L.N. 2.95
- Dynamotor SA 5088 Imp. 13V. Out P. 450V. 4.95
- GP7 Tuning Units—New—cased 4.95
- GP7 Tuning Units—Used—cased 3.95
- GP7 Tuning Units—Used—no case 2.95
- BC 376 H Model Xtal. Test Osc. Ec. 14.95
- BC-610 plug in tuning unit, new asst'd freq. 3.50

# TV SCOOPS!

For Hams—  
**DON'T BE BLAMED FOR TVI!**

F.C.C. tests have proven that the new Low-Pass Filter Kit,\* developed by W2GX, attenuates all frequencies above 40 MCS. This "M" derived filter for 160 through 10 meters prevents TVI



while you're operating. Eliminates all frequencies above 40 MCS at 60 DB or better, passes all frequencies below 40 MCS. Fits any 52-72 ohm feeders. Insertion loss less than 1/60th of 1 DB. Full directions included.

Cat. No. N-279.

**\$4.99** plus 25c shipping charges in U. S.

\* Hi and Low Pass Filters manufactured by a division of Niagara Radio Supply Corp. Dealer inquiries invited.

For Servicemen—

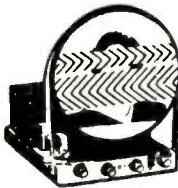


## RCA SOUND POWERED PHONES

Talk up to 10 miles without batteries with these sound powered phones. No loss in power EACH when parallel-ed. Ample volume, excellent type rubber-cushioned ear phones. Type "Q" has swing-away microphone. Type "O" has mike on chest set. Adjustable headband, Push-to-talk, 22 ft. of live rubber cord and plug on both types. Unit consists of 1 pr. phones, mike, cord and plug as illustrated.

MI-2475 Type "Q" **\$4.95** EACH  
Cat. No. N-300

For TV Set Owners—  
**Banish Interference**



BLEEP  
BLOOP  
BLAP

Niagara's new Hi-Pass Filter Interference kit\* is positive protection against amateur and other high frequency RF interference, such as diathermy, etc. Fits any 300 ohm antenna feed line. No loss in pictorial brightness. Easily assembled. Full instructions included.

**\$1.95** plus 15c postage and handling in U. S.



## MEET THE WINNER! of last month's TALL TALES CONTEST

Walter Berry of Madrid, Iowa, topped them all this month with this lottapalooza and wins the \$5 prize for March.

"Last winter in Iowa it got so cold my antenna contracted. Only dots went out, dashes stuck in the feeders. When the dots got out the wind blew them back causing the transmission line to explode, scattering dots and dashes all over the yard."

Send your entry in today. It may win!

Write for new catalog N

**IMPORTANT NOTICE:** Please include 20% deposit with C.O.D. orders, unless rated. Orders received without postage will be shipped railway express collect. Send us your inquiries today. We correspond in English, Spanish, French, Italian, Polish, Roumanian, Hebrew, German, Portuguese, etc. Prices subject to change without notice. All stock subject to prior sale. All merchandise f.o.b. N.Y.C. Minimum order \$2.00.

**Niagara Radio Supply Corp.** Phone Dlgby 9. 1132-3-4  
DEPT. N30 160 Greenwich Street, New York 6, N. Y.



# WHAT IS YOUR PROBLEM?

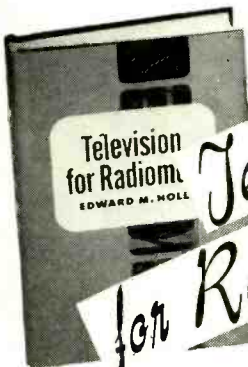
You will find the answer in

*Radio & Television Mathematics*

## A Handbook of 721 problems AND SOLUTIONS

Save time and trouble. Arranged under radio and electronic headings and completely indexed for quick reference, these problems give you step-by-step solutions to every problem commonly arising in work on receivers, power supplies, antennas, amplifiers, tubes, transmitters, etc. If you are ever "stuck" on a calculation; if you need a check on your figuring; or if you want to refresh your memory on the formulas to use for a certain problem—you will find your answer quickly and easily in this book.

Good practice for your FCC exams. This book shows you how to solve every problem requiring mathematics in the FCC STUDY GUIDE for licenses of all classes. You will find no better handbook for practice in solving problems with ease, speed and accuracy. \$6.00



Just Published

*Television for Radiomen*

## The how's AND WHY'S in the practical terms of operation & servicing

This book explains the *theory* as well as the techniques of television construction, operation, and servicing in the clearest, most practical terms. It gives the radioman all the basic information he needs to meet the increasing demand for skilled television technicians. It shows how and *why* all modern equipment operates; includes all the essential mathematics and especially good material on antennas. \$7.00

### SEE THEM FREE

The Macmillan Co., 60 Fifth Ave., New York 11  
Please send me a copy of the books checked below. I agree to remit in full or return the books within ten days without further obligation.

- Radio & Television Mathematics, \$6.00  
 Television for Radiomen, \$7.00

Signed.....

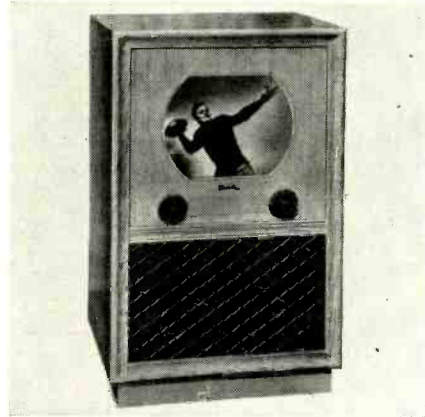
Address.....

plifier to boost the signals received on all channels, and one or more vertical lines of coaxial cable, running through pipe wells in the walls, with branch connections for all outlets.

When using this system it is only necessary to plug the receiver's antenna connection into a wall or floor-board outlet in the same way the power cord is plugged into the utility outlet.

### TRANS-VUE'S "ARISTOCRAT"

A new 16-inch direct-view consoleette which features "eye-level" viewing has been introduced to the trade by Trans-Vue Corporation, 1139 S. Wa-



bash Avenue, Chicago 5, as the "Aristocrat 601."

The new receiver employs the "Ese-O-Matic" tuner which requires only a single knob control. No vernier adjustment of multiple knobs is necessary on this set. All circuits are adjusted by a single adjustment screw, set at the time of installation.

### PHILCO TABLE MODEL

A low-priced table model television receiver which uses a 12½" tube is being offered by Philco Corporation of Philadelphia, Pa., as one of its 1950 line leaders.

Housed in a walnut cabinet, the new model has the Philco Electronic Built-In Aerial System which is claimed to be the only built-in antenna that can



be tuned to match perfectly with any station.

The circuit of this set uses 20 tubes and 2 rectifiers in addition to the cathode-ray tube.

# SHOOTS TROUBLE FASTER!

MAKES MORE MONEY FOR YOU ON JOB OR AT SERVICE BENCH!



PRICE \$9.95

at distributor or postpaid, direct. Sorry, no C.O.D.'s. Ohioans add 3% State Sales Tax

## Signalette

### MULTI-FREQUENCY GENERATOR

In radio service work, time means money. Locate trouble faster, handle a much greater volume of work with the SIGNALETTE. As a trouble shooting tool, SIGNALETTE has no equal. Merely plug in any 110 V. AC-DC line, start at speaker end of circuit and trace back, stage by stage, listening in set's speaker. Generates RF, IF and AUDIO Frequencies, 2500 cycles to 20 Megacycles. Also used for Checks on Sensitivity, Gain, Peaking, Shielding, Tube testing. Wt. 13 oz. Fits pocket or tool kit. See at your distributor or order direct.

Clippard Instrument Laboratory, Inc.

DEPT. N, 1125 BANK STREET CINCINNATI 14, OHIO

QUALIFIED JOBBERS WRITE, WIRE FOR DETAILS.

FREE

it's yours for the asking



Lists over 150 tube types that are directly interchangeable. Saves you time... save you money.

NOTHING TO BUY... Just Fill In Coupon... MAIL TODAY!

NAME .....  
ADDRESS .....  
CITY..... ZONE... STATE.....

SENCO RADIO, INC., Dept. S  
71 West Broadway, New York 7, N. Y.

Radio Men Who Know SAVE AT SENCO

RADIO & TELEVISION NEWS



**Spot Radio News**  
(Continued from page 18)

swer to the rambling problems of what to do with color TV and when, how to allocate the ultra-highs and how to orient the present channel set-ups so that no community suffers from a lack of coverage.

**MICROWAVE FACILITIES** for TV are rapidly becoming an extremely important factor in relaying, according to the fifteenth annual report of the FCC. Circuits, estimated to cost seventeen million dollars, were authorized during the past year, providing a link between Pittsburgh and Chicago, Chicago and Des Moines, Albany and Syracuse, Richmond and Norfolk, and Milwaukee and Madison.

The report also revealed that as of October 31, outstanding radio authorizations exceeded 737,000, an increase of more than 25,000 in the four months since the close of the fiscal year (June, 1949). In a breakdown of these authorizations, the FCC showed that there were 2299 standard broadcasting stations, 815 FM stations, 112 TV and 217 experimental TV, 589 remote pickups, and 29 studio-to-transmitter setups.

On October 31, the official records showed that over 82,000 had been licensed to operate as amateurs and 194 in the citizens service bands.

In an analysis of the status of TV as of June 30, the report disclosed that actually there were only 13 stations licensed, and 58 were operating on a commercial basis under special temporary authorizations. These 71 stations were, according to the review, bringing reception to 42 cities and metropolitan districts as compared with 17 cities served by 30 stations a year ago. The demand for new stations remained greater than the available facilities, so that 237 of a group of pending applications were in the comparative hearing stage at the conclusion of the fiscal year.

Commenting on the experimental TV services, the report declared that there were 175 experimental stations licensed and 30 outstanding construction permits. Included in these figures were 136 relay stations operating in the microwave region and used primarily as pickup, studio-to-transmitter link and interim intercity relay stations. About 30 authorizations were outstanding in the 475 to 890 mc. band, with activities concentrated on studies of propagation, developments in circuits and tubes for use at the ultra-high frequencies, color transmissions, Phonevision, Stratovision, comparisons with transmission conditions in the present bands, and television relaying.

The clear-channel problem, still to be solved, also received a substantial review in the report. According to the FCC, the matter is now awaiting

# ...after 9 months of daily use ON 30,000 MILE TREK THROUGH AFRICAN JUNGLE

with *Arch Oboler*

Famous Radio Playwright.

**E-V CARDYNE takes everything...from  
the heat and humidity of the Congo to  
the rain-swept slopes of the Mountains  
of the Moon, to the snow and ice of  
16,000 foot Mt. Kenya's glacier fields!**



Shows Arch Oboler recording Masai savages in Kenya, British East Africa

*"...trip was made by boat, pack horse, jeep and foot under most difficult conditions...apparatus had to endure penetrating dust and great variations in humidity...used the Cardyne almost entirely...never failed, during months of use and abuse...*

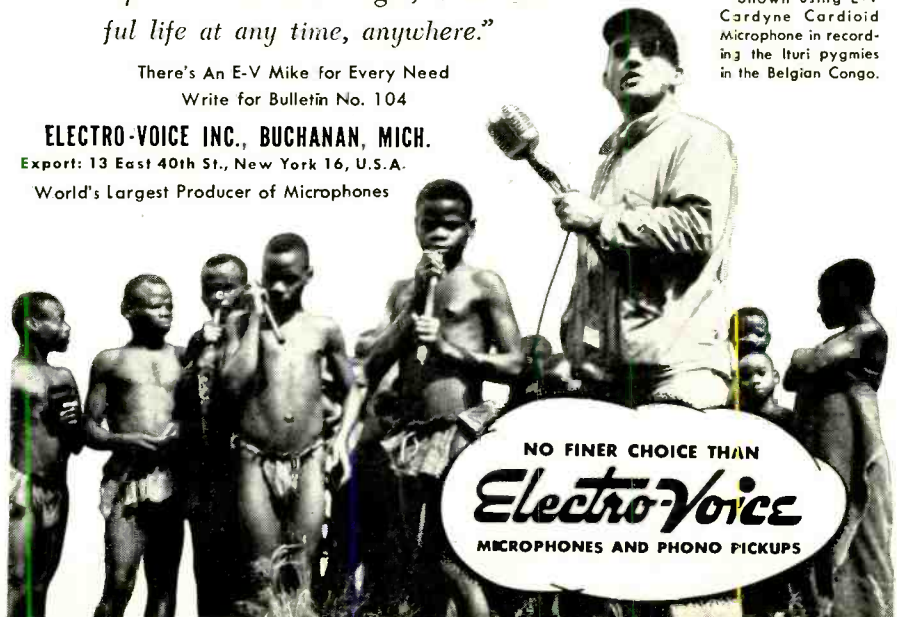
*made recordings of experiences on African safari...for a series of transcribed radio broadcasts...after return to U.S., found the Cardyne to be in thoroughly operative condition from every standpoint...built-in ruggedness of E-V microphones means a longer, more useful life at any time, anywhere."*

Arch Oboler...Author-Director. Winner of Radio's Top Awards, including the Peabody Award (Radio's Pulitzer).

Shown using E-V Cardyne Cardioid Microphone in recording the Ituri pygmies in the Belgian Congo.

There's An E-V Mike for Every Need  
Write for Bulletin No. 104

**ELECTRO-VOICE INC., BUCHANAN, MICH.**  
Export: 13 East 40th St., New York 16, U.S.A.  
World's Largest Producer of Microphones





# Sensational NEW LOW PRICE on Guaranteed Quality Tubes



1A5GT	3Q4	6AU6	6J5	6SL7	12AU7	12SL7	35W4	53
1A7	3Q5	6BA6	6J6	6SN7	12AX7	12SN7	35Z5	58
1H5	3S4	6BA7	6J7GT	6SQ7	12BA6	12SQ7	38	70L7
1L4	3V4	6BE6	6K5GT	6SU7	12BA7	1978	41	75
1N5	5U4	6BF6	6K6GT	6T8	12BE6	25L6	42	76
1P5	5Y3	6BG6	6K7GT	6V6	12F5	25Z6	43	77
1Q5	6A7	6BH6	6P5	6W4	12J7	26	45	78
1R5	6ABGT	6BJ6	6Q7	6X4	12K7	27	45Z5	80
1S5	6AC5	6C4	6S8	6X5	12K8	32L7	46	82
1T4	6AG5	6C6	6SA7	12A8	12S7	35L7	47	84
1T5	6AK5	6D6	6SD7	12AL5	12SA7GT	35	47	84
1U4	6AL5	6F5GT	6SF5	12AT6	12SF5	35B5	50B5	85
1U5	6AQ5	6F6GT	6SJ7	12AT7	12SJ7	35C5	50C5	117Z3
2A5	6AT6	6H6GT	6SK7	12AU6	12SK7	35L6	50L6	117Z6

**\$27.50 PER 100 ASSORTED**

Any Tube Above 32c Each.  
35c Handling Charge On Orders Under 100 Tubes.

ALL ORDERS SHIPPED C.O.D.

## OWL RADIO TUBE COMPANY

32 BECHER STREET • NEWARK 2, N. J.

All Orders Filled Promptly. All Tubes Individually Boxed.

Order NOW... this offer limited to stocks on hand HURRY!

an allocation schedule set up in accordance with the North American Regional Broadcasting Agreement Conference, which recently concluded one series of sessions in Montreal, with a second meeting to begin in the Spring. Detailing the complexity of the issues involved, the FCC discloses that the controversy resolves itself into whether it would be better to share existing nighttime facilities on clear channels with applicants throughout the country proposing to serve areas where little or no satisfactory service presently exists, or to allow only the present licensees on each clear channel to have super power in order to better their coverage. The solution of the problem, said the report, depends on which plan would tend toward betterment of service or duplication of service, particularly as it concerns rural listeners. Also presented are questions such as the economic and competitive effects upon other broadcasters if a few should be allowed super power, and whether this would be conducive to the proper distribution of broadcasting service and the larger and more effective use of radio as contemplated by the Communications Act.

(In a commentary on the "super power issue," made during the Federal Communications Bar Association annual meeting referred to previously, Senator Johnson said: "I hope that the Commission will shortly provide for duplication of clears since the people of this country need more frequencies desperately. Certainly it has the authority to do so. The maintenance of clear channels is an anachronism in modern radio practice. . . . Unfortunately the clears cannot render the local service that many areas deserve, hence they do not serve well. It is archaic to contend any longer that clear channels serve a useful purpose in the country, and the best proof is that the networks now frankly admit that their own seaboard clears might be duplicated without harm to them.")

An interesting dissertation on the operations of the technical information and laboratory divisions of the FCC also appeared in the annual report. In a review of the technical studies probed by the Commission, it was disclosed that radiation and interference received intensive surveying, particularly insofar as television receivers were concerned. The report stated the number of complaints of TVI received by the field division increased far beyond anything anticipated. A study was therefore undertaken to determine the technical phases of TVI, and since the problem is quite complex, a great deal of testing and research will be required before practical solutions can be reached.

The possibilities of single sideband, suppressed carrier applications were also covered in the report. With the ever-increasing demand for frequency space, engineers have turned to the

## 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.

**FEILER** SEND COUPON OR PENNY POSTCARD FOR YOUR FREE COPY TODAY!

FEILER ENGINEERING CO., Dept. 3H5  
1601 S. Federal St., Chicago 16, Illinois

Please RUSH my FREE copy of "How to Simplify Radio Repairs."

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

## Master Mobile

### ANTENNAS MOUNTS



(A) BODY MOUNTS: Swivel Base. (A) Mod. 126, straight spring. (B) Mod. 132, double tapered spring. Shpg. wt. 3 1/2 lbs. **\$7.95** Net price each.

BUMPER MOUNTS: (C) Mod. 133, straight spring. (D) Mod. 140, double tapered spring. Shpg. wt. 3 1/2 lbs. **\$5.95** Net price each.

(D) Mod. 142, less spring insulated for direct mounting for Series 100 Antenna or Extension 92. Shpg. wt. 2 lbs. **\$2.95** Net price.

WHIP ANTENNAS: (H) Stainless steel. Tapered. 72", 78", 86", 90" and 96" length. Postage rate 10 lbs. m.p. Series 100, 3/4" — SAE stud fitting. **\$4.77** Net price. Series 106, plain end. **\$4.11** Net price.

EXTENSION: (F) Mod. 92, 18". **\$2.95** Shpg. wt. 14 oz. Net price.

ALL BAND MOBILE ANTENNA: (G) Center loaded, 8'10" length with either 20, 40 or 75 meter coils. Specify freq. coil desired. Shpg. wt. 3 lbs. **\$7.95** Net price antenna with one coil. Extra coils, 20, 40 or 75 M. Each. **\$2.95**

Order from your dealer or write

**MASTER MOBILE MOUNTS, Inc.**  
5200 Wilshire Blvd. Los Angeles 36, Calif.

## REC'S HI FREQ. SUP HET 2 RF 4 IF STAGES 1 1/2 MC IF COILS CONVERTS TO 2-5-10 MTR'S & 420 band now tunes 195-210 MC

115 VAC 60 cycle 15 tube 2 RF & 4 IF stages on one chassis 25"x11"x8" in a metal case with the following tubes and main parts PWK. Trans. Thor. 70R52 chokes 4 Thor. 13C30 filter cond. 4 Aerovox S-8 oil filled. RF & IF coils and tubes shielded. 2 plate tuning cond. has following tubes 1-955 5-954 4-6SK7 one for each stage IF 2-6SJ7 2-6N7 1-574 Rect. this is a super Het circuit each unit cost the Govt. \$292.95 orig. tunes 195 to 210 megs we have converted one to 2 meters & plenty hot, orig. print with ea. unit we furnish you with a print of our changes for 2 meters, all minor changes. Condensers are mica or silver mica Tubes except the acorns are metal. Check Feb. issue CQ 1940 for hot 10 meter write-up. This Hot 10 Meter Write-up with Print is Available. Price \$1.00 Extra. The 115 VAC pwr. unit has four section filter capacitors and chokes in place of the usual one this can not be beat. These are a new lot just received, a large quantity in both the 400 and 400A, the only difference in the 400 and the 400A is there is a 115 VAC motor .65 RPM forward and reversible used for variable freq. control, this motor can be used for a geared beam plenty of torque 75 ounce inch units are later model with the same circuit and all like new. Send your order in early, send check or money order for the receiver but do not send the shipping charges; we will ship the units F.O.B. by freight, this is the greatest \$ value on the surplus market; sold on a money back guarantee. Each unit with orig. print; we furnish conversion instructions and print for 2 meters. Free.

**MFG. W.E. COST GOVT. \$292 BC406 \$12.95 BC406A \$15.95**

**McCONNELL'S** 3834 Germantown Ave. **XTALS 500KC** standards 2 pin holder  
Phila., Penna. RA 5-6033 **CR-2B/U** brand new \$1.50



single sideband, suppressed carrier method of operation because it offers a saving in the bandwidth requirements. Many technical questions have arisen concerning the actual bandwidth needed for various types of modulation, methods of calculating and specifying power, and so on. The study of these problems was started early in '49 and will probably be continued next year, the annual review declared.

Eight extensive projects involved in determining the over-all frequency characteristics of the low and high bands of television, the responsibility of the FCC lab groups, were also discussed in the report: A study of the effects of the variable hydrographic conditions on wave propagation; a study of terrain effects upon wave propagation; a study of surface coverage (trees, shrubs, etc.) and their effect upon propagation; analytical studies of tropospheric interference; tropospheric interference studies in the ultra-high bands; tropospheric interference standards for the very-high fixed and mobile services; a study of *scatter effect* and its probable impact on the present and future high bands for TV; and the development of automatic devices to scale field charts and analyze the resulting data.

In the letter of transmittal of the report to Congress, Wayne Coy, FCC Chairman, accented the growing importance of TV by declaring: "Broadcast activities are marked by the booming interest in television, and the attendant problems being dealt with by the Commission in order to meet the demand for video expansion and improvement."

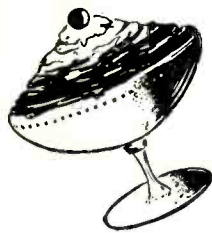
**AFTER THIRTY-THREE** years at the *Bell Labs*, during which the world saw a continuous procession of brilliant contributions to the science of acoustics, Harvey Fletcher has retired. Fortunately his retirement is but a transfer of operations, for he will now concentrate on education and serve as an honorary professor in the electrical engineering department of Columbia University, in charge of a department of acoustical engineering. Good luck, Doc. . . . . L.W.

### SET PRODUCTION

**T**HE recently-released report on set production by RMA member-companies reveals that 9,680,773 radio receivers of all types were manufactured during 1949 by such companies.

Television set production totaled 2,413,897 with 121,238 sets in January 1949, 118,938 in February, 182,361 in March, 166,536 in April, 163,262 in May, 160,736 in June, 79,531 in July, 185,706 in August, 224,532 in September, 304,773 in October, 414,223 in November, and 292,061 in December. Approximately 20 per-cent should be added to the totals in order to compensate for sets produced by non-RMA companies. This brings the over-all television receiver production for 1949 to 2,896,676 sets.

FM-AM and FM sets totaled approximately 963,055 and AM sets 7,030,508 for all companies.



# 'the proof of the PUDDING!'

Impartial and exhaustive tests prove that the new **MODEL IT4-SUPER SONIC TV/FM AMPLIFIER** delivers a higher usable gain with full bandwidth and higher signal to noise ratio than other leading brands at any price!



## model IT4

### SUPER SONIC TV/FM AMPLIFIER

**\$32<sup>50</sup>**  
List

- Improves TV reception in weak signal areas, with or without outdoor antenna.
- Continuous tuning of all 12 TV channels, also FM with ONE knob control.
- Reduces electrical, diathermy interferences and minimizes "ghosts and snow" effects.
- Frequency range: 50 mc to 220 mc, continuously tuned.
- Bandwidth: 6 mc. minimum all channels.
- Insertion gain: Minimum of 18 db at any frequency with 300 input and output impedances.
- Highest signal to noise ratio.
- Input and Output Impedances: 300 ohm balanced to ground and 72 ohms unbalanced.
- Inductances wound with PURE SILVER wire.
- All moving contacts heavily silver plated.

**CHOICE TERRITORIES STILL AVAILABLE**

Write for Free Brochure to Dept. RN1

# SONIC INDUSTRIES INC.

"MANUFACTURERS OF DUOSONIC PHONOGRAPHS"

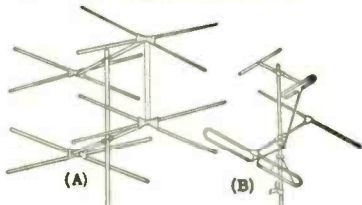
221 WEST 17th STREET, NEW YORK 11, N. Y.



If you don't receive our  
**FREE** BARGAIN CATALOGS  
you're losing money!

## TV Money Savers!

### TV ANTENNAS



#### (A) STACKED CONICAL TV ARRAY

High gain, all band, TV array at amazingly low cost. Direct coupling to 72, 150 or 300 ohm line with minimum loss. All dural construction. Less mast. Shpg. wt. 14 lbs.

Cat. No. DD852A ..... each **\$9.95**  
With dural-steel 10' mast. Shpg. wt. 17 lbs. Cat. No. DD852 ..... ea. **\$11.75**

#### (B) HI-LO DIPOLE AND REFLECTOR

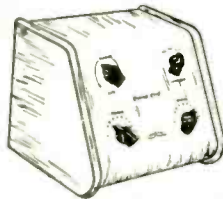
An ALL-BAND antenna that's easy to install, trouble free and highly efficient. Corrosion resistant, 8 foot steel mast. Adjustable mounting base and bracket. All elements securely locked. Dipole and reflectors of hard aluminum to prevent twisting and turning. Separate orientation for each bay. Less Base & Brackets.

Cat. No. DD802A ..... **\$5.35**  
Complete. Cat. No. DD802 ..... **\$5.97**  
Shipping weight: 7 lbs.

**TUBES** Can't mention name; top brand, fully guaranteed!

1B3GT	\$1.20	6BG6G	\$1.75	6AK5	\$0.99
6AG5	.90	6I6	.90	12SN7GT	.79
6AL5	.79	6SN7GT	.79	6AG7	1.28
6AU6	.69	6K6GT	.65	6V6GT	.69
6BA6	.75	5U4G	.65	6SH7	.55

**FEDERAL'S K-111** 300 ohm shielded transmission line  
All the advantages of 300 ohm twin-lead and coaxial cable combines. Minimize ghosts and noise. 100 ft. \$9.90. Ft. **11c**  
Fine quality, 20 gauge twin-lead, 1000 ft. \$11.25; 100 ft. \$1.25; per foot **1 1/2c**



### ASTATIC Chief

**TV Booster**  
A superior, new type of TV Booster offering a vast new scope of enjoyment. Extremely

high gain extends fringe area. 4 tubes with band-pass on all channels. Gain control. Dual tuning for separate tuning on sound and picture. Self-contained power supply. Mahogany cabinet. Cat. No. DD859. Your cost **\$29.10**

## RADIONIC EQUIPMENT CORPORATION

Tribune Theater Entrance  
DD170 Nassau Street :: New York 7, N. Y.  
WOrth 2-0421 :: Open daily 9 to 6—Sat. 9 to 5

### MAIL TODAY!

RADIONIC EQUIPMENT CORPORATION  
Dept. 53  
DD170 Nassau Street, New York 7, N. Y.

Please rush FREE copy of your latest Bargain Catalog of Radio and Television Sets, Parts, Tubes and Accessories.

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

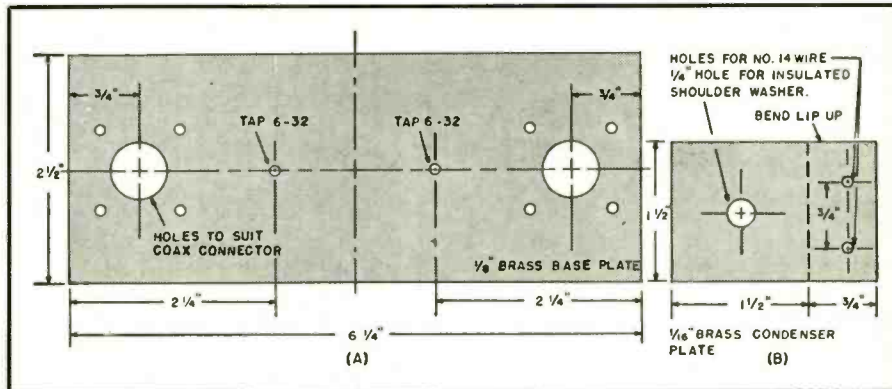
## TVI Filter

(Continued from page 61)

portant, very low inductance. The design capacity of each plate-type condenser is 141  $\mu\text{fd}$ . The actual capacity should agree within 10% of this figure and should be adjusted experimentally, stacking mica sheets for the dielectric until approximately the correct capacity is attained. A "Q"-meter is ideal for this adjustment but the transmitter v.f.o. may be used, comparing the frequency change produced by the addition of the plate condenser to the

denser assembly is shown in the photograph appearing on page 61.

The self-supporting coils are wound of number 14 wire on a  $\frac{1}{2}$ " form, and the form then removed. It is best to check the inductances but this is not absolutely necessary provided the dimensions and photographs are followed closely. Small variations in the individual elements will only slightly modify the transmission characteristic of the filter. For instance, no perceptible change was produced when the sheet-copper shield was removed. Coupling between elements, principally magnetic coupling between the coils, should be minimized. Mounting the



Details for laying out and drilling the brass plate on which filter is assembled.

change produced by the addition of a mica or variable condenser of 140  $\mu\text{fd}$ . In the filter pictured, the mica is stacked to a total thickness of .013", using three or four sheets of .003-.004 mica.<sup>2</sup> A sawcut  $\frac{3}{8}$ " deep and  $\frac{1}{4}$ " in from the edge of each plate forms a small tab which may be bent up or down for small variations in the capacity. The over-all view of con-

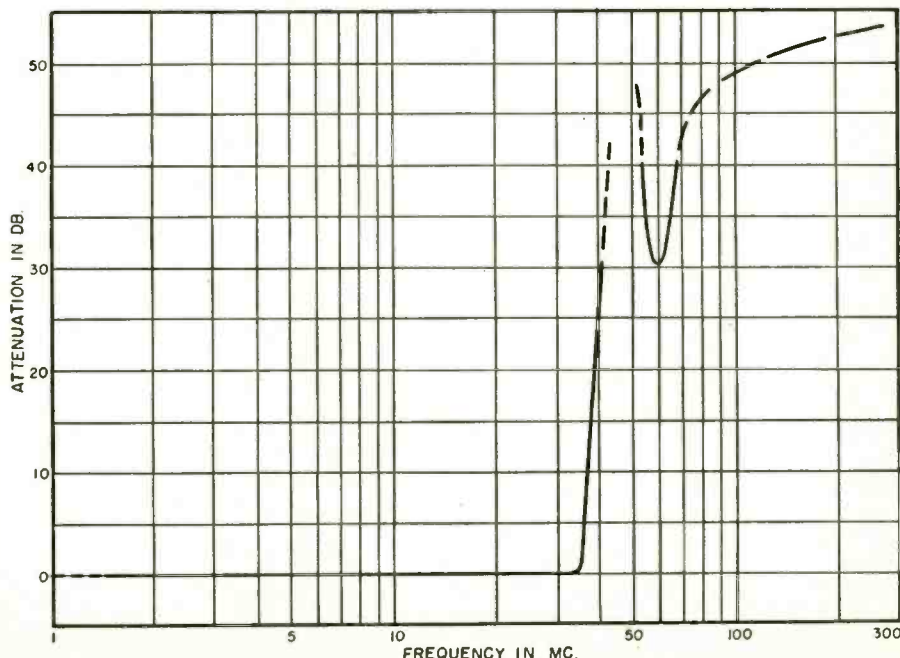
coils as shown will produce negligible magnetic coupling.

Although it has not been tested, an acceptable substitute for the sheet mica should be celluloid or old photographic negatives. The latter should have the emulsion removed by a bath of hot water. These materials are inferior to mica in dielectric strength and power factor but should be usable for moderate power applications.

<sup>2</sup> Mica may be obtained from Mica Insulation Co., 1276 W. Third St., Cleveland, Ohio.

-50-

Transmission characteristics of the TVI filter plotted from 2 to 200 mc.





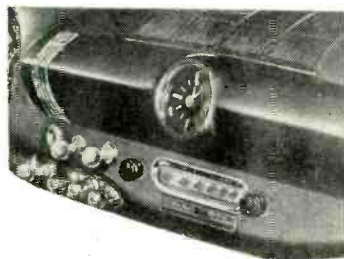
# CREATED A SENSATION

*at the New York Show!*

★ **Enthusiasm**  
and **BUYING** response  
**WAS TERRIFIC!**



## 1949 and 1950 FORD AUTO RADIOS



Six-tube superheterodyne. Six volt storage battery operation. Two dual purpose tubes. Eight tube performance. Specifically designed to fit all 1949 and 1950 Ford cars. Features two unit construction. No hole drilling required for mounting. Installation in a few minutes. Three-gang tuning condenser and tuned R. F. stage for extreme sensitivity. Permanent magnet dynamic speaker with powerful Alnico #5 magnet. Low battery drain. Weight 10 lbs.

### UNIVERSAL MOUNT AUTO RADIOS



**Model X-50**  
**LIST PRICE \$29.95**

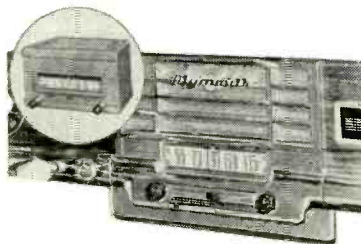


**Model M-90**  
**LIST PRICE \$36.95**



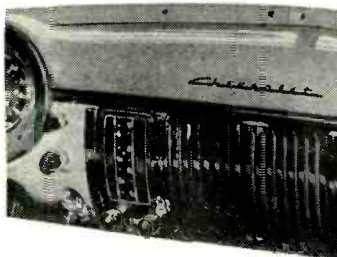
**Model M-92C**  
**with battery charger**  
**LIST PRICE \$45.95**

## 1949 and 1950 PLYMOUTH and DODGE AUTO RADIOS



Six-tube superheterodyne. Six volt storage battery operation. Two dual purpose tubes. Eight tube performance. Specifically designed to fit 1949 and 1950 Plymouth and Dodge cars. Single unit construction. Very simple installation. Three-gang tuning condenser and tuned R. F. stage for extreme sensitivity. Permanent magnet dynamic speaker with powerful Alnico #5 magnet. Low battery drain. Weight 10 lbs.

## 1949 and 1950 CHEVROLET AUTO RADIOS



Six-tube superheterodyne. Six volt storage battery operation. Two dual purpose tubes. Eight tube performance. Specifically designed to fit 1949 and 1950 Chevrolet cars. Features two unit construction. No hole drilling required for mounting. Installation in a few minutes. Three-gang tuning condenser and tuned R. F. stage for extreme sensitivity. Permanent magnet dynamic speaker with powerful Alnico #5 magnet. Low battery drain. Weight 10 lbs.

**"AUTOMATIC" MEANS TOP PERFORMANCE**

— **DISTRIBUTORS!** —  
Many choice territories still available.  
Write, wire or phone for trade discounts and further information.

**AUTOMATIC RADIO MFG. CO., INC.**

*Automatic Radio*

**122 Brookline Ave.,  
BOSTON 16, MASS.**



# INVENTORY SALE

## ALL PRICES CUT TO BONE

WESTINGHOUSE KUPROX RECTIFIER

25c TUBE SALE—#53-2A7-55-27-01A—6 for \$1.00  
85-31

12 BRAND NEW 10" PHONO RECORDS—Ass't.  
Jazz—Pop—Hillbilly—Polkas ..... \$1.79

WOOD MIDGET CAB. 8 1/2"x5 7/8"x4 1/4" ..... 69c

Slightly used Phono Records. Popular. Jazz, etc.  
Ass't. .... 8 for \$1.00

### POWER PACK KIT

COMPLETE COMPONENT PARTS for Heavy Duty Power Pack. Made from Signal Corps Brand New Parts—Delivers approx. 350 volts—150 mls. 1 Plate Trans., 1 Filament Trans., 2 Chokes and Schematic Diagram, U. S. Gov't cost over \$60. Shipping wt. 30 lbs. SPECIAL PRICE ..... \$3.00

JONES 20 TERMINAL BARRIER TYPE STRIP ..... 25c

### TRANSMITTING FILTER CHOKES

63 Henries, .018 Amp., 930 Ohms ..... 75c

Signal Corps Phones—2 M. Ohms (8 M. Ohms Imp.) ..... \$1.00

2 Ft. Ext. Cord (and Plug) ..... 40c

### OIL FILLED FILTER CONDENSERS

1—MFD—2000 volts ..... 75c ea.  
1—MFD—1000 working volts ..... 6/99c; 12/51.75

FAMOUS BRAND RECORD CUTTING HEAD  
Size 1 3/8"x2 7/8" ready to fit your cutting arm or bracket. SPECIAL ..... \$2.95

### TOBE TUBULAR ELECTROLYTICS

20-30 MFD. 150 V. .... 30-30 MFD. 150 V. .... 30c

40-40 MFD. 150 V. .... 32c

2 1/2 M.H. R.F. CHOKE COIL—27c ea. 5 for \$1.00

3 BAND OVAL DIAL—7 1/2" L x 5 1/2" H ..... 60c

100 RESISTOR ASST. 1/4-1/2 WATT ..... 95c

### Low-Loss Short Wave Variable Condensers

5 Plate—20 MMFD ..... 20c

14 Plate—55-60 MMFD ..... 27c

### Lock Type Air Trimmer Variable Condensers

3 Plate—12-15 MMFD ..... 10c

5 Plate—20 MMFD ..... 11c

8 Plate—30-35 MMFD ..... 13c

10 Plate—40 MMFD ..... 14c

14 Plate—56 MMFD ..... 20c

20 Plate—80-100 MMFD ..... 25c

27 Plate—100-110 MMFD ..... 35c

3 GANG T.R.F. VARIABLE CONDENSERS  
E. S. #000365 Con. 65c  
D.P.D.T. SLIDE TOGGLE ..... 23c  
SWITCH ..... 23c

4 PR. WAFER SOCKETS—\$1.49 per C. each ..... 3c

PHILCO 4 MF—300 V.—1 1/2" CAN CONDENSER—10c ea.

