

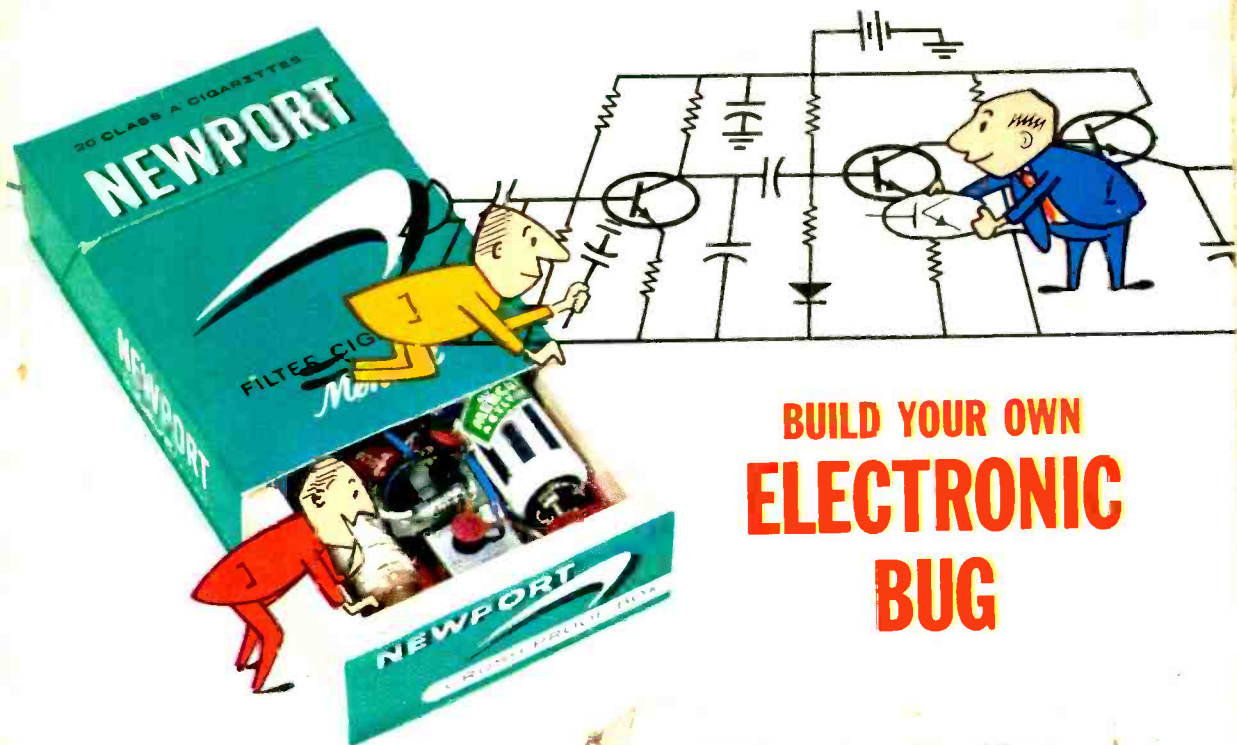
A Shocking Scandal: CB NIGHTMARE IN INDIANA

ELECTRONICS ILLUSTRATED

By the Publishers of MECHANIX ILLUSTRATED

JANUARY 1968 • 50¢

- ★ **EI Rates the Popular Audio Tapes**
- ★ **New Cities Awards for Hams & SWLs**
- ★ **DXing the CIA, FBI & Other Big Brothers**
- ★ **Grim Facts on Cheapie Walkie-Talkies**
- ★ **Learning Languages via Short Wave**
- ★ **A Career at the Service Bench for You?**



**BUILD YOUR OWN
ELECTRONIC
BUG**

Build: Military Aircraft Rec
Lunchbox Ham Statio

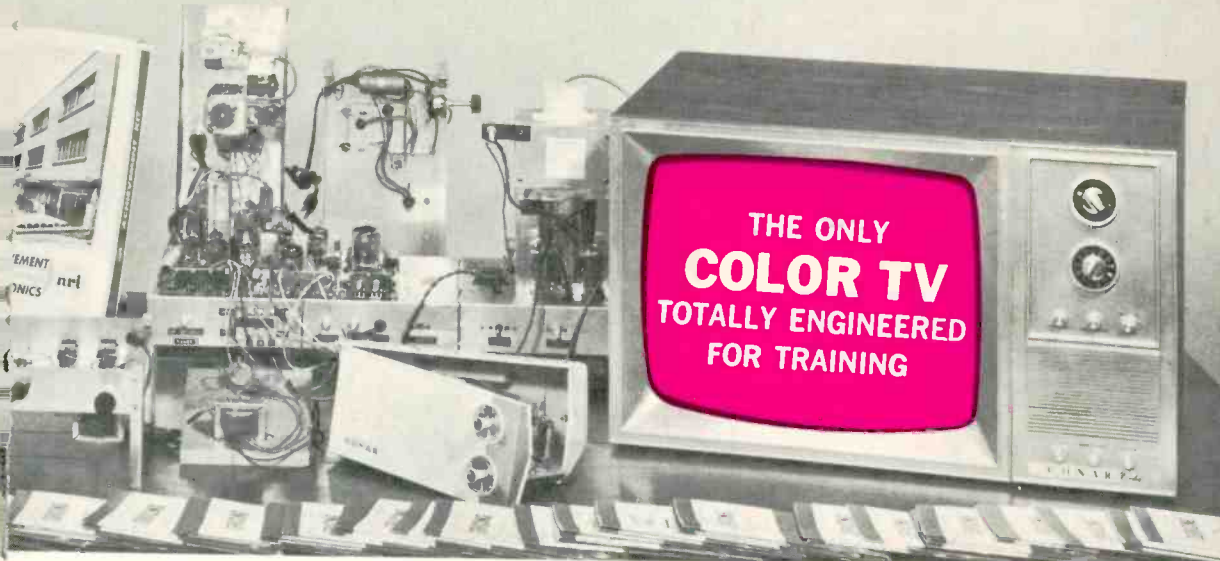
47166

RAMSEY IN
MUEB WENNING

enna
nter

46617 200 710012 000 71900

All this is yours—from the NRI Achievement Kit to new Color TV—when you enroll for NRI's TV-Radio Servicing course. Other courses just as complete. Mail postage-free card.



NRI PROFESSIONAL LAB EQUIPMENT MAKES TRAINING AT HOME IN ELECTRONICS FAST AND FASCINATING

The NRI pioneering "discovery" method of home study is the result of more than half a century of simplifying, organizing, dramatizing subject matter. In each of NRI's major courses you learn by *doing*, demonstrating theory you read in "bite-size" texts programmed with designed-for-learning professional lab equipment. Electronics comes alive in a unique, easy-to-understand, fascinating way, as you learn with your hands as well as your head.

Experience Is Still the Best Teacher

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 the way you learn at home with NRI. You build with professional components. You introduce defects into circuits. You do experi-

ments. The "why" of circuitry and equipment operation comes clear through demonstration. You gain experience with transistors and solid-state designs as well as conventional tube circuits. Everything about NRI training has one ultimate goal—to make you *employable* in Electronics by giving you practical understanding of circuits—the equivalent of months, even years, of on-the-job training.

Train with the Leader

There is no end of opportunity for the trained man in Electronics. You can earn extra money in spare time, have your own full-time business, or qualify quickly for career positions in business, industry, government. Discover the ease and excitement of training at home with the leader—NRI. Mail the postage-free card today for the new NRI Color Catalog. No obligation, no salesman will call. NATIONAL RADIO INSTITUTE, Electronics Div., Washington, D.C. 20016.

NRI has trained more men for Electronics than any other school



RONALD L. WOOD, Fargo, N.D., holds a First Class FCC License and is employed as a studio and master control engineer/technician with station KXJB-TV. He wrote to NRI to say, "Many thanks to NRI for the Electronics training I have received."

GORDON M. DALE, Dunville, Ont., Canada, reports spare-time earnings of \$2000 a year following completion of the NRI TV-Radio Servicing course. "I do this as a sideline to a permanent job," says Mr. Dale, "but am contemplating going into Color TV Sales and Service. I like the NRI course very much."



BERNARD SMOLKOVICH, Ft. Knox, Kentucky, is a Staff Sgt. with the U.S.A. Armor & Engineering Board. "Thanks largely to the NRI diploma I hold, I am a very successful and upcoming Communications Technician. My thanks to your fine staff for their unfailing assistance during my course."

JOHN H. EUBANK, Fayetteville, N.C., reports that NRI has prepared him for a position as Electronics Systems Inspector with IBM. "IBM places a high value on the merits of NRI training. Their technicians seem especially impressed with NRI training kits." Mr. Eubank easily passed the IBM examination.



Pick your field of ELECTRONICS

Now NRI offers you 12 ways to train at home in spare time

Any training—if it is to be worth your time and money—must give you the knowledge and the skills you seek, the knowledge and the skills employers want. That's why NRI puts emphasis on providing a *choice* of carefully developed training plans in Electronics. NRI now offers you 12 ways to train at home . . . 12 ways to meet the challenge of today's job market by training with NRI for a career in Electronics, for part-time

earnings, or simply for developing a new, fascinating hobby. The proof of the quality of NRI training plans is in its record of tens of thousands of successful graduates and the reputation NRI holds throughout the Electronics industry. Move ahead now in this exciting, growing field. Select the training plans of most interest to you and mail the postage-free card. NATIONAL RADIO INSTITUTE, Electronics Division, Washington, D. C. 20016.



TELEVISION-RADIO SERVICING

Learn to fix all TV sets. Course includes your choice of black-and-white or Color TV training equipment. Also learn to fix radios, stereo, hi-fi, etc. A profitable field full or part-time.

ADVANCED COLOR TV

For men who know black & white TV circuitry. 18 lessons, 50 experiments cover all circuits including set-up, alignment. Only Color course with equipment specifically designed for training. End product is your own set.

INDUSTRIAL-MILITARY ELECTRONICS

From basic principles to computers. Comprehensive training teaches fundamentals, then takes you into such modern-day miracles as servos, telemetry, multi-plexing, phase circuitry, others.

COMPLETE COMMUNICATIONS*

Teaches and provides actual practice in operation, service, maintenance of AM, FM, and TV broadcasting stations. Also covers marine, aviation, mobile radio, facsimile, microwave, radar.

