

THE STRUGGLE THAT WILL STRANGLE RADIO

**Radio-TV**

**WHITE'S RADIO LOG**

AM-FM STATIONS/WORLD-WIDE SHORTWAVE LISTINGS

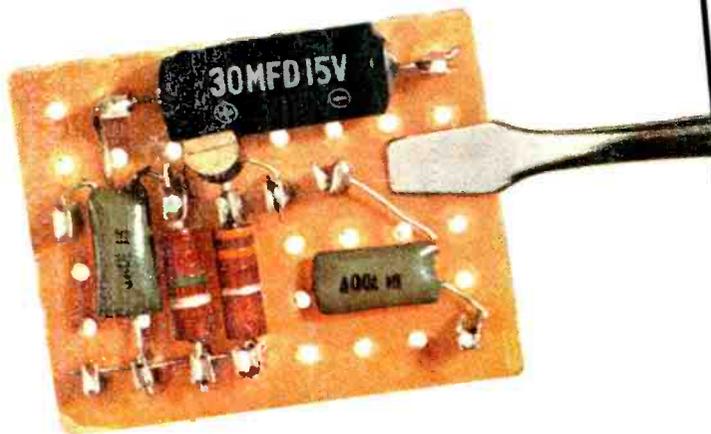


# EXPERIMENTER

OCTOBER-NOVEMBER 75c

SEP 6 1968

**A blast! The most! The end!**  
**Our CB BAND BUSTER**  
**puts out talk power like groovy!**



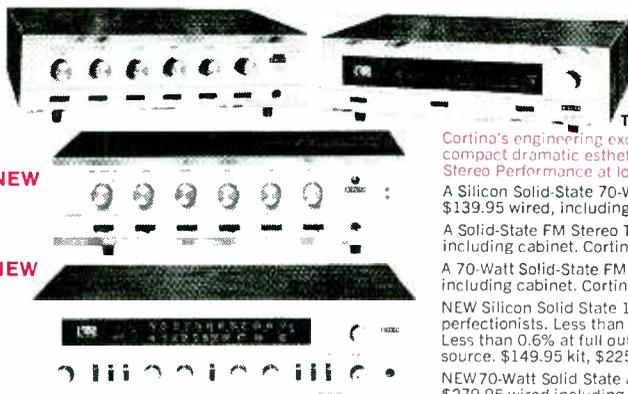
**Voice-boosting, impedance-matching gizmo slips cosily inside your living mike!**

- Build a 3-buck battery renovator
- Visit an honest-to-goodness ham mini-expo
- See a \$10-million bubble bath
- Discover our magnetic audio generator



# EICO Makes It Possible

Uncompromising engineering—for value does it!  
You save up to 50% with Eico Kits and Wired Equipment.



## Cortina Stereo

**THE VERDICT IS IN.** High fidelity authorities agree: Cortina's engineering excellence, 100% capability, and compact dramatic esthetics all add up to Total Stereo Performance at lowest cost.

A Silicon Solid-State 70-Watt Stereo Amplifier for \$99.95 kit, \$139.95 wired, including cabinet. Cortina 3070

A Solid-State FM Stereo Tuner for \$99.95 kit, \$139.95 wired, including cabinet. Cortina 3200.

A 70-Watt Solid-State FM Stereo Receiver for \$169.95 kit, \$259.95 wired, including cabinet. Cortina 3570.

NEW Silicon Solid State 150-Watt Stereo Amplifier designed for audio perfectionists. Less than 0.1% harmonic distortion, 1M distortion. Less than 0.6% at full output. Controls and inputs for every music source. \$149.95 kit, \$225.00 wired including cabinet. Cortina 3150.

NEW 70-Watt Solid State AM/FM Stereo Receiver for \$189.95 kit, \$279.95 wired including cabinet. Cortina 3770.

NEW

NEW

## Eicocraft The newest excitement in kits.

100% solid-state and professional. Fun to build and use. Expandable, interconnectable. Great as "jiffy" projects and as introductions to electronics. No technical experience needed. Finest parts, pre-drilled etched printed circuit boards, step-by-step instructions.

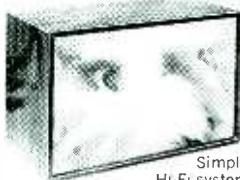
EC-100 Electronic Siren \$4.95, EC-101 Electronic Burglar Alarm \$6.95, EC-102 Electronic Fire Alarm \$6.95, EC-200 Electronic Intercom \$5.95, EC-300 Audio Power Amplifier \$5.95, EC-400 Electronic Metronome \$3.95, EC-500 Tremolo \$9.95, EC-600 Electronic Light Flasher \$3.95, EC-700 Electronic "Mystifier" \$4.95, EC-800 Photo Cell Nite Lite \$4.95, EC-900 Power Supply \$8.95, EC-1000 Code Oscillator \$2.50, EC-1100 FM Wireless Mike \$9.95, EC-1200 AM Wireless Mike \$9.95, EC-1300 Electronic VOX \$8.95, EC-1400 Solid State FM Radio \$9.95, EC-1500 Solid State AM Radio \$8.95, EC-1600 Electronic Bongos \$7.95



### 6 EXCITING NEW PROJECTS

EC-1700 Ham/CB Vox \$8.95,  
EC-1800 Electronic "TOX" \$8.95,  
EC-1900 "Treasure Finder" \$9.95,  
EC-2000 Electronic Organ \$9.95,  
EC-2100 Electronic "Eye" \$9.95,  
EC-2200 Electronic Touch Switch \$8.95

## Color n' Sound



Add a new dimension to your music system. Introducing the first inexpensive solid-state electronic system which provides true synchronization of color with sound. Watch the music you love spring to life as a vibrant, ever shifting interplay of colors.

Simply connect to speaker leads of your HI-FI system (or radio). Kit can be assembled in several hours — no technical knowledge or experience necessary. Kit \$49.95, Wired \$79.95.

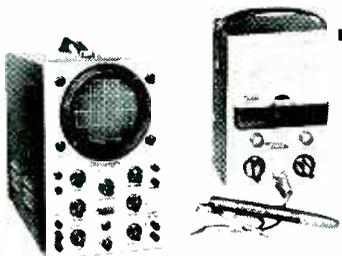
## Automotive

**EICO 888—Car/Boat Engine Analyzer.** For all 6V/12V systems; 4, 6, 8-cyl. engines.



Now you can keep your car or boat engine in tip-top shape with this solid-state, portable, self-powered universal engine analyzer. Completely tests your total ignition/electrical system.

Complete with a Tune-up & Trouble-shooting Manual. Model 888; \$49.95 kit, \$69.95 wired.



## Test Equipment **EICO**

100 best buys to choose from.

"The Professionals"

—laboratory precision at lowest cost.

Model 460 Wideband Direct-Coupled 5" Oscilloscope. DC-4.5mc for color and B&W TV service and lab use. Push-pull DC vertical amp., bal. or unbal. input. Automatic sync limiter and amp. \$99.95 kit, \$149.95 wired.

Model 232 Peak-to-Peak VTVM. A must for color or B&W TV and industrial use. 7 non-skip ranges on all 4 functions. With exclusive Uni-Probe. \$34.95 kit, \$49.95 wired.

### FREE 1969 CATALOG

RTVE-10

EICO Electronic Instrument Co., Inc.  
283 Malta Street, Brooklyn, N.Y. 11207

Send me FREE catalog describing the full EICO line of 200 best buys, and name of nearest dealer.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

Cast your ballot for a successful future!

# 266 ICS COURSES



You get the widest choice from ICS—oldest, largest home study school. Check the list. (Also available, programs tailored to your special needs.) You receive individual instruction, plus success-proved facts

and theory you can apply immediately. Mastery of subject is assured. No skimping. You earn your diploma. Why mark time when you can mark the coupon and get a fast, sure fix on your best course to success.



**ACCOUNTING**  
Accounting (U.S.A.)  
Accounting (Canadian)  
Accounting for Business Programmers  
Accounting for Management Decisions  
Auditing  
Business Law (U.S.A.)  
Cost Accounting  
CPA Review (U.S.A.)  
General Accounting  
Income Tax (U.S.A.)  
Industrial Accounting  
Junior Accounting  
Office Accounting  
Practical Accounting  
Public Accounting  
Small Business Accounting (U.S.A.)  
Starting and Managing a Small Bookkeeping Service (U.S.A.)

**ARCHITECTURE AND BUILDING**  
Architectural Drawing and Designing  
Architecture  
Building Contractor  
Building Estimator  
Building Inspector  
Building Maintenance  
Carpenter-BUILDER  
Carpentry and Millwork  
Fundamentals of Urban Planning  
House Planning and Interior Design  
Mason  
Painting Contractor  
Reading Arch. Blueprints  
Review in Architectural Design and Practice  
Review of Mechanical Systems in Buildings

**ART**  
Amateur Artist  
Commercial Art  
Commercial Cartooning  
Illustrating with Options:—Magazine  
—Advertising Layout and Illustration  
Interior Decorating  
Oil Painting for Pleasure  
Show Card and Sign Production  
Show Card Writing  
Sign Painting and Design's Sketching and Painting

**AUTOMOTIVE**  
Automatic Transmission Specialist  
Automobile Body  
Rebuilding & Refinishing  
Automobile Elec. Tech'n  
Automobile Engine Tune-Up  
Automobile Mechanic  
Automobile Technician  
Diesel-Gas Motor Vehicle Engines  
**BUSINESS**  
Advertising  
Business Administration  
Business Practice (Cond.)  
Canadian Business Course  
Condensed Marketing  
Direct Mail and Mail Order Advertising  
Industrial Psychology  
Inventory Control  
Mag. & News'pr Adv.  
Managing a Retail Business  
Managing a Small Store  
Marketing Management  
Marketing Research  
Modern Executive Mgmt.  
Office Automation  
Office Management  
Production Management  
Purchasing Agent  
Retail & Local Advertising  
Retail Bus. Management  
Retail Merchandising  
Retail Selling  
Systems and Procedures Analysis

**BUSINESS: SALES**  
Creative Salesmanship  
Real Estate Salesmanship  
Salesmanship  
Sales Management  
**BUSINESS: SUPERVISION**  
Basic Supervision  
Industrial Foremanship  
Industrial Supervision Management,  
Salesmanship and Sales Modern Woman as a Supervisor  
Personality Development  
Personnel-Labor Relations (U.S.A.)  
Supervision  
**CHEMICAL**  
Chemical Engineering  
Analytical Chemistry  
Chemical Engineering Unit Operations

Chemical Laboratory Tech'n  
Chemical Process Operator  
Elements of Nuclear Energy  
General Chemistry  
Instrumental Laboratory Analysis  
**CIVIL ENGINEERING**  
Civil Engineering  
Construction Eng'g Tech.  
Highway Engineering Tech.  
Principles of Surveying  
Reading Highway Bl'pts  
Reading Structural Bl'pts  
Sanitary Engineering Tech.  
Sewage Plant Operator  
Structural Eng'g Tech.  
Surveying and Mapping  
Water Works Operator  
**COLLEGE COURSES**  
American History  
Calculus Economics

**COMPUTERS**  
COBOL Programming  
Fortran Programming for Engineers  
Programming for Digital Computers  
Programming the IBM 1401 Computer  
Programming the IBM System/360 Computer, Introduction

**DRAFTING**  
Aircraft Drafting  
Architectural Drafting  
Design Drafting  
Drafting Technology  
Electrical Drafting  
Electronic Drafting  
Introductory Mech. Drafting  
Mechanical Drafting  
Pressure-Vessel and Tank  
Print Reading  
Sheet Metal Layout for Air Conditioning  
Structural Drafting

**ELECTRICAL**  
Electrical Engineering—Electronics Option  
—Power Option  
Electrical Appliance Serv'g  
Electrical Appliance Serv'g with Equipment Training  
Electrical Contractor  
Electrical Eng'g Tech.  
Electrical Home Maint.

Electrical Home Maint. with Equipment Training  
Electrical Instrument Tech.  
Electric Motor Repairman  
Industrial Electrical Tech.  
Power-Line Design & Const.  
Power Plant Operator  
—Hydro Option  
—Steam Option  
Practical Electrician  
Practical Electrician with Equipment Training  
Practical Lineman  
Reading Electrical Bl'pts  
**ENGINEERING (Refresher Courses for Graduate Engineers)**  
Chemical Civil Electrical  
Industrial Mechanical  
Sanitary Structural

**ENGLISH AND BETTER WRITING**  
Better Business Writing  
English for Spanish (U.S.A.)  
Free Lance Writing for Fun and Profit  
Introductory Tech. Writing  
Modern Letter Writing  
Practical English  
Short Story Writing  
**HIGH SCHOOL**  
High School Business  
High School (Canadian)  
High School General  
High School Mathematics  
High School Secretarial  
High School Vocational  
High School College Preparatory—Arts  
High School College Prep.—Eng'g and Science  
Preparatory Course for High School Equiv. Test

**MACHINE SHOP PRACTICE**  
Drill Operator  
Foundry Practice  
Industrial Metallurgy  
Lathe Operator  
Machine Shop Inspection  
Machine Shop Practice  
Metallurgical Eng'g Tech.  
Milling Machine Operator  
Multicraft Maint. Mech.  
Practical Millwright  
Reading Shop Prints  
Rigging  
Tool Engineering Tech.  
Tool Grinder Tool Making

Turret Lathe Operator  
Welding Engineering Tech.  
Welding Process  
**MATHEMATICS**  
Advanced Mathematics  
Math and Mechanics for Engineering Technicians  
Math and Physics for Engineering Technicians

**MECHANICAL**  
Mechanical Engineering  
Aircraft and Power Plant Mechanic  
Hydraulic & Pneu. Power  
Industrial Engineering  
Industrial Eng'g Tech.  
Industrial Instrumentation  
Machine Design  
Quality Control  
Safety Engineering Tech.  
Tool Design  
Vibration Analysis and Control

**PETROLEUM**  
Natural Gas Production and Transmission  
Oil Field Technology  
Petroleum Production  
Petroleum Production Engineering Technology  
Petroleum Refinery Oper.  
Pipeline Engineering Tech.

**PLASTICS**  
Design of Plastic Products  
Plastics Technician

**PLUMBING, HEATING AND AIR CONDITIONING**  
Air Conditioning  
Air Conditioning Maint.  
Domestic Heating with Gas and Oil  
Domestic Refrigeration  
Heating & Air Conditioning with Drawing  
Industrial Air Conditioning  
Industrial Heating  
Pipe Fitting Plumbing  
Plumbing and Heating  
Plumbing & Heating Est.  
Practical Plumbing  
Refrigeration  
Refrigeration and Air Conditioning

**PULP AND PAPER**  
Paper Machine Operator  
Paper Making Pulp Mak'g  
Pulp & Paper Eng'g Tech.

**SECRETARIAL**  
Clerk-Typist Commercial  
Secretary, Engineering  
Secretary, Legal  
Secretary, Medical  
Secretary, Professional  
Shorthand Stenographic  
Typewriting

**STEAM AND DIESEL POWER**  
Boiler Inspector  
Industrial Building Eng'r  
Power Plant Engineering  
Stationary Diesel Engines  
Stationary Fireman  
Stationary Steam Eng'g

**TEXTILES**  
Carding  
Curling and Spinning  
Dyeing and Finishing  
Loom Fixing Spinning  
Textile Designing  
Textile Mill Supervision  
Textile Technology  
Warping and Weaving

**TRAFFIC**  
Motor Traffic Management  
Railway Rate Clerk  
Traffic Management

**TV-RADIO-ELECTRONICS**  
Color Television Principles and Servicing  
Electronics Instrumentation and Servo Fundamentals  
Electronics Technician  
First Class Radio-Telephone License  
Fundamentals of Electronic Computers  
General Electronics  
General Electronics with Equipment Training  
Hi-Fi Stereo and Sound System Servicing  
Industrial Electronics Tech.  
Numerical Control Electronics and Maint.  
Practical Telephony  
Principles of Semiconductor Radio & TV Servicing  
Radio & TV Servicing with Equipment Training  
Second Class Radio-Telephone License  
Sound Systems Specialist  
TV Servicing and Repair  
Telephony, Electronics, & Radio Communications

Clip coupon here . . . take your first step to real success! ICS, Scranton, Penna. 18515



Approved for veterans under the G.I. Bill.  
Accredited member, National Home Study Council.  
Convenient payment plan.  
Special Canadian courses in French and English.  
Special rates to members of the U.S. Armed Forces.

INTERNATIONAL CORRESPONDENCE SCHOOLS Dept. N4334H, Scranton, Penna. 18515

(In Hawaii: P.O. Box 418, Honolulu. Canadian residents mail to Scranton address—further service handled by ICS Canadian Ltd.)

I'm interested in a program of independent study. Send me your free 3-booklet Success Kit:  
(1) "How to Succeed," 30 pages of valuable job tips,  
(2) Sample self-instruction text, (3) Catalog for subject indicated.

(Print name of course. See list.)  
Miss \_\_\_\_\_ Age \_\_\_\_\_  
Mrs. \_\_\_\_\_  
Mr. \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_  
Occupation \_\_\_\_\_ Employed by \_\_\_\_\_ Working Hours \_\_\_\_\_ A.M. to \_\_\_\_\_ P.M.

RADIO-TV EXPERIMENTER is published bimonthly at \$4.00 per year, by Science & Mechanics Publishing Co., 229 Park Avenue South, New York, N.Y. 10003. Second class postage paid at New York, N.Y. and at additional mailing office. Copyright 1968 by Science and Mechanics Publishing Co.



# Radio-TV EXPERIMENTER

October/November 1968

	<b>CB CONSTRUCTION SPECIAL</b>
39	CB Band Buster— <i>break the sound barrier with talk power aplenty</i>
	<b>EXTRA SWL &amp; DX FEATURES</b>
54	Ham EXPO— <i>proves that DXing &amp; show biz do go together!</i>
57	DXing the Himalayas— <i>operation tightrope climbs Everest</i>
65	The Struggle that will Strangle Radio— <i>the case of our vanishing spectrum</i>
76	DX Philatelia— <i>DX in pix!</i>
	<b>SCIENCE SPECIALS</b>
43	\$10 Million Bubble Bath— <i>how to catch nuclei, hot or cold</i>
49	Do you Need a Lab Scope?— <i>inside dope on big-time CRTs</i>
85	Like 600,000 Dry Cells in Series
	<b>CONSTRUCTION PROJECTS</b>
47	3-Buck Battery Booster— <i>belts out mils like crazy</i>
71	Swinging Screamer— <i>for howling magnetic audio</i>
83	Rovin' Recorder— <i>takes your blues away</i>
	<b>ELECTRONICS FEATURES</b>
38	An Introduction to Resistance— <i>cartoon page</i>
42	Crystal Is as Crystal Does— <i>something for the gals!</i>
79	Edison gets the Air
80	Imagineering— <i>design tips from our readers</i>
81	VTR spells Happiness— <i>love at first sight</i>
86	This Round Table Is Three Miles Long!
	<b>AS OUR LAB SEES IT</b>
69	Data Instruments 555 Oscilloscope
89	Radio Shack 10-in-1 Electronic Projects Kit
	<b>COMMUNICATIONS: CB • HAM • SWL</b>
26	CB Rigs & Rigmarole— <i>wot's new</i>
64	Propagation Forecast
91	Ham Traffic— <i>the ham who wasn't</i>
	<b>REGULAR DEPARTMENTS</b>
8	Positive Feedback— <i>editorial chit-chat</i>
14	New Products
20	Ask Me Another— <i>lotsa goodies</i>
29	Bookmark— <i>by Bookworm</i>
32	Literature Library

White's Radio Log, Vol. 50, No. 2—Page 93

Cover  
photo by  
Leonard  
Heicklen



RADIO-TV EXPERIMENTER

# F.C.C. COMMERCIAL OPERATOR LICENSE

## Training

is part of the Grantham

## A. S. E. E.

### DEGREE CURRICULUM

In today's world of electronics employment, an FCC license is important — sometimes essential — but it's not enough! Without further education, you can't make it to the top. Get your FCC license without fail, but don't stop there. To prepare for the best jobs, continue your electronics education and get your Associate Degree in Electronics.

This is good common sense for those who want to make more money in electronics. It also makes sense to prepare for your FCC license with the School that gives degree credit for your license training — and with the School that can then take you from the FCC license level to the Degree level.

The first two semesters of the Grantham degree curriculum prepare you for the first class FCC license and radar endorsement. These two semesters, in addition to other parts of the Grantham

This booklet  
**FREE!**



This free booklet explains what an FCC license and ASEE degree can do for your future.

degree curriculum, are available by correspondence\* at very reasonable tuition. *The ASEE Degree can be earned by correspondence with a minimum of one semester in residence.*

#### Accreditation, and G.I. Bill Approval

Grantham School of Electronics is *accredited* by the Accrediting Commission of the National Home Study Council, and is *approved* for both correspondence and resident training under the G.I. Bill. Mail the coupon, or simply write or telephone for your free copy of our Associate Degree Bulletin which gives complete details of our educational program.



## GRANTHAM School of Electronics



\*Semesters 1, 2, and 3 of the Grantham electronics curriculum are available *also in resident classes* at our Washington, D.C. school — at the address shown below.

• Established in 1951 •

### Grantham School of Electronics

1505 N. Western Ave. or 818 18th Street, N.W.  
Hollywood, Calif. 90027 or Washington, D.C. 20006

Telephone:  
(213) 469-7878

Telephone:  
(202) 298-7460

**Grantham School of Electronics RTV-10-68**  
1505 N. Western Ave., Hollywood, Calif. 90027

Please mail me your free catalog, which explains how Grantham training can prepare me for my FCC License and Associate Degree in electronics. I understand no salesman will call.

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

Address \_\_\_\_\_

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

# Olson



**\*FREE**

Fill in coupon for a **FREE** One Year Subscription to **OLSON ELECTRONICS'** Fantastic Value Packed Catalog—Unheard of **LOW, LOW PRICES** on Brand Name Speakers, Changers, Tubes, Tools, Stereo Amps, Tuners, CB, and other Values. Credit plan available.

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_  
GIVE ZIP CODE \_\_\_\_\_

If you have a friend interested in electronics send his name and address for a **FREE** subscription also.

**OLSON ELECTRONICS  
INCORPORATED**

960 S. Forge Street Akron, Ohio 44308

## WORLD'S FINEST



# ERSIN MULTICORE 5-CORE SOLDER

## NEW EASY DISPENSER PAK only 69¢

BUY IT AT RADIO-TV  
PARTS STORES

MULTICORE SALES CORP., WESTBURY, N.Y. 11591

# Radio-TV EXPERIMENTER

Oct./Nov. 1968

Vol. 25/No. 2

Dedicated to America's Electronics Experimenters

*Editor-in-Chief*  
**JULIAN M. SIENKIEWICZ**  
WA2CQL, KMD4313

*Managing Editor*  
**RICHARD A. FLANAGAN**  
KQD2566

*Technical Editor*  
**CLIFFORD L. FORBES**  
KBQ8535

*Art Editor*  
**JIM MEDLER**

*News Editor*  
**HELEN PARKER**  
KQD7967

*Art Director*  
**ANTHONY MACCARRONE**

*Cover Art Director*  
**IRVING BERNSTEIN**

*Associate Art Director*  
**JOHN YUSKO**

*Art Associate*  
**JACK GOLDEN**

*Advertising Manager*  
**JIM CAPPELLO**

*Production Manager*  
**CARL BARTEE**

*Assistant Production Manager*  
**RENÉE MOELLMANN**

*Kit Division Manager*  
**WILFRED M. BROWN**

*President and Publisher*  
**B. G. DAVIS**

*Executive Vice-President and Assistant Publisher*  
**JOEL DAVIS**

*Vice-President and Editorial Director*  
**HERB LEAVY, KMD4529**

*Vice-President and Production Director*  
**LEONARD F. PINTO**

*Vice-President and Treasurer*  
**VICTOR C. STABILE, KBP0681**

RADIO-TV EXPERIMENTER (Vol. 25, No. 2) is published bi-monthly by Science & Mechanics Publishing Co., a subsidiary of Davis Publications, Inc. Editorial, business and subscription offices: 229 Park Avenue South, New York, N.Y. 10003. One-year subscription (six issues)—\$4.00; two-year subscription (12 issues)—\$7.00; and three-year subscription (18 issues)—\$10.00. Add \$1.00 per year for postage outside the U.S.A. and Canada. Advertising offices: New York, 229 Park Avenue South, 212-OR 3-1300; Chicago, 520 N. Michigan Ave., 312-527-0330; Los Angeles, J. E. Publishers' Rep. Co., 8380 Melrose Ave., 213-653-5841; Atlanta: Pirnie & Brown, 3108 Piedmont Rd., N.E.; 404-233-6729; Long Island: Len Osten, 9 Garden Street, Great Neck, N.Y., 516-487-3305; Southwestern advertising representative: Jim Wright, 4 N. 8th St., St. Louis, 314-CH-1-1965.

EDITORIAL CONTRIBUTIONS must be accompanied by return postage and will be handled with reasonable care; however, publisher assumes no responsibility for return or safety of manuscripts, art work, or photographs. All contributions should be addressed to the Editor, RADIO-TV EXPERIMENTER, 229 Park Avenue South, New York, N.Y. 10003.

Second class postage paid at New York, New York and at additional mailing office. Copyright 1968 by Science and Mechanics Publishing Co.

**MAIL  
ORDER**

# SHOPPING MART

**UNUSUAL  
VALUES**

A selection of products available by mail for readers of Radio-TV Experimenter  
All merchandise sold on a money-back guarantee. Order Direct by Stock No. Send check or M.O.

## SEE YOUR MUSIC IN DAZZLING ACTION with



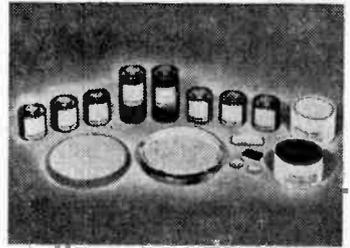
## MUSIC VISION

### Dramatic Breakthrough In Audio-Visual Enjoyment

Lots of fun! Wonderful for parties! Practical, too! Unlimited special effects for bands, dances, clubs, sales meetings, trade shows—put zip into classroom or private music instruction and appreciation. Available in Cabinet Model, Tube Unit, 8" and 12" sets or build your own MusicVision\* with our low-cost Do-It-Yourself Kit—all you'll need is a light source. If you don't have one, the versatile Edmund 35mm 500 Watt Projector is a terrific bargain. Order by stock numbers listed below. Money-back guarantee. Complete information in new catalog available September 10. If you want additional details now, send 25¢ in coin for fully illustrated, 16-page Booklet No. 9006HP "Introduction to MusicVision." \*Patent Pending

Adds a spectacular new dimension to the world of music and entertainment. Now you can actually see your favorite musical selection translated into fantastic patterns of beautiful color—each individual note creating its own unique, twisting, radiating shape... each shape dancing and prancing, whirling and swirling in perfect time with the music. Science, art and electronics combined with dramatic results. Attaches in seconds to your radio, tape recorder, hi-fi or stereo with two alligator clips. Can be used on small screens, large walls, stages and whole auditoriums.

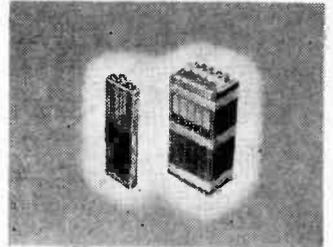
- 8" DO-IT-YOURSELF KIT—Stock No. 71,009HP.....\$22.50 Ppd.
- 8" SET (Motondizer, color wheel, apertures)—Stock No. 71,030HP...\$45.00 Ppd.
- 12" SET (same as above w/larger Motondizer)—Stock No. 71,032HP \$57.50 Ppd.
- WALNUT VENEERED CABINET MODEL—Stock No. 85,181HP.....\$99.50 F.O.B.
- 500 WATT 35mm PROJECTOR (for above sets)—Stock No. 71,057HP \$24.50 Ppd.



### ASTRONOMICAL TELESCOPE KITS

Grind your own mirror for powerful telescope. Kit contains fine annealed pyrex mirror blank, tool, abrasives, diagonal mirror and eyepiece lenses. You build instrument valued from \$75.00 up.

Stock No.	Diam.	Thickness	Price
70,003HP	4 1/4"	3/4"	\$8.00 Ppd.
70,004HP	6"	1"	12.95 Ppd.
70,005HP	8"	1 3/4"	21.00 Ppd.
70,006HP	10"	1 3/4"	34.25 f.o.b.
70,007HP	12 1/2"	2 1/2"	65.85 f.o.b.



### NICKEL-CADMIUM BATTERY BARGAIN!

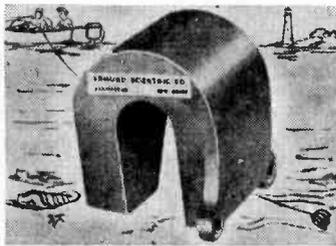
Terrific value—slightly used gov't surplus. Lightweight 3 cell, 6 volt, 4 Amp-hour battery with almost unlimited life. Extremely high current output. Recharges in 1 hour with Edmund kit. Won't deteriorate when left discharged. Minimum maintenance—few drops of water per year. Rugged, shock-and-vibration resistant nylon case. Delivered partially charged, filled with electrolyte. 3 1/2"x2"x8", 2 lb.

Stock No. 70,942HP (battery)...\$15.00 Ppd.  
Stock No. 70,807HP (charger kit)...\$8.00 Ppd.

### TOP-QUALITY LOW-COST STROBE

Create spectacular psychedelic lighting effects with this genuine electronic strobe. Terrific for parties, special occasions, experiments... perfect for combos, night clubs, dances, exhibitions. Adjusts from 1 to 10 short-duration flashes per second—not a make-shift mechanical device. Amaze friends with old-time movie effects. Best party ice-breaker ever—"freeze" the action and "unfreeze" your guests. Practical too—check action of moderate-speed machinery. Xenon lamp gives one million flashes. 6 1/2" diam. reflector. Uses reg. 110-120 volt A.C. current. Handsome solid walnut cabinet, 9 1/4"x9 5/8"x4". Send for Bulletin #75—describes other startlingly new unique lighting effects.

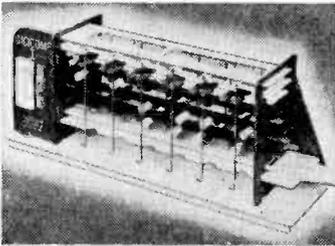
Stock No. 70,989HP.....\$79.95 Ppd.



### "FISH" WITH A MAGNET

Go treasure hunting on the bottom. Fascinating fun & sometimes profitable! Tie a line to our 5-lb. Magnet—drop it overboard in bay, river, lake or ocean. Troll it along bottom—your "treasure" haul can be out-board motors, anchors, other metal valuables. 5-lb. Magnet is war surplus—Alnico V Type—Gov't cost \$50. Lifts over 150 lbs. on land—much greater weights under water.

Stock No. 70,571HP.....\$12.50 Ppd.



### WORKING MODEL DIGITAL COMPUTER

Solve problems, teach logic, play games with miniature version of giant electronic brains! Adds, subtracts, multiplies, shifts, complements, carries, memorizes. Colored plastic parts easily assembled. 12"x3 1/2"x4 3/4". Incl. step-by-step assembly diagrams, 32-p. instruction book covering operation, computer language (binary system) programming, problems and 15 experiments.

Stock No. 70,683HP.....\$5.98 Ppd.

IT'S HERE—BIG, NEW DIGICOMP III  
Stock No. 70,946HP.....\$16.00 Ppd.

## GIANT FREE CATALOG

148 PAGES! MORE THAN 4,000

### UNUSUAL BARGAINS!



Completely new. Packed with huge selection of lenses, prisms, optical instruments, parts and accessories, 100's of charts, illustrations. Many hard-to-get surplus bargains. Enormous variety of telescopes, microscopes, binoculars, magnets, magnifiers, photo components, etc. For hobbyists, experimenters, workshops, factories. Shop by mail. No salesman will call. Simply check coupon or write for Catalog "HP" to Edmund Scientific Co., Barrington, N. J. 08007.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

ORDER BY STOCK NUMBER • SEND CHECK OR MONEY ORDER • MONEY-BACK GUARANTEE

# EDMUND SCIENTIFIC CO. 300 EDSCORP BUILDING BARRINGTON, NEW JERSEY 08007



# Learn I.C.'s... Build this new RCA Audio Amplifier Kit

RCA's new Integrated Circuit Experimenter's Kit, KD2112, is the first of its kind. You get a "short course" in integrated circuits, and you can build a 500-milliwatt audio amplifier or a variable-tone audio oscillator.

The heart of this new "all-parts-included kit" is an RCA linear integrated circuit — a multipurpose wide-band audio amplifier — containing the equivalent of 7 transistors, 11 resistors, and 3 diodes.

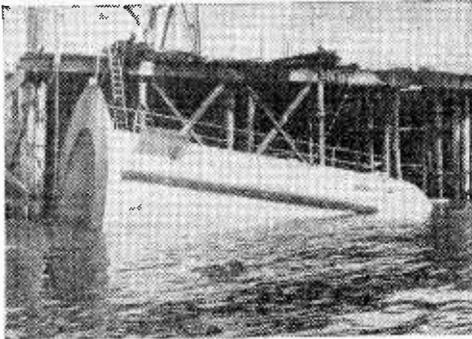
Each kit comes with a 20-page manual which gives complete step-by-step kit construction details. An extra I.C. "chip," with case removed, is also supplied so that its circuitry can be examined.

RCA's new Integrated Circuit Experimenter's Kit KD2112 is available from your RCA Distributor. Ask him for it, and learn more about I.C.'s.

RCA Electronic Components, Harrison, N. J. 07029





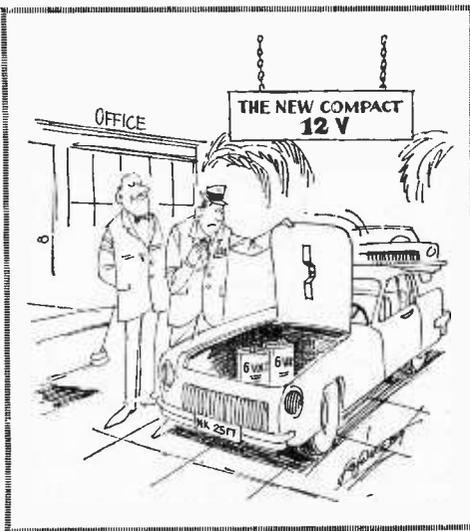


*Watermelon-thimble-beer can? Don't know what to call her but she's mighty like a bomb. This 50-foot contraption, under construction in Vancouver, Wash., will carry 250 tons of explosive to the bottom of the Pacific to test the United States' ability to detect nuclear explosions by other countries.*

Pacific near the Aleutians, open the seacocks to flood the ship and let nature take over. As the ship sank, pressure fuses set for 4,000 feet would automatically detonate the blast.

It didn't work! Instead of sinking like a stone, the Stevenson took so long about it that it drifted off and got lost in a fog-bank. After a month of searching, the Navy finally found its ship, 11 miles away from the intended blast site, sitting bolt upright in 2,800 feet of water, not nearly enough to trip the fuses. Nervous officials ordered a dive-bombing run, in an effort to set off the explosion by concussion, but two dozen 2,000-pounders raised not a peep. Finally the Navy announced that the fuses had deteriorated from their long immersion, the ship was therefore safe, and the whole affair was being scuttled.

(Continued on page 14)



# compact sets

## SPEED DRIVING OF BRISTOL AND ALLEN HEX TYPE SCREWS

**No. 99PS-60  
Bristol Multiple Spine Type  
Screwdriver Set**



4 and 6-flute blades  
with diameters from  
.048" thru .183"

**No. 99PS-40 Allen Hex  
Type Screwdriver Set**



Hex diameters  
from .050" thru 3/16"

Compact, interchangeable blade, Xcelite sets permit quick selection of the right tool for the job. With greater reach than conventional keys, these handy blade and handle combinations make it easier to get at deep set or awkwardly placed socket screws, simplify close quarter work.

Each set contains 9 precision formed, alloy steel, 4" blades; 4" extension; shockproof, breakproof, amber plastic (UL) handle with exclusive, positive locking device.

Sturdy, see-thru plastic cases fit pocket, have flat bases for use as bench stands.

# XCELITE®

XCELITE INC. • 64 BANK ST., ORCHARD PARK, N. Y.  
Send Bulletin N365 on 99PS-60 and 99PS-40 sets.

name \_\_\_\_\_  
address \_\_\_\_\_  
city \_\_\_\_\_ state & zone \_\_\_\_\_

# You Can Always Depend On Heath...

Introducing The Finest  
Stereo Compact You Can Buy...  
The NEW Heathkit AD-27



**NEW**  
kit AD-27  
**\$16995**



**NEW**  
kit AJ-15  
**\$18995\***

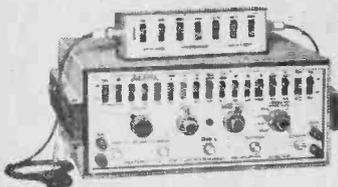


**NEW**  
kit AA-15  
**\$16995\***



**NEW**  
kit IT-18  
**\$2495**

**NEW**  
kit IM-17  
**\$1995**



**NEW**  
kit IG-57  
**\$13500**

**With Features Not Found In Units  
Costing Twice As Much... Designed  
For Those With Limited Space, Limited  
Budgets And A Desire For The Finest  
In A Home Music System**

The AD-27 is mini-sized, measures only 21 $\frac{1}{2}$ " x 14 $\frac{1}{4}$ " x 7 $\frac{1}{2}$ " and fits just about anywhere — on a bookcase shelf, on a desk top. And its classic ebony and walnut styling, with sliding tambor door that disappears inside the cabinet, blends with any room decor... can be operated with door closed or opened. What really counts is the performance the AD-27 delivers. Underneath its beautiful exterior is a really performance-plus package with features like an amplifier that delivers an honest 15 watts of music power per channel with a response curve that is virtually flat from 12 Hz. to 60 kHz. An astounding 45 dB channel separation... harmonic distortion that's less than 0.5% — both measured at full output. All solid-state circuitry... advanced transformerless output circuitry that provides lower phase shift and distortion; and an added feature, protection against severe transistor damage from shorted output leads. All indications of the extra value Heath engineers have designed into the AD-27 Stereo Compact. 120/240 VAC operation, 41 lbs.

## **A** Heathkit AJ-15 Deluxe Stereo Tuner

For the man who already owns a fine stereo amplifier. Heath now proudly offers the superb FM Stereo Tuner section of the Famous AR-15 receiver, with all its fine FM tuning features

Two FET r.f. amplifiers and FET mixer; dual Crystal Filters in the I.F. strip; dual Integrated Circuit I.F. design; Noise-Operated Squelch circuitry; Stereo Threshold and Stereo-Only switch; and beautiful "Black Magic" panel lighting. By unanimous agreement, this is the finest FM tuner. It belongs in your music system. 120/240 VAC operation, 18 lbs. \*Walnut cabinet AE-18, \$19.95.

## **B** Heathkit AA-15 Deluxe Stereo Amplifier

For the man who already owns a good stereo tuner. here is the sophisticated stereo amplifier section of the renowned AR-15 receiver as a separate component. With a heritage experts termed "an audio Rolls Royce" this new AA-15 stereo amplifier has the same deluxe circuitry and performance features as the AR-15.

150 watts music power; Ultra-Low Harmonic & IM Distortion; Ultra-Wide Frequency Response; Ultra-Wide Dynamic Range Preamp; Tone-Flat Switch; Front Panel Input Level Controls; Transformerless Amplifier, Capacitor Coupled Outputs; Massive Power Supply; All-Silicon Transistor Circuit; Positive Circuit Protection; "Black Magic" Panel Lighting; NEW Second System Remote Speaker Switch, 120/240 VAC, 26 lbs. \*Walnut cabinet AE-18, \$19.95.

## **C** Heathkit IT-18 In-Circuit Transistor Tester

At last a realistic price for in-circuit testing of transistors. The new Heathkit IT-18 Tester has the facilities you need and it costs a lot less. Measures Transistor DC Beta in-or-out-of-circuit; measures leakage out-of-circuit; test diodes in-or-out-of-circuit; and has a big 4 $\frac{1}{2}$ " 200 uA meter 10-turn calibrate control. Completely portable by "D" cell (long battery life). Front panel socket for lower power devices. Attached 3' test leads. Rugged polypropylene case with attached cover. Build in 2 hours. 4 lbs.

## **D** Heathkit IM-17 Portable Volt-Ohm Meter

Just right for homeowners, hobbyists, boatowners, CBER's, hams... even sophisticated enough for radio & TV servicing. Features 12 ranges... 4 AC & 4 DC volt ranges, 4 ohm ranges, 11 megohm input on DC, 1 megohm input on AC; 4 $\frac{1}{2}$ " 200 uA meter; battery powered; rugged polypropylene case. Easy 3 or 4 hour kit assembly. 4 lbs.

## **E** Heathkit IG-57 Solid-State Color TV Marker/Sweep Generator... 15 Crystal Markers... 3 Sweep Ranges

The IG-57 combines the features of both a post marker and a sweep generator for less than you'd expect to pay for just one of these functions. This compact easy-to-use instrument has all the facilities you need for critical Color TV and FM alignment... just attach any scope and you're ready. 15 crystal-controlled marker frequencies, 3 sweep ranges... all crystals included. External attenuator provides 1, 3, 6, 10 and 20 dB steps to 70 dB maximum; also can be used with external sweep or marker. Handsome new Heathkit instrument styling. Order your IG-57 now, it's the best investment in Color TV and FM alignment facilities you can make. 14 lbs.

# For Unsurpassed Value and Quality

## Deluxe "295" Color TV ... \$479<sup>95</sup>

(less cabinet)

Big, Bold, Beautiful ... With Advanced Features and Exclusive Heathkit Self-Servicing. Top quality, American brand color tube ... 295 sq. inch viewing area. The built-in dot generator and full color photos and simple instructions let you set-up, converge and maintain the best color pictures at all times. Add to this the detailed trouble-shooting chart in the manual and you put an end to costly TV service calls for periodic picture convergence and minor repairs.

New improved phosphors and low voltage supply with boosted B+ for maximum color fidelity and operation • automatic degaussing • exclusive Heath Magna-Shield • ACC and AGC assures color purity, flutter-free pictures under all conditions • preassembled IF with 3 stages instead of the usual 2 • deluxe VHF turret tuner with "memory" fine tuning • choice of installation—wall, custom or optional Heath factory assembled cabinets • Easy to assemble.

**kit GR-295**, (everything except cabinet), 131 lbs. ... \$479.95  
\$48 dn., \$42 mo. ....

**GRA-295-4**, Mediterranean cabinet (shown), 90 lbs. ... \$112.50  
no money dn., \$11 mo. ....  
Other cabinets from \$62.95

## Deluxe "227" Color TV ... \$419<sup>95</sup>

(less cabinet)

Has same high performance features and built-in servicing facilities as the GR-295, except for 227 sq. inch viewing area. The vertical swing-out chassis makes for fast, easy servicing and installation. The dynamic convergence control board can be placed so that it is easily accessible anytime you wish to "touch-up" the picture.

**kit GR-227** (everything except cabinet) ... \$419.95  
\$42 dn., as low as \$25 mo. ....

**GRA-227-1**, Walnut Cabinet (shown) ... \$59.95  
no money dn., \$6 mo. ....

**GRA-227-2**, Mediterranean Oak Cabinet ... \$94.50  
no money dn., \$10 mo. ....

## Deluxe "180" Color TV ... \$349<sup>95</sup>

(less cabinet)

Same high performance features and exclusive self-servicing facilities as the GR-295 except for 180 sq. inch viewing area. Feature for feature the Heathkit "180" is your best buy in deluxe color TV viewing ... tubes alone list for over \$245. For extra savings, extra beauty and convenience, add the table model cabinet and mobile cart.

**kit GR-180** (everything except cabinet), 102 lbs. ... \$349.95  
\$35 dn., \$30 mo. ....

**GRA-180-5**, table model cabinet and mobile cart ... \$39.95  
(shown), 57 lbs. ... no money dn., \$5 mo. ....  
Other cabinets from \$24.95

### Heathkit Color TV Remote Control

Now change VHF channels and turn your Heathkit color TV on and off from the comfort of your armchair with this remote control kit. The heavy-duty switch contacts are silver-plated to assure long life and trouble-free service. Use with Heathkit GR-295, GR-227 and GR-180 color TV's. Includes 20' cable.

**kit GRA-27**, 4 lbs. ... \$19.95

3 HEATHKIT® COLOR TV'S  
NOW! ALL WITH 2-YEAR  
WARRANTY ON PICTURE TUBE



kit GR-295



kit GR-227



kit GR-180



kit GRA-27

### NEW ... FREE 1969 Heathkit Catalog

Just off the press, 116 page new 1969 Heathkit catalog. Many more color illustrations ... many new products. Completely describes over 300 kits for stereo/hi-fi, color TV, amateur radio, short-wave, test, CB, marine, educational, home and hobby. Save over 50% by doing the easy assembly yourself. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

HEATH COMPANY, Dept. 19-10  
Benton Harbor, Michigan 49022  
In Canada, Daystrom Ltd.

Enclosed is \$ \_\_\_\_\_ plus shipping.

Please send model (s) \_\_\_\_\_

Please send FREE Heathkit Catalog.

Please send Credit Application.

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_

Zip \_\_\_\_\_

Prices & specifications subject to change without notice.

CL-332

**POSITIVE FEEDBACK ★★★★★★★★★★**

*(Continued from page 11)*

But ARPA still wants to test its network. So, it plans to set sail with a strange green and orange vessel whose sole goal is to sink quickly.

Variouly described as a giant watermelon, thimble and beer can by ARPA and the Illinois Institute of Technology Research Institute, which is building the thing, the unmanned object is 50 feet long, with a diameter of 20 feet expanding outward into a 30-foot-wide skirt. A tugboat will tow it into position, which officials hope will be the same spot off Amchitka Island where the Stevenson should have gone down.

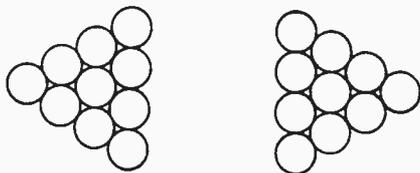
There a radio signal will (everybody hopes) open the first of two ballast tanks to swing the capsule from its horizontal towing position into a nose-up attitude that will allow the second tank to sink it quickly and, more important, straight down. To make sure of where it has gone, a transmitter-equipped buoy will detach itself and bob to the surface, connected to its charge by a thin cable.

Pressure fuses will again be the detonators, since they should pose no problem as long as the object sinks properly at its intended spot. The explosive charge, 250 tons of aluminized ammonium nitrate, will be much smaller than the Stevenson's, largely, according to ARPA, because the Navy was also using the earlier attempt as a way of getting rid of a collection of obsolete bombs, mines and torpedo warheads.

Although the site has been chosen chiefly for its distance from major commercial fishing areas, the State Department plans to notify governments that fish Aleutian waters of the date, time and exact location of the test. Japan has the largest interest in the area, although Korea and Canada may also be concerned.

The idea for the watermelon-thimble-beer can, now under construction at a Vancouver, Wash., shipyard, began the year before the Stevenson didn't work, so it has not been created simply to do what the Liberty ship could not.

**Rack 'em Up.** Here's a sticky little problem that was posed to me by some friends at the American Can Company. They drew the diagram shown below and said, "Can you make the left group of circles the same shape as the right group by moving only 3 circles?" Impossible? Look again! If you believe in flower power, the answer will be seen immediately. Just find the flower and the rest is easy. How easy? I'll let you know next issue.



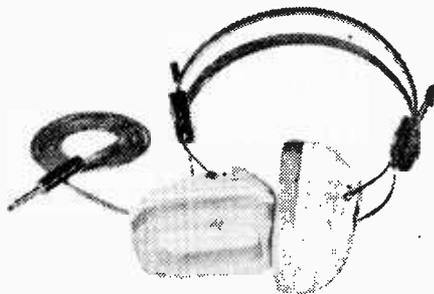
**NEW PRODUCTS**

**HIGH-FIDELITY  
AMATEVR RADIO  
SHORT WAVE  
RECORDERS  
GIMMICKS  
GADGETS  
TOOLS  
ETC.**



**Headset for Your Heads**

The new Kalimar-Tronics T-850 universal headset incorporates a new feature: the same headset can be used for stereo or monophonic listening, for voice or music, with just a flick of the switch. The construction is rugged, the frequency response is from 20 to 20,000 Hz, and the price is a very attractive \$11.95.



*Kalimar-Tronics T-850 Headset*

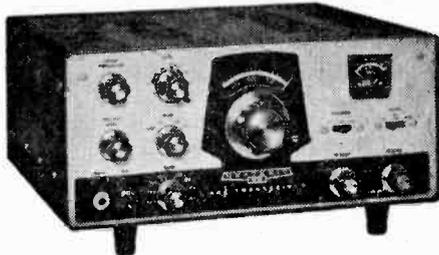
Kalimar-Tronics has a complete line of tape recorder accessories, including the T-650 lapel mike, which retails at only \$1.25. Write to them at Kalimar-Tronics, Inc., 2646 Michigan Ave., St. Louis, Mo. 63118.

**Trade Up From Single Band**

The Heath Company has come up with a five-band, kit-form transceiver version of their single-banders. Selling at \$240.00, the HW-100 operates with a hybrid circuit that uses 20 tubes, two transistors (one an FET for the VFO), six germanium diodes, nine silicon diodes, and one Zener diode. The receiver has a sensitivity fig-

ure of less than 0.5  $\mu$ V for a 10 dB S+N/N ratio for SSB operation. Selectivity is 2.1 kHz at 6 dB down, 7 kHz at 60 dB down.

The transmitter section in SSB continuous duty is 180 watts PEP, CW input is 170 watts on 50% duty cycle. It operates PTT or VOX



Heathkit HW-100 SSB Transceiver

on SSB, and CW transceive is provided by operating VOX from a keyed tone, using grid-block keying. Frequency stability is less than 100 Hz drift per hour after 30 minute warmup; less than 100 Hz variation under a 10% line variation. The Heathkit HP-23 AC supply or the Heathkit HP-13 DC supply can be used for fixed or mobile operation. Write to Heath Co., Benton Harbor, Mich. 49022 for further info.

### On the Hip

Young swingers (or old swingers, for that matter) have a dazzling choice of how to take their music, wherever they go. Philco-Ford's line of 20 portable phonographs range from a tiny phono-only model which plays the 45-rpm Hip Pocket (HP) records, to a top-model FM/AM/FM stereo with 20 full watts of peak music power. The all-transistorized radio line features 12 new FM sets; 3 FM sets are multi-band models and three others are FM/stereo sets. Shown in the center in the photo is the Hipster (Model 1369, \$14.95), and playing the LP at right is Model 1376 (\$24.95). Unit at left



Just three of Philco-Ford's Miniature Phonographs

HERE'S YOUR ONE-SOURCE FOR

## CERAMIC CAPACITORS AND SEMICONDUCTORS

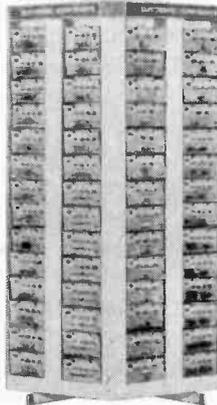


... and NOW

YOU GET

**\$50 OFF\***

when you buy  
Components from



**ERIE'S  
ELECTRONIC  
COMPONENTS  
STATION**

NOW AT YOUR FAVORITE DISTRIBUTOR

**YOUR COMPONENTS ARE  
NEATLY PACKAGED WITH  
COMPLETE DESCRIPTION  
for EASY USE!**

**112 Popular Components . . .**

- 56 CERAMIC CAPACITORS
- 28 SEMICONDUCTORS
- 18 VARIABLE CAPACITORS
- 10 MYLAR CAPACITORS



\*On purchase of only \$2.50



**FOR FREE \$50 Coupon and  
6-Page Components Catalog**

Send to:

ERIE TECHNOLOGICAL PRODUCTS, INC.  
Erie Distributor Sales  
644 West 12th Street • Erie, Pa. 16501

**PLEASE SEND CATALOG AND PRICE DATA . . . TODAY**

NAME \_\_\_\_\_  
COMPANY \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_



resin. Connections can thus be resoldered without cleaning as is required with methods using flux. Soder-Wick requires only one second to desolder a connection and there is less heat transmitted to board and components. Cost of operation is about 1/2 cents. Soder-Wick comes in 5-ft. rolls in two sizes, small and large, each \$1.49 per roll. For descriptive literature, write to Solder Removal Co., 817 Dumaine Ave., San Dimas, Calif. 91773.

### Have a Light, Big Boy!

This is a mail-order item, a fiber optical pen-light device costing \$3.29 including postage and taxes. Called Speck-O-Lite, it emits a full intensity pen-light beam through a 12-in. flexible shielded plastic light guide. For hard-to-see repairs, and troubleshooting, the Speck-O-Lite operates in a pen-light case containing two AA dry cells. A good value for hobbyists. Write for it to Kurz Kasch, Inc., Box 115, Dayton, Ohio 45401.



Kurz Kasch Speck-O-Lite

### Up, Up and Away, DXers!

Mosley has a new line of cubical quad antennas, engineered for top DX efficiency and reliability. There are three single band quads: MCQ-10 for 10 meters; MCQ-15 for 15 meters; MCQ-20 for 20 meters. Each has a lightweight, low wind load spreader mount that eliminates heavy, wind-resistant webbing at the hub. They have the Mosley boom-to-mast clamp with stainless steel U-bolts for stability, and all parts—boom, spreaders, wire, hardware—are pre-drilled and come with concise instructions. With their square shape, the important voltage and current minima and maxima are located midway between the corners; thus eliminating possible signal loss due to spreaders intersecting wire elements at these critical points. MCQ's maintain an SWR of 2.2 or better with flat response

## Buy 10 PAKS & CHOOSE 1 FREE

- \$25 SURPRISE PAK: transistors, rect, diodes, etc. .. \$1
- 5 ONE AMP 800 PIV RECTIFIERS, silicon top hat ..... \$1
- 10 KODAK LENSES, convex, piano, etc. Hobby must \$1
- 50 GERMANIUM GLASS DIODES, 1N34, 1N48 no test \$1
- 40 TOP HAT SILICON RECTIFIERS, no test/asst values \$1
- 25 EPOXY RECTIFIERS, silicon asst, no test ..... \$1
- 40 PRECISION RESISTORS, 1/2-2W. 1% asst values .. \$1
- 30 TRANSISTORS, rf, if, audio, osc, no test ..... \$1
- 60 TUBULAR CONDENSERS, to .5mf to 1KV, asst .... \$1
- 50 DISC CONDENSERS, to .05mf npo, temp coef, asst \$1
- 60 TUBE SOCKETS, receptacles, plugs, audio, etc. .. \$1
- 30 POWER RESISTORS, to 25 watts, to 24K ohms .... \$1
- 3 2N3568 NPN TRANSISTORS, 200mc, 200V, 200hfe, \$1
- 3 2N3563 TRANSISTORS, npn, 600mc, 100hfe, epoxy \$1
- 10 VOLUME CONTROLS, to 1 meg, switch too! ..... \$1
- 10 ELECTROLYTICS, to 100mf, tubulars too, asst .... \$1
- 50 RADIO & TV KNOBS, asstd colors & styles ..... \$1
- 10 TRANS'OR ELECTROLYTICS to 100mf, asst values \$1
- 50 COILS and CHOKES, if, rf, ant, osc, peaking, etc \$1
- 65 HALF WATERS, to 1 meg, 5% popular values too \$1
- 60 HI-QUALITY RESISTORS, 1/2, 1 2W asst values .... \$1
- 10 RCA PHONO PLUGS & JACK SETS, tuners, etc. .... \$1
- 4 INTEGRATED CIRCUITS, gates, etc. no test ..... \$1
- 2 PC INFRARED DETECTOR & FILTER SET science proj \$1
- 2 FIELD EFFECT TRANSISTORS, n channel, hobby .... \$1
- 50 TERMINAL STRIPS, 1 to 8 lug types ..... \$1
- 3 PHOTO ELECTRIC CELLS, hi. imp., schematic ..... \$1
- 3 TRANS'OR AMPLIFIER, WIRED, 3x2x3/4" schematic \$1
- 10 PRINTED CIRCUIT BOARDS, copper clad, 100 uses \$1
- 10 TRANSISTOR SOCKETS, for pnp & npn types..... \$1
- 10 PANEL SWITCHES, toggle, slide, micro, rotary .. \$1
- 5 "SUN" BATTERIES, for 100's of lite sens projs .... \$1
- 5 RAYTHEON CK-722 TRANSISTORS, pnp, most pop \$1
- 5 G.E. 2N107 TRANSISTORS, pnp, audio ckts ..... \$1
- 6 "IBM" COMPUTER BOARDS, many trans, diodes, \$1
- 40 "MICRO" CONDENSERS, for transistor circuitry \$1
- 3 14W. EPOXY TRANSISTORS, npn, silicon, B-5000, \$1
- 15 3 to 12 AMP STUJ RECTIFIERS, up to 600 PIV .... \$1

ADD POSTAGE, avg. wt: 1/2 lb.  CATALOG 10c

## POLY PAKS

P.O. BOX 942X  
LYNNFIELD, MASS.  
01940

## VHF RECEIVER

### AM/FM—MULTI-BAND

### HIGH SENSITIVITY—SELF CONTAINED

Hear police, fire, aircraft, amateur CB, etc. signals. Covers 26 to 54 and 88 to 174 mc in eight calibrated bands. Plus a ninth adjustable band for 15 or 20 meter SW BC listening. Five tubes AC power supply with silicon rectifier.



Write for catalogue of complete line of converters, receivers and audio equipment for recording.

364C

\$59.95

KUHN ELECTRONICS, INC.

1801 Mills Ave.

Norwood, Ohio 45212

## THOUSANDS OF BARGAINS

### TOP VALUES IN ELECTRONIC PARTS

Transistors, Modules, C. B., Speaker, Stereo, Hi-Fi, Photo Cells and Thousands of Other Electronic Parts.

Send for FREE Catalogue

ELECTRONIC DISTRIBUTORS INC.



EDI

Dept. TA-2, 4900 Elston  
Chicago, Ill. 60630  
 RUSH CATALOGUE

Name .....  
Address .....  
City .....  
State ..... Zip Code .....



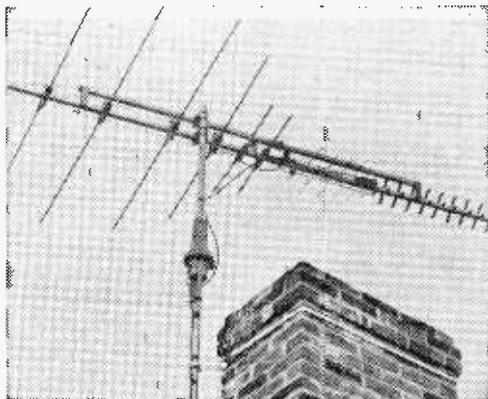


Jensen Professional Sound Calculator I

Professional Sound Calculator I," and the price is \$1.00. Send to Jensen Mfg. Div., The Muter Co., Dept. RTVE, 5655 W. 73rd St., Chicago, Ill. 60638.

### TV Antenna Rotator

Jerrold has decided to enter the antenna rotator arena with their Dyna-Rotor, a fast unit powered by a unique dynamic spline drive, with fewer parts than conventional gear drives. Dyna-Rotor's construction requires no auxiliary or mechanical braking devices which some rotors need to prevent windmilling. Its accuracy is not affected by the length of cable between the con-



Jerrold Dyna-Roto Antenna Rotator

trol unit and the antenna or by the size of the antenna. The Dyna-Rotor is designed to be mounted so that the rotor and the sections of the mast below and above it are in a straight line. This makes it less vulnerable to wind loading, and makes it practical to mount it inside the limited space available at the top of an antenna tower. In its cast aluminum case, the rotor assembly weighs only 5 lb. The instrument has proved out in field tests in sub-zero weather. The Dyna-Rotor is said to rotate the largest TV antennas at the rate of 360° in less than 40 seconds. A pilot light inside the unit illuminates when the antenna is in motion; the light turns off when the antenna reaches its aimed position. The suggested retail price is \$54.95 at Jerrold distributors, and you can write for more information to Distributor Sales Div., Jerrold Electronics Corp., Box A, Philadelphia, Pa. 19105.