5-6 PRONG WAFER SOCKETS ..... \$2.50 per C.

100 ASST. SOCKETS—5-6-7 ..... \$3.50 per C.

1,000 OHM WIRE WOUND POTENTIOMETER ..... 15c

30 HY-FILTER CHOKE SHIELDED ..... 49c

UNSHIELDED ..... 39c

10 WIRE WOUND RES. KIT—5-50 W. ASST. .... 49c

2,000 ohm Wire Wound Rheostats ..... \$1 per doz.

CARTER WIRE WOUND C.T. VARIABLE 20 OHM RESISTORS ..... 85c per doz.

RCA 6 OHM POWER RHEOSTATS ..... 39c

PHILCO AUTO SUPPLY—5-60 per C. 7c ea.

GEN. ELEC. WESTINGHOUSE, etc., 60 CYCLE WATT HOUR METERS, slightly used, perfect condition, same as used in your home. 110-125 volts. 12 Amps ..... \$3.95

Grind your own crystals—Pure Brazilian Quartz, all sizes and thicknesses—1/2 lb. package ..... \$1.00

RCA Band Switches—3 gang, 3 pos. 3 band, 30c 6 gang, 5 pos. 4-5 band, 40c

1. C. A. 30 MH RF choke ..... 25c

Trimmer-Padder Ass't.—all isolantite—singles, dual, triple—100 ass't. pieces ..... \$2.25

5"—450 ohm AC-DC dynamic \$1.35 Philco rotary tap-tone control ..... 25c

ATTENTION: Prospectors, Explorers for Hidden Treasures! Construct a U.S. Army Type of Metallic Mine Detector Amplifier. Amplifier and only (less tubes and batteries) with cables, headphone cord, and jack. Army wiring diagram. Type AN/PRS-1 ..... \$1.95

TUBES—OZ4 ..... 79c

6 ASST. WET ELECTROLYTIC CONDENSERS ..... 59c

RADIO EXPERIMENTER'S SURPRISE PACKAGE—CONTAINS BYPASS & FILTER CONDENSERS, SHORT WAVE TUNING UNITS, 200 OHM CAN FILTER CONDENSERS, SOCKETS, RESISTORS, CHASSIS HARDWARE, OVER 20 LBS. OF VALUABLE PARTS. \$4.95

DRILLED CHASSIS FOR 5-6 tubes 7"x10"x1 1/2"—29c; 8"x10"x1 1/2" ..... 25c

RCA ADJUSTABLE CODE INTERFERENCE WAVE TRAP 456-475 K.C. .... 25c

PHONE JACKS—OPEN & CLOSED AUTO ..... 18c

NATIONAL 5-15—450 OHM CAN FILTER CONDENSER ..... 39c

ERY SPEAKER VOL. CONTROL—60 OHMS ..... 15c

SALE—PHONO RECORD ALBUMS—SALE

10"—3 comp.—15c; 4 comp.—20c; 12 comp.—49c

12"—3 comp.—15c; 4 comp.—20c; 12 comp.—69c

WESTERN ELEC. TRANSMITTING STEP-DOWN TRANSFORMER—AC, 100, 210, 230, 250 V. W.E. 20 AMP RETARD CHOKE TO MATCH. Wt. 125 lbs. ea. Freight Shipments Only. SPECIAL. \$5.00 ea.

75 MFD., 25 V. Tubular Cond. .... 15 for \$1.00

Line Noise Elim. R.F. Choke, #14 Wire ..... 10c

7 Wire Shielded Cable, 24" with Octal Plug ..... \$1.00 per doz.

4 Wire Shielded Cable, 6 Ft. with Plug ..... 7 for \$1.00

Upright Elec. Cond. Clamps, 1 3/8" Diam. .25 for \$1.00

RCA 2-Way Intercommunication Set ..... \$16.50

6 Pr. Amphenol Sockets ..... \$4.00 per C

G.E. Power Trans., 1 1/2 V., 5V., High V. .... 50c

Majestic 6 V. Auto Vibrator ..... 50c

Tube Ring Holders ..... 7c ea.; 15 for \$1.00

10 MFD., 300 V. Cond. .... \$1.00 per doz.

Transmitting Filter Cond. Ass't., W.E., Parvolt, RCA, G.E., Etc. Cap. 1 MFD—3 1/2 MFD. 6 for \$1.00

MINIMUM ORDER \$2.00—NO C.O.D.  
SHIPMENTS—PLEASE INCLUDE POSTAGE

NEWARK  
SURPLUS MATERIALS CO.

Dept. MA  
324 Plane Street NEWARK 1, N. J.

# 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.

## "TELEVISION EXPERT"

"Here's How to be a Television Expert" is the title of a 23-page, two-color booklet published by *Motorola Inc.* and available at dealers.

Of modern design, the booklet's main theme is an elementary explanation of television, its production, its reception, history, and how the networks are made, etc. Numerous sketches are used to illustrate the answers to those questions most often asked about television by the layman.

The booklet is not designed as promotional literature and may, therefore, be used as an educational piece in schools or for any group interested in learning about television.

## ACCESSORY PRODUCTS

Three types of biconical television aerials, six handy alignment jigs for servicing *Philco* television receivers, a three-speed record changer, and 45 r.p.m. record adapter disc and non-slip driver are among the new accessory products described in a series of data sheets available from the Accessory Division of *Philco Corporation*, Philadelphia, Pennsylvania.

Detailed descriptions of these products as well as an isolation probe used with the company's Electronic Circuit Master, Model 7001, are covered in these bulletins.

For information on the isolation probe ask for the bulletin on Part No. 43-5127; on the automatic record changer (Model M-20) the bulletin on Part No. 45-9566-1; on the biconical television aerials and the television alignment jigs ask for the bulletins by name.

## TRANSFORMER CATALOGUE

A new transformer catalogue which lists a complete line of transformers for broadcasting and other professional applications as well as for amplifier constructors, audio enthusiasts, the replacement field, and hams, has just been published by *Peerless Electric Products Division of Aitec Lansing Corporation*, 161 Sixth Avenue, New York 13, New York.

The line includes output, input, interstage, plate and filament, power smoothing and swinging chokes, modulation and replacement types. Also listed are several new additions to the company's line including power transformers, television receiver power transformers and chokes, matching transformers for the 70 volt RMA standard line as well as the conventional 500 ohm distribution line, output transformers for the Type

2A3 tubes, a new output transformer for push-pull parallel 6L6 tubes with secondary for the new RMA 70 volt line as well as voice coils, etc.

## SELF-LOCKING NUTS

A new 4-page folder prepared especially for design engineers and production men is currently available from *The Palnut Company*, 23 Cor-dier Street, Irvington 11, New Jersey.

Details of construction savings and assembly with the company's washer-type, self-locking nuts on sheet metal products, decorative parts, and components are given in the booklet. The material included covers assembly procedures and methods of application on electrical equipment, radio, television, ranges, etc.

Pertinent dimensions, screw tension figures, materials, and finishes are also included to provide complete data for the engineer.

## AUDIO EQUIPMENT

Laboratory instruments, potentiometers, decades, gain sets, precision resistors, and other products used in the audio field are covered in a new 40-page catalogue published by *Cinema Engineering Co.* of 1510 W. Verdugo Ave., Burbank, California.

Included in Catalogue No. 11-A are graphs and tables for computing attenuators and branching networks. Complete technical tables cover precision wirewound resistors in four different alloys of wire. There is also a listing of laboratory patch panels, cords, jacks, and transmission lines. The material is illustrated with charts, diagrams, mixer circuit, schematic drawings, and attenuator formulas.

## TV PARTY BOOK

On the premise that much of today's home entertaining revolves around the television receiver, *Starrett Television Corporation* of 601 West 26th Street, New York 1, New York, has issued a 24-page booklet entitled "21 Terrific Television Parties."

This handy little publication offers 21 new television games including charades, quizzes, puzzles, anagrams, spelling bees, "name" games, definitions, hidden term games, Valentine and Anniversary games, etc.—all pertaining to home television viewing and entertaining. Answers and results are provided in a back section of the booklet and, in addition, detailed suggestions for invitations, refreshments, home decorations, and



prizes accompany the instructions for each game.

Distribution is being handled through *Starrett* dealers.

### FASTENER DATA

The new 28-page booklet just released by *Pheoll Manufacturing Co.*, 5700 Roosevelt Road, Chicago 50, Illinois, contains valuable fastener information for manufacturers who perform partial or complete assembling operations.

Products illustrated include screws in round, pan, truss, fillister, flat, and oval head styles. These are listed in both slotted and Phillips recessed head types. Hexagon head units are also available in plain, indented, and slotted head types.

A copy of the "Sems" (lock washer screws) bulletin may be secured by requesting Catalogue No. 80-A.

### ADC TRANSFORMERS

*Audio Development Company* of 2833 Thirteenth Avenue South, Minneapolis 7, Minnesota, has recently released a 16-page catalogue covering its line of transformers.

Known as Catalogue No. 49A, the new publication includes data on case dimensions, chokes, filament transformers, bandpass filters, sound effects and special filters, impedance matching transformers, interstage units, input transformers, jacks and jack panels, line-to-grid transformers, line-to-v.c. units, microphone cable transformers, miniature audio and modulation transformers, output and power transformers, patch cords and plugs, preamplifier plate-to-line units, reactors, and subminiature transformers.

Complete performance data and ratings are given on each of the units described.

### TV REPLACEMENT GUIDE

Of interest to service technicians is the new 20-page booklet "Television Components Replacement Guide" recently released by *Standard Transformer Corporation*, Elston, Kedzie, and Addison Streets, Chicago 18, Illinois.

This guide, Form DD338C, lists *Stancor* replacement transformers for 215 television receivers and chassis made by 43 manufacturers. Replacement parts numbers are listed together with manufacturers' parts numbers for positive identification.

The guide will be issued periodically as additional information is compiled.

### "SELETRON" UNITS

The *Seletron Rectifier Division* of *Radio Receptor Co., Inc.*, 251 West 19th Street, New York 11, New York, has prepared a new 4-page folder showing typical industrial applications of its "Seletron" selenium rectifiers in units up to 75 kw. as developed by the company's customers.

Illustrated and described are typical installations used in theaters,

# MORE VALUE!



### GN-45 HAND GENERATOR

6 Volts, 3 Amps  
500 Volts, 0.14 Amp

Used with Signal Corps Radio Set SCR-284. Has many applications. Brand New, Original Packing.

ONLY \$12.95

### DYNAMOTORS

Dynamotor for DY-12 Power Supply for AR-13	Only \$7.95
Type DM-33-A, in. 28 V. o u t. 540 VDC, 250 mills	Brand New 1.95 (Excellent—Used \$1.25)
Type DM-53-A, 24 V. in. 220 V. 80 MA	Brand New 1.95
INVERTER—PE-206, 28 V. in. 80 V. at 500 VA, 800 cy. out.	Brand New 4.95 (Used Excellent Condition 3.25)
BD-77	NEW 5.95
DM-32	Used .75
PE-94C	NEW 5.95

### OIL FILLED CONDENSERS

Famous Make T1H 50020, 2 MFD, 5000 VDC.	\$4.25
Nationally Advertised, 2 MFD, 600 VDC	.29
Famous Makes, 4 MFD, 600 VDC	.79
Highest Quality 23F47, 2 MFD, 4000 VDC.	3.25
Highest Quality 25 Mu-f, 6000 VDC.	1.95
Highest Quality 30 Mu-f, 90 V, 3 phase.	1.19
60 cycles	
Mica Capacitor, Type G1 ceramic .04 1000 Volts, 25 amps at 1000 KCS.	1.29
Type DT-4W1, CAP. 1 MFD, 400 Volts, Tubular, Box of 25	2.98

### Multitester Foundation BIAS METER 1-97A

Contains a zero center 3 1/2" round Marlon voltmeter, calibrated 0-100 volts—each side. Movement is one mill each side of center. The unit is mounted in a steel box 7" x 5" x 4 1/2" and contains 3 contact push button, line cord dual 100 MFD at 200 V DC condenser, a potentiometer 6 1/2 RC 1% wire wound non-inductive resistors, one 400 ohm, two 2500 ohm, one 5000 ohm, one 10,000 ohm, one 15,000 ohm.

Excellent for building a zero center multitester with ranges of 1, 10, 100, 1000 volt.

COMPLETE BRAND NEW \$3.95

WESTON, Model 528, 0 to 3 and 0 to 15 amp. A.C. 25-500 Cyc. with leather case, leads and clips. BRAND NEW \$6.95

WESTON, Model 269, 0 center, 100 mA each side. BRAND NEW \$5.95

BD-72 12 line portable monocond. magneto-telephone SWITCHBOARD used primarily in field wire systems.

BRAND NEW \$22.95 USED, EXCEL- LENT CONDITION \$14.95

BD-71 6 Line Portable, same specs as above—NEW \$14.95

### TYPE MN-20E ROTATABLE LOOP UNIT

8" diameter, used with MN-26 Compass and RA 10DB. Manufactured by Bendix.

A TERRIFIC BUY! ONLY \$11.95

### BC-223 TRANSMITTER

Range of 2000 to 5300 KC. Complete with all Tuning Units. Recommended for use of ship-to-shore and ham operation.

NEW—Original Cases \$27.95

### BEACON RECEIVER BC-1206-C

Manufactured by Setchell-Carlson  
Frequency Range—195 KC to 420 KC, IF Frequency—135 KC.  
Receiver Sensitivity—3 Microvolts for 10 Milliwatts output.  
Output Impedance—300 Ohms and 4000 Ohms to be selected internally.  
Power Output—230 Milliwatts.  
Volume Control—RF Gain Control.  
Power Supply—24-28 Volts Aeroplane Battery. Current—.75 Amperes.  
BRAND NEW—ONLY \$6.95

### TUBES

Standard Brands—All New Tubes

304TL	\$1.95	832A	\$ 4.89
5BP4	2.45	725A	6.95
872A	1.19	726A	13.95
10Y	.39	316A	.39
4AP10	2.29	1625	.39
7CP1	2.95		

### FILTERS

FL5 Lazy Q Radio Filter Unit, high impedance, NEW \$0.75  
FL8 Filter with Plug and Jack, Good Condition 1.29

WRITE FOR OUR FREE CIRCULAR!

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., NEW YORK 13, N. Y.

PHONES: RE 2-8177 and WO 4-2915

# THAT'S WHY MORE AND MORE BARGAIN HUNTERS PICK PLATT



### FIELD TELEPHONES

Army surplus, completely reconditioned with new handsets, electrically tested, in good used condition. Only \$6.95

LIKE-NEW FIELD TELEPHONES \$8.95

### SOUND POWERED HANDSETS

Reconditioned, Guaranteed

SPECIAL! Each \$7.95



### HEADSETS—Excellent Buys!

HS-33 with cord and plug, used, good condition \$1.19  
HS-23—Brand New with ear pads 2.75  
HS-33—Brand New with ear pads, cord and PL54 plug. 2.75  
TH-37A—1200 ohms with dual plugs. 2.95  
HS-16A—520 ohms 2.95

### CORDS AND PLUGS

CD 508A Cord Assembly with SW 14-U Switch and 2 cord attachments with JK 48 Jack and PL 68 Plug. Value—\$5.00. Our Special Low Price, Brand New \$3.95  
CD 307A with PL 55 and JK New \$5.95  
JK 26 Jack with cord, good condition. 12c  
JK 26 Jack only—Brand New 8c  
PL 55 Plug—NEW 25c  
PL 68 Plug—NEW 12c  
3 Conductor Cotton Covered Telephone Cord, 6 ft. with plug 19c

### MICROPHONES

T-24-G, 200 ohms, single button, 8 ft. rubber cord with PL-106 Plug and JK 38 Jack. BRAND NEW \$1.95  
T-17-B, Hand-held carbon microphone for use in voice communication. Effectively covers the audio frequency range from 300 to 2600 CPS. 200 ohms, with press-to-talk switch, 5 ft. rubber cord and plug. NEW \$1.95  
T-30 Microphone suitable for aircraft use. Responds to frequencies in the range of 400 CPS to 2000 CPS. Complete with cord and plug. Original Packing. NEW \$1.29  
T-36-C Hand Carbon Microphone. 24 ft. cord, 3 contact amphenol plug. 2.95

### 274-N COMMAND EQUIPMENT

Sensational Buys! BRAND USED NEW \$ 2.75  
BC-442 \$ 1.85  
BC-450, 3 Receiver Remote Control .89  
BC-453 12.95 8.95  
BC-455 6.95  
BC-456 2.95  
BC-457 5.95  
BC-458 5.95 7.95  
BC-459 14.95 24.95  
BC-646 1.95  
3 Receiver Rack 1.50  
2 Transmitter Rack 1.50



### TRANSMITTER-RECEIVER

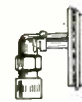
Conversion of BC-646 Bringing Excellent Results.

Navy Model ABA-1 (CG-43AAG)

Army Model SCR-515A known as the BC-645

450 MC—15 Tubes

BRAND NEW—ORIGINAL CARTON. Can be easily converted for phone or CW 2-way communication. Covering for the following bands: 420-450 MC ham band, 450-460 MC for fixed or mobile, 460-470 MC for citizens, 470-500 MC television experimental. Size 10 1/2 x 13 1/2 x 4 3/4. Contains 15 tubes: 4-7F7, 4-7H7, 2-7E6, 2-6F6, 2-955, 1-WE-316A door knob. Complete as shown above. only \$17.95



BC-645 ANTENNA. only 39c

BC-645 TRANSMITTER-RECEIVER ONLY, Brand New.

ORIGINAL PACKING. \$12.95

### SELSYN INDICATOR

For use with beam antennas for indicating direction of antennas. 1-82-B, 5" type. \$4.95  
Now





# IN DETROIT IT'S AARON

REFER TO OUR FEB. AD FOR RCVRs, XMTRS & ETC.

RELAYS		
LEACH P-3-1280 ohms, 7 MA kickoff	...	\$0.25
LEACH RELAY-14 VDC-DPST-15 amp contacts	...	.50
LEACH 355-D-24 VDC-SPDT-160 ohms	...	.75
LEACH RELAY-28 VDC-400 ohms	...	.75
LEACH 1220-28 VDC-DPST-95 ohms	...	.75
LEACH 1054-22-34 VDC-DPST-80 ohms	...	.50
LEACH 5055-24 VDC-Selenoid-25 ohms	...	.50
LEACH RELAY-28 VDC-125 ohms	...	.35
CLARE 811377-24 VDC-DP-makes 6 contacts, breaks 6 contacts, 300 ohms	...	.35
GUARDIAN ELECTRIC #32957-24 VDC-DPST-200 ohms	...	.50
6 VDC-50 ohms	...	.75
24 VDC-DPDT-200 ohms-6 amp contacts	...	.50
24 VDC-SPST-60 ohms	...	.35
24 VDC-SPST-500 ohms	...	.35
28 VDC-SPDT-4500 ohms, with arm	...	.50
STRUTHERS DUNN-115 VAC 60 cy.-DPST-200 ohms	...	1.50
RATCHET RELAY-coil # 5533-28 VDC with 8 shaft and wafer switch	...	1.00
RELAY SWITCH-14 VDC 60 ohms & 28 VDC 60 ohms	...	.49
RELAY-115 VAC 60 cy.-DPDT	...	1.50

RADIO FILTERS PL-8 or PL-5	97c	
FILTER COND.-30 MFD @ 450 VDC-15 MFD @ 450 VDC-15 MFD @ 350 VDC-40 MFD @ 25 VDC-new	79c	
ELECTROLIC COND.-16-16 MFD 300 VDC-new	49c	
PYRANOL CAPACITOR-GE-5 MU 600 VDC-new	69c	
AEROVOX OIL COND.-.01 MMF @ 5000 VDC	\$2.95	
.02 MMF @ 8000 VDC	2.95	
1 MMF @ 3000 VDC	1.75	
BUTTERFLY COND.-with silver plated loop attached approx. 1" x 1" x 1"-new-98-156 MC	38c	
100-300 MC	49c	
PORCELAIN TRIMMER COND.-7-17 MMF-new	39c	
5 GANG TUNING COND.-40 MMF for sec. 2 to 1 Gear reduction-new	\$1.95	
COIL ASSY BOX-contains variable & fixed cond.-chokes-resistors-coils-out of BC-312 & BC-348 revr.-new	1.50	
COIL UNIT C-439-new-for revr. BC-AS-220-(20) 3398 KC & 2500-4700 KC	75c	
CERAMIC COIL FORM & TUNING SLUG-3F2015-1-1 1/2" long x 1/2" dia new	25c ea. 5 \$1.00	
7 PRONG PLUG IN IF COIL-made by Collins-enclosed in can. (2) 300 MMF variable trimmer cond. (6-8.4 & 8.4-12 MC) new	75c	
30 MC SLUG TUNED IF COIL-new	25c	
COILS FOR BC-307-A XMTR. NO TANK INDUCTANCE COIL-(high & low freq) 1 st. winding-34 turns, taps on 17, 23 & 29 turn.	2nd. winding-24 turns, taps on 10, 16 & 20 turn. Both mounted on ceramic 7/4" x 1/2" coil form.	79c
PA TANK INDUCTANCE COIL-37 turns, taps at 11, 23, 30 turn. Mounted on ceramic 4 1/2" x 2" coil form	50c	
ANTENNA LOADING INDUCTANCE COIL-11 turns, taps at 4, 6, 7, 9, 10, 11 turns. Mounted on ceramic 2 1/2" x 2" coil form	35c	
CHOKES 5 H-.1 amp-GE stock #3C324-4-for BC-18 & BC-375 xmtr.-new	49c	

NEW 348 MAINT. KITS IN ORIG. BOXES	
SPARES for BC-348-Q Revr.-contains 6 dial lamps (L.M.27)-6 fuses-16 brushes-1 Allen wrench-1 tuning wrench-1 voltage regulator (rub neon) 110 V 1/2 W RCA-991	\$1.39
SPARES for BC-348-O Revr.-contains 16 brushes-6 fuses-B L.M. 27 dial lamps-1 set screw wrenches	\$1.00
SPARES for BC-375 XMTR.-contains 8 brushes-8 fuses-12 fuse links-4 wrenches-1/4 pt. Glyptal varnish	\$1.29

RESISTOR & CONDENSER KITS-contains 43 resistors, various ohmage & wattage values-20 condns., mica, ceramic and oil filled-new	\$2.25
VOLUME CONTROL KITS-contains 10 controls-from 2000 to 25000 ohms 2 W. type-wound-new	\$1.95
CRYSTAL UNIT-BENDIX TYPE MX-9-A-3333 KC, 3 prong, NEW	\$1.25
COIL SET & CRYSTALS FOR RX-TX BC-721-B-on freq. of 5500 KC (5500 & 5955 kcals., ant. tank coils)	79c
J-38 BREAK-IN TELEGRAPH KEY-on bakelite base-45"x30" has binding post-including silver switch-1/16" slow keying contacts, etc.	39c
EXTENSION CORDS-new-with PL 55 & JK 26 plugs-3 ft. 39c	5 ft. 60c
CORDS CD-416-for throat mike-with PL 68 & JK 48-6' long-a real buy-new-39c ea. 3 for \$1.00	
24 VDC BELLS-new-use for alarm systems-wire two in series to work on 110 VAC	75c
DYNAMIC MIKE & HEADSETS-Mark 2	1.19
TRANSTAT VOLTAGE REGULAR-Type RH-115 VAC 400 cy.-.2 KVA-output 75 to 120 V at 6 amp-Black wrinkle finish metal case-weight 11 lbs.-new	\$2.95
INTERSTAGE XFMR.-Standard Xfmr. Corp. stock #220136-1.5 300 ohms to grid-new	75c
STEP-DOWN XFMR.-in metal box with 2 fusetron thermal cutouts-115 V pri./21 V 5 amp sec. or 230 V/480 pri. 115 V sec. @ 150 VA 60 cy. ideal for 24 V supply	\$5.95
SELSYN INDICATORS-new-181 G & 182 F. ea. \$3.95 Dm-33-A-Dynamotor for BC-450	\$1.00
Dm-53-A-G.E.-used with BC-733	\$1.59
PE-101 Dynamotor for BC-645-new in cartons	\$2.95
PERMANENT MAGNETIC MOTOR #5068571-27.5 VDC-10,000 RPM-made by Delco	\$3.75
24 VDC RADAR SWITCHING MOTOR-simple 10 min. conversion to 115 VAC-DC-a cool running motor that will take up to a 1 1/2" fan blade. (Conversion data included)	\$2.95

CONTROL BOXES	
BC-AO-231 Radio Control Box	\$0.35
BC-AO-232 Radio Control Box	.35
BC-345 Switchbox	.25
BC-366 Jackbox	.25
BC-434-A Control Box for BC-433 Compass revr.-contains 5 grain of wheat bulbs-1 S meter, 5 mil movement	2.95
BC-450-A Control Box for command revrs.-3-B MC, 6-B 1 MC, 190-550 KC	1.50
BC-451 Radio Control Box	.50
BC-461 Reel Control Box with coupler-switches-Jacks-knobs	1.95
BC-602-B-used with SCIT-522 receiver	1.50
BC-629-B Jackbox-new	.39
BC-648-A-used with BC-645 trans/ceiver-contains 3 LM45 bulbs-sockets-new	1.00
BC-913 Switchbox-new	1.00
BC-958-BC-965-used with BC-966 IFF revr.-contains 3 LM45 bulbs-sockets-new	1.00
RE-1 ARR-1 Junction Box-12 or 24 VDC contains aligning trimmer-relay switch-2 SO-239 amphenols	1.00
C/30 ARC-5-new	1.00
C/31 ARC-4	.50
MC-125-A Control dial	.25
BENDIX STATION BOX 3613	1.00
BENDIX CONTROL UNIT 3616	1.95
BENDIX ANT. LOOP SWITCH BOX 3724	.35

WE Buy, Sell & Trade any quantity of new or used electronic equipment. All items used, unless otherwise stated, Michigan residents please add 3c tax. 25% with order balance including postage C.O.D.

**AARON ELECTRONIC SALES**  
3400 CHENE, DETROIT 7, MICHIGAN - LOrain 8-9966

electroplating and similar processes, elevator motor supplies, and power packs for d.c. motors.

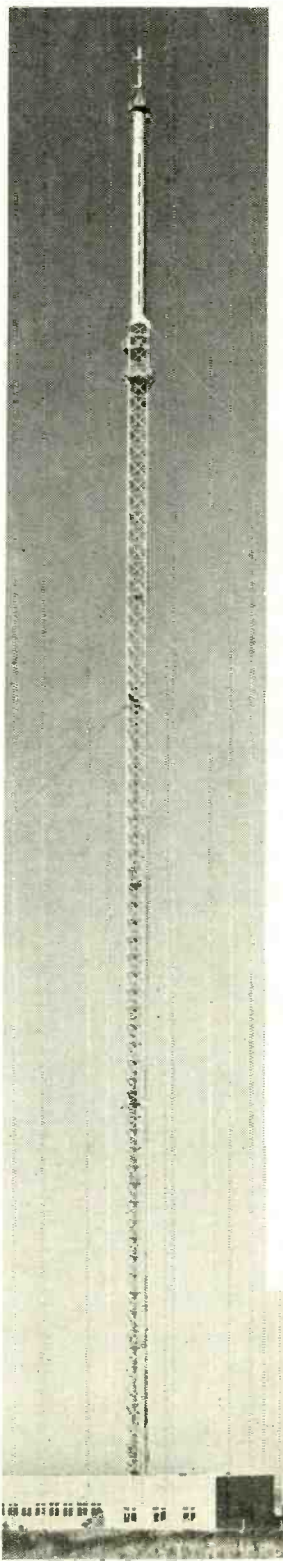
### STACKING DATA

An explanation and detailed drawings of the proper procedure in stacking high band antennas is given in Engineering Bulletin No. 58 just released

by Technical Appliance Corporation of Sherburne, N. Y.

The information is provided in easy-to-understand form as a service to the TV installation technician. Dimensions and proper phasing of antennas (for Channels 7-13) are given for both two-stacked and four-stacked arrays.

## BRITAIN OPENS WORLD'S MOST POWERFUL TV STATION



**T**HE new television transmitting station which was opened at Sutton Coldfield, near Birmingham, England, on December 17th is the world's most powerful video transmitter.

Owned and operated by the British Broadcasting Corporation, the new transmitter has an output of 35 kilowatts. This is several times more powerful than any U. S. television transmitter now in operation. According to the Radio Industry Council, such a high power beam has never before been radiated over such a wide frequency band as 3 mc.

The top of the new 750 foot lattice-steel antenna mast is over 1300 feet above sea level and 385 feet higher from the ground than the cross on the dome of St. Paul's Cathedral. Its base is level with the top of the antenna mast at Alexandra Palace, transmitting site for television programs in the London area.

The entire mast, weighing 140 tons, is pivoted on a steel ball 2 inches in diameter and held in position by four sets of steel guys, the topmost being attached at a height of 710 feet. A two-man electric elevator operates inside the lattice tower to a height of 600 feet. After that maintenance men have to climb. The eight dipole antenna array has electric heaters for de-icing.

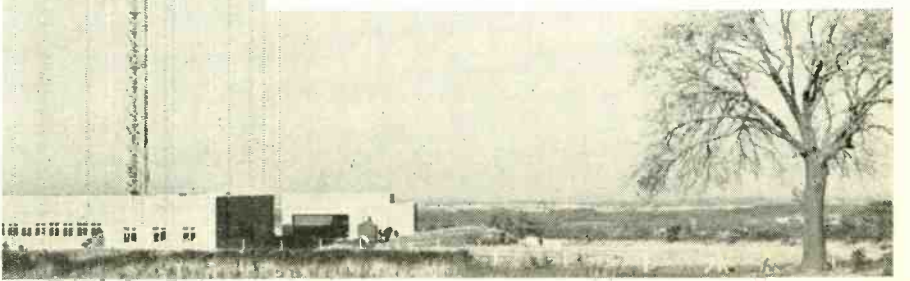
The radio relay link, which beams the visual signal from London to Birmingham on a wavelength of 30 centimeters, consists of two terminal and four repeater stations and has unique technical features. It can be reversed to work in the opposite direction so that London can receive television broadcasts originating in Birmingham. Eventually the relay will operate in both directions simultaneously.

The repeater stations, each of which amplifies the received signal ten million times, are fully automatic and could be left unattended for months. If trouble should develop, duplicate equipment automatically comes into service and the engineers in London and Birmingham are informed by signal lights of what has happened.

At a later stage a new coaxial cable, which has been laid between London and Birmingham, will become available as an alternative to the radio link.

With the opening of the new station in the Midlands, manufacturers of television receivers have been working overtime to meet the demand for new sets. Total production in November was 35,000 units or 3000 more than was produced in October, which was the previous record month. Before the opening of service from the new transmitter, an estimated 40,000 receivers had been sold to dealers in the Midlands and an estimated 250,000 people witnessed the first telecast.

The BBC's new television transmitter at Sutton Coldfield. At the top of the mast is the wideband antenna consisting of two tiers of four vertical folded dipoles, arranged in cruciform, which radiate both sound and video signals. The section below the TV antenna is to be used for v.h.f. if present BBC plans materialize.







### NEW SENSATIONAL LOW PRICE

Be money ahead with SUPREME Manuals. For the remarkable bargain price (only \$2 for most volumes) you are assured of having in your shop and on the job, needed diagrams and other essential repair data on 4 out of 5 sets you will ever service. These manuals pay for themselves with time saved on a couple of jobs, after that you use them FREE. Join 128,000 shrewd radio servicemen already benefiting with SUPREME Manuals. Don't spend large sums for bulky, space-wasting manuals of other publishers, don't buy additional drawings every few weeks, be wise, use SUPREME Manuals to get the most in diagrams for smallest cost. Send "no-risk" coupon below.

Compiled by M. N. Beltman, radio engineer, teacher, author, & serviceman.

### AMAZING BARGAIN IN SERVICE MANUALS

Here is your low-priced, money-saving source of radio diagrams and service data for all popular sets. Above is a photograph of these giant-sized manuals—available to radio servicemen at only \$2 for most volumes. Let these easy-to-use manuals guide you to quick fault finding and simplified repair of any radio. Eliminate guesswork, cut hour-wasting jobs to pleasant moments. These manuals cover every popular radio of all makes, from old-timers to new 1949 sets. Clearly printed circuits, parts lists, alignment data, and helpful service hints are the facts you need to be more expert in radio servicing. There are nine volumes in all as illustrated above. Each manual is mammoth-size, 8½x11 inches, sturdy manual style binding, average manual has 194 pages of diagrams and practical service data. Use coupon below to order on 10-day no-risk trial or see these manuals at your jobber.

**Record Changers**  
**Post-War Manual**  
 Service expertly all modern (1945-1948) record changers. Includes every popular make. Just follow simplified factory instructions to make needed adjustments and all repairs. Hundreds of photographs and exploded views. Large size 8½x11 inches. 144 fact-filled pages. Available at your radio jobber, or sent post-paid, price only. **\$1.50**

**Radio Servicing Course-Book**  
 Here is your practical radio course of 22 easy-to-follow lessons. Review fundamentals, learn new servicing tricks, all about signal tracing, oscilloscopes, recording, P.A., test equipment, and T.N. Just like a \$100.00 correspondence course. Everything in radio servicing. With self-testing questions and index. Large size: 8½x11". **\$2.50**  
 New 1949 Edition Price postpaid, only **\$2.50**



### NO RISK TRIAL ORDER COUPON

**SUPREME PUBLICATIONS, 3727 W. 13th St., Chicago 23, ILL.**

Ship diagram manuals checked at right and any books checked below. I am to have a 10-day trial under your guarantee of satisfaction.

Post-War Record Changers... **\$1.50**  
 Radio Servicing Course-Book... **2.50**

I am enclosing \$..... send postpaid.  
 Send C.O.D. I am enclosing \$..... deposit.

New 1949 Manual, \$2.50  
 1918  
 1917  
 1916  
 1912  
 1911  
 1910  
 1939  
 1926-1938 — \$2.50

**PRICED AT ONLY \$2 EACH**

Name .....

Address .....

**Supreme Publications**  
 Sold by all Leading Radio Jobbers

## 1060-2 N. ALLEN AVE. PASADENA 7, CALIF. PHOTOCOON SALES SYCAMORE 4-7156 RYAN 1-8271

### MARCH SPECIALS

Please write for our 1950 complete catalog.