FCC LICENSE*

Prepares you for First Class FCC Radiotelephone License exams. You begin with fundamentals, advance to required subjects covering equipment, procedures.

MATH FOR ELECTRONICS

A brief course for engineers and technicians who need a quick review of essential math used in industry, communications, government. Basic arithmetic review, short-cut formulas, modern digital number systems, much more.



BASIC ELECTRONICS

A concise course in Electronic terminology and components. A wealth of useful information to help you better understand the field. For anyone who wants a basic understanding of Radio-TV Electronics.

ELECTRONICS FOR AUTOMATION

Not for beginners, but for men with some knowledge of Electronics who want an understanding of process control, ultrasonics, telemetering and remote control, electromechanical measurements, other subjects.

AVIATION COMMUNICATIONS*

Prepares you to install, maintain, service direction finders, ranges, markers, Loran, Shoran, Radar, landing systems. Earn your FCC License with Radar Endorsement.

MARINE COMMUNICATIONS*

Covers transmitters, direction finders, depth indicators. Radar, Sonar, other equipment on commercial ships, pleasure boats. Prepares for FCC License with Radar Endorsement.

MOBILE COMMUNICATIONS*

Learn to install and maintain mobile transmitters and receivers used by police and fire departments, public utilities, construction firms, taxis, etc. Prepares for FCC License.

ELECTRICAL APPLIANCE REPAIR

Prepares you quickly to repair all types of appliances, including air conditioning, refrigeration, small gasoline engines. An easy, practical course leading to profitable part-time or full-time business of your own.

* NOTE: You must pass your FCC License exam (any Communications course) or NRI refunds in full the tuition you have paid.

Over 50 Years of Leadership in Electronics Training

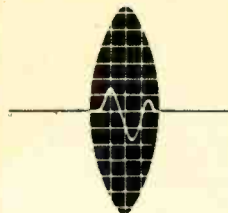


ELECTRONICS ILLUSTRATED

JANUARY, 1968

A Fawcett Publication

Vol. 11, No. 1



AMATEUR RADIO

Lunchbox Ham Station	Len Buckwalter, K10DH	57
25 Major Cities Award for Hams & SWLs		63
The Ham Shack	Wayne Green, W2NSD/1	77
Incentive Licensing is Back!	Malcom Bliss	82
6-Bit Ground-Plane	Stephen E. Maziarz	106

CITIZENS BAND

CB Nightmare in Indiana	Robert M. Brown, KOD2239	46
CB Corner: Onward and Upward with the Pros	Len Buckwalter, KQA5012	100
Walkie-Talkies' Rocky Road to 50 mc	Robert Long	102

AUDIO & HI-FI

AM-FM Cartridge for Tape Players		62
Bedroom Stereo Control Center	Walter G. Salm	67
Hi-Fi Today: Dropping the Bombs	John Milder	72
EI Tests the Popular Audio Tapes	Robert Angus	93

SHORT-WAVE LISTENING

Learn a Language Via Short Wave	Arthur S. Cookfair	33
Eavesdrop on Military Planes	Charles Green, W6FFQ	41
25 Major Cities Award for Hams & SWLs		63
The Listener: Logging the Yemen Conflict	C. M. Stanbury II	86
Eavesdropping on Big Brother	Tom Kneitel, K2AES	90
Notes From EI's DX Club		110

SURVEILLANCE ELECTRONICS

Build Your Own Bug	Walt Henry	29
--------------------------	------------	----

ELECTRONICS FOR THE HOME

Pinch-Penny Stroboscope	Rufus P. Turner	70
-------------------------------	-----------------	----

ELECTRONIC MUSICAL INSTRUMENTS

Electronic Voicing for Wind Instruments	Alan R. Surpin	38
---	----------------	----

AVIATION & SPACE

The Latest on DXing Apollo		104
----------------------------------	--	-----

CONSUMER ELECTRONICS

Those Cheapie Walkie-Talkies	E. L. Garrett	73
------------------------------------	---------------	----

YOUR CAREER

A Career at the Service Bench for You?	Art Margolis	87
--	--------------	----

YOUR LIBRARY

Broadsides		21
Good Reading	Tim Cartwright	56

NEW PRODUCTS

Electronic Marketplace		24
Electronics in the News		114

KIT REPORT

FET Stereo Tuner		84
------------------------	--	----

HOBBY & BUSINESS OPPORTUNITIES

Swap Shop		111
Classified Ads		120

REGULAR FEATURES

Feedback	6	Over & Out	Rodrigues	112
1967 Index	116	Subscription Blank		122
Uncle Tom's Corner		Tom Kneitel, K2AES/KQD4552		8

Audit Bureau of Circulations



MEMBERSHIPS

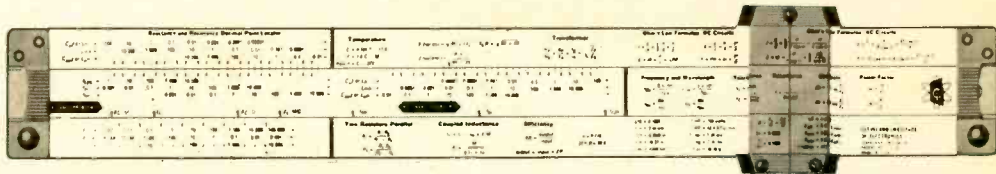


Magazine Publishers Association, Inc.



COVER — Ektachrome by John Capotosto. Schematic by Aubrey Kochman. Figures by Edward Appleby. Newport pack by P. Lorillard Co.

IN ELECTRONICS AND ELECTRICITY THIS AMAZING NEW SLIDE RULE SEPARATES THE MEN FROM THE BOYS!



LOOK WHAT YOU GET...

YOU GET... a patented*, high-quality, all-metal 10" electronics slide rule. "Your computer in a case". Has special scales for solving sticky reactance and resonance problems... an exclusive "fast-finder" decimal point locator... widely-used electronics formulas and conversion factors. PLUS... all the standard scales you need for non-electronic computations such as multiplication, division, square roots, logs, etc.

YOU GET... a complete, "AUTO-PROGRAMMED" self-tutoring instruction course. Four fast-moving lessons with hundreds of easy-to-understand examples and diagrams. You'll learn how to find quick, accurate answers to complex electronics problems... soon be your outfit's slide rule "expert". Free examination and consultation service if you want it plus a Graduation Certificate! **THIS COURSE ALONE IS WORTH FAR MORE THAN THE PRICE OF THE COMPLETE PACKAGE!**

YOU GET... a sturdy, handsome carrying case. It's made of genuine top-grain leather, doubly reinforced at the "wear-spots", features heavy duty liner for extra slide rule protection, has a removable belt loop for convenient carrying. "Quick-Flip" cover makes it easy to get your rule in and out of the case. Stamps you as a real "pro" in electronics.

**A \$50.00 VALUE FOR LESS
THAN \$25.00!**

*Under U. S. Patent #3,120,342

NOW... take full advantage of what you know about electronics and electricity... solve complex problems in seconds while others plod along the old-fashioned "pad and pencil" way!

READ WHY OTHERS CALL THIS REMARKABLE NEW SLIDE RULE PACKAGE TODAY'S BIGGEST BARGAIN IN ELECTRONICS.

The Editor of Popular Electronics, Mr. Oliver P. Ferrell says:
"Why didn't someone think of this before. The convenience of having all relevant formulas imprinted right on the slide rule saved me time the very first day!"

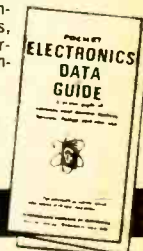
A student, Mr. Jack Stegleman says:
"Excellent, I couldn't say more for it. I have another higher-priced rule but like the CIE rule much better because it's a lot easier to use."

The Head of the Electrical Technology Dept., New York City Community College, Mr. Joseph J. DeFrance says:
"I was very intrigued by the 'quickie' electronics problem solutions. Your slide rule is a natural!"

SPECIAL BONUS OFFER:

ANYONE WHO SENDS IN THIS COUPON WILL RECEIVE, ABSOLUTELY FREE, A HANDY POCKET ELECTRONICS DATA GUIDE.

It's a useful, pocket-sized electronics "encyclopedia"... jam-full of valuable facts, formulas and other helpful information. Carry it with you... when it comes to electronics, you'll be the "man-with-the-answer"!



Cleveland Institute of Electronics

Dept. EI-119, 1776 E. 17th St., Cleve. Ohio 44114

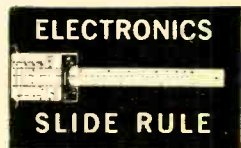
ACT NOW! SEND SPECIAL "NO-RISK" COUPON TODAY!

CIE Cleveland Institute of Electronics
1776 E. 17th Street, Dept. EI-119, Cleveland, Ohio 44114

Please send FREE illustrated Slide Rule Booklet and FREE Pocket Electronics Data Guide.

NAME _____ (Please Print)
ADDRESS _____ COUNTY _____
CITY _____ STATE _____ ZIP _____

A leader in Electronics Training... since 1934



**GET
BOTH FREE!**

Weller®

...the soldering tools
professionals depend on



The original Dual Heat Soldering Guns

Preferred by technicians for their fast heating copper tips, exclusive trigger-controlled dual heat, and high soldering efficiency. Available in 3 watt-age sizes, each with spotlight.

100/140-watt Model 8200, 145/210-watt Model D-440, and 240/325-watt Model D-550. Also in complete kits:

- Model 8200PK includes 100/140 watt gun, extra tips, tip-changing wrench, flux brush, soldering aid and solder
- Model D-550PK heavy-duty 240/325 watt gun kit with soldering, cutting and smoothing tips, wrench and solder

Dependable MARKSMAN Irons in a size for every job



Ideal for deep chassis work and continuous-duty soldering, Marksman irons outperform others of comparable size and weight. All five feature long-reach stainless steel barrels and replaceable tips.