## SHOOT TV TROUBLE FAST

### With H. G. Cisin's Copyrighted RAPID "TV TROUBLE SHOOTING METHOD"

Without experience or knowledge, this guaranteed new method of servicing TV sets enables you to **DIAGNOSE** TV troubles as rapidly as an expert. **NO THEORY—NO MATH**—you can locate all faults in record-breaking time regardless of make or model. "TV TROUBLE SHOOTING METHOD" is the most valuable aid to TV servicing ever written. Be a TV Trouble Diagnostician. Increase your present earnings. Open your own profitable Business or get a high-paying skilled job.

It's all in this book . . .

**Nothing more to Pay—Nothing else to Buy**

Alphabetically listed are 85 picture troubles, over 58 raster and 17 sound troubles. By this unique copyrighted method you know EXACTLY WHERE the trouble is; plus step-by-step instructions, including 69 RAPID CHECKS, help to find faulty parts. 13 IMPORTANT PRELIMINARY CHECKS NEEDED NO INSTRUMENTS! Of the 69 Rapid Checks, OVER 45 ALSO REQUIRE NO INSTRUMENTS! Rapid checks include emergency checks for distorted pictures, defective tubes including PIX tube, plus 57 others. ALL EXPLAINED IN SIMPLE LANGUAGE, PERFORMED WITHOUT INSTRUMENTS. MANY CHECKS USE THE PICTURE TUBE AS A GUIDE. H. G. Cisin, the author, is the inventor of the AC/DC midjet radio. He licenses ICA, AT&T, etc. He has also trained thousands of technicians now owning their own prosperous TV service organizations or holding highly paid TV positions. His years of experience are embodied in this remarkable new book.

Guaranteed Money Back in 5 Days if Not Satisfied!

ABSOLUTELY FREE with each order: Your choice of Cisin's newest books: **BASIC ELECTRICITY—Vol. 1** or **TV-RADIO TUBE SUBSTITUTION GUIDE**. These sell for 50¢ ea. **ACT NOW—get 2 books postpaid at cost of only one!**

**\$1** Postpaid

**RUSH COUPON NOW!**

H. G. CISIN, Consulting Engineer—Dept. RE-10  
Amagansett, N. Y.  
Enclosed find \$1. Rush Trouble Shooting Method and free book marked above (if not marked Basic Elec. will be sent).  
 Send all 3 books. Enclosed find \$1.50

Name .....  
Address .....  
City..... Zone..... State.....

### COMING IN NOVEMBER

If you enjoy making furniture you'll find a special treat waiting for you at most of the newsstands on Nov. 7. That's the day **WOOD PROJECTS 1969** edition goes on sale.

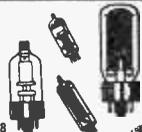
**WOOD PROJECTS 1969** will cost only 75¢ at newsstands or \$1 per copy, postpaid, from Science & Mechanics Publishing Co., 229 Park Avenue South, New York, N. Y. 10003. Better reserve **YOUR** copy **NOW**.

Tape this ad to the back of your TV or Radio Set

**ALL TV-RADIO \$1.50**  
**RECEIVING TUBES**

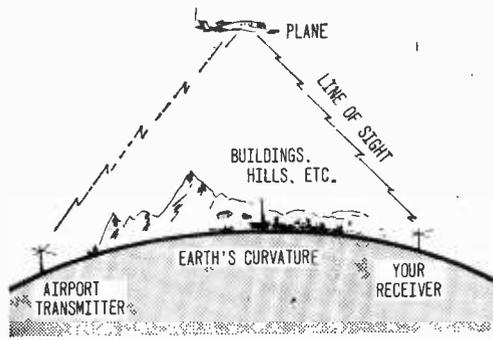
• ALL BRAND-NEW, First Quality. All Types Available • Orders Shipped First Class Same Day Rec'd. • Unconditionally Guaranteed. • 24 Month Warranty.

Send \$1.50 for ea. tube + 50¢ postage & handling of entire order. **FREE:** Write for TV Test Chart and Tube List to Dep't RTV-108



**UNIVERSAL TUBE CO.** Cape May, N.J. 08204





ceiver, as shown in the drawing. However, the Chicago towers are 40 to 50 miles away. Their VHF stations don't need tall antennas because they don't have to communicate with vehicles on the ground. For you to receive them, you'll need a tall antenna support.

**Signal Chasers?**

*Will you please give me the address of the new club called the International League of Signal Chasers, which is devoted completely to SWL card swapping?*

—A. T., Citrus Heights, Calif.

The address we don't have, but perhaps some member reading this will write to A.T. at 7908 Clearview Drive and tell him. It reminds us of the famous International League of Redhead Chasers formed many years ago.

**Laser Lover**

*Where may I obtain plans, material, schematics, etc., for a laser?*

—J. H. R., Lufkin, Tex.

Lasers are expensive and aren't yet in the typical experimenter's budget category. Elementary models are usually made to accompany



"How's that for power, Gladys?"



**GEIGER COUNTER, MLTRY SURPLUS**  
like new with book, untested  
**SURPLUS SPECIAL** ..... \$10.00

**10 amp TRIACS**

**SALE**

PRV Sale	100	200	300	400
	1.40	1.75	2.25	2.60

**VARACTOR SIMILAR TO MA4060A**  
Good for 40 watts at 432 MC, each tested in circuit. W/diagram for 432 MC tripler.  
..... \$5.00 each  
All prepaid to you in U.S. Send 25¢ for 96-page catalog.

**JOHN MESHNA JR.**  
19 ALLERTON ST. LYNN, MASS. 01904

**WRITE NOW FOR 1969 SENT FREE 1001 BARGAINS IN**  
**McGEE'S CATALOG**  
SPEAKERS—PARTS—TUBES—HIGH FIDELITY COMPONENTS—RECORD CHANGERS—TAPE RECORDERS—KITS—EVERYTHING IN ELECTRONICS

McGEE RADIO CO.,  
1901 McGee St. (RTE) Kansas City, Missouri 64108  
 SEND 1969 McGEE CATALOG  
NAME.....  
ADDRESS.....  
CITY.....STATE.....ZIP.....

**TUBES! CORNELL TUBES!**  
FREE Send For FREE  
**CORNELL'S**  
New 1968 CATALOG  
Many New Items  
**30¢** per tube  
IN LOTS OF 100  
**33¢** per tube  
WE SELL PICTURE TUBES  
4219 N UNIVERSITY AVE., SAN DIEGO, CALIF. 92105

**SURPLUS SALE**  
We are selling out our surplus at reduced prices. Send 3 unused 6¢ stamps for our flyer.  
**BIGELOW ELECTRONICS, Dept. RT**  
P.O. Box 71 Bluffton, Ohio 45817



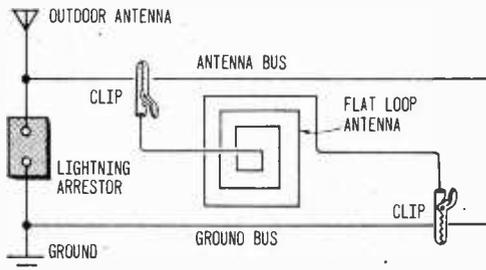
Or drop into a radio service shop and have them look up the schematic in an old Rider manual. Of course, there are always the prop departments in Hollywood!

### Less Light, More Signal

*I have a radio and TV repair shop in a local hardware store here. The store building is less than a year old and has approximately 65 80-watt fluorescent fixtures which play havoc with AM radios. The signal-to-noise ratio is so low you can get only one local station. This condition has made radio repair almost impossible. I have tried various line filters to no avail. If there is a practical solution to this problem I would sure like to hear it.*

—R.L.W., Palmetto, Ga.

Don't use fluorescent lights directly over your bench. Install incandescent lamps. Install an outdoor wire antenna and using clip leads, connect the antenna and a ground to a loop antenna. Place the set to be repaired on or near



the loop. The signals will be inductively coupled to the loop inside of the radio and should be strong enough to override the noise. As shown in the diagram, you can run two heavy, bare copper wires or copper tubing along the wall or shelf above the bench. Use standoff insulators to support the one connected to the an-



# RADIATION DETECTOR

## AN/PDR-27 RADIAC SET



A portable, water-tight, battery operated radiation detector and indicator. It is capable of detecting and measuring Beta and Gamma radiations together—or Gamma radiation alone. The test unit can be carried by hand or by the shoulder strap. The Probe is attached to the main unit by a coiled cord. Visual indication is provided by the radiac meter, aural indication is provided by the headphones. Battery voltage required: 13.5 VDC & 1.5 VDC. Also 22.5 —DCV. With Tubes: 3/502AX, 1/3V4, 2 GM tubes BS-1 & 2. Headset and Manual contained in metal carrying case: 9 1/2 x 15 x 10 3/4". Wt.: 28 lbs.

Prices: Used—Not Checked ..... \$19.95  
Used—Checked ..... \$29.95

Prices F.O.B. Lima, Ohio—25% Deposit on C.O.D.'s. Dept. 38  
HUNDREDS OF QUALITY GOVT. SURPLUS ELECTRONIC  
ITEMS AVAILABLE.

**BIG FREE CATALOG—Send for your copy today!**

**FAIR RADIO SALES**  
1016 E. EUREKA • Box 1105 • LIMA, OHIO • 45802

SPARE TIME OPPORTUNITY

# MONEY

**PANELISTS AT HOME WANTED BY  
NEW YORK RESEARCHER**

Leading research firm seeking people to furnish honest opinions by mail from home. Pays cash for all opinions rendered. Clients' products supplied at no cost. For information write:

Research 669, Mineola, N. Y. 11501, Dept. 662.

**TRANSISTORIZED CONVERTER  
KITS \$5.00 EACH**

Three kits available. Marine 2-3 mc, police & fire, high band 100-200 mc, low band 26-60 mc. 1 mc tuning on car radio. Full instructions.

ANY KIT \$5.00 pp. WIRED \$15.00 pp.

FRED MESHNA, NO. READING, MASS. 01864



Don't Miss the all new  
**ELECTRONICS HOBBYIST**  
**1968 Fall-Winter Edition**  
at your Newsstand September 5th

Now you can reserve the newest, most exciting magazine for those whose interest in electronics is on the hobby level. The **ELECTRONICS HOBBYIST** contains easy to build, tested and proven construction projects of every description.

**SPECIAL**—in this issue—the best in communications projects with extra emphasis on low-cost receivers you can build. For Hams, CBers, SWLers, experimenters and just anybody who enjoys listening to radio.

**FOOLPROOF DESIGN! EASY CONSTRUCTION!** Each construction project has been carefully researched and tested by experts. Each article is complete with theory, construction tips, parts lists, diagrams and photos.

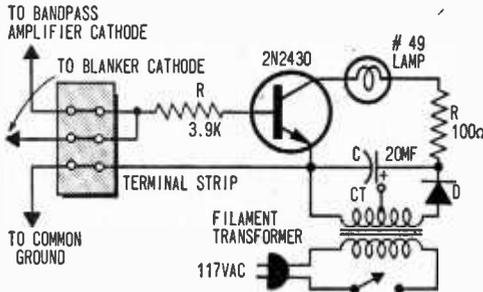
**RESERVE YOUR COPY NOW!**

**ELECTRONICS HOBBYIST**  
229 Park Ave. South / N.Y., N.Y. 10003 RTV-10  
Please reserve my copy of the Fall-Winter 1968 Electronics Hobbyist. Enclosed is \$1.25, which includes postage and handling.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



burst. This provides forward bias on the transistor, causing the lamp to glow.

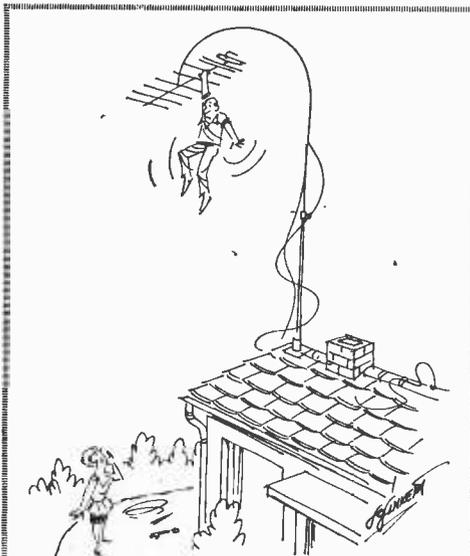


### Respect for the Aged

I have recently acquired an old Howard radio made in Chicago. For tubes it has three type 26 and a T227 plus rectifier. The last patent is April 1, 1924. The serial number must be 10271-No. 7 and it's called a Neurodyne. It also has a battery eliminator. I wonder if you could tell me its age and approximate value. It works and is in excellent condition.

—F. J., Sterling, Ill.

Vintage 1928. Value—whatever the junk man will pay for iron and copper. Possibly some radio-TV store would like it for a publicity gag. Don't dump it tomorrow though—we'll probably have someone write in because they always wanted one exactly like their Aunt Tillie's.



"No luck so far, dear! The TV man is on vacation, the fire engine just went out on an alarm, the rescue squad is delivering a baby, none of the doctors I phoned make house calls and supper is getting cold."

# FREE



WRITE FOR YOUR FREE COPY TODAY

BURSTEIN-APPLEBEE CO., DEPT. RTVV  
3199 MERCIER ST., K. C., MO. 64111

NAME \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

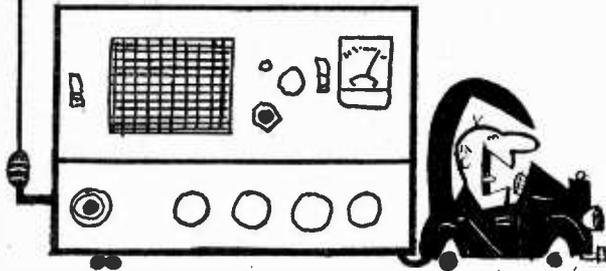
## Keep up to date with SCIENCE & MECHANICS

Science & Mechanics—the only magazine that keeps you right up to date on developments in space technology, weapons, automobiles, medicine, boats, planes, tools, new products, and exciting world events.

Keep up to date. Make sure of your home delivered copy by returning the coupon today.

SCIENCE & MECHANICS RTV-10  
229 Park Ave. S., N. Y., N. Y. 10003  
12 issues \$4; 24 issues \$8; 36 issues \$12. (Foreign: Add \$1 a year.)  
Please enter my \_\_\_\_\_ year(s) subscription.  
 I enclose \$ \_\_\_\_\_  Bill me.  
Name \_\_\_\_\_  
Address \_\_\_\_\_ (Please Print)  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

# CB RIGS & RIGMAROLE



a  
what's  
new  
product  
column  
that's  
fun  
to  
read

■ Safari, so good! Yup, you won't want to miss this sleeper, even though it's a good *Knight*. Why we mean the all-new, all-transistor *Knight-kit Safari IV*. It's a compact 12-channel, 5-watter which slips quietly 'neath any dashboard to do its job. Or, you may want to use it on your desk or bookshelf to dress up your base station. Dress-up because there are a minimum of knobs, switches, dials, gongs, and whistles on this set—it's made *not* to look like master control at NBC or CBS. The little lady will probably dig it the most for this reason.

Anybody (even the clumsiest clod—that's *you?* Oops! Sorry about that) can build this kit since it's supplied with highly detailed step-by-step pictorial instructions. Many of the circuits which would normally give a builder trouble have been pre-wired for you.

The receiver has a 1.5  $\mu$ V sensitivity rating,

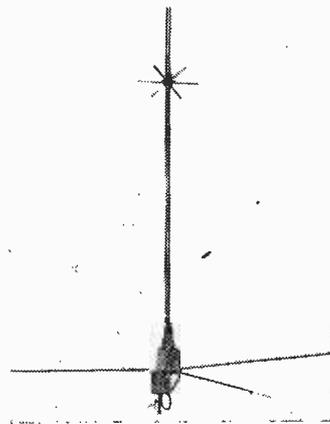


All right, guys, stand back! What has the Safari IV got that draws a mob every time.

4 kHz selectivity (6 dB down for 10 mW input).

All of this and a Channel 9 crystal, too, for only \$79.95 (there goes that nickel less again for you budget-minded operators). The *Knight-kit Safari IV* comes from *Allied Radio*, 100 North Western Ave., Chicago, Ill. 60680.

**Mosleying Around.** Mosley Electronics, 4610 N. Lindbergh Blvd., Bridgeton, Mo. 63042, an-



Mosley Marine CB Antenna

ounces a marine CB antenna called the Channel Cat. This eliminates the bothersome need for radials or other miserable ground systems required for boat installations of radio gear.

The antenna is 8-feet long and is made of stainless steel. It loads through a water proof coil mounted in a heavy-duty fold-over hinge.

What with new marinas monitoring CB each day, there just isn't any possible excuse for you  
(Continued on page 28)

# World's greatest hear-ins.

1968  
High Fidelity  
Music Shows

New York  
Sept. 19 thru Sept. 22  
Statler Hilton

Watch your local  
newspaper for  
show schedules.

San Francisco  
Oct. 31 thru Nov. 3  
Civic Auditorium

Latest High Fidelity Components

Complete seminar  
program for  
all interests.

Meet and talk with the experts

Exciting sound demonstrations.



The World  
of the  
"Solid State"

## CB RIGS & RIGMAROLE

to put a CB rig on the little ol' Lulu Belle.

Mosley will send you reams of data on this and their other fine antennas if you contact them. Tell 'em we sent you.

**Here, Fido!** You may not be able to teach an old dog new tricks, but you sure can teach CBers *New-Tronics*, especially when they came up with something as jazzy as their new Pro-27-SD antenna.

Just in case you're from squaresville, Bunky, that "SD" tacked on the tail end of the model number stands for Super Deluxe. In this case, it means ease of getting on the air through the use of a telescoping mast (no mass of parts to sort through and build). It means a moisture shield over the base insulator to keep the moisture out and the electrons in for a better SWR. Top this off with a .64 electrical wavelength for the *l'il darlin'* and you got a whing-ding of a base station antenna which is guaranteed to fling your voice through hill and vale.

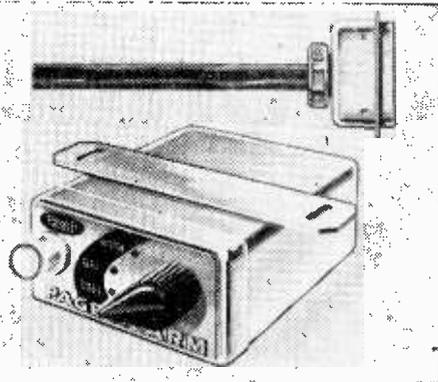
Want more information on this \$40 (actually \$39.95, but let's not quibble about pennies) wonder? Drop a note to *New-Tronics Corp.*, 3455 Vega Avenue, Cleveland 13, Ohio.

**A Page of History.** A brand new call decoder unit, the *Page Alarm 2P1Q*, has been brought out by *Reach Electronics* of Airport Industrial Park, Lexington, Nebraska.

What this thing is is (yuck, what English!) a step towards making your CB communications a bit less bothersome. At least it will keep your mobile rig stony silent until a special coded tone sequence is sent out by your own base station. This tone will activate your rig—nothing else will, not even the strongest signal on the band. You won't hear the chatter on a channel for hours on end.

The set can be adjusted to some 200 different codes so there is virtually no chance of somebody else's unit turning on your receiver by accident. In fact, the base station can put each of his mobile units on a different tone code and then "turn on" each one individually without disturbing the entire network with a message intended for only 1 unit.

If the driver of the mobile is away from the set when the call to him goes out, the vehicle's horn can be made to give a short "beep" to rouse him from his coffee break. Then, if



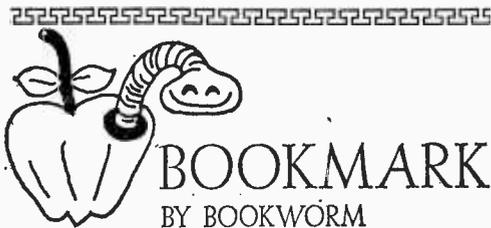
Page CB Alarm 2P1Q

desired, the device can even be by-passed and the rig can be set to function as any regular CB rig would.

It's really a pretty nice thing and has many, many, applications. It can be wired into any CB rig. Since it has no moving parts and is all-transistorized there should be a minimum of problems with servicing the thing. Sure, the switches move, but they're hermetically sealed to protect them. ■

**No, It's Not Too Late!** Okay, okay! So some of you jokers missed the 1968 CB BUYERS' GUIDE. But as the old saying goes, "Better late than never!" So, if you want your copy, order it now before the supply evaporates. Send \$1.25 to CB BUYERS' GUIDE, 229 Park Ave., So., New York, N. Y. 10003 and we'll rush your copy in a plain wrapper. No one but you will be the first to see our bikinied cover girl and valuable CB transceiver test reports. Go man! ■





## BOOKMARK BY BOOKWORM



**It Started With Ohm.** Practicing engineers and technicians, students, and electronic hobbyists have long needed a convenient reference to the *methods and devices* used in electronic measurements. This need is answered in the new, illustrated sourcebook, A. C. J. Beeren's *Measuring Methods and Devices in Electronics*. Concentrating on the why and how of measurements, the text fully covers the general procedures which are a day-to-day necessity for the electronics engineer and technician.



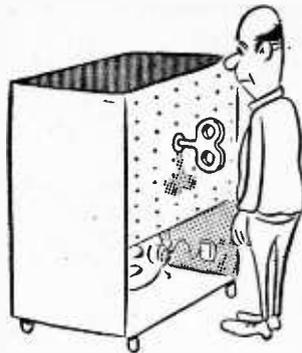
The text describes the operation and properties of the various types of measuring instruments: amplifier-voltmeters, the cathode ray oscilloscope, signal generators, impedance measuring bridges, frequency meters, etc. Numerous methods of measurement are discussed, and then compared to insure that the reader clearly understands the techniques involved in measuring current, voltage, power, frequency, resistance, capacitance and inductance. Also included are techniques for making measurements on passive and active networks, and on tubes and transistors.

Another practical and realistic feature of this new sourcebook is the guidance provided for determining the limits of accuracy. This part of the text explains sources of error, both human and mechanical.

Get your copy of *Measuring Methods and Devices in Electronics* today at your local bookstore or direct from the publisher—Hayden Book Company, Inc., 116 West 14th Street, New York, N. Y. 10011.

**Radio on the Go!** With the recent emergence of mobile radio as an important means of commercial and emergency communications, the need has been felt for a concise, comprehensive guide to the equipment and practices in the area.

# Can't find the key to electronics?



—then get your electronics cool with this introductory offer to the two leading electronics magazines! Use coupon:

DAVIS PUBLICATIONS, INC. RTV-10  
229 Park Ave. S./New York, N.Y. 10003

Yes! I want to find the key to electronics.

■ Begin my subscription to both **RADIO-TV EXPERIMENTER** and **ELEMENTARY ELECTRONICS** at your special low-subscription rate of **\$7.00**

Bill me later.  Check enclosed.

Name .....

Address .....

City ..... State..... Zip.....

(Outside U.S.A. & Canada add \$1.50 pstge. & hndlg.)

—Now, both of these fine magazines will be delivered to you at the special subscription rate of just **\$7.00** . . . save \$2 from newsstand price.



## ELEMENTARY ELECTRONICS

The magazine that serves up electronics theory in pleasant spoonfuls and reinforces the knowledge you gain with exciting and useful projects.

## RADIO-TV EXPERIMENTER

The magazine dedicated to the hobbyist—the man who wants to obtain a fuller and broader knowledge of electronics through the applications of his hobby.





Soft cover  
210 pages  
\$4.50

**Guide to Mobile Radio** by Leo G. Sands (our "Ask Me Another" expert) fulfills this need. The author defines mobile radio as two-way radio communications operated for private or commercial purposes, but not used by amateurs. He covers one- and two-way systems, industrial and business radio, railroad radio, right-of-way radio systems, systems used by police and fire departments, common-carrier systems, mobile relay systems, integrated communications systems, and frequencies available. It includes information on the different types of equipment available, including its installation, servicing, and maintenance, and discusses power supplies, antenna systems, remote control, portable equipment, selective calling, licensing, and field surveys.

It's a great book if you're on the go, so why not pick up a copy. Write to Chilton Book Co., 401 Walnut St., Philadelphia, Pa. 19106. ■

📖 **Multiple Audio.** Many readers of the ol' Bookworm's column doubtless would like to get better sound from their audio system, but they don't want to go broke doing it.

For them, *101 Easy Audio Projects*, by Robert M. Brown and Tom Kneitel, tells of a hobby that is fun, yet requires a minimum cash outlay. Robert M. Brown and Tom Kneitel are no strangers to RADIO-TV EXPERIMENTER. Aside from having books reviewed previously in this column, both authors have graced the pages of this magazine with bylined articles.

*101 Easy Audio Projects* contains complete instructions for building 101 simple, inexpensive audio projects—using junkbox parts salvaged



Soft cover  
168 pages  
\$3.25

from old radio and television chassis! Test equipment, audio amplifiers, AM and FM tuners, reverb units, eavesdropping amplifiers, time-delay control boxes, and hearing aids are just a few of the many projects. Because junkbox parts are used, the projects can be built for a fraction of their cost new. Many of them can be completed in just one evening. What's more, the reader not only will have fun building the projects, but will learn basic electronics painlessly.

Copies of this book are available from electronics parts distributors and bookstores throughout the country, or from the publisher, Howard W. Sams & Co., Inc., 4300 West 62nd Street, Indianapolis, Ind. 46268. ■

📖 **Test Gear Roundup.** Go into any service shop, and you are likely to find a wide assortment of test equipment (and this ol' Bookworm waiting for his TV to be fixed). These test instruments may be grouped into broad categories: ammeters, ohmmeters, voltmeters, wattmeters, oscilloscopes, signal generators, and numerous component testers. Each has been designed to meet specific needs of the industry.



Soft cover  
192 pages  
\$4.25

These instruments are covered in a new book, *Understanding Electronic Test Equipment*, by Joseph A. Risse. The text is devoted to the many testing, measuring, and indicating devices that have been developed for the electronics industry. Examples of typical instruments in each category are discussed, together with those that deviate from the normal. Operating principles, functions, and applications are detailed to provide an in-depth treatment of what makes the instruments work. With this information the reader can better understand, make better use of, and even calibrate his test equipment after repairing it. The latest solid-state devices are included in detail. Schematic diagrams and drawings are provided, with photographs of several typical instruments.

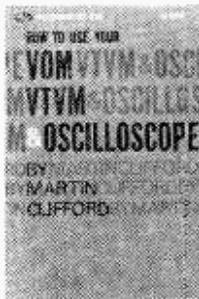
The book is aimed toward the service technician. However, students, technicians, and engineers will find the information invaluable. Copies are available from electronics parts distributors and bookstores throughout the country, or direct from the publisher, Howard W.

Sams & Co., Inc., 4300 West 62nd Street Indianapolis, Ind. 46268. ■

📖 **The Big Three.** Here's a brand-new book that tells how to get more out of these three basic pieces of electronic test equipment—an ideal guide for anyone who wants to brush up on the VOM, VTVM, and oscilloscope. Naturally, its title is *How to Use Your VOM, VTVM and Oscilloscope*. Whether the reader wants to know more about how these instruments work, or how to use them in everyday applications, this book contains the answers. Moreover, it will be of tremendous value in helping the reader select the instruments best suited to his individual needs.

Part I deals with the volt-ohm-milliammeter—that's VOM, folks. How it works, even down to the meter movement, range multipliers, linear, non-linear, and logarithmic scales, VOM types, etc., are explained in detail. Included are general guidelines for using a VOM, including many uses and how to care for the instrument.

Part II is devoted to complete description of VTVM types, including transistorized units and



Soft cover  
192 pages  
\$3.95

their various applications in troubleshooting a broad range of circuits from simple to complex. Part II goes into servicing with the VTVM, pointing out applications where the VTVM is unique as a measuring device.

Part III discusses that eye-ball instrument, the oscilloscope. If the reader has never completely understood this instrument, he will after reading this book. He will acquire a thorough understanding of the basic and specialized scope circuits. Even if he has been using a scope for years, he will learn new applications, and perhaps truly understand the intricacies of scope measurements for the first time.

Written in easy-to-understand language, *How to Use Your VOM, VTVM and Oscilloscope* is illustrated with scores of drawings, schematics, and troubleshooting charts. You can get your copy by writing directly to the publisher, Tab Books, Blue Ridge Summit, Pa. 17214. ■

**Whatta Ya Hear?** What with monitoring the emergency service (police, fire, etc.) bands be-

coming so popular these days, it seemed that the next logical step would be for someone to bring out directories of the stations to be heard in various areas. Well, that's what is now available in special bulletin, newsletter format; each bulletin covers a specific metropolitan area and gives the call signs, locations, and frequencies of all emergency service dispatchers for a major city and all of its surrounding communities and counties. Each lists hundreds of stations and will give you the key to where all of the action is taking place. At the present time the following areas are available: New York city area, Philadelphia area, Chicago area, Detroit area, San Francisco area, Boston area, and the police stations in the entire southern California region. Other areas are in preparation. Emergency Radio Service Monitoring Bulletins are published by Communications Research Bureau, Box 56, Commack, N. Y. 11725. \$1.00 per city area.

📖 **The Dam Broke.** We've got to admit it—we just don't have enough space to include all the ol' Bookworm reviews in our issues of RADIO-TV EXPERIMENTER. Some very good reviews have been piling up at our offices and rather than let the pile get any higher, we decided to *mini-review* several of them. Although the space allotted for the books below is small, the texts are worthy of your consideration—read on, carefully.

● *Easy Way To Service Radio Receivers* by Leo G. Sands. Tab Books, Blue Ridge Summit, Pa. 17214. Cloth \$6.95; paper \$3.95; 176 pp.

This book will enable the reader to quickly diagnose and repair any standard AM broadcast receiver. Over 100 circuit diagrams and photos.

● *abc's of Ham Radio*, by Howard S. Pyle. Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis, Ind. 46206. Paper, \$2.50. 144 pp.

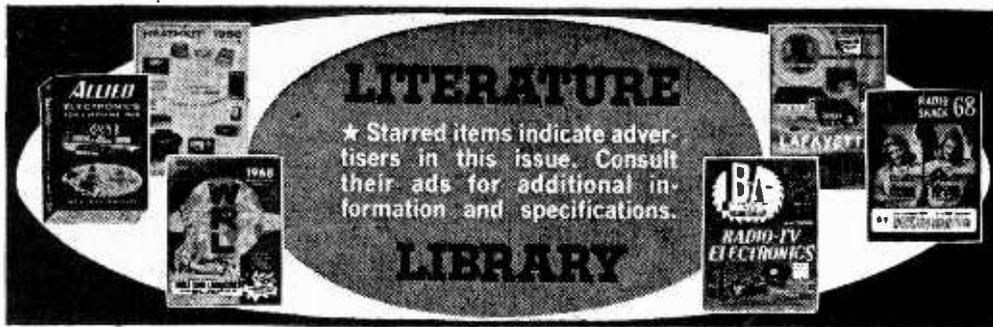
This is the third edition, with all the latest FCC regulations, how to apply for a license, what to expect in the exam, many other hints on becoming a full-fledged ham by a long-time operator.

● *How To Use Signal Generators in the Laboratory*, by John D. Lenk. John F. Rider, 116 W. 14th St., New York, N. Y. 10011. Paper, \$3.25. 109 pp.

Covers a variety of test procedures using the signal generator as a basic tool. Serves as advanced textbook or on-the-job reference.

● *Handbook of Semiconductor Circuits*. Tab Books, Blue Ridge Summit, Pa. 17214. Cloth, \$7.95. 448 pp. Original publisher, U.S. Government.

There are 124 examples of standard transistor circuits, complete with operational data for amplifiers, oscillators, logic and switching circuits, power supplies, and various nonlinear circuits; each with design philosophy section. ■



## CB—AMATEUR RADIO— SHORTWAVE RADIO

102. No never mind what brand your CB set is, *Sentry* has the crystal you need. Same goes for ham rigs. Seeing is believing, so get *Sentry's* catalog today. Circle 102.

130. Bone up on the CB with the latest *Sams* books. Titles range from "ABC's of CB Radio" to "99 Ways to Improve your CB Radio." So Circle 130 and get the facts from *Sams*.

107. Want a deluxe CB base station? Then get the specs on *Tram's* all new Titan 11—it's the SSB/AM rig you've been waiting for!

101. If it's a CB product, chances are *International Crystal* has it listed in their colorful catalog. Whether kit or wired, accessory or test gear, this CB-oriented company can be relied on to fill the bill.

96. Get your copy of *E. F. Johnson's* new booklet, "Can *Johnson 2-Way Radio Help Me?*" Aimed for business use, the booklet is useful to everyone.

★129. Boy, oh boy—if you want to read about a flock of CB winners, get your hands on *Lafayette's* new 1968 catalog. *Lafayette* has CB sets for all pocketbooks.

103. *Squires-Sanders* would like you to know about their CB transceivers, the "23'er" and the new "S5S." Also, CB accessories that add versatility to their 5-watters.

46. A long-time builder of ham equipment, *Hallcrafters* will send you lots of info on ham, CB and commercial radio equipment.

122. Discover the most inexpensive CB mobile, Citi-Fone 11 by *Multi-Elmac Company*. Get the facts plus other CB product data before you buy.

116. Pep-up your CB rig's performance with *Turner's* M+2 mobile microphone. Get complete spec sheets and data on other *Turner* mikes.

48. *Hy-Gain's* new CB antenna catalog is packed full of useful information and product data that every CBER should know. Get a copy.

111. Get the scoop on *Versa-Tronics'* Versa-Tenna with instant magnetic mounting. Antenna models available for CBers, hams and mobile units from 27 MHz to 1000 MHz.

45. CBers—get your copy of *World Radio Labs* 1968-69 CB Catalog No. 2. You've got to see to believe *WLR's* special CB bonus offers. This is the catalog for big CB buyers.

50. Get your copy of *Amphenol's* "User's Guide to CB Radio"—18 pages packed with CB know-how and chit-chat. Also, *Amphenol* will let you know what's new on their product line.

115. Get the full story on *Polytronics Laboratories'* latest CB entry Poly-Pup. Full 5-watts, great for mobile, base or portable use. Works on 12 VDC or 117 VAC.

100. You can get increased CB range and clarity using the "Cobra-23" transceiver with speech compressor—receiver sensitivity is excellent. Catalog sheet will be mailed by *B&K Division of Dynascan Corporation*.

54. A catalog for CBers, hams and experimenters, with outstanding values. Terrific buys on *Grove Electronics'* antennas, mikes and accessories.

## ELECTRONIC PARTS

★135. Get with ICs! *RCA's* new integrated Circuit Experimenter's Kit KD2112 is the first of its kind and should be a part of your next project. Get all the facts direct from *RCA*. Circle 135.

★140. How cheap is cheap? Well, take a gander at *Cornell Electronics'* latest catalog. It's packed with bargains like 6W4, 12AX7, 5U4, etc., tubes for only 33¢. You've got to see this one to believe it!

132. Discover 18 new and different professional-quality amplifiers, tuners, and preamps completely assembled on PC-boards now offered by *Amperex*. Prices will amaze you!

★1. *Allied's* catalog is so widely used as a reference book, that it's regarded as a standard by people in the electronics industry. Don't you have the 1968 *Allied Radio* catalog? The surprising thing is that it's free!

★2. The new 1968 Edition of *Lafayette's* catalog features sections on stereo hi-fi, CB, ham gear, test equipment, cameras, optics, tools and much more. Get your copy today.

★8. Get it now! *John Meshna, Jr.'s* new 46-page catalog is jam packed with surplus buys—surplus radios, new parts, computer parts, etc.

23. No electronics bargain hunter should be caught without the 1968 copy of *Radio Shack's* catalog. Some equipment and kit offers are so low, they look like misprints. Buying is believing.

★5. *Edmund Scientific's* new catalog contains over 4000 products that embrace many interests and fields. It's a 148-page buyers' guide for Science Fair fans.

★106. With 70 million TV and 240 million radios somebody somewhere will need a vacuum tube replacement at the rate of one a second! Get *Universal Tube Co.'s* Troubleshooting Chart and facts on their \$1 flat rate per tube.

★4. *Volson's* catalog is a multi-colored newspaper that's packed with more bargains than a phone book has names. Don't believe us? Get a copy.

★7. Before you build from scratch check the *Fair Radio Sales* latest catalog for electronic gear that can be modified to your needs. *Fair* way to save cash.

★6. Bargains galore, that's what's in store! *Poly-Paks Co.* will send you their latest eight-page flyer listing the latest in available merchandise, including a giant \$1 special sale.

10. *Burstein-Applebee* offers a new giant catalog containing 100s of big pages crammed with savings including hundreds of bargains on hi-fi kits, power tools, tubes, and parts.

★11. Now available from *EDI (Electronic Distributors, Inc.)*: a catalog containing hundreds of electronic items. *EDI* will be happy to place you on their mailing list.

120. *Tab's* new electronics parts catalog is now off the press and you're welcome to have a copy. Some of *Tab's* bargains and odd-ball items are unbelievable offers.

## ELECTRONIC PRODUCTS

★42. Here's colorful 108-page catalog containing a wide assortment of electronic kits. You'll find something for any interest, any budget. And *Heath Co.* will happily send you a copy.

★44. Kit Builder? Like wired products? *EICO's* 1968 catalog takes care of both breeds of buyers. 32 pages full of hi-fi, test, CB, ham, SWL, automotive and hobby kits and products—do you have a copy?

128. If you can hammer a nail and miss your thumb, you can assemble a *Schober* organ. To prove the point, *Schober* will send you their catalog and a 7-in. disc recording.

126. *Delta Products* new capacitive discharge ignition system in kit form will pep up your car. Designed to cut gas costs and reduce point and plug wear. Get *Delta's* details in full-color literature.

66. Try instant lettering to mark control panels and component parts. *Datapak's* booklets and sample show this easy dry transfer method.

109. *Seco* offers a line of specialized and standard test equipment that's ideal for the home experimenter and pro. Get specs and prices today.

## TOOLS

★78. Select the right tool for easy, speedy driving of Bristol multiple spline and Allen hex-socket screws from *Xcelite's* compact interchangeable sets. Write for Bulletin N365 today!

118. Secure coax cables, speaker wires, phone wires, etc., with Arrow staple gun tackers. 3 models for wires and cables from 3/16" to 1/4" dia. Get fact-full Arrow literature.

**SCHOOLS AND EDUCATIONAL**

★74. Get two free books—"How to Get a Commercial FCC License" and "How to Succeed in Electronics"—from Cleveland Institute of Electronics. Begin your future today!

★136. "Power Engineering," a new 32-page, illustrated brochure by ICS (International Correspondence Schools) describes seven ICS Power Engineering courses that may open a new career for you. Get a copy today!

114. Prepare for tomorrow by studying at home with Technical Training International. Get the facts today on how you can step up in your present job.

★137. For success in communications, broadcasting and electronics get your First Class FCC license and Grantham School of Electronics will show you how. Interesting booklets are yours for the asking.

138. For a complete rundown on curriculum, lesson outlines, and full details from a leading electronic school, ask for this brochure from the Indiana Home Study Institute.

105. Get the low-down on the latest in educational electronic kits from Trans-Tek. Build light dimmers, amplifiers, metronomes, and many more. Trans-Tek helps you to learn while building.

★3. Get all the facts on Progressive Edu-Kits Home Radio Course. Build 20 radios and electronic circuits; parts, tools and instructions come with course.

**HI-FI/AUDIO**

134. Discover PlayTape—America's newest tape cartridge and tape players. Units priced at under \$17 with cartridges at 45-disc prices. PlayTape has one of America's largest recording libraries.

139. Altec Lansing covers both ends of the audio market—microphones and loudspeaker systems. Altec supplies the facts—you do the asking. Circle 139 now!

19. Empire's new 16-page, full-color catalog features speaker systems in odd shapes for beautiful room decor. Also, rediscover Empire's quality turntable line and cartridges.

124. Now, Sonotone offers you young ideas in microphone use in their new catalog. Mikes for talk sessions, swinging combos, home recording, PA systems and many more uses.

26. Always a leader, H. H. Scott introduces a new concept in stereo console catalogs. The information-packed 1968 Stereo Guide and catalog are required reading for audio fans.

85. Write the specs for an ideal preamp and amp, and you've spelled out Dynaco's stereo 120 amp and PAS-3X preamp. So why not get all the facts from Dynacol

119. Kenwood puts it right on the line. The all-new Kenwood stereo-FM receivers are described in a colorful 16-page booklet complete with easy-to-read-and-compare spec data. Get your copy today!

131. Let Elpa send you "The Record Omnibook." It's a great buy and Elpa wants you to have it free. Your records will thank you when the mail-man delivers it.

17. Mikes, speakers, amps, receivers—you name it, Electro-Voice makes it and makes it good. Get the straight poop from E-V today.

27. 12 pages of Sherwood receivers, tuners, amplifiers, speaker systems, and cabinetry make up a colorful booklet every hi-fi bug should see.

99. Get the inside info on why Telex/Acoustech's solid-state amplifiers are the rage of the experts. Colorful brochure answers all your questions.

**TAPE RECORDERS AND TAPE**

123. Yours for the asking—Elpa's new "The Tape Recording Omnibook." 16 jam-packed pages on facts

and tips you should know about before you buy a tape recorder.

31. All the facts about Concord Electronics Corp. tape recorders are yours for the asking in a free booklet. Portable, battery operated to four-track, fully transistorized stereos cover every recording need.

32. "Everybody's Tape Recording Handbook" is the title of a booklet that Sarkes-Tarzian will send you. It's 24-pages jam-packed with info for the home recording enthusiast. Includes a valuable table of recording times for various tapes.

34. "All the Best from Sony" is an 8-page booklet describing Sony-Super-scope products—tape recorders, microphones, tape and accessories. Get a copy before you buy!

35. If you are a serious tape audiophile, you will be interested in the all new Viking/Telex line of quality tape recorders.

**HI-FI ACCESSORIES**

112. Telex would like you to know about their improved Serenata Headset—and their entire line of quality stereo headset.

104. You can't hear FM stereo unless your FM antenna can pull 'em in. Learn more and discover what's available from Finco's 6-pages "Third Dimensional Sound."

**TELEVISION**

★70. Need a new TV set? Then assemble a Heath TV kit. Heath has all sizes. B&W and color, portable and fixed. Why not build the next TV you watch?

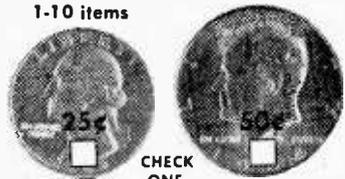
127. National Schols will help you learn all about color TV as you assemble their 25-in. color TV kit. Just one of National's many exciting and rewarding courses.

91. Interesting, helpful brochures describing the TV antenna discovery of the decade—the log periodic antenna for VHF and UHF-TV, and FM-stereo. Get it from JFD Electronics Corporation.

**RADIO-TV EXPERIMENTER**  
 Dept. 1068  
 229 Park Avenue South  
 New York, N.Y. 10003

Please arrange to have the literature whose numbers I have circled sent to me as soon as possible. I am enclosing 25¢ for 1 to 10 items; 50¢ for 11 to 20 items to cover handling. No stamps, please.

1-10 items      11-20 items



CHECK ONE

maximum number of items = 20

Indicate total number of booklets requested

1	2	3	4	5	6	7	8	10	11
17	19	23	26	27	31	32	34	35	42
44	45	46	48	50	54	66	70	74	78
85	91	96	99	100	101	102	103	104	105
106	107	109	111	112	114	115	116	118	119
120	122	123	124	126	127	128	129	130	131
132	134	135	136	137	138	139	140		

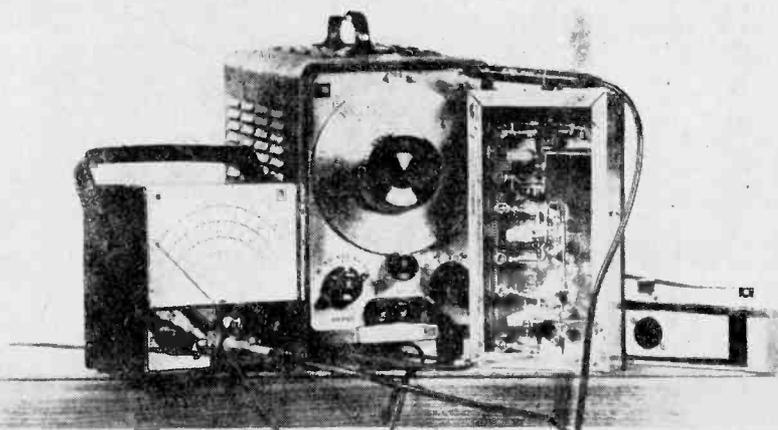
NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

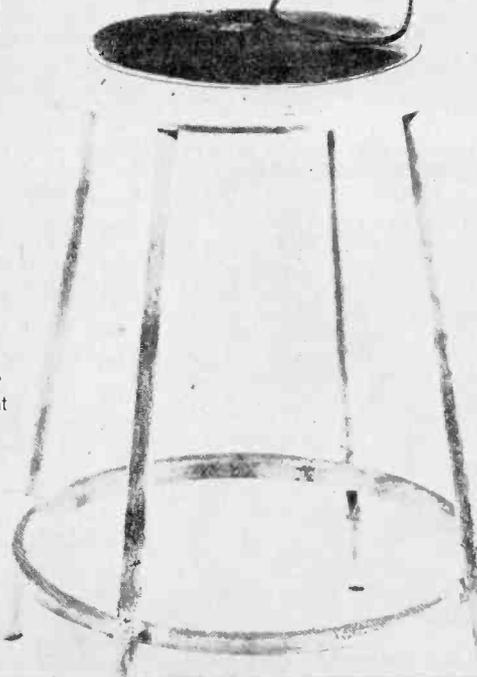
STATE \_\_\_\_\_ ZIP \_\_\_\_\_

# SOMEONE SHOULD DEVELOP AN EASY WAY TO LEARN ELECTRONICS AT HOME



## RCA INSTITUTES DID!

Here is a whole new approach to learning electronics at home! RCA Institutes, one of the nations' largest schools devoted to electronics, has developed a faster, easier way for you to gain the skills and the knowledge you need for the career of your choice. Here for the first time, is a student-proved, scientifically designed way to learn. If you have had any doubts in the past about home training in electronics — if you have hesitated because you thought you might not be able to keep up—or that electronics was too complicated to learn—here is your answer! Read how RCA Institutes has revolutionized its entire home training ideas!



## NEW CAREER PROGRAMS BEGIN WITH "AUTOTEXT" INSTRUCTION METHOD!

Start to learn the field of your choice immediately!

No previous training or experience in electronics needed!

With this new revolutionized method of home training you pick the career of your choice—and RCA Institutes trains you for it. RCA's Career Programs assure you that everything you learn will help you go directly to the field that you have chosen! No wasted time learning things you'll never use on the job! The Career Program you choose is especially designed to get you into that career in the fastest, easiest possible way!

And each Career Program starts with the amazing "AUTOTEXT" Programmed Instruction Method—the new, faster way to learn that's almost automatic! "AUTOTEXT" helps even those who have had trouble with conventional home training methods in the past. This is the "Space Age" way to learn everything you need to know with the least amount of time and effort.

### CHOOSE A CAREER PROGRAM NOW

Your next stop may be the job of your choice. Each one of these RCA Institutes Career Programs is a complete unit. It contains the know-how you need to step into a profitable career. Here are the names of the programs and the kinds of jobs they train you for. Which one is for you?

**Television Servicing.** Prepares you for a career as a TV Technician/Serviceman; Master Antenna Systems Technician; TV Laboratory Technician; Educational TV Technician.

**FCC License Preparation.** For those who want to become TV Station Engineers, Communications Laboratory Technicians, or Field Engineers.

**Automation Electronics.** Gets you ready to be an Automation Electronics Technician; Manufacturer's Representative; Industrial Electronics Technician.

**Automatic Controls.** Prepares you to be an Automatic Controls Electronics Technician; Industrial Laboratory Technician; Maintenance Technician; Field Engineer.

**Digital Techniques.** For a career as a Digital Techniques Electronics Technician; Industrial Electronics Technician; Industrial Laboratory Technician.

**Telecommunications.** For a job as TV Station Engineer, Mobile Communications Technician, Marine Radio Technician.

**Industrial Electronics.** For jobs as Industrial Electronics Technicians; Field Engineers; Maintenance Technicians; Industrial Laboratory Technicians.

**Nuclear Instrumentation.** For those who want careers as Nuclear Instrumentation Electronics Technicians; Industrial Laboratory Technicians; Industrial Electronics Technicians.

**Solid State Electronics.** Become a specialist in the Semiconductor Field.

**Electronics Drafting.** Junior Draftsman, Junior Technical Illustrator; Parts Inspector; Design Draftsman Trainee Chartist.

### SEPARATE COURSES

In addition, in order to meet specific needs, RCA Institutes offers a wide variety of separate courses which may be taken independently of the Career Programs, on all subjects from Electronics Fundamentals to Computer Programming. Complete information will be sent with your other materials.

### LIBERAL TUITION PLAN

RCA offers you a unique Liberal Tuition Plan—your most economical way to learn. You pay for lessons only as you order them. No long term contracts. If you wish to stop your training for any reason, you may do so and not owe one cent until you resume the course.

### VALUABLE EQUIPMENT

You receive valuable equipment to keep and use on the job—and you never have to take apart one piece to build another. **New—Programmed Electronics Breadboard.** You now will receive a scientifically programmed electronic bread-

board with your study material. This breadboard provides limitless experimentation with basic electrical and electronic circuits involving vacuum tubes and transistors and includes the construction of a working signal generator and superheterodyne AM Receiver.

**Bonus From RCA—Multimeter and Oscilloscope Kits.** At no additional cost, you will receive with every RCA Institutes Career Program the instruments and kit material you need to build a multimeter and oscilloscope. The inclusion of both these kits is an RCA extra.

### CLASSROOM TRAINING ALSO AVAILABLE

RCA Institutes maintains one of the largest schools of its kind in New York City where classroom and laboratory training is available in day or evening sessions. You may be admitted without any previous technical training; preparatory courses are available if you haven't completed high school. Coeducational classes start four times a year.

### JOB PLACEMENT SERVICE, TOO!

Companies like IBM, Bell Telephone Labs, GE, RCA, Xerox, Honeywell, Grumman, Westinghouse, and major Radio and TV Networks have regularly employed graduates through RCA Institutes' own placement service.

SEND ATTACHED POSTAGE PAID CARD FOR COMPLETE INFORMATION, NO OBLIGATION. NO SALESMAN WILL CALL.

ALL RCA INSTITUTES COURSES  
AVAILABLE UNDER NEW GI BILL.

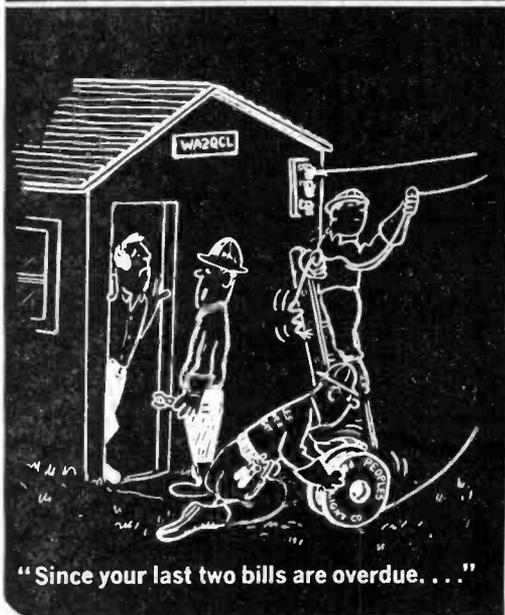
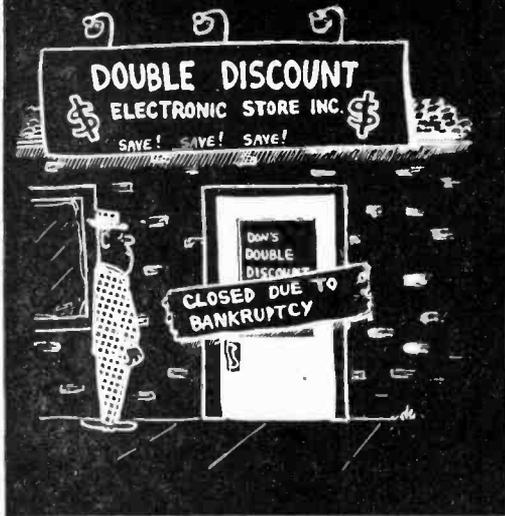
Accredited Member  
National Home Study Council

RCA INSTITUTES, Inc., Dept. RX-08  
320 West 31st St., New York, N. Y. 10001

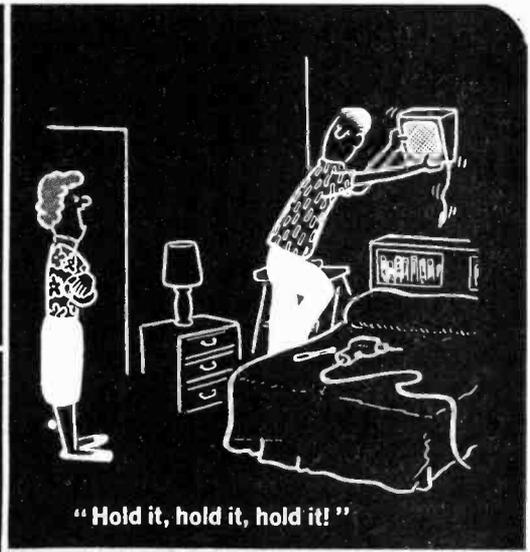
# RCA

AN  
INTRODUCTION TO  
**RESISTANCE**

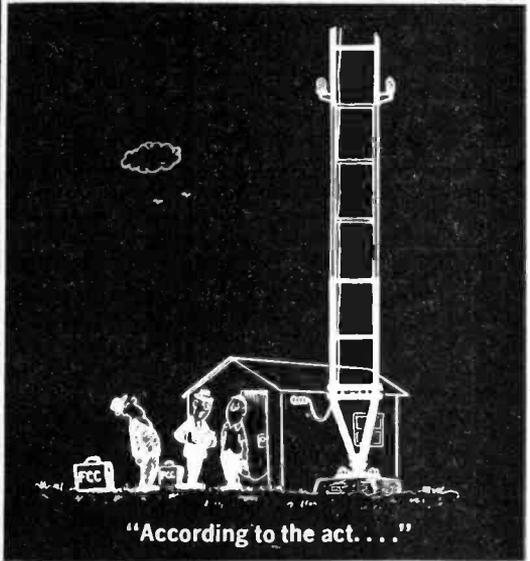
by Jack Schmidt



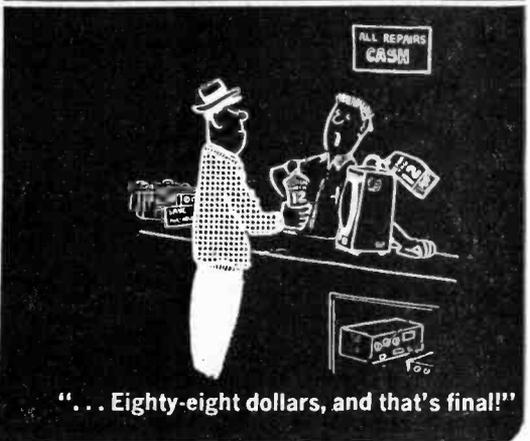
"Since your last two bills are overdue..."



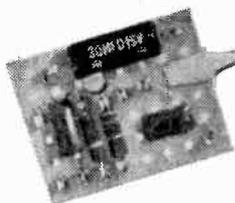
"Hold it, hold it, hold it!"



"According to the act..."



"... Eighty-eight dollars, and that's final!"



# CB BAND BUSTER

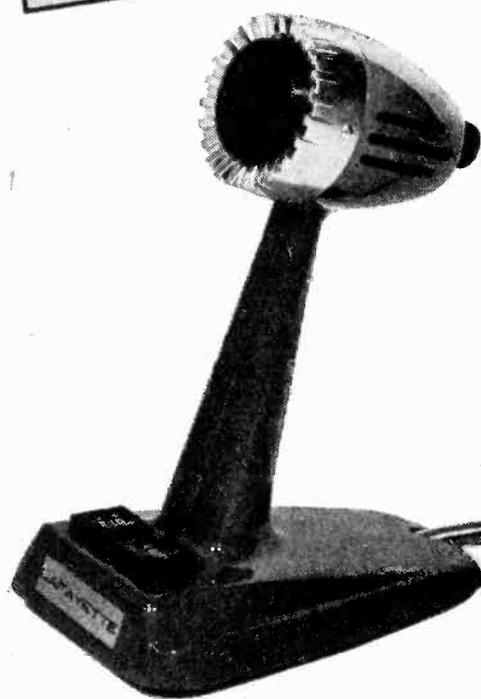
By Herb Friedman KB19457

Break the CB sound barrier  
with this booming mike preamp

□ If you think you're losing some of that precious CB power along the uncertain and sometimes sorry road leading from mike to antenna, chances are you're right! All CB transceivers have certain design characteristics built into them. Thing is, what the designers had in mind doesn't always work out when you're operating the rig.

Take this business of power, for example. Our Band-Buster is a mike pre-amplifier designed to make your signal top dog on the CB bands. It does this job handsomely by taking advantage of a couple of built-in transceiver characteristics which are flexible enough to permit Band-Buster to take over the reins and boost your talk power.

**Two Tricks.** First of all, CB transceivers are designed for *average* voice levels. The overall modulator gain is fixed so that a person speaking at an average



# CB BAND BUSTER

voice level—and at an average distance from the mike—will be able to modulate the transmitter 100%.

This is a good idea, but just who has an average voice, and what is an average mike distance? Your voice might just be somewhat weaker than average, or maybe you hold the mike 12 inches away rather than the more usual 6 inches. If this is true, your rig's modulation might never make it out of the basement.

The second factor to be considered is that nearly all modern transceivers limit modulation of the carrier to 100%. This means that even if you shout the modulation won't exceed 100% (or 90%, if that happens to be the rated maximum level).

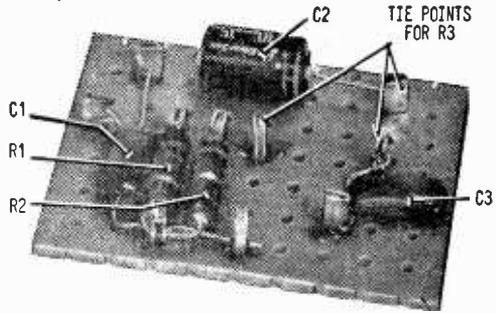
Some manufacturers make good use of this limiting feature by providing a *range boost* or DX boost circuit. This is simply additional amplification that boosts the level of modulation, while depending on the limiting feature to prevent overmodulation. In other words, more output power is obtained, but distortion is kept to a minimum.

With all this in mind, we can appreciate how the CB Band-Buster takes advantage of modern transceiver design. The mike pre-amplification increases your talk power to above average levels, while the built-in 100% modulation limit ensures that there will be no distortion of the transceiver output. Your voice will hit the front end with full force, but the unit's design will make sure that you don't overmodulate. Just turn up the volume and get all the advantages of a speech clipper!