- ARC-1 AIRCRAFT TRANSMITTER-RECEIVER**—10 channel RT18/ARC-1, Excellent Condition with tubes..... **\$695.00**
- SCR-522 EQUIPMENT**  
 SCR-522 TRANSMITTER-RECEIVER, with tubes. Excellent condition. **\$60.00**  
 PLUGS—Set for SCR-522.....NEW **3.75**  
 PE-94C—24 Volt Dynamotor.  
 Used **\$2.50**.....NEW **4.50**  
 BC-602 Control Box.....NEW **.95**  
 BC-631 Jack Box.....NEW **.79**  
 AN-104A Antenna  
 NEW STEEL **\$1.95**.....COPPER **2.95**
- SOUND POWERED HEAD AND CHEST SET.**  
 Made by Automatic Elec. Co. .... PAIR **\$11.00**  
 NEW—EACH **5.95**
- ELECTRONIC MEGAPHONE**—Light weight portable for use by coaches, cheer leaders, police, fire depts., etc. Ready to operate, includes LS-6C Speaker, BC-641C Amplifier, Carrying Case, and batteries..... **\$39.50**  
 BC-641C AMPLIFIER only..... **9.95**
- BASSETT AIRCRAFT RADIOS & ACCESS**  
**Two Way Radio Freq. 3105 K.C.**  
**ALL NEW EQUIPMENT**
- MC6—1½ Watt Trans-Recr. Tubes, crystal, battery case, antenna..... **\$31.50**  
 MC61—3 Watt Trans-Recr. Tubes, crystal, vibrapak, antenna, 12 volts..... **44.50**  
 MR3A Receiver Range, weather and tower freq..... **13.50**  
 MCU1 Aircraft Microphone..... **4.95**  
 HEADSET and PLUG..... **2.95**  
 MODEL TR 15—Trailing Antenna Wire Set. **6.95**
- WESTON ELECTRICAL TACHOMETER**  
 METER, Model 545 for use with Model 724 magneto. Speed 0-2,000 R.P.M. Ratio 2:1..... BRAND NEW **\$17.50**  
 WESTON TACHOMETER GENERATOR, Model 724, Type C..... GOOD USED **16.75**
- BC-464—TARGET RECEIVER—5 Channel remote, battery case, antenna 68-73 MC..... NEW **\$14.95**
- INTERPHONE AMPLIFIER—CMX50128A, 12 V. 6 Watts P.O. T.C.S. Equipment—tubes and dynamotor..... **8.50**
- HANDY-TALKIE Crystal and Coil Sets—3885 K.C. to 5,500 K.C. Specify frequency—2 crystals and 2 coils per set..... NEW **2.25**

- PE-103 DYNAMOTOR POWER SUPPLY.**  
 COMPLETE with dynamotor, filter, relay unit, battery cables, and shock mount. Part of SCR-284. BRAND NEW **\$19.50**
- BC-620 Mobile FM Transceiver—P. O. SCR-610. Includes 10 meter band. Excellent condition with tubes..... **\$11.95**  
 PE-120 Power supply with tubes—Excellent condition **5.50**  
 Combination BC-620 and PE-120... Both for **14.95**
- FL-8 Range Filter..... NEW **\$1.95**  
 HS-23 HEADSET—BRAND NEW **\$8.00**  
 ohm with ear pads..... **2.45**  
 HS-33 HEADSET—With ear pads..... **1.29**  
 HS-30 HEADSET—Complete with matching transformer, 6' cord and PL 55 plug..... NEW **1.95**  
 HS-30 HEADSET..... **.95**  
 DYNAMIC HEADSET AND MIKE—P.O. Mark II..... NEW **1.95**  
 HEADSET EXTENSION CORD—CD-307A with PL-55 and JK-26..... **.49**  
 HEADSET ADAPTER MC-385D—High to low impedance..... NEW **.35**  
 T-32 DESK MIKE. USED **\$1.95**..... NEW **3.00**
- MN-26C—BENDIX RADIO COMPASS. REC.V., 150-1,500 K.C. Tubes—Excellent cond. **\$17.50**
- TRANSFORMERS—6200 V. @ 325 ma. secondary—easily C.T. for 3100-0-3100 @ 650 ma.—Primary 105/410/0/115 V. 60 cycles—American Transformer Company..... NEW \$39.50**
- 2.5 V. @ 10 amps. C.T.—15,000 volt insulation—115 V. A.C. primary—Kenyon S-9883..... **5.95**  
 200-0-200 @ 50 ma.—6.3 V. @ 3 amps, 115 V. A.C. Primary..... NEW **1.95**  
 115 V. A.C. Primary—700 volts C. T. @ .075 amps. 6.3 V. @ 1.2 amps; 5 V. @ 3 amps..... NEW EA. **2.25**
- WELDING TYPE W. TRANSFORMER—190 amps—5 volt secondary—115 V. A.C. primary, mfg. by American Transformer Co. .... BRAND NEW **16.95**
- INTERPHONE AMPLIFIER—BC-709—Ideal for Aircraft, booster for telephone system, etc. .... NEW **\$4.50**

- 400 Cycle INVERTER—G.E. 5DZ1N3A Input 27 V., 35 amps. Output 115 V., 485 V.A. single phase..... **\$12.50**  
 400 Cycle INVERTER—G.E. PE-218 Input 27 V., 100 amps. Output 115 V., 1,500 V.A. single phase..... NEW **29.50**  
 800 Cycle INVERTER—PE-206..... NEW **5.95**  
 800 Cycle Blower and Motor—1 ph 6,700 R.P.M. 120 V. CAY-21773..... **1.50**  
 24 V. D.C. Blower and Motor—17.00 R.P.M.—1.35 amps. A. G. Redmond Co. .... **1.95**
- 5CP1—5" CATHODE RAY TUBE, 4 for \$4.25..... **\$1.45 each**
- APN-1 ALTIMETER INDICATOR, basic movement 0-1 ma.; 5 ma. shunt, 270° dial. An excellent basic movement for constructing your own meters..... NEW **\$1.95**
- METER RECTIFIER, full wave midgeit Selenium 10 volts, 30 ma..... **.29**
- APN-1 ALTIMETER, Complete..... NEW **34.50**
- I.F. Transformer—1st, 2nd or 3rd. from SCR-522, 12,000 K.C. Iron Core tuning, can be tuned to television I.F. Frequency by removing padder cond. 3 for \$1.00..... EACH **.35**
- BC-348 Mounting Base..... **\$2.25**  
 BC-348 Outlet Plug..... **.69**  
 BC-348 Mounting Base and Outlet Plug..... **2.50**
- TEST EQUIPMENT**
- BC-221 Freq. Meter—125 K.C. to 20,000 K.C. Excellent Condition..... **\$69.50**  
 I-122 Signal Generator by Espy Mig. Co. 15-27, 95-127 M.C..... **79.50**  
 TS-34/AP Portable Oscillograph made by Western Electric. Excellent condition. **250.00**  
 IE-19A Test set for SCR322. Complete..... **250.00**
- IDEAL MOBILE POWER SUPPLY**
- PE-237 Heavy duty vibrator power supply, 6, 12, or 24 V., Input 25 V., 95 ma.; 105 V., 42 ma.; 6.5 V., 2 amps; 6 V., 500 ma.; 1.3 V., 450 ma.; small supply 100 V., 17 ma.; 1.35-450 ma. with tubes, shock mounted. BRAND NEW **\$27.50**
- MINE DETECTOR-SCR-625A** Used for locating metal, underground pipes, gold, etc. NEW WITH MANUALS..... **\$59.50**  
 USED EXCELLENT COND. .... **39.50**
- SURPLUS RADIO CONVERSION MANUAL, Vol. 1, 115 pages of circuits and data..... Postpaid **\$2.50**  
 CD-501 CABLE for PE-103 BC-354..... NEW **1.95**  
 SPEAKER—6" P.M. Compartment, 25 watts, 50-6,000 ohms. Waterproof. Excellent Used..... **8.95**
- TERMS:** Prices f.o.b. Pasadena. 25% on all C.O.D. orders. Californians add 3% sales tax.



**RADAR, COMMUNICATIONS  
AND  
SONAR TECHNICIANS  
W-A-N-T-E-D  
For Overseas Assignments**

**Technical Qualifications:**

1. At least 3 years practical experience in installation and maintenance.
2. Navy veterans ETM 1/c or higher.
3. Army veterans TECH/SGT or higher.

**Personal Qualifications:**

1. Age, over 22—must pass physical examination.
2. Ability to assume responsibility.
3. Must stand through character investigation.
4. Willing to go overseas for 1 year.

Base pay, Bonus, Living Allowance, Vacation add-up to \$7,000.00 per year. Permanent connection with company possible.

Apply by Writing to  
**D-4, P.O. Box 3575,  
Philadelphia 22, Pa.**

Men qualified in RADAR COMMUNICATIONS or SONAR give complete history. Interview will be arranged for successful applicants.

**MAGNERASER**

**FOR 100% TAPE ERASURE  
WITHIN SECONDS**

Erases all brands of magnetic tape — even when severely overloaded, and actually lowers the noise level 3 to 6 db. below that of unused tape! If you operate any tape recorder, you should have a MAGNERASER for quick, 100% complete tape erasure. Safely push-button prevents accidental erasure. Also invaluable for demagnetizing record-playback and erase heads. Operates on 100 to 130 volts, 25, 50 or 60 cycle current. Weights 2½ lbs. Size 4½ x 2 inches.



**Net Price \$18.00**



Order today from your dealer. If he cannot supply you, send us your order with your dealer's name and address. All orders shipped within 24 hours.

\*Trade Mark Registered

**Accessories Division**

**AMPLIFIER CORP. OF AMERICA**

**398-2 Broadway New York 13, N. Y.**

**CODE SENDING  
RECEIVING SPEED**



**Free Book**

**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 radiotelegraph experts and code champions.

**CANDLER SYSTEM**

Box 928, Dept. 2-C  
Denver, Colorado

**What's New in Radio**

*(Continued from page 80)*

tric eye) which makes perfect recording every time.

The "Reelest" has been designed for easy portability. The specially designed case permits the unit to operate with the top cover down while all controls are accessible for operation. A hinged flap protects the controls as well as providing space for cord and microphone when the unit is being carried.

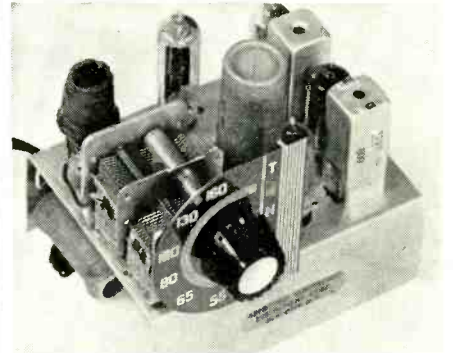
For full particulars or additional data, requests for this information should be addressed to Department E-4 of the company.

**MINIATURE BC TUNER**

Approved *Electronic Instrument Corp.* of 142 Liberty Street, New York 6, New York, is currently marketing a miniature superheterodyne broadcast tuner which has been designated the Model A-600 AC.

The circuit of the tuner is a standard superheterodyne using miniature tubes. The power supply is a standard 117 volt, 60-cycle full-wave rectifier. A power transformer isolates the line from the chassis, thus eliminating shock hazards.

The output cable is attached within the tuner to the low output tap but if



higher output is desired connection can be made to the medium or high output taps.

Since the unit measures only 4" x 4" x 5" and weighs 2½ pounds, it is ideally suited for applications where space is at a premium.

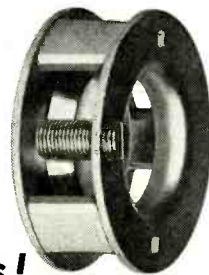
**SEMI-FLEXIBLE COAX**

*Andrew Corporation*, 363 East 75th Street, Chicago 19, Illinois, now has available a ⅜" diameter, semi-flexible coaxial cable (Type 83) for connecting transmitters to antennas in installations of 300 watts or less, to connect communications receivers to antennas, and to connect the phase sampling pick-up device to the phase monitor in broadcast directional systems.

The outer conductor material is a soft-temper copper tubing which is easily bent by hand although the company does not recommend repeated flexure. The cable is easily uncoiled and laid in place and, once installed,

**RADIO & TELEVISION NEWS**

**Look for the  
QUAM  
FOCALIZER  
UNIT**



**in better television receivers!**

The new QUAM FOCALIZER UNIT, utilizing Alnico permanent magnets instead of the more expensive and less stable wire wound construction, not only provides better, sharper focus of the television image, but is unaffected by operating temperature and voltage fluctuations.

With a QUAM Focalizer Unit in the set it is unnecessary to refocus the image because the coil has heated, increasing resistance and weakening the magnetic field. Since there is no wiring, voltage fluctuations have no effect on the operation of the QUAM Focalizer.



Focusing is done upon installation of the set by a simple operation—it is then permanent! You will find the QUAM Focalizing Unit in the better Television Receivers.

**THE QUAM ION TRAP**

The improved and simplified construction of the QUAM ION TRAP, also utilizing permanent magnets, makes it preferred equipment for better television receivers.

**QUAM-NICHOLS CO. 33rd Place and Cottage Grove  
CHICAGO, ILLINOIS**  
Makers of QUAM Adjust-A-Cone SPEAKERS



it provides a permanent transmission line which is highly stable both electrically and mechanically.

For best results, the cable should be maintained under gas pressure at all times. Suitable gas-tight end terminals and other appropriate fittings are available. Upon request the cable will be shipped under pressure.

Bulletin 29-A gives full details on the cable and accessories. A copy is available on request.

#### RELAY ENCLOSURE

A new dust-tight, plug-in enclosure for the small *Clare* Type "J" relay is now being offered by *C. P. Clare &*



Co., 4719 West Sunnyside Avenue, Chicago 30, Illinois.

Entrance of dust is prevented by the steel cover and by the use of a Neoprene gasket which is closely fitted to the relay terminals at the factory.

Installation is facilitated by use of a standard radio-type plug, which also reduces wiring costs. The base is secured to the chassis to prevent plug from being jarred or accidentally pulled from its socket. The dust-tight cover is easily removable for inspection.

A bulletin, No. 108, covers the new enclosure and is available on direct request to the company.

#### GRAY EQUALIZER

The *Gray Research & Development Co., Inc.* of Hartford 1, Conn., has announced the addition of the Model 603 to its line of equalizers. The new unit is said to provide a greater range of response curves and additional compensation to accommodate pickups of different characteristics than did previous models.

The high-frequency characteristic obtainable with the Model 603 com-



prise five steps ranging from flat response to a heavy roll-off for worn records. An auxiliary knob permits instant adaptation to the use of either

March, 1950

# SAVE \$30!

## 7-IN. PORTABLE TELEVISION SET

REGULAR \$119.50 VALUE

# \$89.97



**WE AGREED NOT TO MENTION THE NAME—BUT WE GUARANTEE YOU'LL BE PLEASSED!**

- You can get 10-in. picture with this set, order Glenwood unbreakable enlarging lens (our stock No. 35B33) at only \$8.79.
- Get maximum low cost TV enjoyment.

The ideal all-purpose television receiver. Carries easily from place to place, operates from its own antenna—no connections required except plugging in power cord. Antenna is adjustable for length and direction for maximum picture brightness. Brings in crystal clear pictures even under variable conditions of lighting and signal strength. 18 Tubes plus Picture Tube and 4 Rectifiers, 23 sq. in. rectangular picture on face of the 7-inch tube. Push-button tuning

provides instant station selection on any of the 12 tuning channels. Sturdy wood cabinet covered with tan leatherette. Cover with carrying handle hinges and snaps to side of set, fully protecting picture tube and controls. Matched antenna extends from top of cabinet. Size overall 20 in. wide, 10 1/2 in. high by 18 3/4 in. deep. Shpg. wt. approx. 53 lbs. For 105-125 volt 60 cycle AC only. No. 39A20  
EACH ..... \$89.97



## IT'S A RECORDER, A RADIO AND A PHONOGRAPH

### THE WILCOX-GAY Recordette

- The Recordette is compact in design, and easily portable, weighing less than 18 lbs.
- Has four-position switch, "Listen-Phono", "Listen-Radio", "Record-Radio", "Record-Mike"—plus volume level indicator.

chassis has low impedance loop antenna. Quality PM speaker, Crystal pickup and recording cartridge. Crystal microphone is carried in special holder on inside cover. Tan-and-brown leatherette-covered case, 18 x 12 1/2 x 6". With tubes, mike, cutting needle, pack of steel playback needles. For 110-120 volts, 60 cycles AC. Shpg. wt. 20 lbs.

No. 31B229  
SPECIAL EACH ..... \$49.95

Prices FOB Kansas City. Remit with order or send 25% deposit when COD.



# BURSTEIN-APPLEBEE CO.

1012-14 MCGEE ST. KANSAS CITY 6, MO.

### RADIO COURSES

- RADIO OPERATING • CODE
- RADIO SERVICING • ELECTRONICS
- F.M. TELEVISION

### REFRIGERATION SERVICING

Write for Catalog T.S. and Picture Brochure

YMCA

TRADE & TECH. SCHOOL  
229 W. 66 St., N. Y. 23  
ENdicott 2-8117

### New Selenium Rectifiers Less Than Surplus

—Guar.—F.W. Bridge-Types

INPUT	1.2 Amps	\$2.64
From 0-18V. AC	2.4 Amps	3.07
OUTPUT	6.4 Amps	4.09
0-14.5V. DC	13.0 Amps	7.67

Also available—FWCT-3 PH—Write for prices

### TOGGLE SWITCH SPECIALS

60 Amp.—SPST—Ch #8905K682	Each	\$0.95
30 Amp.—DPDT—Center off—C-2	Each	.50
35 Amp.—DPST—Momentary—C-6B	Each	.50
35 Amp.—SPDT—Momentary—B-21	Each	.35

Standard Transformers—Power & Pila.	\$2.50
60 mil., \$1.75; 100 mil.	
3" Aircraft Meter—Wheel position indicator—#6532-LJ-A	Each 1.25
Q5B R.F. Sections only—190-550KC.	1.00
Very special, each	
American Quality Carbon Mike Xfmr—shielded—cased—small	Each .90

### FREQUENCY MAKER BASIC KIT

1000Kc Ntal and Matching shielded miniature resonant plate, tank	\$2.95
24V. CT. 1 AMP. PILA TRANSFORMER—Small—New F.B. Surplus conversion	Each 1.95

F.O.B. N.Y. Rated firms, 10 days. Quantity discounts.  
GREENWICH SALES CO.  
59 Cortlandt St. New York City 7



BARGAIN HUNTING? **RADIO SERVICEMEN!**  
Write for SENSATIONAL CATALOG  
**HENSHAW RADIO SUPPLY**  
3619 TROOST KANSAS CITY, MO.



## IMPOSSIBLE? NOT FOR PEAK!

### BARGAINS OF THE MONTH

5 Volt 15 amp. Transformer, Shielded, 110/220 V. Pri. Fully Cased.	\$1.79
.001 600 VDC Pigtail Micas.	20 for .99
.004 1000 VDC Pigtail Micas.	12 for .88
250 mmf Midget Variable, Steatite Ins.	2 for .88
325 mmf Midget Variable, Steatite Ins.	2 for .98
1/2 meg Potentiometers.	.23 ea. 5 for .95
50,000 ohm 1% WW Prec. Resist.	19 ea. 6 for .95
6 Henry 50 ma Filter Chokes.	4 for .95
2" GE Meter 0.5 ma. (amp scale)	ea. 1.79
2" GE Meter 0.30 amps DC.	ea. 1.79
3" Triplett Meter 0.75 amps AC.	ea. 1.99
.07 1000 VDC Xmitting Mica.	3 for .99
.02 600 VDC Xmitting Mica.	6 for .99
.001 600 VDC Xmitting Mica.	10 for .99
3/3 mfd 600 VDC Oil Condenser.	ea. .49
6 mfd 1000 VDC Oil Condenser.	ea. .99
1 mfd 7500 VDC Oil Condenser.	ea. .88
.35 mfd at 16 KV plus 7 mfd 8 KV.	ea. 3.95
1" x 1" mfd 1200 VDC.	ea. .99
100 ohm 100 Watt Adjustable Resistor.	ea. .39
500 ohm 50 Watt Adjustable Resistor.	ea. .29
1.5 or 50 ohm 25 Watt Adjustable Resistor.	ea. .19
.02 400 Volt Tubulars.	20 for .99
10 K or 15 K pots.	19 ea. 6 for .99
.0006 mfd Pigtail Silver Micas.	10 for .95
.006 mfd 600 VDC Pigtail Micas.	12 for .99
.01 mfd 600 VDC Pigtail Micas.	10 for .99
2 mfd 250 VAC GE.	6 for .99
Miniature Headphones Type HS30.	.59
Transformers for above.	.39
3" Westinghouse Meter 0-20 ma.	2.79

### PANEL METERS—BRAND NEW

2" 0-1 ma Basic.	\$2.95	3" 0-1 ma Basic.	\$3.95
2" 0-20 ma Basic.	1.75	2" 0-1 amp R.F.	2.45
2" 0-10 V. AC.	2.50	3" 0-100 ma.	3.50
2" 0-30 V. DC.	2.50	3" 0-80 ma.	3.95
2" 0-300 V. AC.	2.95	3" 0-2 ma DC.	3.95
3" Square Weston.	3" 0-200 ma DC.	3.95	
0-200 micro amp.	8.75	3" 0-20 ma DC.	3.50

HIGH CURRENT TRANSF. 820 Volts CT at 775 Ma. Pri. 110/220 Volts 60 cycles. Fully Cased. \$5.95

### RELAY SPECIALS

Advance Antenna Relay 110V 60 Cy Coil Ceramic Insulation DPDT.	ea. \$1.89
Dunco Relay 6 Volt 60 Cy Coil, Ceramic Insulation, DPST.	ea. 1.69
Allen Bradley Solenoid, 110V 60 Cy Coil, DPST.	ea. 2.95
28 amp contacts.	ea. 2.95
Westinghouse "MN" Overload Relay, adjustable 250 Ma to 1 amp. manual reset.	ea. 4.95
GE "POT" Instantaneous overload relay adj. 100-200 Ma. Elect. reset 110V 60 Cy.	ea. 7.50
4PDT.	ea. 7.50
GE overload relay 640 Ma. easily made adjustable. elect. reset 110V 60 Cy. Only—ea.	2.50

UTC type PA 5000 ohm plate to 500 ohm line and 6 ohm voice coil. 10 watt. 60 to 10,000 cps ±1 DB. CLOSE OUT AT \$1.99

### FILAMENT TRANSFORMERS

110 V 60 Cy Pri. Fully Cased.	
2.5 Volt 10 Amp.	\$3.49
2.5 Volt CT 21 Amp.	4.75
6.3 Volt 10 Amp.	1.89
5 1/2 V CT 21A, 7.5V 6A, 7.5V 6A.	4.95
5 Volt 4A, 6.3V, 3A.	2.45
2.5V CT 20A, 2.5V CT 20A.	6.95

### OIL CONDENSERS

20 mfd 330 vac—	\$1.85	8 mfd 2000 vdc—	\$5.95
1 mfd 600 vdc—	.29	10 mfd 2000 vdc—	5.95
2 mfd 600 vdc—	.39	2 mfd 4000 vdc—	4.95
4 mfd 600 vdc—	.59	1 mfd 5000 vdc—	4.50
6 mfd 600 vdc—	.79	1/2, 1 mfd 7000 vdc—	2.25
8x8 mfd 600 vdc—	1.39	1 mfd 7500 vdc—	9.25
10 mfd 600 vdc—	.89	.01/.01 mfd 12 kv dc—	5.75
20 mfd 600 vdc—	2.95	1 mfd 12,500 vdc—	5.50
4 mfd 1000 vdc—	.95	.005/.01 mfd 12kv dc—	5.50
2 mfd 1500 vdc—	1.25		
4 mfd 1500 vdc—	2.25	.65 mfd 12,500 vdc—	12.95
6 mfd 1500 vdc—	2.95		
1 mfd 2000 vdc—	1.45	2 mfd 18 kv dc—	59.50
2 mfd 2000 vdc—	2.25	1 mfd 15 kv dc—	15.95

### CHOKE BARGAINS

6 Henry 80 ma 220 ohms.	2 for \$0.99
8 Henry 150 ma 140 ohms.	.99
1.5 Henry 250 ma 72 ohms.	.59
6 Henry 300 ma 65 ohms.	3.75
Swing, 1.6/12 Hy 1 Amp/100 ma 15 ohm.	19.95

### SCOPE TRANSFORMERS

Pri 110V 60 Cy—Hermetically Sealed	
2500V RMS @ 12 Ma.	\$2.95
1050V RMS @ 20 Ma. 20V 4.5A, 2.5V 5A.	4.75
4400V RMS 4.5 Ma., 5V 3A, 15kv Ins.	4.95

### GENERAL PURPOSE TRANSFORMERS

Ideal for Bias, Filament, Isolation, Stepdown, etc. 2 isolated 110v pr sec. 110v at 900 ma plus 6.3 @ 2 amps. Fully cased. Now \$1.49 ea.

### 30 WATT WIRE WOUND RESISTORS

OHMS 100-150-2500-3k-4k-4500-5k-5300-10k-15k-18k.	15 ea. 8 for \$0.99
---	---------------------

Eimac Vacuum Condenser 50 mmf 32 KV Type VC50-32 ea. \$5.95

### MEGOHM METER

Industrial Instruments model L2AU 110/220 volts 60 cycle input. Direct reading from 0-100000 megohms on 4" meter can be extended to 500000 megohms with external supply. Sloping hardwood Cabinet 15" x 8" x 10". Brand new with tubes plus running spare parts including extra tubes. Reg. price \$160.00. **OUR PRICE \$49.95**

### PEAK ELECTRONICS CO.

188 WASHINGTON STREET DEPT. MR  
NEW YORK 7, N. Y.

the Pickering cartridge or the General Electric variable reluctance pickup, for which correct compensations are provided. In all cases exceptionally close adherence to the correct characteristics is obtained.

A selection of 150 or 250 ohms impedance can be made by making appropriate connections to the equalizer terminal board. The controls are mounted on a clearly marked panel which is connected to the equalizer by means of an 18 inch shielded cable.

### TWO-WAY SPEAKER SYSTEM

Holl Audio Industries of Hollywood 28, California, has recently added the Model 800 F, low distortion, two-way loudspeaker to its line of audio equipment.

Among the features of this new unit is the special plastic treatment of the cone compliance to improve edge dampening and reduce distortion caused by cone breakup, the reduction of cone resonance and cabinet "boom," the elimination of the usual 60-90 cycle bass reflex boom, correct matching of the highs and lows, thus eliminating the need for pads on the high



section, and a full frequency range from 40 to 15,000 cycles.

The loudspeaker is housed in a furniture-finish cabinet which measures 37 1/2" high by 25 1/2" wide by 16" deep. Bass reinforcement is by the vented tube method. Acoustical padding is used on all interior walls. The multicellular high-frequency horn is driven by an Alnico V PM driver. The woofer section has a 15", 25 watt loudspeaker with 25 ounce Alnico V magnet. The free air resonance of the cone is 40-45 c.p.s. The 800 cycle crossover has air core windings and meets theater standards.

### DYNAMIC MICROPHONE

A new dynamic microphone, the TV 655, has been announced by Electro-Voice, Inc. of Buchanan, Michigan.

This slim, versatile microphone with ultra-wide range and high fidelity dynamic performance and utility, requires no additional closely-associated auxiliary equipment.

Engineered and built to meet the need in studio and remote telecasting and broadcasting, the new TV 655 is suitable for special events announcing, sportscasting, audience partici-

## Chicago INSTRUMENTS



for 1950

- WIDER RANGES
- MORE ACCURACY
- GREATER CONVENIENCE
- LOWER PRICES

NEW

### MODEL 431A MULTITESTER

AC AND DC VOLTS

0-15 / 30 / 150 / 300 / 1500 / 3000

DC CURRENT

0-1/5 / 150 Mils. 0-7 1/2 Amps.

Ohms Full Scale: 0-10,000/100,000/1 Meg.

Ohms Center Scale: 0-60 / 600 / 6,000

Drawn Aluminum Case: 6 1/8" x 3 1/4" x 2 1/4"

PRICE ONLY \$16.60

See the new Chicago Instruments at your Jobber or write today for circular.

### CHICAGO INDUSTRIAL INSTRUMENT CO.

536 W. Elm Street, Chicago 10, Illinois

## SAVE MONEY BRAND NEW GUARANTEED GENERAL ELECTRIC SELSYN

### Type 2J1G1

Will operate from 110 volts, 60 cycle by using a resistor or a condenser in series. Size is 2 1/4" in diameter x 4 3/4" long. Ideal for beam antenna position indicator.

Price \$2.75

per pair — removed from new equipment



### HAYDEN TIMING MOTORS

#### Type 45629R

110 volts, 60 cycle, 2.2 watts, 1/240 R.P.M.

Price \$3.00 ea. net, new

#### Type 36938-2

110 volts, 60 cycle, 2.2 watts, 1/2 R.P.M.

Price \$3.00 ea. net, new

#### Type 33669-2

110 volts, 60 cycle, 2 watt, 1/60 R.P.M.

Price \$3.00 ea. net, new

#### Type 1600

110 volts, 60 cycle, 2.3 watts, 1 R.P.M.

Price \$2.70 ea. net, new

### NEW ADDRESS

### INSTRUMENT ASSOCIATES

37 EAST BAY VIEW AVE.  
GREAT NECK, N. Y.  
IMperial 7-1147



pation, recording, and high quality sound amplification. It can be used either on a stand or in the hand or on a boom. It does not hide the performer's face and can be easily concealed among studio props.

This model is omni-directional, becoming slightly directional at extremely high frequencies. It provides smooth, peak-free response over the range of 40 to 15,000 c.p.s., plus or minus 2.5 db., according to the company.

A bulletin giving specifications and operational characteristics of the TV 655 is available on request. Ask for TV Bulletin No. 156.

#### NEW V.T.V.M. KIT

Heath Company of Benton Harbor, Michigan, has placed a new v.t.v.m. kit on the market, the V-4.

Positive automatic meter protec-



tion on all functions is given by the electronic a.c. voltmeter and push-pull d.c. voltmeter circuit. The electronic a.c. voltmeter circuit incorporates a new balance control which allows complete elimination of contact potential, removes meter shift with various ranges, and gives accurate readings on all ranges. The 200 microampere meter uses an Alnico V magnet for accurate readings. The divider resistors are 1% precision ceramic units. The unit provides 24 complete ranges. The meter pointer can be offset from zero for FM and TV alignment. The d.c. probe is isolated for dynamic measurements of receiver voltages without disturbing receiver operation.

#### MIDGET ELECTROLYTICS

A line of small paper tubular condensers, known as Type P85, is now available from Aerovox Corporation of New Bedford, Massachusetts.

Featuring the same materials and general processes used for the company's "Aerocon" Type P87, the new miniature size required new production techniques for handling minute sections, wires, and other components without sacrifice of quality and mass production requirements.

The paper section of the Type P85 unit is Aerolene-impregnated and the unit is sealed with Duranite. The resulting rock-hard, paper-cased tubular

Enter a dynamic profession! Become an

# ELECTRICAL ENGINEER



• MAJOR IN POWER OR ELECTRONICS

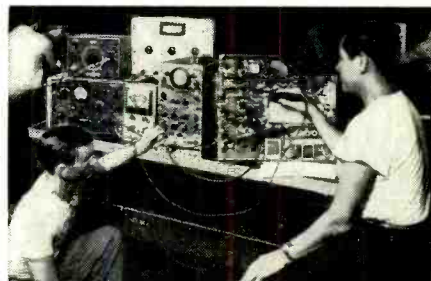
• B. S. DEGREE IN 36 MONTHS

Look at the powerful trends which influence your future in these fields.

Men specializing in *Electronics* enter a science of tremendous, growing value—in communications, radio, television, broadcasting, high-frequency heating, power system control, printing and other fields.

Men specializing in *Power* become equipped to serve the electrical power industry, which must face an 80% expansion of its generating capacity by 1960.

This 47-year-old Technical Institute and College offers important advantages to the young man preparing for these opportunities. He saves a valuable year by gaining his B.S. degree in 36 months of continuous study. He receives *extensive* technical laboratory experience on modern equipment. This is integrated, in each successive term with fundamental education in engineering and the humanities.



The Electronics Course covers 19 technical specialty subjects in Electronic Engineering, including four in Electronic Design.

In One Year of Study, Become an *ELECTRONIC TECHNICIAN*—This certificate is yours after 12 months of study in the Electrical Engineering (Electronics) course.

Prepare here for a Career in *RADIO TELEVISION*—In 18 months you can become a Technician, trained for receiver and transmitter testing, servicing, sales and production.

The World-famous course in Power covers 24 technical specialty subjects in Electrical Power, including 8 in Electrical Design.

## MILWAUKEE SCHOOL OF ENGINEERING

Founded 1903 by Oscar Werwath

Over 35,000 alumni and 1,555 students. Faculty of 85 specialists.

Practical, military or academic training evaluated for advanced credit. Preparatory programs also available.

TERMS OPEN JULY, OCT., JAN., APRIL



Send coupon or letter today for this free, helpful guidance literature (see below).

MILWAUKEE SCHOOL OF ENGINEERING  
Dept. RN-350

1020 N. Broadway, Milwaukee, Wis.

Without obligation send  48-page pictorial bulletin, "Your Career";  110-page

1950 catalog. I am interested in \_\_\_\_\_ course.

Name \_\_\_\_\_ Age \_\_\_\_\_

Address \_\_\_\_\_

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

Check if World War II Veteran

# 30-44 Megacycles FM

## PR-30 Receiver For MOBILE CALLS

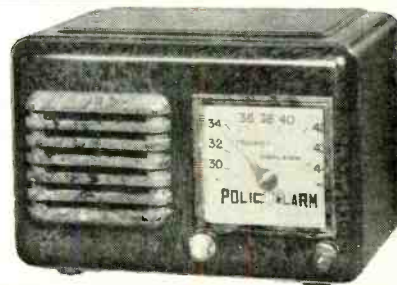
Emergency thrills . . . hear "news in the making" . . . as it happens.

6 Tube superheterodyne, 115 volts, AC or DC. Now you may enjoy . . .

- POLICE
- FIRE
- HIGHWAY TELEPHONE
- MARITIME
- FORESTRY

**\$44.95**  
LIST PRICE

PR-7 POLICALARM tunes 152-162 mc. \$39.95  
See your dealer or write Dept. RN-4



★ POLIC FM ALARM

RADIO APPARATUS CORP.  
303 FOUNTAIN SQ. THEATER BLDG.  
INDIANAPOLIS 3, INDIANA



# NORMAN RADIO DIST. INC.



Offers Speedy Delivery From Stock!

## NEW EICO Push-Pull

### 5' TV OSCILLOSCOPE

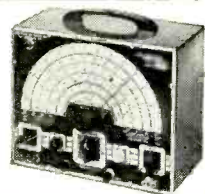
Model 425-K

ALL-NEW laboratory precision scope has Push-Pull deflection and .05 to 1 volts per inch sensitivity. Wide range, flat from 5 cps to 500 kc. with full gain setting, useful to 2 1/2 mc. Wide-range, multi-ribator, sweep circuit from 15 cps to 75,000 cps. Direct connection to blades of CRT available at rear of cabinet. Z axis intensity modulation feature included. Size: 8 1/2" x 17" x 13" high. Complete with 3-6SN7s, 2-6J5s, 2-5Y3s, and 5B1P CRT. **FACTORY-BUILT OSCILLOSCOPE Model 425. Fully wired and tested..... \$69.95**



## EICO SIGNAL GENERATOR KIT

Model 320-K. For service, lab, and school use in FM-AM alignment and to provide TV marker frequencies. Ceramic insulated variable condensers. Highly stable Hartley oscillator has range of 150 kc to 100 mc with fundamentals to 34 mc. Colpitts audio oscillator supplies pure 400 cycle sine wave voltage for modulation. Large 9" dial. Easy-to-read calibrations. Easily aligned. Complete with tubes, 10" x 8" x 4 3/4". 3-color etched panel. **FACTORY WIRED AND ALIGNED Model 320. Ready to use..... \$29.95**



## NEW! Sensational TV-FM SWEEP SIGNAL GENERATOR KIT

Model 360-K. • Crystal marker oscillator with variable amplitude. • Covers all TV and FM alignment frequencies between 500 kc and 228 mc. • Sweep-width variable from 0-30 mc. with mechanical inductive sweep. • All TV and FM Channels marked directly on panel for instantaneous reference. • Provides for injection with external signal generator marker. • Phasing control included. • Vernier driven, tuning dial for master oscillator directly calibrated in frequencies. • 3-color etched panel, and durable steel cabinet. • Complete with all tubes: 6X5GT, 12AU7, two 6C4's. Crystal not included. 5 Mc crystals available, each \$3.95. Size: 10" x 8" x 6 3/4". **FACTORY-BUILT AND TESTED MODEL 360. Ready to use..... \$39.95**



**EICO**  
**145K MULTI-SIGNAL TRACER KIT \$18.95**  
Wired \$28.95

## EICO MODEL 221-K VTVM KIT

Build this High Precision Vacuum Tube Voltmeter. 15 different ranges! AC and DC ranges: 0.5/10/100/500/1000 volts. Ohmmeter range: 2 ohms to 1 megohm. Zero Center for TV discriminator alignment. Big 4 1/2" meter cannot burn out. Double triode balanced bridge circuit assures stable, guaranteed performance. 110-130 V. AC 50-60 cycle. Size 9 1/2" x 6" x 5" **\$23.95**

**FACTORY-WIRED VTVM Model 221. Same, but completely wired, calibrated, and tested..... \$49.95**

Send 20% deposit with your order.

We feature the complete EICO line. See page 85 for other laboratory precision EICO instruments and kits.

**NORMAN RADIO DIST. INC.**

94-29 Merrick Road Jamaica, N. Y.



offers the heat and humidity resistant qualities associated with plastic tubulars. These condensers can be used at 212 degrees F. without drips. They have extremely high initial resistance and recover same upon heating.

## MINIATURE TERMINAL LUGS

Designed and engineered to meet the requirements of the radio component parts trend toward lighter and smaller sized equipment, the new line of miniature terminal lugs announced by U.S. Engineering Co., Glendale 3, California,



nia, is of special interest to manufacturers of aircraft and armament electronic equipment, and manufacturers of hearing aid devices and other small size radio units.

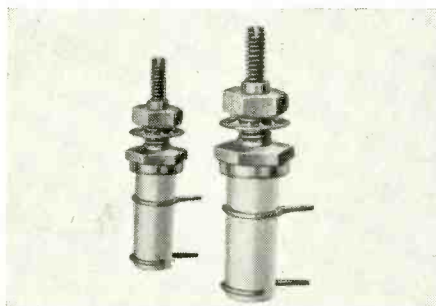
The new miniature series, like the company's standard line, is silver-plated and specially treated to prevent corrosion. All undergo rigid inspection to maintain tolerances.

Full details on the new series are available from Department H. Inquiries should be addressed to the company at 521 Commercial Street.