- 25-watt, 1 1/4-oz. Model SP-23 with 1/8" tip (In kit with extra tips, soldering aid, solder—Model SP-23K)
- 40-watt, 2-oz. Model SP-40 with 1/4" tip
- 80-watt, 4-oz. Model SP-80 with 3/8" tip
- 120-watt, 10-oz. Model SP-120 with 1/2" tip
- 175-watt, 16-oz. Model SP-175 with 5/8" tip

NOW a BATTERY OPERATED IRON for field servicing

Use this lightweight service tool for automotive wiring, model planes, or mobile communications. Works from any 12 volt battery or 12-14 volt AC/DC supply. Supplied complete with long-life patented "Temperature Sensing" tip, 12-ft. power cord and terminal clips. Model TCP-12—12 volt; Model TCP-24—24-28 volts.



Complete Weller Line includes replacement tips and solder at your Electronic Parts Distributor

WELLER ELECTRIC CORPORATION, Easton, Pa.
WORLD LEADER IN SOLDERING TECHNOLOGY

ELECTRONICS ILLUSTRATED

By the Publishers of MECHANIC ILLUSTRATED

editor **ROBERT G. BEASON**
managing editor **Robert D. Freed**
feature editor **Robert Long**
art editor **Lou Rubsamen**
editorial associate **Alan R. Surpin**
production editor **Rosanne Walsh**
advertising mgr. **John F. Webster**

CONTRIBUTING EDITORS

amateur radio **Wayne Green, W2NSD/1**
citizens band **Len Buckwalter, KQA5102**
swi-dx **C. M. Stanbury II**
special projects **Herb Friedman, W2ZLF/KBI9457**
audio **Harry Kolbe**
audio **John Milder**

EXECUTIVE STAFF

president **W. H. Fawcett, Jr.**
general manager **Roger Fawcett**
secretary-treasurer **Gordon Fawcett**
circulation director **Roscoe K. Fawcett**
asst. general manager **Donald P. Hanson**
vp., magazine div. **George H. Allen**
vice president **Ralph Daigh**
production director **R. Bruce Besten**
art directors **Al Allard, Ralph Mattison**

ELECTRONICS ILLUSTRATED is published bi-monthly by Fawcett Publications, Inc., Fawcett Bldg., Greenwich, Conn. 06830. Second-class postage paid at Greenwich, Conn., and at additional mailing offices.

EDITORIAL OFFICES: 67 W. 44th St., New York, N.Y. 10036 (phone 212-661-4000). Contributions must be accompanied by sufficient postage and will be handled with care, though the publishers assume no responsibility for return thereof.

ADVERTISING OFFICES: 67 W. 44th St., New York, N.Y. 10036 (phone 212-661-4000); 101 E. Ontario St., Chicago, Ill. 60611 (phone 312-DE 7-4680); 1532 Guardian Bldg., Detroit, Mich. 48226 (phone 313-WO 2-4860); 2978 Wilshire Blvd., Los Angeles, Calif. 90005 (phone 213-DU 7-8258); 681 Market St., San Francisco, Calif. 94105 (phone 415-EK 7-3441); 1430 W. Peachtree St., N.W., Atlanta, Ga. 30309 (phone 404-TR 5-0373); James B. Boynton, 370 Tesquesta Dr., Jupiter, Fla. 33458 (phone 305-746-4847); 123 S. Broad St., Philadelphia, Pa. 19109 (phone 215-PE 5-3636).

SUBSCRIPTIONS: \$3 per year (6 issues) in U.S. and possessions and Canada. All other countries \$4 for 6 issues. All subscription correspondence, including changes of address (Form 3579), should be addressed to **ELECTRONICS ILLUSTRATED**, Subscription Dept., Fawcett Bldg., Greenwich, Conn. 06830. Foreign subscriptions and sales should be remitted by International Money Order in U.S. funds payable at Greenwich, Conn.

COPYRIGHT © 1967 by Fawcett Publications, Inc. The title **ELECTRONICS ILLUSTRATED** is registered in the U.S. Patent Office. Reproduction in whole or in part is forbidden without written permission of the publishers; however, permission is hereby granted to quote from this issue of this magazine on radio or television, provided a total of not more than 1,000 words is quoted and credit is given to the title of this magazine and issue, as well as the statement, copyright 1967, by Fawcett Publications, Inc.

PRINTED IN U.S.A. BY FAWCETT-HAYNES PRINTING CORP., LOUISVILLE, KY. 40201. Microfilm copies of current and back issues are available from University Microfilms, 313 N. First St., Ann Arbor, Mich. 48103.



A SUBSIDIARY OF  BELL-HOWELL

SEE WHY so many DeVry-trained Men Step Into Electronics Jobs the Day after Graduation!

EVERY GRADUATE CAN ALSO RECEIVE EMPLOYMENT HELP THROUGH HIS ENTIRE CAREER, AT NO ADDED COST

DeVry's greatest claim to fame is the progress of its graduates. Our aim is to prepare a man so thoroughly that we can recommend him to employers . . . ready to step into a job the day after graduation. If we expect to continue to help employers, our graduates have to be good! That is why we provide top quality instruction—followed by career-long employment service at no added cost.

DeVry's educational programs are designed to prepare men 17-45 in their spare time at home or in any of our three well-equipped, modern resident schools in Chicago, Phoenix or Canada. Why not fill in and mail coupon for free facts today?

Approved for Veterans.

For FREE Information

Lack of technical experience is no barrier to the man who wants to prepare for a career in ELECTRONICS. Send coupon for two FREE booklets and find out why.



DeVRY INSTITUTE of TECHNOLOGY 4141 Belmont Avenue, Chicago, Ill. 60641, Dept. EI-1-Y

Please give me your two free booklets, "Pocket Guide to Real Earnings," and "Electronics in Space Travel"; also include details on how to prepare for a career in Electronics. I am interested in the following opportunity fields (check one or more):

- | | |
|--|---|
| <input type="checkbox"/> Space & Missile Electronics | <input type="checkbox"/> Communications |
| <input type="checkbox"/> Television and Radio | <input type="checkbox"/> Computers |
| <input type="checkbox"/> Microwaves | <input type="checkbox"/> Broadcasting |
| <input type="checkbox"/> Radar | <input type="checkbox"/> Industrial Electronics |
| <input type="checkbox"/> Automation Electronics | <input type="checkbox"/> Electronic Control |

Name _____ Age _____

Address _____ Apt. _____

City _____ State or Province _____ Zone or Zip Code _____

Check here if you are under 16 years of age.

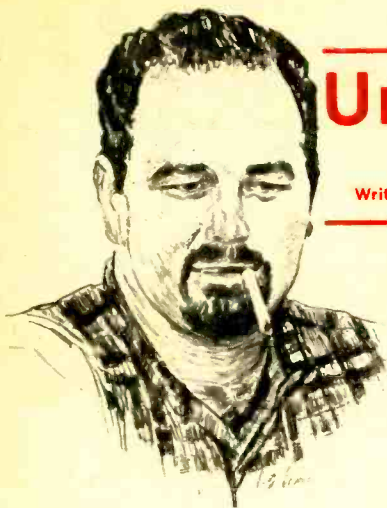
**HOME STUDY AND RESIDENT SCHOOL PROGRAMS
AVAILABLE IN CANADA. SEND FOR DETAILS.**

2106

Accredited Member of National Home Study Council

DeVRY INSTITUTE OF TECHNOLOGY
4141 BELMONT AVENUE, CHICAGO, ILLINOIS 60641

January, 1968



Uncle Tom's Corner

By Tom Kneitel, K2AES/KQD4552

Uncle Tom answers his most interesting letters in this column.
Write him at Electronics Illustrated, 67 West 44th St., New York, N.Y. 10036.

★ *Recently I took a loud hi-fi amplifier and made it even louder with a preamp. Trouble is that now I get a lot of hum and distortion at high volume levels. I've used shielded leads and even reversed the AC plug—but to no avail. It also distorts at high volume levels (even when the preamp volume is turned down). What can I do?*

Steve Glowinski
Kenilworth, N.J.

Sounds like you're overloading the preamp input with a high-level cartridge. You'll never get much until you understand the difference between quality and volume.

Query Dept. One year ago, FCC Chairman Rosel Hyde stated that "eight reports involving possible violation of Section 15.11, Prohibition Against Eavesdropping, were investigated since the new rules became effective April 8, 1966. Most violations were apparently made in an effort to obtain evidence for domestic-relations proceedings." A few months later, the FCC said that the information on the possible violations was confidential.

Six months ago, after the Freedom of Information Law went into effect, the FCC was asked to disclose details of these eight cases; they still declined, stating that "the reports . . . are considered to be internal working papers and are not required to be released to the public . . ."

If, indeed, these were only domestic-relations cases, why were they not disclosed and the violators prosecuted?

After so much time and effort went into passing anti-bugging laws the best the FCC was able to do was to turn up only eight

possible violations—and these apparently centered around errant husbands and wives? What happened to organized crime's use of bugs? What about illegal uses in industry and government?

Sen. John McClellan, head of the Senate Subcommittee on Criminal Laws and Procedure, is probing into the bugging business. He already has told his committee about these goings-on. He has photostatic copies of the FCC's mysterious denials in the investigative transcript and says he's going to reveal the whole thing.

Is a full-scale investigation of some arbitrary FCC practices in the wind?

★ *Did you ever hear of a substance known as DZ? What is it and what's such a big secret about it?*

Wardell Melwin
Frankfort, Ky.

DZ is one of the newest tools of our military's CBW (Chemical and Biological Warfare) effort. An incapacitating gas made from LSD, DZ has been a source of great frustration since experiments with it have failed to produce desired effects. Although rumors about DZ are constantly trickling out of Ft. Detrick, Md., CBW's test site, it's still considered a top secret. By the way, we are now spending well over \$250 million per year on CBW research. Other CBW experiments include Sarin and VX, both colorless, odorless and tasteless nerve gases; HD, a mustard gas; DM which produces violent nausea and gastric effects; and CN/CS riot control agents, which are souped-up tear gases. CS is ten times stronger than CN.

★ *I have been reading your column for about two years and nothing in it has ever offended me. Could you insult me in print or something?*

Mort Salter
Washington, D.C.

Sorry, you're not important enough.

[Continued on page 10]

EICO Makes It Possible

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



Cortina Stereo

Engineering excellence, 100% capability, striking esthetics, the industry's only **TOTAL PERFORMANCE STEREO** at lowest cost.

A Silicon Solid-State 70 Watt Stereo Amplifier for \$89.95 kit, \$129.95 wired, including cabinet. Cortina 3070.