**FET Does It.** A quick look at the schematic should convince you that your Band-Buster will do the job that you thought couldn't be done. The sock-it-to-me feature here is obviously Q1—an N-channel FET (field-effect transistor) that has a high input resistance and will therefore accept a high-impedance source like a ceramic or crystal mike.

Since the FET has an input impedance of tens of megohms, the mike's load will only be that of input resistor R1. Here R1 is 2.2 megohms, which is the usual load for a mike. However, if the mike you're using calls for a different value, R1 can be changed without affecting total performance.

Nominal gain for the Band-Buster is

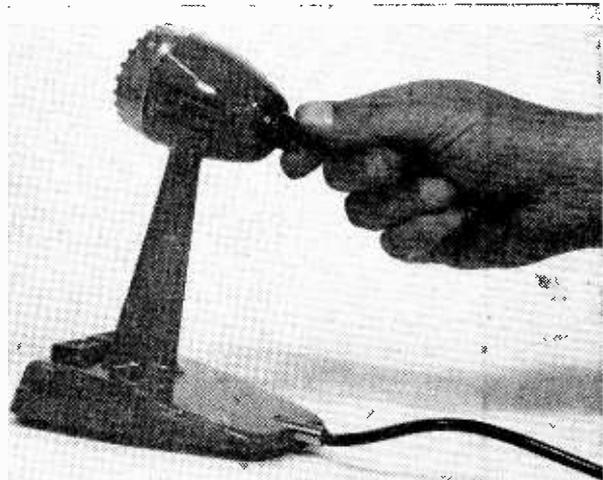


Components mount on top side of board. Capacitors C1 and C3 are flush to conserve space.

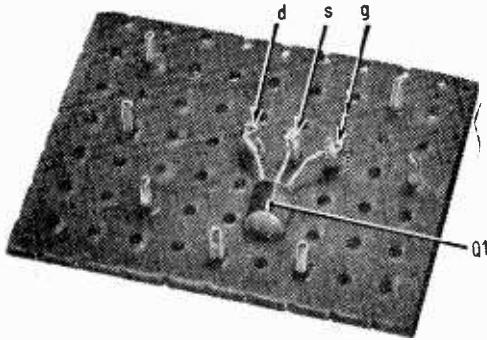
10 dB, while the frequency response is almost ruler-flat from 20 to 15,000 Hz. Even with high-output mikes, distortion is almost unmeasurable. Just make sure your transceiver's modulation is limited to 100% and you'll get all the talk power you want.

Though the preamplifier can be built into a small aluminum cabinet, it can also be installed directly in the microphone case, or even in the mike's base. Our photos show a custom installation in a good-quality CB base-station mike available from Lafayette Radio (see Parts List).

While the same installation techniques can be used with other microphones, the exact procedure will depend on the particular mike you choose. However, the perf-board assembly should be used in all instances. It's just a question of where to place the assembly and the volume control, whether it be in the microphone head or in the base.



Band-Buster's output level is set by adjusting R3—a miniature volume control with switch.

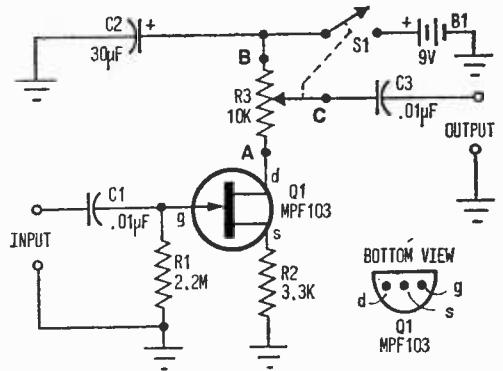


In author's model, Q1 (FET) mounts on underside of board. This side is covered with tape.

**Perf Package.** The Band-Buster assembly is wired on a 1/4 x 1 1/2-in. section of perforated wiring board. Flea clips are used as tie points. To keep the assembly as small as possible, all components must be mounted flat on one side of the board. In the author's model, the FET is mounted on the *underside* with its flat side against the board. (The cover version shows Q1 mounted on the same side with other components.)

Mount and tack-solder all topside components, then install Q1 using full-length leads. To avoid heat damage, use a heat sink (such as an alligator clip) on Q1's leads when soldering. If you're going to install the Band-Buster in the mike case, volume control R3 must be the miniature type specified. A standard potentiometer and switch will probably not fit into any ordinary case.

The volume control's connecting leads are soldered to points A, B, and C in the sche-



FET has high input resistance to match high-impedance mike. Value of R1 depends on mike.

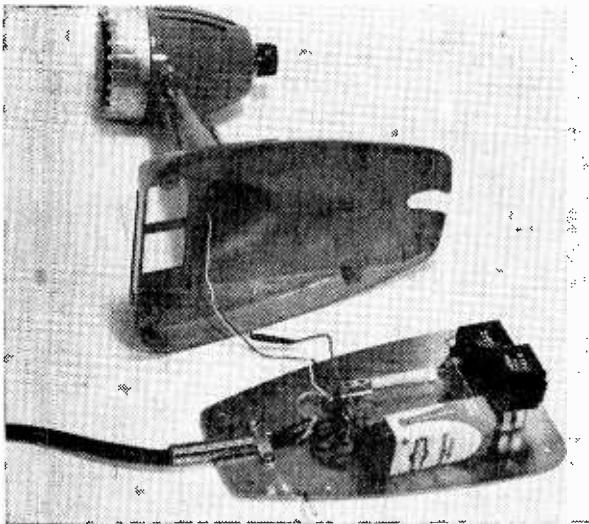
#### PARTS LIST FOR CB BAND-BUSTER

- B1—9-V battery (Burgess 2U6 or equiv.)
- C1, C3—.01-µF, 10-VDC disc capacitor
- C2—30-µF, 10-VDC electrolytic capacitor
- Q1—N-channel field-effect transistor (Motorola MPF103 or equiv.)
- R1—2,200,000-ohm, 1/2-watt 10% resistor
- R2—3300-ohm, 1/2-watt 10% resistor
- R3—10,000-ohm miniature potentiometer with spst switch (Lafayette 32H7364 or equiv.)
- S1—Spst switch (on R3)
- Misc.—High-impedance mike (Lafayette 99H-4607 or equiv.), battery connector, perf board, flea clips (Vector T28, Lafayette 19H8302 or equiv.), solder, wire, hardware, etc.

matic. Shielded connections should not be necessary as either a metal cabinet or the metal microphone case will do the job. However, if the mike's case is plastic and the Band-Buster is installed within, keep R3's leads as short as possible. Even then, it might be necessary to use shielded leads.

The photos show how the Band-Buster was installed in the Lafayette mike. First, the front of the mike was removed and the microphone element was eased out of the case. Then the two connecting leads were unsoldered (excessive heat could ruin the element, so use a small soldering iron). Be sure to note which is the hot (insulated) lead. Finally, a 1/4-in. hole was drilled in the back of the microphone case for volume control R3.

The control was then pre-wired to the perf-board assembly. The back of the perf-board (the FET side in the author's model) was covered with a layer of tape to prevent the tie points which stick through the board from shorting to the mike case. Finally, the original mike connecting leads were soldered to the Band-Buster *output* and new leads



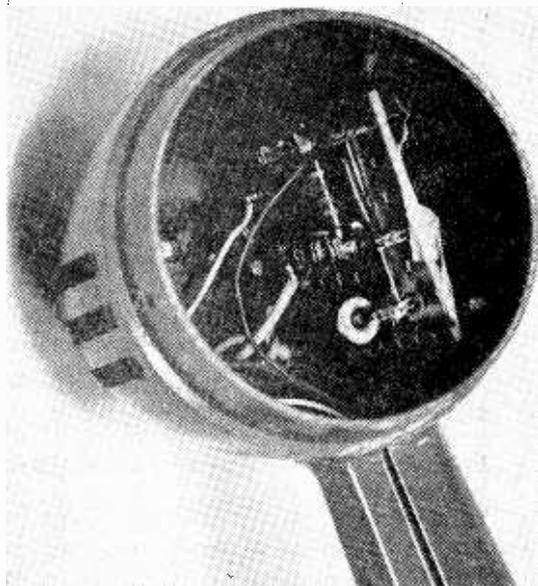
Here, battery is mounted in base of mike. You may have to tape battery to outside of case.

# CB BAND BUSTER

were connected between the mike element and the preamp *input*. The entire assembly was then eased into the case.

**Battery in Base.** The pre-wired B+ lead from S1 (on the back of R3) was fished down to the microphone base, where it was connected to battery B1's positive terminal. The battery's negative terminal was connected to the case to act as the system ground for both the mike and the switching leads. It required quite a bit of customizing to fit the battery into the base. We suggest that if the battery doesn't go into the base easily, you run the battery connection out of the unit and tape the battery to the case. You should get many months of service from your battery as the Band-Buster uses only 500  $\mu$ A.

Best results are obtained if a modulation meter is used when you are adjusting or using the Band-Buster. First place the microphone at a comfortable working distance, then advance R3 (turning power *on*) until your rig peaks at 100% modulation. If your transceiver has built-in limiting you can give a little extra gain to obtain some of the bene-

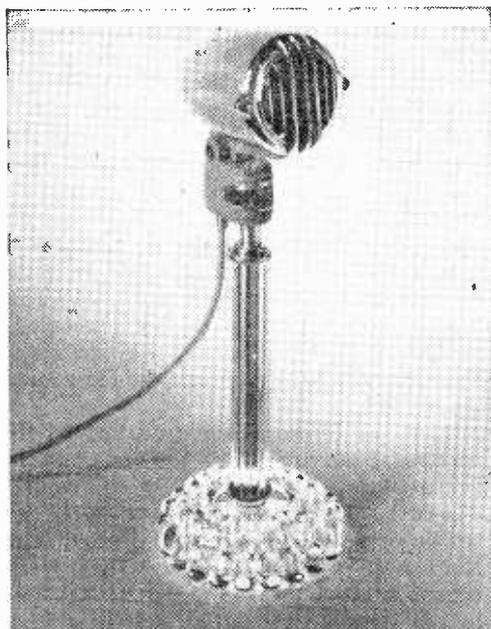


**Band-Buster assembly mounted in mike case. Only volume control R3 takes hardware.**

fits of speech clipping. Use a grease pencil, marking pen, or a piece of tape to mark the setting of R3's knob so that it can be easily reset whenever you use the mike. ■

---

## Crystal Is as Crystal Does



■ Here's a mike stand that ought to bedazzle the shack of any lady ham or CBer. These crystal desk stands are made from discarded glass table lamps and cost next to nothing. A quick trip to a store, rummage sale, or perhaps your own attic should turn up just the lamp you need.

Remove the line cord and socket from the lamp. Since both lamp threads and mike threads are usually  $\frac{5}{8}$ -27—which is standard for most pipe, the mike will screw onto the stand in a jiff. Most radio stores carry adapters and converters should you need to make any modifications.

Small bits of felt or rubber cement on the bottom of the stand will protect surfaces from nasty scratches. And should your mike have connections in the mounting socket, don't panic. Just run your mike cable through the pipe in the lamp and attach the cable to the connector on top. A rubber pad under the base can be hollowed out so the cable will come out flush, natch.

—Art Trauffer ■

# \$10- MILLION BUBBLE BATH

By Jorma Hyypia

Sometime next year a switch will be flicked. Instantly, the same amount of electrical power normally consumed by a single Christmas tree bulb will surge through the world's largest electromagnet. The result: a magnetic field 40,000 times stronger than the earth's. The world's biggest and most expensive bubble bath will be in operation.

The bubble bath—more profoundly called a bubble chamber—will be used to detect subatomic particles created by an atom smasher. Located at the Atomic Energy Commission's Argonne National Laboratory, the project constitutes a dramatic pioneering effort for two reasons. First, the bubble chamber will be unusually large, having a volume some 25 times greater than that of the next largest existing detector of this type. Second, it will be the first bubble chamber of major size to utilize a *superconducting magnet* that can—despite its great size—sustain a high magnetic field with virtually no consumption of electricity.

We'll have more to say about this remarkable, somehow almost unbelievable magnet shortly. But first, let's make certain that we all know (*Continued overleaf*)

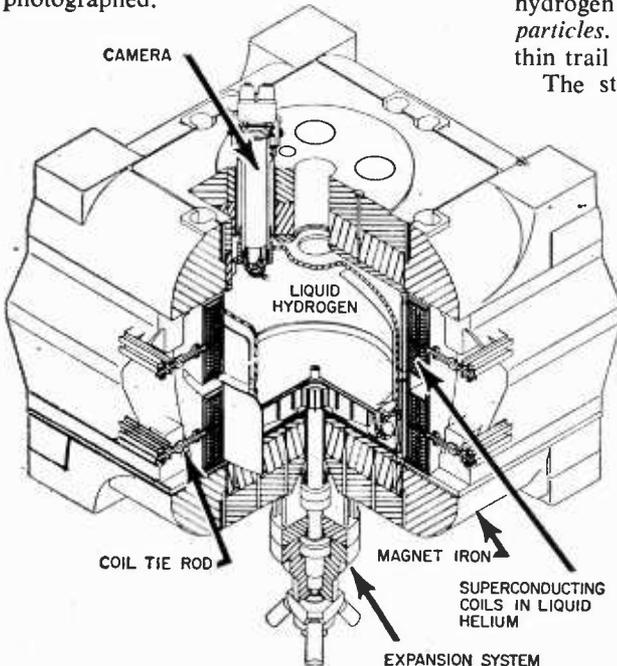
# BUBBLE BATH

what a bubble chamber is, and what it does.

**Catcher's Mitt.** The bubble chamber is a sort of supersize, scientific catcher's mitt into which subatomic speedballs are pitched over a magnetic homeplate. The molecules of a liquid contained in the bubble chamber represent the opposing batters that now and then connect with a speeding particle to deliver a pop-fly or a home run, depending on how the scientific game is played.

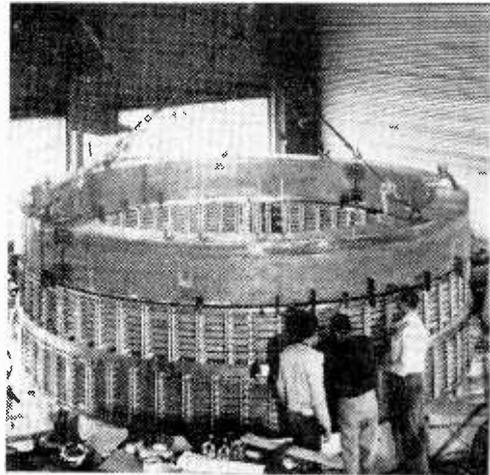
A bubble chamber is one of the best tools physicists have for studying nuclear particles. The chamber usually contains liquid hydrogen (as in the Argonne installation) or some other liquefied gas. The gas must be liquefied in order to crowd the gas molecules closer together to form a better target; the liquid in the chamber must be produced from a gas so that it has tendency to expand rapidly.

The nuclei of the hydrogen atoms act as targets for the beam of particles hurled at them by an accelerator (atom smasher). When these particles collide with hydrogen nuclei, new particles are created. Both the incoming particles and those created through the collision mechanisms leave trails of tiny bubbles in the liquid hydrogen that can be photographed.



← Left, cutaway view of 12-ft ID hydrogen bubble chamber.

→ Right, technicians prepare first of 30 coils for big magnet.



100-ton magnet nears completion as containment can is placed over top coil assembly.

How are these trails formed? The bubble chamber is something like a huge, very cold pressure cooker; an applied pressure keeps the liquid hydrogen slightly below its boiling point. Just before the incoming particles enter the chamber, the pressure is suddenly reduced just enough to bring the liquefied gas near its boiling point (about  $-423^{\circ}\text{F}$  for hydrogen).

Heat created by the speeding, electrically charged particles as they pass through the chamber, in combination with the reduced pressure, is just enough to bring the liquid hydrogen to a boil *along the paths of the particles*. This boiling is manifested as a thin trail of tiny gas bubbles.

The strong magnetic field produced by the large superconducting magnet surrounding the bubble chamber causes each track to *curve*; the degree of curvature provides a measure of the *momentum* exhibited by each particle.

**Proton Pitcher.** The proton speedballs are hurled into the bubble chamber catcher's mitt by a type of atom smasher called a Zero Gradient Synchrotron (ZGS). Synchrotrons are atom

smashers that accelerate atomic particles to very high speeds. They do so by providing electromagnetic wind-ups that send the particles around and around the circular accelerator perhaps a million times, at increasingly higher speeds, before they are hurled at the target chamber. The Argonne synchrotron has a wind-up and throwing muscle rated at 12.5 billion electron volts (BeV), which makes this atom smasher one of the world's largest. It can accelerate 10 trillion protons and pitch (pulse) them at the target once every four seconds.

The Argonne accelerator is called a zero gradient synchrotron because the machine's magnetic field is uniform or unchanging from the inside to the outside. Other types of synchrotrons have variable magnetic fields. For example, the so-called Alternating Gradient Synchrotron (AGS) has a series of magnetic sections that cause the magnetic field to alternately increase and decrease toward the outside of the field. The resulting switchback focusing keeps the speeding protons from wandering off course in their travels around the circular track.

Because the ZGS can produce a larger number of accelerated particles than any other multi-billion volt atom smasher now in operation or under construction, it is ideal for those experiments in which the expected, or hoped-for particle collisions are rare. Obviously, the larger the number of proton speedballs thrown, the greater the probability that some will collide with the hydro-

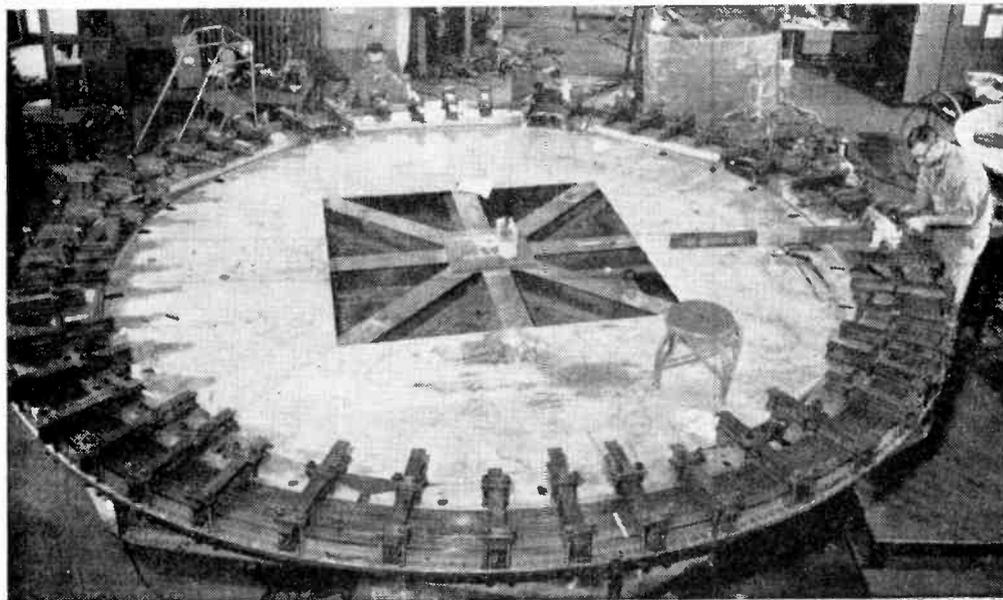
gen nuclei in the bubble chamber. Neutrino collisions, for example, are rare-occurrence reactions that are best studied with high particle density machines such as the ZGS.

The ZGS doesn't only throw out a lot of subatomic balls indiscriminately; it can be made to select particles of single types and energies best suited to the experiments at hand. Like a baseball pitcher, the ZGS can, at will, switch from a speedball (high energy proton) to a slow ball (lower energy proton).

**Cool Pillbox.** The bubble chamber is a stainless-steel, pillbox-shaped vessel measuring 13.5 ft. on the outside, 12 ft. on the inside. It will be filled with 7000 gallons of liquid hydrogen or deuterium (heavy hydrogen) kept under a pressure of 90 lb. per square inch (psi) and at a temperature below  $-423^{\circ}\text{F}$ .

The piston applying the pressure will be sealed to the bubble chamber by means of a flexible, stainless-steel torodial bellows. This bellows (again, the world's largest) is 152 in. in diameter and weighs 4800 lb. It is designed to operate for at least 50 million flexing cycles before breakdown.

Construction of the bellows was in itself a marvel of engineering ingenuity. A stainless-steel cylinder 1/16 in. thick, 42 in. high, and 126 in. in diameter was fitted on a specially constructed 50-ton fixture. Water pressure at a maximum of 800 lb. psi was applied to the inner surface of the cylinder; simultaneously, a downward pressure was exerted



# BUBBLE BATH

by a 7-ton upper ring on the fixture. At the maximum pressure of 800 lb. psi, a total load of over 2½ million lb. was exerted on the upper ring. Thus, without the use of an external die, the cylinder was compressed and bowed outward to form the doughnut-shaped bellows!

**Frozen Ohms.** When the superconducting magnet wrapped around the bubble chamber is cooled to within a few degrees of absolute zero, it will be capable of developing a magnetic field strength of 20,000 gauss—that's 40,000 times stronger than the magnetic field of the earth.

If a conventional electromagnet were used to create a field of this strength, it would consume 10 million watts of electric power—enough to fully supply a town of 10,000 people. *The superconducting magnet does the same job using only 10 watts of power!*

The magnetic field will store 80 million joules of energy. That is equivalent to the energy potential of 100 lb. of TNT explosive. The force within the coils will be trying to squeeze the coils together with a pull of 4 million lb.; one million lb. of force will thrust down on the entire coil package!

More than half a century ago scientists learned that electricity will flow without perceptible resistance through certain metals made extremely cold. But it wasn't until 1961 that a way was found to form superconductors capable of supporting electric currents in high magnetic fields.

The operating temperature of the Argonne superconducting magnet will be  $-453^{\circ}$  F., or just a few degrees above absolute

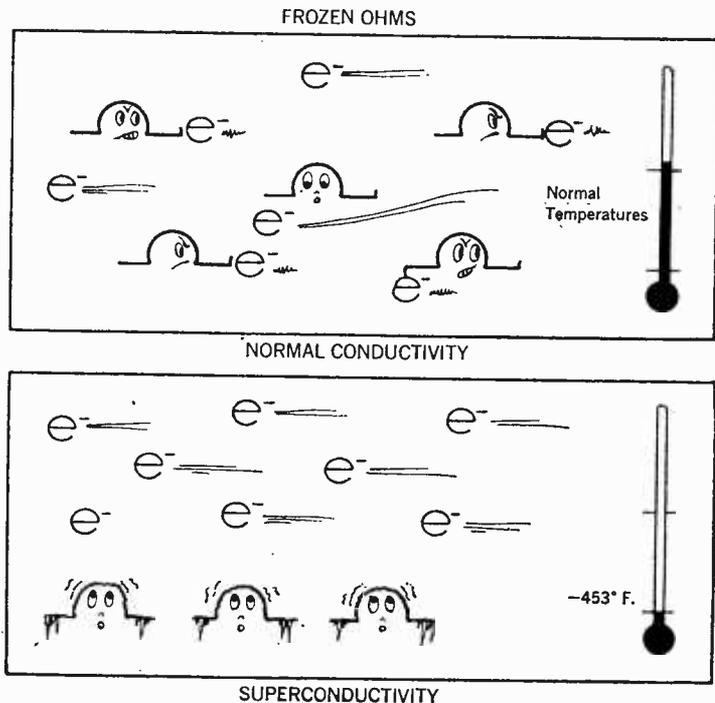
**High efficiency of bubble chamber's magnet results from use of superconducting metals. Electron flow is unimpeded at absolute zero.**

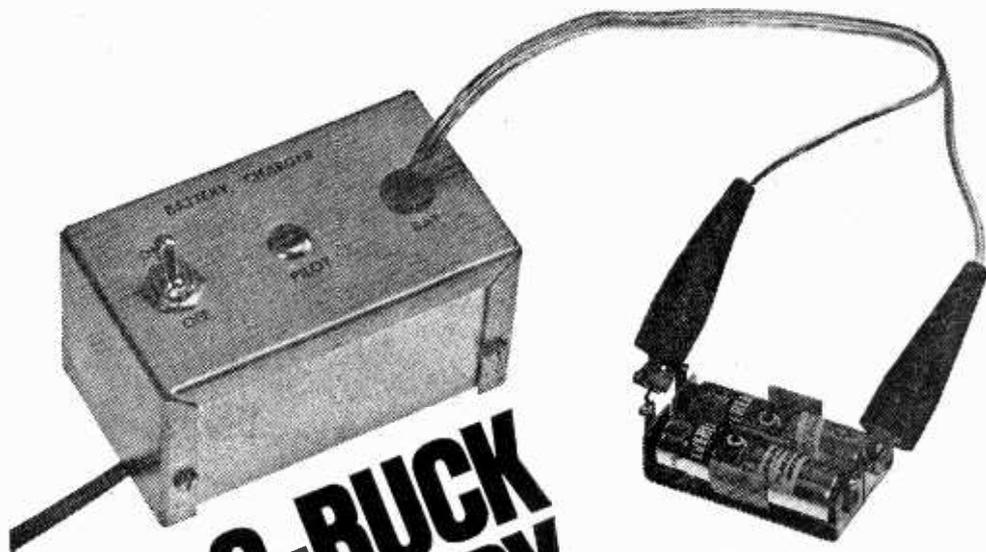
zero. The magnet will be cooled to this level by means of liquid helium and a 250-hp compressor (750 times more powerful than the compressors used in home refrigerators). To maintain the low temperature over periods of time, the magnet coils will be surrounded by a cryostat (low-temperature system) consisting of an inner can, aluminum radiation shield, and 100 layers of aluminized Mylar plastic film. The cryostat and its components will be placed into a large aluminum vacuum vessel.

**Hundred Ton Coil.** The magnet coil assembly will weigh a cool 100 tons. Half of this weight will be contributed by the superconducting material made of niobium-titanium alloy. Some 32 coils—two of which are put aside as spares—have been wound from 25 miles of superconducting filament that is 1/10 in. thick and 2 in. wide. The filaments are held together with a mixture of epoxy cement and Teflon plastic containing glass fibers.

The finished coil will have an outside diameter of 18 ft., an inside diameter of 16 ft. The magnet, in final conformation, will be made up of two halves, each containing 15 individually stacked coils.

If the final bubble chamber and its supporting concrete structure could be viewed unobstructed, it would probably resemble  
*(Continued on page 118)*





# 3-BUCK BATTERY BOOSTER

By James I. Randall

One mighty module packs a wallop  
that'll empty your battery box pronto

■ These days, with all the transistorized equipment around, batteries are common as bikinis. Flashlights, toys, electric toothbrushes, and tools add up to this charged-up bonanza with a rapidity that's beyond belief. As a result, every household's parts box usually has enough batteries to fill a mini-sized boxcar.

Trouble is, most of these batteries are either dead as a dodo, or they'll pump out only a few last spurts of current before fading away into oblivion. To clear out your parts box and juice up half the gizmos that are lying around your house, just take on our 3-Buck Battery Booster and you'll be on your way.

Our Battery Booster is a simple, low-cost trickle charger that you can build in one evening. It will increase the useful life of your batteries considerably. Overnight, it will recharge any small dry cell that has a rating from 1½ to 2½ volts. This range

should cover most of the equipment you use, and the batteries can be used over and over again.

**Magic Module.** Heart of the 3-Buck Battery Booster is a solid-state module that measures only 5/8 in. in diameter and ¼ in. high. It contains all the circuitry needed to electronically trickle charge your batteries at a safe and constant 3-mA rate.

Just add a line cord and plug, and two short lengths of wire to connect the module to the battery. The schematic diagram shows how the author added a toggle switch and a pilot light. These are convenient and add little of the cost of the charger, but they are not required.

Our photos show both the completed battery charger in use—charging two Penlite cells in parallel—and an interior view of the wiring and parts layout. This model was built into a 2¼ x 2¼ x 4-in. aluminum Minibox which was later painted with a

# BATTERY BOOSTER

copper-colored Krylon spray. After the decals were in place, three final coats of clear Krylon plastic spray were added. Of course, any kind of case will do just as well. But if it's metal, be sure to insulate the 117-VAC connections with tape or spaghetti to avoid possible shorts.

**Off and Charging.** To operate your Battery Booster, connect the test leads shown as J1 and J2 to the battery (or batteries) to be renovated. Be careful to observe the correct polarities. Plug in the charger and turn on the power. The pilot lamp should then light up.

It is advisable to leave the Booster on overnight, or for at least 12 hours. After the battery is fully charged, first unplug the unit, then disconnect the leads from the battery.

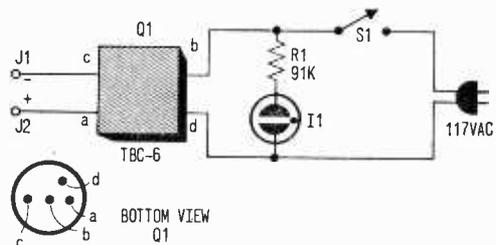
If you have a milliammeter and a voltmeter, you may want to test the operation of the charger before using it. A simple test circuit is illustrated. With the charger connected to a 9-V transistor radio battery (Eveready 216 or equiv.) the milliammeter should indicate a constant charging current of 3 mA, and the voltmeter should show about 10V. (Incidentally, this test circuit could be made a permanent part of the Booster if you'll be charging 9-V cells exclusively.)

For charging C and D cells, or Penlite batteries, you can use holders like the one shown in the lead photo. This allows you to charge several batteries at once.

Many factors influence the rate of charging a small battery. Age, composition, quality, and type of service all play a part. In

general, you should be able to renovate any small dry cell so that its normal life is extended 10 times. While mercury batteries have been known to explode during charging, this is very unlikely due to the low charging rate of your Battery Booster.

The unit has successfully recharged ordinary zinc-carbon, alkaline, mercury, and even nickel-cadmium batteries. Storage batteries, however, cannot be renovated with this type of charger. So that's it. Keep the Booster blasting during those chilly fall and winter evenings and your parts box will be empty in a jiff. ■



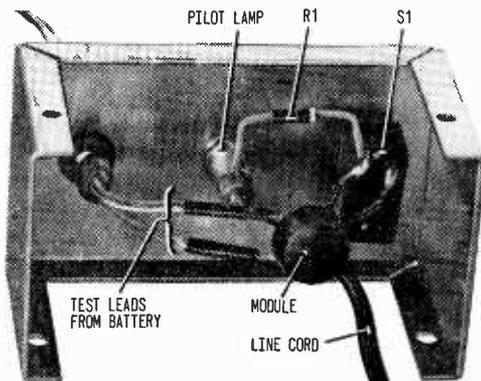
Schematic diagram for the 3-Buck Booster is simplicity in itself. Unit can charge most any battery with an output up to 22V.

## PARTS LIST FOR BATTERY BOOSTER

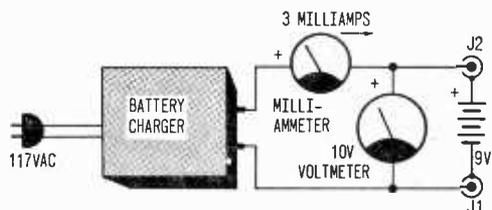
- I1—110-VAC neon lamp assembly (Lafayette 99H6226 or equiv.)
- J1, J2—Test clips (Mueller 45C, Lafayette 32H3502 or equiv.)
- Q1—Charger module (Cordover TBC-6)
- R1—91,000-ohm, 1/2-watt 5% resistor
- S1—Spst toggle switch (Lafayette 99H6150 or equiv.)

Misc.—Zip cord, AC plug, strain-relief plug, test leads, insulators for test clips (Lafayette 32H3528C, red or black), 2-cell battery holders, 2 1/4 x 2 1/4 x 4-in. Minibox (see text), spaghetti, grommets, decals, wire, solder, hardware, etc.

Note—the battery charger module is available from Carl Cordover & Co., 104 Liberty Ave., Mineola, N.Y. 11501. Price is \$1.50 including postage and handling. Elsewhere, the module is available at most Lafayette Associates Radio Stores for \$1.00.



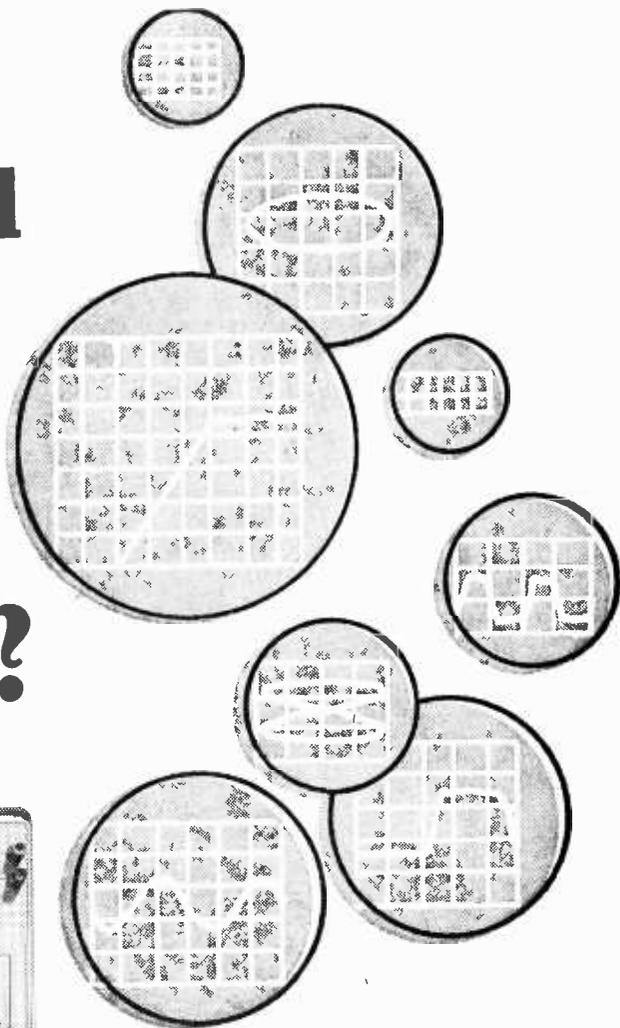
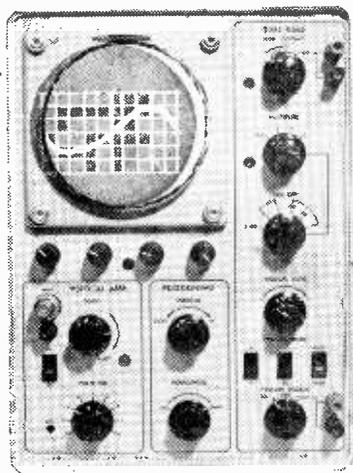
Interior view of author's unit with bottom part of Minibox removed. As explained in text, S1, R1, and pilot lamp are optional.



Test circuit shown above will tell you whether your Battery Booster is operating properly. Unit pumps 3 mA into 9-V cell.

# Do You Need A Lab Scope?

By Lars Jorgensen



Expensive and versatile, these glorified CRTs add more horsepower to your lab than a barrel full of the hottest power supplies

□ Experimenters and technicians are constantly moving up to more complex equipment. Sometimes the old shack is hardly recognizable when compared to what it used to be. Rows of gadgets that were only pure theory a few years ago line the wall and most of them catch very little dust!

Among the numerous devices designed for the advanced worker in electronics is the laboratory oscilloscope—or lab scope, for short. This article will deal exclusively with this exciting piece of equipment.

Interestingly enough, many people seem willing to spend several hundreds of dollars for complicated receivers, multifarious hi-fi equipment, or color TVs. But just mention such an outlay for a scope, and friends, relatives, and wife start howling.

# Do You Need A Lab Scope?

Honest injun! If you're just starting in electronics or if you only get around to using test equipment once in a blue moon, a lab scope certainly isn't for you (give your wife better grounds for divorce!). However, if you're well versed in electronics and sometimes work with the latest advanced, super-duper chassis in either the entertainment or industrial field, the lab scope may well prove to you that Ford isn't the only one with a better idea. It might even make test procedures fun again.

**Count The Ways.** First thing to explain is that a lab scope is a precision instrument designed primarily to display complex waveforms and pulses. The scope not only controls the display, but it also permits an accurate measurement of the waveform. Some of its outstanding features include:

- a stable power supply with electronically *regulated* voltages (so waveforms don't jump)
- vertical and horizontal (sometimes!) amplifiers which are *calibrated* for peak-to-peak (P-P) voltages (i.e., so many volts per centimeter) using precision attenuators
- a triggered sweep (sawtooth) oscillator which functions as a calibrated time base (i.e., so many seconds, milliseconds, or microseconds per centimeter) and which permits the signal being displayed to *initiate* the sweep so that any desired portion of the waveform can be analyzed
- AC/DC *coupling* that allows AC input for display of AC signals over a specified frequency range, or a DC input which displays a DC reference line for measurements of amplitude (the DC input also preserves the waveform of slowly varying signals).

All of these scope features are designed for signals which go far beyond the simple sine wave. Pulses are, of course, basic. Pulse amplitude, duration, and rise time lend themselves to calibrated oscilloscope displays, and anyone who works with switching and logic circuitry will be on Easy Street with such an instrument. However, even the waveforms encountered in FM, TV, ham radio, and stereo servicing can be demanding enough so that laboratory precision may be needed. The choice between a lab or service grade scope is up to you!

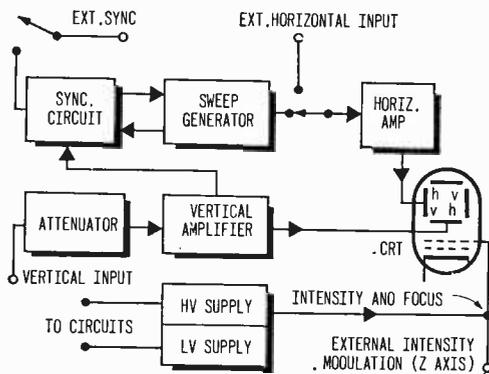
Until recently, the experimenter and service technician who needed a scope had little in the way of choice. One scope was just about like any other and all were similarly priced. The choice was either between a *wideband* scope for TV servicing (with a vertical frequency response to about 4 or 7 MHz) and a *utility* scope having a response to about 500 kHz.

A few dollars difference purchased a stepped attenuator rather than a variable attenuator for the vertical input, or perhaps one could get two fixed sweep frequencies for TV servicing. Otherwise, features were more advertising copy than true performance.

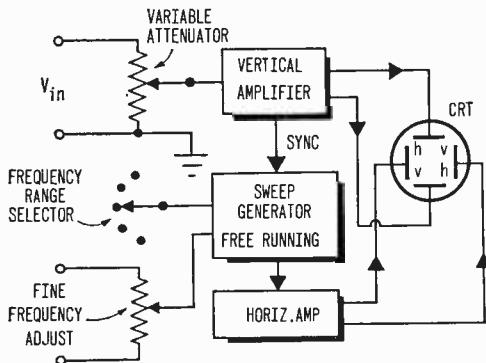
Today, however, true lab scopes are for the having and many experimenters and technicians are spending the extra two or three hundred dollars for the added performance. They realize that modern equipment almost requires the lab scope, and that tomorrow's equipment will demand it.

**Honest Appraisal.** Let's compare the service grade scope against the lab scope in terms of what it means to you. First, the average lab scope generally advertised is not exactly a laboratory scope. Actually, it's a *calibrated* scope. All laboratory scope means is precision accuracy of about 1%. But because any scope with 1% accuracy is also a calibrated scope, we have come to apply the term lab scope to any calibrated scope with 5% accuracy or better.

So, in fact, we're talking about calibrated scopes, though from here on out we'll refer to the calibrated scope as a lab scope just as most everyone else does. (The difference between 5% and 1% accuracy represents several hundred dollars, though both the calibrated and lab scope do the same job.)



**Fig. 1. Cheaper scopes have push circuit to 2 plates of CRT, others have push-pull output.**

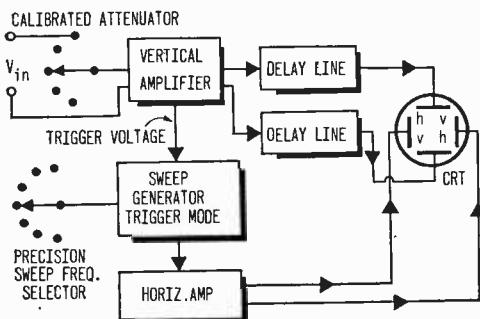


**Fig. 2. Service-grade scope has free running sweep synced by voltage from vertical amp.**

To refresh your memory, a block diagram of an ordinary scope is shown in Fig. 1. Note the layout of basic circuits. A more detailed look at the controls of a typical service-grade scope is shown in Fig. 2. This scope is a relative indicating device, because without external calibrating equipment the user has no idea of actual voltage or frequency of the applied signal.

The vertical-amplifier gain control is a pot which is adjusted until a convenient CRT trace size is obtained. The horizontal sweep frequency is simply adjusted until the trace locks in (synchronizes). Unless the vertical amplifier is calibrated with an external known voltage, or the time base (sweep frequency) is calibrated with an external oscillator via a *Lissajous* pattern, the operator can be certain only of the input waveform.

**Sweep Clean.** As a general rule, most service-grade sweeps are calibrated in broad frequency ranges. For example, a typical scope has a *coarse* sweep adjustment which sets the sweep range from 10 to 100 Hz, 100 to 1000 Hz, 1 to 10 kHz, and perhaps even 10 to 100 kHz. A *fine* sweep control lets you zero in on any one frequency.



**Fig. 3. Lab scope has calibrated vertical and horizontal inputs. No external inputs needed.**

Higher priced service scopes often have a so-called calibrated, stepped vertical-input attenuator which varies the gain of the vertical amplifier in steps of 10X. Too, they may even have a built-in calibration voltage which allows the user to calibrate the vertical input in terms of x-volts per division. For example, the scope might be calibrated so each centimeter (cm) or 1/4 in. on the CRT graticule represents 1 volt peak-to-peak (P-P). Hence, an input voltage which occupies 3 divisions would be 3 V P-P.

On the other hand, a lab scope has an integrated, specially calibrated vertical input and time base. However, the time base (horizontal sweep) is no longer calibrated in terms of frequency; instead, it is calibrated in *time per centimeter* (or graticule division, which is usually a centimeter).

For instance, a lab scope might have a time base of 1 microsecond (*us*), which is equivalent to 1 MHz/cm, or 100 microseconds (10,000 Hz/cm). In fact, most lab scopes are calibrated from 1 *us*/cm to 1 sec/cm in a 1:2:5 decading; i.e. 1 *us*, 2*us*, 5*us*, 10 *us*, etc.

The complete time-base range can be on one switch or on two switches—one control provides a coarse time base in multiples of 10X (1 *us*, 10 *us*, 100 *us*), while another control provides the 1:2:5 multiplication. A 1-*us* setting together with a 2X multiplier would give a time base of 2 *us*; with a 5X multiplier it would be 5 *us*, etc.

**Trigger Happy.** Just as important as the calibration feature of the time base is the fact that it is also *triggered*. The lab scope's sweep can be started on virtually any part of the input waveform! Fig. 3 shows how it's done.

The input signal coming out of the vertical amplifier is fed into a delay line which momentarily delays the arrival of the signal at the CRT's vertical plates. However, the signal's trigger voltage to the time base's sync circuits is tapped off before the delay line. Until this trigger is applied to the time-base sync there is no horizontal sweep—all that is seen is a dot at the left side of the CRT.

When a signal is applied to the scope it triggers the sawtooth oscillator and starts the sweep. But note that because of the delay line the signal has not yet reached the CRT. This is done to permit the operator to observe any part of the waveform (within the scope's limits). A *trigger level* control in the time-base sync circuit triggers the sweep at either the positive or negative por-

# Do You Need A Lab Scope?

tion of the waveform. After the sweep has been initiated by the trigger voltage, the vertical input passes through the delay line and goes on to the CRT for display—all in a period of a few microseconds.

**Touch and Go.** If this is confusing, take a look at four examples of a triggered and calibrated sweep (see box). The first trace shows a square-wave input which triggers the sweep generator at the leading edge (when waveform goes up from left to right) of its positive pulse.

The second trace indicates that the sweep is triggered when the positive pulse reaches its peak amplitude. And the third trace shows the sweep beginning when the negative pulse has attained maximum value.

None of this is accomplished by adjusting the horizontal centering control. Instead, the trigger level for the time base is set so that the sweep is triggered in proportion to the delay (in the delay line) set up between the vertical amplifier and the plates of the CRT.

Within the limits of the scope, a waveform can be triggered at any point between its maximum (peak) positive and negative values. In more technical language, the trigger can be set for practically any positive- or negative-going value of the waveform.

In the fourth trace, the leading edge of the positive pulse has been expanded and magnified for a more detailed display of the input signal. This was done in order to get a look at the *glitch* (spurious signal), which appears just where the pulse reaches maximum value. By increasing the vertical gain and switching on the  $\times 5$  multiplier (which decreases the time per division of the sweep), you can have an expanded display anywhere you want it.

So much for triggering the horizontal sweep (time base). To see that the time base is also calibrated, take another look at the first trace. This is a 60-Hz square wave generated by a home-brew voltage calibrator.

**Pulses are precision controlled by lab scope. Comparison of trace with graticule divisions shows calibration accuracy.**

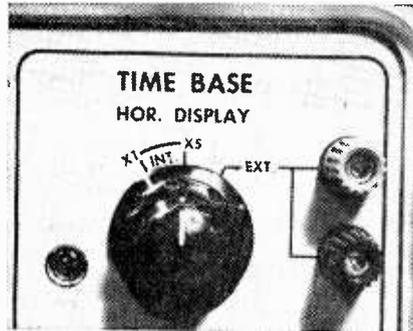


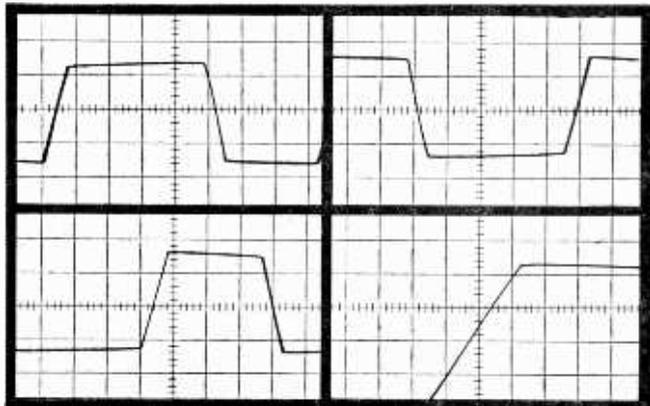
Fig. 4. Besides selecting internal or external sweep, this control also expands trace.

If the scope's time base is set to 2 ms/cm (milliseconds per cm), the width of 1 cycle of the square wave occupies 8.3 cm on the CRT. Since the signal frequency is given by the formula  $f = 1/\text{time}$ , we have  $f = 1/8.3 \times 2 \text{ ms}$  or 60.1 Hz (the 0.1 figure is due to the scope's rated tolerance).

**At the Controls.** For a practical illustration of how to get such traces on your lab scope, let's take a quick look at the time base controls of a typical, relatively inexpensive model, the Heath IO-14. Fig. 4 shows the switch that selects a particular kind of time base display.

It can select either the scope's internal sweep oscillator or an external oscillator (the smaller knob on this concentric control is the external gain control). The switch is shown set to  $\times 1$ —internal. The  $\times 5$  position expands the sweep five times for magnification (which is the same as multiplying the time base by  $5\times$ ).

Fig. 5 shows the two controls which set the sweep rate. These are the time/cm and multiplier controls. Finally, Fig. 6 shows the three time base switches. The mode switch (+ to -) determines whether the sweep is



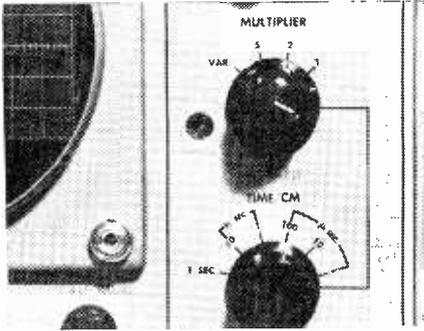


Fig. 5. Time/cm control increases sweep frequency by 10:1; multiplier gives 1:2:5 steps.

triggered on the positive or negative portion of the waveform, while the AC/DC switch removes the trigger level's DC component. The Auto/Norm switch determines whether the oscillator is free running (Auto) as in a service-grade scope, or is triggered (Norm).

**Frequency Is Fine.** To understand more about the advantages of a lab scope, we now turn to frequency measurements. To measure frequency with a service-grade scope, it's necessary to use a signal generator (connected to the external horizontal input) as the time base. The result is a Lissajous figure. In the first example (see box), we see an oval. This means the vertical input signal has the same frequency as the signal at the horizontal input. In this instance, since the generator is set to 1 kHz, the input signal is also 1 kHz.

The next trace shows two ovals, so the input signal is now twice that of the signal generator, or 2 kHz. Since the third trace shows three ovals, the input signal must be three times that of the generator, or 3 kHz. However, these are easy examples. When you get Lissajous patterns that contain ratios of 5:4, 8:6, or even more complex values, measuring frequency can turn out to be quite a chore.

Now let's see how easy it is to measure frequency with a lab scope. Again we'll use

**Lissajous figures show frequency and phase relationships between a scope's vertical and horizontal inputs.**

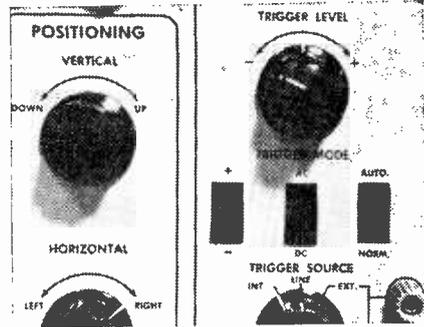
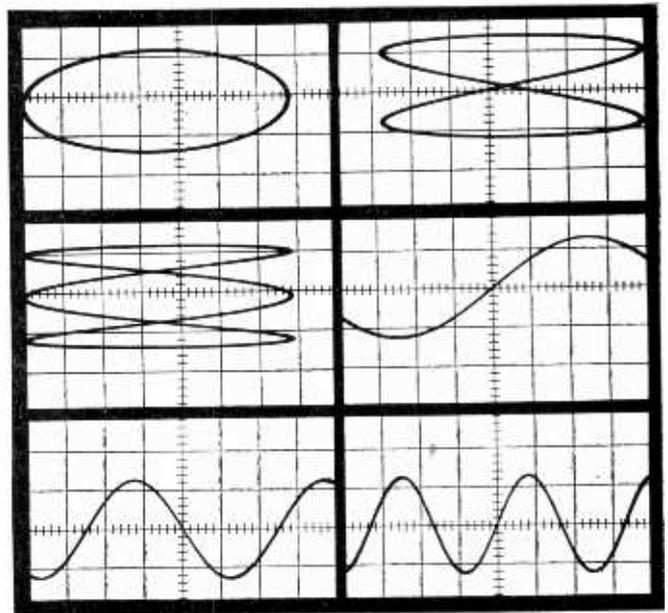


Fig. 6. After switch selects pos/neg trigger, level determines part of signal triggered.

inputs of 1, 2, and 3 kHz, but without any external generator connected to the horizontal input. With the time base set to 100  $\mu$ s/cm, we find that one complete cycle occupies 10 cm (the trigger has been adjusted so the sweep starts at the beginning of the cycle). Since  $f = 1/\text{time}$ ,  $f = 1/10 \times 100 \mu$ s or 1 kHz.

What this means is that the frequency of the input signal has been measured directly, using only the internal calibrated time base. If we keep the time base set to 100  $\mu$ s/cm and feed in a 2-kHz signal to the scope, we get the two cycles appearing in trace no. 5. One complete cycle now occupies 5 cm, and since  $f = 1/\text{time}$ ,  $f = 1/5 \times 100 \mu$ s or 2 kHz.

The sixth trace shows three cycles resulting from a 3-kHz input and a time base of  
(Continued on page 114)



# *The Editors of* **RADIO-TV EXPERIMENTER** *attend a* **HAM MINI-EXPO**

□ Radio signals aimed at the moon from Australia skid off the lunar surface and bang, land a half-million miles away in New Jersey. On the planet Jupiter, a magnetic storm belts out waves toward a radio telescope located on Long Island, near New York City. And satellite trackers snatch signals from an orbiting spacecraft.

Sound like a top notch operation of NASA? Not this time. It's the work of enthusiastic hams proving to the world that their hobby is not only alive and

well, but anxious to fling open its doors to all comers. That sums up the theme of *Ham Radio Expo*, a recent 3-day exhibition unlike any hamfest you've ever seen. Expo hams abandoned the usual in-group talk and went after neophytes with a "C'mon in, the water's fine!"

And jump in they did. The Expo site at Garden State Plaza, a big shopping center in northern New Jersey, swarmed with fascinated, rubber-necking throngs at the sound of the bell. Exhibits did a landslide business as people talked on the air, gawked at their image on TV, or sent messages via ham networks. The fifteen ham clubs that ran the exposition more than proved that amateur radio is swinging along nicely toward the year 2001.

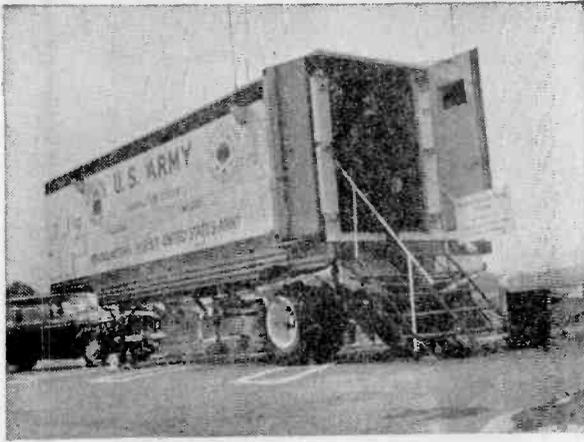
But the purpose of *Ham Radio Expo* was more than mere showmanship. It was a strong effort to fight ham radio's sluggish growth rate by luring in the curious newcomer. According to one measuring rod it was a rousing success. Officials wondered if they could muster instructors to handle all who signed up for code classes. Code, no less! ■



Information booth located near show entrance helped attract public. Show's two main organizers are seen right out front. At left is Mel Snyder, who represents 15 ham clubs that prepared and managed exhibits. Mel is talking to Steve Flehinger, an official of shopping center at Garden State Plaza. Center gave hams exhibition areas and publicity free.

Visitors were surprised and delighted to discover that hams can send telegrams free of charge overseas. Many took advantage of it by sending hundreds of messages through this MARS (Military Affiliate Radio System) exhibition. Red Cross volunteers filled out message forms; most messages were sent to servicemen stationed at overseas bases.

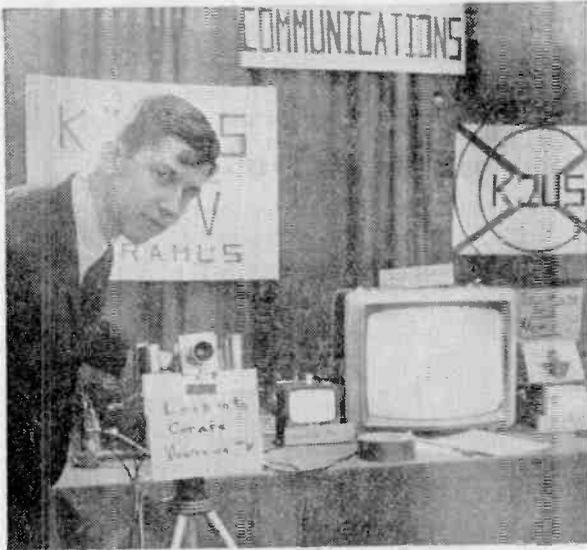




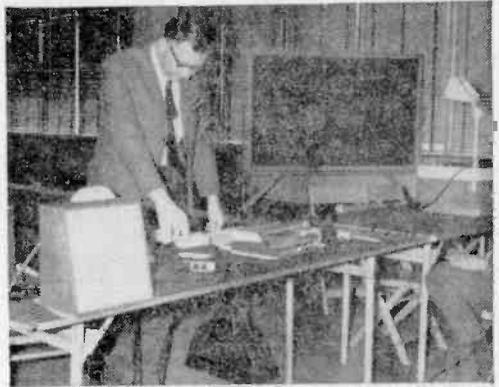
**MARS** transmitting station located just outside exhibition hall. Van housed operators who had equipment which could speed messages toward the next link in system. Message would go by radio to Washington, D.C., then to Hawaii, and from there, to South Vietnam.



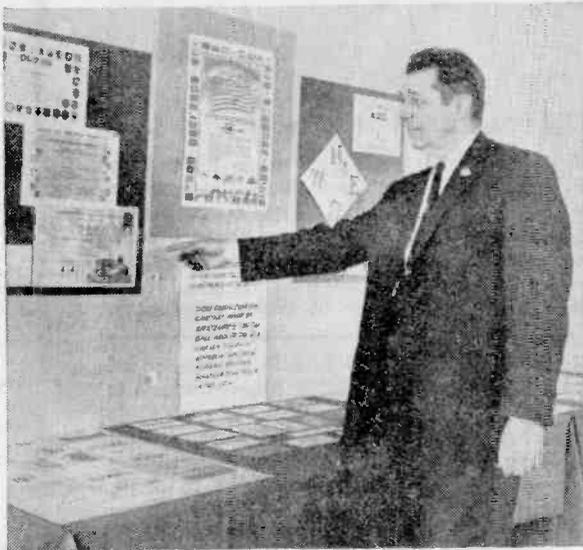
Besides seeing themselves on camera, visitors witnessed two-way contact on ham TV. Signals were transmitted on 440 MHz, ham TV band.



Smile, you're on TV! People could peer into home-brew camera, see themselves on nearby monitor. Vidicon tube protrudes from camera.



Story of how amateur radio went to the moon is described by Ray Naughton, VK3ATN, an Australian who broke international vhf record for distance in 1966. His 300-ft. rhombic antenna sent out a 150-watt signal which bounced off the moon, was received on earth by a ham in New Jersey. Distance: about a half-million miles. Pretty good for 2 Meters.



Impressive display by North Jersey DX Association shows off QSL cards and DX awards. Cards from world over informed one and all of ham radio's international flavor, while awards told of hot competition for DX. Explaining display is well-known luminary of ham radio, Stu Meyer, W2GHK. Stu is executive V.P. of Aerotron, makers of 2-way radios.

# HAM MINI-EXPO



Zaaap went spark transmitter back in radio's infancy. Here effect is re-created by Earl Raser of Quarter Century Wireless Association. He owns a radio museum in Trenton, N.J.



Arcing voltage of old-time spark transmitter is clearly visible in background as Earl Raser keys his rig. Sparks come from wheel energized by circa 1915 equipment.