## CERAMIC COIL FORMS

Two new ceramic coil forms, designed to fit into small or hard-to-reach places, have just been announced by Cambridge Thermionic Corporation, 463 Concord Avenue, Cambridge 38, Massachusetts.

Designated Types LS-5 and LS-6, these two coil forms are made of silicone impregnated ceramic for high re-



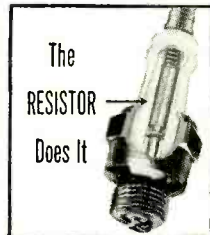
sistance to moisture and fungi. The LS-5 measures 1 1/16" in height (mounted) and 3/8" in diameter. The LS-6 is 1 3/16" high and 5/16" in diameter. The ring terminals are adjustable. Both sizes are provided with a spring lock for the slug, which can be furnished in high, medium, or low frequencies. The mounting stud is brass, cadmium plated to withstand severe service conditions. The mounting hardware is furnished with the forms.

A new catalogue, the #300, covers these coil forms. A copy may be secured from the company. -30-

# Help end INTERFERENCE

# AUTO-LITE Resistor SPARK PLUGS

THE NEW Auto-Lite Resistor Spark Plugs reduce spark plug interference with radio and television reception and in addition offer car owners smoother idling, better engine performance on leaner gas mixtures and longer electrode life. Gain friends by recommending them to your customers with TV sets, car radios and radio telephone installations.



## FREE PROMOTION MATERIAL

Helpful, instructive folder, "TV brings change in car ignition behavior."



Big, colorful reprint of Auto-Lite's Saturday Evening Post television ad for your window.



A highly informative folder showing construction features of Auto-Lite Resistor Spark Plugs.



An attractive counter card featuring "Suspense" on radio and TV. Creates interest in television and set purchases.

The Electric Auto-Lite Company, Toledo 1, Ohio  
Please send me FREE promotion material on suppression of spark plug interference with radio and TV through use of Auto-Lite Resistor Spark Plugs.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City & State \_\_\_\_\_

Tune in "Suspense"...CBS Radio Thursdays...CBS Television Tuesdays

**RADIO & TELEVISION NEWS**



## International Short-Wave

(Continued from page 59)

for listeners in Eritrea. ETB has been heard widely in the United States around 1000-1100 weekdays and on Sundays from as early as 0930; on Sundays, several religious programs are radiated, some of which are in *English*. Schedule seems irregular, signals are poor, badly QRM'd.

*Formosa*—Sanderson, Australia, still lists BCAF, 8.995, heard 0530 with Chinese program; *English* lesson 0700.

*France*—Paris is now using 9.550, 9.680 to North America 1945-2000 in *English*.

A frequency of 15.1000 is being used by Paris at 0630-0645; 6.145 is used 0030-0045, 0130-0145, 1300-1445. (Bluman, Israel)

*French Indo-China*—Station officials have informed Bellington, N. Y., that the name of *Radio Saigon* has been changed to "*Radio France Asie*," since it is now a Vietnamese outlet. Schedules for the most part remain unchanged.

*French West Africa*—*Radio Bamako* advises it has an output of 2 kw. on 15.030; the station is operated by the government and is on the air at irregular intervals. Programs consist of meteorological forecasts, government, and industrial news, and now and then some music. (*The Broadcaster*, Perth, Western Australia) FGJ9, Bamako, is listed on 15.025 with 350 watts and as "inactive."

*Germany*—Patrick, England, reports that some time ago he logged a station on approximately 5.880 around 1200 relaying AFN programs from Munich's m.w. station.

*Radio Frankfurt*, 6.190, has a good signal around 0130. (Bluman, Israel)

*Greece*—The Armed Forces in Central Greece, outlet at Larissa, has moved to approximately 6.770 from 6.745, but still has bad CWQRM; is heard afternoons.

*Holland*—Latest schedules for *Radio Nederland's* International Service are: *English*—0500-0555 to Australia

(Continued on page 140)

# WANTED

GOOD LOOKING OLD CONSOLES  
THAT NEED A NEW "HEART"

install an

**ESPEY AM/FM CHASSIS**

and your favorite console is "right-up-to-date"



Rated an excellent instrument by America's foremost electronic engineers. Fully licensed under RCA patents. The photo shows the Espey Model 511, supplied ready to play. Equipped with tubes, antenna, speaker and all necessary hardware for mounting.

ATTENTION SERVICEMEN—Did you know there are over 19 million consoles waiting to have a modern AM/FM chassis installed? Here is a gigantic sales market just waiting for you to develop. In fact there are thousands of out-moded radios in your "backyard" just waiting to be replaced.

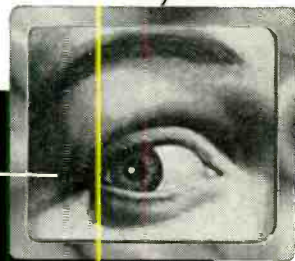
Makers of fine radios since 1928.

Write for literature RN for complete specifications on Model 511 and others.

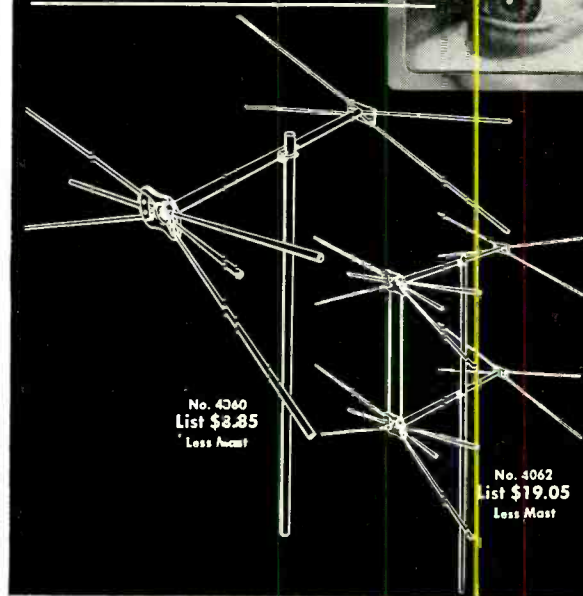
**ESPEY**  
MANUFACTURING COMPANY, INC.  
528 EAST 72nd STREET, NEW YORK 21, N. Y.  
TEL. TRofalgar 9-7000

only **WALSCO**

gives so much  
for so little...



crystal-clear TV reception.



No. 4340  
List \$8.85  
Loss None

No. 4062  
List \$19.05  
Loss Most

amazing antenna  
out-sells all others!

- only **WALSCO** features a *silicone-treated styron molded insulator* to assure crystal-clear TV reception.
- only **WALSCO** uses *marine type high tensile dural* for elements . . . with a "yield point" 94% higher than ordinary aluminum.
- only **WALSCO** uses a *butt-seamed tubing* for elements to assure the *highest* elasticity.

WRITE FOR FREE ILLUSTRATED CATALOG 49-T

WALSCO New TV Alignment Tools are used everywhere. Available at your local jobber.

**WALTER L. SCHOTT CO.**

Beverly Hills, California  
Chicago 5, Illinois



# PERFECT AUDIO!

DESIGNED BY EXPERTS  
FOR EXPERT EARS!



• This is IT—Sun Radio's great all-triode amplifier—engineered from design published by Consumer's Research, Inc., Washington, N. J. Definitely TOPS in its price class.

Flat frequency response from 20 to 15,000 cycles. Distortion less than 2.5%. 10-watt 7-tube all-triode amplifier provides highest reproductive fidelity. Tube complement: 1-6SC7, 2-6SN7, 1-6J5, 2-6B4G and 1-5U4G Rectifier.

Available alone (\$42.50 in kit form; \$69.50 laboratory wire and tested, ready for use). Also in "219" Home Music System package (FM tuner, record changer, amplifier, speaker, connecting cables, for only \$215).

FREE . . .

"Audio Equipment" — 68-page manual catalog — gold mine of sound-system dope. Yours on request.



**Sun Radio**  
& ELECTRONICS CO. INC.  
124 DUANE ST. • NEW YORK 7, N.Y.  
2 Blocks North of Chambers St.  
BARCLAY 7-1840

lia, New Zealand, and Pacific Area, 21.48, 17.775, 15.22, and for listeners in Europe, 6.025; 1230-1325 to South Africa, Great Britain, Continental Europe, 11.73, 9.59, 6.025; 2100-2155 to United States and Canada, 11.73, 9.59. Dutch—0715-1000 to Indonesia and Far East, 21.48, 17.775; 1330-1530 to Europe and Africa, 11.73, 9.59, 6.025; 1830-2055 to Surinam and Netherlands Antilles, 11.73, 9.59. Afrikaans—1530-1555 to South Africa, 11.73, 9.59, 6.025. Arabic—1400-1430 to Near East and Egypt, 9.59; 1600-1630 to North Africa, 11.73. French (weekdays only)—1130-1215 to Near East and Southeastern Europe, 15.22, 11.73, 6.025; 1630-1715 to North Africa, Europe, 11.73, 9.59, 6.025. Hindustani and *English*—1100-1130 to South and Southeastern Asia on 15.22, 11.73. Indonesia—0800-0900 to Indonesia, 15.22. Spanish (weekdays)—1730-1825 to South America and Spain, 11.73, 9.59, 6.025; 2200-2255 to Central America and Caribbean Area, 11.73, 9.59. The "Happy Station Programs" of Eddie Startz are radiated Sundays and Wednesdays 0930-1100 on 15.22, 6.025 to East, Far East, Europe; at 1600-1730 on 9.59 and (Sundays only) on 6.025; to North America at 2200-2330 on 9.59 and (Sundays only) on 11.73. On Tuesdays 0600-0730 on 21.48, 17.775, 15.22, and 6.025 to Pacific, Australia, New Zealand, and Europe.

*Korea*—HLKA, 7.933, noted 0445 with Western music, then news in Korean. (Sanderson, Australia)

*Lebanon*—In Newfoundland, *Radio Levant*, 8.030V, Beirut, fades in around 1230. (Peddle) Starry, Pa., and Sutton, Ohio, report this one around 0000-0130. Pearce, England, airmails that Beirut now has *English* 1000-1100, and signs off that period with "Knights-bridge March."

*Madagascar*—Tananarive is reported heard on approximately 9.694 around 2215-2245; uses some French.

*Malaya*—BFEB, Singapore, has replaced 6.045 with 6.175; when relaying BBC news 0700 gives frequencies as 15.300, 11.880, 9.690, 6.175. (Cox, Delaware)

*Malta*—Forces Broadcasting Service, Middle East, was still testing when this was compiled; appeared to be using 6.140 and 4.965 from 2330; 4.965 and one of several other frequencies (7.220, 7.270, or 6.140) appeared to be in use around 1100-1700. Bluman, Israel, airmails me that the FBS network to Egypt is being expanded; he had heard FBS, Cyprus, on 11.850, calling Malta on test 0315-0330.

*Mauritius*—V3USE, Forest Side, is widely reported on approximately 15.055 around 0930 to 1200 when it signs off after playing a few bars of "God Save the King." Uses mostly French. Has been heard irregularly in the U. S. around 2100-2330 close-down, identifying at 2200 and/or 2245 in *English*; it is also reported to have been heard with *English* news at 2200 on occasion. Is a bad spot, has terrific QRM.

*Mongolia*—Radio Sweden reports

RADIO & TELEVISION NEWS

## ADSON FOR VALUE!

SAVE \$\$\$ ON TV ACCESSORIES!



**ANCHOR TV BOOSTER**  
Recommended By Famous Consumer Research Lab.

Boosts signal in fringe areas and trouble locations. Gives 2 1/2 times more gain in signal strength across all channels. Minimizes ghosts. Features exclusive impedance matching of its output to in-put of set. **\$22.00**



**DIETZ ENLARGING LENS**

4-Way Adjustable Bracket. Optically perfect picture magnifier gives bigger and better pictures for your TV enjoyment. Compare these prices and order today!

7" . . . . . 5 8.95  
10" . . . . . 11.95  
12" . . . . . 15.95

**TV WAVE TRAPS**

An amazing device for improving TV reception. Connects to lead-in line. Choose one of three to eliminate interference from FM, diathermy, or amateur stations. Each only \$2.89

Low Priced! **EMC MULTITESTER**

A versatile, compact tester for radio receiver servicing. 3" square meter. Ranges — Volts AC: 0-12/120/600/1200/3000. Volts DC: 0-6/60/300/600/3000. Mill Amps DC: 0-6/30/120 ma. 0-1.2 ambs. Mill Amps AC: 0-30/150/600 ma. Ohms: Up to 1 megohm. **MODEL 102 . . . . . \$13.90**



**"RADIO KITS"**  
5-Tube Superhet Kit

Crystal clear reception thru entire tuning range of 550 kc. to 1600 kc. 5 tube advanced design circuit. 115V AC-DC. Full size Alnico Pm speaker. Complete with handsome cabinet, nothing else to buy. Easy to assemble. **Kit Model S-5. \$13.95**



**2-BAND RECEIVER KIT**, standard and foreign broadcast. Kit Model S-6X, complete. **\$17.45**

Satisfaction guaranteed. Send check or money order. 25% deposit with C.O.D. All orders shipped within 24 hours, F.O.B. New York. Please include postage.

**ADSON RADIO & ELECTRONICS CO.**  
221 Fulton Street, New York 7, N.Y.

## SOUNDTRONICS SPECIALS

**SARKES TARZIAN**

13 Channel T.V. Tuner

Less Tubes, w/Diagram. . . . . **\$3.25**



**R.C.A. T.V. POWER TRANSFORMER**

775 V. C.T. @ 230 MA, 6.3 V. @ 9 Amps,  
5 V. @ 2 Amps, 5 V. @ 3 Amps. . . . . **\$6.75**

**TOP BRAND TUBULAR CONDENSERS**

.1 MFD 1000 Working Volt. . . . . **7c**  
.05 MFD 400 V. . . . . **5c** .25 MFD 400 V. . . . . **5c**  
.035 MFD 600 V. . . . . **5c** .15 MFD 400 V. . . . . **5c**

**F.P. ELECTROLYTIC SPECIAL**

10-10-10-20 MFD 450-450-450-25 Volts  
**35c each** 3 for **\$1.00**

**TOP NAME TRANSFORMERS**

Shell Type Power Trans. 700 V. C.T. @ 60 MA,  
6.3 V. @ 2 Amps, 5 V. @ 2 Amps. . . . . **\$1.98**  
6 Volt Fil. Trans. 12 Amps. . . . . **1.98**

**TRANSFORMER POWER SUPPLY**

115 V. 60 CY., 300 V. @ 55 MA.,  
6.3 V. @ 2 Amps. Has 5Y3, 2 - 8 HY.  
Chokes, 3 - 30 MFD Filters, Pilot Term.  
Strip, Meas. 5"x5"x8".  
Completely wired. . . . . **\$6.85**



B&S #22 1250 Volt Insul. Aeroglas wire, white with tracer  
100' . . . . . **59c** 1000' . . . . . **\$4.95**

**T.G. 10 KEYERS W/TUBES** . . . . . **\$24.95**

**U.T.C. CHOKES P.A. CASES**

10 HY. @ 66 MA. \$ .97 10 HY. @ 110 MA. \$1.40  
10 HY. @ 150 MA. 1.85 10 HY. @ 150 MA. 2.25

**100 ASST. NEW POP. TYPE CODED INSUL. RES.** 98c

Drake 6 V. Pilot Light Assy. Taken from new equip.  
Less bulb. . . . . **10c**

Min. Order, \$4.00. Send for FREE Flyer.

## SOUNDTRONICS LABS.

632 Arch St., Phila. 6, Pa. MA 7-2775



Ulan-Bator-Choto in Soviet-Mongolia daily on 8.400 to around 1000.

**Mozambique**—Laubscher, South Africa, lists new schedule of *English* broadcasts from Lourenco Marques as CR7BE, 9.715 (claimed by station, actually appears to be 9.763), 0000-1100; CR7BU, 4.932, 1000-1600; CR7AA, 6.137, 0000-1000; and CR7AB, 3.493, 1100-1600; on Sundays, CR7BE and CR7AA begin 0200.

**Nigeria**—A station reported on 9.655 by Simpson, Australia, and Cushen, N. Z., relaying BBC's General Overseas Service around 0200 is believed to announce "This is Nigeria." (Radio Australia)

**Pakistan**—Recently, Pakistan outlets have been moving about a great deal. At the time this was compiled, Karachi seemed to be using 11.770.5 with Dacca, approximately 7.635, in parallel, for news 0700 and 1015; the 15.335 outlet, formerly Dacca, was being heard with news 2100, but Karachi, 11.885, seemed to not be in use; the 15.335 channel at 2115 was announcing as "in the Home Service of *Radio Karachi*," so may be Karachi moved from 11.885 instead of actually being Dacca, as formerly. Karachi has been reported testing on 15.15 and on 9.645, irregularly. A station on approximately 11.81, which has been QRM'g VLC7, 11.81, in the East Coast beam from *Radio Australia* around 0700-0830 or later, is believed to be a Pakistan outlet.

**Panama**—HP5K, 6.005, Colon, noted 0600-0630 in *English*. (Hefner, D. C.)

**Philippines**—The new Philippine station on approximately 4.985 has been identified by Cushen, N. Z., as DYB2, relaying medium-wave DYBR; it announces "This is Davao," so is assumed to be at Davao, Mindanao; schedule was given as 0500-0900. (Radio Australia) Heard in Australia at 0630 with musical program and news. DZH4, 6.000, heard 0645 with sponsored program of music and news. DZH7, 9.748, noted 0500 with news, then music. DZH3, 9.505, noted 0530 with sponsored program of music.

**Poland**—Warsaw, 9.527, noted 0200 with Polish news, then music. (Sanderson, Australia)

**Portugal**—Mesquita e Sousa, Portugal, says Radio Clube Portugues at Parede is now CSB51, instead of CS2WI.

**Sao Tome**—CR5SA, "Radio Clube de Sao Tome," 9.615, has been heard by DeMyer, Mich., signing on 1445 with nice signal; all-Portuguese; is buried in QRM from 1500.

**Saudi-Arabia**—Bluman, Israel, says regular schedule of Mecca is now 1200-1300 on 3.960, 5.985, 9.645, and 11.950. (Radio Australia)

**South Africa**—Laubscher, South Africa, reports that as of May 1, the South African Broadcasting Corporation will begin its commercial program in the Transvaal; other provinces will follow later with commercial programs; the new service will be known as "*Springbok Radio*" and will use s.w. frequencies in the 31-, 40-, 60-, 90-, and



**FOR . . .**

- RADIO SERVICING
- TELEVISION SERVICING
- AMATEUR RADIO
- HIGH FIDELITY SOUND

Stancor transformers are original components in thousands of radio and television receivers made by the biggest names in the industry—they have to be good to be specified by critical design engineers and value-conscious purchasing men!

Why shop around? Specify Stancor for your replacement work. You will get a dependable, honestly-rated transformer. You'll cut down on expensive call-backs. You will keep your customers.

FREE For complete, accurate specs and prices of the complete Stancor stock line, write for your copies of the literature illustrated above. Just ask us for the Stancor transformer library. Standard Transformer Corporation, 3584 Elston Avenue, Chicago 18, Illinois.

*It's Stancor*

**FOR TRANSFORMERS**

**MOST COMPLETE LINE IN THE INDUSTRY**



**FOR BARGAINS IN**

Receivers, Transmitters, Amplifiers, Television Sets, Batteries, Instruction, Surplus Parts, Phonograph Records, and many more items.

Read

**RADIO & TELEVISION NEWS**  
Classified Columns Every Month

**WILL BUY**

Any quantities of new or used Electronic Surplus Equipment: APN-9, RTA-1B, TS-67, TS-170, ARC-1, ARC-3, ART-13, BC-221, BC-348, SCR-522, etc.

State Condition and Best Price.

BOX 491, c/o RADIO & TELEVISION NEWS  
185 N. Wabash Ave. Chicago 1, Ill.



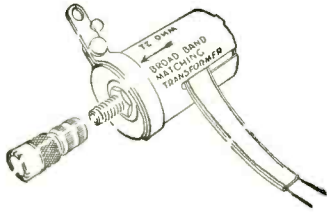
**RADIO ENGINEERING  
TELEVISION  
ELECTRONICS**

Thorough training in all phases of radio and electronics, open to high school and junior college graduates. Old established school specializing in Radio training exclusively. Modern laboratories and courses. Enrollments limited. Approved veteran training.

**VALPARAISO TECHNICAL INSTITUTE**  
Dept. RD Valparaiso, Ind.



# GHOSTS ?



## POOR PICTURE?

Clear up your TV picture with the WORKSHOP T-72 transformer ... Designed to match coaxial cable to 300 ohm sets, the T-72 cuts out ghost-producing standing waves and helps put sparkle into your TV picture. The T-72 is a *must* for the installation crew's kit. Ask your distributor today about the WORKSHOP T-72.

## COAX CABLE CONNECTORS



### For TV and Laboratory Use

Pictured is the W-50 — a male cable connector for RG-59/U. WORKSHOP makes other coaxial connectors for every problem — receptacles, junctions, adaptors, male and female. Each is silver-plated, solderless, easy to use, and inexpensive. All can be used with our compact, constant impedance R-4A coaxial switch.

**THE WORKSHOP ASSOCIATES, Inc.**  
Specialists in High-Frequency Antennas  
62 NEEDHAM STREET, NEWTON HIGHLANDS 61, MASSACHUSETTS

120-meter bands; specific frequencies have not yet been given. Schedules will be 2345-1600. By that time it is expected that regular SABC schedules will most likely be the same, doing away with the "mid-morning" and "mid-afternoon" (in South Africa) breaks as at present.

*Southern Rhodesia*—Laubscher, South Africa, says, according to press dispatches, a new transmitter of 15 kw. should be in operation from Salisbury by this time. While no frequency was listed, it will most likely be 3.320 which Laubscher heard testing some months ago. Plans have been made to extend schedules in both Northern and Southern Rhodesia soon.

*Spain*—Radio Nacional de Espana, Madrid, Spain, is now issuing a monthly program leaflet in *English*, free of charge. (Sklenar, Nebraska, others)

*Sweden*—Radio Sweden is sending out a new, all-*English* verification card. (Skoog, Sweden) A sample sent me is quite attractive.

*Syria*—Damascus has been testing on 5.005 to 5.005 in parallel with 6.000, 11.750, according to Bluman, Israel; news 0530, 1400. (Radio Australia)

*Tahiti*—A phone station at Papeete that might possibly come into broadcast use has been heard by Balbi, Calif., with fine signal on 9.035, around 0300-0430, calling Paris.

*Tangiers*—The new "Voice of America" relay station (Tangier I) is widely reported heard with fine signals afternoons to 1730 closedown.

*Thailand*—Bangkok appears to have replaced 6.010 with 6.240 in parallel with approximately 9.796 for the overseas transmission at 0500-0630 and for the native program at 0700-1030. Now announces as "The Overseas Broadcasting Station of Thailand."

*USA*—It is widely reported that WWV now announces in *voice* at 5-minute intervals, giving the time.

*USSR*—Petropavlosk, 6.075, has dropped its 0123-0230 transmission. (Balbi, Calif.)

*Vatican*—Paddle, Newfoundland, reports HVJ on 7.280 at 1515 in Czech. Is heard in England on 7.28 around 1500 in parallel with approximately 9.643, 5.970, according to Pearce.

\* \* \*

### Last Minute Flashes

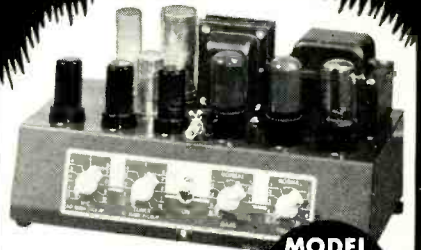
At press time I received a flash from Dilg, Calif., that he had picked up a strong signal on approximately 6.095 to 6.100 around 1050; played western orchestral music; had numerous breaks but the same type of music continued to after 1200; no announcements 1130 or 1200; signal unusually good for 49 meters that late; evidently was a test of some kind but Dilg did not know from where; from strength must have been at least a 100 kw. transmitter, he said.

Starry, Pa., reports good signal from Johannesburg, 9.523, around 0100-0200.

*Radio Douala*, Cameroons, sent verification letter in 17 days; listed frequency of 9.150, said using 600 watts with Delta antenna oriented NW-SE; said will have a new 1 kw. transmitter

## NEW PRECISION ELECTRONICS MUSIC AMPLIFIER

the undisputed "Best" or your money refunded



MODEL 100 PG \$49.50

Performance limited only by your input and output components. For any magnetic or crystal pickup, radio, or microphone. Multiple impedance to match any speaker.

Also available in models 50 PG and 200 PG.

Write for literature and name of your nearest jobber.

PRECISION ELECTRONICS, Inc.  
641-643 MILWAUKEE AVENUE  
CHICAGO 22, ILLINOIS

SPECIALISTS IN SOUND...

## "Alumilite" TV TOWER

LIGHT—6 pounds to 12-foot section—no heavy roof burden  
EASY TO ERECT. Universal base fits any pitch or flat roof. Bolt sections together and install in one to two hours  
STRONG Cross braces every two feet, lattice braces between, resist high winds  
DURABLE. All aluminum, needs no painting, no maintenance  
LOW PRICED. Engineered design uses all material to best advantage. Sales method cuts out middlemen's profit

Order immediately one of two ways:

- (1) Remit 90% now, balance C.O.D.
- (2) Send full amount with order, save collection fee and transportation charge. We ship prepaid, guarantee satisfaction or money refunded.

PRICES: All prices include universal base. All sections completely fabricated, ready to bolt together. All bolts and hardware furnished.

12-ft. Tower	\$17.50
24-ft. Tower (Two 12-ft. Sections)	32.50
36-ft. Tower (Three 12-ft. Sections)	47.50
48-ft. Tower (Four 12-ft. Sections)	62.50
10-ft. Mast, if desired, adds 8 feet to Tower height. Price...\$2.00	

\$17.50 UP

Factory-to-user plan not only means lower price but avoids pick-up cost and bother. You'll appreciate it.



ASSOCIATED TELEVISION COMPANY

513 Pennwood Ave. Pittsburgh 21, Pa.

RADIO & TELEVISION NEWS



ready in 1950 and will then use 7.278; wants reports. (Starry, Pa.)

Paris-Inter, 6.200, 100 kw., is a strong signal in Norway with its Light Program weekdays 0515-0830, 1400-1815; Sundays 0130-1815. (Halvorsen)

I recently heard a Chinese station on approximately 6.100 carrying the 0830 news from Peking; good signal; possibly Chungking?

Radio Pakistan has been heard on 9.645 with news 1015. (Balbi, Calif., Fried, Mich.)

Cebu, Philippines, 6.140, heard in Texas 0830 in English. (Stark)

Pearce, England, reports Radio International, Tangiers, on 6.110 at 1700 with program in Spanish.

The Chinese Communist outlet around 6.650 does not take the Peking network program either before or after 0830. (Balbi, Dilg, Calif.)

Ponta Delgada, Azores, CS9MB, 4.845, is good level in Norway 1700-1900, reports Halvorsen. The same monitor reports the Blue Danube Network, Salzburg, Austria, is now scheduled weekdays 0000-1800, Sundays 0100-1800; that Dornbirn, French Zone, is scheduled 0000-0300, 0500-0810, 1000-1800; Salzburg operates on 9.533, Dornbirn on 6.000.

Port-au-Prince, Haiti, 4VRW, at the time this was compiled had moved from 9.785 to 10.200. (Balbi, Calif.)

Radio Ceylon, 15.12, heard around 1335-1425 calling AIR with news dispatches, talks. (Fargo, Ga.)

Dilg, Calif., flashed that Rangoon seemed to have moved from 6.035 to around 6.070-6.075, heard signing off 1015. Balbi, Calif., flashed that BED2, 11.725, Taipei, Formosa, had replaced the 15.235 channel 2300-0100.

Radio Pakistan at Karachi has been heard on 17.835 at 0110 in parallel with 11.885; heard reopening 0700 on 17.770 and 11.810 as well as on 11.770 which is quite noisy; transmission closes 0830, but comes on again 0900 on 9.645 and 11.770. The "Voice of Free China" at Taipei, Formosa, has moved to the 41-meter band, approximately 7.260, where has news 0610, and identifies as BED2, BED4, and BED7. A station heard a recent Saturday at 0620 on measured 18.406 with news identified as "The Voice of the Viet Nam" and is assumed to be operating from French Indo-China. Australian DX-ers report Bangkok is now heard on 15.910 in parallel with 6.240 at 0500; they list call for 15.910 as HSJ4. DZH7, 9.740, Manila, will soon increase power from 300 watts to 3 kw. and will beam in the direction of Bombay; wants reports to The Far Eastern Broadcasting Company, P.O. Box 2041, Manila, Philippines. (Radio Australia)

On the day this went to press, HVJ, Vatican City, was an excellent signal here in West Virginia in its (daily) 1315 English period.

\* \* \*

### Acknowledgement

Many thanks, fellows, for the extremely good cooperation, especially with regard to data for the English newscast list. KRB.

March, 1950

## GREYLOCK OFFERS POPULAR TYPES OF

# RADIO TUBES

## At a TERRIFIC LOW PRICE!



You'll find sensational values in popular tube numbers that you'll need for everyday servicing. Take advantage of this money saving offer—Stock up NOW.

1A4P	1U4	6AT6	6CSGT	6W4	12AU7	19T8	39/44
1A6	1U5	6AU6	6J6	6X4	12BE6	25L6GT	53
1C6	3A4	6BA6	6K6GT	6X5GT	12BF6	5Z6GT	57
1F4	3Q4	6BA7	6SK7GT	12A8GT	12J5GT	50	77
1R5	3V4	6BE6	6SQ7GT	12A6	12J7GT	58S	117Z3
1S5	6AQ5	6BH6	6U6GT	12A7	12K7GT	5W4	6SD7GT
1T4	6AQ5	6C4	6U7G	12AU6	12Q7GT		

All tubes in this box may be purchased in lots of 100 assorted, at \$32.95 per hundred or 39c each, individually. Net, F.O.B. N.Y.C. No additional discount allowed. All Greylock tubes carry the Standard RMA 90-day guarantee.

# \$32.95

Per hundred as sorted. Net. F.O.B. N.Y.C. Also available in smaller quantities at 39c ea.

### PM SPEAKER BARGAINS

(Less Transformer)



Cat. No. 209 3" Alnico #5...ea.	\$ .97
In cartons of 30.....ea.	.87
Cat. No. 210 4" Alnico #5...ea.	.97
In cartons of 30.....ea.	.87
Cat. No. 215 5" Alnico #5...ea.	.97
In cartons of 30.....ea.	.87
Cat. No. 216 6" Alnico #5.....ea.	1.39
In cartons of 24.....ea.	1.24
Cat. No. 217 6" 2.13 oz. Alnico #5.....ea.	1.59
In cartons of 24.....ea.	1.39
Cat. No. 271 6"x9" PM, 2.15 oz. Alnico #5...ea.	2.29
In carton lots of 24.....ea.	2.09
Cat. No. 272 6"x9" PM, 3.16 oz. Alnico #5...ea.	2.59
In carton lots of 24.....ea.	2.39

### UNIVERSAL PUSH-PULL OUTPUT

HEAVY DUTY pp output, matches all single or pp tubes, specially low priced while quantities last.....only



99c

### FP CONDENSERS

STANDARD BRAND TOP QUALITY



Mfd.	W. V. D. C.	Your Cost
8	500	\$ .29
10/20/20	453/25/25	.35
30/20/20	450/25/25	.39
10/10/10/20	450/350/150/25	.39
20-20	450	.59
50	350	.39
80/40/10/20	250/250/250/25	.29
40-20	250/25	.29
100/30/30	150/150/150	.49
30/30/100/100	150/150/25/25	.49
40/40/20/200	150/150/50/10	.49
20/20/20	50/50/50	.29
2000	15	.29

SPECIAL: Assortment of 14 condensers consisting of 1 of each of above types, \$3.89

### INDOOR ANTENNA

For Television Sets

Provides excellent reception on channels 2 to 13. Hand-some, solidly constructed.

Smashing low price. **\$1.39** Each. 6 for .....\$7.95

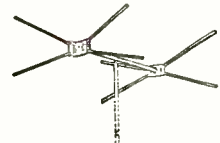


### TELEVISION CATHODE RAY TUBES

First Quality Fully Guaranteed



Type	Size	Your Cost Each
7JP4	7"	16.88
10BP4	10"	19.95
12LP4 (Reg. or Tinted)	12 1/2"	24.95
15AP4 or 16HP4	16"	39.95
Rectangular Glass	15 or 16"	38.95



ALL CHANNEL CONICAL ANTENNA with Reflectors

Less mast, Model V-1.....\$4.95  
All Channel Double Stacked Conical Antenna with Reflectors, less mast, Model W-2.....\$9.95

Write for our new bargain catalog N-3. TERMS: Net C.O.D. F.O.B. N.Y.C. Orders under \$5, \$1 handling charge.

## GREYLOCK ELECTRONICS SUPPLY CO.

30 CHURCH STREET NEW YORK 7, N. Y.

"A Trusted Name in Radio"

### AUDIO ENGINEERING SCHOOL

Practical engineering training in Audio fundamentals, Disc, Film, Magnetic Recording, and Audio frequency measurements. Studio training simulates Broadcast, Motion Picture, Television, and Commercial Recording work.

Approved for Veterans

### HOLLYWOOD SOUND INSTITUTE, Inc.

1040-N North Kenmore, Hollywood 27, Calif.  
Correspondence Courses Available  
Specify if Veteran or Non-Veteran



### RADIO and TELEVISION

Thorough Training in All Technical Phases

APPROVED FOR VETERANS

WEEKLY RATES DAYS—EVENINGS

RCA GRADUATES ARE IN DEMAND

For Free Catalog write Dept. RN-50

Correspondence Courses Available

RCA INSTITUTES, INC.

350 West 4th St., New York 14, N. Y.

### MAX SAYS: Check These Buys!

#### 5 TUBE SUPERHET KIT:

Compl. w/all tubes, AC/DC, 4" Alnico 5 PM spkr., your choice brown or gray plastic cabinet \$11.95

#### SPEAKERS:

10" PM w/tr. 6L6.....	\$2.95
10" Dynamic w/tr.....	1.95
8" PM w/tr. 6L6.....	2.39
6" PM Rolla w/tr. 6L6/op.....	1.95
5" PM Alnico V 1.47 oz.....	1.10

25% off, 25 or more, any one item

#### CRYSTAL CARTRIDGES:

N-7 WEBSTER.....	\$1.15
L-40 ASTATIC.....	1.15
L-71 ASTATIC compl. w/arm.....	1.59
S-3 American w/perm. needle.....	1.69
P30 Shure, for muted stylus.....	1.35

10% off, 25 or more, any one item

#### 50L6 OUTPUT TRANS..... 39c

25% Deposit, Bal. C.O.D. Write for our bargain filled price lists.

### M. FISHER & SON

2941 N. 5th St. Philadelphia 33, Pa.



# SAVE \$ ON \$UN SURPLUS AND STANDARD SPECIALS!

## CRYSTALS Low Frequency

FT-241A holder 1/2" pin spacng. for ham and general use. Xtal controlled Signal Generators, marked in army MC harmonic frequencies—Directions for deriving fundamental frequencies enclosed. Listed below by fundamental frequency, fractions omitted.

412	424	437	448	483	495	511	518
413	425	438	462	484	496	512	519
414	426	440	468	485	497	515	522
415	427	441	472	487	498	516	523
416	429	442	473	488	503		
418	431	443	474	490	504		
419	433	444	475	491	506		
420	434	445	477	492	507		
422	435	446	479	493	508		
423	436	447	481	494	509		

**49¢**  
each  
10 for \$4.50

372	376	379	381	384	387
374	377	380	383	386	388
375					

**49¢**

390	393	396	401	404	409
391	394	397	402	405	411
392	395	400	403	408	

**79¢**

450	464.815	529.166	533.333	538.888
452.777	465.277	530.555	536.111	
461.111	526.388	531.944	537.500	

**99¢**

Frequency Standard 98.356  
kc—3-prong holder **3.98**

## HAM CRYSTALS FT-243 holders, 1/2" pin spacng. for ham and experimental use. Fractions omitted

4190	6073	6173	6906	7840	7973
5030	6075	6206	6940	7873	7975
5485	6100	6208	6973	7906	8240
6006	6106	6773	7740	7925	8273
6025	6140	6840	7773	7950	8306
6040	6150	6873	7806		

**49¢**  
each  
10 for \$4.50

3735	5760	5900	6406	6606	7406	7706	8340
5305	5773	5906	6425	6640	7440	8173	
5675	5775	5925	6440	6673	7473		
5677	5806	5940	6450	6706	7506		
5700	5825	5973	6473	6740	7640		
5706	5840	5975	6475	6806	7673		
5725	5850	6273	6506	7306			
5740	5873	6340	6540	7340			
5750	5875	6373	6573	7373			

**99¢**  
each  
10 for \$9.00

## SCR-522 CRYSTALS

5910	6470	6522.9	6610	7480	7810
6370	6497.9	6547.9	7350	7580	7930
6450					

**1.29**

SPECIAL  
200 kc Xtals without holders 2 1/2" x 2 3/2"  
69¢ each 3 for \$2.00

## BC-610 CRYSTALS

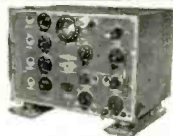
2045	2220	2305	2435	3202	3510	3945	3995
2105	2258	2320	2442	3215	3520	3955	
2125	2260	2360	2532	3237	3550		
2145	2282	2390	2545	3250	3570		
2155	2300	2415	2557	3322	3580		

**1.29**

Payments must accompany order. Enclose 20¢ for postage and handling. Minimum order \$2.00 plus postage. Crystals shipped packed in cloth bags inasmuch as they are shock mounted. All shipments guaranteed.