A Solid-State FM Stereo Tuner for \$89.95 kit, \$129.95 wired, including cabinet. Cortina 3200.

A 70-Watt Solid-State FM Stereo Receiver for \$159.95 kit, \$239.95 wired, including cabinet. Cortina 3570.



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.



Electronic Siren \$4.95, Burglar Alarm \$6.95, Fire Alarm \$6.95, Intercom \$3.95, Audio Power Amplifier \$4.95, Metronome \$3.95, Tremolo \$8.95, Light Flasher \$3.95, Electronic "Mystifier" \$4.95, Photo Cell Nite Lite \$4.95, Power Supply \$7.95, Code Oscillator \$2.50, FM Wireless Mike \$9.95, AM Wireless Mike \$9.95, Electronic VOX \$7.95, FM Radio \$9.95, AM Radio \$7.95, Electronic Bongos \$7.95.



Two years ahead! Model 7923

All Solid-State 23-Channel 5W Transceiver. 4 exclusives: dual-crystal lattice filter for razor-sharp selectivity; efficient up-converter frequency synthesizer for advanced stability; precision series-mode fundamental crystals; Small: only 3"H, 8"W, 8 1/4"D. \$189.95 wired only.

The best buy in tube-type CB—"Sentinel-Pro" 23-channel dual conversion 5W Transceiver \$169.95 wired only.

Citizen's Band

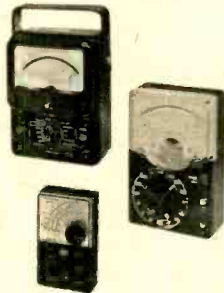


EICO Trans/Match (Model 715) is a professional test set designed for complete checking of ham and CB equipment. Kit \$34.95; Wired \$49.95.

Truohm

Professional Portable Multimeters by EICO. The industry's greatest V-O-M values. Designed, made to Eico's high standards of professionalism. Each complete with batteries & test leads. Backed 100% by famous EICO warranty.

- Model 100A4, 100,000 Ω /V, \$34.95.
- Model 30A4, 30,000 Ω /V, \$19.95.
- Model 30A3, 30,000 Ω /V, \$15.95.
- Model 20A3, 20,000 Ω /V, \$12.95.
- Model 4A3, 4,000 Ω /V, \$8.95.
- Model 1A1, 1,000 Ω /V, \$5.95.

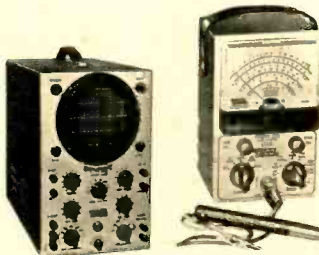


Automotive

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; \$44.95 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. \$109.95 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.* \$29.95 kit, \$49.95 wired.

FREE 1968 CATALOG

EICO Electronic Instrument Co., Inc.
131-01 39th Ave., Flushing, N. Y. 11352

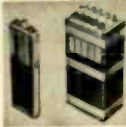
Send me FREE catalog describing the full EICO line of 200 best buys, and name of nearest dealer.

Name _____
Address _____
City _____
State _____ Zip _____

UNUSUAL BARGAINS

EXCELLENT XMAS GIFTS!

NICKEL-CADMIUM BATTERY BARGAINS



Terrific value—used government surplus. Quick-charge, lightweight 6-volt nickel-cadmium battery, 4-amp. hour capacity. Almost unlimited life—thousands of discharge-charge cycles with minute deterioration. Charges fully in approx. 1 hr. with Edmund Charger Kit. Hundreds of uses for hobby, photography, model building, industry, etc. Only few drops of water yearly for full maintenance. Req. minimum of electrolyte-sealed to prevent loss. Delivers nearly 100% output at below freezing. Maintains constant voltage through major portion of capacity. Five vented 1.2 volt cells strapped in a polypropylene bands. 3 1/2" x 2" x 6". (10 & "Jumbo" 275 Ampere Hour Batteries also available. Write for info.)
 Stock No. 70,942EB.....\$15.00 Ppd.
 ONE NEW 1.2 VOLT NICKEL-CADMIUM CELL.....\$ 3.95 Ppd.
 Stock No. 40,798EB.....\$ 3.95 Ppd.
 CHARGER KIT FOR 6-VOLT BATTERY.....\$ 8.00 Ppd.
 Stock No. 70,807EB.....\$ 8.00 Ppd.

GIANT WEATHER BALLOONS



"Balls of fun" for kids, traffic stoppers for stores, terrific for amateur meteorologists. Create a neighborhood sensation. Great backyard fun. Exciting beach attraction. Made of heavy duty neoprene. Inflate with vacuum cleaner or auto air hose; or locally available helium for high rise.
 Stock No. 60,968EB... (8' diam.)...\$2.00 Ppd.
 Stock No. 60,632EB... (16' diam.)...\$7.00 Ppd.

Order by Stock No.—Check or M.O.—Money-Back Guarantee
**EDMUND SCIENTIFIC CO., 300 EDSORP BUILDING
 BARRINGTON, NEW JERSEY 08007**

MAIL COUPON FOR FREE CATALOG

SEND FOR FREE CATALOG "EB"

EDMUND SCIENTIFIC CO. 300 EDSORP BUILDING, BARRINGTON, N.J. 08007

Completely new 1988 edition. New items, categories, illustrations. Dozens of electrical and electromagnet parts, accessories. Enormous selection of Astronomical Telescopes, Microscopes, Binoculars, Magnifiers, Magnets, Lenses, Prisms. Many war surplus items for hobbyists, experimenters, workshop, factory. Mail coupon for catalog "EB."



NAME _____
 ADDRESS _____
 CITY _____ STATE _____ ZIP _____

LEARN COMPUTING AT HOME!

Now you can learn the computer programming profession at home without leaving your job. No math or technical training needed.

Industry and government desperately need 50,000 programmers. In less than a year you can be trained to fill a \$7,000 starting position. In three years you can earn \$10,000 a year... or even more!

Yes, computer programming is a way to move ahead fast. You can become an in-demand professional programmer with just a few hours of home study a week. Mail the coupon today for full details.

FREE BOOK TELLS ALL

Computer Usage Education, Dept. 506
 51 Madison Avenue, New York, N. Y. 10010
 Send me full information about learning computer programming at home.

PRINT
 NAME _____
 ADDRESS _____
 CITY _____
 STATE _____ ZIP _____

★ Can you identify stations calling themselves Surfboard 13 and 14 which I hear in the 5-mc band?

Phil Raczka
 South Euclid, Ohio

Where are stations that identify as Two Gun, Trust Fund, River-River, Noah's Ark, Magic Carpet?

John Shoptaw
 Morehouse, Mo.

The following stations were heard at about 11.2 mc: Ocean One, F-24, and Outway. Who and what are they?

David Jones
 Albany, Ga.

Whoa! Stations using these tactical call-signs number into the thousands. Operated by military units, they are located aboard ships, aircraft, tanks and even Jeeps. There is no callbook of these stations since the names they use are changed on a regular basis to maintain secrecy. Only the land-based stations seem to retain their calls. DXers sometimes can figure out the identity of specific stations by intensive monitoring and fitting together scraps of information from their transmissions. Recently-identified tactical stations are: Toreador in San Francisco and Butterfield in San Diego. These are operated by NORAD (North American Air Defense Command) on 8796.5, 12338, and 17335 kc.

★ At a used ham-gear auction I picked up a 6-meter rig that bears only the trade name Black Widow. Although it works like a charm it looks hideous. But it causes all manner of comments. Most people offer to buy it from me. Ever hear of it?

Burley Watkins
 Tulsa, Okla.

Black Widow VHF gear is almost legendary. It appeared from California, almost mysteriously, in the mid-1950s, and won instant popularity with earnest VHF operators because of its outstanding performance. Its source was never fully explained. Nor was its circuitry or even the type numbers of some of the tubes. Ugly and hand-made looking, it was seldom advertised, difficult to purchase and vanished from the market around 1960, as suddenly and strangely as it had first appeared. Don't sell it, it's a real collector's item.

[Continued on page 12]

The
PERFECT 36

BOLD...REVOLUTIONARY

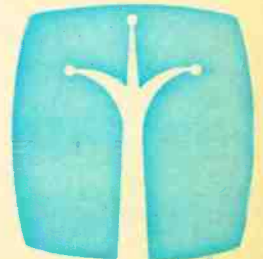


The PERFECT 36 is a citizen's band breakthrough by Shakespeare's internationally famous engineer-designers. The easily installed, performance-shaped, 36-inch fiberglass roof-top mobile antenna has rugged solid-state construction and handsome rocketry design. And our patented parallel fiber process completely encloses this ultra-sensitive, space-age circuitry in a power-pack unit providing the maximum performance and range-expansion which "turns country miles into city blocks." Fiberglass perma-durability eliminates problems caused in other antennas by moisture, rain, dust, salt air, extreme cold, vibrations, abrasions, and other physical hazards. Fiberglass' flex-strength inhibits "set" damage on impact with doors, frames, low limbs, etc., insuring that our non-corrosive, anti-static antenna never gets "out of tune." In bringing this bold, new shape to the market, we made no compromise between performance and structural make-up. With The PERFECT 36 we have created tomorrow's finest antenna today.



...count on Shakespeare
 GLASS FIBER
WONDERSHAFT ANTENNAS

C/P Corporation A Subsidiary of Shakespeare
 RFD 3 Columbia, S. C. 29205



★ *I have obtained an Army-surplus BC-244-D receiver for radio astronomy work on 1296 mc. My friends tell me that this World War II veteran is totally useless for this purpose. What do you say?*

*Jan Tarsala, WN6VRN
Monterey Park, Calif.*

With a little luck and patience you might hear Earth.

Inside Dept. Watch for apartment houses in large cities to begin banning electric guitars because of tenant complaints. It's already starting in New York . . . A home color-TV tape recorder is in the works. Costing \$1,250, it will tape a full-length color film on \$20 worth of regular 1/4-in. recording tape . . . Scientists in Houston are working on a plan to harness and use electricity from hurricanes, estimated to be about 16 trillion kwh per day . . . Our military intelligence people have a tape recording of Israeli pilots talking about the American flag flying on the USS Liberty shortly before they attacked the ship. Reason we had the ship in such dangerous waters was to eavesdrop on both Arab and Israeli high-security radio

transmissions which were being sent with highly directional beam antennas.