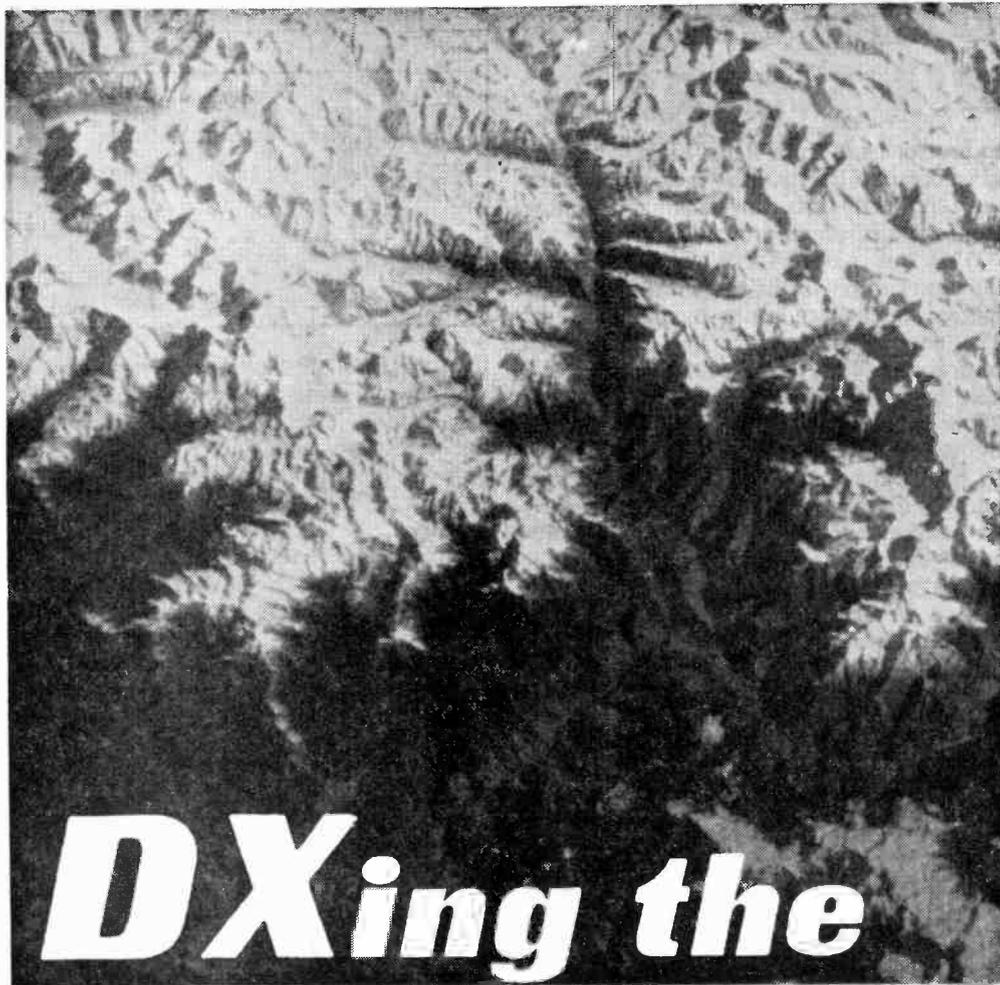
Pulling parts from a muffin tin, ham demonstrates home-brew rig. Actually, he's building a Heath SB-301 receiver donated specially for the show. Davis Pub. contributed too!



Visitors to the exhibition were treated to free lectures, films, and demonstrations on all phases of ham radio. Here, a group sees film on basic concepts of long-distance communications. Movie was part of display put on by Watchung Hills High School (N.J.) radio club. Group is active in radio astronomy.



Ham's own satellite, OSCAR, is demonstrated by Thomas Ruby, WA2TQQ. Main package is at left, with cover and antenna at right. This model is OSCAR II, one of series thrust into orbit by NASA rockets. Exhibit was set up by Long Island (N.Y.) ham group called NASTAR. Group is also working on a repeater station to be placed on moon by Apollo astronauts.



# ***DXing the*** **HIMALAYAS**

*By C.M. Stanbury II*

*Looking for a thrill? Start your own Operation Tightrope and log the illusive Asian stations that broadcast above 40 meters!*

■ For mountain climbers, Mount Everest is the ultimate challenge and for many North American DXers, remote Himalayan nations like Nepal, Tibet, and their neighbors are the absolute summit. Reason one is that the area is generally rough to hear. Reason two is that broadcasting stations in the Himalayan lands—like everything else in these exotic countries—are shrouded in mystery and controversy.

Nepal, home of Mount Everest itself, was once as forbidding and mysterious as neighboring Tibet. Today, the kingdom (a constitutional monarchy) openly encourages tourism and, though technically neutral, maintains a defense pact with India in order

# DXing the HIMALAYAS

to protect itself from Red China. This tiny kingdom also boasts what is apparently the most powerful broadcast station operating from the Himalayas proper—R. Nepal.

This rare piece of DX recently boosted the power of one of its two shortwave transmitters, then extended its overall schedule. The new 100-kW outlet has been logged several times in North America on 4600 kHz between 0600 and 0900 EST (0300-0600 PST). East coasters should try this frequency around sunrise (see our chart). R. Nepal also operates a 5-kW transmitter on 7105 kHz, which, despite that lower power, can be heard a little later than the 60-meter operation. Both transmitters broadcast in parallel; studios and transmitters are located at the capital, Katmandu.

**Afghanistan.** Some thousand miles to the West of Katmandu we find the Himalayas' most widely heard broadcaster, R. Afghanistan. Transmitting from sites near Kabul, R. Afghanistan beams programs both to Asia and Europe on several of the upper SWBC bands. Though technically neutral like Nepal, the Kabul regime is definitely left of center.

R. Afghanistan's most widely reported transmission, and the most easily heard in North America of all from the Himalayas, is its English-language session for Europe at 1300-1330 EST on 15265 kHz (this is preceded by a German broadcast on the same channel). Even if you are using only the simplest of shortwave receivers you should be able to log this one, though conditions will of course vary from day to day. Those hardy souls who want to log Kabul the hard way should try R. Afghanistan's home service down on 4770 kHz around dawn. West coasters will also have a chance for it around sunset, listeners' time.

Both R. Nepal and R. Afghanistan, incidentally, are excellent verifiers.

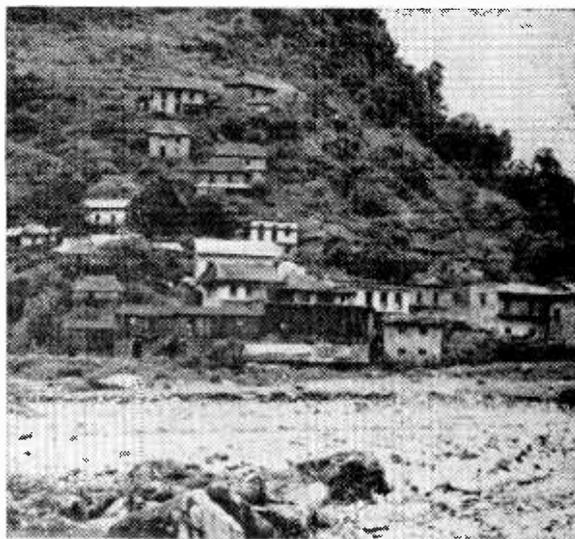
**Tibet.** From here on, Himalayan DX matters get really tough. Until the 1950s Tibet was a holy Tantric Buddhist state famous (to the outside world at least) for such myths as the Abominable Snowman and the Third Eye (currently very big in flying-saucer circles). Beginning in 1950 Tibet was invaded by another horde of fanatics—the Red Chinese Maoists. Since

## Himalayan Shortwave at a Glance

kHz	Station	Time
3277	R. Kashmir, Srinagar	Dawn
3345	R. Kashmir, Jammu	Dawn
3965	R. Pakistan, Pashawar	Dawn
4600	R. Nepal, Katmandu	Dawn
4770	R. Afghanistan, Kabul	Dawn
5935	Lhasa, Tibet	(See text)
6122	R. Pakistan, Rawalpindi	Dawn
7105	R. Nepal, Katmandu	0600-0900 EST
15265	R. Afghanistan, Kabul	1230-1330 EST

then the invaders have used every form of violence and repression to convert the Tibetans. Today, Tibet is for all practical (but not necessarily legal) purposes an integral part of China. Even so, a good many SWLs still prefer to consider it a separate DX country.

There is really very little reliable information available on frequencies and schedules of local Red Chinese broadcasters, and the



A typical village perches on the Himalayan foothills in the northern region of Nepal, where the vast majority of nation's eight million people live. Fierce jungles on southern slopes are full of wild beasts and malarial mosquitoes. This area is virtually uninhabited and will doubtless remain so. Nepal is a true challenge for all DXers.

Communist-controlled station at Lhasa, Tibet is no exception. However, according to a recent but unconfirmed report from a DXer in India, the Lhasa transmitter uses 5935 kHz for some home-service programs around 0915 EST (east coasters would have to try the frequency a little earlier). Also, depending upon the altitude of the transmitter site, it's possible some of R. Peking's propaganda aimed at India is relayed from Lhasa.

Now merely because you hear a R. Peking transmission on 5935 doesn't mean that you have logged Tibet. Even assuming this 5935 spot is in fact used by Lhasa, other Red Chinese transmitter sites might also use that same frequency at various times of the day. Still more intriguing or infuriating, if you like, is that you'll probably never know for certain. Except for R. Peking itself, no Communist Chinese broadcast station is currently verifying. And while Peking does QSL, no DXer has yet been able to get them

to list the transmitter site. So if a Chinese station does appear at 5935 on your dial, you'll just have to sprout one of those all-knowing third eyes.

**Kashmir.** Though they normally verify, shortwave stations in Kashmir (whose control is a matter of bitter dispute between India and Pakistan) are almost as difficult to log as those in Tibet. R. Kashmir, presently controlled by the Indian government, operates transmitters at Srinagar and Jammu. Srinagar is occasionally received in North America on 3277 kHz, while the frequency for Jammu is listed as 3345. If you can hear R. Afghanistan on its 60-meter channel, switch down to 90 meters and try for these.

Meanwhile, in the Northern provinces of Pakistan, R. Pakistan operates regional SWBC stations at Rawalpindi on 6122 kHz and Pashawar on 3965 kHz in what is 75-meter amateur territory over here. Again, the best time to try is around dawn. ■

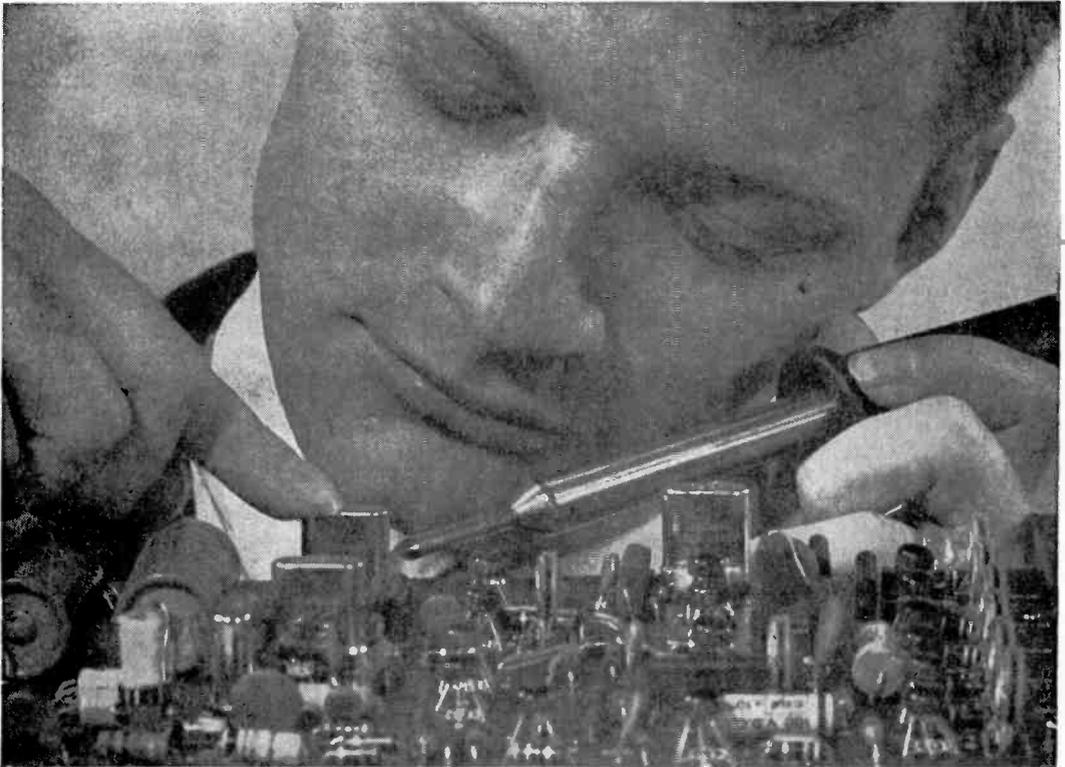


Shigatse, Tibet, (above right) home of Tibet's Panchen Lama and country's second largest city. In 1959, Communist China deposed Dalai Lama and set up government of its own. Panchen Lama was selected as new leader.

In Ying Kiang Choi, Tibet, natives bring horses to town to sell to purchasing bureau.



**NRI “hands-on” training  
in communications  
can give you as much as  
2 years of on-the-job  
experience.**



**EARN YOUR FCC LICENSE – OR YOUR MONEY BACK**

NRI Communications training programs will qualify you for a First Class Commercial Radiotelephone License issued by the FCC. If you fail to pass the FCC examinations for this license after successfully completing an NRI Communications course we will, on request, refund in full the tuition you have paid. This agreement is valid for the period of your active student membership and for six months after completion of your training. No school offers a more liberal FCC License agreement.

# Experience is still your best teacher



**NRI Achievement Kit** is educator-acclaimed and the original "starter" kit in home study training. Imitated but never duplicated, this kit is designed and personalized for you and your training objective. It has one purpose — to get you started quickly and easily.



**"Bite-Size" Texts** average an easily-digested 40 pages of well-illustrated, scientifically prepared subject matter in the course of your choice. Questions in each book are carefully hand-graded and returned to you with helpful instructional notes. You get unlimited personal help from the day you enroll.



## Designed-For-Learning Equipment

Like this phone-cw transmitter (Kit #7 in the Communications course) is engineered from chassis up to demonstrate principles you must know. NRI does not use modified hobby kits for training, but the finest parts money can buy, professionally and educationally applied.

*...here's how you get it with unique NRI training at home*

Ask any teacher, job counselor, engineer, technician or prospective employer about the need for practical application of theory in Electronics. He'll tell you Electronics is as much a "hands-on" profession as dentistry or chemistry. That's how you learn at home with NRI. You prove the theory you read in "bite-size" texts, by actual experimentation with the type of solid-state, transistor and tube circuits you'll find on the job today — *not* hardware or hobby kits. You introduce circuit defects, analyze results, discover quickly the kind of trouble-shooting and design techniques that will make you employable in Electronics.

## Train with the leader — NRI

NRI lab equipment is designed from chassis up for effective, fascinating training — not for entertainment. The fact that end results are usable, quality products is a bonus. In Communications, for example, you build and analyze, stage by stage, your own 25-watt phone/cw transmitter. It's suitable for use on the 80-meter amateur band, if you have an interest in ham radio. In TV-Radio Servicing your practical training gives you your choice of monochrome or color TV sets. All training equipment is included in the low tuition — you pay nothing extra. Discover for yourself the ease, excitement and *value* of NRI training. Mail postage-free card today for new NRI Catalog . . . or use the coupon below. No obligation. No salesman will call on you. NATIONAL RADIO INSTITUTE, Washington, D.C. 20016.

### APPROVED UNDER NEW GI BILL

If you have served since January 31, 1955, or are in service now, check GI line on postage-free card or in coupon.

MAIL THIS COUPON IF CARD IS GONE



**NATIONAL RADIO INSTITUTE** 5-108

Washington, D.C. 20016

Please send me your new NRI Catalog. I understand no salesman will call and there is no obligation.

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

Address \_\_\_\_\_

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

Check for facts on new GI Bill

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

# FD

## Propagation Forecast

By C. M. Stanbury II

October-November 1968

Take a gander at our listings for Asia. With the closings of BBC Botswana, R. Americas and R. Libertad, top SWL attention will now be focused on the Far East. Our Far East Propagation Forecast predictions are based on the best (and the most interesting) DX available during any given time period, which obviously involves many factors in addition to mere signal strength alone.

This forecast method can produce some pretty weird looking predictions, as demonstrated by the night choices (listeners' time) for Red Hot Asia. For example, at 0600-0900 we have picked two such very widely separated bands as 19 and 49 meters. Prob-

lem here is that the best and most interesting stations will be on 49 meters, but their signals will often be so poor that on many days they will actually be "available" to only a few North American listeners. Signals on the 19-meter band, on the other hand, will normally be strong, clear and available to all.

Meanwhile Latin American predictions are deceptive. There appear to be only a few minor changes but in fact night-time reception will be tremendously improved because the noise level will have fallen off so drastically. Also, African stations heard on 60, 49 and 41 meters will be from equatorial countries instead of southern nations as was the case several months ago. ■

RADIO-TV EXPERIMENTER PROPAGATION FORECAST

Oct./Nov. 1968 LISTENER'S STANDARD TIME	ASIA (except Near East)	EUROPE, NEAR EAST & AFRICA (N. of the Sahara)	AFRICA (S. of the Sahara)	SOUTH PACIFIC	LATIN AMERICA
0000-0300	(19), 25, (31)	31, (41), 49	41, 49, (60e)	25	49, 60
0300-0600	25, (31), (41), 49	31	(31-poor)	31, 60	49, 60
0600-0900	(13), 19, (25), 49	16, 19	19	25, 31, (60)	31, 49, (60), (90)
0900-1200	16, 19	16, 19	19	25	25
1200-1500	19	16, 19	25	(19-poor)	19, 25
1500-1800	16, 19	(19), 25, 31	25, 31, (60e)	(19-poor)	31
1800-2100	16, 19	25, 31	25, 31	16, 19	49, 60, 90
2100-2400	16, 90	25, 31	41, 60	19, 25, (41w)	49, 60, 90

To use the table put your finger on the region you want to hear and log. move your finger down until it is alongside the local standard time at which you will be listening and lift your finger. Underneath your pointing digit will be the shortwave band or bands that will give the best DX results. The time in the above propagation prediction table is given in *standard time* at the listener's location which effectively compensates for differences in propagation characteristics between the East and West Coasts of North America. Abbreviations: w—Western North America and e—Eastern North America. When w or e follow a band listing, it means the band is only good for that part of the continent. The shortwave bands in brackets are given as second choices. Refer to White's Radio Log for World-Wide Shortwave Broadcast Stations list.

# the STRUGGLE that WILL STRANGLE



# RADIO

■ Radio broadcasters once played a 1910 version of rock-and-roll. A station about to go on the air would rock a receiver dial to find a quiet spot on the band. Once a clear frequency was found, the station would roll the transmitter onto it and start broadcasting. The listener at home would search out his favorite program like the ham circling a rare DX station.

Today, the bands forgive no such free-swinging on the frequencies. Broadcaster and policeman, ham and ship-owner grip their channels with a try-and-budge-me fervor. Their fear pervades every group that takes to the air to communicate, broadcast, control, or relay. The reason? Radio's once seemingly unlimited spectrum is slipping away.

What is the spectrum? Who owns it? Why is it vanishing? What happens on radio's Doomsday, which nearly occurred in Detroit, when police tried to call headquarters but couldn't get through? Or the time a boatman shouted a distress call on an emergency frequency and raised no one? What about the beleaguered ham and CB operator who daily fight a radio traffic jam? The answer to these questions could begin with a simple technical reality: the radio spectrum, like pure air and water, is not a limitless resource.

*(Continued overleaf)*

# The Struggle That Will Strangle Radio

**Top To Bottom.** Nations of the world define the radio spectrum according to the chart of Fig. 1. It begins at 10 kHz, which is in the area of the upper range of human hearing. (An electrical signal at that frequency emanating from a loudspeaker would be heard by most people as a half-pitched tone.) But transformed into an electromagnetic wave and pumped from an antenna, it travels at the speed of light. Range is poor, however, since it takes higher frequencies to launch the wave any appreciable distance. So much for the spectrum's bottom end.

At the pinnacle is 300 GHz. Here the wave nudges the visible light region. But a

States is confronted with the foreboding prospects that available frequencies in some part of the spectrum are inadequate to satisfy certain interests and goals. In simple words, the demand has exceeded the supply . . ." What he didn't say is this: that the struggle to fit more and more stations into an already jammed spectrum will effectively strangle radio.

**Keeper Of The Spectrum.** To see who controls the dwindling supply, we look to the ITU or *International Telecommunications Union*. Consisting of about 130 countries, its task is to carve up the radio spectrum and decide how the portions are used. It designates, for example, 2850-3025 kHz for aeronautical mobile and reserves 150 MHz for radionavigation satellites.

The ITU, however, does not dictate which

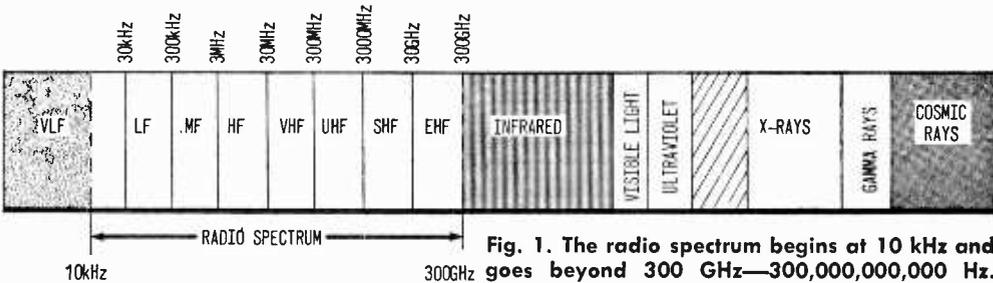


Fig. 1. The radio spectrum begins at 10 kHz and goes beyond 300 GHz—300,000,000,000 Hz.

signal is useless long before it reaches 300 GHz. The earth's atmosphere is a sponge for frequencies much over 10 GHz. Energy absorption is so great that fully two-thirds of the spectrum's total span is rendered impractical for communications. Only the lower segment contains workable frequencies. So the spectrum looks vast on paper, but is mostly useless in practice.

Although the spectrum is strait-jacketed by these limits, the same can't be said for services clamoring to get on it. Not only is space at a premium, but it's doled out in special fashion. A TV station, for example, needs an elephantine signal fully 6 MHz wide. Even *half* that signal would gobble the spectrum's first three bands! If a radioteletype station must communicate with South America, it needs a slot somewhere between 3 and 30 MHz. Otherwise the signal could expire at the state line.

William Plummer, a government communications expert, recently issued an ominous warning on the spectrum's condition. Said he: "There is ample evidence that the United

country may use a particular frequency. It merely determines *function* so the world utilizes each band in similar fashion. It's the individual nation that does the actual parceling out of frequencies to the end user.

In the U.S., the pie is sliced up by two agencies. For government stations, allocations are handled by the Director of Telecommunications (who answers to the president). Everything else—civilian, business, industry—is assigned by the Federal Communications Commission. The FCC follows the mandate that the spectrum is a natural resource, owned and used by the people without charge.

And how we've used it! Fact is, few other natural resources have been so thoroughly developed for public safety, pleasure, and profit. But a close scan through the spectrum's several parts exposes foreboding stresses and strains.

**From VLF To EHF.** International treaty divides the spectrum into eight sections. They're handy divisions that pull the multitude of frequencies into perspective in terms

<b>THE RADIO SPECTRUM AT A GLANCE</b>	
<b>Band</b>	<b>Typical Services</b>
<b>VLF</b> (Very Low Frequency) 30 kHz and below	Radionavigation (beacon), maritime
<b>LF</b> (Low Frequency) 30 kHz to 300 kHz	Aeronautical, maritime, radiolocation, radionavigation (beacon)
<b>MF</b> (Medium Frequency) 300 kHz to 3000 kHz	AM broadcasting, amateur, disaster, industrial, distress and calling, public safety, radio astronomy, maritime, aeronautical
<b>HF</b> (High Frequency) 3 MHz to 30 MHz	International broadcasting and long-range communications, amateur, citizens band, standard frequency, CAP, industrial, scientific and medical equipment, radio astronomy, public safety, aeronautical, facsimile, space research, maritime
<b>VHF</b> (Very High Frequency) 30 MHz to 300 MHz	Television broadcasting, FM broadcasting, space telemetry, satellite, survival equipment, land mobile, public safety, amateur, radioastronomy, amateur, aeronautical mobile and navigation, maritime, meteorology
<b>UHF</b> (Ultra High Frequency) 300MHz to 3000 MHz	Television broadcasting, satellite, space research, radio-sonde, radionavigation, radiolocation, land transportation, public safety, citizens band, aviation, industrial, amateur
<b>SHF</b> (Super High Frequency) 3 GHz to 30 GHz	Communications satellite, weather satellite, radionavigation satellite, television pickup, radar, amateur, radionavigation, radio astronomy, space research
<b>EHF</b> (Extremely High Frequency) 30 GHz to 300 GHz	Space research, radio astronomy, radiolocation, amateur, experimental

**Fig. 2.** As hams, Cbers or SWLs we are concerned with only a portion of the radio spectrum. A look at the total spectrum will indicate the extent to which all usable bands are crowded.

of performance and practical use. As you can see from Fig. 2, the sections carry a myriad of services intimately tied to our daily lives; from radio and TV broadcasting, communications and public-safety agencies, to space research, shortwave, and industry. Sharing the bands are countless military stations that carry the traffic of national security. To get a grip on the vanishing spectrum, let's examine those eight divisions in some detail.

**VLF.** This is radio's basement. VLF can

lay down a blanket of radio waves that saturates vast areas. It travels almost completely by earth-hugging ground waves—reliable signals that resist changing band conditions. The penetrating ability of VLF even allows communications with submarines below the surface of the water. VLF is mainly used for long-distance communications by *on-off* keying and navigation systems.

The flaw in VLF is bandwidth. Since the whole band is merely 20 kHz wide (running

## The Struggle That Will Strangle Radio

from 10 kHz to 30 kHz), precious few signals can occupy it in any given region at the same time. As few as four voice channels on VLF would begin to crowd its edges.

**LF.** As the twin of VLF, the Low Frequency band shares similar qualities. Good ground waves makes LF useful for navigation (where signals can be extremely narrow). With additional room on the spectrum (a total of 270 kHz), some voice operation starts to appear. But though LF has long been the beacon band, bristling growth in shipping and air transport has nearly exhausted its usefulness. It's been just about abandoned in favor of more sophisticated navigation systems on higher bands.

**MF.** The Medium Frequency band is best known for standard AM broadcasting. Growth in this industry has been so vigorous that frequency allocations for nearly every town are now taken. Before World War II, there were less than 1000 broadcast stations; today, the number of AM broadcasters is heading toward 5000.

It's a mammoth job just fitting these stations checkerboard fashion over the country without mutual interference. Stations often operate with complex antenna patterns to keep signals strong in some areas, curbed in others. Some stations reduce power at night to limit long-ranging waves, while daytimers close down completely. Broadcasting is bigger in every respect, except in its band.

The remainder of MF, just above the broadcasters, is also feeling a pinch. LORAN, the Long Range Navigation system that guides coastal and oceanic craft, is squeezed into this corner of the spectrum. Above it is the marine band on 2 to 3 MHz with channels for pleasure and commercial boats. With an estimated eight million boat owners, conditions on the band are often chaotic. At the outset of World War II there were about 4000 licensed stations in the marine band; today the count exceeds 100,000. Crowding on the marine band has grown to such critical proportions that a second marine band had to be created on 156 MHz.

**HF.** As the most dramatic performer of them all, High Frequency lures a staggering number of stations into the 3- to 30-MHz band. The special attraction is long-distance transmission through the ionosphere. As hams know, the HF signal is easily sent

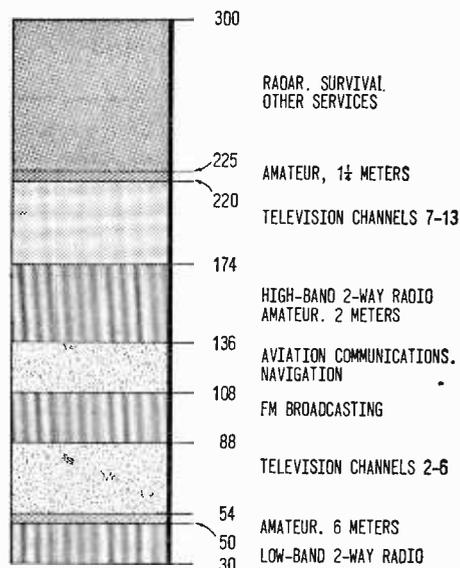
skipping around the world on puny power. And the five most popular ham bands—80, 40, 20, 15, and 10 Meters—dot the HF band. Thing is, hams have plenty of company. Since an army of other stations takes the free ride through the ionosphere, the HF band is rapidly reaching a saturation point.

One HF trouble spot is international broadcasting by about 5000 shortwave stations. Though governments of the world agree on certain shortwave bands (near 6, 7, 9, 11, 15, and 21 MHz), activity in the bands is frenetic. The global broadcasters aren't assigned specific frequencies, so it's common to hear two stations transmitting on one channel. Or they wash over each other because of too close spacing.

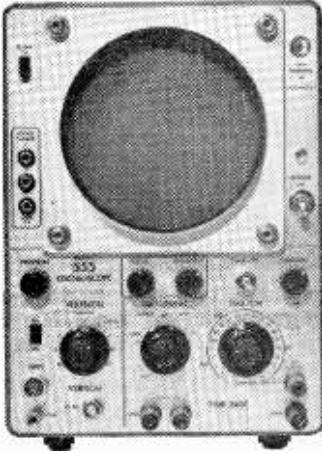
The problem was acute enough when the air was filled with powerful signals of such giants as Voice of America, Radio Moscow, and the BBC (which can pour out 500 hours of programs a week from some 40 transmitters). Today, the emerging nations of Africa and Asia are adding their voices to the din.

HF is also the medium for overseas communications outfits that carry a huge volume of message traffic, data, and press services. Their powerful rigs and rhombic antennas fire potent signals to every corner of the globe. To foil changing ionospheric conditions, they flit among dozens of HF frequencies. Ships and aviation are also handed chunks of HF to satisfy long-range commu-

*(Continued on page 115)*



**Fig. 3.** Here's the crowded VHF band all stacked up—it's as crowded as it looks.



DATA INSTRUMENTS DIVISION  
MODEL 555  
Lab-Grade Oscilloscope

■ When we first heard about Data Instruments' 555 scope, we thought someone was pulling our leg. Though the info at hand specifically stated that the 555 was a general-purpose scope, the specs suggested that it was lab grade—and for only \$284. Also, the 555 looked every inch a lab scope, having a calibrated vertical-input attenuator, calibrated time base, and adjustable triggering level. The big question: exactly what is the 555?

Data Instruments' 555 proves to be a hybrid. Most of its circuits are solid-state, yet the vertical-input preamplifier and vertical- and horizontal-output stages use tubes. Extensive use of subassemblies results in a 5-in. scope that's only slightly larger and heavier than a typical 3-in. job.

These PC subassemblies are unusual in that the location of every single component is clearly marked. Also, all calibration potentiometers are clearly indicated. This is one piece of solid-state gear no technician will have trouble servicing or adjusting.

A coax connector feeds the vertical input, and the vertical attenuator is calibrated directly in volts/cm—the actual steps being 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, and 10

V/cm. A separate control allows the vertical gain to be adjusted continuously.

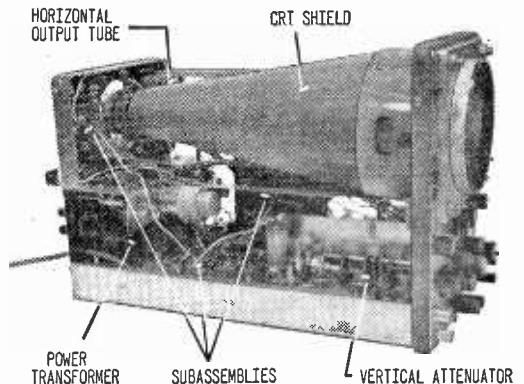
The time base is calibrated directly in cm/sec from 1  $\mu$ s/cm to 1 s/cm. There is also a variable time base control, and a calibrated 5 $\times$  horizontal expansion.

One control allows the time base to be triggered with either positive or negative signal slopes from the power line, an internal signal, or an external source. There is also provision for an external horizontal input. A trigger level control allows the time base to be triggered on virtually any part of the input signal. Trigger stability and DC balance controls are also on the front panel, as well as a three-step voltage calibrator (5, 0.5 and 0.05 P-P volts).

While the scope is made in Japan and internal hardware is of the metric variety, the front panel has a standard bezel which accepts American graticules, CRT hoods, and camera mounts.

**Test Traces.** Actual performance was surprisingly good, particularly in view of the 555's price tag of \$284. The vertical bandwidth is rated for a  $-3$  dB response from DC to 7 MHz and this checked right on the button. The horizontal response was also within  $-3$  dB from 2 Hz to 200 kHz.

Both the vertical calibration accuracy and the time base accuracy are rated at 5%. The internal voltage calibrator is rated at 3%. While the scope met these specifications exactly, we found it extremely easy to bring the accuracy within 1 to 3% (and we can't



A uhf coax connector feeds vertical input of scope. Full-length CRT shield results in an absolutely hum-free trace. Note PC boards.

# LAB CHECK

see why the scope isn't calibrated to this higher accuracy).

The overall CRT linearity was superb, far exceeding the performance we have seen on lab scopes priced as high as \$1000. Astigmatism adjustment was excellent, and the CRT trace could be made razor sharp over the entire screen except for 1 cm at the extreme left side where it was only acceptably sharp.

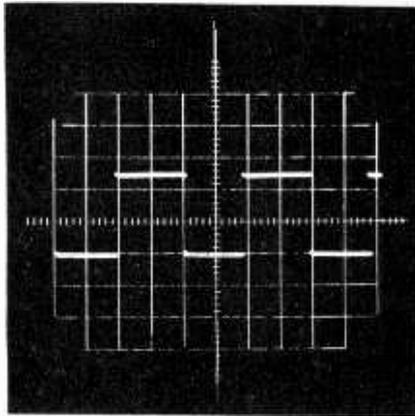
Naturally, at the 555's very low price (for a lab scope) there are bound to be a few drawbacks. The graticule illumination is not even, the lower left side being somewhat darker than the rest. While this isn't particularly noticeable in general use, it does show up in photos of the CRT. We solved the problem by replacing the graticule with an American model. Also, the tilt bracket on the bottom of the scope is too big. The bracket puts excess pressure on the plastic support—so much so that the support snapped the first time we used the tilt. Remedy here is to reduce the size of the tilt bracket.

Finally, and this is no fault of the instrument, there are no delay lines included that would allow the time base to be triggered before the CRT trace begins. However, delay lines would add at least \$100 to the price, and they are really not necessary unless you're particularly interested in examining the leading edge of a pulse waveform.

**Internal Construction.** While the sub-assemblies in this scope are not supported even as well as assemblies found in kit oscilloscopes, several months' hard use has not produced any deficiencies in operation. In fact, this has been one of the most trouble-free scopes we have used.

The PC assemblies use a medium-weight epoxy board, and the boards are positioned for good air flow. Because there are only three tubes in addition to the CRT, there is very little heat dissipation and we experienced no instability due to thermal effects. All internal adjustments for calibration, including the vertical-attenuator frequency-compensating trimmers, are specifically oriented for easy adjustment—none are buried under other components.

**Summing Up.** The front-panel controls have one of the best arrangements we have run across in lab scopes and are self explanatory. The three main controls—vertical gain,

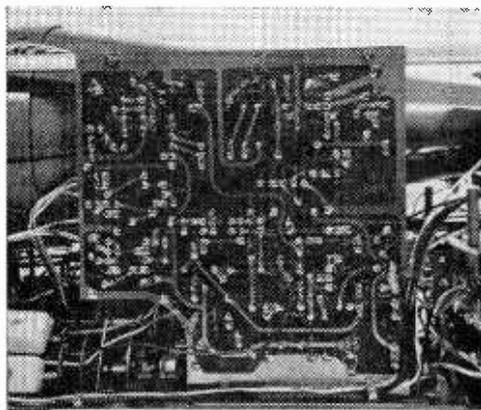


**Built-in voltage calibrator produces square wave of approximately 1 kHz. This allows you to adjust low-capacity probes in a jiff.**

triggering, and time base—are grouped in a line and are the only controls which are generally used once the scope is set up. In effect, the 555 is a student's scope from the standpoint of efficiency and ease of operation.

We found the model 555 oscilloscope performed, at the very least, exactly as described, and that it can easily be calibrated to better than the specified 5% accuracy. We would recommend it particularly for students, as well as experimenters, technicians, and production labs. It is especially attractive for schools trying to equip science labs on shoestring budgets. We rate it an outstanding buy in test equipment. The 555 comes equipped with a 10X low-capacity probe and an input-jack adapter.

For additional information write to Data Instruments Div., Dept. TEC, 7300 Crescent Blvd., Pennsauken, N.J. 08110. ■



PC boards in 555 are mapped on foil side to show circuit functions, transistor terminals, and even test voltages for servicing.



# SWINGING SCREAMER

■ This simple magnetic audio generator will do things that a sophisticated electronic generator won't do half as easily. It can hoot like an owl . . . wail like a banshee . . . sound an air-raid warning . . . drive stray dogs away. It's great for making piercing squeals. And for more serious experimental applications it also provides continuous audio frequencies all the way from near-DC to inaudible highs.

To be sure, the Screamer will never replace conventional, wholly electronic audio generators with their undistorted sine wave signals. Still, a Screamer made from junk-box parts can provide surprisingly clean waveforms that are quite acceptable for many audio or electronic applications.

Perhaps the best reason for building this generator is for its unique entertainment value. Just about everyone has heard squeals and howls emanate from an on-the-fritz radio; even electronically unsophisticated people aren't surprised to hear strange sounds issue from conventional electronic devices. On the other hand, this howler produces a very different reaction. Anyone who personally operates the manually

By Jorma Hyypia

# SWINGING SCREAMER

cranked version of the Screamer is bound to be fascinated and mystified by the spooky sounds that this deceptively simple device can create.

**How It Works.** Basically, the Screamer involves nothing more than modulation of the magnetic field of a permanent magnet by means of the teeth of a rotating iron gear. The faster the gear turns, the higher the audio frequency generated.

A simple coil picks up these magnetic disturbances and feeds the signals to an audio amplifier which can be part of a tape recorder, a receiver, or a record player system. Our illustrations also show a step-up transformer. This is not usually needed to produce audible sounds, but you may have to add it to obtain sufficient signal strength to activate some oscilloscopes if you want to observe the audio waveforms.

When used for audio test purposes, the gear should be driven by means of a variable speed motor that can maintain a sustained signal at any set frequency. A motor is not needed for the odd-ball experiments which are conducted far more easily if a relatively simple hand-crank drive is substituted.

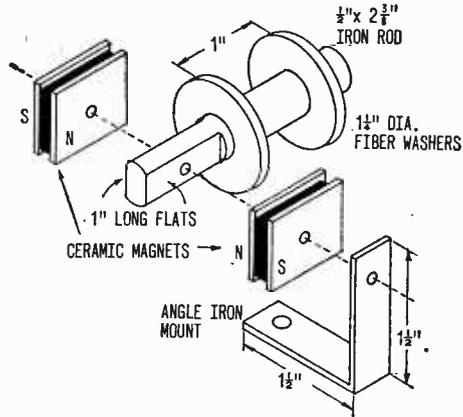
**Induction Magnet.** Construction of the Screamer is substantially simplified if an alnico bar or cylinder magnet is available. This should be at least  $1\frac{1}{4}$  in. in length and up to  $\frac{1}{2}$  in. in diameter.

If such a magnet proves hard to come by, a wholly satisfactory alternative is to make a cylinder magnet from a length of soft iron rod.

To do so, cut an iron rod (about  $\frac{3}{8}$  in. dia) to a length of  $2\frac{3}{8}$  in. and file two flat surfaces on one end of the rod as shown in the illustrations. Buy two magnetic cupboard-door catches and remove the ceramic magnets and their metal pole plates. Look for catches in which the pole plates measure  $\frac{7}{8} \times \frac{3}{4}$  in.; these plates and the ceramic piece between them should have a hole already drilled through their centers.

Drill a hole through the flat surfaces of the iron rod so that the magnet sandwiches can be fastened on either side by means of a brass bolt. Also, use the same bolt to attach an angle-iron mounting bracket.

Make certain that *like* poles of the ceramic magnets contact the iron bar by first

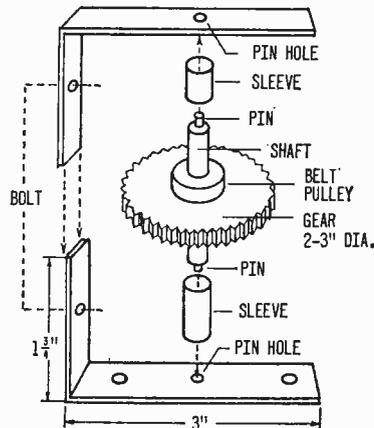


**Permanent bar magnet can be made by bolting 2 ceramic magnets to flats filed at one end of iron rod. Like poles face one another.**

testing the magnets to see which plate surfaces repulse each other. By virtue of induced magnetism, the bar should now be a strong permanent magnet.

**Coil Construction.** Coil specifications are not at all critical. Actually, all you need do is to wrap about 50 turns of black-insulated bell wire around the remaining portion of the iron rod to obtain good pickup of the signal. But very little extra effort is required to make a more sensitive and better-looking coil.

Cut two  $1\frac{1}{4}$ -in. dia fiber washers from stiff cardboard or, preferably, from  $\frac{1}{8}$ -in. thick masonite. Make the center holes just large enough so that washers can be forced onto the rod for tight fits. Space the washers 1 in. apart and cement in place with Duco cement or a similar adhesive. Be sure to



**Gear assembly is mounted in U-bracket made from 2 angle irons. Gear and belt pulley should spin freely on the stationary shaft.**

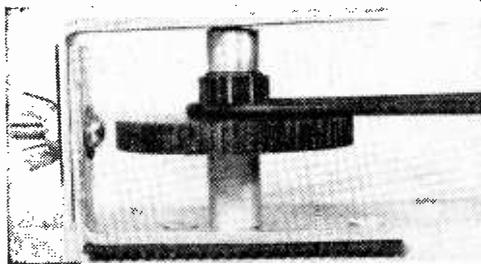
Overall layout of Swinging Screamer is shown at right. Any kind of variable speed motor can be used to spin gear to generate a wide range of audio frequencies. Audio transformer is optional, but be sure to adjust magnet/coil sensing element for best position (highest output) before actually mounting it on plywood base next to gear.

leave about  $\frac{3}{16}$  in. of bar protruding beyond the washer at the end of the rod.

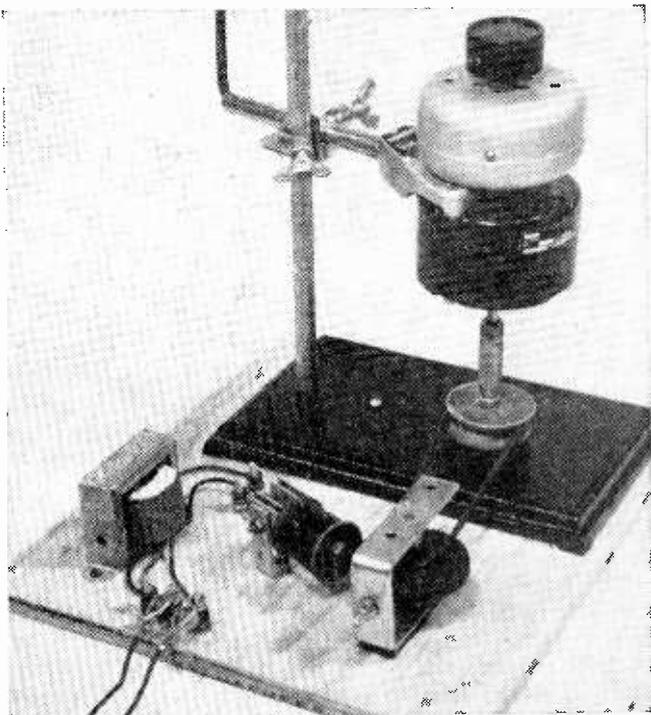
Wind the coil neatly, layer upon layer, using enamel-coated magnet wire (or bell wire if the preferred magnet wire is not available). A layer of thin paper or self-adhesive paper masking tape wrapped over each layer of wire will help produce a more evenly wound coil. Use any gauge magnet wire from #18 to #24 that may be available (the author used 250 turns of #20 wire). Wrap plastic electrical tape over the final layer of wire to make a secure and neat job.

**Gear Assembly.** Don't attempt to find an exact match for the gear shown in the illustrations, since this one came from the author's junk box. In general, here's what to look for.

The gear *must* be made of iron—not brass or aluminum. It should be fairly thick (about  $\frac{1}{4}$  in. is good) and have teeth that are not excessively flat at the tops. The gear can be



Large gear is used as transducer, while small gear serves as handy belt pulley. Note sleeves supporting pulley and rubber pad.



of most any diameter, though it should be at least 2 in. across to permit use of speed-changing pulleys (more about this later). Avoid gears having excessively fine teeth. On the other hand, the more teeth your gear has, the lower the motor drive speed required to attain any desired frequency level.

As a rough guide in selecting a satisfactory gear, these are the specifications shown in the illustrations: diameter,  $2\frac{1}{4}$  in.; thickness,  $\frac{1}{4}$  in.; number of teeth, 70. Attached to the large gear is a smaller gear  $\frac{5}{8}$  in. in diameter. This serves as a convenient pulley for the drive belt. If a similar double gear can't be found, improvise a pulley that can be attached to the gear you select. For example, try removing one flange from a spool used to contain surgical adhesive tape; bolt the other flange to the gear and use the center tube as a pulley.

Mounting the gear is about the most critical part of the entire construction job; it is not difficult, but it must be done carefully. The gear must spin as smoothly as possible, without noticeable wobble, for two reasons. Excessive wobble will cause the gear to bang against the magnet rod which must be positioned very close to the gear. The wobble will also create spurious signals that will greatly distort the audio frequencies generated.

*(Continued overleaf)*

# SWINGING SCREAMER

If the gear is attached to the supporting shaft, two wobble-free bearings must be devised. A far easier way to solve the problem is to use a stationary shaft which the gear can spin on freely.

Obtain a metal rod that fits the gear axle hole as snugly as possible without binding. Cut the shaft to size after making the supporting U-bracket from two angle irons. If you have access to a metal turning lathe, turn both ends of the shaft down to form pins about  $\frac{1}{16}$  in. to  $\frac{1}{8}$  in. in diameter. Lacking a suitable lathe, cut the rod just long enough to fit snugly between the arms of the U-bracket and then drill holes about  $\frac{3}{8}$  in. deep in each end.

Pick a drill of such size that you can hammer a large nail (spike) tightly into each hole. Cut the spikes off, leaving short mounting pins on each end of the rod. Alternatively, if the angle irons used to make the bracket are wide enough, drill holes large enough to take the full diameter of the gear shaft.

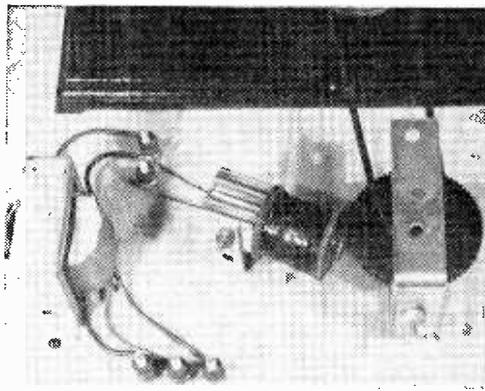
Cut a piece of metal tubing just long enough to slip onto the lower section of the shaft to support the gear at a convenient height between the bracket arms. Another length of tubing above the gear keeps the gear from bouncing up and down.

To make the U-bracket, cut down one side of each 3 in. angle iron as shown. The short arms are bolted together with a bolt and wing nut. This two-piece U-bracket facilitates assembly of the gear unit and also permits easy disassembly if pulley wheels of other diameters are used to step up the gear's rpm.

Grease or oil the shaft to make the gear turn smoothly. This done, screw the U-bracket onto a plywood panel as shown. A piece of flat rubber under the bracket will dampen vibrations and reduce noise.

**Sensor Position.** Before mounting the magnet/coil sensing element to the ply-

**Additional pulleys made from plywood and masonite discs can be attached to transducer gear to attain different speeds.**



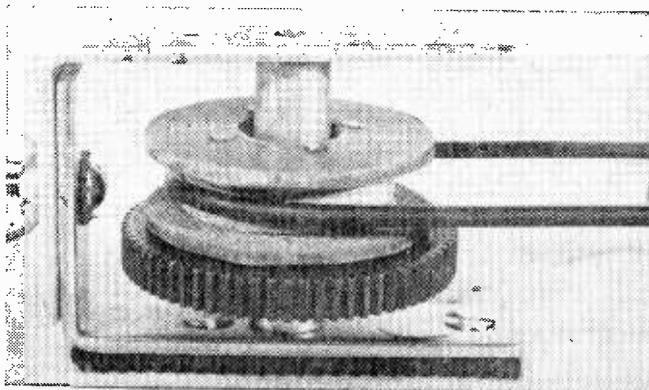
**Magnet/coil sensor works best if placed at angle to gear. Pole almost touches gear.**

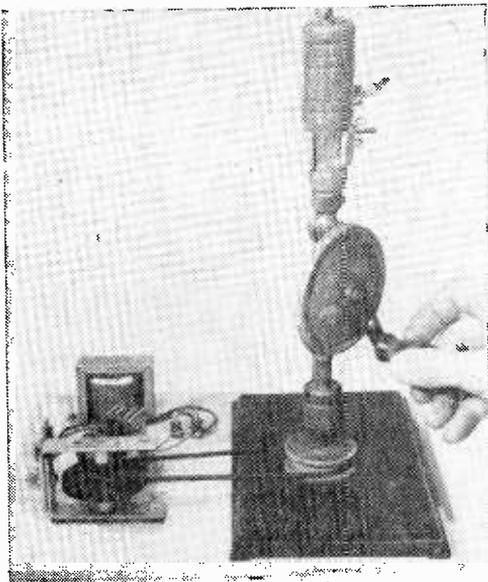
wood base, determine the best position by checking the intensity of the sound produced. The end of the bar magnet must be very close to the gear. A head-on, perpendicular positioning of the magnet end may not give the strongest signal. Try angling the magnet slightly as shown in the illustrations.

When the best position is found, mount onto the plywood base with only one screw in the end hole of the angle-iron support to permit swivelling of the sensor during final adjustments.

**Step-up Transformer.** You may obtain an entirely adequate signal by simply coupling the sensor leads directly to the microphone input of your audio amplifier. If not, try adding just about any audio transformer you find in your junk box. An old output transformer having an 8-ohm secondary and a 5000- to 8000-ohm primary works well.

Connect the magnet/coil wires to the low-impedance (i.e., secondary) leads of the transformer, and the audio amplifier or oscilloscope to the high-impedance side (this is now the secondary).





Manual drive system such as shop drill is preferable if strange sound effects are desired.

**Drive Motor.** To obtain good signals for general audio experimentation, the gear should be driven by a variable-speed motor. A low-voltage DC motor equipped with a rheostat to control the speed is ideal. (The author drives his generator with a variable-speed AC motor intended for mixing chemical solutions.)

The motor should be provided with a chuck so that various sizes of pulley wheels can be attached. You may have to use a fairly large pulley on the motor to generate very high-frequency sounds. A round rubber belt of the type used in tape recorders (obtained from a radio supply store) makes an excellent drive belt. A belt having a 15-in. circumference is about right.

Incidentally, if your motor shaft is free of wobble, you can attach the gear directly to the motor and forget about making the gear assembly described earlier. However, if the motor shaft does not run true, the sound will be badly distorted.

**Frequency Measurements.** The best way to check the frequency of any audio signal being generated is with the aid of a calibrated oscilloscope. But if a scope is not available, some rough approximations can be obtained by other means.

A stroboscope can be used to determine the gear's rpm and the frequency can be calculated by multiplying the gear speed (revolutions per second) by the number of

teeth on the gear. For example, if the gear has 70 teeth, and is turning at a speed of 224 rpm or about 3.74 revolutions per second, the frequency is about 262 Hz or very close to middle C. If the gear had twice the number of teeth, it would have to turn only half as fast to provide the same frequency.

For very rough approximations, you can compare the generated sounds with a good musical pitch pipe.

**Manual Drive.** In lieu of the motor drive you can use a hand-cranked pulley system to drive the gear. It's virtually impossible to maintain a steady frequency by this means, but as an entertaining noise maker this simple and inexpensive system can't be beat. It's well worth trying even if a motor is used for more serious work.

If you make a pulley wheel about 6 in. in diameter, attach a handle, and use this with a belt drive to turn a gear pulley 1/2 in. in diameter, you can spin the gear at a speed of about 22 rps (this assumes that you turn the large pulley at a speed of 2 rps.) This would give you a frequency limit of about 1540 Hz when using a gear with 70 teeth.

A better hand drive can be had with a small shop drill by simply attaching a small pulley that can be made from a 1/2-in. thick plywood disc sandwiched between two slightly larger discs cut from masonite. The drill gearing will provide higher speeds with less effort.

When the drill handle is given a series of short flicks, the intermittent low-pitch sounds are remarkably like those of a hoot owl. Faster turning at varying speeds will produce wails like air-raid sirens or those spooky, unearthly sounds associated with outer-space science fiction. The same sounds, played at relatively low volume, resemble wind storms. It's obvious that the device could be very handy as a sound effects machine for use in amateur theatrical productions.

**Howloween Fund.** The trick-or-treaters in your family won't fail to see the obvious prank potentials of the Screamer when the next Halloween rolls around. It will be easy enough to set up the rig to startle visitors at your own home. But your own small fry will probably want a portable unit they can carry around the neighborhood.

A hand-cranked Screamer equipped with a battery-operated amplifier and speaker, housed in a portable box, may turn the trick. It's worth a try—provided your neighbors have a sense of humor and won't scream! ■

# DX PHILATELIA

By Don Jensen

■ Maybe you figured stamp collecting was kid stuff—you know, like steaming scraps of carmine and ultramarine stickem from old envelopes, sorting stamps by country and hinging them in leather-bound albums. If so, you're as out of date as Uncle Hiram's knickers.

The trend today in the ancient hobby of philately is topical collecting. Now, enthusiasts specialize in stamps picturing some specific theme, such as flowers, birds, transportation . . . or radio.

No, we're not trying to convert you. Chances are if you've been bitten by the DX bug, you'd rather fight than switch. But many SWLs have found they can double their fun by collecting postage stamps with radio or electronic themes as a supplement to their shortwave listening hobby. Take a good look at the stamp on your next QSL card. You just may find a surprise bonus stuck up there in the corner.

Your collection of radio philately can be as broad or as narrow as you wish. Since the early 1920s, scores of countries have issued stamps showing almost every aspect of electronics. Some honor broadcasting pioneers or scientists whose discoveries made electronics history. Others commemorate anniversaries of radio milestones, the establishment of a country's first station or admission to the International Telecommunications Union. To DXers, perhaps the most interesting are those that show actual shortwave stations.

As a starting point for your collection, how about the 5¢ Voice of America stamp, issued by our government in February to mark the 25th anniversary of the nation's radio voice to the world? Your post office



This 1960 Saudi Arabian series celebrates the development of telecommunications in that eastern country.



Radio Japan was founded in 1935, when its government was embarked on its expansionist East Asian Co-Prosperity moves. Twenty-five years later, in June 1960, Japan issued this 10 yen, rose-carmine anniversary stamp showing R. Japan's waves encircling the earth.



Radio amateurs got a boost when the U.S. Post Office printed this stamp several years ago. It shows an oscilloscope display and a radio dial.



Though better known for roulette than radio, Monaco issued a series of multicolored stamps in December 1951 honoring Radio Monte Carlo. The shortwave station's tower rises from the mountains behind the playground of the Roman Sea.



On March 13, 1959, Russia issued two stamps to mark the 100th anniversary of the birth of Popov, the scientist they credit with discovering the principles of radio.

The multicolored 60-kopek stamp shows the famed trellis tower radiating the word peace in five languages. The graceful tower was built in 1922 for Moscow's first station, a 12-kW transmitter said then to be the most powerful in the world. Today it's used for TV.

The use of Popov's wireless for rescue work at sea is shown in the black, brown, and blue-gray 40-kopek issue. The stamp depicts the rescue of some shipwrecked Czarist Russian fishermen in 1900.



West Germany's Berlin hosted the Funkausstellung 1963, a radio exhibition, and issued this blue, ultramarine, and gray 20-pfennig stamp. The city's symbol, the Berlin bear, beckons visitors to the exhibit.



The Comores, a group of French islands off the east coast of Africa, printed a pair of stamps in December 1960 to commemorate the opening of the Radio-diffusion Television Francaise station at Dzaoudzi. The 20-franc stamp shows a view of Dzaoudzi and radio symbols (antenna, coil, and ground). The 25-franc issue lists this rare DX station's shortwave frequencies and French language identification slogan.



A four-stamp block of Voice of America 5¢ stamps issued by the U.S. in the early part of 1968.

Strange as it seems, Communist Rumania issued this 40-bani stamp for a U.S. space communications development, the satellite that on Aug. 19, 1964 first relayed television programs of the Olympic Games across the Pacific from Tokyo. The purple stamp also shows television antennas and the five interlinked rings that symbolize the world Olympics.



Though usually used for telecommunication work, the transmitter at Bridgetown, Barbados, on occasions is used for broadcasts of cricket matches and horse races to the more remote Caribbean islands. A map of the island and the station's wireless mast, along with a portrait of King George VI, are shown on this \$1.20, olive and carmine colored stamp issued in May 1950.



might still have a few of these on hand. If not, write to the Philatelic Section of the Post Office Department, Washington, D.C. and ask for an order blank. If the stamp is still listed, you can have it for 5¢ a copy.

The inauguration of the BBC's relay station on tiny Ascension Island was the occasion for the issuance of a special commemorative in 1966. Europe's original swinging pop-music station, Radio Luxembourg, is depicted on a dark lilac, 3-franc stamp is-

sued in August 1953. A year earlier, Iran printed a 10-rial stamp on the 30th anniversary of the introduction of radio broadcasting to that country.

Among the older issues are Guatemala's, marking the beginning of radio-telegraphy in Central America, and a 9¢ green, commemorating Marconi's first transatlantic radio message, printed by Newfoundland when that Canadian province still had its own postal service. Both stamps are over 40 years old and are rare.

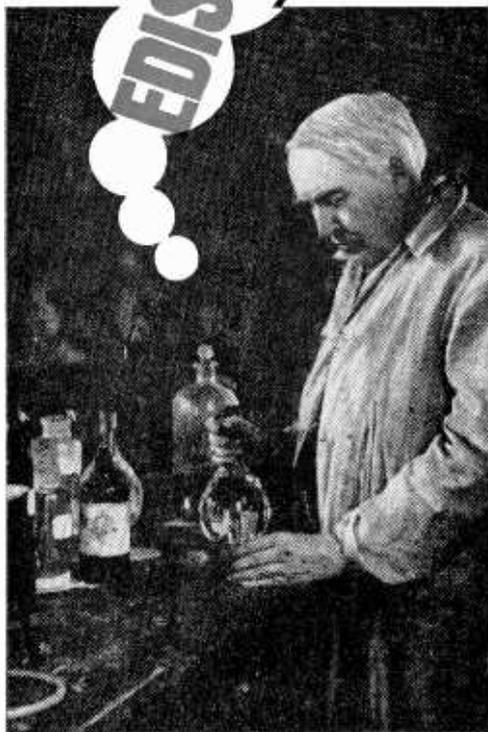
These stamps, plus the others shown and listed, will get your collection off to a good start. An hour or so spent studying one of the standard stamp catalogs will give you many more to look for. Of course, your local stamp dealer can offer a lot of help, too.

One final tip — mounted and framed, your radio stamp collection makes a great wall decoration in your DX den. ■

One sure way to build a specialized stamp collection is to enlist the aid of a local or mail order stamp dealer. The stamps listed in our table are inexpensive and offer a good start. When purchasing stamps it's best to refer to them by their "Minkus World Wide Stamp Catalogue" number.