## Reduced for Clearance!

**BENDIX TA-12 TRANS-MITTER, 100 watt.** 4 separate ECO's with tubes. 3—807, 4—12SK7. Complete instructions for converting to 10, 20, 40, and 80 meters supplied. Only a few left at this low price.



Like New **29.95** Used **19.95**

**RECORD CHANGERS,** single speed automatic, removed from new console combinations, single post... \$9.95 double post... \$14.95 Special Capehart record changers, value \$85.00—reduced to \$17.95.

**TERMS:** All items F.O.B., Washington, D.C. All orders \$30.00 or less, cash with order. Above \$30.00, 25 per cent with order, balance C.O.D. Foreign orders cash with orders, plus exchange rate.

**SUN RADIO**  
OF WASHINGTON, D. C.  
938 F STREET, N. W. WASH. 4, D. C.

## TV Interference Patterns

(Continued from page 49)

ting into the video circuit. The frequency of the audio signal determines the number of bars obtained. The higher the frequency, the greater the number of bars.

Now adjust the signal generator to deliver an unmodulated r.f. signal—the frequency is not too important, but should be somewhere between 100 kc. and 1 or 2 megacycles.

In this case, the frequency of the signal is greater than line sweep frequency, so that the individual lines will be made brighter and darker along their length. This may result in the vertical line pattern shown in Fig. 1B. The lines may not only be vertical, but may slant either to the right or left, as shown in Fig. 1C.

Whether the lines are perfectly vertical, or slant to one side, as well as the number of lines seen, all depend on the frequency of the interfering signal with respect to line frequency (15,750 c.p.s.). This can be readily demonstrated by varying the frequency of the signal generator over a fairly broad range. At some frequency settings the line pattern will not be obtained, but a very coarse "grain" effect will be seen.

This type of interference pattern (vertical and slanting lines) may be caused by interference from a strong r.f. carrier signal, whether a ham station, broadcast station, or other source. It is quite a distinctive pattern and easily recognized once seen in its different forms.

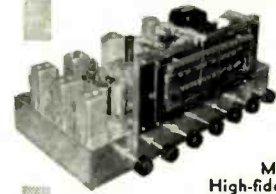
To demonstrate the type of interference pattern caused by an AM modulated r.f. signal, simply switch the signal generator to deliver a modulated r.f. output. The vertical lines will still be seen, but horizontal bars will also be present. The modulated r.f. signal may, at certain frequencies, form a "checkerboard" pattern.

If the signal generator is tuned to deliver an r.f. signal with a frequency of 4.5 mc., then a very fine grain-like pattern may be seen on the screen. This is the same type of pattern obtained when there is a strong beat between the video and audio carriers due to misalignment of the video i.f. stages, misadjustments of traps, or due to turning the contrast control too high in high definition sets.

Since fine lines which may be perfectly vertical, or which may slant either to the right or left are obtained with different frequency r.f. signals, we might expect FM interference to give us a combination of changing lines... lines which slant first one way, then another, and which vary in number. If the frequency variation is smooth and does not occur in jumps, then the line variation must be smooth, and the effect of a "wavy line" pattern might be expected.

And this is exactly the type of pattern that is obtained due to FM inter-

## Have you ever really heard FM?



MODEL RJ-20  
High-fidelity FM-AM Tuner  
incorporating tone controls

### To truly enjoy FM . . .

and the unmarred brilliance Armstrong-circuit FM alone makes possible — you need the performance of the RJ-20. The man who knows radio knows nothing less will give equal performance.

Music is flawless, noise-free — every instrument sounds true . . . speech is clear, with astonishing "presence". Tuning is precise and drift-free.

### And for better AM . . .

Superior performance with maximum tonal quality. Wide-range tone control to suit your taste; 20 db. treble and bass boost.

Also available: RJ-12A FM-AM tuner with triple tuned IF transformers in AM, RV-10 FM tuner only. All with same Armstrong FM circuit.

Free Bulletin RN-150 gives performance curves and data on these high-fidelity tuners.



**BROWNING**  
LABORATORIES, INC.  
WINCHESTER, MASS.  
ENGINEERED FOR ENGINEERS

Be Sure...  
Rely on these  
**ERIE RESISTOR**  
components



If your distributor cannot supply you, write us for information. New catalog on request.

Electronics Division  
**ERIE RESISTOR CORP., ERIE, PA.**  
LONDON, ENGLAND TORONTO, CANADA.



ference, whether from an FM station or from a piece of r.f. equipment whose frequency varies rapidly under load (such as diathermy equipment). The basic pattern can be demonstrated by manually shifting the signal generator frequency rapidly back and forth over a small range, and watching the screen of the TV set. The type of pattern obtained, typical of FM interference patterns, is shown in Fig. 1D.

The general technique of demonstrating television interference patterns as described is not only of value to the service technician trying to gain experience in TV, but may also be used to good advantage in schools, where some of the interference conditions encountered are discussed. An actual demonstration of the type of pattern obtained in a particular case of interference enables the student to get a much clearer picture than the longest lecture type description, or the best photographic reproduction. —30—

### Broadband Converters

(Continued from page 40)

nal boosters, etc. It should have its variable condenser, a mica padder, open to about half its capacity when the r.f. and oscillator circuits are tuned, and then adjusted for maximum signal. Its adjustment may require a slight touching up of the r.f. coil tuning in order to repeat the output signal.

The photographs of the dual 6AG5 converter may make it appear more complicated than it is. This is because equipment not required for converter operation was mounted in the same box. A break-in relay and antenna switch were added for transmitter operation. The antenna switch can be of the double-pole, miniature type where a transmitter is not to be used in conjunction with the converter. Here it is used for antenna switching, converter and transmitter filament switch, and as a safety to keep the transmitter high voltage from being applied until filament voltage is applied. A triple-pole, double-throw switch is needed in this case. The break-in relay may be applied to any converter so that it removes screen grid or oscillator voltage from the TB-17 (war surplus) carbon mike button when pushed for transmission.

A break-in relay is not a "must," it simply removes the need for turning down the receiver gain each transmission and decreases the recovery time of the receiver by keeping it from becoming blocked. —30—



March, 1950

<p><b>MICROPHONES</b></p> <ul style="list-style-type: none"> <li>• Pressure</li> <li>• Velocity</li> <li>• Cardioid</li> <li>• Varacoustic</li> <li>• Hand Sets</li> <li>• Sound Power Telephones</li> <li>• Stands, Plugs, Cables and Connectors</li> </ul> 	<p><b>AMPLIFIERS</b></p>  <ul style="list-style-type: none"> <li>• Pre-Amplifiers</li> <li>• Line Amplifiers</li> <li>• Voltage Amplifiers</li> <li>• Power Amplifiers</li> <li>• Remote Amplifiers</li> </ul>	<p><b>SPEAKERS</b></p>  <ul style="list-style-type: none"> <li>• Cone Type</li> <li>• Horns and Drivers</li> <li>• High-Fidelity Speakers</li> <li>• Speaker Accessories</li> </ul>	<p><b>SPEAKER HOUSINGS</b></p>  <ul style="list-style-type: none"> <li>• Baffles, All Types</li> <li>• Console Cabinets</li> </ul>
<p><b>INTERCOM SYSTEMS</b></p>  <ul style="list-style-type: none"> <li>• All Master Systems</li> <li>• Master-Remote Systems</li> <li>• Combination Systems</li> </ul>			<p><b>PORTABLE SOUND SYSTEMS</b></p> 
<p><b>CUSTOM-BUILT EQUIPMENT</b></p>  <ul style="list-style-type: none"> <li>• Consoles</li> <li>• Desks</li> <li>• Turrets</li> <li>• Cabinets</li> </ul>			<p><b>PROGRAM CONTROL UNITS</b></p>  <ul style="list-style-type: none"> <li>• Single Channel</li> <li>• Dual Channel</li> <li>• Custom-Built</li> </ul>

## Why shop around?

It's easy to get the right equipment from RCA's full line of matched sound products

Buy your sound products the easy way. The wide variety of RCA Sound Products simplifies your problem of finding the right equipment for your sound jobs.

Every item in RCA's extensive sound line is electronically engineered with its own special characteristics to give top performance, dependable long-life service with quality appearance. Not only is the

RCA Sound Products line built right, it is also priced right to enable you to build a steady volume of profitable business.

No other manufacturer offers so extensive a line of "matched" sound products from the smallest "ballyhoo" system to the largest systems for industrial, educational, institutional, church, hotel, hospital or commercial users.

See your RCA Sound Products Distributor for catalog and new sound sales manual



**SOUND PRODUCTS**  
**RADIO CORPORATION of AMERICA**  
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N. J.

In Canada: RCA VICTOR Company Limited, Montreal

### TELEVISION RECEIVER—\$1.00

Complete instructions for building your own television receiver. 16 pages—11" x 17" of pictures, pictorial diagrams, clarified schematics, 17" x 22" complete schematic diagram and chassis layout. Also booklet of alignment instructions, voltage and resistance tables and trouble-shooting hints. —All for \$1.00.

CERTIFIED TELEVISION LABORATORIES  
5507-13th Ave., Brooklyn 19, N. Y.

SEND TODAY FOR YOUR  
BIG FREE 16 PAGE  
BARGAIN BULLETIN

DOW TRADING 70 W. UNION  
PASADENA, CALIF.

## BLISS Electrical Training

ELECTRICAL SCHOOL

Intensive 32 weeks' residence course in fundamentals of industrial electrical engineering, including radio and electronics. Extensive laboratory, shop work, drafting. Prepares for electrical technician and engineering

aides in communications, power, manufacturing, business machines, sales, service. G. I. approved. 57th year. Enter Mar. 6, Sept. 5. Catalog. 7605 TAKOMA AVE. WASHINGTON 12, D. C.





See the  
Whole Picture  
on all-new 16"

**NATIONAL**  
TELEVISION



Now at last, see the *whole picture* exactly as transmitted on a big 16" rectangular screen. No lost corners! No corner distortion! The new black face increases the contrast, eliminates glare. Even old films are reproduced on these new history-making National models with a sharpness and clarity never before achieved!

**ALL-NEW CHASSIS** features a built-in "turnstile" antenna with directional switch, a highly sensitive turret tuner, four stages of I.F. for extra gain in fringe areas, and a full 4 mc. video bandwidth for magnificent "hair-line" fidelity!



MODEL TV-1625

Handsome console of hand-rubbed mahogany veneer with the revolutionary 16" rectangular tube, all-new chassis and a 12" speaker. . \$339.95

Also available in table model  
TV-1601 at \$289.95

**National**



**NATIONAL COMPANY, Inc.**  
MALDEN, MASSACHUSETTS

## Condenser Tester

(Continued from page 48)

condenser is larger than 90  $\mu\text{fd}$ , other means must be employed to determine its capacity.

One other adjustment which is necessary is the initial tuning. This is accomplished by a third variable condenser connected across the tuned circuit. The calibrated condenser is set to zero on the dial and this last condenser adjusted to give zero beat in the detector. When the unknown is connected, the calibrated condenser is then returned to give zero beat. Sometimes zero beat is not a desirable reference point. In this case, some pitch such as 500 cycles can be used, but a special caution is then necessary. There are two adjustments which will give this beat, one either side of zero beat. If the initial adjustment is on the high-frequency side of zero beat, the final tuning must also be on the high side, otherwise, a large error will result.

The detector is of the oscillating type. That is, enough of the output is returned in the proper phase to the input so that the circuit oscillates. This makes it possible to have an audio beat note between the incoming signal and the self oscillations of the detector. The output of the detector which consists of the audio beat frequency plus the two radio-frequency currents which produce the beat is sent through a filter which eliminates all but the audio beat and passes this to an audio amplifier.

The foregoing paragraphs explain the basic principles of the instrument. A few refinements were embodied in the unit which were dictated by necessity. First of these was in the main oscillator. In order to obtain the

necessary stability of frequency, an oscillator having a fundamental frequency of 80 kc. was used. On the other hand, the detector was adjusted to 560 kc., the seventh harmonic of the oscillator fundamental. This brings about two advantages. First, the frequency change of the oscillator is multiplied sevenfold so that the observer has no difficulty detecting the change. Second, the frequencies of the two circuits are independent of adjustment of each other. Were the oscillator and detector on the same frequency, they would tend to "pull" each other into zero beat. All the audio amplification that is required is a single beam pentode amplifier. This provides ample output.

The accompanying diagram shows the complete circuit of the unit.  $C_6$  is the calibrated tuning condenser;  $C_5$  is the semi-adjustable condenser which may be removed from the circuit when capacities greater than 45  $\mu\text{fd}$ . are being measured;  $C_1$  is the initial adjustment condenser.  $C_1$  is actually connected across the detector circuit instead of the oscillator. This was done in order to reduce the components in the oscillator tuned circuit. Since the detector needs a tuning condenser anyway, it was found that greater stability results through this arrangement.

One additional feature which is of interest is incorporated in the audio output circuit. It is necessary to have a reference audio frequency for the initial and final adjustments. An ordinary earphone was tested and found to have a natural resonant frequency of about 800 cycles. This was fastened to a 1.5 inch diameter tube whose length was adjusted to have the same resonant frequency. When the proper audio frequency, 800 cycles, is obtained, the audio output is stronger than at any other frequency.

Top view of the completed condenser tester with the cover removed to show parts layout.





The necessity for having an external audio reference was thus eliminated. A surplus F.L. 8 or F.L. 30 filter could also be used in the input circuit to the audio amplifier with an ordinary transformer and speaker in the output. A 440 cycle tuning fork which may be purchased in almost any music store makes a convenient reference tone if the resonant earphone circuit suggested is undesirable.

The entire unit is housed in a 5" x 6" x 9" standard metal box. A chassis, 8 3/4" x 4 3/4" x 1 1/2", was made from a piece of 20 gauge galvanized sheet iron obtained from a local roofing concern. The only special shielding required is the shield can for the detector coil. A metal 6J7 avoids the necessity of shielding this tube. It can be seen from the photograph that the small filter choke and power transformer are on the left below the earphone assembly. Immediately to the right of the resonating cylinder is the rectifier. Next is the 6C5 80 kc. oscillator behind which is the 6G6 audio amplifier. The detector tube is on the extreme right hand end of the chassis with the shield can for the coil mounted behind and to the left.

The variable condenser, C<sub>1</sub>, was made from a variable mica padder condenser in order to conserve space beneath the chassis. A short length of 1/4" brass rod, to which the knob was fastened, may be soldered to the head of the adjusting screw.

## HANDY PLUG-IN ANTENNA

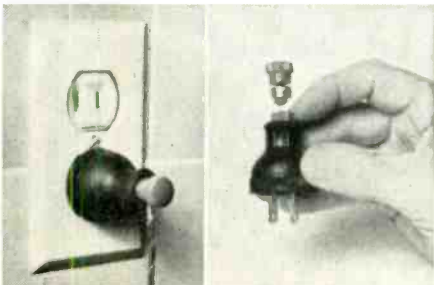
By ARTHUR TRAUFFER

USING the house electrical wiring and the outdoor power lines as an antenna is by no means a new idea, but here is a simple and very handy method of doing it.

As shown in the photographs, you simply push a small mica condenser into the hollow handle of a rubber plug, connect one wire lead to a binding post of the type shown, and connect the other lead to one prong of the plug. The condenser used measures about 7/16" wide and 1 1/16" long. You can enlarge the opening in the rubber handle with a rat-tail file, if necessary, before pushing the condenser in place.

This antenna gives very good results with any AM receiver; it can be plugged into any outlet in the house, and it completely eliminates the nuisance of stringing up an outdoor or indoor antenna.

Two views of the handy "plug-in" antenna showing method of assembling the unit and the unit in use. The largest capacity condenser which will fit plug should be used.

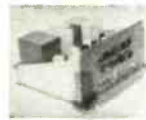


March, 1950

# SAVE UP TO 95% SENSATIONAL SURPLUS VALUES!

## BC-1072 XMITTER

157-187 MC. Input 117VAC 60 cy. Has parallel rod OSC using 2-826 PP, contains power supply, general radio varic. 1.5A. 3 1/2" 0-5 kilovoltmeter. 10 tubes and loads of other parts too numerous to mention. **\$19.75**  
With tubes. Less Blower. Used.



## BC-1068 RCVR

150-210 Mcg. Contains 115 V AC 60 Cy. power supply. Inductance tuning for RF. Ant., DET., and OSC. Makes ideal FM or 2 meter rcvr. with few modifications. Has 14 tubes: 1-6SN7, 1-6H6, 3-6SH7, 3-6AC7, 2-6AB7, 1-6J5, 1-5U4G, 1-9006, 1-6E5 ind. Used. **\$22.50**  
801H BC-1068 and BC-1072. **\$38.95**

## ARC-5 VHF SET

R-28 RCVR: Superhet operating on 4 xtal channels 100-156 Mc remote control to actuate turret-tuning mechanism. 12 tubes—4-717A, 1-12A6, 3-12SH7 and 2-12SL7GT w/dyn. Originally \$65.00.  
MD-7 MODULATOR: Contains all necessary circuits, and components for plate mod of T-23 Xmitter, w/dyn. which supplies plate and screen voltages for mod. Used. Originally \$36.00.  
T-23 XMITTER: MCW and phone on 4 channels, 100-156 Mc. automatic turret-tuning, tank circuits remote controlled. 4 tubes—2-1625, 2-832A. Originally \$50.00.  
**COMPLETE SET \$42.50**



## APS-13 WARNING RADAR

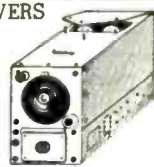
17 tubes as follows: 9-6AB5, 5-6J6, 2-2D21, and VR-105. 410 to 420 Mc. and 30 Mc. IF. Good deal for conversion and citizen band. With instruction book. **\$16.95**  
Originally over \$100

## APN-1 ALTIMETER TRANSCEIVER

418-462 MC FM. With dyn. and 14 tubes. Excellent cond. **\$5.95**  
APN-1 INDICATOR. Basic Movement 0-1 MA., 5 MA., shunt 270" dial. New **2.95**

## COMMAND RECEIVERS

Tested Before Shipping  
190-550 KC Used. Orig. \$40. Now. **\$9.95**  
3-6 MC Used. Orig. \$30. Now. **4.95**  
3-6 MC New. Orig. \$35. Now. **6.50**  
6-9.3 MC Used. **7.95**  
1.5-3 Mcg. Used. Excel. lent **14.95**  
ARR-2. Used **9.95**



## ARC-4 VHF TRANSCEIVER

140 to 144 Mc Crystal Controlled. Xmitter has 832 final Modulated by 6L6's. 10 Watt Output. 13 Tube Receiver, containing 2 individual RF sections and a 10 Mc IF Amplifier. Both RF sections may be operated simultaneously or either one individually. Comes with Xtal, Dynamotor and Tubes. Used. Good. **\$19.95**  
Originally \$150.00

## RED HOT SUPER SPECIAL

BC-956 IFF UNIT—Includes 4-speed combination AC 110V motor and 18V Input dyn. 450V 60 MA output. gear box having 4 drive shafts mounted on one end. All shafts on gear box will turn simultaneously at 4 different speeds ranging 5-4000 RPM in different steps from each of the 4 shafts. Also included 2 chassis containing 13 tubes, carbon pile regulator, loads of other USABLE parts. Comes with full instructions for use of AC motor and 18V dyn. No cost or additional equipment needed. Only 5 minutes of your time. **\$6.95**

WRITE FOR NEW 1950 CATALOG

## V&H RADIO & ELECTRONICS SUPPLY

DEPT. R-7, 2033-37 W. VENICE BLVD. LOS ANGELES 6, CALIFORNIA

## PRE-TESTED MAGNETIC TAPE

For standard price of \$5.50 per roll, you get brand new Scotch Brand 111A or B Plastic Tape 1/4 inch x 1200 feet with hi-fidelity musical program recorded 7 1/2 inches per second, single track. Ideal for checking recorder speed, volume and head alignment. State type music desired (classical or popular) and whether 111A or B. Send check or M. O. for \$5.60, prepaid shipment.  
**SOUND TAPE SALES, Box 365, LaGrange, Illinois**

## RADIO ENGINEERING!

Complete Radio Engineering course incl. Telev., U.H.F., and F.M. B.S. Degree Courses also in Civil, Elect., Mech., Chem., and Aero. Eng., Bus. Adm., Aect. Visit campus, see well equipped labs. Low cost. Prep courses. Personalized instruction. Grids successful. Founded 1884. Enter March, June, Sept., Jan. Write for Catalog.

DEGREE IN 27 MONTHS

TRI-STATE COLLEGE

1630 College Ave. Angola, Indiana

## ARB RECEIVER

6-Tube, 4 Band Super Het. Frequency Range. 196 Kc to 9 Mc. Covering Range Broadcast, Boat and Amateur Frequencies. The Unit also has facilities for Loop Input, with Tubes, Dynamotor. Used. With Control Box, Plugs, Remote Tuner, and Flex Switch. Very clean condition. **\$34.50**



## COMMAND XMITTERS

BC-459, 7-9.1 Mc. Excell. Cond. **\$8.95**  
T-22 ARC-57-9.1 Mc. Orig. \$50. Now **12.75**  
3-4 MC. Used. Orig. \$30. Now **12.50**  
5-3-7 MC. Used. Orig. \$30. Now **12.95**  
T-21 ARC-5-5.3-7. New. Orig. \$40. Now **5.95**  
4-5.3 MC. Used. Orig. \$30. Now **3.49**  
T-20 ARC-5. New. Orig. \$40. Now **6.95**  
2-1-3 MC LN. Orig. \$40. Now **9.95**

## ASB-7 INDICATOR

Makes a beautiful scope foundation kit. Has 5BPI, 4-6AC7, 3-6H6. Can also be used for remote television indicator w/ dyn conversion. Good cond. **\$10.75**  
Orig. \$30.

## 100 WATT BENDIX TRANSMITTER TA-12

3-807 tubes. 4-12SK7's, 2 5 amp RF meter and separate master oscillators. Easily changed to cover 20-40-80 meters and using crystal 10 meters also. Thus giving you a complete coverage transmitter. 7 section and position switch changes ECO, IPA and output tank simultaneously. Comes with MP-28 Mod. & dynamotor. **USED \$29.50 NEW \$45.00**



## BC-611 "HANDIE-TALKIES"

FREQ. 3-9 MC. No wires to attach. Easy to operate. Push button controlled. No skill necessary. Already tuned to set frequency. Crystal controlled. Transmitter and receiver in same case. Only 5 1/2 lb. with batteries (batteries can be supplied). Small: 1 1/2" x 3 3/4" x 5 3/4". Aluminum case. Complete with tubes, crystals and 1 set of batteries. **PRICE ON REQUEST**  
Used, good cond.

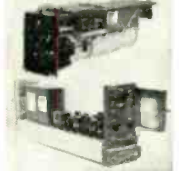
BC-433 G COMPASS RCVR.—Used with tubes **\$14.95**  
RS/ARN-7 COMPASS RCVR.—Usac with tubes **14.50**  
SCR-522—VHF Transceiver. 100-156 Mcs. Used. Good **37.95**

APS-13 ANTENNA, New **\$1.49**  
SCR-274 ANT. RELAY UNIT, contains 50 mmfd. 5 KV Vacuum Condenser and 0-10 AMP. RF METER. Used, excellent. **1.95**  
ARR-2 RCVR. 234-258 MC FITS 274N RCVR. RACK **10.95**

GO-9 XMITTER—Brand New with tubes for Hi-Freq. and Mod Unit only. Consists of 3 Units: HI-FREQ. XMITTER 3000-18000 Kc. Band Switching 837 ECO, 837 BUFFER, and 803 FINAL AMP. LOW-FREQ. SECTION uses 801 OSC, 807 Buffer, 803 Final Amp. Freq. Range 300-600 Kc. RECTIFIER UNIT 523 Low-Voltage Rect., 2 Type 1616 Hi-V. Rect. Refer to surplus radio conversion manual for complete writeup and conversion to 10 meters. **\$79.50**

## BC-1073 WAVEMETER

PWR. SUPPLY SECTION: 110 V 60 Cy, 330 V DC 85 MA 2 section filter. Also 15 tubes: 10 6NS7's, 1-5Y3, 1-6H6, 1-6J5, 1-6V6, 1-6SA7. Can be purchased separately at **\$9.95**  
WAVEMETER SECTION: has high quality resonant cavity tuning from 150-210 Mc, oscillator, heterodyne amplifier, electric tuning eye, precision millen gear drive and collapsible antenna. Cavities in these units may be used as oscillator and a pair beat together to give 0-420 meg. Also can be used to calibrate rcvr. and xmitters by checking built-in oscillator against cavity and tune rcvr. to built-in OSC freq. which is then corrected to wavemeter freq. Used 9006, 6S75 and 6V5 tubes. **\$14.00**  
PWR SUPPLY AND WAVEMETER IN ONE CASE. BOTH FOR **\$22.50**



## BC-924 FM XMITTER

Freq. range 27-39 Mc. 25 watts output 4 channels, tunable throughout entire range, band width 20 Kc. ECO controlled, 7-6S17, 2-6J5, 1-6AG7, 1-6V6, 1-VR-150/30, 1-6SL7, and 2-815. Complete with tubes, less dynamotor. **\$21.95**



## IMPORTANT

NO ORDER LESS THAN \$5.00. Send 50% deposit on cost of item or full amount to save COD charges. Do not send shipping costs. It will be COD only. Shipments sent via rail way express unless other instructions given. Merchandise subject to prior sale. Prices subject to change at any time.

# STEADY PROFITS

YOUR OWN BUSINESS WITH COVIDEO

Coin Operated Television

Place these specially built television sets that play 30 minutes for 25c in the thousands of available public places, hotel rooms, tourist courts, etc. They yield immediate profits and steady income. Install Covideo, the finest made. Limited capital required. Send for further information. Write today.

COVIDEO Coin Operated Television, Dept. B

212 Broadway, Phone BEekman 3-0038-9  
NEW YORK 7, N. Y.



147



Now...Shortcut your mastery of the best

## TELEVISION SERVICING TECHNIQUES



HERE IS an up-to-the-minute manual covering TV receiver installation and servicing. You get a detailed picture of both AM and FM circuits, operation, and servicing. Everyday TV receiver jobs go faster with the understanding of fundamentals you get in this down-to-earth manual.

Elaborate trouble-shooting charts show symptoms, causes and cures for over 50 common TV receiver problems. Simplified diagrams, schematic drawings, and photographs help show you what to do and how to do it.

## BASIC TELEVISION

PRINCIPLES AND SERVICING

By **BERNARD GROB**  
Instructor, RCA Institutes  
592 pages, 6 x 9, over  
400 tables, charts,  
illustrations  
**\$6.50**

THIS NEW book combines well-rounded self-instruction in basic TV principles with practical, ready-reference receiver trouble-shooting guidance. Each block of receiver circuits is discussed separately to ensure clear understanding of all details.

You get more than enough material to qualify for the FCC's added FM and TV requirements for the 1st class license test.

### COVERS FULLY

Oscilloscope operation—ratio detector system and intercarrier sound receivers—automatic synchronizing control and synchro-guide system—projection systems—sequential, simultaneous color TV—picture tubes from 3NP4 to 20BP4—power supplies—brightness control—separation of the synchronizing signals, etc., etc.

### 10 DAYS FREE EXAMINATION

McGraw-Hill Book Co., 330 W. 42nd St., NYC 18  
Send me Grob's BASIC TELEVISION Principles and Servicing for 10 days' examination on approval. In 10 days I will remit \$6.50, plus few cents for delivery, or return book postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

Name.....  
Address.....  
City..... Zone..... State.....  
Company.....  
Position..... RN-3-50

## The ROSE CO. TV SCOOP!

630 Jr. Type TV Chassis A Steal At **\$124.50**  
Complete (Less CR Tube)  
16" Glass Picture Tube (1 yr. guarantee)  
**\$44.50**

FACTORY WIRED

**NOTE:** This is NOT a KIT but a FACTORY CUSTOM ENGINEERED, WIRED, TESTED and aligned TV chassis. Just plug in and it works. FULL TV CHANNEL, COVERAGE, INTERCARRIER CIRCUIT, SYNCHRONIZED FM AUDIO SYSTEM, minimum operating controls, RCA tuner. 22 tubes including 2 rectifiers.

**OTHER CHASSIS BARGAINS**  
22 Tube RCA lic. as above for 12 1/2"..... **\$119.50**  
29 Tube RCA lic. 630 Type Chassis, 16"..... **154.50**  
30 Tube as above but with voltage doubler. **164.50**  
12 1/2" Tube..... **29.50**

**RCA LIC. 12 1/2" TABLE MODEL TV "ALL CHANNELS" A REAL BUY AT \$147.50**  
Complete including Picture Tube. Manufactured by Electromatic.

- ### TV ACCESSORIES
- RCA Type Antenna: Folded dipole Hi. & Lo. adjustable reflectors, complete with hardware and 5 ft. mast..... **\$5.45**
  - FOLDED DIPOLE and Reflector, hifred. antenna..... **\$2.75**
  - TABLE TOP 3 Section antenna..... **\$2.75**
  - 300 Ohm Twin Lead..... per 100 ft. **\$1.65**
  - per 1000 ft. **\$10.95**
  - CHIMNEY MOUNTS complete with straps for mounts up to 1 1/2"..... List **\$4.50** per pr. **\$1.59**
  - WALL MOUNTS—distance from wall to mast is adjustable to 20" clearance from wall. List **\$7.00** per pr. **\$3.15**
  - HEAVY STEEL wall mounts—clearance of 4" from wall. List **\$1.50** per pr. **49c**
  - NEW TYPE STAND OFF insulators for 1 1/2" mast, snaps on the mast (You do not need to screw into wall)..... per 100 **\$4.00**
  - In lots of 10, .05 each
  - All Prices F.O.B. New York, 25% Deposit required on all orders, Minimum Order \$5.00.
- THE ROSE COMPANY 98 Park Place**  
New York 7, N.Y. (Corner Greenwich Street)  
Write Dept. RNI for Descriptive Literature.

## Behind the Scenes

(Continued from page 41)

rect focus is achieved by movement of the tube—the image orthicon—while the lens remains stationary.

NBC cameramen are trained according to good motion picture standards, since the composition of the picture is of prime importance. The cameraman's function throughout the performance is to select the proper lens and align optically for best composition. He is in constant communication with the technical director in the control room through a direct phone line, and he wears an ear-plug receiver, specially designed by NBC engineers.

**Boom man—microphones:** The standard adjustable motion picture type of microphone boom is used in a television studio. The microphone is suspended from this boom and its characteristics are unidirectional. This is preferable because of its back sound-rejection qualities. The boom man must manipulate his controls so that the microphone follows the actor as he moves from one place to another during the performance. The boom man receives his instructions from the audio engineer in the control room through a headphone.

**Light direction man—lights:** The lighting of the show comes under the supervision of the light direction man and two or three assistants.

A highly flexible and controlled incandescent lighting system is used most. Spotlights are used for modeling effects, broad (or flood) lights are utilized for filler light and general key illumination. This is similar to units utilized in standard motion picture lighting practice.

**Stage Manager:** This man—in the studio—is the visible representative of the program director, and he indicates to the performers the wishes of the director in reference to cues, positions, speeding or slowing of action, and so on. Since the stage manager is constantly on the move around the studio, he would be hampered if he had to use standard phone connections for communications from the director. He is, therefore, equipped with a small radio receiver, called a "pocket ear," over which the director actually broadcasts to him. The power used in this transmission is only sufficient to reach the stage manager... it cannot project outside the confines of studio.

The men who control the activities of these technicians operating in the studio are located in the control room.

### In the Control Room

**Program Director:** He is in charge of the entire operation, and is guided by physical and technical limitations as interpreted by his technical director working beside him. It is the program director who, during rehearsals, has set the action of the program, and has determined the actual shots and angles

## 1950 PROGRESSIVE EDU-KIT ONLY \$14.75

ABSOLUTELY NO KNOWLEDGE OF RADIO NECESSARY. YOU NEED NO ADDITIONAL PARTS. EXCELLENT FOR BACKGROUND IN TELEVISION. BUILD 15 RADIOS. . . .

The PROGRESSIVE EDU-KIT will help you, if you want an EDUCATIONAL AND INTERESTING HOBBY, or if you want to GET INTO A WELL-PAYING BUSINESS, or if you want to INCREASE YOUR KNOWLEDGE OF RADIO.

Absolutely no knowledge of radio is necessary. The PROGRESSIVE EDU-KIT is the product of many years of teaching and engineering experience. The detailed instructions and quizzes are clearly written and illustrated, so that they can be understood by anyone between the ages of 12 and 80.

The PROGRESSIVE EDU-KIT is not merely a collection of radio parts accompanied by a radio diagram. IT IS PRACTICALLY A RADIO COURSE, offered at a mere fraction of its real value. You will be taught to build radios in a progressive manner. First, you will build a very simple I-tube receiver. The next set is a little more advanced. Gradually you will find yourself constructing elaborate radio sets, and doing work like a professional radio technician. Every part is illustrated. EVERY STEP INVOLVED IN BUILDING THESE SETS HAS BEEN CAREFULLY PLANNED. YOU CANNOT MAKE A MISTAKE.

Each of the 15 radios you will build operates on 110-120 volts, AC or DC. These sets have been designed to teach you the PRINCIPLES OF RADIO. Therefore, you will build a variety of circuits. THE PROGRESSIVE EDU-KIT IS EXCELLENT FOR LEARNING THE PRINCIPLES OF RECEIVER, TRANSMITTER, AND AMPLIFIER DESIGN. It is used in many Radio Schools and Colleges in U.S.A. and abroad. It is used by the Veterans Administration for veteran training.

Quizzes are provided as part of the PROGRESSIVE EDU-KIT. They will be corrected by our staff at no extra cost.



FREE 1950 EXTRAS:

ELECTRICAL AND RADIO TESTER SCREWDRIVER  
BOOK ON TELEVISION  
GENEROUS HANK OF WIRE

ELECTRIC SOLDERING IRON  
ALIGNMENT TOOL  
SPOOL OF ROSIN CORE SOLDER  
MEMBERSHIP IN RADIO-TV CLUB

ORDER YOUR PROGRESSIVE EDU-KIT TODAY, OR SEND FOR FREE "KIT-KATALOG"  
POSTAGE PREPAID ON CASH ORDERS. C.O.D. ORDERS ACCEPTED IN U.S.A.

**PROGRESSIVE ELECTRONICS CO.**

497 Union Ave., Dept. RN-31  
Brooklyn 11, New York



according to his interpretation of the action.

**Technical Director:** This man is the program director's "right arm." He supervises the entire technical operation of the show and instructs the cameramen as to the type of shot desired by the program director. In constant communication with the cameramen throughout the performance, he manipulates the camera-switching panel which actually puts each camera on the air as the program director "calls the shots." A red light appears on top of a camera when it is switched on the air by the technical director.

A corresponding red light appears in the visor of the camera on the air—as an additional guide to the cameraman. The technical director also manually controls "dissolves," "superimpositions," "split-screen" and other special camera effects. He is in touch with the film studio and passes along "stand-by" and "roll" cues to start the motion picture projectors when film inserts, titles, or commercials on film are used as part of the show.

**Video Engineer:** During rehearsals and the actual performance, the video engineer adjusts the picture in reference to brightness and contrast before it is sent out on the air. He constantly observes scenes from each camera and tries to match—as closely as the eyes can detect—the pictures of all three. There are also other voltage adjustments necessary from time to time while on the air. Before the program goes on the air, it is his responsibility to make necessary adjustments for the proper functioning of the system—after the hour-long camera warmup period—for linearity, alignment of image orthicon, various voltages, beams, target and proper scanning, done with the aid of a test pattern.

**Audio Engineers:** The audio engineer is responsible for the sound pickup and its quality for transmission to master control. He also mixes background music and sound effects with dialogue. The boom-man in the studio is directly under his supervision, as is the record man in the control room.

**Record Man:** This man must pick certain music passages from standard recordings and play them for background or for transition bridges. He takes his cues from a marked script or by direct cue from the program director. This requires exceptionally accurate "spotting" of records—always done by hand. In some puppet shows, the voice of the puppet is recorded and must be played back to fit in with the dialogue of live actors on the air. This is the record man's responsibility. However, sound effects are not handled by the record man, but by a sound effects man in the studio, and are picked up by a separate microphone.

All of the aforementioned technicians and their supervisors, the directors, work in close coordination to achieve the high degree of precision so necessary in modern television. —50—

# TUBES! NATIONALLY ADVERTISED BRANDS TUBES!

RCA—Kenrad—Sylvania—Tung-Sol—National Union—G. E.—Philco—Hytron  
All new tubes. 100% guaranteed. Individually boxed.