★ *Recently I was given an old Atwater Kent Model 55 (from the late 1920s). It's in rather good condition but two of the tubes are missing. Since I'd like to put it into working condition could you give me any information on the set?*

*Al Kuntzler III
Atlanta, Ga.*

The tube line-up for the 55 is: two type 24As, two 27s, two 45s running push-pull in the audio and an 80 in the power supply. Somewhere in Atlanta there must be an old radio shop that has these tube types gathering dust in the basement. Or try EI's Swap Shop column.

Thanks Dept. I want to thank the EI reader in Dallas who cut my picture from the head of this column and sent it to the FBI. Seems I bear a striking resemblance to a guy on their top-ten wanted list, being sought for murder and arson. The FBI

[Continued on page 14]

EARN A KING-SIZE PAY CHECK AS A COLOR TV SERVICE SPECIALIST!



BUILD AND KEEP THIS BIG SCREEN COLOR TV RECEIVER!

Money, skill and experience come fast with CTI training. You learn by doing! CTI provides you with more than just lessons. As part of your training you build an ultra-modern Big Screen Color TV Receiver (as illustrated above)—and you keep it! Plus parts, kits, tools—everything you need to become a highly paid color TV technician. Get the facts that can put more money in your pockets—fast! Use the coupon to send for the free CTI book—TODAY!

New Color TV Training Program Puts You in The BIG MONEY LEAGUE!

8,000,000 color sets in use in 1967. About 70-million regular black and white TV sets. That's a conservative estimate by the television industry. It should give you an idea of the urgent demand for trained TV technicians. Now is the time to get in on the ground floor and reap the rewards—higher pay, wider range of top-money job opportunities and greater job security.

APPROVED FOR GI TRAINING If you served since January 31, 1955 or are in service, check GI line in coupon

COMMERCIAL TRADES INSTITUTE—Dept. EI-168
1400 Greenleaf, Chicago, Illinois 60626

Please send me all the facts on **COLOR TV Servicing.**

Name _____ Age _____

Address _____ Phone _____

City _____ County _____

State _____ Zip Code _____

Check for facts on GI Bill

CTI specializes in training men in 4 other high-paying fields. Check one for free information.

- Automation Electronics
- Air Conditioning, Refrigeration & Heating
- Modern Auto Mechanics
- Building Construction

BULL 20 RADIO

Reg. U. S. Pat. Off.

CIRCUITS AT HOME
with the New Improved
PROGRESSIVE RADIO "EDU-KIT"®

only
\$26.95



Training Electronics Technicians Since 1946

A Practical Home Radio Course

Now Includes

- ★ 12 RECEIVERS
- ★ 3 TRANSMITTERS
- ★ 50. WAVE GENERATOR
- ★ SIGNAL TRACER
- ★ AMPLIFIER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ EXCELLENT BACKGROUND FOR TV
- ★ **SCHOOL INQUIRIES INVITED**

★ Sold in 79 Countries

**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 in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis. You will learn the basic principles of radio. You will construct, study and work with 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, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying, instructional material.

You will receive 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 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.

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 capacitors, 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 professional electric soldering iron, and a self-powered Dynamic Radio and Electronics 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 servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High 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.

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.

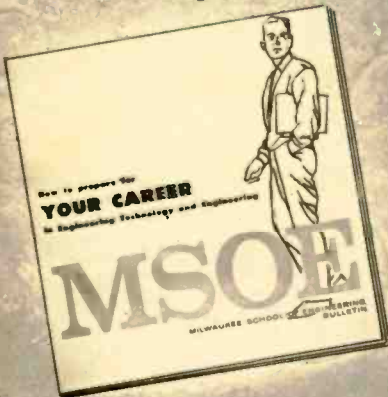
UNCONDITIONAL MONEY-BACK GUARANTEE

- 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 plus Radio & TV Parts Jackpot worth \$15.)
- 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 _____
City & State _____ Zip _____

PROGRESSIVE "EDU-KITS" INC.
1186 Broadway, Dept. 593AE, Hewlett, N. Y. 11557

Thinking of college and a space age career?



Send for this booklet on ENGINEERING TECHNOLOGY AND ENGINEERING

Learn how you can prepare for a dynamic career as an electrical or mechanical engineering technician or engineer in such exciting, growing fields as avionics, missiles, reliability control, fluid mechanics, data processing, metallurgy, microelectronics, and advanced aerospace research.

MSOE offers residence study programs leading to these degrees in engineering technology and engineering:

- 2 years — Associate in Applied Science
- 4 years — Bachelor of Science

Also get facts about scholarships and financial aids, job placement and other student services, plus photographs of MSOE technical laboratories and student activities. Courses approved for veteran training. For your copy, just mail the coupon — no obligation.

MSOE

Milwaukee, Wisconsin

EI-168

Milwaukee School of Engineering
Dept. EI-168, 1025 N. Milwaukee Street
Milwaukee, Wisconsin 53201

Please send the "Your Career" booklet.
I'm interested in

- Electrical fields Mechanical fields

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

Address.....

City..... State..... ZIP.....

people, although courteous, gave me a few white whiskers before they cleared me.

★ *About three years ago I took a flight that passed over northern Canada. Somewhere north of Hudson Bay there appeared in huge letters on the ground a totally outrageous and unprintable four-letter word. The flight crew told me it had been there for years but could offer no explanation. What's the story?*

*Peter Praag
New York, N.Y.*

An Air Force friend tells me that between 1950 and '52 a bored technician stationed at a U.S. radar installation left this monument that neither time nor government can eradicate. Using a bulldozer abandoned by the Air Force, he spent two years and great effort pushing boulders into this single word. It can still be seen from 10,000 ft. Government officials have exchanged memos full of circumlocutions (no Latin equivalent of the word exists) but failed to find a solution that wouldn't alert the press and embarrass everyone involved. So if life exists on other planets, this may be the first message received from us.

Horse's Mouth Dept. The people at Du Pont have sent me their booklet, *The Anatomy of a Rumor*, in answer to a couple letters in this column about the supposed toxic properties of Du Pont's Teflon at high temperatures. Here's the straight scoop as Du Pont presents it:

The most serious effect attributable to Teflon, even after 20 years of exhaustive testing, is something known as polymer-fume fever. It can occur only under special circumstances, particularly when a cigarette you are smoking contains particles of Teflon. The fever is much like a round of flu lasting from a few hours to a couple days and is without after-effects. In fact, it looks like the cigarette does you more harm than the Teflon.

Otherwise, the hazard of working with Teflon might be compared with that of paints or most common cooking oils. In industrial quantities (and only at advanced temperatures) Du Pont felt the hazard might possibly become appreciable—so they put a warning on the label. And that warning may have been what triggered the rumors in the first place.

★ *Here's a stumper I've asked many technicians. My answers run 50-50 yes and no. A power amplifier is feeding perhaps 100 or more 3.2-ohm speakers through coupling transformers (between output transformer and speaker) of approximately 90-ohm primary and 3.2-ohm secondary. If the terminals on the secondary side of one or more of the coupling units were shorted, would the extra load damage the amplifier?*

*Conrad Olson
Pueblo, Colo.*

I'm probably sticking my neck out but I'll go along with the no voters. It may lower the sound level or cause some distortion but nothing short of an open transformer will damage the amplifier. Tell you what, why not build the thing and try it out? If I'm wrong—well, sorry about that.

★ *For my 15th birthday my father gave me a pair of small German Army portable transceivers which he brought back from the last war. They look to be in good shape but the tubes are missing. The sockets are marked L63 and OSW3106 and the rigs operate on 100 mc. Can you tell me if there are any sources of 20-year-old foreign tubes, O great supplier of trivial facts?*

*Frank L. Howard
Bremerton, Wash.*

I suggest that you get a ham license and tune these rigs up in one of the ham bands before you find yourself the star attraction at the FCC's version of the Nuremberg trials. Forget trying to scratch up the German tubes, you'll find that good old Yank types 6J5 and 6V6 will do. But you may be able to shout farther than these sets will communicate.

★ *As part of my hobby of DXing on the TV bands I have tried but failed to photograph some of the distant stations I have seen. I know this is possible because I've seen such pictures in magazines. What's the secret?*

*Robert C. Bostick
Fresno, Calif.*

Adjust your TV image for soft contrast and set your camera shutter for 1/25 or 1/30 sec. If you use Tri-X film shoot at f-6.3. With either Verichrome Pan or Plus-X use f-3.5. For color pictures get daylight-type high-speed Ektachrome and use a lens opening of f-2 or f-2.8. It is necessary to use a Wratten 2B or Skylight filter when shooting in color to absorb ultraviolet radiation from the picture tube.

Now... the most enjoyable, most rewarding electronic kit project of your life



a Schober Electronic Organ!

HAD YOUR FILL of amplifier kits, receiver kits, meter kits, all the conventional kits? Then go to work on the biggest, most fascinating kit of them all—and end up with a finer musical instrument than you could buy for twice the price. The Schober Theatre Organ at left, for example, plus Schober's self-teaching music courses, lets you *participate* in music, not just listen to it. This is one electronic project the wife and kids will encourage—because it's for them, too! It contains the best components available—thousands of them—plus the kind of unmistakable, step-by-step instructions you've dreamed of and Schober is famous for.

The Theatre Organ (above), costs just \$1550 if you use your own amplifier and speaker system, and you can pay as you build to spread out the cost. There are three other Schober Organ models, too, starting at \$645. Each one includes every bit and piece you need, including a magnificent walnut console—unless you want to build your own woodwork and save even more. And each model has the kind of pipelike tonal variety you don't often find in electronic organs. The free Schober color catalog has lots of pictures and data; and for 25¢ we'll send you 72 pages of schematics and tech specs so you can see just what you're buying.

FREE INFORMATION AND DEMONSTRATION RECORDING
Send today for your free copy of Schober's 16-page, full color booklet, plus 7" free recording.

The Schober Organ Corp., Dept. EI-10
43 West 61st Street, New York, N. Y. 10023

- Please send me Schober Organ Catalog and free 7-inch "sample" record.
- Enclosed please find \$1.00 for 12-inch L.P. record of Schober Organ music.
- Enclosed is 25¢ for schematics and tech specs.

NAME

ADDRESS

CITY..... STATE..... ZIP NO.....