Country	Catalog No.	Stamp Theme	Year Issued
Argentina	824	ITU Radio Conference	1954
Brazil	790	Inter-American Radio Conference	1945
Brazil	1105	Modern antenna at Brasilia	1960
Bulgaria	769	Radio towers	1947
Bulgaria	1239	Transmitting tower	1959
Cameroons	463	VHF relay station at Edea	1963
Czechoslovakia	1214	Antenna	1958
Dominican Republic	526	Communications emblem	1945
Dominican Republic	645	Modern communication system	1956
Falkland Islands	144	50th Anniversary of station VPC	1962
Rhodesia/Nyasaland	20	VHF antenna mast	1959
France	534	Radios for the Blind Fund	1938
Germany	157	Radio station at Nikolassee	1952
Honduras	318	Radio station	1929
Japan	539	Anniversary of broadcasting in Japan	1950
Korea	359	10th Anniversary of admission to ITU	1962
Malagasy	530	Aerials at Tananarive	1963
Paraguay	1019	Antenna—Progress series	1961
Poland	676	Radio tower	1949
Russia	1456	Radio Day	1949
Sweden	441	Modern design radio tower	1953
Taiwan	483	Microwave antenna	1961
Tunisia	714	Radio antenna tower	1962
United Arab Republic	689	Radio communications	1959
Vietnam	35	1st Anniversary of admission to ITU	1952

# EDISON gets the air

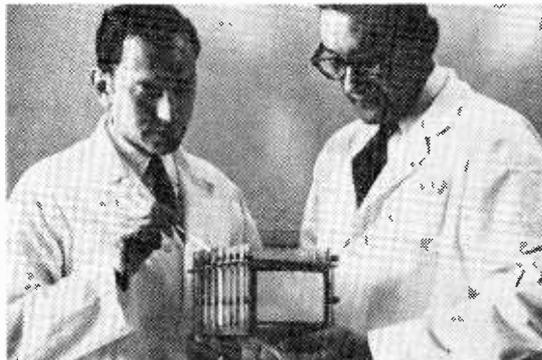


Here are Dr. Frederick P. Kober (left) and Melvin Yarish, developers of the new battery that gave Edison the air. The experimental iron-air cell they are examining may put the "go" in the electric cars.

■ Everyone might all be riding around today in electric automobiles if only Thomas Edison had been smart enough to put some air into the storage battery he invented way back in 1903. Now Edison's oversight has been corrected. General Telephone & Electronics scientists have given the out-moded Edison cell a new breath of life by converting it into an "air breathing" battery.

The Edison cell, also called a *nickel-iron-alkaline battery*, consists of perforated nickel-plated steel tubes having alternate layers of pure nickel and nickel hydroxide. The negative element is comprised of a grid containing granulated iron oxide. The electrolyte is a strong solution of potassium hydroxide with some lithium hydroxide added as catalyst. This battery is durable and lightweight, but has one serious shortcoming: a *lower* current capacity than the more popular lead-acid battery.

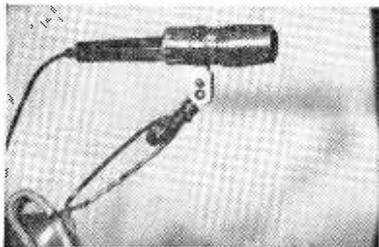
**Breath of Life.** The new GT&E battery utilizes a porous iron anode and air-depolarized cathodes. The air cathode is an oxygen (air) permeable hydrophobic structure supported on a nickel grid containing  
(Continued on page 118)



# IMAGINEERING DESIGN TIPS



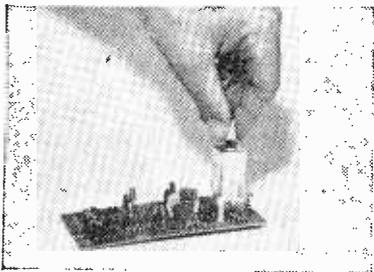
Photos by Moto



## A LIGHT MIKE STAND

• Makes no matter whether you are a pro or amateur tape recordist you'll always have need for a clip-on mike stand. To make one quickly just snap out the electrical works from the rear of a socket on a clip-on photoflood holder. Slip the mike into the empty socket shell—a few wraps of tape will give the mike a snug fit.

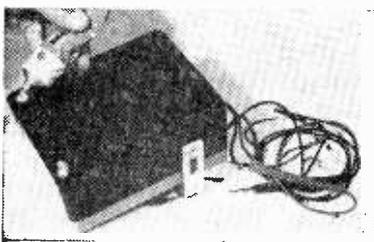
—H. Bram



## GIVE A KNOB A JOB

• About the toughest job during alignment is turning threaded shafts on slug-tuned coils. Make the job easier on yourself by slipping a solderless connector on the shaft and twisting tight. These connectors are available at the hardware counter in five-and-dimes. A drop of epoxy will make the knob stick forever on shafts that need frequent twisting.

—Jack Cass



## PUTTING THE SQUEEZE ON SHOCK

• Give your VOM or VTVM a cushion to rest on. Add rubber feet to your test gear's case and avoid the bangs and vibrations that shatter the meter's jewels. Squeeze some liquid rubber cement (GE's RTV cement will do fine) on the corners of the case. Snip off pointed ends after the cement hardens.

—Al Wise



## DIOGENES AND JACK

• If you want to find an honest man or do emergency work on your car at night—plan ahead. Replace the cable that comes with your auto hand spotlight with a coiled mike cord. Put a phone plug at the end of the cord and install three fused phone jacks under your hood, on the dash and in the trunk. Make a patch cord for extra length to reach another car.

—M. Lincoln

• Send your Imagineering Design Tips with full details and a photo or drawing to Radio-TV Experimenter, 229 Park Ave. South, New York, N.Y. 10003. The top ideas selected by the editors will win \$10.00. Entries become the property of Radio-TV Experimenter and can't be returned.

RADIO-TV EXPERIMENTER

By Joe Gronk

Marjorie Conners, caseworker in Buffalo, N.Y., shows videotaped replay of 2½-year-old Amy to Mr. and Mrs. Joseph Garrett. The Garretts subsequently adopted Amy in first use of videotape to expedite interstate adoption.



Spells  
Happiness

---

Here's the inside scoop  
on how TV's eye  
serves as a godfather  
and not as Big Brother!

---

■ Little Amy, a 2½-year-old girl from Wilmington, Delaware, has a real home now, thanks in part to videotape recording, television's familiar *instant replay*. Amy's new parents, Mr. and Mrs. Joseph Garrett of Buffalo, N.Y., adopted her after first seeing her tiny form as a television picture played back from a videotape recording (VTR). This unique experiment in human relations is the first adoption to be facilitated by the use of videotape recording, according to Norman W. Paget, executive director of the Children's Aid Society of Erie County in Buffalo.

Paget arranged for Amy to be videotaped

# VTR Spells Happiness

on an Ampex VR-6000 portable closed circuit videotape recorder by the Children's Bureau of Delaware in Wilmington. After the initial recording was completed, the tape was shipped to Buffalo for replay on a similar machine and viewing by the Garretts on a TV set.

Mrs. Garrett said: "When our social worker showed us the tape of Amy, we felt that we knew her. We were more relaxed about going to see her. And when we actually met her, we loved her immediately and



Little girl who stole the show—and stole her way into the hearts of Mr. and Mrs. Joseph Garrett of Buffalo, N.Y.—is Amy, whose likeness above is what the Garretts saw when they watched special videotape replay arranged by Children's Aid Society of Erie County, N.Y. Garretts later adopted Amy after meeting the child in person.

wanted to take her home then and there.

The taping project, pioneered by Paget, is a part of a program to facilitate adoption of hard to place children through Adoption Resources Exchange of North America (ARENA), a nationwide clearing house for adoption agencies. ARENA is an arm of the Child Welfare League of America.

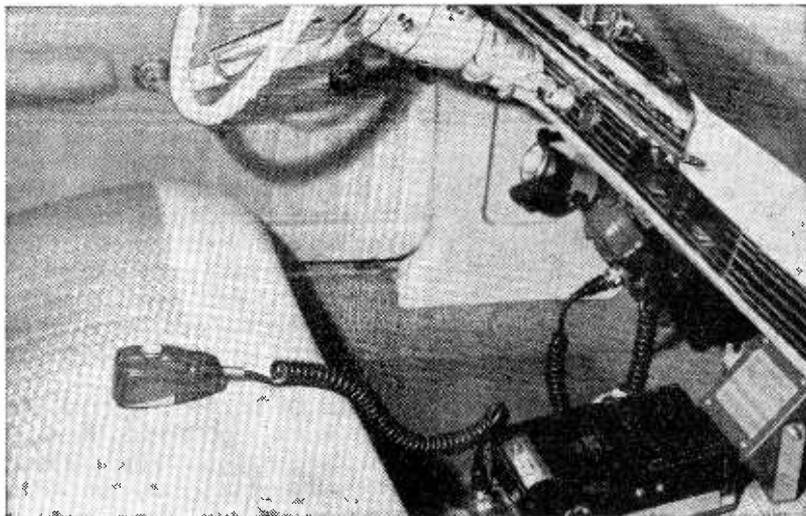
A videotape recorder, used with a television camera and television receiver, records images and sound on magnetic videotape for instant or delayed playback as a television picture. The tape may be replayed countless times or erased and used to record new information. But one thing that cannot be erased is that imperceptible tug on one's heart that only a lonely child can make. ■

Going home are Mr. and Mrs. Joseph Garrett, daughter Angela, 5, and newly adopted Amy, 2½, shown here as they leave adoption agency for family's residence in Buffalo.



If doin' 70 on the ol' freeway  
can't keep you from being bored,  
take a gander at this cozy setup  
and start taping those blues away

# Rovin' Recorder



By Frank Deems

■ Here is a simple accessory you can build in one evening to extend the usefulness of your portable tape recorder. It'll transform any battery-powered unit into a Rovin' Recorder for your car, and a Rovin' Recorder can very well prove one of the handiest devices you've ever owned.

Hams and CBers will find this accessory useful for keeping notes to be written later in their log books. Businessmen can dictate letters; public speakers can organize speech notes. Housewives can complete their shopping lists or leave messages for the car's next driver. The uses are endless!

**Your Own Rig.** A special bracket for the recorder is the answer. The bracket must be designed to fit the requirements of your recorder and your car, but the unit shown in our photos can be considered typical of the many cassette models available.

Though dimensions and construction details will differ from one bracket to another, keep in mind when building the bracket that it must hold the recorder securely, and in a position where it may be conveniently operated by the driver. This can be accomplished by mounting the bracket on the

transmission hump of the car and using suitable cables and connectors so the recorder can be operated with a push-to-talk mobile mike.

For my Rovin' Recorder, I use a Norelco Carrycorder with a simple bracket that I built in a couple of hours using a piece of  $\frac{1}{8}$ -in. Masonite and three scrap pieces of soft aluminum. The Masonite was cut  $\frac{1}{8}$  in. wider than the recorder, and about  $1\frac{1}{2}$  in. longer. The extra length of Masonite provides space for a mike connector.

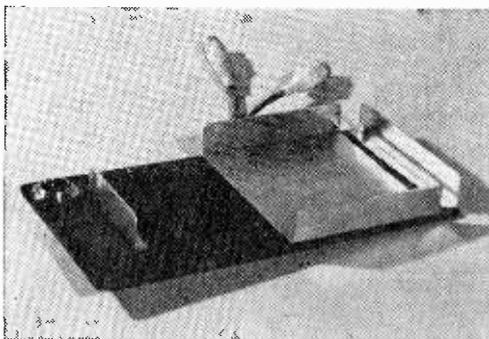
This was necessary since the mike I wanted to use didn't have the right connectors for the recorder, and I wanted to keep the original connector on the mike so it could be used as a spare for my two-meter ham mobile rig. Another advantage was that the coiled mike cord could be pulled out to its full length without pulling the plugs from the recorder.

**Snug Fit.** The pieces of aluminum were cut to appropriate size with a hacksaw and bent at right angles so they could be attached to the Masonite to hold the recorder safely in place. Epoxy cement was used to attach the aluminum braces, and they were care-

# Rovin' Recorder

fully spaced to fit snugly against the sides of the recorder. Edges and corners were filed smooth before they were cemented in order to make the unit more attractive and prevent accidental cuts.

Next, a hole for the mike connector was cut in the bottom portion of the Masonite board. I used the same type connector that would go on the front panel of a radio. The connector will have four leads: two for the



**Top view of recorder bracket. Braces are made of aluminum scrap. Connector up front accommodates mobile mike with push-to-talk switch.**

push-to-talk function, and two for the audio output.

These wires were cut long enough to allow the plugs to be inserted or removed from the recorder easily, yet not so long that they would disturb the driver. A short length of lamp cord was used for the push-to-talk switch, while a piece of coax carried the audio signal to the recorder.

Many radio and hi-fi stores carry connectors needed for the wide variety of recorders on the market. If you have trouble locating the right connectors for your foreign-made recorder, write to Switchcraft, Inc., 5555 N. Elston Ave., Chicago, Ill. 60630 for a catalog covering their line.

After you have your own bracket completed and have bench-tested it with your recorder, you're ready to mount the unit on the transmission hump, where it will be easiest to operate while you're driving. Climb out of the car and check underneath to make sure the area is clear of brake lines, the gas line, electrical wiring, etc., before you start drilling holes!

The bracket should be narrow enough so

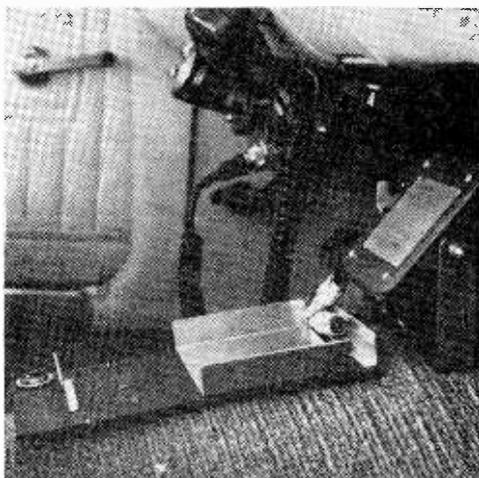
that only two screws are necessary to hold it securely to the transmission hump. If you're not so fortunate, you can stabilize it by using additional screws, or by shaping some wood blocks to fit under the Masonite so that they press against the sloping sides of the hump. Glue these to the bottom side of the Masonite with wood glue or epoxy.

**Slow Speed.** Use flat-head, sheet-metal screws, drilling through the Masonite first, then carefully drilling through the hump in exactly the right locations. Make the holes in the Masonite large enough for the screws to drop through without the threads engaging. Then counter-sink the holes so the screw heads will be flush with the surface.

Use a smaller drill for the hump so that the screw threads will engage the metal. You'll probably need screws at least  $\frac{3}{4}$  in. long. If you have an SCR speed control for your electric drill, here's a good place to use it. This way you can avoid pulling up an awkward lump of the padding under the floor mat.

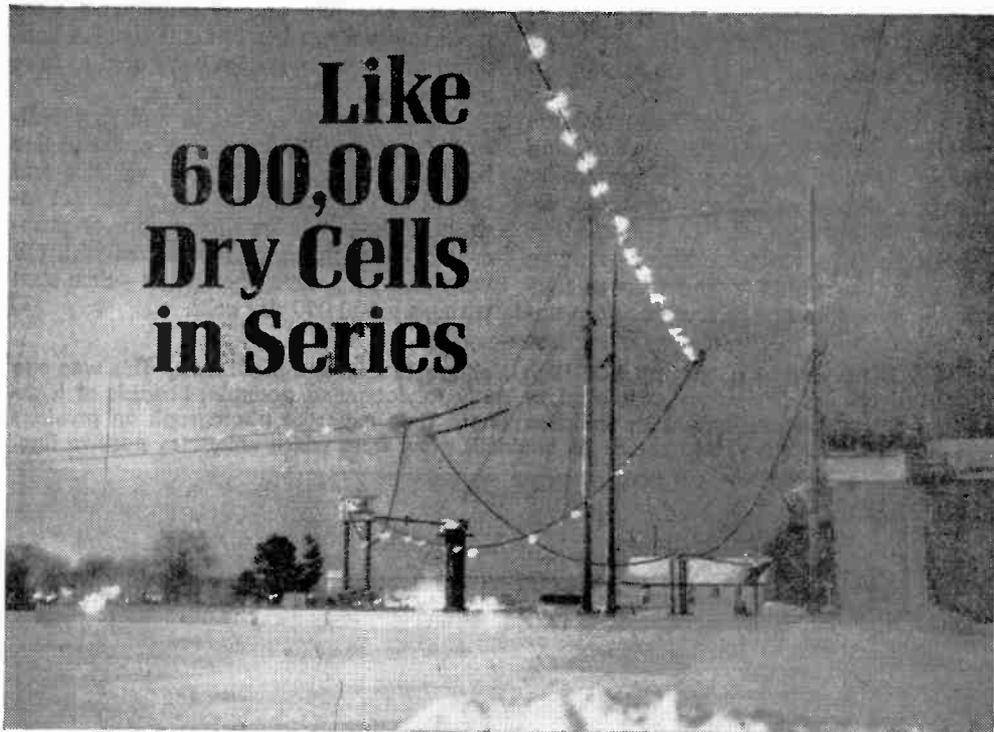
After the bracket is attached, use a sharp knife to cut a piece of  $\frac{1}{4}$ -in. foam rubber so it fits snugly between the aluminum braces. This will serve as a protective pad to prevent vibration and road shocks from damaging your recorder as you drive along.

All that remains is to put the recorder in the bracket, connect the mike, drive away, and watch that traffic! ■



**Bracket on transmission hump is ready for installation of recorder. Connector cables underneath are fastened to Masonite with a cable clamp. This prevents any strain on connector's terminals. Speaker at right and mike above are for two-meter mobile rig.**

# Like 600,000 Dry Cells in Series



## There will be no surprises when Canada turns on the world's hottest DC line!

■ Did you ever stop to think about the problems you would have after you wired up 600,000 dry cells in series? Our Canadian friends are investigating such headaches today before the completion of their Nelson River Project that'll have the distinction of having the highest voltage direct current (900 kilovolts) transmission system in the world.

Since 1960, the National Research Council of Canada has been conducting research on problems relating to electrical discharge originating with such high voltage DC transmission lines.

It is a known fact that when high-voltage DC transmission conductors are subjected to high surface voltage gradients, an electrical discharge called corona occurs in the adjacent air. This discharge is a major contributor to ionic flow (leakage currents) through the air from line to ground and from line to line. Until very recently the possible hazards from ionic flow to persons and property in the vicinity of high voltage DC conductors were unknown.

With the advent of overland high voltage DC power transmission, the Canadian Stand-

ards Association Task Group on Clearances felt it had become necessary to examine this area.

Among objects in closest proximity to such ionic flow will be large trucks and farm machinery passing under transmission lines. Aside from the obvious dangers caused by direct flashover to these vehicles, it was deemed important to know of any other hazardous conditions—and uncomfortable physiological effects—which may be encountered at clearances greater than the flashover distance.

In such cases, ions originating mainly at corona discharges on the conductors will flow to vehicles under the line. The vehicle would build up a charge if not grounded. A voltage appearing on a vehicle, because of intercepted ionic flow, will cause a current to flow in a person who bridges the semi-insulated path from vehicle to ground. Such a bridging would occur, for example, when a driver stepped out of his cab after parking beneath DC lines.

Full-scale tests were conducted at the National Research Council high voltage DC test station at Ottawa. In these investiga-

# 600K Dry Cells

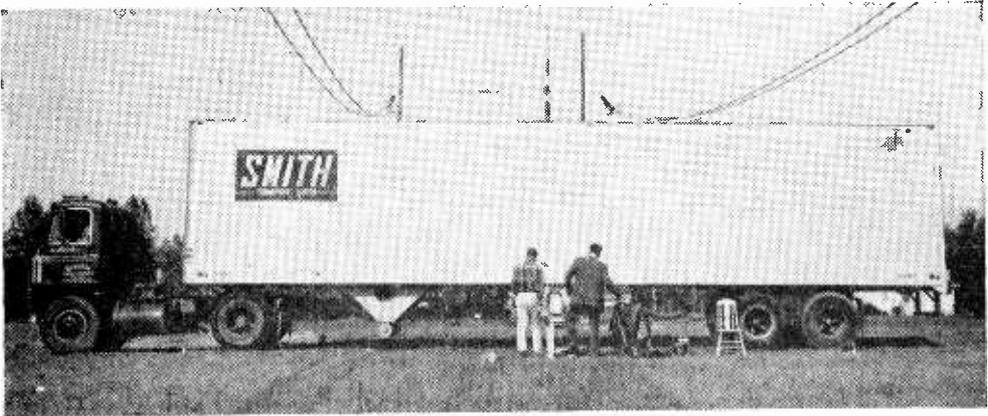
tions leakage currents (ionic flow) to large vehicles were measured and consideration was given to possible dangers introduced by voltages and energy storage on these vehicles.

For these tests, several vehicles—ranging in size from a station wagon to a tractor-trailer—were placed in various positions un-

der the DC line and measurements were made under a number of conditions. A bulldozer and a pulley system were used to raise and lower the transmission line.

The test results are all in and they indicate that, for a DC line at any practical line height, voltages appearing on vehicles and caused by intercepted ionic flow will not introduce a safety hazard to persons or property. That includes cars equipped with CB whip antennas. Don't believe us—then start wiring up 600,000 dry cells. ■

**Tractor trailer undergoing tests at NCR High Voltage Test Station in Ottawa. This was one of several vehicles of various sizes used in study to determine potential hazards of leakage currents from direct-current transmission lines. Time exposure photograph on previous page represents actual visible record of luminous glow from which emanates positive line.**

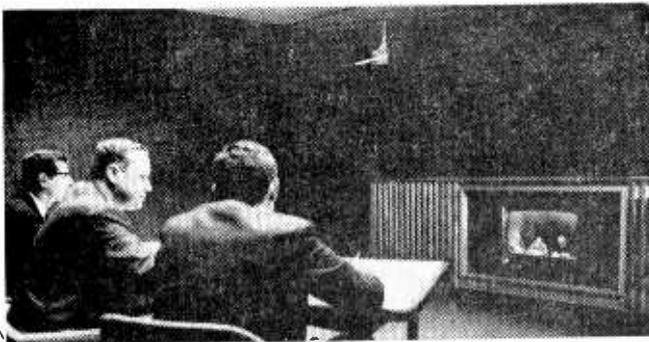


## This Round Table is Three Miles Long!

□ King Arthur would have had a royal ball with a round table like this one! A two-way, closed-circuit conference television system with stereophonic sound, the installation was designed by the Raytheon Company for the First National Bank of Boston. Already in operation, the system saves busy executives many a lost hour by linking the

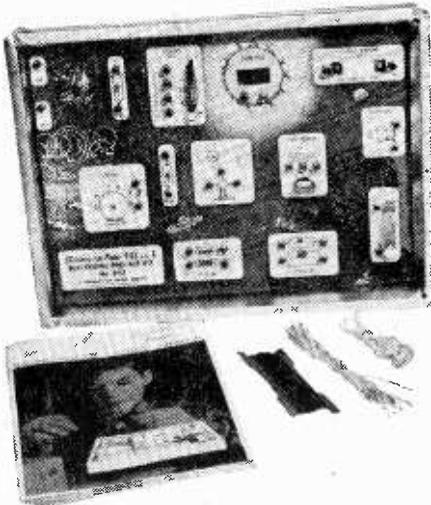
bank's headquarters in downtown Boston with its computer center in Dorchester, Mass., some three miles away.

Key feature of the conference television system is a 10-ft long console, similar in appearance to a home-entertainment center. Within the console is a TV monitor, stereo speaker, and a TV camera. ■



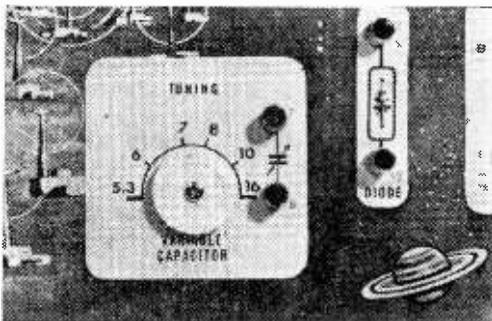
One of two studios used by Boston's First National Bank for its CCTV conference setup. Studios also contain ceiling microphones which provide clear stereo voice pickup from any part of room and ceiling camera with zoom lens that can be used for closeups of documents on conference table.

## RADIO SHACK MODEL 28-202

Beginner's 10 in 1  
Electronic Project Kit

■ In the good old days of vacuum tubes, electronic project kits were generally restricted to experimenters with some previous experience in electronics (or radio, as it was called then). The kits were complex and they were sometimes hazardous.

The transistor, thank goodness, changed all this. In spite of the myriad nonsense kits patched together for science fairs and misguided parents, conditions have recently improved, and now that the pros have taken over kit design, the beginner stands a chance of getting something worthwhile.



The more expensive, advanced experimenter kits are loaded with quality components, top-flight ideas for circuits, and excellent instruction manuals. And even the budget-priced beginner's kit such as Radio Shack's model 28-202 do a lot more than build a cat-whisker radio. A variety of components and simplified wiring devices allow the beginner to experiment to his heart's content.

The Radio Shack 10 in 1 project kit (28-202) consists of a frame on which most of the kit's components are permanently mounted. These include capacitors, resistors, a diode, transistor, solar cell, tapped antenna coil, tuning capacitor, audio transformer, telegraph key and battery holder.

**Springboard.** Each component is terminated at both ends (on the frame) with a nifty spring clip that allows you to hook the components up by simply slipping their wires into the spring. The terminals are opened by bending the spring back, natch! Extra spring terminals allow you to connect external components such as an earphone or antenna wire.

The instruction manual supplied with the kit contains 8 experiments. These include the usual code practice oscillator, a diode radio, a diode radio plus audio amplifier, a transistor radio, an audio amplifier, an AM wireless microphone, an AF/RF signal tracer, and a low-frequency oscillator.

Each project contains a short description of the circuit, a short paragraph on how to use the project, and some basic theory. A schematic of the circuit and a helpful wiring diagram round out the package.

The wiring diagram is actually a series of straight lines which pass through numbered circles. The circles correspond to the com-



Each component on frame is identified by name and its electrical symbol. Spring clips allow easy connection of pre-stripped wires.

# LAB CHECK

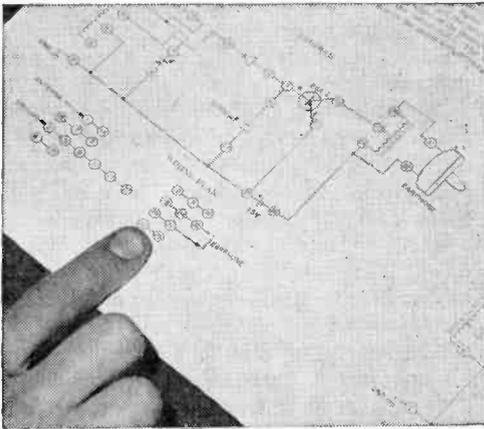
ponent numbering on the main frame. For example, one wiring procedure shows the series 2-5-23-32. Looking at the main frame, we see that ground (2) connects to the antenna coil (5) which connects to a 500k resistor (23) that connects to the earphone (32). The beginner can start by following this simple procedure and advance later to the schematic. In the end, he should be able to experiment with his own circuit ideas.

To help even the rank beginner, four pages at the beginning of the manual give some insight into what each component does

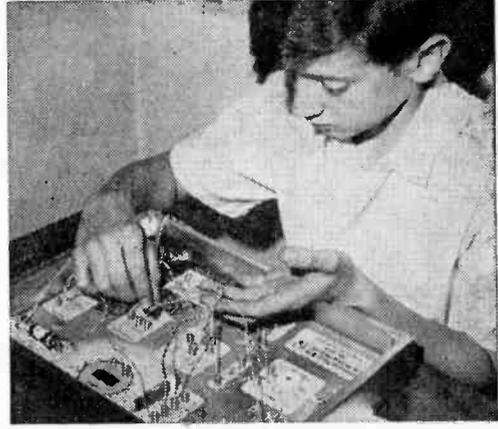
and how it works. Admittedly, the explanations are about as brief as one could imagine, but they do suffice for the average beginner.

As far as performance is concerned, don't expect too much from a beginner's kit. We tried all the projects and they will do just what is claimed and no more. The radio circuits do receive stations—the stronger ones. The code practice oscillator does not have booming volume but it's adequate to help someone learn code. The other circuits tell the same story. They work well enough to illustrate the theory while giving the experimenter a feeling of accomplishment.

For additional information write to Radio Shack, Dept. D, 730 Commonwealth Ave., Boston, Mass. 02215. ■



Wiring diagram includes line-circle drawings as well as standard schematic. Beginner can easily understand circuit without schematic.

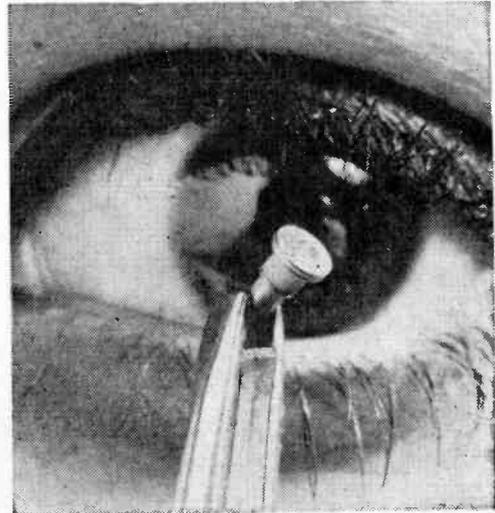


All projects are powered by a single AA battery that fits into holder on frame. There's absolutely no danger of receiving a shock.

## Laser Detector Sees Spectrum

■ The flea-sized electronic gizmo on the tip of the tweezers is a new electronic eyeball developed by Texas Instruments to improve laser communications. Laser light passes through a glass opening and strikes a tiny chip of light-sensitive material inside the detector.

When light strikes the chip, it triggers an *avalanche* flow of electrons. This avalanche effect makes the TI detector about 200 times more sensitive than other models. Its bandwidth is so high (i.e., it handles so many frequencies) that communications engineers can put all vhf and uhf TV channels as well as the entire FM radio band on just a single beam of laser light, and pick off each desired channel with just one detector. Whew! ■





# HAM TRAFFIC DE W7DQS

## The Case of the Ham Who Wasn't

■ There was quite a flap in a large western city a while back when a mysterious signal jammed a commonly used ham frequency for better than two hours. Normal use of the frequency was disrupted. And some hams got pretty hot under the collar about the strong interference until a pair with mobile rigs finally traced the problem to its source.

It seems a couple of juveniles had walked into a ham's unlocked shack while the op was at work, pulling open every drawer and flipping every switch they could find. Naturally they left a transmitter keyed on in the process.

The whole thing was accidental and the kids were too young to know better. Nonetheless, some definite damage to equipment resulted. Worse yet, there was that almost complete disruption of a frequency often used for important and sometimes emergency messages.

A few days later, much the same thing happened, though for only a few minutes this time. In this instance, the trouble was in a different ham shack, clear across town from the site of the first interference case. The trouble this time was apparently caused by a defective connection which put the

transmitter on the air while the op was in another room.

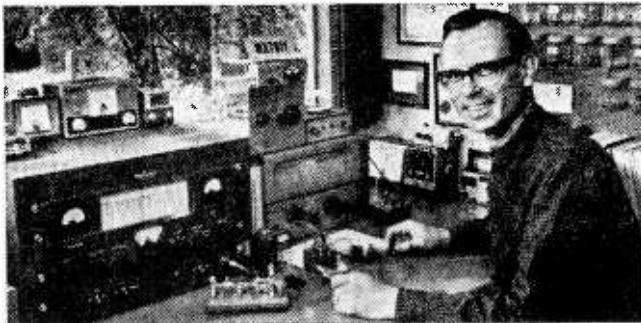
Both cases point up an important lesson for all of us. If we leave our equipment turned on while we're away, we should do everything possible to prevent accidental keying of the rig. And if there's a possibility of prowlers, no matter how young, we should install some sort of safety switching to make it difficult or impossible for an intruder to turn on the transmitter.

A runaway transmitter can become a serious headache for everyone on the band.

**Those QSL Manners.** The QSO may end like this: "Thanks a lot for the QSO, old man, and I'd sure appreciate a QSL from you. I don't have my new cards printed yet, but I'll send you one when they get here."

Rats, fiddlesticks, and good grief! Since when does a QSL card have to be a fancy job in 16 colors hot off the press of a professional printer?

True, those colorful jobs with the fancy art work look nice and jazz up the shack walls. But it's a serious mistake to feel they're necessary. An ordinary post card, so long as it bears all pertinent information about time, date, and band on which the QSO occurred, is all that's necessary. ■



QRP pro, By Wingett, WA7BIY, of Bellevue, Washington, shows 'em how it's done with a 180-milliwatt rig that's just to the left of his key. An industrial photographer, By specializes in flea-power rigs and generally operates on 40 meters (around 7040, 7140, and 7135 kHz). When conditions get rough, he uses a one-transistor rig that runs five watts! By really gets good mileage.

---

# HAM TRAFFIC

---

There are many hams just aching to get QSLs from certain stations they've worked to make up a DXCC, WAS, or other certificate; others simply want a memento of a pleasant QSO. They're thwarted because the man they worked was out of printed QSL cards, then forgot to send one when his supply arrived from the printer.

The moral here goes this way: if you're out of cards and get a request for a QSL, send along a plain post card immediately with the pertinent information on the QSO. You can always send that fancy printed job later on.

**Blowing The Whistle.** The problem of discourteous, inconsiderate, and sometimes just plain illegal operations on the ham bands is still with us. Old timers argue, "Heck, man, it's been with us since the very beginning of radio." They're right, of course, but that doesn't alter the fact that the problem is worse than ever.

To complicate the issue, there are stories going around supposedly giving the low down on how the individual ham can start the legal machinery to lower the boom on violators of the ham regulations. This is a very touchy subject, and one which the individual ham should approach with great caution.

You probably won't get yourself in hot water with the authorities, but you can easily become extremely embarrassed in front of your fellow hams if you go off half-cocked in attempting to bring a rule-breaker before the long arm of the law. Too, you can stir up hard feelings among hams who don't understand your true motives.

One of the rumors making the rounds has it that the Department of Justice has set up a legal procedure whereby you can get action on rule violations by filing affidavits describing the violations with the FCC. Trouble with this one is, it just isn't so!

For this reason, see that you don't make any wild threats to some loose-lipped clod about "I'll see you in court, buddy." You may well end up having to eat your words.

However, this doesn't mean that you can't do something about violations. But you will have to be a bit more cool headed about what you do.

Though we may sometimes think it isn't so, the FCC is truly interested in getting re-

ports from hams regarding violations they have heard on the air. Unlike some other government bureaus, the FCC really is undermanned, so there's a limit to how much enforcement the Commission can provide. However, if you do your share by giving them some solid information they can base an investigation on, they'll do everything they can to crack down on the offender.

The best way you can help is to call the nearest FCC monitoring station on the land-line while the violation is occurring so the boys there can monitor it for themselves. You might hesitate to spend the money for the call, but look at it this way: if you see a bank being robbed, you don't write the cops a letter about it—you call 'em on the phone—right?

If you can't get Uncle Big Ears on the phone while the rule busting is going on, then the next best thing is to make detailed notes right away about what you heard and send off a letter to the FCC (address: Washington, D.C. 20554). And send a copy of your letter to the nearest monitoring station or field office.

Include in it all the *facts* you can, such as times, frequencies, and call letters and names (if used). If you hear the same characters night after night, or on certain days of the week, or certain times of the day, include a description of this pattern so the FCC boys can go looking for the violators. If you have some assumptions about who the baddies are, make sure you state in your letter that these are *beliefs*, not *facts*.

And having done your duty, keep your mouth shut from there on out! This will be hard to do, because most of us would like to brag that we told Uncle about that "nasty so-and-so who's been clobbering the band." However, if the so-and-sos hear they've been reported to the FCC, they'll probably go off the air, making it impossible for the monitoring stations to catch them in the act. Also, you'll only stir up hard feelings among some of your fellow hams for being a "stool pigeon." It's too bad this has to happen, but we must realize it will and conduct ourselves accordingly.

**Mail Order Licenses.** To allow shut-in handicapped persons a chance to obtain Advanced and Extra Class licenses, the FCC has adopted a rule permitting them to take license exams by mail, in the same manner as is done for Novice, Technician, and Con-

(Continued on page 117)

# WHITE'S RADIO LOG

## Volume 50, Part 2

**An up-to-date Broadcasting Directory of North American AM, FM and TV Stations. Including a Special Section on World-Wide Shortwave Stations**

**T**his is the second part of *White's Radio Log*, published in three parts twice each year. This format permits the Editors of RADIO-TV EXPERIMENTER to offer its readers two complete volumes of *White's Radio Log* each year, while increasing the scope of the *Log* and inserting station changes as they occur.

In this issue of *White's Radio Log* we have included the following listings: U. S. AM Stations by Location, U. S. FM Stations by States, Canadian AM Stations by Location, Canadian FM Stations by Location, and the expanded, up-to-date World-Wide Shortwave Section.

In the Dec. 1968-Jan. 1969 issue of RADIO-TV EXPERIMENTER, the *Log* will contain the following listings: U. S. AM Stations by Call

Letters, U. S. FM Stations by Call Letters, Canadian AM Stations by Call Letters, Canadian FM Stations by Call Letters, and the expanded World-Wide Shortwave Section.

In the event you missed any part of the *Log* published earlier this year, you will have a complete copy of *White's Radio Log* by collecting any three consecutive issues of RADIO-TV EXPERIMENTER during 1968. The three consecutive issues comprise a complete volume of *White's Radio Log* that offers complete listings with last minute station change data that cannot be offered in any other magazine or book. If you are a broadcast band DXer, FM station logger, like to photograph distant TV test patterns, or tune the shortwave bands, you will find *White's Radio Log* an unbeatable reference.

### WHITE'S QUICK REFERENCE INDEX

U. S. AM Stations by Location.....	94
U. S. FM Stations by States.....	104
Canadian AM Stations by Location.....	109
Canadian FM Stations by Location.....	110
World-Wide Shortwave Stations.....	110

# WHITE'S RADIO LOG

## U. S. AM Stations by Location

Location	C.L.	kHc	Location	C.L.	kHc	Location	C.L.	kHc
Altona, Man.	CFAM	1290	Aspen, Colo.	KNSO	1260	Barre, Vt.	WSNO	1450
Altoona, Pa.	WFBG	1290	Astoria, Oreg.	KAST	1370	Barstow, Calif.	KWTC	1290
	WRTA	1240		KVAS	1230		KIOT	1310
	WVAM	1430	Atchison, Kans.	KARE	1470	Bartlesville, Okla.	KWON	1400
Alturas, Calif.	KGN	1370	Athens, Ga.	WGAU	1340	Bartow, Fla.	WBAR	1460
Altus, Okla.	KWHW	1450		WDOL	1470	Bassett, Va.	WODY	900
Alva, Okla.	KALV	1430		WKAC	1080	Bastrop, La.	WBCG	930
Amarillo, Tex.	KDJW	1410		WRFC	960		KVOB	1340
	KPUR	1040		KQXI	790	Batavia, N.Y.	WBTA	1490
	KGNC	710	Athens, Ohio	WATH	970	Batesburg, S.C.	WBLR	1430
	KIXZ	940		Woub	1340	Batesville, Ark.	KBTA	1940
	KRAY	1350	Athens, Tenn.	WLAR	1450	Batesville, Miss.	WBLE	1290
	WMLB	1310		WYXJ	1390	Bath, Maine	WJTO	730
Ambridge, Pa.	WMBA	1460	Athens, Tex.	KBUD	1410	Bath, N.Y.	WAIL	1260
Amerieus, Ga.	WDEC	1290	Atlanta, Ga.	WPLO	590	Baton Rouge, La.	WULX	1550
	WISK	1390		WIGO	1400		WLLS	1380
Ames, Iowa	KASI	1430		WAOK	1380		WIBR	1300
	WOI	640		WBRB	790		WJBO	1150
Amherst, Mass.	WTTT	1430		WGKA	1190		WLCS	910
Amherst, N.S.	CKDH	1000		WGST	920		WXOK	930
Amherst, N.Y.	WUFO	1480		WGUN	1010	Battle Creek, Mich.	WBCG	930
Amite, La.	WABL	1570		WUIN	1010		WKFR	1400
Amory, Miss.	WAMY	1580		WQXI	790		WVOC	1500
Amsterdam, N.Y.	WAFS	1570		WBS	750		WHAB	1260
	WCSS	1490		WYZE	1480	Baxley, Ga.	WHAB	1260
Anaconda, Mont.	KANA	580	Atlanta-Decatur, Ga.	WGUN	1010	Bayard, N.M.	KNFT	950
Anacortes, Wash.	KZIP	1310	Atlanta, Tex.	KBUD	1410	Bay City, Mich.	WBGM	1440
Anaheim, Calif.	KEZY	1190	Atlanta, Iowa	KJAN	1220	Bay City, Mich.	KIOX	1170
Anchorage, Alaska	KBVR	1270	Atlantic Beach, Fla.	WTKX	1600	Bay City, Tex.	KIOX	1170
	KFKD	750	Atlantic City, N.J.	WPFG	1450	Bay Minnetta, Ala.	WBCA	1120
	KENI	550		WLDB	1490	Bayamon, P.R.	WLWZ	1600
	KYAK	630		WMDI	1340		WRSJ	1560
Andalusia, Ala.	WAAO	1530	Atmore, Ala.	WATM	1590	Baytown, Tex.	KWBA	1360
	KMRE	1580	Atoka, Okla.	WMIH	1110	Beacon, N.Y.	WBNR	1280
Anderson, Cal.	WHUT	1470	Attleboro, Mass.	WARA	1320	Beardstown, Ill.	KWBE	1450
Anderson, Ind.	WHBU	1240	Auburn, Ala.	WAUD	1230	Beatrice, Nebr.	WBMA	1450
	WAIM	1230	Auburn, Calif.	KAHI	950	Beaufort, N.C.	WBMA	1450
	WANS	1280	Auburn, Ind.	WIFF	1570	Beaufort, S.C.	WBEU	960
Andrews, Tex.	KACT	1360	Auburn, N.Y.	WMBO	1340		WSIB	1490
Annapolis, Md.	WANN	900		WAB	1590	Beaumont, Tex.	KLVI	560
	WYRE	810	Auburn, Wash.	KAS	520		KPYC	1450
	WNAV	1430	Auburndale, Fla.	WTWB	1570		KTRR	790
	WNAAM	1490	Auburndale, Wis.	WLBL	930	Beaver Dam, Wis.	WBEV	1430
	WPAG	1050	Augusta, Ark.	KMCC	1190	Beaver Falls, Pa.	WBVP	1230
	WRAJ	1440	Augusta, Ga.	WAUG	1050	Beekley, W. Va.	WJLS	560
Anniston, Ala.	WAN	1490		WBBQ	1340		WCTR	1060
	WDNG	1450		WBA	1230	Bedford, Ind.	WVNR	620
	WHMA	1390		WGC	580	Bedford, Pa.	WBFD	1340
Annyllle-Cleona, Pa.	WAHT	1510		WRDW	1480	Bedford, Va.	WBLT	1350
	KANO	1470	Augusta, Maine	WRDO	1400	Beeville, Tex.	KIBL	1490
Anoka, Minn.	WADS	690		WFAU	1340	Bel Air, Md.	WVOB	1520
Ansonia, Conn.	WATN	930	Aurora, Colo.	KOSI	1430	Belen, N. Mex.	KARS	860
Antigo, Wis.	WATN	930	Aurora, Ill.	WMBR	1290	Belfast, Me.	WBME	1230
Apollo, Pa.	WAVL	910		WKKD	1580	Belleville, Mont.	KBVW	830
Apopka, Fla.	WTLN	1520	Aurora, Mo.	KSWM	940	Belleville, Ohio	WBMP	1290
Apple Valley, Cal.	KAYR	960	Austell, Ga.	WACX	1600	Bellefontaine, Ohio	WOHP	1390
Appleton, Wis.	WAPL	1570	Austin, Minn.	KAUS	1480		WBLF	1330
	WHBY	1250		KAUG	970	Bellefonte, Pa.	WBLF	1330
Aquadilla, P. R.	WALM	1340	Austin, Tex.	KNOW	1490	Bell Fourche, S. Dak.	KBFS	1450
Arab, Ala.	WRAB	1350		KLWJ	970	Belle Glade, Fla.	WSWN	900
Arcadia, Fla.	WAPG	1480		KTBC	590	Belle Glade, Ont.	CBQ	970
Arcata, Calif.	KENL	1340		KOKE	1370	Bellefonte, Pa.	WBLT	1350
	KATA	1340		KVET	1300	Bellefonte, Pa.	WBLT	1350
Ardmore, Okla.	KVSO	1240	Avalon, Cal.	KBIG	740	Bellingham, Wash.	KPUG	1170
Ardmore, Tenn.	WSLV	1520	Avondale Estates, Ga.	WAVO	1420		KGMI	790
Arcelbo, P. R.	WCNM	1280		WAPB	1440		KQST	1550
	WMI	1070	Aztec, N. Mex.	KNAP	1340	Bellingham-Ferndale	KENY	930
	WNIK	1230	Bayton, N.Y.	WBAB	1340		WGGC	1270
Argentia, Nfld.	VOUS	1480	Bad Axe, Mich.	WLEI	1340	Belmont, N.C.	WGEZ	1490
Arkadelphia, Ark.	KVRC	1240	Bainbridge, Ga.	WMGR	930	Belmont, N.C.	WBEL	1380
Arkansas City, Kans.	KSOK	1280		WAZA	1360	Belton, S.C.	WHBP	1390
Arlington, Fla.	WDJC	1220	Baker, Mont.	KFLN	960	Belton, Tex.	KTON	940
Arlington, Va.	WAVA	780	Baker, Oreg.	KBKR	1490	Beltzville, Miss.	KYWB	1480
	WEAM	1390	Bakersfield, Calif.	KAFY	550	Belvidere, Ill.	KBUN	1450
Arroyo Grande, Calif.	KOAG	1280		KBIS	970	Bend, Oreg.	KBND	1110
	KSYP	990		KERN	1410		KGRJ	940
Artesia, N.M.	KQXI	1550		KGEE	1230	Bennetsville, S.C.	WBSC	1550
Arvada, Colo.	WNES	1570		KUZZ	800	Bennington, Vt.	WBTC	1370
Ashburn, Ga.	WJLK	1310		KLVD	1350	Benson, Minn.	KBMO	1290
Ashbury Park, N.J.	WJLK	1310		KWAC	1490	Benson, N.C.	KYWB	890
Asbury Park-Eatonville, N.J.	WHTG	1410	Bellingham, Wash.	KPUG	1170	Benton, Ark.	KBBA	690
Asheboro, N.C.	WGWR	1260	Baldwinsville, N.Y.	WSEN	1050		KGKO	850
Asheville, N.C.	WISE	1310	Ballinger, Tex.	KRUN	1400	Benton, Ky.	WCBT	1290
	WLOS	1380	Baltimore, Md.	WBAL	1090	Benton Harbor-St. Joseph, Mich.	WHFB	1060
	WSKY	1230		WBMD	560	Berkeley, Calif.	WKAT	1400
	WCMG	1340		WBMD	750	Berkeley Springs, W. Va.	WCST	1010
Ashland, Ky.	WTRC	1420		WCAO	600		WMOU	1230
Ashland, Ohio	WNCO	1340		WCBM	680	Berlin, N.H.	WBRL	1400
Ashland, Oreg.	KWLN	1400		WBBB	1360	Berlin, Wis.	WISS	1090
	KRVG	1350		WFBR	1300	Berry Hill, Tenn.	WYOL	1470
Ashland, Va.	WIVE	1450		WTHH	1250	Berryville, Ark.	KTHS	1480
Ashland, Wis.	WATW	1400		WSID	1010	Berwick, Pa.	WBRX	1280
Ashtabula, Ohio	WAQI	1600	Bamberg-Denmark, S.C.	WWIN	1400	Bessemer, Ala.	WYAM	1450
	WREO	970		WVBD	790	Bethesda, Md.	WGMS	570

Every effort has been made to ensure accuracy of the information listed in this publication, but absolute accuracy is not guaranteed and of course, only information available up to press-time could be included. Copyright 1968 by Science & Mechanics Publishing Co., a subsidiary of Davis Publications, Inc., 229 Park Avenue South, New York, New York 10003.

Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz
Big Stone Gap, Va.	KBYG 1400	Brewster, N.Y.	WPUT 1510	WINW 1520	WAPD 1150		
Biloxi, Miss.	WLOX 1490	Brewton, Ala.	WEBJ 1240	WNYN 900	WDEF 1370		
Billings, Mont.	KBMY 1240	Bridgeport, Ala.	WBTS 1480	KCAN 1550	WDD 1310		
	KGHL 790	Bridgeport, Conn.	WICC 600	Cape Girardeau, Mo.	KFVS 960		
	KOOK 970		WDJZ 1530		KZYM 1220		
	KOYN 910	Bridgeton, N.J.	WNSJ 1240	Carbondale, Ill.	KGMO 1550		
Binghamton, N.Y.	KURL 730	Brighton City, Utah	KBUH 800	Carbondale, Pa.	WC 1020		
	WJNR 680	Brighton, Colo.	KBRN 800	Caribou, Maine	WFST 600		
	WKOP 1360	Brinkley, Ark.	KBRI 1570	Carlisle, Pa.	WHY 960		
	WNBF 1290	Bristol, Conn.	WBIS 1440		W100 1000		
Birmingham, Ala.	WAFI 1070	Bristol, Tenn.	WOP1 1490	Carlsbad, N.Mex.	KAVE 1240		
	WBRC 960		WKYE 1550		KCCC 930		
	WCRT 1260	Bristol, Va.	WCYB 690	Carmel, Calif.	KFBM 740		
	WAQY 1230	Brockton, Mass.	WFHG 980	Carmi, Ill.	KRML 1410		
	WENN 1320		WOKW 1410	Carnegie, Pa.	WZOU 1590		
	WATV 900	Brockville, Ont.	CFJR 1450	Caro, Mich.	WKYO 1360		
	WSGN 610	Broken Bow, Nebr.	KCNI 1280	Carolina, P. R.	WVOZ 1400		
	WYDE 850	Bronson, Mo.	KBHM 1220	Carrington, N.Dak.	KDAK 1600		
	WYOK 690	Brookfield, Conn.	WINE 940	Carrizo Springs, Tex.	KBEN 1450		
Blasbe, Ariz.	KSUN 1230	Brookfield, Mo.	KGHM 1470		KCM 1380		
Bishop, Calif.	WJLW 1330	Brookhaven, Miss.	WJMB 1340	Carroll, Iowa	WBRQ 590		
Bishopville, S.C.	WAGS 1380	Brookhaven, Pa.	WJMB 1340	Carrollton, Ga.	WLBB 1100		
Bismarck, N.Dak.	KFYR 550	Brookings, Oreg.	KURY 910	Carrollton, Mo.	KADL 1430		
	KBMR 1350	Brookings, S.Dak.	KBRK 1430	Carrollton, Ga.	KPTL 1300		
Bismarck-Mandan, N.Dak.	KBOM 1270	Brookline, Mass.	WBOS 1600	Carson City, Nev.	WBHF 1450		
		Brookneal, Va.	WOD1 230	Cartersville, Ga.	KRML 1410		
Black Mountain, N.C.	WBMS 1350	Brooksville, Fla.	WVJB 1450		WZAM 900		
	WFGW 1010	Brownfield, Tex.	KKUB 800	Carthage, Mo.	KDWO 1490		
Black River Falls, Wis.	WUIS 1260	Brownfield, Pa.	WASP 1130	Carthage, Miss.	WCEP 1480		
		Brownsville, Tenn.	WBHT 1520	Carthage, Tenn.	WRKM 1350		
Blackfoot, Idaho	KBLL 690	Brownsville, Tex.	KBWD 1380	Carthage, Tex.	KGAS 1590		
Blackshear, Ga.	WBSG 1350	Brownwood, Tex.	KEAN 1240	Carthursville, Mo.	KCRV 1370		
Blackstone, Va.	KLFR 580	Brunswick, Ga.	WIGG 1440	Casa Grande, Ariz.	WMOG 1490		
Blackwell, Okla.	KARI 550		WMOG 1490	Casey, Ill.	WKZI 800		
Blaine, Wash.	KARI 550		WYNR 790	Casper, Wyo.	KTWO 1030		
Blakely, Ga.	WBBK 1260	Brunswick, Maine	WCME 900		KATI 1400		
Blanding, Utah	KUTA 790	Brunswick, Md.	WTRI 1520	Cathedral City, Calif.	KVOC 1230		
Bloomington, Ind.	WJBC 1230	Bryan, Ohio	WBNO 1520		KWXY 1340		
Bloomington, Ill.	WTT3 1370	Bryan, Tex.	KORA 1240	Chase, S.C.	WLEY 1080		
Bloomington, Pa.	WCNR 930		WTFW 1150	Chase, P.R.	WLEY 1080		
	WGNR 550	Bryson City, N.C.	WBHN 1590	Cedar City, Utah	KSUB 590		
Blountstown, Fla.	WKMK 1000	Buchanan, W.Va.	WBUC 460	Cedar Falls, Iowa	KCFI 1250		
Blue Earth, Minn.	KBWE 1560	Bueyrus, Ohio	WBCE 1540	Cedar Rapids, Iowa	KCRG 1600		
Bluefield, W.Va.	WHIS 1440	Buffalo, N.Y.	WBEN 930		KLWV 1450		
	WKOY 1240		WYSL 1400		WMT 600		
Blythe, Calif.	KYOR 1450		WBR 970		KIAK 1360		
Blytheville, Ark.	KYOR 1450		WGR 590	Cadartown, Ga.	WGAA 1340		
Boaz, Ala.	WBSA 1800		WOL 1230	Colina, Ohio	WCSM 1350		
Boea Raton, Fla.	WBSR 740	Buffalo, Wyo.	KBBS 1450	Center, Ala.	WEIS 990		
Bogalusa, La.	WIKC 1490	Burford, Ga.	WDYZ 1460	Center, Tex.	KDET 930		
	WBOX 920	Burbank, Cal.	KBBQ 1500	Centerville, Ala.	WBIB 1390		
Boise, Ida.	KATN 1010	Burley, Idaho	KBAR 1230	Centerville, Iowa	KDS 1400		
	KBDI 950	Burlington, Colo.	KNAB 1140	Centerville, Ind.	WON 930		
	KEST 790	Burlington, Iowa	KBUR 1490	Centerville, Miss.	WLSB 1580		
	KGEM 1140		KYND 1150	Centerville, Tenn.	WHLP 1570		
	KIDO 630	Burlington, N.C.	WBBB 920	Centerville, Utah	KBBC 1600		
	KYME 740		WBAG 1150	Central City, Ky.	WNES 1050		
Boliviar, Mo.	KBLR 1130	Burlington, Vt.	WDDT 1400		WMTA 1360		
Bolivar, Tenn.	WBOL 1360		WJOY 1280	Centralia, Ill.	WMTA 1210		
Bonham, Tex.	KFYN 420	Burnett, Tex.	WVMT 620	Centralia & Chehalis, Wash.	KELA 1470		
Boone, Iowa	KFGQ 1260	Burney, Cal.	KATL 1440	Central Point, Ore.	KPTB 1400		
	KWBG 1590	Burns, Oreg.	KRNS 1280	Centreville, Ala.	WBIN 1110		
Boone, N.C.	WATA 1450	Burnsville, N.C.	WKYK 1540	Caros, Calif.	KLDC 920		
Boonville, Ind.	WBNI 1540	Butler, Ala.	WPRN 1240	Carbam, N.C.	WVCS 1590		
Boonville, Mo.	KBRT 1370	Butler, Mo.	KMAM 1590	Chadron, Nebr.	KCSR 610		
Boonville, Miss.	WBIP 1400		WBUS 1050	Chambersburg, Pa.	WCHA 800		
Boonville, N.Y.	WHUZ 900	Butte, Mont.	WISB 680		WCBG 1590		
Borger, Tex.	KHJZ 1490		KXLF 1370	Champaign, Ill.	WDWS 1400		
	KBBB 1600	Cabin, John, Potomac, Md.	WXLN 950	Chanute, Kans.	KCRB 1460		
Boston, Mass.	WBZ 1030	Cadillac, Mich.	WATT 1240	Chapel Hill, N.C.	WCHL 1360		
	WOPZ 1150	Cadiz, Ky.	WKDZ 1110	Charleroi, Pa.	WESA 940		
	WLD 1080	Cagus, P.R.	WYJP 1110	Charles City, Iowa	KCHA 1580		
	WEZE 260	Cairo, Ga.	WGRA 790	Charleston, Ill.	WEIC 1270		
	WEEL 590	Cairo, Ill.	WKRO 1490	Charleston, Mo.	KCHR 1350		
	WHDH 850	Calais, Maine	WDY 1230	Charleston, S.C.	WCSC 1390		
	WMEX 1510	Caldwell, Idaho	KCID 1490		WKE 1340		
	WRK 680	Calera, Ala.	KBN 910		WQNL 730		
	WRYT 950	California, Calif.	WBYE 1370	Charleston, W.Va.	WCSA 680		
	KBOL 1480	Calhoun, Ga.	KICG 1490		WCHS 580		
Boulder, Colo.	KBAN 1410	Camas, Wash.	WCWA 900		WGW 1490		
Bowling Green, Ky.	WKCT 930	Cambridge, Md.	WEBS 1110		WKZ 950		
	WBN 1340	Cambridge, Mass.	KVAN 1480		WTFP 1240		
	WLB1 1410	Cambridge, Ohio	WCN 1240		WXVA 1550		
	KPCR 1530	Camden, Ark.	WILE 1270	Charlotte, Meh.	WCER 1390		
Bowl Green, Ohio	WMG5 790	Camden, N.J.	KAMD 910	Charlotte, N.C.	WB1 1100		
Bozeman, Mont.	KXJ 450	Camden, S.C.	KJWH 1450		WAYS 610		
	KBMN 1230	Camden, Tenn.	WCAM 1310		WGI 1600		
Bradbury Hgts., Md.	WPGC 1580	Camden, Va.	WACN 1390		WHTC 1310		
Braddock, Pa.	WLOA 1550	Camden, W.Va.	WFNL 1220		WSTC 930		
Braddock's Heights, Md.	WMMH 1370	Cameron, Tex.	KMIL 1330		W124 1240		
	WTTA 1490	Camden, Ark.	WILE 1270		WWOK 1480		
Bradenton, Fla.	WBRD 1420	Camden, N.C.	KAMD 910		WRPL 1540		
	WESB 1490	Camden, S.C.	KJWH 1450	Charlotte Amalie, V.I.	WBNB 1000		
Brady, Tex.	KNEL 1490	Camden, Tenn.	WCAM 1310		WSTA 1340		
Brainerd, Minn.	KLIZ 1380	Camden, Va.	WACN 1390		WBNE 1000		
	KVBR 1340	Cameron, Tex.	KMIL 1330	Charlottesville, Va.	WCHV 1260		
Brandon, Miss.	WRKN 970	Camilla, Ga.	WCLB 1220		WELK 1400		
Brantford, Ont.	KMHI 1220	Campbell, Ohio	WHOT 1339		W1NA 1050		
Brattleboro, Vt.	CKPC 1360	Campbellsville, Ky.	WTCD 1450	Chase City, Va.	WMEK 980		
	WTSA 1450	Canandaigua, N.Y.	WCCR 1550	Chatham, Va.	WKBY 1080		
	WKVT 1490	Canon City, Colo.	KRLN 1400	Chattahoochee, Fla.	WSPB 1580		
Brawley, Calif.	KROP 1300	Canonsburg, Pa.	WARO 540		WMOC 1450		
Brazil, Ind.	WCMC 1380	Canton, Ga.	WCHK 1290				
		Canton, Ill.	WBYS 1560				
Breckenridge, Minn.	KBMW 1450	Canton, Miss.	WMGO 1370				
		Canton, N.C.	WWIT 1470				
Breckenridge, Tex.	KSTB 1430	Canton, Ohio	WHBC 960				
Bremen, Ga.	WWCC 1440		WDIO 1060				
Bremerton, Wash.	KBRO 1499						
Brenham, Tex.	KWHI 1280						
Brevard, N.C.	WPNF 1240						