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
0A4G	\$.96	5U4G	\$.54	7N7	\$.80	31	\$.96
O1A	.80	5V4G	.85	7Q7	.72	32	1.15
O24	.60	5W4	.96	7V7	.96	32L7GT	1.15
IA5	.80	5X4G	.65	7W7	.96	33	1.15
IA5P	1.40	5Y4G	.65	7X7	.96	34	1.15
IA5GT	.65	5Y3GT	.45	<b>SPECIAL — SAVE</b> Lots of 10    Lots of 100 <b>IT4</b> ..... \$4.90    \$45.00 <b>155</b> ..... 4.50    41.00 <b>3Q4</b> ..... 4.90    45.00 <b>354</b> ..... 4.90    45.00 <b>1A5GT</b> ..... 4.90    45.00 <b>1C5GT</b> ..... 4.90    45.00 <b>26</b> ..... 2.90    25.00 <b>27</b> ..... 2.90    25.00 <b>56</b> ..... 2.90    25.00 <b>76</b> ..... 2.90    25.00			
IA6	1.15	5Z4	.96				
IA7GT	.72	5Z4	.96				
IB4P	1.40	6A3	.96				
IB5/25S	1.15	6A4/LA	1.15				
IC5GT	1.15	6A6	.96				
IC6	1.15	6A7	.72				
IC7	1.15	6A8GT	1.15				
ID5GP	1.40	6AB7	1.15				
ID7G	1.15	6AC5	.96				
ID8GP	1.40	6AC7	.96				
IE5GP	1.15	6AD7G	1.15				
IF5	.96	6AE6	1.40				
IF5G	.96	6AF6G	.96				
IG4	.96	6AG5	.96				
IG6GT	.96	6AK5	1.25				
IH4G	.80	6AL5	.80				
IH5GT	1.15	6AL7	.96				
IH6G	.96	6AQ5	.72				
IJ6G	.96	6AQ5	.72				
IL4	.72	6AT6	.84				
IL4A	.96	6B6	.72				
IL6A	.96	6B6	.72				
IL6B	.96	6B6G	.65				
IL6C	.96	6B4G	.96				
IL6D	.96	6B7	1.15				
IL6E	.96	6B8G	1.15				
IL6F	.96	6C4	.80				
IL6G	.96	6C5	.80				
IL6H	.96	6C6	.80				
IL6I	.96	6C8G	1.15				
IL6J	.96	6D6	.60				
IL6K	.96	6D8	1.15				
IL6L	.96	6E5	.80				
IL6M	.96	6F5GT	.80				
IL6N	.96	6F6	.72				
IL6O	.96	6F7	1.15				
IL6P	.96	6F8G	1.15				
IL6Q	.96	6G6G	.96				
IL6R	.96	6H6GT	.60				
IL6S	.96	6J5GT	.54				
IL6T	.96	6J6	.96				
IL6U	.96	6J7	.96				
IL6V	.96	6K7	.96				
IL6W	.96	6K8	.85				
IL6X	.96	6L6	1.26				
IL6Y	.96	6L6GA	1.15				
IL6Z	.96	6L7	1.15				
IA8	1.75	6N7	.85				
IA9	.80	6P5GT	.80				
IA10	.85	6Q7	.72				
IA11	.72	6R7	.96				
IA12	1.40	6S7	.96				
6S8GT	\$.85	6V7G	\$.96				
6S9GT	.60	6W7G	.96				
6S10GT	.72	6X5GT	.54				
6S11GT	1.15	6Y6G	.85				
6S12GT	.72	6Y7G	1.15				
6S13GT	.72	6Z7G	.80				
6S14GT	.72	7A4	.72				
6S15GT	.80	7A5	.72				
6S16GT	.60	7A6	.72				
6S17GT	.85	7A7	.72				
6S18GT	.85	7A8	1.40				
6S19GT	.80	7B4	.72				
6S20GT	.72	7B5	.72				
6S21GT	.72	7B6	.72				
6S22GT	.72	7B7	.72				
6S23GT	.72	7B8	.72				
6S24GT	.72	7C5	.72				
6S25GT	1.15	7C6	.72				
6S26GT	1.15	7C7	.72				
6S27GT	1.15	7E6	.72				
6S28GT	.80	7E7	.80				
6S29GT	.80	7F7	.80				
6S30GT	.65	7F8	.96				
6S31GT	1.15	7G7	.96				
6S32GT	.72	7H7	.72				
6S33GT	.80	7L7	.80				

ALL NATIONALLY ADVERTISED BRANDS

TERMS: 25% with Order — Balance C.O.D.—F.O.B. Chicago. Prices Subject to Change Without Notice. Minimum Order \$2.00.

**FRANKLIN-ELLIS CO.** 1313 West Randolph Street  
Dept. RN-3A Chicago 7, Illinois

**LEARN RADIO!**  
**PREPARE FOR A GOOD JOB!**  
 BROADCAST ENGINEER  
 COMMERCIAL OPERATOR (CODE)  
 RADIO SERVICEMAN

**Television Servicing**

(Approved for Veterans)  
 SEND FOR FREE LITERATURE  
**BALTIMORE TECHNICAL INSTITUTE**  
 1425 EUTAW PLACE, BALT. 17, MD.

**DROP US A CARD!**  
**GET ON THE MAILING LIST FOR**

**R&M Monthly BARGAIN BULLETIN**

• LATEST, LOWEST QUOTATIONS ON Standard & Surplus  
**Radio-TV Equipment**  
**R&M RADIO CO.**  
 2701 WILSON BLVD.  
 ARLINGTON, VIRGINIA

**RADIO Surplus Buys**

**COMMAND RECEIVERS**  
 Used, Good

BC 453 1.9-550  
 KC ..... \$12.95  
 BC 454 3-6 MC. \$ 5.85  
 BC 455 6.9-1 MC. \$ 6.95  
 6½" CONTROL CABLE for above command sets ... \$ 1.00

**LIKE NEW**

R-5/ARN-7 COMPASS RECEIVER... \$14.95  
 BC-433G COMPASS RECEIVER ... \$14.95  
 BC-603 FM RECEIVER ... \$12.95  
 BC-604 FM TRANSMITTER ... \$15.95

**ARC-4 VHF TRANSMITTING RECEIVER**  
 140 to 144 MC Crystal controlled. 10 watt output. 13-tube receiver, containing 2 individual RF sections and A10 MC. 1F amplifier. Both RF sections may be operated simultaneously or individually. Less crystal, dynamotor and tubes.  
**USED, GOOD \$5.95**

ARC-4 SCHEMATIC ..... \$1.00  
 CONVERSION TO 144-148 MC. .... \$1.00  
 12 & 24V DYNAMOTOR FOR ARC-4. \$4.95

**LINEMAN'S TOOL & SAFETY BELT**  
 (Web Type). NEW ..... \$3.95

SEND 10c FOR COMPLETE SURPLUS CATALOG!

Enclose full amount with order. • All Equipment F.O.B. Pasadena

**C & H SALES CO.**  
 2176 RO-3 East Colorado • Pasadena 8, Calif.



INTRODUCING the  
SUCCESSOR to the  
famous S-10-A  
**POCKETSCOPE®**

**NEW IMPROVEMENTS  
AND FEATURES**

Especially Designed For  
**TELEVISION  
SERVICEMEN**



**MODEL  
S-10-B**

**So Portable!  
So Functional! \$69.00  
So Accurate!  
So Dependable!**

Here's the serviceman's dream of a pocket-size general purpose oscilloscope for television servicing! Weighs only 5¾ pounds . . . rugged . . . compact! Its amazing performance makes it a must on every service call . . .

Linear sweep from 10 cycles to 50 kc . . . Response of vertical and horizontal amplifiers within 0 to -2 DB from 20 cycles to 150 kc—effective even higher than 350 kc . . . Intensity jack provides for modulating beam so video observations can be made on screen . . . Self-calibration with test signal . . . Independent positioning and amplification in both vertical and horizontal channels.

**POCKETSCOPE**

The Ideal General-Utility Oscilloscope! ®

Magnetically shielded cathode ray tube . . . telescoping light-shield . . . wide angle vision . . . functional controls and terminals.

**WATERMAN PRODUCTS CO., INC.**  
PHILADELPHIA 25, PA.

MANUFACTURERS OF POCKETSCOPES  
RAKSCOPES . . . D.C. AMPLIFIER  
RAYONIC TUBES AND OTHER ELECTRONIC TECHNICAL EQUIPMENT

**AFCA NEWS**

*This Association is a patriotic non-profit organization, with chapters in most of the larger cities, dedicated to developing and maintaining efficient personnel, commissioned, enlisted, civilian, for the supply (including design and development), installation, maintenance, and operation of communications and electronic equipment for Army, Navy, and Air Force and their supporting civilian activities. It publishes a magazine "SIGNALS" at its national headquarters in Washington. Every American interested in any way in communications is eligible and invited to join. Dues are \$5.00 per year. Application should be submitted to the secretary at 1624 Eye St., N. W., Washington 6, D. C., who will furnish details upon request.*

**NATIONAL CONVENTION**

For the second time in four years, part of the AFCA annual convention will be held at the Signal Corps Center, Fort Monmouth, on May 13th. The first day of the meeting, May 12th, will be spent in New York City and will be devoted to business meetings, conferences, and the annual banquet, plus a visit to the Photographic Center in Astoria, L. I.

Delegates will arrive at Fort Monmouth as guests of Maj. Gen. F. H. Lanahan, Jr., commanding general, and AFCA's Fort Monmouth Chapter to take part in a full-day program, during which they will be addressed by Maj. Gen. Spencer B. Akin, Chief Signal Officer, and other dignitaries.

The tentative itinerary will include outdoor and indoor exhibits, a tour of the Signal Corps Engineering Laboratories, other post activities, and luncheon with Signal Corps troops in the field.

During the afternoon, the visitors are scheduled to witness a combat problem, high speed wire laying, and other demonstrations, followed by a review of troops during which Signal Corps participation in the Civil, Spanish, and both World Wars will be symbolized.

The exhibits and demonstrations being planned will include television, radar, radio relay, high frequency equipment and others that will present the Army's progress in electronic and communications fields.

**AFCA CHAPTER NOTES**

**Atlanta**  
The part that photography has played in the production of visual education aids at Camp Gordon's two

Army technical training schools was discussed by Capt. Roger L. Leonard, Signal Corps, at the annual winter dinner-meeting of the chapter on January 10th at the Fort McPherson Officers' Club.

Capt. Leonard was well qualified to present this subject. He is in charge of one of the largest photographic laboratories in the Third Army area, and has helped to develop the use of still photography in preparing training aids used at both the Southeastern Signal School and the Military Police School. He has also helped to develop the film library at Camp Gordon which is considered one of the most complete of its kind.

W. H. Mansfield, Atlanta Chapter President, was elected Secretary of the *Southern Bell Telephone and Telegraph Company* on January 1st. Forty years in telephone service, Mr. Mansfield has been Assistant Secretary and Assistant Treasurer, as well as Assistant Vice-President. He will continue to serve as Assistant Treasurer. He is also a director of the *Inter-Mountain Telephone Company* of Bristol, Va., and of the *Carolina Telephone and Telegraph Company* of Tarboro, N. C.

**Chicago**

The Chicago Chapter's January meeting was held at the *Automatic Electric Company* plant with C. S. Cadwell, president of the firm, acting as host.

C. F. Ffolliot, director of the company's products design section, described "Automatic Toll Ticketing" and K. A. Regel, manager of industrial sales, spoke on "Adventures in Remote Control."

After a short recess the U. S. Navy's color film entitled "To The Shores of Iwo Jima" was shown.

Chapter President Oliver Read presided over the well-attended meeting and introduced the speakers.

**Kentucky**

The chapter's January dinner-meeting was preceded by an informal get-together at the Lexington Signal Depot Officers' Club.

"Atomic Warfare" was the subject of a talk by Maj. Frank C. Healy, graduate of a course in radiological defense at the Army Chemical Center, Edgewood, Md.

**Louisiana**

Louisiana Chapter officers are co-operating with officials of local posts of other military associations in sponsoring the fourth annual Industry-Army conference being held in New



Orleans on February 27th. The chapter will give a luncheon on that day in honor of Maj. Gen. Spencer B. Akin, Chief Signal Officer.

**New York**

The results of the chapter's annual election are as follows: President—Col. Thompson H. Mitchell, Exec. Vice-President, *RCA Communications, Inc.*; Vice-Presidents—Lt. Col. Ralph G. Edwards, *AT&T Co.*; Capt. Roy W. M. Graham, Chief of Staff of Eastern Seafarmer, USN; Col. Peter C. Sandretto, *Federal Telecommunication Laboratories*; Treasurer—Maj. Theodore N. Pope, *Bell Telephone Laboratories*; Secretary—Lt. Col. David Talley, *IT&T Corp.*

**Sacramento**

Mather Field Air Base was the scene of the chapter's December 5th meeting. Members gathered at the Officers' Club and were welcomed by Brig. Gen. Carl B. McDaniel, Commanding Officer of Mather Field, who gave a resume of the background, history, mission, and training program of the base.

After dinner, the members were taken by bus on a tour of the training facilities of the base. Of special interest was the great quantity of communication and electronic equipment utilized in the training aids.

The program was concluded at the Officers' Club with the motion picture "Guided Missiles." This picture depicted the early experiments, manufacture and launching of the V-1 and V-2 rockets by the Germans during World War II; the improvements and development made by the U. S.; and the relative dependence of guided missiles upon communications and electronics.

**Seattle**

Radar was discussed by representatives of three varied activities at the December 13th meeting of the chapter in the American Legion Hall.

Commander Dean of the Coast Guard described the radar equipment used by the Coast Guard in performing its duties in wartime and in peace. Some of the subjects he covered were: air search and warning, safety at sea, aids to navigation, radar beacons, enforcement of maritime regulations, ice patrol, protection of life and property at sea, use of balloons and radar equipment in plotting wind directions.

Mr. Hogg of *General Electric* illustrated his talk with pictures of various types of radar and their uses, ranges covered, technical operations requirements, areas in which certain types are preferred and why. This was followed by a film showing the use of radar in locating enemy craft, homing and navigation in general.

Mr. Kasrow of the CAA concluded the program with a discussion of air traffic control, navigation by instruments, position reports, moving target indicators, identification of planes,

March, 1950

# SEE LEO FIRST... for HALLICRAFTERS!

*Fellows—I'll bend over backward to give you a better deal. My EZ Payment Plan is the lowest in the country. I finance my own paper—it saves you money. No Red Tape, No Delays! Liberal Trade-Ins on your present equipment. Let's get acquainted!*



LEO I. MEYERSON WØGfq

## SX-71 RECEIVER

The SX-71 offers superior Ham Band performance in the moderate price range—value packed with features specifically asked for by Hams. Features include Double Conversion sharp selectivity, plus built-in NBFM at moderate cost. 10 tubes plus voltage regulator and rectifier.



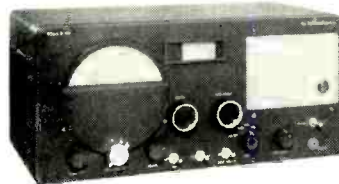
**\$179.50**

Low Down Payments

"Guaranteed Satisfaction From The World's Largest Distributor Of Amateur Radio Transmitting Equipment."

## S-40A RECEIVER

Frequency Range 540 KC to 43 MC. Temperature compensated oscillator. One RF, 2 IF. 3 Watt Output. 4 Bands. 8 tubes plus rectifier. Internal speaker. Has AF & RF gain controls, AVC, BFO, and Noise Limiter switches.



The finest set on the market at this low price. **\$79.95**

Low Down Payments



Deal with the "World's Most Personalized Radio Supply House". Send for your new complete WRL Catalog containing everything new in radio.



## GIANT RADIO REFERENCE MAP

Just right for your control room wall. Approximately 28" x 42". Contains time zones, amateur zones, leading shortwave stations, monitoring stations. **25c**

**FREE**

WRITE—WIRE  
PHONE 7795

WORLD RADIO LABORATORIES R-3  
744 West Broadway Council Bluffs, Iowa  List Of Used Equipment

Please send me:  
 Radio Map  SX-71 Info  
 New Catalog  S-40A Info

Name .....  
Address .....  
City ..... State .....



## HIGH FIDELITY ENTHUSIASTS

Have you sent for literature on the revolutionary development in amplifier design that can be used with any input device, post, present or future—and is guaranteed against obsolescence FOR LIFE? Also features ABSOLUTE FIDELITY\* circuit! New noise suppressor! Volume expander! Designed by A. C. Shaney, of course. Write today for full specifications on ACA-100-VV (Double "V" for Very Versatile).

\*Trade Mark Registered

**AMPLIFIER CORP. OF AMERICA**

398-2 Broadway New York 13, N. Y.

## 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. A wavy 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





## 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.



### AUTO RADIO VIBRATORS

A Complete Line of Vibrators . . . Designed for Use in Standard Vibrator-Operated Auto Radio Receivers. Built with Precision Construction, featuring Ceramic Stack Spacers for Longer Lasting Life.

NEW MODELS NEW DESIGNS  
NEW LITERATURE  
"A" Battery Eliminator, 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.

and the use of radar in avoiding thunderstorms.

### South Carolina

The second meeting of the South Carolina Chapter was held in Charleston on December 1st at the U. S. Navy Shipyard. Arrangements for the meeting were made by chapter members on duty at the Shipyard, under the guidance of Capt. R. E. Melling.

Following dinner at the Officers' Club, Capt. Logan McKee of the Naval Shipyard, welcomed the members and guests and gave an interesting account of his experiences during his Naval career. He emphasized the need for associations of special services to promote a better understanding and closer working arrangements between the armed forces and civilian components.

Ralph Grist, Co-ordinator of Military Services for the *Southern Bell Telephone and Telegraph Company*, then made formal presentation of the chapter charter. He stressed the advantages of the association and the importance of civilian exponents in the development of communications activities applicable to use by the armed forces during time of emergency.

At the close of the meeting, the entire assemblage was conducted on a tour of the Naval Reserve Communications Training Center.

-50-

### Square-Wave Clipper

(Continued from page 37)

Low frequency phase shift and response tests are usually made with a 20 to 60 c.p.s. square wave, the exact frequency depending on the low frequency response of the amplifier being checked.

A dip at one point in the square wave, as illustrated in Fig. 3G may be caused by a drop in amplifier gain over a narrow range of frequencies (or at one frequency). If the drop in gain occurs at the square-wave frequency, then the dip spreads over the entire half cycle and we get the condition of Fig. 3F.

Too low a value of coupling condenser, too small a value grid resistor, or a partially open coupling condenser may cause differentiation of the square wave, resulting in a pulsed output signal as shown in Fig. 3H.

The transient response of the amplifier may be checked by noting if there is any overshoot or damped oscillations following the leading edge of a high frequency square wave as shown in Fig. 3I. A damped oscillation of this type may be caused by distributed capacities and lead inductances resonating at a low frequency, causing a sharp rise in amplifier gain at that point. This condition may also be caused by an undamped peaking coil in a video or scope amplifier.

The frequency at which the circuit

MODEL A-460

## Approved TELEVISION FIELD STRENGTH METER

\$79.50  
ONLY




Field Strength Meter; television 12 channel tuner; video IF channel; large 6" directly calibrated meter; hammer-tone finished panel; ideal for locating antenna systems; testing transmission lines; testing efficiency of indoor antennas; checking booster efficiency, etc.

Model A-460 is housed in a heavy gauge steel cabinet, battleship grey finish with 6 tubes (standard brands) 1N34 Crystal, operating instructions, circuit diagram and guarantee. Weight 25 lbs. D-18" x H-10" x W-12".

Write for 12-page catalogue.

APPROVED ELECTRONIC INST., CORP.  
142 Liberty St. N.Y.C.

## 150 WATT XMITTERS



**Govt. Cost \$1,800!**

7 plug-in Tuning Units  
0.2-12.5 mc. except BC  
Ant. Tun. Unit; 24-V. Dyn.; Mounts, Plugs.  
Convert to 12 V. (as BC-191 for SCR-193), 115 V., or crystal control!  
BC-375-E, complete.

PRICE, each . . . . . \$79.50

Write for circular, quantity discounts

### RADIOSONDES (AN/AMQ-1D)

Govt. 72 mc. Aerial Weather Station! Comes with 3A5 tube; sensitive relay; 3 weather-checking elements. Rewire one to use as receiver. Original packing! Wired ready to use!

SPECIAL, ea. . . . . \$2.49

### CORD SET CD-508A

Has D.P.S.T. press-to-talk Switch SW-141-P. 1 Plug PL-68 on 5-ft. 3-concl. & Jack JK-48 on 4-ft. 2-concl. rubber-covered cord. Condition used.

CLOSE-OUT . . . \$ .50 ea. (min. quan. 2)

All prices F.O.B. N.Y.C.; 20% with order. Int. C.O.D.; items subject to prior sale.

## COMPONENTS SUPPLY CO.

161A Washington St.  
New York 6, N. Y., BEekman 3-8717, 8

## SPECIAL

### CLOSE OUT SALE

of Genuine G.E. TV Antennas

ONLY 1500 LEFT

AT THIS

AMAZINGLY LOW PRICE



Television Antenna UKA-005  
Frequency response flat over both high and low TV bands

Included in the kit are:  
1 3/4" folded dipole with terminal block.  
2 3/4" aluminum reflector rods with coupling  
1 cross arm with most clamp attached.  
1 five foot aluminum mast (1 1/4" d.).  
3 mast-transmission line spacers.  
1 pkg. of necessary hardware.  
1 complete set of instructions.

Your Cost ONLY \$2.95

LIST PRICE - - - \$15.95  
10% CASH With Orders

FOUR STORES TO SERVE YOU



509 ARCH STREET, Philadelphia  
6205 MARKET STREET, West Phila.  
6th & ORANGE STS., Wilmington  
4401 VENTNOR AVE., Atlantic City



resonates (and at which the peak in response occurs) can be determined by spreading the observed signal on the oscilloscope screen until the individual "cycles" in the damped oscillation can be counted. The number of individual cycles, multiplied by square-wave fundamental frequency, gives the approximate frequency at which the peak occurs. Although the value determined in this manner is not absolutely accurate, it is sufficient for all practical work.

In general, the low frequency characteristics of an amplifier are checked by applying a square-wave signal with a frequency near the lower limit of the amplifier. If the flat top of the square wave is tilted, phase shift occurs. If the leading edge is gradually rounded, there is a gradual falling off in amplifier gain at higher frequencies. If there is a peak or a dip in the signal there is either a peak or a drop (respectively) in amplifier gain at some particular frequency. The frequency at which the peak or drop occurs can be determined approximately by the ratio of the time of the peak or dip with respect to the time for the complete cycle of the square wave.

The high frequency response characteristics of an amplifier are checked in the same manner. For high frequencies, however, in addition to the above mentioned characteristics, transient response can also be checked.

For p.a. amplifiers, square waves at frequencies of 60 c.p.s. and 1000 c.p.s. are normally sufficient. For high fidelity audio amplifiers, frequencies of 20 c.p.s., 200 c.p.s., and 1500 c.p.s. should be employed. Finally, for wide-band amplifiers, additional square waves with frequencies about a decade apart should be used, the highest frequency being about one-tenth the upper frequency limit of the amplifier.

In all cases, however, make sure the scope you are using has a flat enough response to enable you to observe a square wave at the frequency used.

-30-

### FARRIS HEADS "REPS"

**R.** W. FARRIS has been named head of "The Representatives" of Radio Parts Manufacturers, Inc. to fill the unexpired term of Leslie M. DeVoe, who asked to be released from further responsibilities this year.

Mr. Farris, a member of the Missouri Valley Chapter, has been active in the affairs of the association for eleven years. Prior to his election as a member of the national Board of Governors, he was president of his chapter for three years.

In addition to naming Mr. Farris, the Board of Governors devoted considerable time at its meeting to an extensive review of national activities, organizational matters, and budget allocations for 1950. They confirmed tentative plans made by the Industry Relations Committee for participation by the organization in the 1950 Parts Distributors Conference and Show, to be held May 22-25 at the Stevens Hotel in Chicago.

-30-

March, 1950

# HERE IT IS!

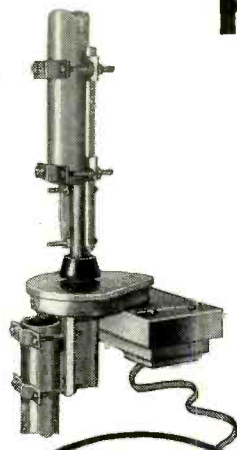
## A DIRECTION INDICATOR

### NOW BUILT INTO THE POPULAR

# NICHOLAS ANTENNA ROTATOR

**MODEL \$49<sup>50</sup>**  
**VMO LIST**

## CHECK THESE FEATURES...




- ★ METER READS CONTINUOUSLY—SHOWS WHERE ANTENNA IS BEAMED AT ALL TIMES.
- ★ ACCURATE WITHIN A FEW DEGREES AT ANY VOLTAGE.
- ★ ATTRACTIVE—EASY TO READ METER DIAL.
- ★ COMPACT, UNOBTRUSIVE UNIT REQUIRES LITTLE SPACE—HARMONIZES WITH CABINET AND FURNITURE.

The above hi-lites are in addition to the numerous other quality features of the Nicholas Antenna Rotator Motor.

WRITE FOR COMPLETE INFORMATION

## NICHOLAS EQUIPMENT COMPANY

Bellevue, Ohio

### 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 9, N. Y.

---

**AUDIO (SOUND) ENGINEERING HOME STUDY TRAINING**  
Practical, easy-to-understand lessons, written by competent Audio Engineers and Educators, prepare you for a better job and a good future in the Television, Radio, Motion Picture, and Recording Industries.  
Write today for details—Learn while you earn!!

**HOLLYWOOD TECHNICAL INSTITUTE**  
Div. R.N.  
4925 Santa Monica Blvd. Hollywood 27, California

### R. & T. BARGAINS

SCR-274N COMMAND SETS. Used, excellent condition. Includes Q-Fiver. (9 pcs.) .....\$40.00

TRANSMITTER BC-375E incl. 7 tuning units, dynamotors, antenna tuner, used, excellent condition. (Shpg. Wt. 266 lbs.) ..... 39.50

SCR-522 TRANSMITTER - RECEIVER AND DYNAMOTOR. Used, excel. condition ..... 39.50

KEY, Code practice J38 (prepaid)..... .59

CATHODE RAY TUBE 5CP7 ..... 1.49

TRANSFORMER. Kenyon Trans. Co. primary 110v 60 cy; sec'dy. 5v 60amp C.T. .... 4.49

F.O.B. Berwyn, Md. Cash with order. Orders without postage will be shipped express collect. No exports.

**R. & T. ELECTRONICS CO., INC.**  
9715 Baltimore Blvd.  
Berwyn, Maryland Phone: TOWER 5384





## WITH THESE ELDICO FILTERS

Transmitter Dual Low Pass Filter  
10 Mc cut off—over 75 db harmonic  
attenuation. 52-72 ohm input and out-  
put. For use at other impedances use  
an antenna tuning network. Good for  
1 KW input—Negligible fundamental  
attenuation. No effect on antenna per-  
formance.  
Model TVT-62

\$ 7.99 in kit form  
Coax Dual Filter 10.99 wired and tested

Receiver Hi Pass Filter  
40 MC Cut off—No attenuation  
to signals above 40 Mc. Efficient  
on any manufactured set. Will  
not affect picture, quality or  
strength. Available for coaxial  
or twinax installation.  
TVR-300 for Twinex... \$1.98 in kit form  
TVR-62 for coax... 3.98 wired and tested



Brute Force Line Filter  
Similar to ARRL's—Page 508 ARRL  
Handbook 1949 Edition. Will handle 1  
KW—Completely filtered and shielded.  
\$5.98 in kit form  
8.98 wired and tested  
(Add 25c To Cover Packing and  
Shipping Each Filter.)

### GDA GRID DIP OSCILLATOR

The most valuable piece of test  
and measuring equipment in the  
ham's shack would be the grid  
dip oscillator. The "Grid-Dipper"  
has taken the country by storm.  
The GDA kit builds an exact dupli-  
cate of the Grid Dipper and  
includes the special handy case  
and a complete application and  
instruction book. Complete with  
tube and internal power supply,  
range 3 mc to 250 mc covered in  
six steps. size 5 1/2" x 2 3/4" x 3".  
\$21.50

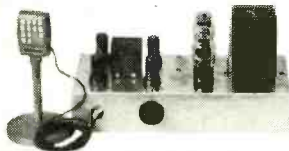


### TR-75 TRANSMITTER KIT

Simple enough  
for the begin-  
ner to assem-  
ble. Uses the  
time proven  
6L6 oscillator-  
807 amplifier  
combination.  
Pi-network out-  
put. Husky  
power supply

delivers 600 volts to the 807. Complete... includ-  
ing a smartly styled shielded cabinet.  
Unbelievably low priced at... \$34.95

### MD-40 LOW POWER MODULATOR



40 watts of audio, the MD-40 is a kit of the same  
superior parts that go into its bigger counterpart,  
the MD-100. In place of the 807's, two 6L6s are  
used. Complete, including the same standard com-  
munications Electro-Voice 915 high-level crystal  
microphone, only \$29.95

IN STOCK FOR IMMEDIATE DELIVERY

NOTE: Price Net, F.O.B., N.Y.C.  
and subject to change without notice.

Telephone: **hrc** Luxembourg 2-1500

**HARVEY**  
RADIO COMPANY INC.  
103 West 43rd St., New York 18, N. Y.

## Off-Frequency Inversion

(Continued from page 57)

verter to remove the interfering signal by placing it on the cut-off side of the asymmetrical filter so that only the desired signal and the sideband free of interference, or containing less interference, is heard.

The unit today is an adaptor or accessory. Whenever industry chooses to incorporate this development in receivers, it would eliminate the separate power supply and audio system now provided in the inverter. As an accessory, the receiver audio system is superfluous. If built into a receiver, only two or three, instead of the present nine, tubes would be required because the detector is duplicated and because more amplification is required under present conditions in view of the loose coupling into the receiver. Building it in could save 20 to 30 db. of gain now needed with the method of coupling employed.

The U.S. Coast Guard is the first large-scale user of MCL-4 equipment. As of September 1949, they have procured or ordered sufficient units for 118 radio stations ashore and afloat. In the mobile radio field channel widths are 60 kc. with heavy interference encountered up to several channels removed when stations are in close proximity. The MCL-4 signal splitter with its ability to attenuate off-frequency interference approximately 100 db. at 1 1/2 kc. removed from carrier on voice reception, 135 db. down on c.w., and 120 db. down on c.w. audio images shows every promise of making satisfactory communication in channels of narrow width and adjacent channel operations possible. Several channels of communication, without sub-channeling, now become feasible in the bandwidth allocated to single stations today.

From all indications the MCL-4 is one answer to our overcrowded frequency spectrum problem.

### REFERENCES

- McLaughlin, J. L. A.: "Exit Heterodyne QRM," QST, October, 1947.
- "Selectable Single-Sideband Reception Simplified," QST, April, 1948.

-30-



## BUY DIRECT SAVE!!

From Factory  
New Improved RCA  
Licensed 16"—630  
Chassis  
Plus \$1.90 Fed. Excise Tax (Less CRT)

**\$149.95**

CHECK THESE IMPORTANT FEATURES

- Completely wired and aligned by expert technicians.
- Automatic gain control.
- Voltage doubler.
- Wide angle deflection yoke will spread any 16" picture tube.
- Latest type Standard Coil tuner for high sensitivity. UHF adaptation, and easy servicing.
- Full tube complement.

19"—630 Chassis—\$159.95 plus \$1.90 Fed. Excise Tax. (Less CRT)

All glass 16" C-R Tubes... \$39.85

All glass 19" C-R Tubes... \$79.50

16" or 19" Black Tubes \$2.00 Additional  
Regular RMA guarantee on all tubes and chassis

Beautiful cabinets for above—available  
Terms: \$25.00 deposit on all orders—Balance C.O.D.  
P.O.R.—N.Y. Factory  
Prices subject to change without notice

IMMEDIATE DELIVERY Visit our showrooms

**AD-RITZ MFG. CORP.**  
158 Grand Street 231 Centre Street  
New York, N. Y. New York, N. Y.  
Phone WO 4-6763 Phone WO 2-5962

## TUBES TESTED GUARANTEED

10BP4	\$14.95	12LP4	\$18.95
Standard Brand tubes	RCA	Sylvania	Hytron
14B6	79c	6N7	89c
5AZ4	55c	5U4	59c
12A W7	69c	11B3	98c
7AD7	89c	6SH7	49c
7AT	69c	6116	49c
6J6	89c	6SC7	69c
6AK5	89c	6SN7	69c
VR53/6K7	29c		

Standard Turret Tuner, complete with tubes	\$26.85
RCA Horizontal Output Transformer 211T5	4.95
RCA Horizontal Output Transformer 211T1	3.75
RCA Vertical Output Transformer	3.75
RCA Deflection Yoke	4.50
RCA Focus Coil	3.90
Controls—10 ohms to 25 Megohm W.W. and carbon	.29
1/2 Meg 1 Meg With Switch	.45
Selenium Rectifiers	
75 Ma. 100 Ma. 59c	200 Ma. .79
Crystal Cartridges	
L-70 L-71 MLLP1	1.25
6 Tube Superhet Kit with tubes	11.95
5 tube Superhet Kit with tubes	10.95
Superhet Variable Condensers	.49
FM Superhet Variable Condensers	.99
Automatic Changers	7.95
Phono-arms Hook-up wire AN connectors, hardware, speakers, antenna loops. Write in for your needs.	
Famous 10" Wired 31 tube 630 chassis, Less C-R tube	\$174.95

**BERGEN RADIO & TELEVISION CO.**  
345 Bergen St., Newark, N. J.

*Hurry* *Hurry*

### WHILE THEY LAST!

For SCR274N and ARC5

FT221 Mount for 3-receiver rack	ea. \$1.25
FT222 Mount for 3-receiver control box	ea. .75
FT223 Mount for modulator	ea. 1.25
FT226 Rack for 2-trans. 274N	ea. 1.45
FT227 Mount for FT226 Rack	ea. 1.25
FT228 Mount for trans. control	ea. .75
FT229 Mount for ant. relay 274N	ea. 1.45
FT232 Mount for FT234 Rack	ea. 1.45
FT234 Rack for 1-transmitter 274N	ea. 1.45

add 65c for postage and handling

Resistors for BC348, etc.

5 ohm 12 watt, 50 ohm 5 watt, 2500 ohm 12 watt, 11000 ohm 12 watt for BC375 and BC191	ea. .17
126 ohm 7 watt, 15000 ohm 15 watt, 20000 ohm 15 watt, 75000 ohm 2 watt for SCR274N and ARC5	ea. .17
190 ohm tapped at 3 ohm for BC348	ea. .12
Volume Control for BC348 dual-pot	ea. 2.25

add 25c for postage and handling

Flexible Tuning Shafts and Cables

For SCR274N and ARC5 up to 91"	ea. .95
R/ Angle drive MC211A for above	ea. .55
For ARB, MN26, ARN7, BC433, RU16 up to 13"	ea. 2.45
R/ Angle drive MC136 for above	ea. .95

add 45c for postage and handling

All equipment brand new and perfect.

**LONG ISLAND RADIO CO.**  
164-21 Northern Blvd., Flushing, N. Y.



**TV Troubleshooting**  
(Continued from page 66)

continue using the signal from the video amplifiers or else use the vertical sweep signal, as outlined previously, for checking the picture i.f. stages. Weak sound in Intercarrier type sets is sometimes due to misalignment of the picture i.f. stage, thus preventing adequate sound signal to reach the second detector. This can be verified by detuning the local oscillator on the r.f. tuner slightly. If this brings in the sound stronger, possibly at the expense of the picture, then re-alignment is indicated and a suitable generator and v.t.v.m. or scope are needed.

On receivers using separate sound i.f.'s the chance of misalignment in either the sound stage or the trap in the picture i.f. stages is increased. Detuning of the oscillator at the r.f. tuner will usually show if this is the case. Aside from misalignment, the sound i.f. stages can be checked by the same method as outlined previously for the picture i.f.'s, using either the vertical sweep signal or a 60-cycle signal which can be obtained from the power supply.

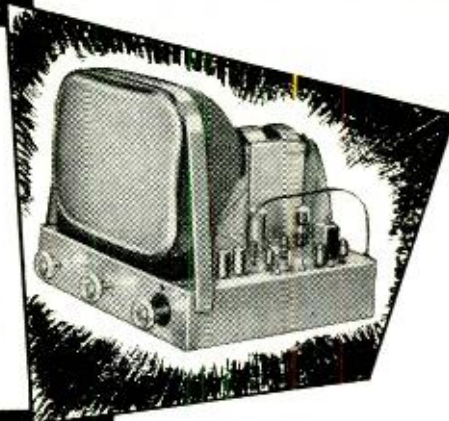
3. *No picture or weak picture but good sound.* In Intercarrier type receivers the presence of normal sound indicates that the picture i.f.'s and detector are operating properly. The picture can be lost entirely only in the circuit following the removal of the sound, i.e., in the d.c. restorer, if any, or in the leads or sockets connecting to the picture tube. The audio amplifiers are used as a signal tracer by connecting a .05  $\mu$ f. condenser across the volume control and touching the free end first to the plate of the video amplifier from which the sound signal is removed. Then follow the picture signal through all coupling condensers, sockets, etc., until the break is located.