**10 Reasons why
RCA Home Training is
Your best
investment
for a rewarding
career
in electronics:**



Performing transistor experiments on programmed breadboard — using oscilloscope.

1 LEADER IN ELECTRONICS TRAINING

When you think of electronics, you immediately think of RCA...a name that stands for dependability, integrity and pioneering scientific advances. For over a half century, RCA Institutes, Inc., a service of Radio Corporation of America, has been a leader in technical training.

2 RCA AUTOTEXT TEACHES ELECTRONICS FASTER, EASIER, ALMOST AUTOMATICALLY

Beginner or refresher, AUTOTEXT, RCA Institutes' own method of programmed Home Training will help you learn electronics more quickly and with less effort, even if you've had trouble with conventional learning methods in the past.

3 THOUSANDS OF WELL PAID JOBS ARE NOW OPEN TO MEN SKILLED IN ELECTRONICS

RCA Institutes is doing something positive to help men with an interest in electronics to qualify for rewarding jobs in this fascinating field. Every year, literally thousands of high paying jobs in electronics go unfilled just because not enough men take the opportunity to train themselves for these openings.

4 WIDE CHOICE OF CAREER PROGRAMS

Start today on the electronics career of your choice. On the attached card is a list of "Career Programs", each of which starts with the amazing AUTOTEXT method of programmed instruction. Look the list over, pick the one best suited to you and check it off on the card.

5 SPECIALIZED ADVANCED TRAINING

For those already working in electronics or with previous training, RCA Institutes offers advanced courses. You can start on a higher level without wasting time on work you already know.

6 PERSONAL SUPERVISION THROUGHOUT

All during your program of home study, your training is supervised by RCA Institutes experts who become personally involved in your efforts and help you over any "rough spots" that may develop.

7 VARIETY OF KITS YOURS TO KEEP

To give practical application to your studies, a variety of valuable RCA Institutes engineered kits are included in your program. Each kit is complete in itself. You never have to take apart one piece to build another. At no extra cost, they're yours to keep and use on the job.

8 FROM RCA INSTITUTES ONLY - TRANSISTORIZED TV KIT, VALUABLE OSCILLOSCOPE

Those enrolled in RCA's television course or program receive complete transistorized TV Kit. All students receive a valuable oscilloscope—both at no extra cost and only from RCA Institutes.

9 UNIQUE TUITION PLAN

With RCA Home Training, you progress at the pace that is best for you! You only pay for lessons as you order them. You don't sign a long-term contract. There's no large down-payment to lose if you decide not to continue. You're never badgered for monthly

bills. Even if you decide to interrupt your training at any time, you don't pay a single cent more.

10 RCA INSTITUTES GRADUATES GET TOP RECOGNITION

Thousands of graduates of RCA Institutes are now working for leaders in the electronics field; many others have their own profitable businesses. This record is proof of the high quality of RCA Institutes' training.

CLASSROOM TRAINING ALSO AVAILABLE

If you prefer, you can attend classes at RCA Institutes Resident School, one of the largest of its kind in New York City. Coeducational classroom and laboratory training, day and evening sessions, start four times a year. Simply check "Classroom Training" on the attached card for full information.

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 TODAY! FREE DESCRIPTIVE BOOK YOURS WITHOUT OBLIGATION! NO SALESMAN WILL CALL!

All RCA Institutes courses and programs are approved for veterans under the New G.I. Bill.

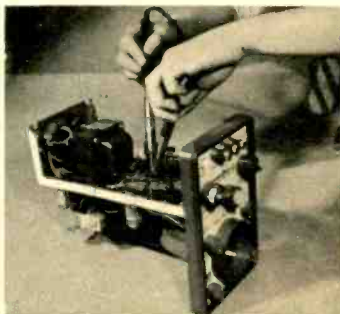
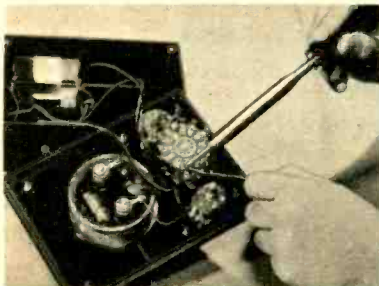
RCA INSTITUTES, INC. Dept. EI-18
320 West 31st Street
New York, N.Y. 10001

ACCREDITED MEMBER National Home Study Council



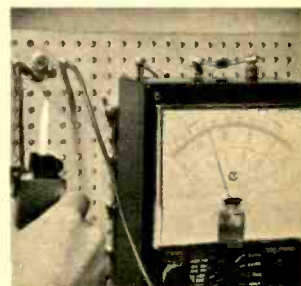
The Most Trusted Name in Electronics

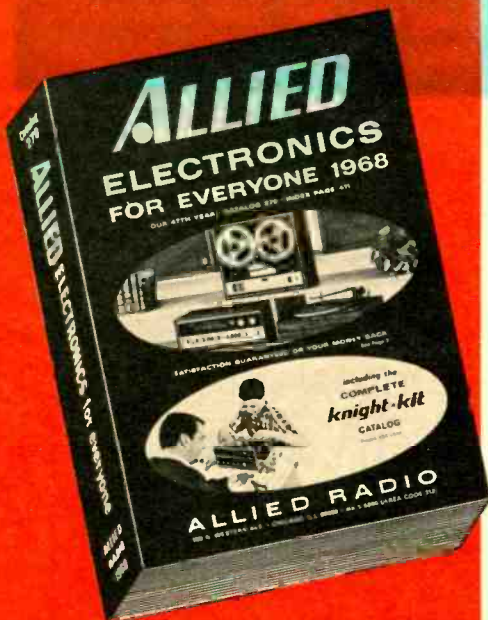
Construction of Multimeter.



Construction of Oscilloscope.

Temperature experiment with transistors.





Why buy by Mail from ALLIED?



Each year Allied fills more than a million orders by mail. That's because only the complete facilities of the world's largest electronics supply house can satisfy all the needs of hi-fi enthusiasts, CB users, engineers, Hams, and experimenters.

WORLD'S LARGEST SELECTIONS

Shop through the pages of this complete 518-page electronics buying guide. It gives you full descriptions and low prices on thousands upon thousands of items.

FIRST WITH THE LATEST FOR 47 YEARS

Allied has always been the first to offer the latest developments in Electronics. See them now in Allied's new 1968 Catalog.

What has the New 1968 ALLIED catalog got for YOU?

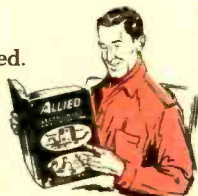
YOU SAVE AT ALLIED

Check Allied's lower prices. Look for the special values available only in the Allied catalog.

**No Money Down
Up to 2 Years to Pay**

YOU ENJOY "EASY CHAIR" SHOPPING

Shopping's easier at Allied. You always know exactly what you get. And, the selection of merchandise is so vast, no single store could ever assemble and stock it all.



MANY PRODUCTS NOT AVAILABLE ANYWHERE ELSE

Allied stocks thousands of unusual and special items not available elsewhere. Many are specially designed and built to Allied's specifications to save you money.

**Satisfaction Guaranteed
or Your Money Back!**

WE SELL QUALITY-TESTED MERCHANDISE

Allied's own Quality Control Department must approve items of merchandise before they can be offered for sale.

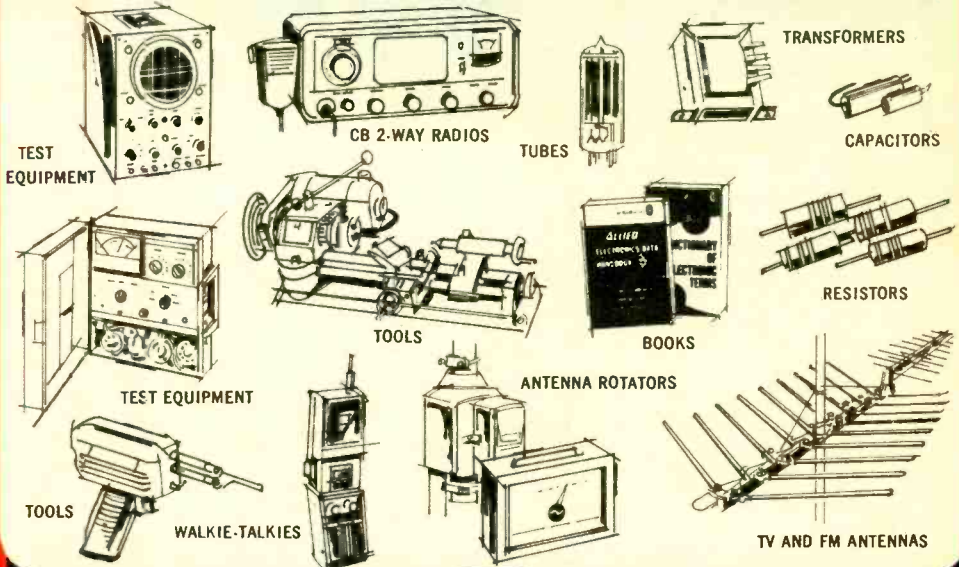
If it's from Allied - you can depend on it.

IMMEDIATE SHIPMENT

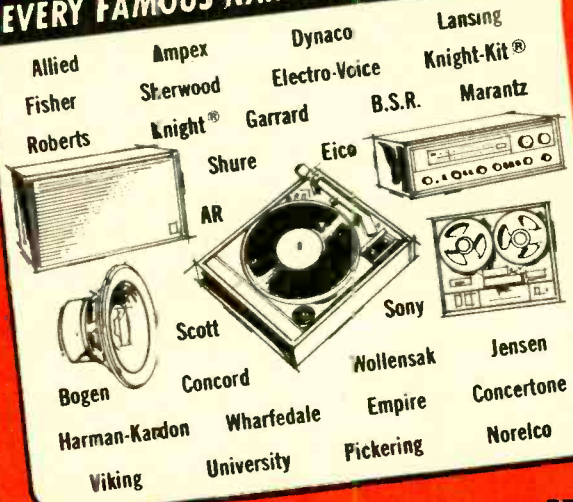
Orders are filled promptly - usually the same day they're received.