# WHITE'S RADIO LOG

Location	C.L.	kHx	Location	C.L.	kHx	Location	C.L.	kHx
Cortez, Colo.	KVFC	740	De Kalb, Ill.	WLSK	1360	Eastland, Tex.	KERC	570
Cortland, N.Y.	WKRT	920	De Land, Fla.	WBS	480	E. Lansing, Mich.	WKAR	890
	KFLY	1240	Delano, Calif.	KCHJ	1010	E. Liverpool, Ohio	WOH	1490
Corvallis, Ore.	KLOO	1340	Delaware, Ohio	WDLE	1550	East Longmeadow, Mass.	WTYM	1600
Corydon, Ind.	WPDF	1550	Delray, Bch., Fla.	WDBF	1420		WUFF	710
Coshocton, Ohio	WTNS	1560	Del Rio, Tex.	KDLK	1230	E. Moline, Ill.	WDLM	960
Cottage Grove, Ore.	KNND	1400		KWDR	810	E. Point, Ga.	WTJH	1260
Cottonwood, Ariz.	KVRD	1240	Delta, Colo.	KDTA	1400	East Prairie, Mo.	KXCL	1090
	KV10	1600	Deming, N.Mex.	KOTS	1230	E. Syracuse, N.Y.	WPAA	630
Coudersport, Pa.	WFRM	600	Demopolis, Ala.	WXAL	1400	Easton, Md.	WGLD	1460
Council Bluffs, Iowa	KFNF	920	Denham Sprgs., La.	WLB1	1220	Easton, Pa.	WEEX	1230
	KRCB	1360	Denison, Iowa	KDSN	1580		WEST	1400
Courtenay, B.C.	CFCP	1440	Denmark-Bamberg, Tex.	KDSX	950	Eaton, Ga.	WXPQ	1520
Covington, Ga.	WGFS	1430		KDSS	950	Eatontown, N.J.	WHTG	1410
Covington, Ky.	WCLB	1320	Denton, Tex.	WWBD	790	Eau Claire, Wis.	WEAQ	790
Covington, La.	WARB	730		KDSS	950		WECL	1050
Covington, Tenn.	WKBL	1250	Denver, Colo.	KDEN	1340	Eau Gallie, Fla.	WMEG	920
Covington, Va.	WKEX	1340		KFML	1390		WTAI	1590
Cowan, Tenn.	WZYX	1440		KHOW	630	Ebensburg, Pa.	WEND	1580
Cozad, Neb.	KAMI	1580		KIMN	950	Edenton, N.C.	WCDJ	1260
Craig, Colo.	KRAI	350		KJLH	990	Edinburg, Tex.	KGDN	710
Crane, Tex.	KRRR	1380		KLZ	1580	Edmonds, Wash.	KGON	680
	KBSN	370		KBTR	710	Efingham, Ill.	WCRA	1090
Crawfordsville, Ind.	WCVL	1550		KOA	850	Elba, Ala.	WELB	1350
	KPOD	1240		KPOF	910	Elberton, Ga.	WSGC	1400
Creston, Iowa	KSIB	1520		KFSC	1220	El Cajon, Calif.	KDEO	910
Crestview, Fla.	WGNL	1010		KTLL	1280	El Campo, Tex.	KULP	1390
	WCLB	1320	Denver City, Tex.	KTLA	1400	El Centro, Calif.	KWJ	1230
Crewe, Va.	WSVS	800	De Queen, Ark.	KQDN	1390		KAMP	1495
Crockett, Tex.	KIVY	1290	De Ridder, La.	KDLA	1010	El Dorado, Ark.	KDMS	1290
Crookston, Minn.	KROX	1260	DeSoto, Mo.	KHAD	1190		KELD	1400
Crossett, Ark.	KAGH	900	Des Moines, Iowa	KCBC	1390	Eldorado, Kans.	KBTO	1380
Crossville, Tenn.	WAEP	1310		KIDA	940	Eldorado Springs, Mo.	KESM	1580
Crowley, La.	KSIG	1450		KRN	1350	Eleele, Kanai, Hawaii	KUAI	720
Crystal Lake, Ill.	WCLR	850		KRNB	1460	Elgin, Ill.	WRM	1410
Cuero, Tex.	KCFH	1600		KWKY	1150	Elizabeth City, N.C.	WCNC	1240
Cullman, Ala.	WFMM	1450		WHO	1040		WGAI	560
	WKUL	1340	Detroit, Mich.	WCAR	1130		WBEI	1240
Culpeper, Va.	WCVA	1490		WJBK	1500	Elizabethton, Tenn.	WID	1520
Cumberland, Ky.	WGPC	1380		WJL	1400		WIEL	1400
Cumberland, Md.	WCUM	1230		WJR	160	Elizabethtown, Ky.	WIEL	1400
	WKYR	1270		WW	950	Elizabethtown, N.C.	WBLA	1440
	WTBO	1450	Detroit Lakes, Minn.	WXYZ	1270		WBKE	1240
Cummings, Ga.	WSNE	1410		KDLM	1340	Elk City, Okla.	WBKE	1240
Cushing, Okla.	KUSH	1600	Devils Lake, N.Dak.	KDLR	1240	Elkhart, Ind.	WCMR	1270
Cuyahoga Falls, Ohio	WCUE	1150	DeWitt, Ark.	KDEW	1470		WIFM	1540
	WGTO	540	Dexter, Mo.	KDEX	1590	Elkins, N.C.	WDNE	1240
Cypress Gardens, Fla.	WCYN	1400	Diboll, Tex.	KSPJ	1260	Elko, Nev.	KELK	1420
	WDCF	1350	Dickinson, N.Dak.	KDIX	1230	Elkton, Md.	WSER	1550
Cynthiana, Ky.	WDVC	910	Dickson, Tenn.	WDKN	1260	Ellensburg, Wash.	KXLE	1240
Dade City, Fla.	WKEG	1560	Dillon, Mont.	KDBM	1490	Ellenwood, N.Y.	WDEA	1370
Dadeville, Ala.	WKRT	1410	Dillon, S.C.	WDC	800	Elmirth, Mo.	WDEA	1370
Dainersfield, Tex.	KEGG	1560	Dimmitt, Tex.	KDHN	1470	Elmira, N.Y.	WELM	1410
Dalhart, Tex.	WAAK	960	Dinuba, Calif.	KRDU	1130		WENY	1230
Dallas, N.C.	KROW	1480	Dixon, Ill.	WXIN	1460	Elmira Heights-Horseheads, N.Y.	WEHH	1590
Dallas, Ore.	KRLD	1080	Dodge City, Kans.	KGNO	1370		KROD	600
Dallas, Tex.	KIXL	1040		KEDD	1550	El Paso, Tex.	KELP	920
	KSKY	660	Dodgeville, Wis.	WDMP	810		KHEY	690
	KLIF	1190	Donaldsonville, Ga.	WDLV	1090		KINT	1590
	WFAA	570	Donaldsonville, La.	KDFN	1500		KIZZ	1150
	WFAA	820	Doniphan, Mo.	WDEN	1600		KSET	1340
	KBOX	1480	Ooathan, Ala.	WAGF	1320	El Reno, Okla.	KELR	1460
	WRR	1310	Douglas, Ariz.	WDFG	1450	Ely, Minn.	WELY	1450
Dalton, Ga.	WBLJ	1230		KAUF	1450	Ely, Nev.	KELY	1290
	WRCD	1430	Douglas, Ga.	WDMG	860	Elyria, Ohio	WEOL	930
	WTT	1530	Douglas, Wyo.	KXIV	1050	Eminence, Ky.	WSTL	1600
Danbury, Conn.	WLAD	800	Douglasville, Ga.	WDGL	1520	Emporia, Kans.	KVOE	1400
Danville, Ill.	WDAN	1490	Dover, Del.	WKEN	1600	Emporia, Va.	WEA	860
	WITY	980	Dover-Foxcroft, Me.	WDME	1340	Emporium, Pa.	WLEM	1250
Danville, Ky.	WHIR	1230	Dover, N.J.	WRAN	1510	Endicott, N.Y.	WENE	1490
Danville, Pa.	WPGM	1570	Dover, N.H.	WTSN	1270	Englewood, Colo.	KGMC	1150
Danville, Va.	WBTH	1350	Dover, Ohio	WJER	1450	Englewood, Fla.	WENG	1530
	WYPR	970	Dowagiac, Mich.	WDOW	1440	Englewood, Tenn.	WENR	1090
	WDVA	1250	Doylstown, Pa.	WBUX	1570	Enid, Okla.	KCRC	1390
	WILA	1580	Dublin, Ga.	WBTL	1330		KGA	950
Dardanelle, Ark.	KCAB	980	Du Bois, Pa.	WCLI	1230	Enterprise, Ala.	WIRB	600
Darlington, S.C.	WDAR	1350	Dubuque, Iowa	WDGL	1420	Enterprise, Ore.	KWVR	1340
Davenport, Iowa	WOC	1420	Durham, N.C.	KDTH	1370	Ephrata, Pa.	WGSA	1310
	KWNT	1580		WDBQ	1490	Ephrata, Wash.	KULF	780
	KSTT	1170	Duluth, Minn.	KDAL	610	Erle, Pa.	WVYN	1260
Dawson, Ga.	WDWD	990		WFCB	560		WJF	1440
Dayton, Ohio	WHIO	1290		KAOH	1380	Erwin, Tenn.	WEMB	1420
	WING	1410	Quamas, Ark.	KDDA	1560	Escanaba, Mich.	WDSC	680
	WONE	980	Dumas, Tex.	KDDD	800		WLST	600
	WAVI	1210	Duncan, Okla.	KYRD	1350	Escondido, Calif.	KOWN	1450
Dayton, Tenn.	WDNT	1280	Dundee, N.Y.	WFLR	1570	Esplanade, N. M.	KATE	1320
Daytona Beach, Fla.	WNDB	1150	Dunkirk, N.Y.	WDOE	1410	Estes Park, Colo.	KKEP	1470
	WMFJ	1450	Dunn, N.C.	WBSB	780	Estherville, Ia.	KILR	1070
	WRD	1340	Du Quoin, Ill.	WDQN	1580	Etowah, Tenn.	WCPH	1220
Deadwood, S.Dak.	KDSJ	980	Durango, Colo.	KIDP	990	Eufaula, Ala.	WULA	1440
Dearborn, Mich.	WKSR	1310	Durant, Okla.	KFSO	750	Eugene, Ore.	KEED	1450
Deatur, Ala.	WOS	800	Durham, N.C.	WDNC	620		KASH	1600
	WAJF	1490		WSSR	1490		KATR	1320
	WMSL	1400		WTIK	1310		KORE	1050
Decatur-Atlanta, Ga.	KGUN	1010	Dyersburg, Tenn.	WDSG	1450		KERG	1280
	WDMN	1310		WTR0	1330		KPNW	1500
Decatur, Ill.	WDZ	1050	Eagle Pass, Tex.	KEPS	1270		KUGN	590
	WSOY	1340	Eagle River, Wis.	WERL	950		KZEL	1540
Decatur, Ind.	WADM	1540	Easley, S.C.	WELP	1360	Eunice, La.	KEUN	1490
Decatur, Iowa	KDEC	1240	E. Grand Forks, Minn.	KRAD	1590	Eureka, Calif.	KINS	960
Decatur, Mo.	KWLC	1240				Eustis, Fla.	WLCO	1240
Deer Lodge, Mont.	KDRG	1400						
Deerfield, Va.	WABH	1150						
DeFrance, Ohio	WONW	1280						
De Funik Springs, Fla.	WDSP	1280						
	WZEP	1460						

Location	C.L.	kHx	Location	C.L.	kHx	Location	C.L.	kHx	Location	C.L.	kHx
Evanston, Ill.	WEAW	1330		WMYR	1410	Gardner, Mass.	WGAW	1340	Greensburg, Pa.	WHJB	820
	WNMP	1590		WCAI	1350	Garner, N.C.	WKBC	1070	Greenville, Ala.	WGVY	1380
Evanston, Wyo.	KEVA	1240	Ft. Payne, Ala.	WFAA	1400	Gary, Ind.	WGCA	1200	Greenville, Ky.	WKYF	1600
Evansville, Ind.	WRDZ	1400		WZB	1250		WGCB	1370	Greenville, Mich.	WFLB	1360
	WRGF	1280	Ft. Pierce, Fla.	WRN	1380	Gaston, N.C.	WGIC	1380	Greenville, Miss.	WDB	950
	WKY	820		WIRA	1400		WLTC	1370		WDDT	900
	WJPS	1330	Ft. Scott, Kans.	KMDO	1600	Gate City, Va.	WGAT	1050		WGVN	1260
Eveleth, Minn.	WEVE	1340		KFPW	1230	Gaylord, Mich.	WATC	900	Greenville, Pa.	WGRP	940
Everett, Pa.	WSKE	1050	Ft. Smith, Ark.	KFSA	950	Geneseo, Ill.	WGEN	1500	Greenville, N.C.	WNCT	1070
	KRKO	1380		KTCS	1410	Geneva, Ala.	WGEA	1150		WOOA	1340
	KWVZ	1230		KWHN	1320	Geneva, Ill.	WGSB	1480		WPXY	1550
Evergreen, Ala.	WBLO	1470	Ft. Stockton, Tex.	KFST	860	Geneva, N.Y.	WGVH	1250	Greenville, S.C.	WABG	950
	WKXS	1090	Ft. Valley, Ga.	WFFM	1150	Georgetown, Del.	WGTN	900		WFBC	1330
Exeter, N.H.	WKXR	1540	Ft. Walton Beach, Fla.	WNUE	1400	Georgetown, Ky.	WAXU	1580		WHYZ	1070
Fairbanks, Alaska	KFAR	660		WNUJ	1500	Georgetown, S.C.	WGTN	1400		WHRB	1490
	KFRB	900	Ft. Wayne, Ind.	WFTW	1260		WINH	1470		WMUJ	1260
	KDHL	920		WGL	1250	Georgetown, Tex.	KGTN	1530		WQOK	1440
Fairbault, Minn.	WKOK	1480		WFWR	1090	Gettysburg, Pa.	WGET	1320	Greenville, Tex.	KGVL	1490
Fairbury, N.C.	WKMT	1310		WQWJ	1190	Gillette, Wyo.	KIML	1270	Greenwich, Conn.	WGCH	1400
Fairfax, Va.	WEEL	1810		WLYV	1500	Gladewater, Tex.	KWCA	1290	Greenwood, Miss.	WABG	950
Fairfield, Ill.	WF1W	1390		WKJG	1380	Glasgow, Ky.	WKAY	1490		WGRM	1240
Fairfield, Iowa	KMCD	1570	Ft. Worth, Tex.	KJIM	870		WCDS	1440	Greenwood, S.C.	WCRS	1450
Fairfield, O.	WCN	1560		KBUJ	1540		KLTZ	1240	Greer, S.C.	WEAB	800
Fairhope, Ala.	WABF	1220		KFKJZ	1270	Glasgow, Mont.	KLTZ	1240		WEAB	800
Fairport, Minn.	KSUM	1270		KNOK	970	Glen Burnie, Md.	WISZ	1590		WCKI	1800
Fairmont, N.C.	WBAF	850		KNOK	970	Glendale, Ariz.	KRUZ	1360		WCKI	1800
Fairmont, W.Va.	WMNN	920		WBAF	820	Glendale, Calif.	KRWL	970	Granada, Miss.	WRDR	1230
	WTCS	1490	Fortuna, Cal.	KXOL	1360	Glendive, Mont.	KXGN	1400	Gresham, Oreg.	KRDR	1230
Fairway, Kan.	KUDL	1380	Fosston, Minn.	KEHG	1480		KGLE	500	Gratona, Va.	WMNA	730
Fajardo, P.R.	WMDD	1480	Fosteria, Ohio	WFOB	1430	Glennallen, Alaska	KCAM	790	Griffin, Ga.	WKUJ	1450
Falfurrias, Tex.	KPSO	1260	Fountain City, Tenn.	WROL	1490	Glens Falls, N.Y.	WBSA	1410		WHIE	1320
Fall River, Mass.	WALE	1400		WFS	1600		WW45	1450		WGRI	1410
	WSAR	1400	Fountain Inn, S.C.	WFIS	1600	Glenville, Ga.	WKIG	1580	Grinnell, Iowa	KGRN	1410
	WYU	990	Fowler, Calif.	KLIP	1220	Glenwood Spgs., Colo.	WGLN	980	Grinnell, Conn.	WVJ	1400
Falls Church, Va.	WFAZ	1220	Framingham, Mass.	WKQX	1190		KZLN	980	Grove City, Pa.	WSAJ	1340
Falls City, Neb.	KTNC	1230	Frankfort, Ind.	W1LO	1570	Globe, Ariz.	KQWJ	1240	Grundy, Va.	WNRG	940
Fargo, N.Dak.	WDAY	970	Frankfort, Ky.	WFKY	1490	Gloucester, Va.	WDDY	1420	Guayama, P.R.	WXRF	1590
	KFGO	790	Franklin, Ky.	WFRN	1220	Gloversville-Johnston, N.Y.	WENT	1340	Guilford, Miss.	WROA	1890
	KFNW	900	Franklin, La.	KFRN	1390	Gold Beach, Oreg.	KBYL	1220	Gunnison, Colo.	KGUC	1490
	KQWB	1530		WFCG	1110	Golden, Colo.	KIGM	1250	Guntersville, Ala.	WDBX	1250
Farlbaunt, Minn.	KDHL	920		WFCG	1050	Golden Meadow, La.	KLEB	1600	Guthrie, Okla.	KWRW	1490
Farmersville, La.	KTDL	1470	Franklin, N.C.	WFTN	1240	Golden Valley, Minn.	KQRS	1440	Guymon, Okla.	KGYN	1210
Farmington, Me.	WKJT	1380	Franklin, N.H.	WFTN	1240		KUXL	1570	Hackensack, N.J.	WJRZ	970
Farmington, Mo.	KREI	800	Franklin, Pa.	WFRJ	1450		KUXL	1570	Hagerstown, Md.	WARK	1490
Farmington, N.M.	KENN	1390	Franklin, Tenn.	WAGS	950	Goldsboro, N.C.	WFCM	730	Haines City, Fla.	WJEF	1240
	KWYK	960	Franklin, Va.	WYSR	1250		WGBR	1150	Haleyville, Ala.	WHAN	980
	KRZC	1280	Franklington, La.	WFCG	1150		WGW	1350	Halfway, Md.	WHAG	1410
Farmville, N.C.	WFAA	1250	Frederick, Md.	WFMD	930	Gonzales, Tex.	KCTI	1450	Hamden, Conn.	WCDD	1220
Farmville, Va.	WFLO	870	Frederick, Okla.	KTAT	1570	Goodland, Kans.	KLOE	730	Hamilton, Ala.	WERH	970
Farrell, Pa.	WFAR	1470	Fredericksburg, Va.	KNAF	910	Gordon, Ga.	WC1K	1560	Hamilton, Mont.	KYLQ	980
Farwell, Tex.	KZOL	1570		WFLS	1350	Goshen, Ind.	WKAM	1460	Hamilton, Ohio	WMOH	1450
Fayette, Ala.	WWVF	990	Fredericktown, Mo.	KFTW	1450	Gouverneur, N.Y.	WIGS	1230	Hamilton, Tex.	KCLW	900
Fayetteville, Ark.	KHOG	1440		WUZ	1370	Grafton, N.D.	KGPC	1340	Hamlet, N.C.	WJBC	1250
	KFAY	1250	Fredonia, N.Y.	WFLZ	1570	Grafton, N.Y.	WVA	1300	Hammond, Ind.	WJBO	230
	WFNC	940	Freesport, N.Y.	WGBB	1240	Graham, N.C.	WSML	1190	Hammond, La.	WFRP	1400
	WFLB	1490	Freesport, Tex.	KBRZ	1460	Graham, Tex.	KSVA	1330	Hampton, N.J.	WNJH	1580
	WIDU	1600	Fremont, N.Y.	WBFC	1490	Grand Coulee, Wash.	KFDR	1360	Hampton, S.C.	WBHC	1270
Fayetteville, Tenn.	WEKR	1240	Fremont, Mich.	WBSH	1550	Grand Forks, N.D.	KFJM	1370	Hampton, Va.	WVEC	1490
	KBFR	1250	Fremont, Neb.	KHUB	1340		KILO	1440	Hancock, Mich.	WFLC	920
	KFIL	1060	Fremont, Ohio	KARM	430	Grand Haven, Mich.	KNOX	1310	Hanford, Calif.	KBG	820
Fernandino Beach, Fla.	WFBF	1570	Fresno, Calif.	KBIF	900		WGHN	1370	Hannibal, Mo.	KHMO	1070
Ferriday, La.	KFNW	1600		KIRV	1510	Grand Island, Neb.	KMMJ	750	Hanover, N.H.	WDSL	1400
Festus, Mo.	KJCF	1400		KEAP	980		KRGI	1430	Hanover, Pa.	WHVR	1280
Festus-St. Louis, Mo.	KXEN	1010		KKEX	1550	Grand Junction, Colo.	KKREX	1100	Hardin, Mont.	KHDN	1230
Findlay, Ohio	WF1N	1350		KFRE	940		KKREX	1100	Hardsburg, Ky.	WHPC	1520
Fisher, W.Va.	WELD	690		KGSB	600		KEXO	1230	Harlan, Ky.	WHLL	1410
Fitchburg, Mass.	WEIM	1280		KMAK	1340		KSTR	620	Harlingen, Tex.	KGST	1530
	WFGL	960		KMJ	580	Grand Prairie, Tex.	KWSL	1340	Harrison, Tenn.	WHBT	1600
Fitzgerald, Ga.	WCB	600	Friona, Tex.	KNNN	1070		KPCW	730	Harrisburg, Ill.	WEBQ	1240
Flagstaff, Ariz.	KAFF	930	Front Royal, Va.	WFR	1450	Grand Rapids, Mich.	WJEF	1290	Harrisburg, Pa.	WFCB	1460
	KEOS	690	Frostburg, Md.	WFRB	560		WF1E	1570		WCB	580
Flat River, Mo.	KFMO	1240	Fulton, Ky.	WFUL	1270		WGRD	1410	Harrison, Ark.	KHOZ	900
Flat, Mich.	WFDF	910	Fulton, Miss.	WFTO	1330		WLAV	1430	Harrisonburg, Va.	WHBG	1360
	WTRX	1330	Fulton, Mo.	KFAL	900		WMAX	1480		WKCY	1300
	WANN	1420	Fulton, N.Y.	WOSC	1300		WOZD	1300		WVA	550
	WMRP	1570	Fuquay Spgs., N.C.	WAKS	1460	Grand Rapids, Minn.	WOZY	1490	Harrodsburg, Ky.	WFBN	1420
	WKMF	1470	Gadsden, Ala.	WAGD	1350		KORT	1230	Hartford, Conn.	WDRS	1360
Flomaton, Ala.	WTBC	990		WETO	930	Grangeville, Idaho	WGNV	920		WCCC	1290
Florence, Ala.	WJOL	1340		WAXX	570	Granite City, Ill.	WGNV	920		WPOP	1410
	WOWL	1240	Gaffney, S.C.	WEGC	1500	Granite Falls, N.C.	WKJK	900	Hartford, Wis.	WTKM	1540
	W1NK	1370	Gainesville, Fla.	WDFW	980	Grants, N.Mex.	KM1N	950	Hartselle, Ala.	WHRT	860
Florence, S.C.	WOLS	1230		WGGG	1230	Grants Pass, Oreg.	KAGI	930	Hartsville, S.C.	WHS	1510
	WYNN	540		WRUF	850		KAJO	1270	Hartsville, Tenn.	WJKM	1090
Floydada, Tex.	KFLD	900	Gainesville, Ga.	WUWU	1390	Grayson, Ky.	WGHJ	1370	Hartwell, Ga.	WKLY	980
Fond du Lac, Wis.	WHFP	1310		WUGA	550	Gt. Barrington, Mass.	WSBS	860	Harvard, Ill.	WMCW	1600
Fordyce, Ark.	KBJT	1570		WDUN	1240	Gt. Bend, Kans.	KVGB	1590	Harvey, Ill.	WBEF	1570
Forest, Miss.	WABG	1370	Gainesville, Tex.	KGAF	1580	Gt. Falls, Mont.	KFB	1810	Hastings, Mich.	WBCH	1220
Forest City, N.C.	WBBO	780	Gaithersburg, Md.	WGBB	1580		KUDI	1450	Hastings, Minn.	KDWA	1460
	WAGY	1320	Galax, Va.	WBOB	1360		KMNS	560	Hastings, Neb.	KICS	1250
	KVAC	1490	Galesburg, Ill.	WGIL	1400		KARR	1400	Hattiesburg, Miss.	WBKH	950
Forrest City, Ark.	KXJK	950		WAIK	1590	Greeley, Colo.	KFKA	1310		WFOR	1400
Ft. Atkinson, Wis.	WFAW	940	Gallatin, Tenn.	WHIN	1010		KYOU	1450		WHBY	1230
Ft. Bragg, Calif.	KDAC	1230		WAMG	1130	Green Bay, Wis.	WUJ	1360	Havelock, N.C.	WUSM	1350
Ft. Campbell, Ky.	WABG	1370	Gallipolis, Ohio	W1EH	990		WDUZ	1400	Haverhill, Mass.	WHAV	1490
Ft. Collins, Colo.	KCOL	1410	Gallup, N. Mex.	KYVA	1230	Greenville, Tenn.	WGRV	1340	Havre, Mont.	KOJM	610
	KZ1X	600	Galveston, Tex.	KILE	1400		WSMG	1450	Havre de Grace, Md.	WASA	1330
Ft. Dodge, Iowa	KVFD	1400		KGBC	1540	Greenfield, Mass.	WHAI	1240	Hawkinsville, Ga.	WCEH	610
	KWMT	540	Gander, Nfld.	CBG	1450	Greensboro, N.C.	WBG1	1470	Haynesville, La.	KLUV	1580
Ft. Knox, Ky.	WSAC	1470	Garden City, Ga.	WNMT	1520		WCOG	1320	Hays, Kans.	KAYS	1400
Ft. Lauderdale, Fla.	WSRF	1580	Garden City, Kan.	KUPL	1240		WAL	1510	Hayward, Wis.	WHSN	910
	KXGI	1360		KUPK	1050		WKTB	1550	Hazard, Ky.	K139	1390
Ft. Morgan, Colo.	KFTM	1400	Garden City, Mich.	WTAK	1090		WGBG	1400	Hazelhurst, Ga.	WVQJ	920
Ft. Myers, Fla.	W1NK	1240	Gardiner, Me.	WABK	1280	Greensboro, Ind.	WPRE	950	Hazelhurst, Miss.	WMDC	1220
							WTRF	1380	Hazleton, Pa.	WAZL	1490

# WHITE'S RADIO LOG

Location	C.L.	kHz
Heber Springs, Ark.	KAWW	1370
Helena, Ark.	KFFA	1360
Helena, Mont.	KCAP	1340
	KBLL	1240
Hemet, Calif.	KHSJ	1320
Hemingway, S.C.	WKYB	1000
Hempstead, N.Y.	WHLI	1100
Henderson, Ky.	WSDN	880
Henderson, Nev.	KBMI	1400
	KTOO	1280
Henderson, N.C.	WHNC	890
	WIZS	1450
Henderson, Tenn.	WHHM	1580
Henderson, Tex.	KGR1	1000
	KWRD	1470
Hendersonville, N.C.	WHPK	1450
	WHVL	1600
Henryetta, Okla.	KHEN	1590
Hereford, Tex.	KPAN	860
Hickmer, N.Y.	WALY	1420
Hermiston, Oreg.	KOHU	1570
Herndon, Va.	WHRN	1440
Herrin, Ill.	WJPF	1340
Hettinger, N.Dak.	KNDC	1490
Hibbing, Minn.	WMFG	1240
Hickory, N.C.	WHRC	1290
	WSPF	1000
	WINU	1510
Highland, Ill.	WEFF	1430
Highland Park, Tex.	KVIL	1150
Highland Springs, Va.	WENZ	1450
High Point, N.C.	WMFR	1230
	WNOS	1590
	WHPE	1070
Hillsboro, Ohio	WSRW	1590
Hillsboro, Oreg.	KUIK	1360
Hillsboro, Tex.	KHBR	1560
Hillsdale, Mich.	WCSR	1340
Hillsville, Va.	WHHV	1400
Hilo, Hawaii	KPUA	970
	KIPA	1110
	KIMO	850
Hinesville, Ga.	KGML	990
Hinton, W. Va.	WMTD	1390
Hobbs, N.Mex.	KHEW	1480
	KHOB	1390
	KDJI	1270
	KVYL	1370
Holbrook, Ariz.	KDJI	1270
Holdenville, Okla.	KVYL	1370
Holdrege, Nebr.	KUVR	1380
Holland, Mich.	WHTC	1450
	WHBL	1290
Hollister, Cal.	KMPG	1520
Hollywood, Fla.	WGMA	1320
Holly Springs, Miss.	WKRA	1110
	WREB	930
Holyoke, Mass.	WHAL	1320
Homer, La.	WHBS	1270
Homestead, Fla.	WJLD	1400
Homewood, Ala.	KRME	1460
Hondo, Tex.	KAIM	870
Honolulu, Hawaii	KCCN	1420
	KGMB	590
	KZOD	1210
	KHAI	1090
	KPOI	1380
	KIKI	830
	KGU	760
	KHYV	1040
	KKUA	890
	KHON	1270
	KOHO	1170
	KORL	650
	KTRG	990
	KUMU	1500
Hood River, Oreg.	KIHR	1340
Hope, Ark.	KXAR	1480
Hopewell, Va.	WHBS	590
Hopkinsville, Ky.	WOP	1230
	WKOA	1480
Hoquiam, Wash.	KGHO	1560
Hornell, N.Y.	WHHG	1320
	WLEA	1480
Horseheads, N.Y.	WIQT	1000
Hot Springs, Ark.	KXOW	1420
	KZNG	1340
Hot Springs, S.Dak.	KOBH	580
Houghton, Mich.	WHDF	1400
Houghton Lake, Mich.	WHCR	1290
Houlton, Maine	WHOU	1340
Houma, La.	KJAN	1490
Houston, Miss.	WCPC	940
Houston, Mo.	KBTC	1250

Location	C.L.	kHz
Houston, Tex.	KCOH	1430
	KENR	1070
	KILT	810
	KNUZ	1280
	KODZ	1010
	KPRC	950
	KTHT	790
	KTRH	740
	KXYZ	1320
	KYOK	1590
Howell, Mich.	WHM	1350
Hudson, N.Y.	WHUC	1230
Hugo, Okla.	KIHN	1340
Humacao, P.R.	WALO	1240
Humboldt, Tenn.	WIRJ	740
Huntingdon, Pa.	WHUN	1180
Huntington, Ind.	WHLT	1300
Huntington, N.Y.	WGSW	740
Huntington, W.Va.	WKEE	800
	WSAZ	930
	WWHY	1470
Huntsville, Ala.	WBPH	1230
	WEUP	1600
	WFIX	1450
	WAAV	1550
	WVQV	1000
Huntsville, Tex.	KSAM	1490
Huron, S.Dak.	KIJV	1340
Hutchinson, Kans.	KWBW	1450
	KWHK	1269
Hutchinson, Minn.	KDUZ	1260
Hyde Park, N.Y.	WHYW	950
Idabel, Okla.	KBEL	1240
Idaho Falls, Idaho	KID	950
	KTEE	1260
Immokalee, Fla.	WCOF	1490
Independence, Ia.	KUPI	880
	KOUR	1220
Independence, Kans.	KIND	1010
Independence, Mo.	KCCX	1510
Indiana, Pa.	WDAD	1450
Indianapolis, Ind.	WATI	810
	WBRI	1500
	WFBM	1260
	WGEE	1590
	WBCB	1070
	WIFE	1310
	WIRE	1430
	WXLW	950
Indianola, Iowa	KBAB	1490
Indianola, Miss.	WNLA	1380
Indian Rocks Beach, Fla.	WGNP	1520
Indio, Calif.	KREO	1460
Inglewood, Calif.	KTYM	1400
Inkster, Mich.	WCHB	1440
International Falls, Minn.	KGHS	1230
Inverness, Fla.	WYSE	1560
Iola, Kansas	KALN	1370
Ionia, Mich.	WION	1430
Iowa City, Iowa	KXIC	800
	WSUI	910
Iowa Falls, Ia.	KIFG	910
Irontdale, Ala.	WPIH	1480
Iron Mtn., Mich.	WMIQ	1450
Iron River, Mich.	WIKB	1230
Ironton, Ohio	WIRO	1230
Ironwood, Mich.	WJMS	590
Irvine, Ky.	WIRV	1550
Isabella, P.R.	WISA	1390
Ishpeming, Mich.	WJPD	1240
Islip, N.Y.	WLIX	540
Ithaca, N.Y.	WHCU	870
	WTKO	1470
Iuka, Miss.	WVOM	1270
Jackon, Ala.	WHOD	1290
Jackon, Ga.	WJCA	1540
Jackon, Ky.	WEGK	810
Jackon, Mich.	WIBM	1450
	WKHM	970
	WJCO	1510
Jackon, Miss.	WJDX	620
	WJQS	1400
	WJXN	1450
	WOKI	1550
	WUUN	1590
	WRBC	1300
	WLSI	980
Jackon, Ohio	WLMJ	1810
Jackon, Tenn.	WDXI	1280
	WJCA	1540
Jackon, Ky.	WEGK	810
	WIBM	1450
	WKHM	970
	WJCO	1510
	WJDX	620
	WJQS	1400
	WJXN	1450
	WOKI	1550
	WUUN	1590
	WRBC	1300
	WLSI	980
Jackon, Ohio	WLMJ	1810
Jackon, Tenn.	WDXI	1280
	WJCA	1540
Jackon, Ky.	WEGK	810
	WIBM	1450
	WKHM	970
	WJCO	1510
	WJDX	620
	WJQS	1400
	WJXN	1450
	WOKI	1550
	WUUN	1590
	WRBC	1300
	WLSI	980
Jackon, Ohio	WLMJ	1810
Jackon, Tenn.	WDXI	1280
	WJCA	1540
Jackon, Ky.	WEGK	810
	WIBM	1450
	WKHM	970
	WJCO	1510
	WJDX	620
	WJQS	1400
	WJXN	1450
	WOKI	1550
	WUUN	1590
	WRBC	1300
	WLSI	980
Jackon, Wis.	WYLO	540
Jackon, Wyo.	KSGT	1340
Jackonville, Ark.	KGMR	1500
Jackonville, Fla.	WJAX	990
	WAKE	890
	WZON	970
	WZOK	1320
	WIVY	1050
	WMBR	1460
	WOB3	1360
	WPDQ	800
	WQIK	1090
	WVCR	1400
Jackonville, Ill.	WJIL	1550
	WLDS	1180
Jackonville, Miss.	WJQS	1400
Jackonville, N.C.	WJNC	1240

Location	C.L.	kHz
Jackonville, Tex.	WLAS	910
Jackonville Beh., Fla.	KEBE	1400
	WBIX	1010
Jamestown, Ky.	WKYJ	1060
Jamestown, N.Dak.	KEYJ	1400
	KSJB	600
Jamestown, N.Y.	WJTN	1240
	WKSN	1340
Jamestown, Tenn.	WCLE	1280
	WJEB	1500
Janesville, Wis.	WCLO	1230
Jasper, Ala.	WWVB	1360
	WARF	1240
Jasper, Ind.	WITZ	990
Jasper, Tex.	KTXJ	1350
Jefferson City, Mo.	KLIK	950
	KWOS	1240
Jefferson City, Tenn.	WJFC	1480
Jeffersonville, Ind.	WXVW	1450
Jena, La.	KCKW	1480
Jennings, La.	KJEF	1290
Jerome, Idaho	KART	1400
Jerseyville, Ill.	WJBM	1480
Jesup, Ga.	WYAT	1350
John Day, Ore.	KJDY	1400
Johnson City, Tenn.	WJCV	910
	WETB	790
	WJES	1570
Johnston, S.C.	WIZR	930
Johnstown, N.Y.	WJAC	850
Johnstown, Pa.	WARD	1490
	WCRO	1230
Joliet, Ill.	WJLH	1340
	WJIC	1510
Jolietto, Que.	GJLM	1350
Jonesboro, Ark.	KBTM	1230
	WJLH	1370
Jonesboro, La.	KTOC	920
Jonesboro, Tenn.	WJSD	1590
Jonesville, La.	KANV	1480
Joplin, Mo.	WMBH	1450
	KQYX	1560
	KFSB	1310
	WJLH	1370
Joshua Tree, Cal.	KJST	1420
Junction, Tex.	KMBL	1450
June City, Kans.	KJCK	1420
Juneau, Alaska	KJNY	800
Jupiter, Fla.	WJPS	1000
Kailua, Hawaii	KJLH	1180
Kalamazoo, Mich.	WKPR	1420
	WKZO	590
	WKLZ	1470
	WKMI	1360
Kallepoll, Mont.	KGEZ	800
	KOFI	1180
Kane, Pa.	WJCA	950
Kankakee, Ill.	WKAN	1320
Kannapolis, N.C.	WGTL	870
	WRKB	1460
Kans. City, Kans.	KCKN	1340
Kansas City, Mo.	KCMO	810
	KMBZ	960
	WJLH	1370
	WDAF	610
	WHB	710
Kaukauna, Wis.	WKAA	1050
Kenedy-Karnes City, Texas	KAML	990
Kealakekua, Hawaii	KONA	740
Kearney, Nebr.	KGFW	1300
	KRNY	1460
Keene, N.H.	WKNE	1290
	WKBK	1220
Kelso, Wash.	KLOG	1490
Kemmerer, Wyo.	KMER	950
Kendallville, Ind.	WAWK	1140
Kenedy, Tex.	KAML	990
Kennett, Mo.	KBOA	830
	KBXN	1540
Kennewick, Wash.	KSMK	1340
Kennewick-Paseo-Richland, Wash.	KEFR	810
Kenosha, Wis.	WKNT	1050
Kent, O.	WKNT	1520
Keokuk, Iowa	KOKX	1310
Kermit, Tex.	KERB	600
Kerrville, Tex.	KERV	1230
Kershaw, S.C.	WKSC	1300
Kimberlin, Alaska	KTN	350
Kewanee, Ill.	WKEL	1450
Keyser, W.Va.	WKLP	1390
Key West, Fla.	WKWF	1600
	WKIZ	1500
Kilgore, Tex.	KOCA	1240
Killeen, Tex.	KLEN	1050
Kimball, Nebr.	WKTB	1400
King, N.C.	WKTE	1090
King City, Calif.	KRKC	1490
Kingman, Ariz.	KAAA	1230
Kings Mountain, N.C.	WKMT	1220
Kingsport, Tenn.	WKIN	1320
	WKIP	1370
	WGOC	1090
Kingston, N.Y.	WBAZ	1550
	WGHQ	920
	WKNY	1490

Location	C.L.	kHz
Kingstree, S.C.	WDKD	1310
	WKSP	1090
Kingsville, Tex.	KINE	1930
Kingwood, W.Va.	WKST	1560
Kingston, N.C.	WESP	1010
	WFTC	960
	WISP	1230
Kirkland, Wash.	KYAC	1460
	KBLE	1050
Kirksville, Mo.	KIRX	1450
Kissimmee, Fla.	WFPJ	1080
Kittanning, Pa.	WACB	1380
Klamath Falls, Oreg.	KAGO	1150
	KFLW	1450
	KLAD	960
	KNIA	1320
Knoxville, Iowa	WBR	1240
Knoxville, Tenn.	WIVK	850
	WATE	620
	WJBE	1430
	WKXV	900
	WNOX	990
	WROL	1490
	WVST	1220
	WYOP	1350
Kokomo, Ind.	WKOZ	1350
Kosciusko, Miss.	WLNH	1350
Laconia, N.H.	WEMJ	1490
LaCrosse, Wis.	WKBH	1410
	WLCC	1490
	WVCR	620
Ladysmith, Wis.	WLDY	1340
Lafayette, Ga.	WLFA	1590
Lafayette, Ind.	WASK	1450
	WAZY	1410
Lafayette, La.	WBAA	920
	KPEL	1420
	KNBN	830
	KXKW	1520
Lafayette, Tenn.	WEEN	1460
LaFollette, Tenn.	WLAF	1450
LaGrande, Oreg.	KLBM	1450
LaGrange, Ga.	WLAF	1240
	WTRP	620
LaGrange, Ill.	WTQJ	1300
LaGrange, Tex.	KVLG	1570
LaJunta, Colo.	KBZZ	1400
Lake Charles, La.	KLOU	1580
	KPLC	1470
	KADK	1400
Lake City, Fla.	WDSR	1340
	WGRO	960
Lake City, S.C.	WJOT	1260
Lake Geneva, Wis.	WMIR	1550
Lakeland, Fla.	WLAK	1430
	WONN	1390
	WVAB	1380
Lake Placid, N.Y.	WBSR	320
Lakeport, Cal.	KBLC	1270
Lake Providence, La.	KLPL	1050
Lake Tahoe, Calif.	KOWL	1490
Lakeview, Oreg.	KQIK	1230
Lake Wales, Fla.	WIPC	1280
Lakewood, Colo.	KLAK	1600
Lakewood Center, Wash.	KOOD	1480
Lake Worth, Fla.	WLIZ	1380
Lamar, Colo.	KLMR	920
Lamesa, Tex.	KPET	690
Lampasas, Tex.	KCYL	1450
Lancaster, Calif.	KAA	610
	KBYM	1380
Lancaster, Ky.	WIXI	1200
Lancaster, N.Y.	WMMJ	1380
Lancaster, Ohio	WHOC	1320
Lancaster, Pa.	WGAL	1480
	WLAN	1390
Lancaster, S.C.	WLCM	1360
	WAGL	1360
Lander, Wyo.	KOVE	1330
Landett, Ala.	WRLD	1



# WHITE'S RADIO LOG

Location	C.L.	kHz
Monroe, Ga.	WMRE	1490
Monroe, La.	KMLB	1440
	KLIC	1290
	KNOE	540
Monroe, Mich.	WQTE	560
Monroe, N.C.	WIXE	1190
	WMAP	1060
Monroe, Wis.	WEKZ	1260
Monroeville, Ala.	WMFC	1360
Monterey, Calif.	KIDD	630
	KMBB	1240
	KDMA	1460
Montevideo, Minn.	KSLV	1240
Monte Vista, Colo.	KSLV	1240
Montezuma, Ga.	WMNZ	1050
Montgomery, Ala.	WBAM	740
	WAPX	1600
	WC0V	1170
	WFMI	1000
	WHRY	1440
	WBGY	800
	WRMA	950
Montgomery, W.Va.	WMON	1340
Monticello, Ark.	KHBM	1430
Monticello, Fla.	WSD	1900
Monticello, Ky.	WFLW	1360
Monticello, Va.	KVSI	1450
Montpelier-Barre, Vt.	WSKI	1240
Montrose, Colo.	KUBC	580
Montrose, Pa.	WPFL	1250
Montrose, N.C.	WRIK	1550
Moorehead, Minn.	KVOX	1280
Morehead, Ky.	WMOR	1330
Morehead City, N.C.	WMBL	740
Morgan City, La.	KMRC	1430
Morganfield, Ky.	WMSK	1550
Morgantown, N.C.	WMOR	1430
Morgantown, W.Va.	WAIA	1440
	WCLG	1300
Morrilton, Ark.	KVOM	800
Morris, Ill.	WCJS	1550
Morris, Minn.	KMRS	1280
Morristown, N.J.	WMTR	1250
Morristown, Tenn.	WCRP	1550
	WMTN	1300
Morton, Tex.	KRAN	1280
Moscow, Idaho	KRPL	1400
Moses Lake, Wash.	KSEM	1470
	KWIG	1260
Mass Point, Miss.	WIS	1460
Mouton, Ala.	WLCB	1530
Moutrie, Ga.	WMGA	1400
	WMTM	1300
Moundsville, W.Va.	WEIF	1370
Mountain City, Tenn.	WMCT	1390
Mountain Grove, Mo.	KLRS	1360
Mountain Home, Ark.	KTLO	1240
Mountain Home, Ida.	KFLI	1240
Mountainlake Terrace, Wash.	KURB	1510
Mt. Airy, N.C.	WPAQ	740
	WSDY	1300
Mt. Carmel, Ill.	WVMC	1360
Mt. Clemens, Mich.	WBRB	1430
	WGBT	1580
Mt. Dora, Fla.	WJJZ	1460
Mt. Holly, N.J.	WJZ	1460
Mt. Jackson, Va.	WISG	790
Mt. Kisco, N.Y.	WVPI	1310
Mt. Olive, N.C.	WDIS	1430
Mt. Pleasant, Mich.	WCEN	1150
Mt. Pleasant, Tex.	KIMP	960
Mt. Shasta, Calif.	KWSD	620
Mt. Sterling, Ky.	WMST	1150
Mt. Vernon, Ill.	WMLY	940
Mt. Vernon, Ind.	WPCD	1590
Mt. Vernon, Ky.	WRVK	1460
Mt. Vernon, Ohio	WMVO	1300
Mt. Vernon, Wash.	KAPS	1470
	KBRC	1430
Muleshoe, Tex.	KMUL	1380
Mullins, S.C.	WJL	1280
Muncie, Ind.	WLBC	1340
	WERK	990
Munfreesville, Ky.	WLOC	1150
Munising, Mich.	WGON	1400
Murfreesboro, N.C.	WDRD	1090
Murfreesboro, Tenn.	WGSN	1450
	WMTS	810
Murphy, N.C.	WCVP	600
	WKRK	1320
Murphysboro, Ill.	WINI	1420
Murray, Ky.	WNBS	1340
Murray, Utah	KMOR	1230
Muscateine, Iowa	KWPC	860

Location	C.L.	kHz
Muscle Shoals City, Ala.	WLAY	1450
Muskegon, Mich.	WKBB	850
	WKJR	1520
	WTRU	1600
	WMUS	1090
Muskogee, Okla.	KBIX	1490
	KMUS	1390
Myrtle Beach, S.C.	WMYB	960
	WTGR	1520
Naacogoches, Tex.	KEEE	1230
	KSFA	860
Nampa, Idaho	KFXD	590
	KAIN	1340
Nanticoke, Pa.	WNAK	730
Napa, Calif.	KVVO	1450
Naples, Fla.	WNOG	1270
Narrows-Pearisburg, Va.	WNRV	990
Nashua, N.H.	WOTW	900
	WSMN	1590
Nashville, Ark.	KBHC	1290
Nashville, Ga.	KMUS	1600
Nashville, Tenn.	WKDA	1240
	WLAC	1510
	WMAK	1300
	WNAH	1580
	WSIX	980
	WSM	850
	WSMG	1560
Nassau, Bahamas	ZNS-2	1240
Natchez, Miss.	WMIS	1240
	WNAT	1450
Natchitoches, La.	KNOC	1450
Natick, Mass.	WGTR	1060
Naugatuck, Conn.	W0WV	1360
Navasota, Tex.	KWBC	1550
Nebraska City, Nebr.	KNCY	1600
	KSFE	1440
Needles, Calif.	WNAI	1380
Neenah, Wis.	WCCN	1370
Neilsville, O.	WNAL	940
Neon, Ky.	WKYK	1490
Nescho, Mo.	KBTN	1420
Nevada, Mo.	KNEM	1240
New Albany, Ind.	WHEL	1570
	WREY	1290
New Albany, Miss.	WNAU	1470
Newark, Del.	WNRK	1260
Newark, N.J.	WNJR	1450
	WVNI	520
Newark, N.Y.	WACK	1420
Newark, Ohio	WCLT	1430
New Bedford, Mass.	WBSM	1420
	WNBH	1340
New Bern, N.C.	WHIT	1450
	WHYB	1490
Newberry, Mich.	WNBY	1450
Newberry, S.C.	WKDK	1240
	WKMG	1520
New Boston, Ohio	WIOI	1010
New Braunfels, Tex.	KGNB	1420
New Britain, Conn.	WRCH	910
	WRYM	840
New Brunswick, N.J.	WCCT	1450
Newburgh, N.Y.	WGNV	1220
Newburyport, Mass.	WNBP	1470
New Castle, Ind.	WNTW	1550
New Castle, Pa.	WBZY	1140
	WKST	1280
Newcastle, Wyo.	KASL	1240
New City, N.Y.	WRKL	910
New Haven, Conn.	WAVZ	1300
	WELI	960
	WHIC	540
	KANE	1240
	KNIR	1360
New Iberia, La.	KNIR	1360
New Kensington, Pa.	WKPA	1150
New London, Conn.	WNLC	1510
New Martinsville, W.Va.	WETZ	1330
Newnan, Ga.	WG04	1400
	WNEA	1300
New Orleans, La.	WDSU	1280
	WNNR	990
	WBOK	800
	WBOE	1060
	WSNB	1550
	WNPS	1450
	WSHO	1230
	KRIG	1410
	KOEL	950
	WV0M	600
	WYLD	940
	KNEY	1280
Newport, Ark.	WYLD	940
Newport, Ky.	KNOP	740
Newport, N.H.	WCNL	1010
Newport, Oreg.	KNPT	1310
Newport, R.I.	WADK	1540
Newport, Tenn.	WLKJ	1270
Newport, Vt.	WIKE	1490
Newport News, Va.	WGH	1310
	WTID	1270
Newport Richey, Fla.	WGUL	1500
New Richmond, Wis.	WIXK	1590
New Roads, La.	KWRG	1460
New Rochelle, N.Y.	WVOX	1500

Location	C.L.	kHz
New Smyrna Beach, Fla.	WSBB	1230
	WOGO	1550
Newton, Iowa	KCOB	1280
Newton, Kans.	KJRG	950
Newton, Mass.	WNTN	1550
Newton, Miss.	WBKN	1410
Newton, N.J.	WNNJ	1360
Newton, N.C.	WNNC	1230
New Ulm, Minn.	KNU	960
New York, N.Y.	WABC	770
	WADO	1280
	WBXX	1380
	WCBS	880
	WEVD	1330
	WHN	1050
	WHOM	1490
	WINS	1310
	WLIB	1190
	WMCA	570
	WNBC	660
	WNEW	1130
	WNYC	830
	WOR	710
	WVBR	1380
	WVRL	1500
Niagara Falls, N.Y.	WHLD	1270
	WJLL	1440
Nicholasville, Ky.	WNVL	1250
Niles, Mich.	WNIL	1290
Niles, Ohio	WNIO	1540
Noises, Ariz.	KFBR	1340
Nome, Alaska	WNBS	850
Norfolk, Nebr.	WJAG	780
Norfolk, Va.	WTAR	790
	WCMS	1050
	WNOR	1230
	WRAP	850
	WOKD	1440
Normal, Ill.	WNOK	1440
Norman, Okla.	KNOR	1400
Norristown, Pa.	WNAR	1110
N. Adams, Mass.	WMNB	1230
N. Atlanta, Ga.	WRNG	680
N. Augusta, S.C.	WGUS	1380
N. Bend, Ore.	WFNL	1600
North Charleston, S.C.	KBBR	1340
Northampton, Mass.	WNCG	910
	WHMP	1400
North East, Pa.	WHYP	1530
Northfield, Minn.	WGAL	770
N. Little Rock, Ark.	KXLR	1150
North Platte, Nebr.	KJLT	970
	KNOP	1410
	KODY	1240
North Pole, Alaska	KJNP	1170
No. Syracuse, N.Y.	WSCQ	1220
N. Vernon, Ind.	WDCH	1460
No. Wilkesboro, N.C.	WKBC	810
	KNBI	1530
Norton, Kans.	WNVA	1350
Norton, Va.	WNLK	1550
Norwalk, Conn.	WLKR	1510
Norwalk, Ohio	WICH	1310
Norwich, N.Y.	WNYC	1310
Oakdale, La.	KREH	900
Oakes, N. Dak.	KEYD	1220
Oak Grove, La.	KWCL	1280
Oak Hill, W.Va.	WOAY	860
Oakland, Cal.	KNEW	910
	KABL	860
	KNBI	1310
Oakland, Md.	WMSG	1050
Oakland Park, Fla.	WIXX	1520
Oak Park, Ill.	WOPA	1490
Oak Ridge, Tenn.	WATO	1290
Ocala, Fla.	WMOP	900
	WTMC	1290
	WTKT	1370
Ocean City, Md.	WETT	1590
Ocean City, Somers Pt., N.J.	WSLT	1520
Oceanlake, Oreg.	KBCH	1380
Oceanside, Calif.	KUDE	1320
Oella, Ga.	WSIZ	1380
Oconto, Wis.	W020	1260
Odessa, Tex.	WBZB	920
	KOZA	1230
	KOYL	1310
	KRIG	1410
	KOEL	950
Osawatomie, Mo.	KOGA	930
Ogden, Utah	WLO	1430
	KAN	1090
	KSVN	730
	KVOG	1490
Ogdensburg, N.Y.	WSLB	1400
Oil City, Pa.	WKRC	1340
Okeechobee, Fla.	WOKZ	1570
Oklahoma City, Okla.	KBYE	890
	KLBI	1140
	KOCY	1340
	KOMA	1520
	KTKO	1000
	KJEM	800
	KWY	930
Okmulgee, Okla.	KOKL	1240
Old Saybrook, Conn.	WLIS	1420

Location	C.L.	kHz
Olean, N.Y.	WMNS	1360
	WLD	1450
Olney, Ill.	WOL	1440
Olympia, Wash.	KGY	1240
	KITN	920
Omaha, Nebr.	KBON	1490
	KFAB	1110
	KOIL	1290
	KOOD	1420
	KOZN	760
	WOW	590
	KOMW	680
Oneida, N.Y.	WMCR	1600
Oneida, Tenn.	WBNT	1310
O'Neill, Nebr.	KBRZ	1350
Oneonta, Ala.	WCRL	1570
Oneonta, N.Y.	WDOZ	750
Ontario, Cal.	KSDM	1510
Ontario, Oreg.	KSRV	1890
Opelika, Ala.	WADA	1520
	WPHO	1400
Opelousas, La.	KSLO	1230
Opp, Ala.	WAMI	860
Opportunity, Wash.	KZUN	850
Orange, Mass.	WCRB	1390
Orange, Tex.	KOGT	1800
Orange, Va.	WJMA	1440
Orangeburg, S.C.	WDIX	1150
	WORG	1590
	WTND	920
Orange Park, Fla.	WAYR	550
Ord, Neb.	W020	1260
Oregon City, Ore.	KYXI	1520
Orlando, Fla.	WDBO	580
	WHOO	990
	WHYI	1270
	WLOF	950
	WQIS	740
Ormond Beh., Fla.	WQIK	1390
Oronho, Idaho	KLER	950
Oroville, Calif.	KAOB	1340
Ortonville, Minn.	KDIO	1150
Osage Beh., Mo.	KRMS	1350
Oskosh, Ark.	KOSE	860
Oshkosh, Wis.	W050	690
	WOSH	1490
Oskaloosa, Iowa	KBOE	740
Oswego, N.Y.	WSGO	1440
Othello, Wash.	KRSC	1400
Otsego, Mich.	WAOP	980
Ottawa, Ill.	WCMY	1420
Ottawa, Kans.	KOFO	1230
Ottumwa, Iowa	KLEE	1480
Owatonna, Minn.	KRFO	1390
Owego, N.Y.	WEBO	1390
Owensboro, Ky.	WOMI	1490
	WVJS	1420
	WPAF	1080
Oxford, Miss.	WSUH	1280
Oxford, N.C.	W0XF	1340
Oxnard, Calif.	KOXR	910
Ozark, Ala.	W0ZK	900
Paducah, Ky.	WDXR	1560
	WKYX	570
	WPAF	1080
Page, Ariz.	KPEE	1340
Painesville, Ohio	WPVL	1460
Paintsville, Ky.	WSPJ	1490
Palatka, Fla.	WWPF	1260
	WSUZ	800
Palestine, Tex.	KNET	1450
Palm Beh., Fla.	WQXT	1340
Palm Sprgs., Calif.	KDPS	1010
	KDES	920
	KPAL	1450
Palmdale, Calif.	KUTY	1470
Palm Desert, Cal.	KGOL	1270
Palo Alto, Calif.	KIBE	1220
Pampa, Tex.	KPDN	1340
	KGRO	1230
Panama Beach, Fla.	WGNE	1480
	WSCM	1290
Panama City, Fla.	WDLP	590
	WPCF	1430
Paoli, Ind.	WAK	1560
Paradise, Cal.	KEWQ	930
Paragould, Ark.	KDRS	1490
Paris, Ark.	KCCL	1460
Paris, Ill.	WPRS	1440
Paris, Ky.	WPDE	1440
Paris, Tenn.	WTPR	710
Paris, Tex.	KPLT	1490
	KFTV	1250
Parkersburg, W.Va.	WCFE	1050
	WPAR	1450
	WTAP	1230
	WNBI	1450
Park Falls, Wis.	KPRM	1240
Park Rapids, Minn.	KKGC	1540
Parsons, Kans.	KPKC	1240
Pasadena, Cal.	KRLA	1110
	KWKW	1300
Pasadena, Tex.	KLVL	1480
	KIKK	650
Paseagoula-Moss Point, Miss.	WPMP	1590
Pasco, Wash.	KORD	910
Paso Robles, Calif.	KPRL	1230
Pastilio, P.R.	WCGB	1050

Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz		
Patchogue, L.I., N.Y.	WALK 1370 WPAQ 1580	Posahontas, Ark.	KPOC 1420	Pryor, Okla.	KOVO 960 KOLS 1570	Riverside, Calif.	KPRO 1440 KACE 1570		
Paterson, N.J.	WPAT 930	Pocatello, Idaho	KSEI 980 KSNK 1240 KNWN 1290	Pueblo, Colo.	KDZA 1230 KAPI 690 KCSJ 590 KFEL 970 KKAM 1350 KFB 1480	Riverton, Wyo.	KVOW 1450 Riviera Beach, Fla.	WHEW 1600	
Pauls Valley, Okla.	WPAT 930	Pocomoke City, Md.	WDMV 540			Roanoke, Ala.	WELR 1360		
Pawhuska, Okla.	KDOR 1470	Pomona, Calif.	KWOB 1600 KKAR 1220			Roanoke, Va.	WDBJ 960 WDB 1110 WPXI 910 WROV 1240 WSLS 610		
Pawucket, R.I.	WXTR 550	Pompton Lakes, N. J.	WKER 1500	Pueblo, Colo.	KKAM 1350 KFB 1480 KWSB 1420 WPUV 1580 Pullman, Wash.				
Payette, Ida.	KYET 1450	Pompano Beach, Fla.	WLOD 980 WRBD 1470 WBBZ 1230 WPRP 910 WEUC 1420 WPAB 550 WLEO 1260 WISD 1260 WPOK 1080 Pontiac, Ill.			Roanoke Rapids, N.C.	WCBT 1230		
Pearsall, Tex.	KVWG 1280	Ponca City, Okla.	WBBZ 1230			Roaring Sprgs., Pa.	WKMC 1370 CHRL 910 TAY 1570		
Pecos, Tex.	KIUN 1400	Ponce, P.R.	WPRP 910 WEUC 1420 WPAB 550 WLEO 1260 WISD 1260 WPOK 1080	Punta Gorda, Fla.	WCFC 1580	Roberval, Que.	CHRL 910		
Peekskill, N.Y.	WLNA 1420			Punxsutawney, Pa.	WPME 1540	Robinson, Ill.	WTY 1570		
Pekin, Ill.	WFSH 1440			Putnam, Conn.	WNY 1350	Robstown, Tex.	KROB 500		
Pell City, Ala.	WFKK 1430			Puyallup, Wash.	KABE 1450	Rochelle, Ill.	WRHL 1060		
Pendleton, Oreg.	KTIX 1240			Quannah, Tex.	KOLJ 1150	Rochester, Minn.	KRDC 1340 KWEB 1270 KOB 1230		
	KUMA 1290			Quincy, Cal.	KPCO 1370				
Pennington Gap, Va.	WSWV 1570			Quincy, Fla.	WCNH 1230				
	WBSR 1540			Quincy, Ill.	WGEM 1440 WTAD 980 WYD 1350				
Pensacola, Fla.	WBR 940 WBSR 1540 WFL 1230 WCOA 1370			Quincy, Mass.	KFOR 1370	Rochester, N.H.	WVNH 950		
	WWSV 1240			Quincy, Wash.	KFOR 1370	Rochester, N.Y.	WBBF 950 WHAM 1180 WHEC 1460 WNYR 680 WSAY 1370 WRC 1260		
Peoria, Ill.	WXCL 1350 WMBD 1470 WIRL 1290 WPER 1020 WFR 1400 WGR 1310 WPGA 980 KDLS 1310 KEYE 1400 WARU 1600 KTOB 1490 WBSV 1240 WNSB 1340 WML 1110			Quitman, Ga.	WFBF 1490				
	WFL 900 WHAT 1340 WHOC 1420 WIBG 990 WIP 610 WPE 950 WRCP 1540 WTEL 860 WPHB 1260 KKAN 1490 KIFN 860 KASA 1540 KCAC 1010 KHAT 1490 KHEP 1280 KMED 740 KOY 550 KOOL 960 KPHO 910 KRIZ 1230 KTAR 1490 KXIV 1400			Racine, Wis.	WRAC 1460 WRJN 1400 WRAB 1460 WRKB 1400 WWSM 1500 WKIX 850 WYNA 1550 WPTF 680 WLE 570 WRNC 1240 WRNS 1530 WRTL 1460 WCVR 1430 KOTA 1380 KIMM 1150 KRSD 1340 KEZ 920 KFN 1490 WMOV 1360 KRAL 1240 KAPA 1340 KMSX 1240 KRH 990 KEB 850 WHUM 1240 WRAP 1340 WRMG 1430 KRDG 1230 KAHR 1330 KQMS 1400 KVCV 600 KHIP 540 KFBF 1490 KBC 1380 KCAL 1410 WGB 1440 KRBN 1450 KFRB 1240 KOKA 1080 KCUE 1250 KLR 1490 WRDB 1400 KRB 1470 WFR 1600 WREY 1220 WADR 1480 KOH 630 KBET 1340 KLE 1250 KOF 1250 KCBN 1230 WRIN 1560 WEE 1500 KREN 1420 KRXX 1230 WOB 1240 WJMC 1240 WPBC 980 KSCV 980 KALE 960 WRCE 1450 WRIC 540 WKB 1430 WANT 990 WBBL 1480 WRGM 1540 WLEE 1480 WFE 1230 WGOE 1590 WTVR 1380 WRNL 910 WRVA 1140 WXGI 950 WRGM 1540 WVTR 1600 KRC 1360 KLOA 1240 WBUG 1430 KWSR 810 WUNO 1320 WUNO 1320 WUNO 1320 WVTR 1570 WCWC 1600 WRIV 1390 WHRF 1570				
Perry, Fla.	WFL 900 WHAT 1340 WHOC 1420 WIBG 990 WIP 610 WPE 950 WRCP 1540 WTEL 860 WPHB 1260 KKAN 1490 KIFN 860 KASA 1540 KCAC 1010 KHAT 1490 KHEP 1280 KMED 740 KOY 550 KOOL 960 KPHO 910 KRIZ 1230 KTAR 1490 KXIV 1400			Radsford, Va.	WRAB 1460 WRKB 1400 WWSM 1500 WKIX 850 WYNA 1550 WPTF 680 WLE 570 WRNC 1240 WRNS 1530 WRTL 1460 WCVR 1430 KOTA 1380 KIMM 1150 KRSD 1340 KEZ 920 KFN 1490 WMOV 1360 KRAL 1240 KAPA 1340 KMSX 1240 KRH 990 KEB 850 WHUM 1240 WRAP 1340 WRMG 1430 KRDG 1230 KAHR 1330 KQMS 1400 KVCV 600 KHIP 540 KFBF 1490 KBC 1380 KCAL 1410 WGB 1440 KRBN 1450 KFRB 1240 KOKA 1080 KCUE 1250 KLR 1490 WRDB 1400 KRB 1470 WFR 1600 WREY 1220 WADR 1480 KOH 630 KBET 1340 KLE 1250 KOF 1250 KCBN 1230 WRIN 1560 WEE 1500 KREN 1420 KRXX 1230 WOB 1240 WJMC 1240 WPBC 980 KSCV 980 KALE 960 WRCE 1450 WRIC 540 WKB 1430 WANT 990 WBBL 1480 WRGM 1540 WLEE 1480 WFE 1230 WGOE 1590 WTVR 1380 WRNL 910 WRVA 1140 WXGI 950 WRGM 1540 WVTR 1600 KRC 1360 KLOA 1240 WBUG 1430 KWSR 810 WUNO 1320 WUNO 1320 WUNO 1320 WVTR 1570 WCWC 1600 WRIV 1390 WHRF 1570			Rockford, Ill.	WYFE 1150 WRRR 1330 WJWP 810 WRH 1340 WYTC 1150 WAYN 700 KOB 1230 WRKD 1450 WPLK 1260 KVRB 1320 WRKY 800 WINX 1600 WRKH 580 WRKY 1450 WCEC 810 WEED 1390 WRMT 490 WKWS 1290 WYTI 1370 KAMD 1390 WRMI 960 WRGS 1370 KCLU 1590 KTRR 1490 WLAQ 1410 WIYN 1360 WRGA 1470 WRON 710 WKAL 1450 WRNY 1350 WRON 1400 KRWB 1490 KRNR 1480 KRXL 1240 KRXL 1240 KYES 950 KFRD 980 KRDD 1320 KPOP 1110 KRIP 1190 KRK 1280 KGLF 1430 KBIM 910 KRDD 1320 KRIK 960 KSW 1020 WRIP 1430 KXKL 1340 KGCA 1450 KRRR 1340 WRUM 790 KAYT 970 KRUS 1490 KTLU 1580 KRSL 990 WVWR 920 KXRJ 1490 WRUS 610 WHWB 1000 WSYB 1380
Philipsburg, Pa.	WPHB 1260 KKAN 1490	Port Angeles, Wash.	KOLE 1340 KPC 1250 KTP 1450 KACY 1520 WHLS 1450 WPHM 1360 WDL 1530 KGUL 1560 WPGW 1440 WCSH 970 WGAN 580 WLOB 1310 WFOR 1490 KBPS 1450 KLIQ 1290 KEX 1190 KGIN 970 KPA 1410 KPDQ 800 KPOJ 1330 KWJJ 1080 KXL 750		Rails, Tex.	WRAB 1460 WRKB 1400 WWSM 1500 WKIX 850 WYNA 1550 WPTF 680 WLE 570 WRNC 1240 WRNS 1530 WRTL 1460 WCVR 1430 KOTA 1380 KIMM 1150 KRSD 1340 KEZ 920 KFN 1490 WMOV 1360 KRAL 1240 KAPA 1340 KMSX 1240 KRH 990 KEB 850 WHUM 1240 WRAP 1340 WRMG 1430 KRDG 1230 KAHR 1330 KQMS 1400 KVCV 600 KHIP 540 KFBF 1490 KBC 1380 KCAL 1410 WGB 1440 KRBN 1450 KFRB 1240 KOKA 1080 KCUE 1250 KLR 1490 WRDB 1400 KRB 1470 WFR 1600 WREY 1220 WADR 1480 KOH 630 KBET 1340 KLE 1250 KOF 1250 KCBN 1230 WRIN 1560 WEE 1500 KREN 1420 KRXX 1230 WOB 1240 WJMC 1240 WPBC 980 KSCV 980 KALE 960 WRCE 1450 WRIC 540 WKB 1430 WANT 990 WBBL 1480 WRGM 1540 WLEE 1480 WFE 1230 WGOE 1590 WTVR 1380 WRNL 910 WRVA 1140 WXGI 950 WRGM 1540 WVTR 1600 KRC 1360 KLOA 1240 WBUG 1430 KWSR 810 WUNO 1320 WUNO 1320 WUNO 1320 WVTR 1570 WCWC 1600 WRIV 1390 WHRF 1570		Rock Hill, S.C.	WRH 1340 WYTC 1150 WAYN 700 KOB 1230 WRKD 1450 WPLK 1260 KVRB 1320 WRKY 800 WINX 1600 WRKH 580 WRKY 1450 WCEC 810 WEED 1390 WRMT 490 WKWS 1290 WYTI 1370 KAMD 1390 WRMI 960 WRGS 1370 KCLU 1590 KTRR 1490 WLAQ 1410 WIYN 1360 WRGA 1470 WRON 710 WKAL 1450 WRNY 1350 WRON 1400 KRWB 1490 KRNR 1480 KRXL 1240 KRXL 1240 KYES 950 KFRD 980 KRDD 1320 KPOP 1110 KRIP 1190 KRK 1280 KGLF 1430 KBIM 910 KRDD 1320 KRIK 960 KSW 1020 WRIP 1430 KXKL 1340 KGCA 1450 KRRR 1340 WRUM 790 KAYT 970 KRUS 1490 KTLU 1580 KRSL 990 WVWR 920 KXRJ 1490 WRUS 610 WHWB 1000 WSYB 1380
Phoenix City, Ala.	WPNX 1460	Port Neches, Tex.	KPNP 1150	Red Bay, Ala.	WRMG 1430	Rofia, Mo.	KCLR 1490		
	WKKR 1540 WPD 1280 WPIA 1140 KGFX 1060 KCCR 1240 WLSI 900 WPKE 1240 KCLA 1400 KADL 1270 KOTN 1490 KCAT 1530 KPBA 1590 WCMP 1350 WAND 1230 WMLF 1230 WWDY 970 KLOH 1050 WPTW 1570 KKIS 990 KOAM 860 KSEK 1340 KDKA 1020 KYL 1410 WAMO 860 WJAS 1320 WPIT 730 WTAE 1250 WEEP 1080 WGSW 970 WBBA 1580 WBEC 1420 WBRK 1340 WPTS 1540 WERA 1590 KVPD 1400 WVSL 910 WSWV 1590 WEAV 960 WIRY 1340 WKDR 1070 KBOP 1380 WOND 1400 WTC 1050 WFLM 1490 WPNC 1370 WPNH 1300 WPLY 1420			Redding, Calif.	KRDG 1230 KAHR 1330 KQMS 1400 KVCV 600 KHIP 540 KFBF 1490 KBC 1380 KCAL 1410 WGB 1440 KRBN 1450 KFRB 1240 KOKA 1080 KCUE 1250 KLR 1490 WRDB 1400 KRB 1470 WFR 1600 WREY 1220 WADR 1480 KOH 630 KBET 1340 KLE 1250 KOF 1250 KCBN 1230 WRIN 1560 WEE 1500 KREN 1420 KRXX 1230 WOB 1240 WJMC 1240 WPBC 980 KSCV 980 KALE 960 WRCE 1450 WRIC 540 WKB 1430 WANT 990 WBBL 1480 WRGM 1540 WLEE 1480 WFE 1230 WGOE 1590 WTVR 1380 WRNL 910 WRVA 1140 WXGI 950 WRGM 1540 WVTR 1600 KRC 1360 KLOA 1240 WBUG 1430 KWSR 810 WUNO 1320 WUNO 1320 WUNO 1320 WVTR 1570 WCWC 1600 WRIV 1390 WHRF 1570		Rock Island, Ill.	WRKD 1450	
Philipsburg, Pa.	WPHB 1260 KKAN 1490	Port St. Joe, Fla.	WJDE 1080	Red Oak, Ia.	KOKA 1080	Rome, Ga.	WLAQ 1410 WIYN 1360 WRGA 1470 WRON 710 WKAL 1450 WRNY 1350 WRON 1400 KRWB 1490 KRNR 1480 KRXL 1240 KRXL 1240 KYES 950 KFRD 980 KRDD 1320 KPOP 1110 KRIP 1190 KRK 1280 KGLF 1430 KBIM 910 KRDD 1320 KRIK 960 KSW 1020 WRIP 1430 KXKL 1340 KGCA 1450 KRRR 1340 WRUM 790 KAYT 970 KRUS 1490 KTLU 1580 KRSL 990 WVWR 920 KXRJ 1490 WRUS 610 WHWB 1000 WSYB 1380		
Phoenix, Ariz.	KIFN 860 KASA 1540 KCAC 1010 KHAT 1490 KHEP 1280 KMED 740 KOY 550 KOOL 960 KPHO 910 KRIZ 1230 KTAR 1490 KXIV 1400	Portsmouth, N.H.	WBBX 1380 WHEB 750 WPT 1400 WNXT 1260 WHIH 1400 WCVU 1350 WPMH 1010 KPCB 1510	Red Oak, Ia.	KOKA 1080	Rome, N.Y.	WRNY 1350 WRON 1400 KRWB 1490 KRNR 1480 KRXL 1240 KRXL 1240 KYES 950 KFRD 980 KRDD 1320 KPOP 1110 KRIP 1190 KRK 1280 KGLF 1430 KBIM 910 KRDD 1320 KRIK 960 KSW 1020 WRIP 1430 KXKL 1340 KGCA 1450 KRRR 1340 WRUM 790 KAYT 970 KRUS 1490 KTLU 1580 KRSL 990 WVWR 920 KXRJ 1490 WRUS 610 WHWB 1000 WSYB 1380		
Phillipsburg, Pa.	WPHB 1260 KKAN 1490	Portsmouth, Va.	WCVU 1350 WPMH 1010 KPCB 1510	Red Wing, Minn.	KCUE 1250	Roseburg, Oreg.	KRNR 1480 KRXL 1240 KRXL 1240 KYES 950 KFRD 980 KRDD 1320 KPOP 1110 KRIP 1190 KRK 1280 KGLF 1430 KBIM 910 KRDD 1320 KRIK 960 KSW 1020 WRIP 1430 KXKL 1340 KGCA 1450 KRRR 1340 WRUM 790 KAYT 970 KRUS 1490 KTLU 1580 KRSL 990 WVWR 920 KXRJ 1490 WRUS 610 WHWB 1000 WSYB 1380		
Phoenix City, Ala.	WPNX 1460	Port Sulphur, La.	KPCB 1510	Redwood Falls, Minn.	KLR 1490	Roseville, Calif.	KPOP 1110		
	WKKR 1540 WPD 1280 WPIA 1140 KGFX 1060 KCCR 1240 WLSI 900 WPKE 1240 KCLA 1400 KADL 1270 KOTN 1490 KCAT 1530 KPBA 1590 WCMP 1350 WAND 1230 WMLF 1230 WWDY 970 KLOH 1050 WPTW 1570 KKIS 990 KOAM 860 KSEK 1340 KDKA 1020 KYL 1410 WAMO 860 WJAS 1320 WPIT 730 WTAE 1250 WEEP 1080 WGSW 970 WBBA 1580 WBEC 1420 WBRK 1340 WPTS 1540 WERA 1590 KVPD 1400 WVSL 910 WSWV 1590 WEAV 960 WIRY 1340 WKDR 1070 KBOP 1380 WOND 1400 WTC 1050 WFLM 1490 WPNC 1370 WPNH 1300 WPLY 1420	Post, Tex.	KPOS 1370	Redwood Falls, Minn.	KLR 1490	Roseville, Calif.	KPOP 1110		
Pickens, S.C.	WKKR 1540	Post, Tex.	KPOS 1370	Redwood Falls, Minn.	KLR 1490	Roseville, Calif.	KPOP 1110		
Piedmont, Ala.	WPD 1280	Poteau, Okla.	KLCO 1280	Redwood Falls, Minn.	KLR 1490	Roseville, Ga.	KRSL 990		
Piedmont, Mo.	KGFX 1060	Potomac-Cabin John, Md.	WXLN 950 KYRD 1280 WPD 1280 WPAZ 1370 WPAM 1450 WPPA 1360 WEEK 1390 WKP 1450	Redwood Falls, Minn.	KLR 1490	Roseville, N.Mex.	KGLF 1430 KBIM 910 KRDD 1320 KRIK 960 KSW 1020 WRIP 1430 KXKL 1340 KGCA 1450 KRRR 1340 WRUM 790 KAYT 970 KRUS 1490 KTLU 1580 KRSL 990 WVWR 920 KXRJ 1490 WRUS 610 WHWB 1000 WSYB 1380		
Pierre, S.D.	KCCR 1240 WLSI 900 WPKE 1240 KCLA 1400 KADL 1270 KOTN 1490 KCAT 1530 KPBA 1590 WCMP 1350 WAND 1230 WMLF 1230 WWDY 970 KLOH 1050 WPTW 1570 KKIS 990 KOAM 860 KSEK 1340 KDKA 1020 KYL 1410 WAMO 860 WJAS 1320 WPIT 730 WTAE 1250 WEEP 1080 WGSW 970 WBBA 1580 WBEC 1420 WBRK 1340 WPTS 1540 WERA 1590 KVPD 1400 WVSL 910 WSWV 1590 WEAV 960 WIRY 1340 WKDR 1070 KBOP 1380 WOND 1400 WTC 1050 WFLM 1490 WPNC 1370 WPNH 1300 WPLY 1420	Pottsville, Pa.	WPAM 1450 WPPA 1360 WEEK 1390 WKP 1450	Redwood Falls, Minn.	KLR 1490	Roseville, N.Mex.	KGLF 1430 KBIM 910 KRDD 1320 KRIK 960 KSW 1020 WRIP 1430 KXKL 1340 KGCA 1450 KRRR 1340 WRUM 790 KAYT 970 KRUS 1490 KTLU 1580 KRSL 990 WVWR 920 KXRJ 1490 WRUS 610 WHWB 1000 WSYB 1380		
Pikeville, Ky.	WLSI 900 WPKE 1240 KCLA 1400 KADL 1270 KOTN 1490 KCAT 1530 KPBA 1590 WCMP 1350 WAND 1230 WMLF 1230 WWDY 970 KLOH 1050 WPTW 1570 KKIS 990 KOAM 860 KSEK 1340 KDKA 1020 KYL 1410 WAMO 860 WJAS 1320 WPIT 730 WTAE 1250 WEEP 1080 WGSW 970 WBBA 1580 WBEC 1420 WBRK 1340 WPTS 1540 WERA 1590 KVPD 1400 WVSL 910 WSWV 1590 WEAV 960 WIRY 1340 WKDR 1070 KBOP 1380 WOND 1400 WTC 1050 WFLM 1490 WPNC 1370 WPNH 1300 WPLY 1420	Pottsville, Pa.	WPAM 1450 WPPA 1360 WEEK 1390 WKP 1450	Redwood Falls, Minn.	KLR 1490	Roseville, N.Mex.	KGLF 1430 KBIM 910 KRDD 1320 KRIK 960 KSW 1020 WRIP 1430 KXKL 1340 KGCA 1450 KRRR 1340 WRUM 790 KAYT 970 KRUS 1490 KTLU 1580 KRSL 990 WVWR 920 KXRJ 1490 WRUS 610 WHWB 1000 WSYB 1380		
Pine Bluff, Ark.	KCLA 1400 KADL 1270 KOTN 1490 KCAT 1530 KPBA 1590 WCMP 1350 WAND 1230 WMLF 1230 WWDY 970 KLOH 1050 WPTW 1570 KKIS 990 KOAM 860 KSEK 1340 KDKA 1020 KYL 1410 WAMO 860 WJAS 1320 WPIT 730 WTAE 1250 WEEP 1080 WGSW 970 WBBA 1580 WBEC 1420 WBRK 1340 WPTS 1540 WERA 1590 KVPD 1400 WVSL 910 WSWV 1590 WEAV 960 WIRY 1340 WKDR 1070 KBOP 1380 WOND 1400 WTC 1050 WFLM 1490 WPNC 1370 WPNH 1300 WPLY 1420	Poughkeepsie, N.Y.	WEEK 1390 WKP 1450	Redwood Falls, Minn.	KLR 1490	Roseville, N.Mex.	KGLF 1430 KBIM 910 KRDD 1320 KRIK 960 KSW 1020 WRIP 1430 KXKL 1340 KGCA 1450 KRRR 1340 WRUM 790 KAYT 970 KRUS 1490 KTLU 1580 KRSL 990 WVWR 920 KXRJ 1490 WRUS 610 WHWB 1000 WSYB 1380		
Pine City, Minn.	WCMP 1350	Powell, Wyo.	WKIP 1450	Redwood Falls, Minn.	KLR 1490	Roseville, N.Mex.	KGLF 1430 KBIM 910 KRDD 1320 KRIK 960 KSW 1020 WRIP 1430 KXKL 1340 KGCA 1450 KRRR 1340 WRUM 790 KAYT 970 KRUS 1490 KTLU 1580 KRSL 990 WVWR 920 KXRJ 1490 WRUS 610 WHWB 1000 WSYB 1380		
Pineville, Ky.	WLSI 900 WPKE 1240 KCLA 1400 KADL 1270 KOTN 1490 KCAT 1530 KPBA 1590 WCMP 13								



Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz	Location	C.L. kHz
Susanville, Calif.	KSU E 1240	Torrington, Wyo.	KGOS 1490	Vero Beach, Fla.	WAXE 1370	Waxahachie, Tex.	KBEC 1390
Sutton, W. Va.	WSGB 1490	Towanda, Pa.	WTTC 1550	WTTB 1490	WACL 570	Waycross, Ga.	WAYX 1250
Swainsboro, Ga.	WJAT 800	Towson, Md.	WAQE 1580	WQBC 1420	KTCH 1590	Waynesboro, Ga.	WBRO 1310
Sweetwater, Tenn.	WDEH 800	Trail, B.C.	CIAT 610	WVIM 1490	WABO 990	Waynesboro, Miss.	WABO 990
Sweetwater, Tex.	KXOX 1240	Travelers Rest, S.C.	WBBR 1580	Victoria, Tex.	KNAL 1410	Waynesboro, Pa.	WABY 1490
Sylvauga, Ala.	WFLS 1290	Traverse City, Mich.	WTCM 1400	Vieterville, Calif.	KVIC 1340	Waynesboro, Va.	WANV 970
Sylva, N.C.	WMSJ 1480	Trenton, Mo.	KTTN 1600	Vidalia, Ga.	KGIN 1590	Waynesville, Mo.	KFB D 1270
Sylvania, Ga.	WSYL 1490	Trenton, N.J.	WAAT 1500	Vieques, P.R.	WVOP 870	Waynesville, N.C.	WHCC 1400
Sylvester, Ga.	WOGA 1540	Trinidad, Colo.	WBDU 1260	Ville Platte, La.	WV10 1370	Weatherford, Tex.	KZEE 1220
Syracuse, N.Y.	WHEN 620	Troy, Ala.	WTBF 970	Vincennes, Ind.	KVPI 1050	Webster City, Iowa	KJTB 1570
	WFLB 1890	Troy, N.Y.	WHAZ 1330	Vineand, N.J.	WAOV 1450	Weiser, Idaho	KWEI 1260
	WFLR 1490		WTRV 980	Vinita, Okla.	WV3B 1360	Welch, W.Va.	WELC 1150
	WFSR 570		WTKW 600	Vinton, Va.	WV1V 1470	Weldon, N.C.	WSMJ 1400
Tabor City, N.C.	WTAB 1370		WTRM 1390	Virginia, Minn.	WKB A 1650	Wellington, Kan.	KLEY 1130
Tasoma, Wash.	KMO 1360	Troy, N.C.	WKW 1400	Virginia Beach, Va.	WHLB 1400	Wellington, Pa.	KWJ 1490
	KTAC 850	Truckee, Calif.	KH0E 1490	Virouqua, Wis.	WVAB 1550	Wellsville, N.Y.	WLSV 790
	KTNT 1400	Trumann, Ark.	KTMN 1530	Visalía, Calif.	WISV 1360	Wenatche, Wash.	KPQ 560
	KVI 570	Truth or Consequences,		Vista, Cal.	KONG 1400		KUEN 900
Taft, Calif.	KTKR 1310	New Mexico	KCHS 1400	Vivian, La.	KML0 1000		KMEL 1340
Tahlequah, Okla.	KTLL 1350	Tryon, N.C.	WTYN 1550	Waco, Tex.	KNCB 1600		
Tahoe Valley, Calif.		Tucson, Ariz.	KTUC 1400		KWVA 1010		
	KTHO 590		KTUC 1400		KBGO 1580		
Talladega, Ala.	WEYY 1580		KXEW 800		KWTX 1230		
Tallapoosa, Fla.	WNUE 1280		KAIR 1490		KWAD 920		
	WONS 1410		KCEE 790		KWDE 1210		
	WTAL 1450		KIKX 590		KWLG 1530		
	WTNT 1270		KCUB 1290				
Tallassee, Ala.	WTLS 1300		KEVT 690				
Tallulah, La.	KTLD 1860		KHOS 940				
Tampa, Fla.	WALT 110		KHYT 1330				
	WYUO 1550		KTKT 990				
	WFLA 970		KOLD 1450				
	WHBO 1050		KUAT 1550				
	WINQ 1010		KTNM 1400				
	WTMP 1150		KCKK 1270				
	WSOL 1300		KGEN 1370				
	WCPS 760		KJWJ 740				
Tarpon Springs, Fla.	WCWR 1470		KAKC 970				
	WESR 1390		KOME 1800				
Taunton, Mass.	WPEP 1570		KRMG 740				
Tawas City, Mich.	WTOS 1480		KELI 1490				
Taylor, Tex.	WTAE 1280		KDOD 1170				
Taylorville, N.C.	WSTH 860		KFMJ 1050				
	WTLK 1570		WLO 580				
Taylorville, Ill.	WTIM 1410		WTUP 1490				
Tazewell, Tenn.	WNNT 1250		WCEO 1490				
Tazewell, Va.	WTZE 1470		WJRD 1150				
Tell City, Ind.	WTGJ 1280		WACT 1420				
Tempe, Ariz.	KUPD 1060		WNPT 1280				
	TUF 1500		WTFJ 790				
Tempe, Tex.	KTEM 1480		WTBC 1230				
Terre Haute, Ind.	WBOW 1230		WVNA 1590				
	WAAC 1300		WRCK 1410				
	WTHI 1490		WVAB 1580				
	KTER 1570		WABT 500				
	KYFE 690		KBHI 1250				
	KOSY 790		KFI 1270				
	KCMC 740		KLIX 1310				
	KATQ 940		KEEP 1450				
	KFTS 1490		WQTC 1590				
	KTLL 920		KZAK 1330				
	KALM 1290		KDOK 1490				
	KODL 1440		KTBB 600				
	KACI 1300		KZEY 690				
	KRTR 1490		WTRN 1340				
	KTHE 1240		WUND 1540				
	KTR 1230		WBTC 1540				
	KATB 630		WWTG 1540				
	KFTZ 1220		WBUK 1460				
	WTGA 1590		WENK 1240				
	WTHN 1580		WMSB 580				
	WJDB 630		WILL 580				
	WPAX 1240		WKID 1580				
	WLD R 730		WIBX 950				
	WTNC 790		WBVM 1550				
	WTWA 1240		WRUN 1150				
	WUPR 1530		WTLB 1310				
	WVAD 1480		WVU 1490				
	WVGS 1430		WVGF 910				
	WJEM 1150		WVLD 1450				
	WVLS 1450		WVSH 840				
	WVSM 1490		KNBA 1910				
	WVWA 1450		KVOC 1490				
	WVX 950		WFSH 1340				
	WVGA 910		WAKE 1520				
	WVEM 1150		WNWI 1080				
	WVLD 1450		KFDF 1580				
	WVSH 950		WMTG 750				
	WVWA 1450		WKKS 1570				
	WVX 950		KIEN 910				
	WVGA 910		KKEY 1150				
	WVEM 1150		KGAR 1550				
	WVLD 1450		KVAN 1480				
	WVSH 950		WPMB 1500				
	WVWA 1450		WERT 1220				
	WVX 950		WAMR 1320				
	WVGA 910		KVEN 1450				
	WVEM 1150		KUDU 1590				
	WVLD 1450		KUSO 690				
	WVSH 950		KVRA 1570				
	WVWA 1450		KVEL 1570				
	WVX 950		KVVA 1380				
	WVGA 910		KVWG 1490				
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						
	WVGA 910						
	WVEM 1150						
	WVLD 1450						
	WVSH 950						
	WVWA 1450						
	WVX 950						

# WHITE'S RADIO LOG

Location	C.L.	kHx
Wilmington, Del.	WAMS	1360
	WDEL	1150
	WILM	1450
	WTUX	1290
Wilmington, N.C.	WFMD	630
	WHSL	1430
	WKLM	980
	WGNI	1340
Wilmington, O.	WMWM	1090
Wilson, N.C.	WGTM	590
	WLLY	1350
	WVOT	1420
Winchester, Ky.	WNKY	1380
Winchester, Tenn.	WCDT	1340
Winchester, Va.	WINC	1400
	WHPL	610
Windber, Pa.	WWBR	1350
Winder, Ga.	WIMO	1300

Location	C.L.	kHx
Windermere, Fla.	WVCF	1480
Windom, Minn.	KDOM	1580
Window Rock, Ariz.	KHAC	1300
Windsor, Conn.	WEHW	1480
Winfield, Ala.	WEZQ	1300
Winfield, Kan.	KNIC	1550
Winnemucca, Nev.	KWNA	1400
Winfield, La.	KVCL	1270
Winnier, S.Dak.	KWYR	1260
Winnssboro, La.	KMAE	1570
Winnssboro, S.C.	WCKM	1250
Winona, Minn.	KWNO	1230
	KAGE	1380
Winona, Miss.	WONA	1570
Winslow, Ariz.	KVNC	1010
	KINO	1230
Winston-Salem, N.C.	WAAA	980
	WAIR	1340
	WFCM	1550
	WSJS	600
	WTOB	1380
	WKBX	1500
Winter Garden, Fla.	WDBL	1600
Winter Haven, Fla.	WSPR	1490
	WINT	1360
Winter Park, Fla.	WABR	1440
Wisconsin Rapids, Wis.	WFHR	1320

Location	C.L.	kHx
Wolf Pt., Mont.	WTMB	1460
Woodburn, Ore.	KVCK	1450
Woodbury, Tenn.	KWRF	1540
Woodruft, S.C.	WSWJ	580
Wood River, Ill.	WRTI	500
Woodruff, S.C.	WSWJ	1516
Woodside, N.Y.	WWRL	1600
Woodville, Tex.	KVLL	1220
Woodward, Okla.	KSIW	1450
Woonsocket, R.I.	WNRI	1380
	WWON	1240
Woooster, Ohio	WRFI	960
Worcester, Mass.	WAAB	1480
	WNEB	1230
	WORC	1310
	WTAG	580
	WTOR	1340
Worthington, Minn.	KWDA	730
Worthington, Ohio	WRFD	880
Wynne, Ark.	KWYN	1400
Wyoming, Mich.	WERX	1530
Wytheville, Va.	WYVE	1280
Xenia, O.	WELX	1110
	WGIC	1500
Yadkinville, N.C.	WYDK	1480
Yakima, Wash.	KIT	1280
	KIMA	1460
	KBBQ	1380
	KQOT	930

Location	C.L.	kHx
Yankton, S.D.	KUTI	980
	KYAK	1390
	KYNT	1450
	WNAX	570
Yazoo, P.R.	WKFE	1550
Yazoo City, Miss.	WAZF	1230
York, Nebr.	KVCL	1370
York, Pa.	WNOW	1250
	WOKR	1350
	WSBA	910
York, S.C.	WYCL	980
Youngstown, Ohio	WBBW	1240
	WFMJ	1590
	WKBN	1370
Ypsilanti, Mich.	WYSI	1480
	WYNZ	1520
Yreka, Calif.	KSYC	1490
Yuba City, Calif.	KUBA	1600
	KZIN	1450
Yuma, Ariz.	KLBU	1320
	KVOY	1400
	KYUM	560
Zanesville, Ohio	WHIZ	1240
Zarephath, N.J.	WAUZ	1380
Zebulon-Wendell, N.C.		
	WETC	540
Zephyrhills, Fla.	WPAS	1400
Zion, Ill.	WZBN	1500

## U. S. FM Stations by States

Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz			
<b>ALABAMA</b>											
Abbeville	WARI-FM	94.3	Tueson	KFMM	99.5	Gilroy	KPER-FM	94.3			
Albertville	WQSB	105.1		KCEE-FM	96.1	Glendale	KFMU	97.1			
Alexander City	WRFS-FM	106.1		KVOA-FM	93.7		KUTE	101.9			
Andalusia	WNBX	98.1	<b>ARKANSAS</b>			Hayward	KUTX	101.7			
Athens	WHMA-FM	100.5	Blytheville	KLCN-FM	96.1	Hemet	KHSJ-FM	105.5			
	WJOF	104.3	Camden	KWEH	97.1	Inglewood	KTYM-FM	103.9			
Bay Minette	WATM-FM	104.1	Conway	KASC	91.5	La Canada	KUNF	88.9			
Birmingham	WWSM	105.5	Crossett	KVEE-FM	105.1	LaSierra	KSDA	89.7			
	WAPI-FM	99.5	Dardanelle	KAGH-FM	104.9	Lodi	KCVR-FM	97.7			
	WBRC-FM	106.9	El Dorado	KCAB-FM	102.3	Long Beach	KLOM-FM	92.7			
	WCRT-FM	96.5	Fayetteville	KREL	99.3		KJLH	102.3			
	WFSM	93.7		KFAV	92.1	Los Altos	KLON	88.1			
	WVSU-FM	91.1	Ft. Smith	KNWA	103.9		KPGM	97.7			
Carrollton	WRAG-FM	94.1		KFPW-FM	94.9	Los Angeles	KPSR	91.5			
Clanton	WKLF-FM	97.7		KMAG	99.1		KJFC	88.7			
Cullman	WFMH-FM	101.1	Harrison	KTCS-FM	99.9		KABC-FM	95.5			
Decatur	WKLN	92.1	Hot Springs	KHOZ-FM	102.9		KBBI	107.5			
	WDRM	102.1	Jacksonville	KBHS-FM	98.1		KBSA	105.1			
	WRSA	96.9	Jonesboro	KGUS	97.5		KBMS	105.9			
Dothan	WOOD-FM	92.7	Little Rock	KGMR-FM	100.3		KCBH	98.7			
Enterprise	WIRB-FM	96.9		KBTM-FM	101.8		KFCF-FM	92.3			
Fairhope	WABF-FM	92.1		KASU	91.9		KFOX-FM	100.3			
Florence	WQLT	107.3		KARK	103.7		KGBS-FM	97.1			
Gadsden	WLJM	103.7		KAAV-FM	98.5	San Fernando	KHJ	101.1			
Hamilton	WERH-FM	92.1		KMYO-FM	95.7	San Francisco	KMET	94.7			
Homewood	WJLN	104.7	Magnolia	KFMV	107.9		KMLA	100.3			
Huntsville	WAFR	99.1	Manmoth Springs	KAMS	103.9		KNX-FM	93.1			
	WDA	92.9	Newport	KNBY-FM	105.5		KOST	103.5			
Jackson	WHOD-FM	104.9	Osceola	KOSE-FM	98.1		KPFK	90.7			
Mobile	WKRQ-FM	99.9	Pine Bluff	KOTN-FM	92.3		KPOL-FM	93.9			
	WMFC-FM	98.5	Siloam Springs	KUOA-FM	105.7		KPRH-FM	102.7			
	WLPR	96.1	Texarkana	KADO	107.1		KRKB-FM	96.3			
Montgomery	WFMI	88.9	<b>CALIFORNIA</b>				KUSC	91.5			
	WFAJ	103.3	Akiah	KLIL	94.3	Los Angeles-Avalon	KXLU	89.1			
	WHYY-FM	101.9	Alameda	KIAJ	92.7		KHOF	99.5			
Muscle Shoals	WLAY-FM	105.5	Anaheim	KEZR-FM	95.9		KBIG-FM	104.3			
Oneonta	WKLD	97.7	Angwin	KANG	89.9	Los Banos	KLBS-FM	95.9			
Ozark	WOAB	104.9	Apple Valley	KAVR-FM	102.3	Los Gatos	KLGS	95.3			
Scottsboro	WCNA-FM	98.3	Arata	KTDQ	90.5	Marysville	KRFD	99.9			
Seima	WHBB-FM	100.1	Atherton	KPEN	101.3	Mendocino	KMFB-FM	92.7			
	WQX-FM	100.9	Auburn	KAFI	101.1	Merced	KAMB	101.3			
Sylacauga	WLS-FM	98.3	Avalon	KBIG	104.3	Mesado	KBEE-FM	103.5			
Tusumbia	WVNA	100.3	Bakersfield	KERN-FM	94.1	Mojave	KTRB-FM	104.1			
Tuscaloosa	WTBO-FM	95.7		KGFM	101.5	Monterey	KDOL-FM	97.7			
	WACT-FM	105.5		KIFM	96.5	Newport Beach	KMBE-FM	96.9			
<b>ALASKA</b>									Northridge	KOCM	101.1
Anchorage	KNIK	105.5		KUZZ-FM	107.9	Oakland	KEDC-FM	88.5			
	KAMU	102.1	Berkeley	KPFA	100.7	Oceanside	KAFE	98.1			
College	KHAR-FM	103.9		KALX	90.7	Ontario	KUDE	102.1			
	KUAC	104.9		KPFB	89.3	Oxnard	KSDM-FM	93.5			
<b>ARIZONA</b>									Pasadena	KPMJ	104.7
Bisbee	KSUN-FM	92.1	Bijou	KPAT-FM	102.9	Palm Springs	KPCS	89.3			
Flagstaff	KAFB-FM	92.9	Bishop	KHUR	99.9	Quincy	KPPC-FM	106.7			
Globe	KWJB-FM	100.3	Carlsbad	KIBS-FM	100.7	Palm Springs	KGEC	104.7			
Mesa	KBUZ-FM	104.3	Carmel	KARL-FM	95.9	Quincy	KFRW	95.9			
	KMND-FM	93.7	Cathedral City	KRMF-FM	94.7	Redding	KEWB	104.3			
	KRFM	95.5	Chico	KWXY-FM	103.1	Redondo Beach	KKOP	93.5			
Phoenix	KFCF	91.5	Chico	KEQR	107.7	Redlands	KCAL-FM	96.7			
	KITH	101.3	Claremont	KSPC	88.7	Ridgecrest	KUOR-FM	89.1			
	KMEQ-FM	96.9	Coachella	KCHV-FM	93.7	Riverside	KLDA-FM	95.5			
	KOOL-FM	94.5	Davis	KDVS	91.5	Riverside	KBBL	95.1			
	KNIX-FM	102.5	Escondido	KCCR	93.3	Riverside	KACE-FM	92.7			
	KOY-FM	92.5	Esccondido	KOWN-FM	92.1	Riverside	KDUU	97.5			
	KTAR-FM	98.7	Fresno	KFMR	104.9	Riverside	KUCR	88.1			
	KYEW	93.3		KARM-FM	101.9	Sacramento	KERS	90.1			
	KHEP-FM	101.5		KFIG	94.5		KFBK-FM	96.9			
Scottsdale	KDPT-FM	100.7		KFRE-FM	93.7		KEBR	100.5			
Show Low	KVVM	93.5		KMJ-FM	97.9		KHIQ	105.1			
Tempe	KUPD-FM	97.8	Garden Grove	KXQR	102.7		KJML	106.5			
				KTBT	94.3		KRAK-FM	92.9			







# WHITE'S RADIO LOG

Location	C.L.	MHz
Salisbury	WSTP-FM	106.5
Sanford	WWGP-FM	105.5
Shealy	WOHS-FM	96.1
Statesville	WFMX	105.7
Tabor City	WTAB-FM	106.7
Tarboro	WCPS-FM	104.3
Thomasville	WTNC-FM	98.3
Washington	WITN-FM	99.3
Williamston	WIAM	103.7
Wilmington	WPRV	98.9
	WHLF-FM	97.3
	WVOT-FM	106.1
Wilson	WAAA-FM	107.5
Winston-Salem	WFDD-FM	88.5
	WEPL	93.1
	WSJS-FM	104.1

## NORTH DAKOTA

Bismarek	KFYR-FM	92.9
Devils Lake	KDLR-FM	96.7
Fargo	KFNW-FM	97.7
	WDAY-FM	93.7
	KDSU	91.9
Grand Forks	KVCB	94.7
Jamestown	KSNJ	93.3
	KKND	95.5
Minot	KCJB FM.	97.1

## OHIO

Akron	WAKR-FM	97.5
	WAPS	89.1
	WAUP	88.1
	WCUE-FM	96.5
Alliance	WFAH-FM	96.7
Archbold	WHFD	95.9
Ashland	WNCO-FM	101.3
	WRDL	88.1
Ashtabula	WREO-FM	97.1
Ashtabula	WOUB-FM	91.3
	WATH-FM	95.5
Bellaire	WOMP-FM	100.9
Berea	WBWC	88.3
Bowling Green	WAWR-FM	93.5
	WBGU	88.1
Bryan	WBNO-FM	100.9
Bucyrus	WBGO-FM	92.7
Cambridge	WILF-FM	100.7
Canton	WNYN-FM	96.9
	WTOF	98.1
Cedarville	WCDR-FM	90.1
Cellina	WMER-FM	94.3
Chillicothe	WCSM-FM	96.7
Cincinnati	WBEX-FM	98.3
	WAEF	98.5
	WCPO-FM	105.1
	WEBN-FM	102.7
	WAKW	93.3
	WGUC	90.9
	WKRC-FM	101.9
	WZIP-FM	92.5
Circleville	WNRE	90.3
Cleveland	WBQE	90.3
	WCRF-FM	103.3
	WCLV	95.5
	WDOK	102.1
	WERE-FM	98.5
	WGAR-FM	99.5
	WK-FM	100.7
	WCJW	104.1
	WKYC-FM	105.7
	WNOB	107.9
	WRUW-FM	91.1
	WXEN	106.5
	WZAK	93.1
Cleveland Hts.	WCUF-FM	92.3
Columbus	WCBE	90.5
	WBNS-FM	97.1
	WCOL-FM	92.3
	WMNI-FM	99.7
	WNCI	97.9
	WOSU-FM	96.3
	WSPD	94.7
	WTVN-FM	96.3
Conneaut	WFIZ	105.5
Dayton	WHIO-FM	99.1
	WONE-FM	104.7
	WDAO	107.7
DeGraff	WDEG-FM	91.1
Delaware	WSLN	85.7
Dover	WJER-FM	101.7
E. Liverpool	WRTS	104.3
Eaton	WCTS	92.9
Elyria	WBEA	107.3
Fairfield	WCNW-FM	94.9
Findlay	WFIL-FM	94.9
Fostoria	WFDO	95.7
Fremont	WFRO-FM	98.3
Gallipolis	WJEH-FM	101.5

Location	C.L.	MHz
Granville	WDUB	90.9
Greenville	WDRK-FM	106.5
Hamilton	WQMS	95.7
	WHOH	103.5
Hillsboro	WSRW-FM	106.7
Holland	WPOS-FM	102.3
Kent	WKSU	89.7
	WKNT-FM	100.1
Kenton	WKTN-FM	98.3
Kettering	WVU-FM	99.9
Lancaster	WHOK-FM	95.5
Lima	WIMA-FM	102.1
	WTGN	97.7
Logan	WLGK-FM	98.3
London	WLNO	106.3
Mansfield	WVNO	106.1
	WCLW-FM	105.3
	WCNO	89.3
Marion	WMOA-FM	94.3
Marion	WMRN-FM	105.9
Medina	WDBN	94.9
Miamisburg	WFCL	95.9
Middletown	WPFB-FM	105.9
Midway	WVVO-FM	93.7
Mount Vernon	WVU-FM	100.7
Newark	WCLT-FM	95.3
Norwalk	WLKR-FM	95.3
Oberlin	WBOC	88.7
Oxford	WMUB	88.5
	WOXR	97.7
Piqua	WPTV-FM	95.7
Port Clinton	WVWR-FM	94.0
Portsmouth	WPAV-FM	104.1
	WNXT-FM	99.3
	WSOM-FM	105.1
	WLEC-FM	102.7
	WMVR-FM	105.5
	WBLV-FM	103.9
	WEEC-FM	100.7
	WUSO	90.3
Stuebenville	WSTV-FM	103.5
St. Athens	WKTL	90.7
Sylvania	WGLN	105.5
Tiffin	WTFE-FM	103.7
Toledo	WSPD-FM	101.5
	WCVA-FM	104.3
	WMHE	91.7
	WTD5	94.3
	WTRT	99.9
Urbana	WCOM-FM	101.7
Van Wert	WERT-FM	98.9
Wapakoneta	WERM	92.1
Washington Court House	WCHO-FM	105.5
	WOBN	91.5
Westerville	WCSU-FM	88.9
Wilberforce	WKIT	102.3
Williamston	WWST-FM	104.5
Wooster	WCWS	91.9
Worthington-Columbus	WRFD-FM	97.9
Xenia	WQBM-FM	103.9
	WBZI	95.3
Yellow Springs	WYCS	91.5
Youngstown	WKBN-FM	98.9
	WBBW-FM	93.3
	WBED	101.1
Zanesville	WHIZ-FM	102.5

## OKLAHOMA

Bethany	KNBQ	104.9
Chickasha	KNDR	105.5
Durant	KSEO-FM	107.3
Edmond	KWHB	97.7
	KCSC	90.1
Enid	KCRC-FM	96.9
Eufaula	KCES	102.3
Henryetta	KHEN-FM	99.5
Lawton	KLAW	101.5
McAlester	KNED-FM	101.3
Midwest City	KTEA-FM	92.5
Muskogee	KMMN-FM	106.9
Nowata	KNFB	94.3
Oklahoma City	KOKH	89.9
	KKEB	94.7
	KIOO	100.5
	KJEM-FM	102.7
	KOCY-FM	96.1
	KOFM	104.1
	KFNB	101.9
Ponca City	KLOR-FM	99.3
Poteau	KLCO-FM	98.3
Shawnee	KBGC	89.9
Stillwater	KOSU-FM	91.7
	KSPI-FM	98.9
	KVRO	105.5
	KTLQ-FM	101.7
	WQGS	90.5
	KRMG-FM	95.1
	KMOD	87.5
	KOGM-FM	92.9
	KORU	103.3
	KRAV	96.5
	KCCF	95.3

## OREGON

Corvallis	KFLY-FM	101.5
	KBVR	90.1
Eugene	KRVN	91.9
	KORV	93.1
	KFMY	97.9

Location	C.L.	MHz
Grants Pass	KLCC	90.3
Medford	KUGN-FM	99.1
Oretech	KWAX	91.1
Portland	KBMC	94.5
	KZEL-FM	96.1
	KGPO	96.9
	KBOY-FM	95.3
	KTEC	88.3
	KBOO	90.7
	KGMG	95.5
	KLIQ-FM	92.3
	KDIN-FM	91.1
	KPDQ-FM	105.3
	KPFM	97.1
	KPOJ-FM	98.5
	KQFM	100.3
	KRRC	89.3

## PENNSYLVANIA

Allentown	WFMZ	100.7
	WAEB-FM	104.1
	WMUH	89.7
Altoona	WYAM-FM	100.1
	WFBG-FM	98.1
Beaver Falls	WBVP-FM	106.7
	WGEV	88.3
	WAKM	100.9
Bedford	WHGM	103.9
Bethlehem	WHLN-FM	95.1
Bloomsburg	WBYC-FM	106.5
Boyetown	WLOA-FM	96.9
Braddeock	WBUT-FM	97.7
Butler	WDDL-FM	94.3
Carbondale	WHYL-FM	102.3
Chambersburg	WHSB-FM	95.1
Charleroi	WESA-FM	98.3
Clearfield	WCPA-FM	93.5
Danville	WPGM-FM	96.7
DuBois	WCED-FM	102.1
Easton	WEST-FM	96.1
	WJRH	90.5
	WEND-FM	93.9
Ebensburg	WMSH-FM	106.7
Elizabethtown	WFEM	92.1
Ellwood City, Pa.	WFEM	92.1
Erle	WYWN-FM	89.9
Gettysburg	WGET-FM	107.7
Greencastle	WKSL	94.3
Greensburg	WOKL-FM	107.1
Greenville	WGRF-FM	107.1
Grove City	WEDA-FM	95.1
	WSAJ-FM	89.5
Harrisburg	WHP-FM	97.3
	WMSF	94.9
	WTPA-FM	104.1
	WCMB-FM	95.3
	WHHS	89.3
Havertown	WAZL-FM	97.9
Hazleton	WHUN-FM	106.3
Huntingdon	WQMU	103.1
Indiana	WIBF-FM	103.9
Jenkintown	WARD-FM	92.1
Johnstown	WJAF-FM	95.5
Lancaster	WALC-FM	101.3
	WDAC	94.5
Lebanon	WLAN-FM	96.9
Lewisburg	WLBK-FM	100.1
Lewistown	WBUV-FM	90.5
Lewistown	WMRF-FM	95.9
Lock Haven	WBP-FM	92.1
Mansfield	WBNT	89.7
Martinsburg	WJSM-FM	92.5
Meadville	WARC	90.3
	WMGW-FM	100.3
	WXUR-FM	100.3
	WNLP-FM	100.9
	WPFL-FM	96.5
	WYDD	100.7
	WKPS	88.9
	WDRJ	98.5
	WRLC	92.1
Philadelphia	WCAU-FM	98.1
	WPAL-FM	92.1
	WDAS-FM	105.3
	WRCP-FM	104.5
	WFIL-FM	102.1
	WDVR	101.1
	WFLN	95.7
	WHAT-FM	96.5
	WHUY-FM	90.9
	WIFI	92.5
	WIBG-FM	94.1
	WMMR	93.3
	WPEN-FM	102.9
	WPWT	91.7
	WQAL	106.1
	WRTI-FM	90.1
	WXPN	88.9
Pittsburgh	KDKA-FM	92.9
	WAMO	105.5
	WEFP-FM	107.9
	WTAE-FM	96.1
	WVFL-FM	102.5
	WDUD	91.5
	WJAS-FM	99.7
	WKJF	93.7
	WPIT-FM	101.5
	WWSW-FM	94.5
	WYDD	104.7
Pottsville	WPPA-FM	101.9

Location	C.L.	MHz
Reading	WRFY-FM	102.5
	WXAC	91.3
Red Lion	WGCB-FM	96.1
Ridgeway	WKBI-FM	94.3
Seranton	WGBI-FM	101.3
	WEJL-FM	107.1
	WUSV	88.9
	WWDL-FM	104.5
Sellinsgrove	WQSU	91.5
Sharon	WPIC-FM	102.9
Somerset	WVSC-FM	97.7
State College	WMAJ-FM	103.1
	WDFM	91.1
	WRSC-FM	96.7
	WVPO-FM	98.5
Stroudsburg	WKOK-FM	93.5
Sunbury	WWSB	89.7
Tamaqua	WBMR	89.7
Telford	WTTC-FM	95.3
Towanda	WGMR-FM	102.3
Tyrene	WBVB	106.3
Union City	WDFM	91.1
University Park	WRRN	82.3
Warren	WJPA-FM	95.3
Washington	WAYZ-FM	101.5
Waynesboro	WBRE-FM	98.5
Wilkes-Barre	WRKC	88.5
	WYZZ	92.9
Williamsport	WLYC-FM	105.1
	WIAK-FM	100.3
York	WUOW-FM	105.7
	WBSA-FM	103.3
York-Hanover	WYCR	98.5

## RHODE ISLAND

Kingston	WRUI	91.1
Providence	WPJB-FM	105.1
	WBRU	95.5
	WDDO	91.3
	WICE-FM	107.7
	WHIM-FM	94.1
	WPFO-FM	92.3
	WCRQ	101.5
	WBHS	90.5
Warwick	WERI-FM	106.7
Westerly	WUON-FM	103.3
Woonsocket	WUON-FM	106.3

## SOUTH CAROLINA

Aiken	WLOW-FM	95.9
	WAKN-FM	99.3
Anderson	WCAC	101.1
	WANS-FM	107.3
Bamberg	WBBB-FM	92.7
Barnwell	WBWA-FM	101.7
Batesburg	WBLR-FM	92.1
Beaufort	WBUD-FM	98.7
Charleston	WCSC-FM	96.7
	WTMA-FM	95.1
	WSBF-FM	89.3
	WCOS-FM	97.9
	WNOK-FM	104.7
	WUSC-FM	89.9
	WLAT-FM	104.1
Conway	WDAL-FM	105.5
Darlington	WDSC-FM	99.9
Dillon	WVSC-FM	95.1
Easley	WJLP-FM	103.9
Florence	WJMX-FM	103.1
Greenville	WESC-FM	92.5
	WFBC-FM	95.7
	WAFU-FM	94.5
Greenwood	WCRS	96.7
Kingstree	WKDK-FM	100.1
Lancaster	WLCM-FM	107.1
Laurens-Clintn	WLBG-FM	100.5
Myrtle Beach	WMBY-FM	92.1
N. Charleston	WKTM	102.5
Orangeburg	WDLX-FM	106.7
Rock Hill	WRFB	98.3
Seneca	WBFM	98.1
Spartanburg	WSPA-FM	98.9
Sumter	WFIG-FM	101.8

## SOUTH DAKOTA

Brookings	KBKR-FM	94.3
	KESD	88.3
Hot Springs	KBHF-FM	96.7
Madison	KJAM-FM	103.1
Rapid City	WFSR	97.9
Sioux Falls	KELO-FM	97.3



Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz
<b>WYOMING</b>			<b>PUERTO RICO</b>			Fajardo	WMDD-FM	94.7			
Casper	KAWY	94.5	Arecibo	WCMN-FM	107.9	Guayama	WXR-FM	96.5		WITA-FM	107.7
Cheyenne	KVWO-FM	106.3		WNK-FM	107.9	Mayaguez	WKJB-FM	99.1		WKVM-FM	105.7
	KFBC-FM	97.9	Aguadilla	WABA-FM	100.3					<b>VIRGIN ISLANDS</b>	
Laramie	KUWR	91.5	Bayamon	WRSJ-FM	100.7	Ponce	WQYE-FM	94.5	Charlotte Amalie	WBNB-FM	97.9
			Caguas	WVJP-FM	103.3	San German	WLEO-FM	101.9	St. Croix, Christiansted	WESP	101.1
			Camuy	WCHQ	102.9	San Juan	WPAB-FM	93.3		WIVI-FM	99.5
			Carolina	WVOZ-FM	107.7		WRPC	95.1	Christiansted, St. Croix	WIVI-FM	99.5
Agana	KUAM-FM	93.9	Corozal	WORO	92.5		WIAC-FM	102.3			

## Canadian AM Stations by Location

Location	C.L.	kHz	Location	C.L.	kHz	Location	C.L.	kHz	Location	C.L.	kHz
Abbotsford, B.C.	CFVR	1240		CKCM	620	North Vancouver, B.C.	CKLG	730	Shawinigan, Que.	CKSM	1220
Ajax, Ont.	CHOO	1390		CJCN	680		CHWO	1250	Sherbrooke, Que.	CHLT	630
Alma, Que.	CFGT	1270	Gravelbourg, Sask.	CFRG	730	Oakville, Ont.	CFOR	1570		CJRS	1510
Altona, Man.	CFAM	1290		CFGR	730	Orillia, Ont.	CKLB	1350		CKTS	900
Amherst, N.S.	CKDH	900	Guelph, Ont.	CJOY	1460	Oshawa, Ont.	CKLO	1240	Simcoe, Ont.	CFRS	1560
Amos, Que.	CHAD	1340	Halifax, N.S.	CBH	860	Osoyoos, B.C.	CKBO	910	Smiths Falls, Ont.	CJET	630
Antigonish, N.S.	CJFX	580		CHNS	960	Ottawa, Ont.	CBO	910	Sorel, Que.	CFBY	1230
Barrie, Ont.	CKBB	950	Hamilton, Ont.	CJCH	920		CBDF	1250	Stratford, Ont.	CJSD	1320
Bathurst, N.B.	CKBC	1360		CHAM	1280		CFRA	580	Steinbach, Man.	CJCS	1240
Belleville, Ont.	CJBO	960		CHML	900		CKOY	1310	Stephenville, Nfld.	CHSM	1250
Blind River, Ont.	CJNR	730		CKOC	1150	Owen Sound, Ont.	CKPM	1440	Sudbury, Ont.	CFXS	910
Brampton, Ont.	CHIC	750	Hauterive, Que.	CHLC	580	Parry Sound, Ont.	CFOS	560		CFBR	550
Brandon, Man.	CKX	1100	Hearst, Ont.	CFHL	1340	Peace River, Alta.	CKAR-1	1340		CHNO	900
Brantford, Ont.	CKPC	1380	Huntsville, Ont.	CKAR	630	Pembroke, Ont.	CHOV	1350	Summerside, P.E.I.	CKSO	790
Bridgewater, N.S.	CKBW	1000	Hull, Que.	CKCH	970	Pentticon, B.C.	CKOK	800	Swift Current, Sask.	CJRW	1240
Brockville, Ont.	CFJR	1450	Inuvik, N.W.T.	CHAK	860	Peterborough, Ont.	CHEX	980	Sydney, N.S.	CBI	1140
Burns Lake, B.C.	CFLD	1400	Joliette, Que.	CJLM	1350		CKPT	1420		CHER	950
Cabano, Que.	CJAF	1240	Jonquières, Que.	CKRS	590	Pointe Claire, Que.	CFX	1470		CJGB	1270
Calgary, Alta.	CFAC	960	Kamloops, B.C.	CFIK	910	Portage La Prairie, Man.	CFRY	920	Terrace, B.C.	CFTK	590
	CFCN	1060	Kapuskaing, Ont.	CKAP	580	Port Alberni, B.C.	CJAV	1230	Theftford Mines, Que.	CKLD	1230
	CHQR	810	Kelowna, B.C.	CKOY	630	Port Arthur, Ont.	CFPA	1230	Thompson, Man.	CHTM	610
	CKXL	1140	Kenora, Ont.	CJRL	1220		CKPR	580	Trois-Rivières, Que.	CHLN	550
Callander, Ont.	CFCH	600	Kentville, N.S.	CKEN	1350	Powell River, B.C.	CHQB	1280	Tillicumburg, Ont.	CKOT	1510
Cambell River, B.C.	CFWB	1490	Kingston, Ont.	CFRC	1490	Prince Albert, Sask.	CKBI	900	Timsbino, Ont.	CFCL	620
Campbellton, N.B.	CKNB	950		CKLC	1360	Prince George, B.C.	CKPG	550	Toronto, Ont.	CKGB	680
Camrose, Alta.	CFCW	790		CKWS	970	Prince Rupert, B.C.	CFPR	860		CBL	740
Causapscal, Que.	CJBM	1450	Kirkland Lake, Ont.	CJKL	560	Quebec, Que.	CHV	560		CFBR	1010
Charlottetown, P.E.I.	CJCB	630	Kitchener, Ont.	CHYM	1490		CHC	980		CFHI	680
Chatham, Ont.	CFCO	630	Kitimat, B.C.	CKKW	1320		CHRC	800		CHIN	540
Chicoutimi, Que.	CBJ	580	Langley, B.C.	CKTK	1230		CJLR	1060		CHUM	1050
	CJMT	1420	La Pocatière, Que.	CHGB	1310		CKCV	1280		CJBC	860
Chilliwack, B.C.	CHWC	1270	La Sarre, Que.	CKLS	1240	Quebec, B.C.	CKCQ	570		CKEY	590
Churchill, Man.	CHNB	1230	La Tuque, Que.	CKLS	1240	Red Deer, Alta.	CKRD	850		CKFH	1430
Cobourg, Ont.	CHUC	1450	Leamington, Ont.	CHIR	730	Regina, Sask.	CKB	540	Trail, B.C.	CJAT	610
Collingwood, Ont.	CKCB	1400	Lethbridge, Alta.	CHYR	710		CKCK	1300	Truro, N.S.	CKCL	600
Corner Brook, Nfld.	CBY	990	Levis, Que.	CJOC	1220		CKCR	980	Val d'Or, Que.	CKVD	900
	CFB	570	Lindsay, Ont.	CFLS	1240	Revelstoke, B.C.	CKCR	1340	Valleyfield, Que.	CKV	1370
Cornwall, Ont.	CFML	1110	Lindsay, Ont.	CKLY	910	Richmond Hill, Ont.	CFGM	1310	Vancouver, B.C.	CBU	690
	CJSS	1220	Lloyminster, Atta.	CKSA	1080	Rimouski, Que.	CJBR	900		CFUN	1410
Courtenay, B.C.	CFPC	1440	London, Ont.	CKFL	1240	Rivière du Loup, Que.	CHRT	1450		CHQM	1320
Cranbrook, B.C.	CKFK	570		CKSL	1410		CHFP	1400		CJOR	600
Dartmouth, N.S.	CFDR	790	Marystown, Nfld.	CHCM	560	Roberval, Que.	CHRL	1310		CKLG	730
Dauphin, Man.	CKDM	730	Matane, Que.	CKBL	1250	Rosetown, Sask.	CKR	930	Verdun, Que.	CKWX	1130
Dawson Creek, B.C.	CJDC	1350	Medicine Hat, Alta.	CHAT	1270	Rouyn, Que.	CKRN	1400	Vernon, B.C.	CKVL	850
Delboue, Que.	CHVD	1230	Melfort, Sask.	CJVR	1420	Ste. Agathe des Monts, Que.	CJSA	1230	Victoria, B.C.	CFAX	1070
Drumheller, Alta.	CJVD	910	Middleton, N.S.	CKAD	1490	St. Boniface, Man.	CKSB	1050		CJVI	900
Drummondville, Que.	CHRD	1480	Midland, Ont.	CKMP	1230	St. Catharines, Ont.	CKST	610		CKDA	1220
Dryden, Ont.	CKDR	900	Moncton, N.B.	CBAF	1300	St. Jean, Que.	CHRS	1090	Victoriaville, Que.	CFDA	1380
Duncan, B.C.	CHFY	1500	Mont Laurier, Que.	CKWC	1210	St. Jerome, Que.	CKJL	900	Ville St. Georges, Que.	CKVM	710
Edmonton, Alta.	CBX	740	Montagny, Que.	CKBM	1490	Saint John, N.B.	CKBD	1110		CKWB	1460
	CFRN	1260	Montreal, Que.	CBF	690		CFBC	980	Wawa, Ont.	CKWA	1240
	CHED	630		CKM	940		CHSJ	1150	Welland, Ont.	CHOW	1470
	CHFA	680		CFP	600		CBN	640	Weyburn, Sask.	CFSL	1340
	CHQT	1110		CKGM	980		VOAR	1230	Whitehorse, Y.T.	CFWH	570
	CJCA	930		CHUB	570		VOCM	590	Williams Lake, B.C.	CKWL	1240
	CKUA	580		CKKK	1390		VOWR	800	Windsor, N.S.	CFAB	1450
Edmonton, N.B.	CJEM	570		CKKC	610		CHLO	680	Windsor, Ont.	CBL	550
Elliott Lake, Ont.	CKNR	1340		CHNC	610		CHLB	680		CKWV	800
Estevan, Sask.	CJSL	1280		CKMR	790		CHLD	680	Wingham, Ont.	CKNX	920
Flin Flon, Man.	CFAR	590		CKEC	1320		CHLE	680	Winnipeg, Man.	CBW	990
Fort Frances, Ont.	CFOB	800		CJTD	1230		CHLF	680		CFRW	1470
Ft. Nelson, B.C.	CFNL	590		CKNW	980		CKOM	1250		CJOB	680
Fort Simpson, N.W.T.	CFMR	1490		CJRN	1600		CKOJ	1050		CKRC	630
	CKNL	560		CJNB	1050		CKOY	1050		CKY	580
Fort Williams, Ont.	CJLX	800					CKOZ	1050	Woodstock, N.B.	CJJC	920
Fredericton, N.B.	CBZ	970					CKP	1070	Woodstock, Ont.	CKOX	1340
	CFNB	550					CKQ	1070	Yarmouth, N.S.	CJLS	1340
	CFJT	1110					CKR	1070	Yellowknife, N.W.T.	CFYJ	1340
Gander, Nfld.	CBG	1450					CKS	1170	Yorkton, Sask.	CJGX	940
Good Bay, Nfld.	CFGB	1340					CKT	1170			
Granby, Que.	CHBF	1450					CKU	1170			
Grande Prairie, Alta.	CFGP	1050					CKV	1170			
Grand Bank, Nfld.	CJOX	710					CKW	1170			
Grand Falls, Nfld.	CBT	540					CKX	1170			

## Canadian FM Stations by Location

Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz
Belleville, Ont.	CJBC-FM	97.1	Cornwall, Ont.	CJSS-FM	104.5	Kentville, N.S.	CKWM-FM	97.7	Lethbridge, Alta.	CHEC-FM	100.9
Brampton, Ont.	CHIC-FM	102.1	Edmonton, Alta.	CFRN-FM	100.3	Kingston, Ont.	CFRC-FM	91.9		CFPL-FM	95.9
Brandon, Man.	CKX-FM	96.1		CJCA-FM	99.5		CKLK-FM	98.3	London, Ont.	CFW-FM	98.9
Brantford, Ont.	CKPC-FM	92.1		CKUA-FM	98.1		CKWS-FM	96.3	Maniwaki, Que.	CBFL-FM	98.9
Calgary, Alta.	CHFM-FM	95.9	Halifax, N.S.	CHNS-FM	96.3	Kitchener, Ont.	CFCA-FM	105.3	Merritt, B.C.	CFM-FM-3	103.9
Clearwater, B.C.	CFM-FM-2	92.7	Hamilton, Ont.	CKDS-FM	95.1		CHYM-FM	96.7	Montreal, Que.	CBF-FM	95.1
Clinton, B.C.	CFM-FM-4	106.5	Kamloops, B.C.	CFM-FM	98.3	La Pocatière, Que.	CHGB-FM	102.9		CBM-FM	100.7
			Kelowna, B.C.	CJOV-FM	104.7					CFQR-FM	92.5

Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz	Location	C.L.	MHz
	CJFM-FM	95.9	Quebec, Que.	CHRC-FM	98.1		CHSC-FM	105.7	Truro, N.S.	CKCL-FM	100.9
	CJMS-FM	94.3	Red Deer, Alta.	CKRD-FM	98.9		CKTB-FM	97.7	Vancouver, B.C.	CBU-FM	105.7
	CJRM-FM	93.5	Regina, Sask.	CFMQ-FM	92.1	Sudbury, Ont.	CKSO-FM	92.7		CBUF-FM	97.7
	CKGM-FM	97.7	Rimouski, Que.	CJBR-FM	101.5	Sydney, N.S.	CJCB-FM	94.9		CHQM-FM	103.5
Mount Timothy, B.C.	CFM-FM-5	99.7	Saint John, N.B.	CFBC-FM	98.9	Tillsonburg, Ont.	CKOT-FM	100.5		CKLG-FM	99.3
North Bay, Ont.	CKAT-FM	93.7	Saskatoon, Sask.	CFMC-FM	103.9	Timmins, Ont.	CKGB-FM	94.5	Verdun, Que.	CKVL-FM	96.9
Oshawa, Ont.	CKQS-FM	94.9	Sault Ste. Marie, Ont.	CJUS-FM	89.7	Toronto, Ont.	GBC-FM	94.1	Victoria, B.C.	CFMS-FM	98.5
Ottawa, Ont.	CBO-FM	103.3		CJIC-FM	100.5		CHFI-FM	98.1	Windsor, Ont.	CKLW-FM	95.9
Penttiston, B.C.	CFMO-FM	93.9		CKCY-FM	104.3		CHIN-FM	100.7		CKWW-FM	89.7
Port Arthur, Ont.	CKOK-FM	97.1	Savona, B.C.	CFM-FM-1	101.9		CHUM-FM	104.5	Winnipeg, Man.	CFRW-FM	98.3
	CKPR-FM	94.3	Sherbrooke, Que.	CHLT-FM	102.7		CJRT-FM	91.1		CJOB-FM	97.5
			St. Catharines, Ont.				CKFM-FM	99.9		CKY-FM	92.1

## A THANK YOU NOTE FROM THE EDITORS

**Thank you!** The Editors of R-TV EXPERIMENTER would like to thank all readers who offered information on station changes, additions and deletions during the past few months. Though many of the letters overlapped, each aided us considerably in making the task of keeping White's Radio Log as current as possible at press time. If we left your name out, please forgive us!