Weak pictures in Intercarrier type sets are usually accompanied by weak sound and the troubleshooting procedure is the same as in the case for no sound and no picture. If the sound is normal and only the picture is weak, check for an open or shorted peaking coil in the video stages by tracing the picture signal through from the second detector and listening carefully for any loss in volume. In receivers using separate sound i.f. stages, no picture may result from a defect in any of the stages between the point where the sound i.f. is removed and the picture tube. The video amplifier stages are checked by signal tracing when a picture signal can be heard with the free end of the .05  $\mu$ f. condenser touched to the second detector load resistor. If nothing is heard the method of signal substitution outlined above is recommended, preferably using the signal from the vertical sweep circuits.

4. *No vertical sweep or very little*

**LOWEST PRICE IN TV HISTORY!**

**Cal-Rad**  
**TV CHASSIS**  
For Sensational New  
**16-INCH**  
**RECTANGULAR**  
**TUBE**



Not a Kit!  
But a  
Completely Wired  
Television Receiver

**\$129.50**  
less CR Tube

Famous  
National Brand  
16-Inch Circular or  
Rectangular Tube \$39.50

Chassis Size with Tube: HT. 16" — Depth 16" — Width 18"

**3-Knob Control Panel.** Station selector, Picture contrast and off, on-volume control. Simple as A. B. C.

**Automatic Frequency Control Stabilizing Circuit** for locked-in, sharp steady pictures in any location. No tearing out of signal.

**Automatic Contrast Control Circuit** eliminates fading and flutter.

**Automatic Brightness Circuit** increases brightness with advanced contrast settings for balanced picture.

**Automatic Blanking Circuit** eliminates retrace lines.

**Vertical Hold Circuit** eliminates rolling and jumping of picture regardless of channel, location or interference.

**"Standard Coil" Turret Tuner.** Highest gain "front end" tuner available. R.F. Stage and built-in noise rejection circuits. Long distance, fringe area reception. All channel coverage.

**Wide-Band, High Gain I.F. Amplifier** and crystal diode video detector for higher definition and lower noise.

**Exclusive Picture Clarifier Lever.** Finger-tip compensator for individual control of picture clarity and definition.

**Exclusive "Localizer" Control** allows exact adjustment for particular location and antenna. Perfect stability and interlace.

**High Fidelity F. M. Sound.** Over-size Alnico V 6-inch permanent magnet dynamic speaker for clear, distortion-free, static-free sound.

**Engineered Circuits.** Standard, long-life highest quality components. Lower power consumption. Approved safety features. Factory engineered, aligned and tested. Standard R.M.A. Guarantee.

**Latest 1950 Intercarrier Sound.** Picture and sound automatically synchronized. 18-tubes, including 3 dual tubes, 1 triple tube and 3 rectifier tubes. Germanium crystal diode video detector.

**Ready For Your Own Cabinet.** Includes chassis, speaker, 3 lucite knobs, clarifier lever, chassis bolts and washers, knob felts, etc.

**ALL CHANNEL**  
**V-CONE**  
**ANTENNA**



With **\$4.95**  
8-Ft. Mast

**100-FT. 300 Ohm**  
**TV LINE \$1.25**

**MAIL ORDERS**  
**SHIPPED PROMPTLY**  
Send check or money order for 25% deposit (bal. C.O.D.)—or remit full price and save C.O.D. charges. California sales add 3% tax.

**WRITE FOR OUR PARTS BULLETIN**  
We Carry a Complete Stock of Radio and TV Parts

**CALIFORNIA RADIO & ELECTRONICS CO.**

823 N. Highland Ave., Dept. RN, Hollywood 38, California

**New Company!!**  
**NEW STOCK TUBES**

**PRICES?—The Best**

- Inquiries Invited
- Inventories Purchased

**SMITH-BARRY COMPANY**  
162 Greenwich Street, N. Y. 6, N. Y.  
RECTOR 2-2563—2389  
CABLE: SMIBARRY, NEW YORK

**TELEVISION KITS • SETS**  
**FACTORY TO YOU — LOWEST PRICES!**

- **8 1/2" KIT** \$59.50 less tubes
- **10" KIT** \$89.50 with tubes incl. CR tube
- Electromagnetic Kit for 10", 12 1/2", 16"
- Tubes ..... \$84.50 less tubes
- Above Chassis wired up—Ready to operate ..... \$104.50 less tubes
- **10" Kit with Tubes including CR tube**.. \$129.50
- **12 1/2" Kit with Tubes including CR tube**.. 137.50
- **16" Kit with Tubes including CR tube**.. 157.50
- Above Kits wired up ready to operate \$20.00 add.
- **5-DAY FREE TRIAL—MONEY-BACK GUARANTEE**
- Write for free catalogue

**Certified TELEVISION LABORATORIES**  
5507 — 13th AVE. BKLYN. 19, N. Y.



**WHERE TO BUY IT . . .**  
**WHOLESALE RADIO**  
of Baltimore

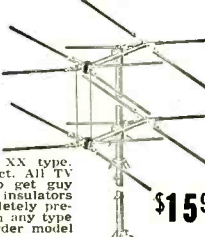
**Sensational Antenna Buy!**  
**SNYDER HI-LO ARRAY**  
Model TV 21



We don't believe you'll find a finer antenna anywhere near this low price. Two folded dipoles (High & Low) with reflectors. Complete with two 3/4 ft. mast sections, guy ring, stand-off insulators. Ready for easy, quick installation. 10 for \$57.50

**\$5.95**

**UNBEATABLE TV RECEPTION**  
**BEST FOR THE FRINGE AREAS**  
**Snyder Lazy XX**  
**TV ANTENNA**  
Complete with three 3 1/2 ft. masts & adj. mounting base



Extremely hi-gain. Superior construction. Designed to withstand all weather conditions. Easily stacked double conical lazy XX type. Just unfold, tighten and erect. All TV channels and FM. You also get guy wire rings, stand-off pole insulators and connecting studs. Completely pre-assembled. Can be used with any type lead-in 72 to 300 ohms. Order model TX-2.

**\$15.95**

**Scoop! New Low Price!**  
**HI-BAND ADAPTER**  
Folded dipole and reflector. Adjustable mounting bracket for complete orientation. Fits existing pole 1 1/2" to 1 3/4" di. Order model HF-3.



**\$1.49**  
\$1.35 ea. in lots of 5 or more.

**T.V. ANTENNA ACCESSORIES**  
Everything for "Perfect-Picture" Installations at low prices!

**STEEL EXTENSION POLES.** Weather Treated.  
10 ft. long, 1 1/4" di. . . . . \$1.95  
5 ft. long, 1 1/4" di. crimped end. . . . . .95  
3 1/2 ft. long, 1 1/4" di. crimped end. . . . . .75

**ANTENNA SWIVEL BASE.** Aluminum. . . . . .39  
Fits 1 1/2" O.D. mast section.

**GUYWIRE.** 6 stranded No. 20 per 50 ft. . . . . .29  
24 reels, 50 ft. ea. interconnected. . . . . 6.00

**72 OHM COAXIAL CABLE RGS9U.** 4c per ft. . . . . 3.75  
Per 100 ft.

**300 OHM TWIN LEAD** (\$1.45 per 100 ft.) 1000 ft. 11.75

**CHIMNEY MOUNT BRACKETS** complete with strap. 1.59

**3/2"-300 OHM STAND OFF INSULATORS.** Wood screw-in type. (3c ea.) per hundred. . . . . 2.75

**WALL BRACKETS.** Adjustable up to 18" from wall. Will hold masts 1 1/2 to 1 3/4" di. . . . . 3.75

**SAMS TV ANTENNA MANUAL.** . . . . . 1.25

**SNAP-ON TWIN LEAD INSULATORS.** Fit 1 1/4" masts. . . . . .06

**Compare These Low Prices!**  
**TELEVISION PARTS**  
FOR ALL 630 T.S. CIRCUITS

**T104—Horizontal (Synch.) Discriminator Transformer.** Interchangeable with RCA type 208F8 **\$1.56**

**T112—Width Control Coil.** Interchangeable with RCA Type 2011R1 **42c**

**T118—Horizontal Deflection Output Transformer.** Interchangeable with RCA Type 211T1 or 211T3 **\$5.40**

**T121—Deflection Yoke.** 8.3 MH vertical 50 MH. Interchangeable with RCA type 201D1 **\$4.50**

**T122—Focus Coil.** 247 Ohms D.C. resistance. Interchangeable with RCA type 202D1 **\$3.60**

**R131—Picture and Sound Control.** 10,000 ohms and 1 megohm dual control, with power switch **\$1.20**

**R168—Vertical and Horizontal Hold Control.** 1 megohm and 50,000 ohms dual control. **\$1.05**

**BRAND NEW RCA FRONT END 12 Channel Tuner.** Complete with three 6J6 tubes and pre-aligned. Type KRK2. **\$29.00** Only

The Above List Shows Just a Few Values! Write for Complete Listing.

WRITE DEPT. QR. 20 TODAY FOR OUR FREE MONTHLY "FYI" BULLETIN  
Phone MUIberry 2134

**WHOLESALE RADIO PARTS CO., Inc.**  
311 W. Baltimore St.  
**BALTIMORE 1, MD.**

sweep. Before attempting to troubleshoot a case of no or improper vertical sweep all vertical adjustments should be tried and, if possible, good tubes substituted in the vertical sweep circuit. Then the vertical oscillator is checked by connecting a .05  $\mu$ f. condenser to the "high" side of the volume control and touching the free end to the output of the vertical oscillator. If this circuit is functioning properly, a rasping hum should be heard, the pitch of which varies as the vertical hold control is adjusted. The vertical saw-tooth wave can be traced through all components up to the deflection yoke and, in the event that the height of the picture is much too small, the approximate amount of gain in the vertical output amplifier can be estimated aurally.

Touch the probe end of the .05  $\mu$ f. condenser first to the grid of the vertical output tube, then to the plate and observe the increase in loudness. If there appears to be no or little difference, this tube is not amplifying properly and a routine voltage and resistance check will quickly locate the guilty component.


To check the operation of the height and vertical linearity control, touch the probe end of the .05  $\mu$ f. condenser to the plate pin of the vertical output tube and adjust these controls. The height control should raise the volume of the hum greatly at one setting and reduce it until it is inaudible while changing the pitch only slightly.

The vertical linearity control will also change the amount of hum coming from the speaker but not as much as the height control. To make sure that the deflection yoke and the connections to it are not shorted or open, touch the probe end of the condenser to each of the three vertical terminals located on the yoke. These terminals can easily be exposed by pulling the cardboard collar off the deflection yoke. A defect of this kind is quite rare and in most cases the tracing of the vertical saw-tooth voltage from the oscillator through the output amplifier will suffice to locate the trouble.

5. Loss of vertical or horizontal sync or both. When the picture appears to move up or down and adjustment of the vertical hold control does not keep it steady for more than a moment as in Fig. 4, the most likely source of trouble is in the vertical sync pulse integrator network. This network, shown in Fig. 3, is used almost universally to remove the horizontal sync pulses and permit only the vertical pulses to pass through in form of a sharp pulse every 1/60th of a second. This network consists of a 22,000 ohm and two 8200 ohm resistors in series, bypassed by a .002 and two .005  $\mu$ f. condensers. These three condensers are the most likely sources of trouble when only the vertical sync pulses appear to be lost.

A quick and sure method of checking the entire vertical sync system is, again, by means of the .05  $\mu$ f. con-

**JOBS in TELEVISION**



TELEVISION TECHNICIANS NEEDED AT ONCE  
QUALIFIED MEN ONLY • GOOD PAY  
STEADY WORK • GOOD FUTURE

**AMERICAN RADIO INSTITUTE**  
CAN TRAIN YOU FOR THIS JOB

New York 2010 B'way (68 St.)  
Buffalo, N. Y. 640 Main St.  
Syracuse, N. Y. 131 Shonnard St.  
Mount Vernon, N. Y. 174 Gramatan Ave.

FREE EMPLOYMENT SERVICE—GI APPROVED

**NEW!**  
**Color on your Television!**

Simply attach TELECOLOR FILTER to front of your set, and enjoy favorite programs in a glorious color tone, instead of dull black and white. "TELECOLOR" Filter is one of the latest discoveries. It has a special formula fluorescent coloring, that gives brilliant pleasing color tone. You will find new happiness in the enjoyable color depth, reduced glare, fog, snow and less eye strain. Everyone is talking about and waiting for 3-color Television costing hundreds of dollars. For a small sum they can enjoy color toning now. TELE-COLOR FILTER is a wonderful gift to friends or relatives who own sets.

10 inch tube . . . . . \$3.00  
12 1/2 inch tube . . . . . 4.00  
16 inch tube . . . . . 6.00

**HARVARD LABORATORY**  
659 Fulton Street, Dept. R-3, Brooklyn 1, New York

**TELEVISION KITS**  
FACTORY TO YOU—LOWEST PRICES!

**10"-12 1/2"-16" KIT \$84.50**  
**COMPLETE (Less Tubes)**

Complete with All Tubes, Incl. C.R. Tube  
10" KIT . . . . . \$129.50  
12 1/2" KIT . . . . . 137.50  
16" KIT . . . . . 157.50

MONEY BACK GUARANTEE

**FEATURING**

- AGC—Automatic Gain Control
- Picture and Sound Automatically Locked
- 12 Channel Tuner
- Electromagnetic Focus and Deflection
- Automatic Stabilized Synchro-Lock Circuit Holds Picture Steady

Money-Back Guarantee—Buy it, inspect it. If you don't think it's the best buy on the market—return unused within 5 days and your money will be refunded.

All prices F.O.B. New York. 20% deposit with order. IMMEDIATE DELIVERY

Any model wired, tested, ready to play, \$20.00 additional.

**SOVEREIGN TELEVISION CO.**  
5508 New Utrecht Ave. Bklyn 19, N. Y.



**PREMAX**

**"OK on 75"**

That's what they say as they register 6 to 8 db. gain over conventional types with this new Base Loaded

**PREMAX**

**Mobile 75 Antenna**

That's equal to more than quadrupling the transmitter power and overcomes most of the "bugs" on 75.

Write for special bulletin and prices



**PREMAX PRODUCTS**

DIVISION CHISHOLM-RYDER CO., INC.  
5006 HIGHLAND AVE., NIAGARA FALLS, N. Y.

**Leotone** FACTORY SPEAKER REPAIRS SINCE 1927

GRILLE CLOTH—12"x14". Hvy. cardboard mtd. for 10" or 12" speaker. Rich Mahogany Tone. .59c  
TV GLARE FILTERS—Increase Contrast—Reduce Eye-strain. Attaches in seconds. 7"—.49c; 10"—.79c; 12"—\$1.29; 12 1/2"—\$1.39; 15"—\$1.98; 16"—\$2.29; 20"—\$2.98.

"DICK TRACY WRIST RADIO." NO BATTERIES! NO TUBES! Uses crystal diode built-in phone. WEAR IT LIKE A WRIST WATCH! Requires aerial & ground. Shpg. wt. 1 lb. ea. \$2.98  
In lots of 12 . . . . . ea. \$2.00

PL-259 (83-15P) PLUGS—Set of 2 on 4' RG-8 cable 49c  
M-359 (83-1AP) ANGLE PLUG ea. 23c; 5 for \$1.00  
ARMY TANK PERISCOPE—Reflector type . . . \$1.49  
TU-17 TUNING UNIT (BC-243 XMTR)—2-3 Mc. Like new . . . . . \$2.49  
4 WAY CONNECTOR SET—PL-179 plug & cable jack. Set . . . . . 49c  
ALNICO MAGNET KIT—Bar, Block, "C", Ring. Kit of 10 parts. Shpg. wt. 2 lbs. (Write for Alnico Magnet Flyer) . . . . . \$1.98

MORE RADIO PARTS FOR LESS!!! LEOTONE'S "JUMBO RADIO PARTS KIT." 17 FULL POUNDS of choice new & dismantled Radio & Electronic components: COILS, TRANSFORMERS, RESISTORS, CONDENSERS, WIRE, HARDWARE, SPEAKER ACCESSORIES, ETC., ETC. All these (shpg. wt. 2 1/2 lbs.) and MUCH, MUCH MORE for only **\$2.95**

PANEL METERS—2 1/2" sq. O-BV. DC. . . . . \$1.29  
0-100 Amps. DC. With shunt . . . . . .98

PE-157 POWER SUPPLY (SCR-511.) Like new, with 173p. tech. manual. Less spkr. & vibrators. Shpg. wt. 20 lbs. . . . . 2.49

RADIO HARDWARE TREASURE. FULL POUND of Nuts, Screws, Washers, Lugs, etc. All in handy SELF-SEALING HINGED LID CAN. Shpg. wt. 2 lbs. . . . . 49c

HIGH FIDELITY CRYSTAL MICROPHONE. Sensitive diaphragm, Imped. (194" O.D., 1/4" deep). Rubber shock-mtd. . . . . 98c  
Less housing . . . . .

ALUMINUM HOUSING for crystal mike. . . . . 15c  
EXPERIMENTAL TUBES for Servicemen. Expert. mentors. Students. Fil. tested. 20 assid. . . . . \$1.00  
revg. types for . . . . .

HEARING AID AMPLIFIER ASSEMBLY (Solenoid, vacuum tube.) Make a REAL VEST RADIO, adding only small phone & simple tuner sect. All components ready-wired. Over-all 1 1/2"x2"x3". WEIGHS ONLY 3 1/2 OZ. in case & tubes. COMPLETE WITH SCHEMATIC FOR BUILDING A 2 OR 3 TUBE SET . . . . . \$2.49

SET OF 2 TUBES FOR HEARING AID AMPLIFIER . . . . . \$2.49  
MIN. ORDER \$2.00. 20% Deposit Req. on all COD's  
Please add sufficient postage—excess refunded.  
Full remittance on foreign orders.

**LEOTONE** RADIO CO.  
87 Dey Street,  
New York 7, N. Y.

denser connected to the volume control. The free or probe end of this condenser is touched to the plate of the sync separator tube, then to the different points along the integrator network shown in Fig. 3. At each successive point the sound should get weaker as more of the vertical sync pulse is being attenuated until only a low, buzzing noise is observed from the "cold" or sync pulse side of the vertical blocking oscillator transformer. If the buzzing sound is lost completely at one point, that is the location of the defective part, most likely a shorted bypass condenser.

When the horizontal sweep circuit appears to be lacking a sync signal the defect cannot always be found by the instrument-less method described here, since the frequency of the horizontal sweep is beyond the audible range of most people and certainly beyond the range of most loudspeakers. If the loss of sync pulse occurs, however, in the circuits where it is together with the vertical pulse, signal tracing by the method outlined for the vertical pulse may locate the trouble.

It should be pointed out here that in certain types of either vertical or horizontal sweeps only a very weak sync pulse is necessary to keep the particular circuit in synchronism. This means that both the vertical and horizontal pulse can be almost lost, yet one of the two circuits will appear perfectly stable. Where both vertical and horizontal synchronism is obviously lacking, i.e., the picture sways sideways and moves up or down, the defect must be in those circuits where both pulses are present. Naturally this means that signal tracing with a .05 µfd. condenser to the volume control will be applicable in this case.

First touch the probe end of the condenser to the plate of the video amplifier from which the sync signals are obtained. This assures their presence at that point at least. Follow the path of the sync pulses through each coupling condenser and resistor. It should be kept in mind that the first tube after the video amplifier is usually a clipper which removes the picture component and often passes sync pulses of much smaller amplitude than those present at the plate of the video amplifier. The sound heard from the plate of the sync clipper may, therefore, be lower than that from the grid. Some receivers employ two sync clipper stages, one of which usually gives some gain too. In order to troubleshoot the sync circuits successfully on an unfamiliar receiver it is necessary to have a schematic diagram so that the observations made by the signal tracing method can be correlated with the proper function of each stage.

**Conclusion**

The suggestions in this article are merely indicative of some of the steps which can be taken right in the cus-

**2 IMPORTANT NEW PHOTOFAC BOOKS**

**"TELEVISION TUBE LOCATION GUIDE"**



Gives Tube position and function in hundreds of important TV receiver models, made by 56 manufacturers.

**FIND THE TROUBLE AND REPLACE TUBES WITHOUT REMOVING CHASSIS**

Nothing like it! The only book that shows the position and function of tubes in hundreds of TV receivers. Often an operational check in the customer's home . . . looking at the picture tube and listening to the sound . . . can give you a clue to the trouble. Many times only a tube failure is responsible. TGL-1 makes trouble diagnosis and tube replacement quick and simple, in most cases without removing the chassis! Each model has its own clear, accurate diagram. Book fully indexed for quick reference. Over 200 pages, handy pocket size, 5 1/2 x 8 1/2". Get two copies . . . one for outside calls and one for your bench. Pays for itself on the first job!

ORDER TGL-1 Only. . . . . \$1.50



**"DIAL CORD STRINGING GUIDE"**

**NEW!**  
SECOND VOLUME  
Covers models from 1947 to October 1949

Over 45,000 servicemen bought the first volume of this invaluable book! New second volume includes 511 different dial cord stringing diagrams used in almost 1000 receivers produced from 1947 to October, 1949 (all new data continuing from where the first volume left off). There's only one right way to string a dial cord . . . and here's the only book that shows you how. Saves time—saves effort. Handy pocket size. Order copies for your tool kit and work bench today.

ORDER DC-2 Only. . . . . \$1.00

**HOWARD W. SAMS & CO., INC.**

Order from your Parts Jobber today, or write direct to HOWARD W. SAMS & CO., INC., 2201 East 46th Street, Indianapolis 5, Ind.

My (check) (money order) for \$ . . . . . enclosed. Send the following books:

- TGL-1 "TV Tube Location Guide" \$1.50
- DC-2 "Dial Cord Stringing Guide" \$1.00

Name . . . . .  
Address . . . . .  
City . . . . . Zone . . . . . State . . . . .



**FREE** Write for Our Monthly Bulletin

**ASB YAGI ANTENNA**

ADJUSTABLE STUB TUNING

5 ELEMENT ROTATABLE ARRAY—450 TO 560 MC. \$7.00  
 SAME EXCEPT DOUBLE STACKED 6 ELEMENT 450 TO 560 MC. \$12.70  
 Same Except Double Stacked 6 Element 370 to 430 MC \$29.40

Suitable for citizens. VHF TV and amateur 420MC bands.

**Build Your Own Geiger Counter**  
 (See Radio & Television News—July, 1949)

1B98 Gamma Counter Tubes..... Only \$9.87

**SURPLUS EQUIPMENT**  
**TROUBLE SHOOTING MANUALS**  
 (includes schematics)

BC-248-J N Q SCR-522 \$1.00 ea.  
 BC-779 BC-610

**COMMAND RECEIVERS**

BC 453—190-550 kc—New—Original Cartons \$12.95  
 BC 455—6-9mc—New—Original Cartons..... 6.95

**SPECIAL!!**  
**FL-8A FILTERS . . . \$1.37**

**HOYT MODEL-515**  
**O-15 AMPERES DC METER**  
**MIRROR SCALE**

Includes test leads and steel carrying case. Meter size 4"x5". Basic movement approx. 12 ma.  
**Special \$3.33 Each**  
**10 FOR \$30.00**

1-82 Selsyn Indicators, 5" diameter—Brand New—Original Cartons..... \$3.95  
 Selsyn Transmitter for above (Used)..... 1.60  
 AN/APN-1 Radio Altimeter, complete with 14 tubes—Excellent used cond..... 7.95  
 10 Henry 400MA Filter Choke, 90Ω DC res. Hermetically sealed; high voltage insulation..... 3.77  
 G.E. 2J1G1 Selsyns, removed from eqpt..... ea. .88  
 Same as above—Brand New, Selsyn..... ea. 1.16  
 Caps for connection to 2J1G1..... .39  
 RCA Sound Power Unit. Use as Mike or Receiver..... pr. 2.22  
 AN/APN-13, Exc. Cond..... 14.95

**TUBE SPECIALS**  
 GUARANTEED BRAND NEW  
 —STANDARD BRANDS ONLY—  
 SELECTED FROM OUR COMPLETE LISTING

1A3..... \$0.45	6Y6G..... \$0.88	5HP4..... \$3.35
1B3GT..... 1.18	7CA..... .19	1P24..... .29
2A3..... .89	7E5..... .29	20E1..... .49
2X2..... .49	10Y..... .19	2C22..... .22
5V4G..... .84	12A6..... .24	2C25..... .27
5Y3GT..... .38	12AT6..... .59	RK-34..... .28
5Y4G..... .46	12AT7..... .99	24G..... .44
5Z3..... .66	12AU6..... .72	211..... .62
6AC7..... .79	12AU7..... .86	304TL..... 1.25
6AG5..... .69	12AX7..... .86	316A..... .66
6AK5..... .69	12BA6..... .94	44A..... .79
6AK6..... .82	12BA7..... .86	807..... 1.15
6AL5..... .69	12BE6..... .64	810..... 7.15
6AQ5..... .72	12SA7GT..... .59	811..... 1.91
6AT6..... .54	12SK7..... .69	813..... 6.95
6AU6..... .72	12SLGT..... .69	815..... 1.72
6BA6..... .66	12SMT..... .79	829..... 4.91
6BE6..... .65	12SQGT..... .59	832..... 3.95
6BG6G..... 1.72	19T8..... 1.04	832A..... 4.91
6BH6..... .72	25Z5..... .65	837..... 1.38
6BJ6..... .72	25Z6GT..... .49	838..... 2.93
6C4..... .21	35L6GT..... .59	866A..... .95
6L5..... .49	35W4..... .45	1613..... .61
6J6..... .89	35Z5GT..... .44	1619..... .19
6K6GT..... .52	50B5..... .69	1624..... .69
6L6GA..... .87	50L6GT..... .57	1625..... .19
6SL7GT..... .69	2AP1..... 3.65	1626..... .29
6SN7GT..... .64	AP1..... 4.63	1629..... .29
6T8..... 1.04	3BP1..... 2.59	9001..... .42
6V6GT..... .59	5BP1..... 2.40	9002..... .39
6W4GT..... .65	5CP1..... 2.87	9003..... .39
6X4..... .59	5CP7..... 3.76	9004..... .39
6X5GT..... .69	5FP7..... .67	9006..... .29

**COAXIAL CONNECTORS**

83-1AP..... \$0.09	UG-21/U..... \$0.67
83-1F..... 1.12	UG-22/U..... .86
83-1H..... .10	UG-23/U..... .63
83-1J..... .80	UG-24/U..... .67
83-1R..... .28	UG-27/U..... .68
83-1RTY..... .45	UG-29/U..... .68
83-1SP..... .28	UG-30/U..... .83
83-1SPN..... .28	UG-30/U..... .94
83-1T..... 1.12	UG-58/U..... .67
83-22AP..... .85	UG-85/U..... .62
83-22F..... .88	UG-86/U..... 1.22
83-22R..... .48	UG-87/U..... .68
83-22SP..... .48	UG-175/U..... .15
UG-12/U..... .63	UG-176/U..... .15

Full Line of Coaxial Connectors in Stock.  
 Prices Sent on Request.

Include Postage with Orders  
**ELECTRONIC RESEARCH LABS.**  
 1021-R Callowhill St. Phila. 23, Pa.

tomers' home to locate certain types of defects without the use of costly instruments. The skilled service technician will be able to adapt this method to many instances other than those given here, and if you know of some, we would like to hear about them. After using this method for a while, the different sounds from various stages and their defects will become familiar and troubleshooting any of the five symptoms listed here becomes a routine just like checking a 5-tube a.c.-d.c. radio. Although we have shown in this article how some television troubles can be found without any instruments, it should be kept in mind that many other defects cannot be located or remedied without the aid of a v.t.v.m., oscilloscope, and suitable signal generators.

Alignment of the sound and picture i.f. and r.f. stages, as well as the sound FM detector, should never be attempted without a good signal generator and v.t.v.m. or a sweep generator and oscilloscope. For good, clear pictures and sound there is no substitute for the somewhat difficult and time-consuming method of alignment as recommended by the manufacturer of the set. For troubleshooting the horizontal sweep and high voltage flyback circuit only the voltmeter and the oscilloscope can help you track down the trouble quickly. The oscilloscope is especially important in the case of non-linearity or poor horizontal synchronism. We want to reiterate that the instrumentless method of troubleshooting as outlined is not proposed as a substitute for using instruments, but as an emergency measure for certain symptoms. It is hoped that this article will stimulate further ideas on using sections of the TV set itself to check other sections, and that it will help to speed up the work of the busy service technician.

**CHECK VOICE COIL**

A QUICK check on the speaker voice coil of a radio, when servicing for inoperation, may be made with the small batteries in the service ohmmeter.

It is only necessary to place the two test leads from the ohmmeter across the speaker voice coil terminals (Fig. 1) and listen for a click at the moment of contact which will be forthcoming if the voice coil is OK . . . . . H.L.

Fig. 1.



**Classified**

Rate 20c per word. Minimum 10 words

**RADIO ENGINEERING**

PANELS for electronic, nucleonic construction projects. Complete service for designers, custom builders. Circular upon request. Gilpin Instrument Works, P. O. Box No. 8, Mt. Clemens, Mich.

RADIO Engineering Broadcasting, Aviation and Police Radio, Servicing, Marine Operating and Electronics taught thoroughly. Expenses low. Write for catalog. Valparaiso Technical Institute, Dept. N., Valparaiso, Ind.

CONVERSION of 10-meter Conset to 75 meters. \$6. Robert Lewis, W8MQU, 3806 LeErda St., Flint, Mich.

**SALE**

6K4 SUBMINIATURE UHF triodes, new, slightly substandard (don't meet Army Rocket Specifications), 6 for \$1.00. 6J6s likewise, 4 for \$1.00. Al Williams, 12015 75th Ave. S., Seattle 88, Wash.

SALE Super-Pros 100-400 KCS. 2.5-20 MCS in 5 bands \$150. .54-20 MCS in 5 bands \$200. Both rack mounted. Perfect condition. W50VX, 814 W. 43rd St., Houston, Tex.

MAGNET Wire, all sizes. Write for prices. Peters Electric Co., Box 1222, Vassar, Mich.

PROSPECTORS! New type Geiger Counter gives amazing sensitivity with low upkeep, unit less battery, \$40. Free information. Marvel Electronics, 1801 S. Trumbull, Chicago, Ill.

21 COIN Radios. J. Horlacher, Rte. 2, Fredonia, N. Y.

TELEVISION Towers, galvanized steel tubing, all welded 10' sections. Weight 16 pounds per section. Built-in thrust bearings and rotor mounts, with a truly Universal rotating hinged base platform. Ramsey Radio & Television, P. O. Box 45, Ramsey, Ill.

BARGAIN 10 lbs., assorted hardware, resistors, condensers, etc., \$2.95 cash. Sands Radio, Box 61, Rego Park Sta., Flushing, N. Y.

TELEVISION, we specialize on antennas for fringe areas, yagis conicals circles. Send for free list. Bevington Service Shop, Bowling Green, Ohio.

ANTI-SLIPSTIK for dial cords and belts. An economical hard crayon that licks the most irritating jobs when applied according to directions. Actually preserves and strengthens old and new cords. Money back guarantee. Send dollar bill and this ad to Walcor, 603 Sherman Ave., Peoria 5, Ill.

WEBSTER Chicago record changer and wire recorder replacement parts. We ship everywhere! Friend's Wholesale Distributors, 106 N. 6th St., Philadelphia 6, Pa.

RECORD Changer Parts for leading makes. We ship everywhere. Friend's Wholesale Distributors, 106 N. 6th St., Philadelphia 6, Pa.

NOTICE: Surplus Radio Equipment, parts and supplies. Write John R. Aab, Radio Division, Spartan Aero Repair, Municipal Airport, Tulsa, Okla.

BARGAINS. New and reconditioned Hallicrafters, National, Collins, Hammarlund, RME, Meissner, other receivers, tuners, television receivers, transmitters, amplifiers, speakers, etc. Lowest wholesale prices. Terms. Shipped on trial. Liberal trade-in allowances. Write. Henry Radio, Butler, Mo., and 11240 W. Olympic, Los Angeles, Calif.

FOR SALE: Hickok 305, \$100.00; Hickok 288X, \$120.00; Hickok 203, \$55.00; Sprague Telohmike \$37.50; Tripolett 2405 V.O.M., \$30.00; Riders 1 to 5 Abridged 6 through 17, \$140.00. All in excellent condition. Paschall's Radio Service, 3012 Crenshaw St., Ft. Worth 5, Tex.

FULL Wave Rectifiers, RA-50, In 115/1/60 Out 12KV, 35ma, DC; MG sets 110V DC to 110V AC, 1KW; also 6V Vibrators. Vetsalco, 74-21st Ave., Paterson, N. J.

BC-348-Q. Perfect condition, converted to A.C. \$75.00. Box 42, Holden, Mass.

CODE Practice Tapes, Radiotelegraph. For school and individual use. Fit standard phototube keyers. \$2.50 each, postpaid. For list write: Ultradyne Electronics, Oswego, Ore.

HOTTEST surplus list in the country. Electronics-Hydraulics, Aircraft-Gadgets. Dick Rose, Everett, Wash.

PARTS for articles described in this magazine. Reasonable. Leo J. Vince, W8FYA, 2805 E. 117th St., Cleveland 20, Ohio.

RADIO Diagrams under seven tubes, 30c; over six tubes, 60c. Record Changers, 60c; Television Diagrams with service data, \$1.00 up. State manufacturer and model number. Kramer's Radio Service, 36 Columbus Ave., New York 23, N. Y.



**LOWEST Prices** Radio Tubes, parts. Bargain lists, 5c. Potter, 1314 McGee, Kansas City 6, Mo. **ENGRAVED** Laminoid lapel pins 25c. Literature free. W2SPV, 4309 Willis, Merchantville, N. J. **SALE.** Standard brands Radio tubes, parts. Send for our free listing. Jos. Kase Electronics, 245 Echo Pl., Bronx 57, N. Y. **URANIUM ORE!** (Carnotite) Geiger Testing, approximate 1 lb., \$5.00. Rozak, Herminie, Pa. **ALL Steel T.V. Towers** which can be erected to 70' or more. Build to climb. Shipped direct from the factory at \$8.50 F.O.B. per 10' section. Weight 20 pounds per section. Write for more details. The Youngstown Steel Towers, 1316 Wilson Avenue, Youngstown 8, Ohio.

**WANTED**

**LABORATORY** quality test equipment for cash. The Overbrook Co., Overbrook 81, Mass.

**ANYTHING** in Cameras, lenses & equipment in exchange for radio & amplifier kits, parts, AM & FM tuners, 3, 4, & 5 tube amplifiers also Zenith portable. J. Kasperski, 1003 Front St., E. Hempstead, N. Y.

**WANTED** Infrared Telescopes, Sniperscopes, Sniperscopes. Send description and price. E. Respass, 430 Blvd., Atlanta, Ga.

**WANT** to buy BC447, APS-6, ARC-5. Interested in substantial quantity for parts requirements new or used condition acceptable. Harry O. Eyrse, P. O. Box 218, Grand Prairie, Tex.

**WANTED** dirt cheap: Portable tape recorder with radio and hour's recording capacity. T. McGrant, Box 36, Louisville, Ky.

**HELP WANTED**

**INSTRUCTORS** in Electronics and Radio. Prefer former Navy Radio Technician instructors willing to locate in the Detroit, Mich., area. Write to Box 452, c/o Radio & Television News, 185 N. Wabash Ave., Chicago, Ill.

**SITUATION WANTED**

**HOLDER** first class phone, radio telegraph second, desires work in Broadcast station, anywhere in United States. Edward F. Doherty, 72 Mosher St., Holyoke, Mass.

**SECOND** Class Phone Licensee wants position. Receiver servicing, Navy operating experience. Herschel Jefferis, Waldron, Kan.

**PATENT ATTORNEYS**

**LANCASTER.** Allwine & Rommel. Registered Patent Attorneys. Patent practice before U.S. Patent office. Validity and Infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Suite 414, 815 15th St., N.W. Washington 5, D.C.

**HERMAN** Lewis Gordon, Registered Patent Attorney. Patent Investigations and Opinions. Warner Building, Washington, D. C.

**CORRESPONDENCE COURSE**

**USED** Correspondence Courses and Educational Books bought, sold, rented, catalog free. Educational Exchange, Summerville, Ga.

**CREI** advanced radio engineering course & introductory course, \$60. A Baron, 3342 Short-Parkway, Brooklyn 29, N. Y.

**RAILWAY** Telegraph Instruction. Be a Telegrapher. Complete training. Instruments furnished. Positions waiting. Details. Bell Telegraph Railway Institute, 10 Parker Ave., San Francisco 18, Calif.

**AMATEUR** radio licenses. Complete code and theory preparation for passing amateur radio examinations. Home study courses. American Radio Institute, 101 West 63rd St., New York 23, N. Y.