ALLIED RADIO, DEPT. 4-M, BOX 4398, CHICAGO, ILLINOIS 60680

EVERYTHING IN ELECTRONICS



EVERY FAMOUS NAME IN STEREO HI-FI



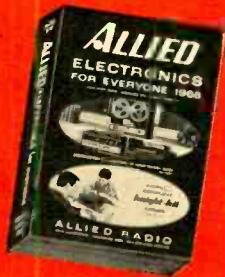
EVERYTHING IN KNIGHT-KITS



Discover the fun, enjoy the savings, gain the satisfaction of "building your own". Over 100 famous Knight-Kits to choose from.

In all the world—there's no other catalog quite like ALLIED'S...WOULDN'T YOU LIKE ONE FOR YOURSELF?

FREE!



ALLIED RADIO, Dept. 4M
 P. O. Box 4398, Chicago, Ill. 60680

Send me your 1968 Catalog

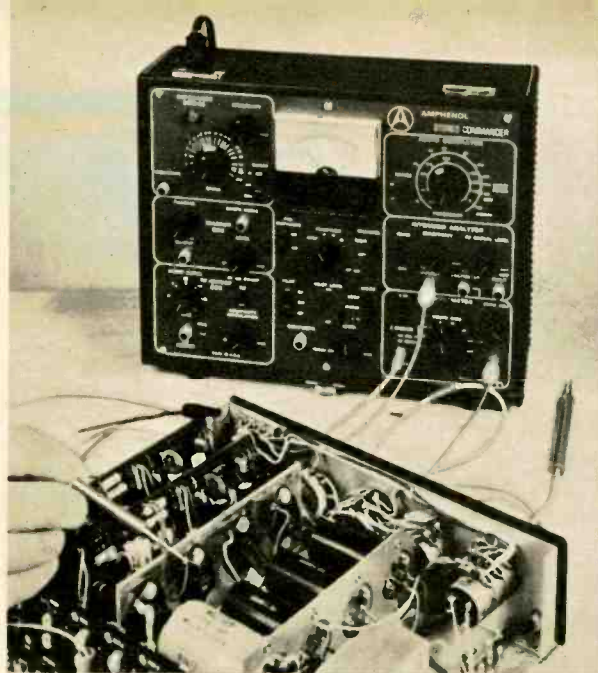
NAME — Please Print _____

ADDRESS _____

CITY _____

STATE _____ ZIP CODE _____

MULTI-SERVICE. . . The 880 Stereo Commander combines in one portable unit seven service instruments for FM tuners and multiplex receivers. It provides four signal sources: audio generator (sine or square wave) supplying signal to other sections of the 880, RF sweep oscillator for an FM signal source that can be modulated with signal from the audio generator, multiplex simulator, crystal-controlled 10.7-mc oscillator for use as a marker. Measuring instruments include: IM distortion analyzer, impedance bridge, VTVM (0.1 to 1,000 V) that also serves as an indicator for the impedance bridge and the IM distortion analyzer. Output of the 880 is 5 V for stereo, 3 V for mono. \$329.95. Amphenol Corp., Distributor Div., 2875 S. 25th Ave., Broadview, Ill. 60153.

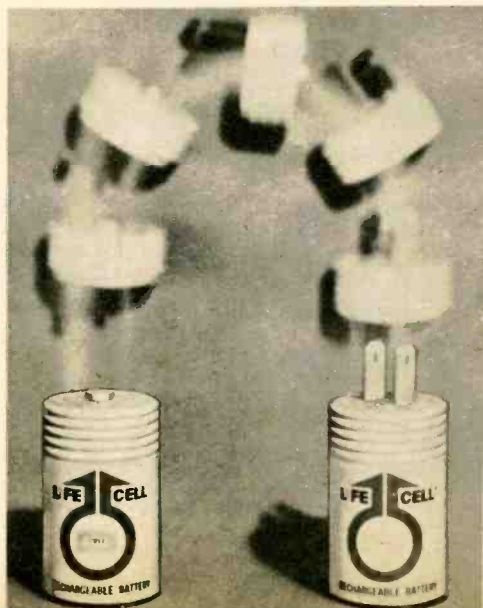


Electronic Marketplace



Bi-Elemental. . . The AKG D-200E is a two-way cardioid dynamic microphone. Separate elements handle high- and low-frequency ranges. The elements are connected through a 500-cps crossover network similar to those found in 2-way speaker systems. Overall frequency response is rated at 30-15,000 cps. Advantage claimed for the woofer-tweeter arrangement is linear off-axis frequency response. This is one of the first AKG products to be issued under that name in this country in some time—Norelco, which distributes AKG products, has been using its own name. The internally shock-mounted D-200E comes with stand adaptor, 15-ft. cable, connector, case. \$69. AKG Microphone-Headphone Div., North American Philips Co., 100 E. 42nd St., New York, N. Y. 10017.

Rechargeable. . . The Life Cell is a self-contained rechargeable 1.5-V D cell that, according to the manufacturer, never will have to be replaced. The cell is in two sections and is recharged by first removing the top portion and reversing it (as indicated in the photo), exposing the male plug. This is then inserted in an AC outlet for about 24 hours. (Regular recharge schedule, such as once-a-month, is recommended.) The Life Cell can be used in any application where a D cell is required. \$4.45 each; \$8.45 per pair. Waldom Electronics, Inc., 4625 W. 53rd St., Chicago, Ill. 60632.



TOM McCAHILL SAYS:

"There's COLD CASH In Repairing These Things!"



Each time a buddy of mine moans about the lousy repair job he got on his refrigerator or toaster or washing machine, I'm reminded of the fact that a good Appliance repairman is a mighty rare breed these days.

This neighbor of mine had refrigerator trouble just last month, and needed some speedy repair service. After phoning half a dozen repairmen who were booked solid for days, he finally had to settle for a bum job from a guy who had no business calling himself an Appliance repairman. This brings me to an important point. No one who wants to earn money in Appliance repair needs to learn by trial and error. There's a great, low-cost home study plan on the market that covers every type of Appliance repair in detail. The course was prepared by the Appliance Division of the National Radio Institute, one of the biggest and best schools in the field. Thousands of guys like yourself have studied with NRI, and many of them have more than paid for the low tuition fee within their first couple months servicing Electric Appliances.

If you want to make money (and who doesn't) in a field that's crying for good talent, make certain you send for a free NRI catalog. Get the details on the well-illustrated lessons that teach you how to repair home, farm and commercial Appliances, and small gasoline engines. You'll be amazed at how little the training costs. And you'll even get a professional Appliance Tester without extra cost.

NRI has been in the home study field since 1914, and they have a staff of 150 experts in Washington, D.C., who guide you through the course with more personal attention than you'd find in some classrooms. If you're really out to learn, they can furnish a

special course in air-conditioning and refrigeration repair, too.

Even if you've never tried to put a toaster in working order, even if your schooling never went beyond the tenth grade, I'm as certain as my name is McCahill that you can make money in the Appliance repair field with the help of this NRI course.

Do yourself a favor right now. Send off the coupon below and NRI will send you a free catalog. If you don't like the looks of this material, you can forget the entire deal, and you'll be out only one postage stamp. But remember, the Appliance repair field needs qualified men *now*. And you can qualify with NRI training.

Tom McCahill

P. S. NRI won't send a representative to call on you. They've never needed any with this great course!

APPLIANCE DIVISION, NATIONAL RADIO INSTITUTE
3939 Wisconsin Avenue, Washington, D. C. 20016

AVAILABLE UNDER NEW GI BILL.
If you served since January 31, 1955
or are in service, check GI line below.

504-018

OK—I want to see for myself. Send me the free book on Professional Appliance Servicing. No salesman will call.

Name _____ Age _____

Address _____

City _____ State _____ Zip Code _____

Accredited Member National Home Study Council.

Check for facts on new GI Bill.

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**

782 S. Forge Street Akron, Ohio 44308

Audio-Color

Lets you see your music



**ASSEMBLED
\$54.95**

**KIT FORM
\$44.95**

\$5 DOWN — \$5 MONTH

Walnut finished cabinet included / Shipped REA Collect

Easy to build, easy to install. All transistor **AUDIO-COLOR** adds a visual dimension to musical enjoyment. A brilliantly moving panorama of color casts dancing images on a soft frosted screen, reflecting rising and falling volume with each beat of the music. Here's a truly unique and exciting new musical experience. Make check or money order to **CONAR**.

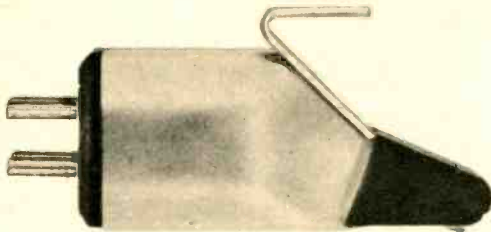
SEND FOR FREE CONAR CATALOG

CONAR

Division of National Radio Institute,
Dept. AE8C, 3939 Wisconsin Ave.,
Washington, D.C. 20016

Electronic Marketplace

Light Footed. . . The 999VE is a stereo cartridge designed for high-quality playback systems. It features an all-diamond elliptical (0.2 x 0.7 mil) stylus and, according to the manufacturer, will track at 30 cm/sec. with a force of less than 1



gram. Frequency response is listed at 6-35,000 cps, output at 5 mv per channel. Recommended tracking force is 1/2 to 1 1/2 grams; total weight, 7 grams. \$74.95. Empire Scientific Corp., 845 Stewart Ave., Garden City, N.Y. 11530.

Quick Switch. . . The T-R Switch Model 381B is an automatic antenna switch designed for ham use on CW, SSB or AM phone, particularly for break-in operation. Through it, receiver and transmitter can be coupled permanently to the same antenna. During transmission, the signal is blocked automatically so that it cannot enter the receiver's antenna terminals. Switching is instantaneous. A band-selector switch couples the receiver to the ham bands from 10 to 80 me-



ters. It matches 52- to 72-ohm coax antenna leads. \$79.50. Barker & Williamson, Inc., Bristol, Pa. 19007.

"King of the hill"

Keep on top of your solid-state replacements... with RCA "Top-Of-The-Line" SK-Series. They make up just a handful of types—17 transistors, 2 rectifiers, and 2 integrated circuits. Together these 21 RCA SK-Series types can keep you ahead of 9,000 solid-state replacements in entertainment-type equipment. Designed especially for this purpose, you'll find these devices useful in line-operated and battery-operated radios, phonographs, tape recorders, TV receivers, AF amplifiers, and automobile radios.