Dan Adams, San Jose, Calif.  
 Stephen Albert, Newton, Mass.  
 Lloyd Andrew, Manassas, Va.  
 William Bussiere, Chicago, Ill.  
 Don Davis, Albuquerque, N.M.

Kevin Coffee, Hubbard Woods, Ill.  
 Jason Farlam, Capetown, Ontario  
 R. J. Faust, Key West, Fla.  
 Emery Flinn, Jr., Carrollton, Ga.  
 Mike Griffin, New Albany, Ind.  
 John W. Haralson, Augusta, Ark.  
 Ronnie Hill, Sheppard AFB, Tex.  
 Frank Jersawitz, Decatur, Ga.  
 James Keenan, Omaha, Neb.  
 Rock Kousek, Plantation, Fla.  
 Frank La Belle, Montreal, Quebec  
 Samuel Lepek, Downsview, Ontario  
 William F. Nichols, Jr.,

Barrington, Ill.  
 Harold A. Ort, Jr., Gloversville, N.Y.  
 Jerry Padgett, Kansas City, Kans.  
 David Palmieri, Mechanicsville, N.Y.  
 John Rieger, Milwaukee, Wis.  
 Michael H. Regan, Wheeler AFB, Calif.  
 Prentice Satori, Sewanee, Tenn.  
 Gladys Sienkiewicz, Brooklyn, N.Y.  
 David C. Sommers, Menasha, Wis.  
 Sheldon Swartz, Taunton, Mass.  
 William J. Walsh, Suffern, N.Y.  
 G. E. Williams, Stockton, Calif.  
 Gary Yates, Ogden, Utah

## World-Wide Shortwave Stations

■ It's quiz time again, gang! Lots of sweat and tears and for no prizes; just a test of your equipment and tuning abilities. How well can you do? Scoring instructions at the end.

1. Revolution anybody? You can tune in on the on-again, off-again Haitian revolt by listening to the clandestine broadcaster *La Voix de l'Union Haitienne Internationale* at 1100 GMT on 15260 kHz.

2. *Radio Aparaceida*, 9635 kHz, in Brazil, is looking for tape recordings of their signals. If you send them a 5 minute recording of someone speaking over their transmitter they'll send you a special diploma. Enclose four International Reply Coupons, you'll get the diploma via airmail. Their address is *Radio Aparaceida*, Praca NS, Aparaceida 315, Brazil.

3. A genuine rare country, the Maldive Islands. Listen for the *Maldive Islands Broadcasting Service* on 9552 kHz at 0700 to 0930 GMT.

4. Not a rare country, but a rarely monitored station is XEJN in Huayacocotla, Vera Cruz, Mexico. They announce *Sistema Educativa* on 2390 kHz around 0215 GMT and then give school lessons. Can you hear them? (Turn page)

### SHORTWAVE CONTRIBUTORS

Robert Angelus, Cincinnati, Ohio  
 Lewis Warren, Ocala, Fla.  
 Fred Eberhardt, Flint, Mich.  
 Kerry Matthews, Miami Beach, Fla.  
 D. Y. MacDermott, Vancouver, B.C.  
 Leon Ingle, Redwood City, Calif.  
 Paul Pliaconis, Frankfort, Ky.  
 Anthony J. Stockbridge, Bryn Mawr, Pa.  
 Nick Trezza, Mobile, Ala.  
 Ernie Kollmar, Phoenix, Ariz.  
 Ronnie Harper, Montreal, P.Q.  
 Tom Kneitel, New York, N.Y.  
 Clarence Crane, Skokie, Ill.  
 Pat Tanzer, Olympia, Wash.  
 Ricky Vezzani, East Northport, N.Y.  
 George Schnaars, APO, San Francisco  
 Chuck Winans, Arlington, Tex.  
 Harry Wandoloski, Cheboygan, Wisc.  
 Sam Rurode, Albuquerque, N.M.  
 Felix Rodriguez, Galveston, Tex.  
 Al Underhill, Schenevus, N.Y.  
 Richard Curtis, Woburn, Mass.

5. There are scads of foreign aeronautical communications stations on 8956 kHz. How many ground stations can you log in a 30 minute period tonight?

6. Estonia is one of the tiny Baltic nations which was swallowed up by the USSR some years ago. Seldom heard on the air, you might be able to log *Eesti Raadio Tallin* on 6085 kHz someday around 2000 GMT. Wanna try?

7. A new frequency for *Radio Japan!* Can you log them on 21640 kHz during their 0215 GMT transmission?

8. The frequency of 8243 kHz is an old favorite of passenger steamships when they want to place ship-to-shore calls from the high seas. How many can you log here in a one hour period?

9. The *Council of Churches* in Jawa,

Indonesia, has started a new station on 4087 kHz. It broadcasts at 0730, 1500, and 1930 GMT. It's not easy to hear in the U. S.

10. One of the last of the old time low frequency police stations is KCA999 of the New Hampshire State Police in Concord. They are heard across the country when conditions are right on 1682 kHz. Or you can try for Elko, Nev. cops on 1634 kHz—they're the lowest on the air. Don't cop out! Try for this one.

**Scoring.** You get 10 points each for numbers 1, 2, 3, 4, 6, 7, 9, and 10. One point for each station in numbers 5 and 8. If you score 20 or below, try harder; 21 to 40, you show promise; 41 to 60, nice going; 61 to 80, you must be doing something right; 81 to 90, we're proud of you; above 91, nobody likes a showoff!

kHz	Call	Slogan	Location	GMT	kHz	Call	Slogan	Location	GMT
<b>90-Meter Band—3200-3400 kHz</b>									
3250	—	R. RSA	Capetown, S. Africa	0200	5980	—	R. Demerara	Georgetown, Guiana	0935
3305	VL8BD	R. Daru	Papua	1115	5990	—	R. Sweden	Stockholm, Sweden	0035
3335	VL8CD	R. Wewak	Gwelo	0415	6005	CFCX	CFCX	Montreal, Que.	2130
3365	H1RL	R. Exitos	New Guinea	1130	6010	CJXC	CJXC	Sydney, N.S.	2300
3390	—	R. Zaracay	Sanlago, D.R.	0300	6015	—	R. Abidjan	Abidjan, Ivory Coast	0710
3972	—	R. Ulan Bator	Ulan Bator, Mongolia	1415	6025	—	R. Portugal	Lisbon, Portugal	0205
3990	—	V. America	Monrovia, Liberia	1400	6045	—	Forces BC	Athens, Greece	2210
<b>60-Meter Band—4750-5060 kHz</b>									
4765	—	R. Brazzaville	Brazzaville, Congo	0515	6070	CFRX	CFRX	Toronto, Ont.	2120
4770	YVNW	R. Bolivar	Bolivar, Venez.	0100	6080	CKFX	CKFX	Vancouver, B.C.	0810
4782	—	R. Mali	Mali	1245	6090	—	R. Phnom Penh	Phnom Penh, Cambodia	1415
4795	XZK	R. Rangoon	Rangoon, Burma	1300	—	HISD	HISD	Prague, Czech. Santo Domingo, D.R.	2300
4805	YDB2	RR1	Djakarta, Indonesia	1345	6103	—	R. Peking	Peking, China	1345
4810	YVMG	R. Popular	Maracaibo, Venez.	0415	6105	—	RR1	Djakarta, Indonesia	1115
4820	HRVC	R. Evangelica	Tegucigalpa, Honduras	1230	6110	—	Burasi Baku	Baku, Azerbaijan SSR	1450
4860	—	R. Peking	Peking, China	1245	—	—	BBC	London, England	2345
4870	—	R. Cotonou	Cotonou, Dahomey	2200	6120	LRX1	R. Splendid	Buenos Aires, Arg.	2330
4875	—	R. RSA	Capetown, S. Africa	0430	6125	ORU	V. Friendship	Brussels, Belg.	0000
4910	—	E. Gran Colombia	Quito, Ecuador	0500	6130	—	R. Nacional	Madrid, Spain	0030
4915	—	R. Ghana	Accra, Ghana	0530	6140	—	R-TV Francaise	Papeete, Tahiti	0615
4937	OAX9E	R. Tropical	Tarapoto, Peru	0330	6150	—	R. RSA	Capetown, S. Africa	2335
4945	—	R. RSA	Capetown, S. Africa	0230	6155	—	Austrian R.	Vienna, Austria	0230
4965	—	R. Santa Fe	Bogota, Colombia	0500	6175	—	Ici Paris	Paris, France	0705
4970	YVLK	R. Rumbos	Caracas, Venez.	0030	6180	TGWB	R. Nacional	Guatemala City, Guat.	0030
4973	—	R. Yaounde	Cameroon	2215	6195	—	R. Tirana	Tirana, Albania	0130
4980	—	R. Ghana	Accra, Ghana	0545	6200	—	R. Tirana	Tirana, Albania	1400
4985	—	R. Cruz del Sur	La Paz, Bolivia	0240	6320	—	R. Peking	Peking, China	1400
4990	YVMQ	R. Barquisimeto	Caracas, Venez.	0215	6345	—	R. Peking	Peking, China	1400
5010	OAXBV	R. Eco	Iquitos, Ecuador	0500	6480	—	R. Pyongyang	Pyongyang, N. Korea	1200
5030	YVKM	R. Continente	Caracas, Venez.	0240	6590	—	R. Peking	Peking, China	1200
5040	XZK	R. Rangoon	Rangoon, Burma	1330	<b>41-Meter Band—7100-7300 kHz</b>				
5040	YVQM	R. Maturin	Caracas, Venez.	1015	7100	—	R. Budapest	Budapest, Hungary	0005
5045	—	E. de Guinea	Bissau, Port. Guinea	2300	7125	—	R. Conakry	Conakry, Guinea	0735
5046	—	R. Lome	Lome, Togo	1425	7130	—	BBC	London, England	0020
5050	—	R. Malaysia	Singapore, Malaysia	1330	7135	—	R. Monte Carlo	Monte Carlo, Monaco	0700
5075	—	R. Peking	Peking, China	1115	7160	—	R. Malaysia	Sarawak	1100
5095	HJGC	R. Sutatenza	Bogota, Colombia	0230	7180	—	R. Baghdad	Baghdad, Iraq	1450
5933	—	R. Chenglin	Chenglin, China	1245	7245	—	R. Austria	Vienna, Austria	0700
<b>49-Meter Band—5950-6200 kHz</b>									
5950	YNRG	R. Zelaya	Bluefields, Nicaragua	0000	7255	HVJ	R. Vatican	Vatican City	0050
5970	—	R. Canada	Montreal, Que.	0830	7295	—	V. America	Morocco	0630
5975	—	BBC	London, England	0319	7300	—	R. Malaysia	Kuala Lumpur, Malaysia	1110
7325	—	BBC	London, England	0325	7325	—	BBC	London, England	0325
7580	—	R. Pyongyang	Pyongyang, N. Korea	1420	7580	—	R. Pyongyang	Pyongyang, N. Korea	1420
9360	—	R. Nacional	Madrid, Spain	0145	9360	—	R. Nacional	Madrid, Spain	0145

**31-Meter Band—9500-9775 kHz**

9500	—	R. Berlin Int'l.	Berlin, E. Germany	0145
9520	ZL18	N.Z. Calling	Wellington, N.Z.	0830
—	—	R. Kuwait	Kuwait	1430
9525	—	R. RSA	Johannesburg, S. Africa	2345
—	—	R. Havana	Havana, Cuba	0235
9545	DMQ9	Deutsche Welle	Cologne, W. Germany	2345
—	—	R. Ghana	Accra, Ghana	1900
9562	—	R. Nacional	Lima, Peru	1200
9570	—	R. South Africa	Capetown, S. Africa	0530
9580	—	BBC	London, England	2120
9585	—	R-TV Francaise	Paris, France	0600
9590	PJB	R. Nederland	Bonaire, Neth. Antilles	0140
—	—	R. Pres Balmaceda	Santiago, Chile	0130
9600	—	R. Tashkent	Tashkent, Uzbek, SSR	1415
9610	—	R. Australia	Perth, Australia	0430
9615	TIRCA	V. de Victor	San Jose, C.R.	0530
9620	—	R. Belgrade	Belgrade, Yugo.	1530
—	—	V. Vietnam	Saigon, S. Vietnam	1500
9622	CXA6	—	Montevideo, Uruguay	0240
9625	—	Kol Yisrael	Tel Aviv, Israel	2130
—	—	R. Canada	Montreal, Que.	0130
9640	—	BBC	London, England	0710
—	—	V. America	Greenville, N.C.	2200
9655	HLK5	V. Free Korea	Seoul, S. Korea	0750
—	—	R. Warsaw	Warsaw, Poland	0345
9660	—	R. Sofia	Sofia, Bulgaria	0000
9675	—	R. Warsaw	Warsaw, Poland	0730
9690	—	R. Nacional	Buenos Aires, Arg.	0000
—	—	R. Cooperativa	Santiago, Chile	0300
9695	—	Swiss BC	Berne, Switz.	2315
9700	—	AFRTS	Delano, Calif.	0815
—	—	R. Sofia	Sofia, Bulgaria	0000
9710	PJB	R. Nederland	Bonaire, Neth. Ant.	0330
—	—	R. Malaysia	Kuala Lumpur, Malaysia	1600
9720	—	R. Senegal	Dakar, Senegal	0700
9725	—	V. America	Greenville, N.C.	0215
9730	—	R. Berlin Int'l.	Berlin, E. Germany	0100
9755	—	R. Pakistan	Karachi, Pakistan	1520
—	—	R. Minería	Santiago, Chile	1030
9760	—	R. Nacional	Madrid, Spain	2335
—	—	V. Vietnam	Hanoi, N. Vietnam	1600
9765	DMQ9	Deutsche Welle	Cologne, W. Germany	2115
—	—	R. Japan	Tokyo, Japan	0900
9770	4VEH	V. Evangelique	Cap Haitien	1115
9775	—	R. Peking	Peking, China	0315
9780	—	R. Moscow	Moscow, USSR	1135
—	—	R. Peking	Peking, China	0315
9785	—	R. Moscow	Moscow, USSR	0400
9790	—	R. Peking	Peking, China	0145
9833	—	R. Budapest	Budapest, Hungary	1145
9945	—	R. Peking	Peking, China	1450
11570	—	R. Moscow	Moscow, USSR	1315
11600	—	R. Peking	Peking, China	1515
11658	—	R. Peking	Peking, China	0345
11705	—	R. Sweden	Stockholm, Sweden	0715
11710	—	R. Australia	Melbourne, Australia	2330
11715	—	Swiss BC	Berne, Switz.	2105
11720	—	R. Canada	Montreal, Que.	0000
11725	—	BBC Far East	Tabrau, Malaysia	2100
11730	PCJ	R. Nederland	Hilversum, Neth.	1645
11735	—	R. South Africa	Capetown, S. Africa	1820
—	—	R-TV Francaise	Rabat, Morocco	0935
—	—	R. Peking	Peking, China	1815
11740	HVJ	R. Vatican	Vatican City	1815

**25-Meter Band—11750-11975 kHz**

11750	—	Austrian R.	Vienna, Austria	1850
—	—	R. Moscow	Moscow, USSR	0000
11765	—	V. Nigeria	Lagos, Nigeria	1700
11770	—	R. South Africa	Capetown, S. Africa	2345
11780	—	BBC	London, England	0000
—	ZL3	N.Z. Calling	Wellington, N.Z.	0620
11785	—	Austrian R.	Vienna, Austria	1500
11790	—	R. Vilnius	Vilnius, Lithuania	2245
11795	—	R. Nacional	Rio de Janeiro, Brazil	0015
—	DMQ11	Deutsche Welle	Cologne, W. Germany	1800
—	WINB	WINB	Red Lion, Pa.	2100

11815	—	RAI	Rome, Italy	2200
—	PJB	R. Nederland	Bonaire, Neth. Antilles	2130
11835	—	R. Algerienne	Algiers, Algeria	1645
11840	—	V. West	Lisbon, Portugal	2350
11850	—	R. Ghana	Accra, Ghana	2100
11865	—	R. Havana	Havana, Cuba	2000
—	—	BBC	Ascension I.	2215
11900	—	R. RSA	Johannesburg, S. Afr.	0445
11915	HJCJB	V. Andes	Quito, Ecuador	0345
11925	—	V. West	Lisbon, Port.	1100
11930	—	R. Havana	Havana, Cuba	1800
11935	—	V. West	Lisbon, Port.	0215
11940	—	R. Bucharest	Bucharest, Rumania	2030
11945	—	R. Canada	Montreal, Que.	2245
—	DMQ11	Deutsche Welle	Cologne, W. Germ.	0145
—	—	R. Peking	Peking, China	0445
11950	—	R. Moscow	Moscow, USSR	0450
—	ELWA	R. Village	Monrovia, Liberia	0615
—	—	V. Vietnam	Saigon, S. Vietnam	1230
11975	ELWA	R. Village	Monrovia, Liberia	0815
11985	—	R. Kiev	Kiev, USSR	1500
12010	—	R. Peking	Peking, China	0335
12030	—	Gorovit	Novosibirsk, USSR	0345
12037	—	BBC	London, England	0315
12060	—	R. Moscow	Moscow, USSR	0515
12095	—	BBC	London, England	0315
15050	—	R. Euzkadi	(clandestine)	1500
15070	—	BBC	London, England	1530
15080	VUD	All India R.	Delhi, India	1800

**19-Meter Band—15100-15450 kHz**

15100	—	R. Pakistan	Karachi, Pakistan	1730
15105	—	Windward I. BC	St. Georges, Grenada	2030
—	—	R. Rural	Rio de Janeiro, Brazil	2315
15110	ZL21	N.Z. Calling	Wellington, N.Z.	0430
15140	—	BBC	Ascension I.	0150
15180	—	R. Moscow	Moscow, USSR	0425
15200	—	BBC	London, England	2245
—	—	R. RSA	Johannesburg, S. Africa	2345
15240	VUD	All India R.	Delhi, India	1345
15245	—	R-TV Francaise	Paris, France	1920
—	ZYE21	R. Marajoara	Belem, Brazil	2150
—	—	V. Nigeria	Lagos, Nigeria	1700
15252	ETLF	R. ETLF	Addis Ababa, Ethiopia	1500
15260	—	—	—	—
15265	VUD	All India R.	Delhi, India	2250
15270	—	V. America	Morocco	1700
15275	4VEH	V. Evangelique	Cap Haitien, Haiti	0340
15285	PJB	R. Nederland	Bonaire, Neth. Antilles	0130
—	—	R. Havana	Havana, Cuba	2000
15300	—	R. Australia	Melbourne, Australia	0200
15320	—	—	—	—
15355	WNYW	R. N.Y. Worldwide	New York, N.Y.	0230
15360	—	R. RSA	Johannesburg, S. Africa	2050
15365	—	R. Nacional	Tenerife, Canary Is.	0245
15385	—	Far East BC	Manila, Phil.	0010
—	—	R. Peking	Peking, China	0245
15410	ETLF	R. ETLF	Addis Ababa, Ethiopia	1950
15430	HLK	V. Free Korea	Seoul, Korea	0400
—	—	Austrian R.	Vienna, Austria	0100
15435	—	BBC	London, England	0815
15450	—	R. Moscow	Moscow, USSR	2200
15520	—	R. Pyongyang	Pyongyang, N. Korea	0210
15550	—	R. Peking	Peking, China	0240
16315	—	R. Pyongyang	Pyongyang, N. Korea	0100
17400	—	R. Moscow	Moscow, USSR	1950
17680	—	R. Peking	Peking, China	0030

**16-Meter Band—17700-17900 kHz**

17700	—	R. Berlin Int'l.	Berlin, E. Germany	1900
17720	BED29	V. Free China	Taipei, Formosa	0030
17730	WNYW	R. N.Y. Worldwide	New York, N.Y.	1600
17740	—	BBC	London, England	2035
17765	DMQ17	Deutsche Welle	Cologne, W. Germany	1800
17770	ZL5	N.Z. Calling	Wellington, N.Z.	0445
17775	—	R. Moscow	Moscow, USSR	0415

(Continued on page 118)

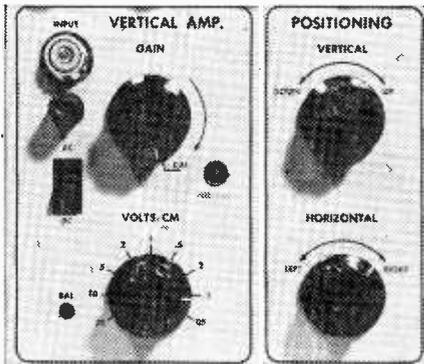
## Need A Lab Scope?

*Continued from page 53*

100  $\mu$ s/cm. One complete cycle occupies 3.3 cm. Thus,  $f = 1/3.3 \times 100 \mu$ s or 3.03 kHz (this figure is within scope's 5% accuracy rating).

With a calibrated scope the operator can instantly determine the frequency of the vertical input signal. And with the triggered sweep, he obtains instant synchronization for any signal within the scope's range.

**Vertical Attenuator.** The calibrated vertical input is another feature of the lab scope. Fig. 7 shows the Heath IO-14's input controls. These are typical of lab scopes.



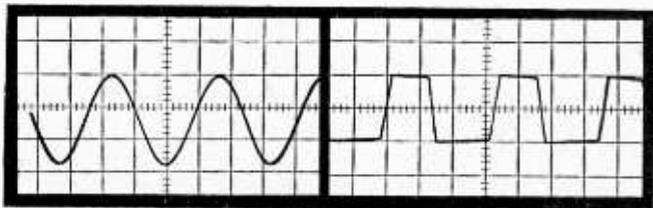
**Fig. 7. Vertical amplifier is calibrated for volts/cm when gain control is in CAL. position.**

Note that the input is calibrated directly in volts/cm. The normal position for the gain control is the calibrated position, though it can be adjusted for a relative gain if desired. There is no guesswork or need for an external calibrator when the gain control is set to the calibrated position.

Two last traces (in box) show how the calibrated vertical input is used. In the first, an input signal is fed into the scope and the vertical attenuator is set for a trace of convenient size.

Looking at the attenuator we find it is set for 1 V/cm. Counting graticule units, we see that the trace occupies 2.8 cm between its peak positive and negative values. The input voltage is therefore  $1 \text{ V/cm} \times 2.8$  or 2.8 V P-P.

**Space occupied by trace indicates amplitude of signal.**



**Calibrated input of Data Instruments 555 scope. Lab check of unit appears on page 69!**

The last trace shows a more typical application. One of our staff members built a scope calibrator and wanted it checked out. The calibrator was supposed to have a 1 V P-P output. With the IO-14's vertical attenuator set to 0.5 V/cm, we obtained a trace exactly 2 cm high. The input voltage was therefore  $0.5 \text{ V/cm} \times 2$  or 1 V P-P—right on the button.

Of course, this is only part of the story. There are many features of more complicated lab scopes which cannot be discussed briefly. A quick look at the catalogs of manufacturers like Tektronix and Hewlett-Packard will reveal whole lines of professional scopes and plug-in accessories which go way beyond the basic features discussed here.

Plug-in amplifiers are available that measure frequencies in the uhf range, or even higher. All sorts of precision time bases can be plugged in, and there are even scopes that display two signals simultaneously.

However, most of us don't need a control room equipped like the ones at Cape Kennedy. Any lab scope you choose to replace your service-grade model is sure to provide convenience and excitement enough. ■

## Struggle That'll Strangle

(Continued from page 68)

nications. No wonder HF is sagging under the sheer weight of signals! A small transmitter can be plunked down anywhere in the world, a modest antenna erected, and communications conducted with almost any other point on the globe—if, that is, you can find a clear frequency.

**VHF.** The near-absence of ionospheric skip on 30-300 MHz makes the Very High Frequency band a star performer for mobile communications and TV-FM broadcasting. Signals tend to travel line-of-sight, so it's possible to assign the same frequencies to different geographic areas with little risk of interference. The distance of mobile signals is usually limited to about 50 miles. Yet the short range of VHF hardly rescues it from the fate of lower bands.

Mobile radio has grown so rapidly that further assignments on VHF are a nightmare to find. A decade ago, there were about a million and a half transmitters licensed by the FCC. Today the figure is more than five million. How large will it grow? A government official recently estimated the total market for mobile radio at 25 million units. That would put 2-way radio in one of every four American cars. (What he didn't say is *where* those units will go!)

The largest slice of VHF is taken by television broadcasting. As you can see in Fig. 3, Channels 2-6 and 7-13 are grouped in different sections, taking nearly one-third of the total band. The FM broadcasters, another burgeoning group, slide in just above TV Channel 6. Sales of FM radio are booming (some 15 million sets produced in 1967), and the band is filling up fast as more stations take to the air.

**UHF.** Until recently, Ultra High Frequency was a forbidden frontier. It had been held back by costly equipment, sophisticated design, and limited signal range. But the mounting number of services demanding room on the airwaves burst the barrier. UHF not only opened up in a few short years but actually started groaning under its load. Nevertheless, the UHF mobile band from 450-470 MHz is one remaining escape hatch for services once assigned in crowded HF and VHF bands. Just above the mobile band are UHF-TV channels which run from 470 to 890 MHz. As in VHF, television gulps a

huge portion of the UHF spectrum.

**SHF and EHF.** Perched at the lofty end of the radio spectrum, the Super and Extremely High Frequency regions are vast, sparsely populated bands awaiting exploitation. But there are few takers, and the reason is technology. Frequencies are so elusive and critical that hardware costs skyrocket. Equipment becomes impractical for routine, economical communications. The highest bands remain the province of such sophisticated systems as radar, navigational and distance-measuring equipment, satellites and microwave channels for TV relay. As the last frontier, the upper regions still lie beyond the grasp of most spectrum users.

**Full House.** This conspiracy of too-few frequencies and too many users led one observer to remark we're "spectrum-starved." Down on the low bands we're absolutely famished. The four low bands seemingly make up *half* the eight-band spectrum. But this is where Mother Nature turns into the Wicked Witch of the North.

If you check the frequency spans in the chart of Fig. 1, you'd see that the four lower bands *combined* could fit into a small corner of the next higher one (VHF). Radio, which began on the lower bands, filled them up generations ago. This accounts for a migration to higher—and roomier—regions. But statistics up there are hardly encouraging, either.

The FCC reports that VHF and UHF bands (from 25 to 890 MHz) have about 34 percent of their frequencies set aside for government use. A whopping 60 percent is allocated to the broadcasters (TV and FM). That leaves only 6 percent for aviation, marine, amateur, citizens, and land-mobile (land-mobile includes police, fire, various utilities, business and industry). As an expanding economy and rising population demand more radio services of every type, something's got to give.

There are plenty of solutions for keeping the spectrum from evaporating completely. Trouble is, some are controversial; others must wait for hardware to come off the drawing boards. Consider what's being done to ease the glut.

**Shuffling Channels.** One FCC tactic is to spirit away frequencies not fully utilized by one service and reassign them to another. Hams still wince when they recall how the 11-Meter band was taken away and given to CBers back in 1958. But few dispute that ham activity on 11 Meters had been virtually

## Struggle That'll Strangle

(Continued from preceding page)

nil. More recently, ham bands on 220 MHz and higher have been mentioned as possible casualties in the race for spectrum space. In another juggling action, the FCC took 23 channels away from public-safety stations in Puerto Rico and the Virgin Islands and re-assigned them to fill urgent business needs.

The hottest channel-swapping issue is now in the debating stage. In the search for more frequencies, land-mobile interests have set their sights on UHF television. (The UHF mobile band now runs from 450-470 MHz, halting immediately below TV Channel 14.) They want to ascend through TV Channel 14 to Channel 20. One proposal suggests that where a UHF-TV channel is not broadcasting in a given area, it should be cut into dozens of 2-way radio frequencies. Thus, the UHF band would be doled out on a shared basis, with communications in some areas, television in others.

How the plan might work was recently outlined by Alan S. Boyd, U.S. Secretary of Transportation. He said the key to the idea is the fact that a 2-way radio user doesn't care what frequency he has so long as his calls get through at reasonable cost. Thus the user would not receive a single frequency in the usual sense, but a service. In other words, a 2-way user could be shifted around the bands but never be deprived of an operating channel. This would open the way to sharing UHF-TV frequencies.

If, for example, Channel 14 is unused in an area, it could be farmed out to mobiles. But since the channel remains primarily for TV broadcasting—the mobiles getting only secondary access, the mobiles could be booted off the channel to make room for a television assignment. It's believed a pooling approach would come up with another frequency for the dislocated mobile. Equipment modification would be minor.

Boyd gave Los Angeles as an example of where the UHF-TV plan might work. He said there are 450 mobile channels now dormant in this heavily congested area. Existing 2-way radios could be quickly modified to put them on those channels. Within six months, 300 more 2-way channels would become usable.

Broadcasters, not surprisingly, view the whole affair with alarm. Quipped the Presi-

dent of the National Association of Broadcasters: "If police and firemen must have additional spectrum space to function effectively, this is one thing. But the need of every delivery truck driver to communicate with his home office seems less pressing."

He further challenges the idea: "Before broadcasting is deprived of any frequencies, it should be established . . . that the diversion is for essential and superior services." And he also charges that "an enormous power grouping" is aligned against the broadcasters in the spectrum fight. The alliance is said to include such communications-oriented groups as AT&T, the National Association of Manufacturers, the U.S. military, the President's Office of Telecommunications Management, and huge corporations.

The FCC could be considered part of the group. Not long before these statements, the Commission announced a plan to undertake an extensive study of the radio spectrum with an eye toward reallocating the upper and lower ends of UHF-TV to meet the needs of land-mobile.

**For Whom Bell Tolls.** If the broadcasters are perturbed over possible tampering with UHF-TV frequencies, another plan could send them scampering up their towers to fly a distress flag. There are proposals afoot to take *all* TV off the airwaves and distribute it on a wired system. This would blow a gigantic hole in the spectrum, creating a vacuum to be filled by mobile radio.

Will it happen? The President of Motorola (a leading 2-way manufacturer) thinks so. His prediction: ". . . It is inevitable that the TV services . . . will in the course of time all convert to cable. I think it must come . . . Only this portion of the spectrum (25-900 MHz) possesses the propagation characteristics essential for the increasing overall non-fixed communications needs of our society." Voicing one government expert, who wished to remain nameless: he feels the shift of some frequencies from TV to mobile is just a matter of time, and he predicts the move may come within 10 years. Two factors—economics and disrupting of services—are the big stumbling blocks.

**Launch Pad To Lunch Pad.** Another solution to the spectrum squeeze is up-and-awayyy. Visionaries are talking about orbiting satellites for TV broadcasting directly to the home. Since a satellite is high in the sky, there are no obstructions or signal-blocking horizon between transmitter and home antenna. Thus a broadcasting satellite

could use a microwave signal to see the whole country at a glance. Channels would be on Super High Frequency where spectrum space is astronomical. But the technical problems are also extra-terrestrial.

Although NASA communicates with the planet Mars on five watts, it's done on multi-million dollar hardware. Microwave receivers in each home is hardly yet practical. And the home antenna installation could cost upwards of \$100. In another comment, Motorola's president said: "I personally don't envision practical economic and spectrum-conservation solutions to proposals for satellite-to-home broadcasting. Technically, it is possible, but I am inclined to believe that the system we will use will always require the transmission through some earth link." Is broadcasting forever earth bound?

Somewhat more optimism is apparent in government circles. A \$200,000 study on "Use of the Spectrum by Satellite Systems Through 1980" estimates the U.S. will have 273 orbiting craft within a dozen years. (Today there are 100.) Though most are tagged for technical tasks, six are expected to be used for broadcast purposes. And just one broadcast satellite can radiate scores of radio and TV programs. William Plummer, a government spokesman, faintly hinted at the

problem when he recently said there is a need for more experimenting on the frequency bands above 10 GHz.

Thus the spectrum's salvation is still over the horizon. Amid the clamor for more frequencies, today's palliatives are strictly in the stop-gap class. At the start of 1968, the FCC announced 165 new channels in the mobile UHF band. It was done by "splitting"—a technique that narrows the transmitter carrier from 15 kHz to 5 kHz, thereby allowing more stations on a band. But channel-splitting also extracts a toll in more costly equipment. And it merely delays the day when complete band saturation prevents further splitting.

Who's to blame for the spectrum mess? Chalk it up to the vitality and growth of the U.S. The skyrocketing demand for spectrum space is really a symptom of success. And that success will probably breed the solutions as well.

Some fault may also lie with the man who started it all: Heinrich Hertz. Man's first important entry into a radio band happened in 1884, when Hertz transmitted a spark between two coils. Little did he know that his single frequency—about 140 MHz—would fatten into a spectrum spectacular!

—Len Buckwalter, *K1ODH/KQA5012* ■

## Ham Traffic

(Continued from page 92)

ditional licenses. However, the examinations must be conducted by volunteers who hold the same or higher class license as the one being sought.

With incentive licensing in effect, this rule change is a welcome one. It ensures that the person with the initiative to improve himself also gets the chance to do it.

**Bouquets, Yet!** Sometimes we hams get to feeling the rest of the communications industry is after our throats, since some members of the professional gang look with greedy eyes at our frequencies. So it was really nice to see the "salute to ham radio operators" which appeared a while back in *Communications News*.

The extensive article, which did a fine job of summarizing the many accomplishments of amateur radio, concluded by saying "As we look at the relatively few frequency bands allotted to amateur radio, we can see that these bands are put to good use. . . .

The men and women in the Amateur Radio Service merit our encouragement."

Mighty fine words, those. While we're all patting ourselves on our backs for being so praised, we should also make a firm resolution to do everything we can to continue to be worthy of such a compliment. ■



## Bubble Bath

Continued from page 46

a monstrously large daddy-longlegs spider. To support the 2000-ton chamber and a 1500-ton wall designed to shield off stray sub-nuclear particles, eleven concrete caissons had to be sunk 80 ft. to bedrock. To do the job, it was necessary to call in heavy equipment used to sink foundations for Chicago skyscrapers.

**Costly Kit.** Next time you find yourself worrying about the cost of the electronic kit you're assembling, give a thought to the price tags on the super-kits that tax-supported scientific gadgeteers are putting together.

The entire Argonne bubble chamber project will cost about \$17 million, not counting the ZGS particle accelerator. About \$10 million of the investment is for the bubble chamber alone. Working cheek-to-joule with Argonne physicists, industrial contractors are putting together high-priced components such as these: buildings, over \$3 million; bubble chamber pressure vessel and vacuum can, \$580,000; 50 tons of superconducting metal, \$460,000; helium cryostat vessel to contain the magnet coil, \$400,000; iron components of the magnet, including a 1600-ton yoke, \$894,000; refrigeration compressors, \$326,000; a new type of lens for photographing the bubbles, \$34,000.

All this for what? To take snapshots of the footprints of busted-up atoms. Considering the investment, it doesn't sound like much of a pay-off—not, that is, until you remember that these bubble snapshots will undoubtedly become very important pages in the ultimate scientific picture-book of our universe.

Although the initial cost of the bubble chamber is high, there is one consoling thought to bear in mind: no one can kick about the size of the electric bill! ■

## Edison Gets the Air

Continued from page 79

an electrocatalyst such as platinum black. This battery, like the Edison cell, uses a potassium hydroxide electrolyte.

These modifications have boosted current capacity to as much as 70 watt-hours per pound of battery weight; this compares with about 12 watt-hours for a typical lead-acid battery. Iron-air cells having capacities up to 20 ampere-hours have been made; these have been operated for more than 200 charge-discharge cycles at drain rates that provide 65% discharge in two hours.

**Power Out.** Discharge of the new cell is characterized by two distinct voltage plateaus associated with the iron anode. The first plateau varies from 0.96 to 0.80 volt depending on discharge rate; the second plateau ranges from 0.70 to 0.60 volt. The first plateau represents 65% of the anode capacity in ampere-hours.

The new iron-air battery is said to have potential applications as a rugged and inexpensive power source for appliances such as portable TV sets, industrial machines, military and space equipment. GT&E also claims it may become a power source for automobiles. Perhaps this means only that it may replace the lead-acid battery in conventional gasoline powered cars. And yet, if Edison *had* added air to his battery, he might have put battery design some 60 years further along, right at the outset. The industry might now be inventing batteries that won't come along until after the year 2000. And surely, by that time we will have electric cars, and be rid of the primitive gas-belching contraptions we drive today.

But let's not be too hard on Edison. He couldn't think of everything. After all, it did take a lot of scientific brains over six decades to merely improve what Edison invented back in the electrical stone age. ■

## World-Wide SW Stations

Continued from page 113

kHz	Call	Slogan	Location	GMT
17795	—	R. Moscow	Moscow, USSR	1610
17825	—	R. Japan	Tokyo, Japan	0230
17845	WNYW	R. N.Y. Worldwide	New York, N.Y.	1745
17850	—	R-TV Francaise	Paris, France	2000
17860	ORU	V. Friendship	Brussels, Belg.	2000
17890	HCJB	V. Andes	Quito, Ecuador	2245

kHz	Call	Slogan	Location	GMT
21505	PCJ	R. Nederland	Hilversum, Neth.	1900
—	—	AFRTS	Delano, Calif.	0230
21530	WNYW	R. N.Y. Worldwide	New York, N.Y.	1910

### 13-Meter Band—21450-21750 kHz

21565	—	R. Moscow	Moscow, USSR	1750
21610	—	V. America	Dixon, Calif.	0215
21620	—	R-TV Francaise	Paris, France	1820
21630	—	BBC	London, England	1845
—	—	V. America	Dixon, Calif.	1835
21640	—	R. Japan	Tokyo, Japan	0245
21650	—	AFRTS	Delano, Calif.	1920

# CLASSIFIED Market Place

FOR BIGGER PROFITS! NEW CAREER OPPORTUNITIES!  
READ AND REPLY TO THESE CLASSIFIED ADS

Classified Ads 65¢ per word, each insertion, minimum 10 words, payable in advance. To be included in the next available issue of RADIO-TV EXPERIMENTER, copy must be in our New York Office by Oct. 10th. Address orders to C. D. Wilson, Manager, Classified Advertising, RADIO-TV EXPERIMENTER, 229 Park Avenue South, New York, N. Y. 10003.

## ADDITIONAL INCOME

**PANELISTS At Home Wanted By New York Researcher.** Leading research firm seeking people to furnish honest opinions by mail from home. Pays cash for all opinions rendered. Clients' products supplied at no cost. For information write: Research 669, Mineola, N.Y. 11501, Dept. 633-RV.

## AUTHOR'S SERVICE

**PUBLISH your book!** Join our successful authors: publicity advertising promotion, beautiful books. All subjects invited. Send for free manuscript report and detailed booklet. Carlton Press, Dept. SMH, 84 Fifth Avenue, New York 10011.

## BUSINESS OPPORTUNITIES

**I MADE \$40,000.00 Year by Mailorder!** Helped others make money! Start with \$10.00—Free Proof! Torrey, Box 318-T, Ypsilanti, Michigan 48197.

**FREE Book "990 Successful Little-Known Businesses."** Fascinating! Work home! Plymouth 211-J, Brooklyn, N. Y. 11218.

**FIVE Money Makers.** Free Details. Dixie, 2913 Colonial Ave., Norfolk, Va. 23508.

## DO IT YOURSELF

**MIRACLE MARBLE**—Create beautiful Multi-colored table tops, lamp bases, plaques, statuary, etc. Marble easily made. Illustrated "How-To Booklet"—\$1.00. Process Company, Box 7F, Bellrose, N. Y. 11428.

## EDUCATION & INSTRUCTION

**FCC License and Associate Degree** correspondence/residence courses. School bulletin free. Grantham Institute of Electronics, 1505 N. Western Ave., Hollywood, California 90027.

**EARN Your Degree In Electronics Engineering.** Highly Effective Home Study Courses In Electronics Engineering Technology And Electronics Engineering Mathematics. Free Literature. Cook's Institute Of Electronics Engineering, P. O. Box 36185, Houston, Texas 77036. (Established 1945.)

## ELECTRICAL EQUIPMENT & SUPPLIES

**PROXIMITY switch senses people!** Converts to dimmer, timer, thermostat, photoswitch, etc. Free information. Zonar, 862 Reed, Claremont, Calif. 91711.

**ANNUAL ELECTRICAL GUIDE.** Repair Motors! Generators! Batteries! Build special testers! Armature growler! Battery chargers! Compressor! Electroplater! AC Generator! Battery operated motors! Winding data! Diagrams! Plans! Catalog! Modelec, Box 10025, Kansas City, Mo. 64111.

## FARMS, ACREAGE & REAL ESTATE

**CALIFORNIA land investments.** From \$20.00 down. \$20.00 monthly. Pratz, 11138 Aqua Vista, N. Hollywood, 91602.

## HOME WORKSHOP SUPPLIES

**WORK Benches, Shelving, Bins, Bargain Catalog 35¢.** Falls Church Office Furniture, SM9, Box 219, Falls Church, Virginia 20046.

## HYPNOTISM

**SELF-Hypnosis for self-improvement.** New Concept. Free literature. Smith-McKinley, Box 3038, San Bernardino, California 92404.

## INVENTIONS WANTED

**WE either sell your invention or pay cash bonus.** Write for details. Universal Inventions, 298-5, Marlon, Ohio 43302.

## MISCELLANEOUS

**FANTASTIC Count Down Cigarette Holder.** Now you can stop smoking completely in 6 weeks. Just turn dial and inhale less with each turn. Amazing. \$4.95. "The House of Blackwell," 98 Glenwood Terrace, Fords, N. J. 08863.

**ELECTROSHOCK Module.** Produces 1200 volt shock from 6 volts. No battery drain until touched. Non lethal. Protect property for months on lantern battery. \$5.95 Catalog of interesting projects, plans, kits, 20¢. Franks Scientific Co., P.O. Box 156, Martelle, Iowa 52305.

**CATALOG of all Science & Mechanics Craftprints.** Send 25¢ to cover postage to Craftprint Div., Science & Mechanics, 229 Park Avenue South, New York, N.Y. 10003.

## MONEYMAKING OPPORTUNITIES

**100 MONEY-MAKING Opportunities!** 25¢. Charles Redmond, Box 8454-DC, Los Angeles 90008.

**SUCCESS! Selling Car Insurance.** Free Details. Neale Institute, Box 923, Edmonton-10, Canada.

**MAKE money selling Government Surplus.** Complete directory of surplus depots. How and where to buy for your own use, or for resale. Send \$1.00. Day Enterprises, P.O. Box 502, Connersville, Indiana 47331.

**MAKE Mail Order pay.** Get "How To Write a Classified Ad That Pulls." Includes certificate worth \$2.00 toward classified ad in S & M. Send \$1.25 (includes postage) to C. D. Wilson, Science and Mechanics, 229 Park Avenue South, New York, New York 10003.

## RADIO & TELEVISION

**THOUSANDS AND THOUSANDS** of types of electronic parts, tubes, transistors, instruments, etc. Send for Free Catalog. Arcurus Electronics Corp., M.T. 502-22nd Street, Union City, N. J. 07087.

**"DISTANCE Crystal Set Construction"** Handbook—50¢. 10 Crystal Plans—25¢. Catalog Laboratories, 12041-H Sheridan, Garden Grove, Calif. 92640.

**C.B. BUYERS' Guide**—A new magazine for the buyers of Citizen's Band Electronic Equipment. Send \$1.25—includes Postage to C. B. Buyers' Guide, 229 Park Avenue South, New York, N. Y. 10003.

## START YOUR OWN BUSINESS

**START Profitable Business** in spare time. Investigate many money-making opportunities. Send 25¢ for sample copy of Income Opportunities Magazine, 229 Park Avenue South, New York, N. Y. 10003.

## TREASURE FINDERS—PROSPECTING EQUIPMENT

**TREASURE Hunters! Prospectors!** Relco's new instruments detect buried gold, silver, coins. Kits, assembled models. Transistorized. Weighs 3 pounds. \$19.95 up. Free catalog. Relco-A30, Box 10839, Houston, Texas 77018.

**THERE IS NO CHARGE FOR THE ZIP CODE—PLEASE USE IT IN YOUR CLASSIFIED AD**

**For Greater Classified Profits  
why not try the new combination classified ad medium**

Your classified ad will appear in **SCIENCE & MECHANICS MAGAZINE** as well as in a minimum of four other **SCIENCE & MECHANICS PUBLICATIONS**. Write now for information to C. D. Wilson, Manager, Classified Advertising, **SCIENCE & MECHANICS**, 229 Park Avenue South, New York, N. Y. 10003.

**Hunting for a better job?**

**Here's the  
license  
you need  
to go after  
the big ones**



**A Government FCC License can help you bring home up to \$10,000, \$12,000, and more a year. Read how you can prepare for the license exam at home in your spare time — with a passing grade assured or your money back.**

**I**F YOU'RE OUT TO BAG A BETTER JOB in Electronics, you'd better have a Government FCC License. For you'll need it to track down the choicest, best-paying jobs that this booming field has to offer.

Right now there are 80,000 new openings every year for electronics specialists—jobs paying up to \$5, \$6, even \$7 an hour...\$200, \$225, \$250 a week...\$10,000, \$12,000, and up a year! You don't need a college education to make this kind of money in Electronics. You don't even need a high school diploma.

But you *do* need knowledge, knowledge of electronics fundamentals. And there is only one nationally accepted method of measuring this knowledge...the licensing program of the FCC (Federal Communications Commission).

**Why a license is important**

An FCC License is a legal requirement if you want to become a Broadcast Engineer, or get into servicing any other kind of transmitting equipment—two-way mobile radios, microwave relay links, radar, etc. And even when it's not legally required, a license proves to the world that you understand the principles involved in *any* electronic device. Thus, an FCC "ticket" can open the doors to thousands of exciting, high-paying jobs in communications, radio and broadcasting, the aerospace program, industrial automation, and many other areas.

So why doesn't everybody who wants a good job in Electronics get an FCC License and start cleaning up?

The answer: it's not that simple. The government's licensing exam is tough. In fact, an average of two out of every three men who take the FCC exam fail.

There is one way, however, of being pretty certain that you will pass the FCC exam. And that is to take one of the FCC home study courses offered by Cleveland Institute of Electronics.

CIE courses are so effective that better than 9 out of 10 CIE graduates who take the exam pass it. That's why we can afford to back our courses with this iron-clad Warranty: Upon completing one of our FCC courses, you

must be able to pass the FCC exam and get your license—or you'll get your money back!

**They got their licenses and went on to better jobs**

The value of CIE training has been demonstrated time and again by the achievements of our thousands of successful students and graduates.

Ed Dulaney, Scottsbluff, Nebraska, for example, passed his 1st Class FCC License exam soon after completing his CIE training...and today is the proud owner of his own mobile radio sales and service business. "Now I manufacture my own two-way equipment," he writes, "with dealers who sell it in seven different states, and have seven full-time employees on my payroll."

Daniel J. Smithwick started his CIE training while in the service, and passed his 2nd Class exam soon after his discharge. Four months later, he reports, "I was promoted to manager of Bell Telephone at La Moure, N. D. This was a very fast promotion and a great deal of the credit goes to CIE."

Eugene Frost, Columbus, Ohio, was stuck in low-paying TV repair work before enrolling with CIE and earning his FCC License. Today, he's an inspector of major electronic systems for North American Aviation.

"I'm working 8 hours a week less than before," says Mr. Frost, "and earning \$228 a month more."

**Send for FREE book**

If you'd like to succeed like these men, send for our FREE 24-page book "How To Get A Commercial FCC License." It tells you all about the FCC License...requirements for getting one...types of licenses available...how the exams are organized and what kinds of questions are asked... where and when the exams are held, and more.

With it you will also receive a second FREE book, "How To Succeed In Electronics." To get both books without cost or obligation, just mail the attached postpaid card. Or, if the card is missing, send your name and address to CIE at the address below.



**ENROLL UNDER NEW G.I. BILL.** All CIE courses are available under the new G.I. Bill. If you served on active duty since Jan. 31, 1955, or are in service now, check box on reply card for complete details.

**CIE**

**Cleveland Institute of Electronics**

1776 E. 17th St., Dept. EX-23 Cleveland, Ohio 44114

Accredited Member National Home Study Council  
A Leader in Electronics Training... Since 1934



# BUILD YOUR OWN RADIO

CIRCUITS AT HOME  
with the New Improved  
PROGRESSIVE RADIO "EDU-KIT"®

only  
**\$20.95**

A Practical Home Radio Course

### Now Includes

- ★ 12 RECEIVERS
- ★ 3 TRANSMITTERS
- ★ SQ. WAVE GENERATOR
- ★ SIGNAL TRACER
- ★ AMPLIFIER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR

### EXPANDED "EDU-KIT" NOW INCLUDES

- ★ TRANSISTOR (Solid State) CIRCUITS
- ★ VACUUM TUBE CIRCUITS
- ★ PRINTED CIRCUITS
- ★ HAND WIRED CIRCUITS



Reg. U. S.  
Pat. Off.

Training Electronics Technicians Since 1946

## FREE EXTRAS

### YOUR SET OF TOOLS

- SOLDERING IRON
- ELECTRONICS TESTER
- PLIERS-CUTTERS
- VALUABLE DISCOUNT CARD
- CERTIFICATE OF MERIT
- TESTER INSTRUCTION MANUAL
- HIGH FIDELITY GUIDE • QUIZZES
- TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK
- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

**YOU DON'T HAVE TO SPEND HUNDREDS OF DOLLARS FOR A RADIO COURSE**

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL. You will learn how to build radios, using regular schematics; how to wire and solder punched metal chassis as well as the latest development of Printed Circuit chassis. In a professional manner; how to service radios. You will work with the standard type of RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer. You will learn and practice progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instruction manual.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the low price you pay. The Signal Tracer alone is worth more than the price of the kit.

## THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment. Many thousands of individuals of all

ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

## PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio. You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector Circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

## THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build twenty different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, coils, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C. Radio Amateur License training. You will also receive lessons for Fidelity Guide and a Quiz Book. You receive membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

Progressive "Edu-Kits" Inc., 1186 Broadway, Dept. 550NN, Hewlett, N. Y. 11557

## UNCONDITIONAL MONEY-BACK GUARANTEE

Please rush my Progressive Radio "Edu-Kit" to me, as indicated below:

Check one box to indicate choice of model

- Regular model \$26.95.
  - Deluxe model \$31.95 (same as regular model, except with superior parts and tools).
  - Expanded model \$36.95 (same as Deluxe model, except with 5 additional solid state circuits plus valuable Radio & TV Tube Checker).
- Check one box to indicate manner of payment
- I enclose full payment. Ship "Edu-Kit" post paid.
  - Ship "Edu-Kit" C.O.D. I will pay postage.
  - Send me FREE additional information describing "Edu-Kit."

Name  
Address

## PROGRESSIVE "EDU-KITS" INC.

1186 Broadway, Dept. 550NN, Hewlett, N. Y. 11557

## SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

## FROM OUR MAIL BAG

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend \$240 for a Course, but I found your ad and sent for your Kit."

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The "Trouble-Shooting" tests that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

## PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.