**USED** Correspondence Courses and Books, bought, sold, rented, and exchanged. Catalog free. Lee Mountain, Plsgh, Ala.

**MISCELLANEOUS**

**QSL's, SWL's** by W1HJ1 samples! Box 32C, Manchester, N. H.

**EMBOSSED** Business Cards 1,000, \$3.45 postpaid. Spada Enterprises, 10D Lexington, Wetherstield 9, Conn.

**PHONOGRAPH** Records, 15c. Catalogue free. Paramount. VE-313 East Market. Wilkes-Barre, Pa.

**101 RADIO** repairing tips booklet. Send 50 cents. U. S. Radio, 135 E. 28th St., New York 16, N. Y.

**WILL** sell professional recording studio-radio service shop, apartment connected, downtown large western city. Complete 1st class shop, equipment, studio. 10 years excellent reputation. Further information. Box 498, % Radio & Television News, 185 N. Wabash Ave., Chicago 1, Ill.

**RADIOMEN, Servicemen, Beginners.** Make more money, easily, quickly. \$250 weekly possible. We show you how. Information free. Merit Products, 216-32R 132 Ave., Springfield Gardens 13, N. Y.

There's a BIG Future for YOU in **TELEVISION RADIO-ELECTRONICS**

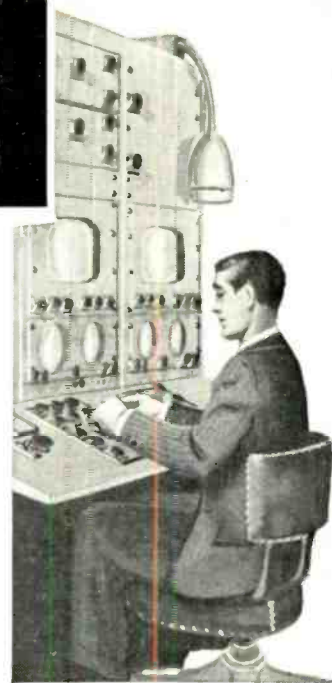
**Builds Your Career in a Minimum of Time**  
**Industry Needs More Trained Men Now**  
**Day and Evening Classes Now Forming**

**G**RADUATES of CREI Residence School are preferred by industry because of their *training* and *ability*. This recognition is the reason that CREI men quickly find good jobs. With 23 years of practical teaching experience in these highly technical fields, CREI offers an outstanding faculty, modern and complete laboratories, shops and equipment.

New students are accepted twice monthly and each may advance as rapidly as he is capable.

CREI is recognized as one of the country's leading technical institutes, offering college-calibre education for the young man who wants a practical career education that leads to a good-paying job in a minimum of time.

Approved for **Veterans' Training**



**Mail Coupon for FREE Catalogue**

**CAPITOL RADIO ENGINEERING INSTITUTE**

Dept. 133 B, 16th & Park Rd., N.W. Washington 10, D. C.

Please send me your illustrated catalog and complete details about the CREI Residence School.

NAME .....  
AGE ..... If in school, what term? .....  
STREET .....  
CITY ..... ZONE ..... STATE .....

- I am entitled to training under G.I. Bill
- Send information on Home Study Courses

**NOW.. quickly, easily**  
**cut SQUARE and**  
**OBLONG openings**  
**in radio chassis**



**WITH THE GREENLEE No. 731 SQUARE RADIO CHASSIS PUNCH**

Now, in 1½ minutes or less you can do hole-cutting jobs that might take an hour with old "drilling and filing" methods. Simply insert GREENLEE Punch and turn with an ordinary wrench... a square or oblong opening is cut immediately. An indispensable, timesaving tool that pays for itself in a hurry.

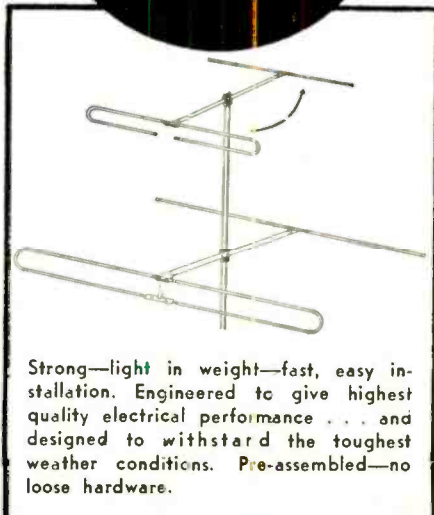


In sizes 3/8", 1/2" and 1"



Write today for facts and prices on this handy Punch. Greenlee Tool Co., 1883 Columbia Ave., Rockford, Ill.

**PHOENIX**  
*Speed - Tennas*  
**DO A BETTER JOB!**



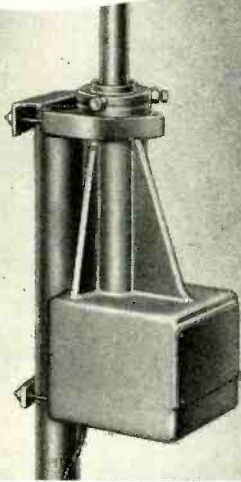
Strong—light in weight—fast, easy installation. Engineered to give highest quality electrical performance... and designed to withstand the toughest weather conditions. Pre-assembled—no loose hardware.

**PHOENIX**  
**ELECTRONICS, INC.**  
Lawrence, Mass.

**AT LEADING JOBBERS**  
Write for folder V of complete line of television accessories.



**CROWN**<sup>®</sup>  
has ALL the Features



Directional Indicator  
Electrical Stops  
Easy Installation  
Life-Time Lubrication  
One-Year Guarantee  
Electrically Safe  
Non-Warp Castings  
Ball Bearing Equipped  
Machine Cut Gears



**CROWN**<sup>®</sup>  
**Antenna Rotator**

Write for details  
**CROWN CONTROLS CO., Inc.**  
New Bremen, Ohio

**FOR BARGAINS IN**

Receivers, Transmitters, Amplifiers, Television Sets,  
Batteries, Instruction, Surplus Parts, Phonograph  
Records, and many more items.

Read  
**RADIO & TELEVISION NEWS**  
Classified Columns Every Month

**Mass. Radio School**

273 Huntington Ave., Boston 15, Mass.  
Offers Training Courses for Radio Techni-  
cian (Pre-Television) and Licensed Radio  
Operator (All Types) including mainte-  
nance and operation of General Electronic  
Equipment. Over 20,000 Alumni and 30  
years' radio-training EXPERIENCE.  
Courses approved for Training for Veterans.

Send for Catalog  
Licensed by Commonwealth of Mass.  
Department of Education

**INDEX**  
*OF Advertisers*

MARCH  
1950

[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
Aaron Electronic Sales	132	Leotron Research Labs.	158
Acorn Electronics Corp.	116	Leotone Radio Co.	157
Ad-Kitz Mfg. Corp.	151	Long Island Radio Co.	154
Adson Radio & Electronics Co.	140		
Alliance Manufacturing Company	6	MacMillan Co., The	124
Allied Radio Corp.	9	Mallory & Co., Inc., P. R.	4th Cover
Almo	152	Mass. Radio School	160
Altec Lansing Corporation	94	Master Mobile Mounts, Inc.	126
Alvaradio Supply Co.	122	Midwest Radio & Television Corp.	120
American Phenolic Corporation	24	Milwaukee School of Engineering	137
American Radio Institute	156	Mosley Electronic Specialties	98
American Television & Radio Co.	152	Murray Hill Books, Inc.	68
Amplifier Corp. of America	88, 134, 151		
Approved Electronic Inst., Corp.	152	McConnell's	126
Arrow Sales, Inc.	89	McGee Radio Company	81, 82, 83
Ashe Radio Co., Walter	97	McGraw-Hill Book Co.	148
Associated Television Company	142		
Audak Company	108	National Company, Inc.	146
Automatic Radio Mfg. Co., Inc.	129	National Radio Institute	3
		National Schools	11
Baltimore Technical Institute	149	Newark Surplus Materials Co.	130
Bell Telephone Laboratories	93	Niagara Radio Supply Corp.	123
Belmont Radio Corporation	13	Nicholas Equipment Company	153
Bergen Radio & Television Co.	154	Norman Radio Dist. Inc.	138
Bliss Electrical School	145		
Royce-Roche Book Co.	101	Offenbach & Reimus Co.	117
Brook Electronics, Inc.	161	Onan & Sons, Inc., D. W.	120
Brooks Radio Dist. Corp.	102	Opad-Green Company	107
Browning Laboratories, Inc.	144	OWI Radio Tube Company	126
Buffalo Radio Supply	119		
Burstein-Applebee Co.	88, 135		
		Peak Electronics Co.	136
C & H Sales Co.	149	Penn Boiler & Burner Mfg. Corp.	108
California Radio & Electronics	155	Phoenix Electronics, Inc.	159
Candler System	134	Photocon Sales	133
Cannon Electric Development Co.	78	Platt Electronics Corp.	131
Capitol Radio Engineering Institute	12, 159	Poly-Tech	106
Centralab, Division of Globe-Union, Inc.	26, 27	Precision Electronics, Inc.	142
		Primax Products	157
Certified Television Laboratories	145, 155	Pratt Radio Tube Company	99
Channel Master Corp.	10	Progressive Electronics Co.	148
Chelsea Television Center, Inc.	111	Pyramid Electric Company	22
Chicago Industrial Instrument Co.	136		
Cleveland Electronics, Inc.	92	Quam-Nichols Co.	134
Cleveland Institute of Radio Electronics	5		
Clippard Instrument Laboratory, Inc.	124	RCA Institutes, Inc.	143
Columbia Electronic Sales	161	R & M Radio Co.	149
Comet Electronic Sales Co.	118	R & T Electronics Co., Inc.	153
Communications Equipment Company	115	Radiart Corporation, The	91
Components Supply Co.	152	Radio Apparatus Corp.	137
Cornell Dublier Electric Corp.	17	Radio Corporation of America	105, 145, 2nd Cover
Covideo	147	Radio Craftsmen Incorporated, The	114
Coyne Electrical, Radio & Television School	80, 90	Radio Ham Shack Inc.	86, 187
Crown-Controls Co., Inc.	160	Radio Parts Company	103
		Radio Supply & Engineering Co., Inc.	104
DeForest's Training Inc.	7	Radiconic Equipment Corporation	128
Dow Trading Co.	145	Rauland Corporation, The	21
Du Mont Laboratories, Inc., Allen B.	3rd Cover	Rose Company, The	148
Editors and Engineers, Limited	84	Sams & Co., Inc., Howard W.	18, 157
Edlie Electronics, Inc.	110	Sangmo Electric Company	15
Electric Auto-Life Company	138	Schott Co., Walter L.	139
Electric Spot, The	112	Senco Radio, Inc.	124
Electro-Technical Industries	112	Simpson Electric Company	23
Electronic Instrument Co., Inc.	85	Smith-Barry Company	155
Electronics Institute, Inc.	88	Sonic Industries Inc.	127
Emmons Radio Supply	96	Sound Tape Sales	147
Erie Resistor Corp.	144	Soundtronics Labs.	140
Espey Manufacturing Company, Inc.	139	Sovereign Television Co.	156
		Sprague Products Company	16
Fair Radio Sales	121	Sprayberry Academy of Radio	19
Federated Purchaser Incorporated	106	Stahl, Inc., Michael	108
Feller Engineering Co.	126	Standard Transformer Corporation	141
Fisher & Son, M.	143	Star Electronic Distributors, Inc.	112
Franklin-Ellis Co.	149	Sun Radio & Electronics Co., Inc.	140
		Sun Radio of Washington, D. C.	144
G. L. Electronics	100	Supreme Publications	133
General Electric Company	20, 67	Sutton's Wholesale Electronics, Bill	92
General Electronic Distributing Co.	95	Sylvania Electric	25
General Test Equipment	153		
Goodheart, R. E.	109	TAB	162
Greenlee Tool Co.	159	Technical Radio Parts Co.	92
Greenwich Sales Co.	135	Telex, Inc.	116
Greylock Electronics Supply Co.	143	Telrex, Inc.	113
		Transvision, Inc.	120
Harvard Laboratory	156	Tri-State College	147
Harvey Radio Company, Inc.	154	Triplet Electrical Instrument Company	29
Heath Company, The	69, 70, 71, 72, 73, 74, 75, 76, 77		
Henry Radio Stores	94	University Loudspeakers Inc.	105
Henshaw Radio Supply	135		
Hickock Electrical Instrument Co., The	98	V & H Radio & Electronics Supply	147
Hollywood Sound Institute	143	Valparaiso Technical Institute	141
Hollywood Technical Institute	153		
Hytron Radio & Electronics Corp.	28	Ward Products Corporation	30
		Waterman Products Co.	150
Indiana Technical College	96	Weiler Manufacturing Company	8
Instructograph Company	151	Wholesale Radio Parts Co., Inc.	156
Instrument Associates	136	Woodland Mfg. Co.	116
		Workshop Associates, Inc., The	142
Jensen Manufacturing Company	14	World Radio Laboratories	151
Lafayette Radio	79	YMCA Trade & Tech. School	135
LaPointe Plascomold Corp.	106		



**Around the Clock**  
(Continued from page 106)

EST	LOCATION	CALL	FF
(NESAT)	Perth (ABC)	VLW3	11.8
		V LX3	9.6
(NF)	Brisbane (ABC)	VLO3	9.6
		VLM	4.9
	Sydney (ABC)	VLI3	9.6
(I)	(Via Pt. Moresby-ABC)	VLT7	9.6
2255 (NS)	Toronto	CFRX	6.0
2258A	Leopoldville (To NA)	OTC2	9.6
2300	London (GOS)	GSI	15.2
		GSD	11.2
		GRY	9.6
		GSC	9.6
		GSB	9.6
		GSL	6.0
		LRV	9.6
	Buenos Aires (SRI-To NA)	CHNX	6.0
	Halifax	CJCK	6.0
	Sydney	CFRX	6.0
	Toronto	CFRX	6.0
	Vancouver	CKFX	6.0
(NS)	Vancouver	CKFX	6.0
	Melbourne (RA-To)	VLE5	21.4
	Forces	VLC9	17.4
	Japan, Asia, No. Pacific)	VLC6	15.2
(SSO)	Manila	VLA6	15.2
		DUH5	11.2
		DUH4	9.6
		DUH2	6.0
	Los Angeles (AFRS-To Pacific)	KCBF	15.2
		KWIX	9.6
		KCBA	6.0
2305A	Taipei (Nationalist China, "Voice of Free China")	BED2	11.2
2315	Delhi (AIR-To Central and Sou. Africa)	VUD11	17.4
		VUD5	15.2
	London (GOS- Dictation Speed)	GSI	15.2
		GSD	11.2
		GRY	9.6
		GSC	9.6
		GSB	9.6
		GSL	6.0
		VED	8.0
2330 (M-F)	Edmonton Lake Success (Un-Via Montreal)	CKLX	15.2
		CHOL	11.2
NFSAT 2345 (F and I)	Manila	DZH3	9.6
	Manila	DZH3	9.6
	Manila	DZH4	6.0

-30-



RUSS PRIEST

**ERRATUM**

In Fig. 3, page 65 of the January issue, grid connections to the 6SN7 dual-diode phase inverter should be interchanged.

**PHOTO CREDITS**

Page	Credit
41	
53, 55, 57	J. L. A. McLat
64	Philco Corp
66	Philco Corp
68	Official AFRS
132	British Broadcasting Corp

**CQ! CQ! COLUMBIA ELECTRONICS! SPECIALS!**

**BC 604 TRANSMITTER**  
20 to 28 mcs. Wide band FM. This unit can be easily changed to 10 and 11 meters NBFM or AM. It has a 2.5 V. 807 in final (1624) and 7-2.5 V. 6L6 (1619). 10 push buttons on front for freq. selection. Complete. Brand new, less dynamotor and xtals. ONLY \$7.95

**TRANSFORMERS 115 V. 60 CY. PRI.**  
5 V. @ 115 amp. \$9.95  
KENYON 400 ma. 3200 V. No center tap. 7.95

ORDER 2 of these Kenyons for 400-0-400 @ 200 ma. 5V. @ 3 amp., 6.3 @ 5 amp. 3.95

**OUTPUT TRANSFORMER—NEW!**  
For LM freq. meter. Z-20,000 to 600 ohm. 95c

**LOW PASS FILTER—NEW!**  
Flat to 3000 cycles 30 db. down at 3100 cycles. Fine for clipping those sidebands \$4.50  
**SPECIAL! MOTOROLA CONTROL HEADS!**  
We just received 200 of 'em. Same kind the cops use. Brand new. Ea. \$2.49

**KW. POWER SUPPLY**  
Here's the unit you've been QRX for. 2900 VDC. After filter consists of 2 Kenyon xfmrs. 1—2.5V. 10 amp. Fil. Xfmr. 2—866A Tubes and 2 sockets, 3-2 mfd. 4000 V. G.E. Cond. Chassis and Bleeder. \$29.50

**SPDT TOGGLE SWITCH.** New, 10 for \$2.50

**RELAYS! NEW!**  
Allied SPST 12 V. Ea. 59c  
DPST 6 V. 10 amp contact. Ea. 79c  
Clare SPDT 3000 ohm. Ea. \$1.25

**METERS! LOOK! METERS!**  
3' De Jure Sq. 0-800 MA. \$3.49  
2' Weston Rd. 0-25 MA DC. \$2.79  
0-25 MA DC. \$2.79  
0-1.5 amp RF. 3.49  
20-0-20 amp DC. 1.75  
2' Westinghouse Rd. 0-300 MA DC. \$2.99  
0-300 MA DC. 2.99  
0-100 MA DC. 2.99  
2' G.E. Rd. 0-15 V. AC-DC. As used in BC 375. \$2.79  
0-8 amp RF. 3.49  
2' Triplet 0-2 amp RF. Rd. \$2.99  
Sq. 0-50 amp AC. 2.99  
2' Hickok Rd. 0-1 movement with a 0-10 scale. Special \$3.29

**S.O.S. BALLOONS!**  
Ride the March winds! New! Ea. \$1.95

**TV. IF STRIP**  
5"x14". Contains sockets and all necessary I.F. xfmrs all mounted with output xfmr. and 4 peaking coils. Plus diagram. NEW! \$7.95

**JACKSON MULTITESTER**  
Model 665J-2. DC. mills 3, 15, 150, 300, 1500 DC ohms 2000, 200,000. AC Volts 3, 15, 30, 150, 300. DC Volts 3, 15, 30, 150, 300. Large 4" sq. Westinghouse IMA. Meter with carrying case. Used but good condition. A hot buy! \$12.50

**2 V. WILLARD WET CELL BATTERIES**  
NO. 20-2, new, boxed. Ea. \$0.87  
Order 2 batts. for only 1.69

**12' COLLAPSIBLE BRASS ANTENNA**  
Shuts to 15". Good used cond. Ea. \$2.75  
**W.E. HANDSET, TYPE TS-7** push-button. New. Ea. \$3.50

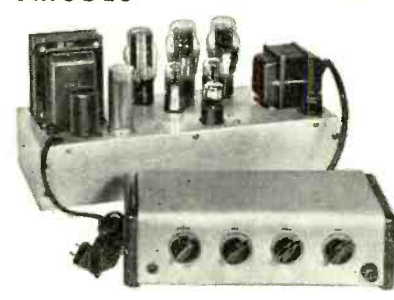
**ARC-5 TRANSMITTERS—COMPLETE.** Used, excellent condition.  
3-4 mcs. Ea. \$9.95  
4-5.3 mcs. less cover. Ea. 2.95  
5-3.7 mcs. less cover. Ea. 2.95

**SEE HERE! SEE OUR SEA GEAR!**  
**RECEIVER & TRANSMITTER COMBINATION:**  
BC-312 Receiver: 8 tubes, covers freq. 1.5 mcs to 18 mcs. 12V operation speaker or headphone output. Good cond.  
BC-223A Transmitter: 4-channel, crystal controlled on marine freq. Has antenna matching network for harmonic suppression and max. power output. A 25-watt job, complete 12V power supply, mike and key, push-to-talk operation. Less crystals. \$99.50  
**BOTH UNITS:**  
ARB RADIO RECEIVER & LOOP: 195 kcs to 9050 kcs in 4 bands. Sharp or broad tuning for extra sensitivity. Has DU-1 loop for automatic direction finding. Covers range of 200-1500 kcs. Loop contains 2-tube, built-in amplifier. \$47.50  
**BOTH FOR:**  
DON'T GET LOST AT SEA! GET THIS ARN-7 RADIO COMPASS: One of the finest automatic direction finders. Covers 4 bands, 100-1750 kcs. Complete with loop, control box, relays, indicators, inverter, flex and loop cables, and plus. Excel. cond. \$67.50  
**COLUMBIA'S HI-POWERED 191 TRANSMITTER:**  
Power output 100 watts. Will really get UR signals thru. Converted to the marine channels. Crystal controlled on 4 diff. freq. Antenna matching unit, 12 or 24 V. dynamotor, mike, everything ready to go. Excel. cond. \$225.00  
MN-26 MDF RADIO COMPASS RECEIVER: Made by Bendix. Freq. range 150 kcs to 1500 kcs. Complete with MN-28 Remote Control, MN-20 Loop, MN-32 Loop Control Box. Good cond. \$59.50  
**NOTE:** Components of any of above units can be purchased separately. Consult us for UP marine radio gear. If YOU need it, COLUMBIA'S got it!

**COLUMBIA ELECTRONIC SALES**  
522 South San Pedro Street  
LOS ANGELES 13, CALIFORNIA

**Add TONE & VOLUME to your TELEVISION**  
with a **BROOK High Quality AUDIO AMPLIFIER**

ALL ATTRACTIVE small remote control console for maximum TRIODES convenience in operation and installation



Model 12A3-10 watts

For you who revel in fine music and abhor distortion—over radio, television, phonograph—the BROOK all-triode high quality AUDIO AMPLIFIER has been developed, after years of intensive engineering research. Now you can have "live" music in your own home... clean... clear... bright music through any good speaker. The use of triodes in all stages—together with Brook designed transformers—means amplification at its level best. For REALISM in critical music reproduction, hear this finest of amplifiers at your Brook Dealer's NOW!

ALL TRIODES



Model 10C3-30 watts

FOR BEST RESULTS — BROOK GIVES

- Extremely High Volume Without Any Loss of Quality
- Brilliant, Clear Tone
- Separate Controls - Stepped for Bass and Treble
- Minimum Distortion
- Reduces Listening Fatigue

Write TODAY for FREE Technical Bulletin and Detailed Distortion Analysis

Sales Agent

**BROOK ELECTRONICS, Inc.**  
Dept. RC-O, 34 De Hart Place, Elizabeth, N.J.



# "TAB"

## THAT'S A BUY

**G-E UJ61 SELSYNS**  
400 cycle! Single 24V or 110 VAC Tested, Used, Guaranteed. 2 for \$1.49

**G-E Liquid Level Transmitter**  
Amazing \$1.00 "TAB" Special!

General Electric T<sub>1</sub> Selsyn for Remote Indication of liquid present in tank. Approx. Gov't Cost \$100. NEW! 2 for 89c

### OIL CONDENSERS

Lowest Prices Ever!

2x5 mfd (10mfd) OILMITE to W.E. spec. \$89.76, 400 mfd. 2 to 65c. C. G. Used. 2 for \$2.00

1 mfd. 1.2 for \$1.05 mfd. 30 for \$1.1

4 mfd. 2 for 1.2x25 mfd. 6 for 1.2

6 mfd. 2 for 1.15 for 1.1

2x1 mfd. 12 for 1.3x1 mfd. 8 for 1.1

3x1 mfd. 10 for 1.3x1 mfd. 8 for 1.1

500 Wvdc 2x2.0 mfd. 4 for \$1.1

0.5 mfd. 10 for \$1.05 mfd. 3 for \$1.1

### SENSATIONAL 2-SPEED PHONO-AMPLIFIER COMBINATION!

In Professional Carrying Case. Powerful Governors Controlled, gear drive GREEN FLYER motor; Weighted turntable for records to 12-inch. Lever controlled 78 (adjustable 45 RPM) and 33 1/3 RPM speeds. 8 inch Spkr. PLUS Exceptional Fidelity Built-In 3-tube 2 to 4 Watt Amplifier. Used Tested Guaranteed. 110 AC or DC. A \$35 Buy! Grab Yours Now for

## \$14.98

ONLY

### SNOOPERSCOPE

Image Converter Tube HiSensitivity simplified design 3" dia. Willemite screen. Resolution up to 350 lines/in. Complete data & Tube. Each \$75.90; 2 for \$14.49; 5 for \$28.75

866A Kit 2 Tubes & Xfrmr. 115V 50C/Hz Output: 2.5vct/10A/10Kvins Plus sects. \$5.95

872A Kit Tube Sects & 12Kvins Xfrmr. \$12.95

# TUBES...

## & GUARANTEED

0A3/VRT5 \$ .98	2C43 464A \$9.39	6A84 \$ .81	6S5F \$ .48	12C8 \$ .35	57 \$ .47	601B \$ .19	1619 \$ .48	K49A \$ .38
0A4G .94	2C44 1.69	6A87/1853 1.08	6S6T .78	12M6 .35	58 .53	HY615 .24	1620 .495	K55B .36
0B1 1.72	2D21 1.30	6AC7 .75	6S70 .97	12J5GT .35	RK65 24.95	WLB19 19.75	1622 1.75	M55B .39
0B3/VR90 .74	2E5 1.89	6AD6Q .81	6S77 .75	12K7 .65	KUG27 2.49	631P1/5N4 3.98	1624 1.62	L623A 3.98
0C3/VRI05 .75	2E22 1.25	6AF60 .77	6S78 .75	12K8 .65	1.10	WL632A 8.98	1626 .35	N80B .39
0Z4 .745	2E24 4.50	6AF60 .77	6S79 .75	12L7GT .55	1.19	702A/7028 2.75	1627 .35	WL121A 2.98
C1A .325	2E25 HY68 4.00	6AG5 .72	6S80 .75	12MGT .55	1.21	703A 3.75	1628 .35	C378 2.61
1A1 .745	2E26 4.45	6AG6 .72	6S81 .75	12N7GT .55	1.22	704A 3.75	1629 .35	N80B 3.98
1A3 .42	2E30 2.35	6AH6 .98	6S82 .75	12P7GT .55	1.23	705A/8021 1.05	1630 .35	44BZDA PILOTS
1A4 .108	2J21 11.45	6AJ5 .73	6S83 .75	12R7GT .55	1.24	707 7.98	1631 .35	MAOXID .50
1A5 .745	2J22 1.75	6AK5 .81	6S84 .75	12S7GT .55	1.25	713A/8011 1.89	1632 .35	49B0X10 .60
1A6 .78	2J22A 9.75	6AK6 .81	6S85 .75	12T7GT .55	1.26	715B 7.29	1633 .35	58R10 .50
1A7GT .66	2J26 8.45	6AL5 .59	6S86 .75	12U7GT .55	1.27	721A 2.65	1634 .35	64 Each .07
1B3 4016	2J31 1.50	6AL7 1.08	6S87 .75	12V7GT .55	1.28	722A/287A 9.95	1635 .35	56T4/3V .18
1B21/7A1A 2.85	2J31 1.50	6AN5 1.08	6S88 .75	12W7GT .55	1.29	723A/B 14.95	1636 .35	10U1A 25
1B22 4.50	2J32 14.85	6AQ5 .52	6S89 .75	12X7GT .55	1.30	724A/B 3.90	1637 .35	311 28V .15
1B23 4.50	2J33 18.95	6AR5 .59	6S90 .75	12Y7GT .55	1.31	726A 6.98	1638 .35	323 3V .10
1B24 4.65	2J34 17.50	6AS5 .59	6S91 .75	12Z7GT .55	1.32	726A/B 6.98	1639 .35	Sylvania
1B26 4.50	2J37 13.85	6AS6 1.89	6S92 .75	12Z8 .55	1.33	726C 29.98	1640 .35	12V120V 15
1B27 4.50	2J38 14.50	6AS7 4.29	6S93 .75	12Z9 .55	1.34	726C/B 6.98	1641 .35	Med. Screw Base
1B29 3.39	2J39 25.00	6AT6 .45	6S94 .75	12Z9 .55	1.35	726C/B 6.98	1642 .35	125V .08
1B32/532A 2.75	2J47 49.95	6AU6 .53	6S95 .75	12Z9 .55	1.36	726C/B 6.98	1643 .35	25W/125V .08
1B33 36.00	2J49 22.50	6AW6 .89	6S96 .75	12Z9 .55	1.37	726C/B 6.98	1644 .35	NEO BULB
1B41 49.95	2J50 39.00	6B4Q .89	6S97 .75	12Z9 .55	1.38	726C/B 6.98	1645 .35	NEZ 000 3.98
1B42 49.95	2J51 39.00	6B4Q .89	6S98 .75	12Z9 .55	1.39	726C/B 6.98	1646 .35	N16/91 .25
1B43 49.95	2J51 39.00	6B8G .87	6S99 .75	12Z9 .55	1.40	726C/B 6.98	1647 .35	NE3 199 .33
1B44 49.95	2J52 39.00	6B8G .87	6S99 .75	12Z9 .55	1.41	726C/B 6.98	1648 .35	NE3 199 .33
1B45 49.95	2J53 39.00	6B8G .87	6S99 .75	12Z9 .55	1.42	726C/B 6.98	1649 .35	NE3 199 .33
1B46 49.95	2J54 39.00	6B8G .87	6S99 .75	12Z9 .55	1.43	726C/B 6.98	1650 .35	NE3 199 .33
1B47 49.95	2J55 39.00	6B8G .87	6S99 .75	12Z9 .55	1.44	726C/B 6.98	1651 .35	NE3 199 .33
1B48 49.95	2J56 39.00	6B8G .87	6S99 .75	12Z9 .55	1.45	726C/B 6.98	1652 .35	NE3 199 .33
1B49 49.95	2J57 39.00	6B8G .87	6S99 .75	12Z9 .55	1.46	726C/B 6.98	1653 .35	NE3 199 .33
1B50 49.95	2J58 39.00	6B8G .87	6S99 .75	12Z9 .55	1.47	726C/B 6.98	1654 .35	NE3 199 .33
1B51 49.95	2J59 39.00	6B8G .87	6S99 .75	12Z9 .55	1.48	726C/B 6.98	1655 .35	NE3 199 .33
1B52 49.95	2J60 39.00	6B8G .87	6S99 .75	12Z9 .55	1.49	726C/B 6.98	1656 .35	NE3 199 .33
1B53 49.95	2J61 39.00	6B8G .87	6S99 .75	12Z9 .55	1.50	726C/B 6.98	1657 .35	NE3 199 .33
1B54 49.95	2J62 39.00	6B8G .87	6S99 .75	12Z9 .55	1.51	726C/B 6.98	1658 .35	NE3 199 .33
1B55 49.95	2J63 39.00	6B8G .87	6S99 .75	12Z9 .55	1.52	726C/B 6.98	1659 .35	NE3 199 .33
1B56 49.95	2J64 39.00	6B8G .87	6S99 .75	12Z9 .55	1.53	726C/B 6.98	1660 .35	NE3 199 .33
1B57 49.95	2J65 39.00	6B8G .87	6S99 .75	12Z9 .55	1.54	726C/B 6.98	1661 .35	NE3 199 .33
1B58 49.95	2J66 39.00	6B8G .87	6S99 .75	12Z9 .55	1.55	726C/B 6.98	1662 .35	NE3 199 .33
1B59 49.95	2J67 39.00	6B8G .87	6S99 .75	12Z9 .55	1.56	726C/B 6.98	1663 .35	NE3 199 .33
1B60 49.95	2J68 39.00	6B8G .87	6S99 .75	12Z9 .55	1.57	726C/B 6.98	1664 .35	NE3 199 .33
1B61 49.95	2J69 39.00	6B8G .87	6S99 .75	12Z9 .55	1.58	726C/B 6.98	1665 .35	NE3 199 .33
1B62 49.95	2J70 39.00	6B8G .87	6S99 .75	12Z9 .55	1.59	726C/B 6.98	1666 .35	NE3 199 .33
1B63 49.95	2J71 39.00	6B8G .87	6S99 .75	12Z9 .55	1.60	726C/B 6.98	1667 .35	NE3 199 .33
1B64 49.95	2J72 39.00	6B8G .87	6S99 .75	12Z9 .55	1.61	726C/B 6.98	1668 .35	NE3 199 .33
1B65 49.95	2J73 39.00	6B8G .87	6S99 .75	12Z9 .55	1.62	726C/B 6.98	1669 .35	NE3 199 .33
1B66 49.95	2J74 39.00	6B8G .87	6S99 .75	12Z9 .55	1.63	726C/B 6.98	1670 .35	NE3 199 .33
1B67 49.95	2J75 39.00	6B8G .87	6S99 .75	12Z9 .55	1.64	726C/B 6.98	1671 .35	NE3 199 .33
1B68 49.95	2J76 39.00	6B8G .87	6S99 .75	12Z9 .55	1.65	726C/B 6.98	1672 .35	NE3 199 .33
1B69 49.95	2J77 39.00	6B8G .87	6S99 .75	12Z9 .55	1.66	726C/B 6.98	1673 .35	NE3 199 .33
1B70 49.95	2J78 39.00	6B8G .87	6S99 .75	12Z9 .55	1.67	726C/B 6.98	1674 .35	NE3 199 .33
1B71 49.95	2J79 39.00	6B8G .87	6S99 .75	12Z9 .55	1.68	726C/B 6.98	1675 .35	NE3 199 .33
1B72 49.95	2J80 39.00	6B8G .87	6S99 .75	12Z9 .55	1.69	726C/B 6.98	1676 .35	NE3 199 .33
1B73 49.95	2J81 39.00	6B8G .87	6S99 .75	12Z9 .55	1.70	726C/B 6.98	1677 .35	NE3 199 .33
1B74 49.95	2J82 39.00	6B8G .87	6S99 .75	12Z9 .55	1.71	726C/B 6.98	1678 .35	NE3 199 .33
1B75 49.95	2J83 39.00	6B8G .87	6S99 .75	12Z9 .55	1.72	726C/B 6.98	1679 .35	NE3 199 .33
1B76 49.95	2J84 39.00	6B8G .87	6S99 .75	12Z9 .55	1.73	726C/B 6.98	1680 .35	NE3 199 .33
1B77 49.95	2J85 39.00	6B8G .87	6S99 .75	12Z9 .55	1.74	726C/B 6.98	1681 .35	NE3 199 .33
1B78 49.95	2J86 39.00	6B8G .87	6S99 .75	12Z9 .55	1.75	726C/B 6.98	1682 .35	NE3 199 .33
1B79 49.95	2J87 39.00	6B8G .87	6S99 .75	12Z9 .55	1.76	726C/B 6.98	1683 .35	NE3 199 .33
1B80 49.95	2J88 39.00	6B8G .87	6S99 .75	12Z9 .55	1.77	726C/B 6.98	1684 .35	NE3 199 .33
1B81 49.95	2J89 39.00	6B8G .87	6S99 .75	12Z9 .55	1.78	726C/B 6.98	1685 .35	NE3 199 .33
1B82 49.95	2J90 39.00	6B8G .87	6S99 .75	12Z9 .55	1.79	726C/B 6.98	1686 .35	NE3 199 .33
1B83 49.95	2J91 39.00	6B8G .87	6S99 .75	12Z9 .55	1.80	726C/B 6.98	1687 .35	NE3 199 .33
1B84 49.95	2J92 39.00	6B8G .87	6S99 .75	12Z9 .55	1.81	726C/B 6.98	1688 .35	NE3 199 .33
1B85 49.95	2J93 39.00	6B8G .87	6S99 .75	12Z9 .55	1.82	726C/B 6.98	1689 .35	NE3 199 .33
1B86 49.95	2J94 39.00	6B8G .87	6S99 .75	12Z9 .55	1.83	726C/B 6.98	1690 .35	NE3 199 .33
1B87 49.95	2J95 39.00	6B8G .87	6S99 .75	12Z9 .55	1.84	726C/B 6.98	1691 .35	NE3 199 .33
1B88 49.95	2J96 39.00	6B8G .87	6S99 .75	12Z9 .55	1.85	726C/B 6.98	1692 .35	NE3 199 .33
1B89 49.95	2J97 39.00	6B8G .87	6S99 .75	12Z9 .55	1.86	726C/B 6.98	1693 .35	NE3 199 .33
1B90 49.95	2J98 39.00	6B8G .87	6S99 .75	12Z9 .55	1.87	726C/B 6.98	1694 .35	NE3 199 .33
1B91 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.88	726C/B 6.98	1695 .35	NE3 199 .33
1B92 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.89	726C/B 6.98	1696 .35	NE3 199 .33
1B93 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.90	726C/B 6.98	1697 .35	NE3 199 .33
1B94 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.91	726C/B 6.98	1698 .35	NE3 199 .33
1B95 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.92	726C/B 6.98	1699 .35	NE3 199 .33
1B96 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.93	726C/B 6.98	1700 .35	NE3 199 .33
1B97 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.94	726C/B 6.98	1701 .35	NE3 199 .33
1B98 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.95	726C/B 6.98	1702 .35	NE3 199 .33
1B99 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.96	726C/B 6.98	1703 .35	NE3 199 .33
1B99 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.97	726C/B 6.98	1704 .35	NE3 199 .33
1B99 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.98	726C/B 6.98	1705 .35	NE3 199 .33
1B99 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	1.99	726C/B 6.98	1706 .35	NE3 199 .33
1B99 49.95	2J99 39.00	6B8G .87	6S99 .75	12Z9 .55	2.00	726C/B 6.98	1707 .35	NE3 199 .33

12C8 \$ .35
-------------