RCA SK-Series transistors and rectifiers and the 9,000 types they replace are cross-referenced in the RCA Solid-State Replacement Guide. It's a handy booklet listing comparably-rated types including industry standard EIA types, foreign types, and those identified only by device manufacturers' or equipment manufacturers' parts numbers.

Check with your RCA Distributor. He stocks the complete line in either cartons or see-through display packs. Also, pick-up your copy of the RCA Replacement Guide SPD-202-D available through your RCA Distributor.

RCA Electronic Components and
Devices, Harrison, N. J. 07029



The Most Trusted Name
in Electronics



Powerful, rugged, sleek Northrop F5-A "Freedom Fighter" is helping to keep the peace for the U. S. and 14 allied nations.



**Powerful.
Rugged.
Sleek.
Lightweight.
Goes anywhere.**

New CB-21 "REACTOR II" eight-channel solid state CB transceiver



only \$13995

Tallyho! Here's the hot new CB-21, the one that packs more punch into less space than any rig airborne! Using advanced techniques of space-age electronics, Hallicrafters has built in more talk power than ever before—cleaner, more readable signal with far less extraneous noise and a **minimum of 3.5 watts output**. Compare the features—then take off for your Hallicrafters dealer!

- Eight channel convenience • 17 transistors, six diodes • Built-in noise limiting circuits • Dual conversion receiver with ceramic filters for superb rejection and selectivity • Illuminated channel selector • PA-hailer circuitry built in

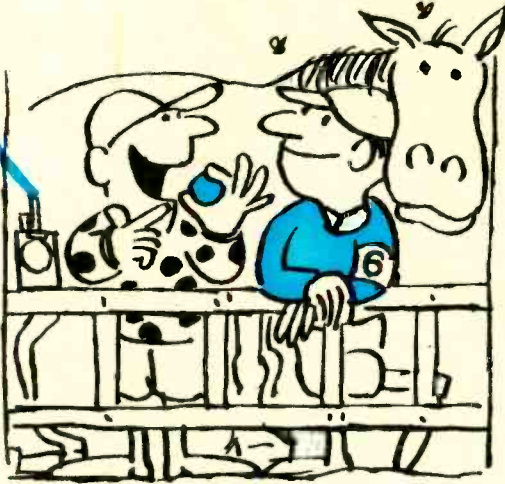


the new ideas in communications

are born at . . . **hallicrafters**

A Subsidiary of Northrop Corporation
5th & Kostner Aves., Chicago, Ill. 60624

Export: International Div., Canada, Gould Sales Co.



BUILD YOUR OWN BUG



By **WALT HENRY** THERE'S a new and insidious invasion under way—it's on peoples' privacy. Listening in on the other guy has now become a big and often profitable sport. The other guy could be your neighbor, close friend, worst enemy, bookie, business partner or the business competition. In other words, anyone—even you!

The urge to snoop manages to hook everyone some of the time. Electronic spying, or bugging as it's popularly referred to, has potentials that are limited only by the imagination and needs of the bugger.

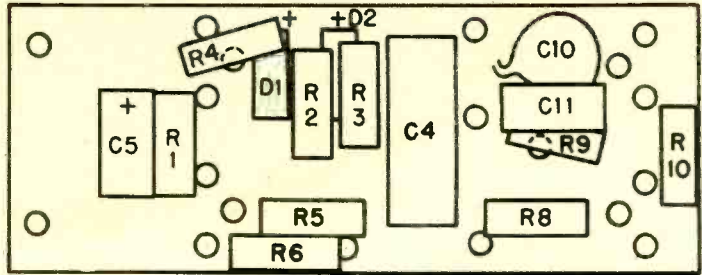
The sale of bugging equipment is big business. Anyone can buy the gear—for a price—and it's usually very expensive. But it need not be. Our electronic bug costs about \$20 to build. It is a subminiature (as you can see on our cover) self-contained radio transmitter. Because it operates in the broadcast band, any AM radio can be used to pick up its signal. Its range is from 10 to 50 ft. depending on the construction of the building in which it is used and the length of its antenna. The range also depends on the sensitivity and selectivity of the receiver.

Construction. As you can see from the photographs, our bug has been made very small. The components specified in the Parts Lists are subminiature. If you want to save money and don't mind making the bug a bit larger, use cheaper imported components. If you want to really cut the size you could use 1/10-watt resistors.

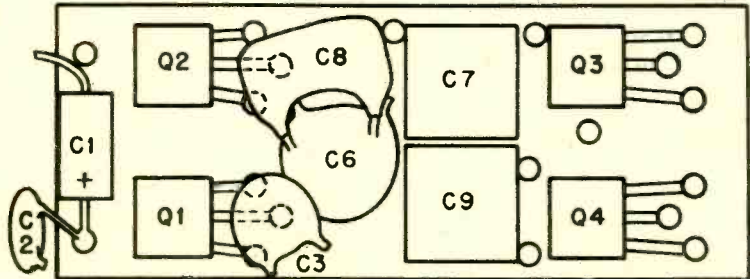
Our bug was built on a $\frac{5}{8}$ x $1\frac{5}{8}$ in. circuit board in which holes were drilled for component leads. A small plastic box makes an ideal case; ours is $2\frac{1}{4}$ x $1\frac{3}{4}$ x $\frac{5}{8}$ in. Use a sharp drill to make the necessary holes in the board and the case and use small dots of cement to hold the coil and other parts in place. If necessary, glue

BUG

Fig. 1—Use these diagrams of the top and underside of circuit board to locate parts. Board dimensions are $\frac{5}{8} \times 1\frac{1}{8}$ in. Circles are holes through which leads pass. Negative lead of C1 and other lead of C2 go to ground.



BOTTOM VIEW



TOP VIEW

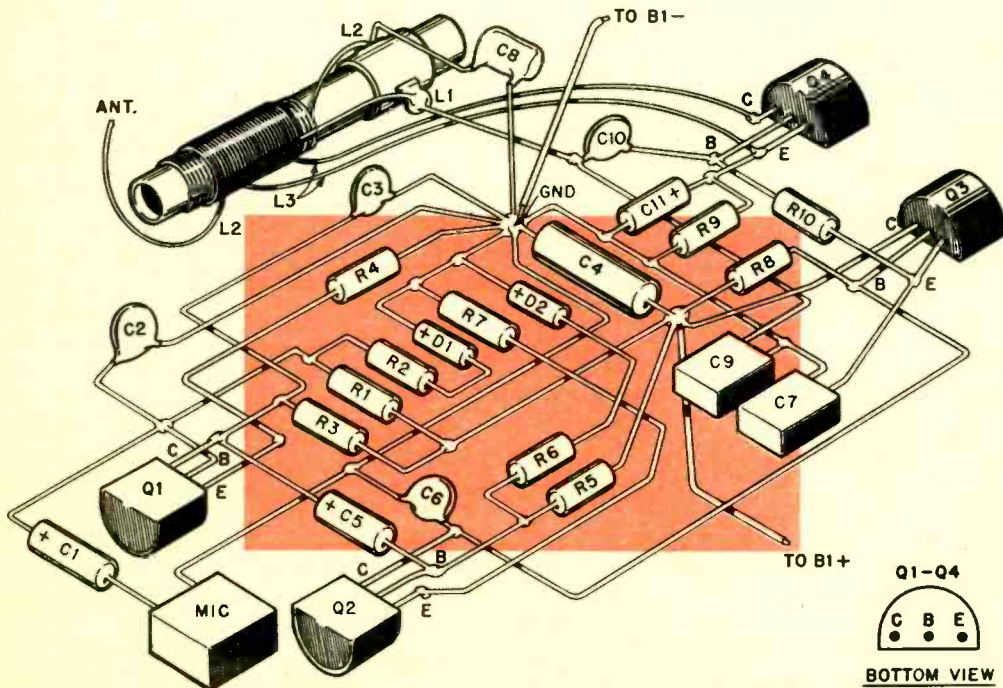


Fig. 2—Use this pictorial only to connect parts. Position them on board as shown in diagrams in Fig. 1.

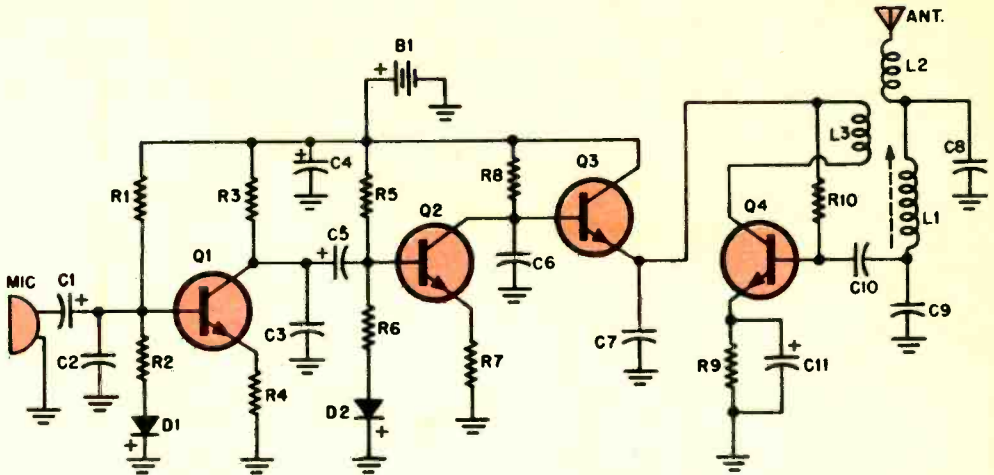


Fig. 3—Transistors Q1, Q2 provide plenty of gain to pick up low-level conversations from microphone. Signal is fed to Q3 which varies power to RF oscillator Q4 causing amplitude modulation of the RF carrier.

PARTS LIST

B1—9.8 V battery (Burgess H-177 or equiv.)
 C1,C5,C11—2.2 μ f, 20 V tantalum electrolytic capacitor (Kemet K2R2J20KS, Allied 43 E 7301. \$1.34 plus postage; not listed in catalog)
 C2,C3,C10—.001 μ f, 75 V subminiature ceramic capacitor (Lafayette 33 C 6902 or equiv.)
 C4—22 μ f, 15 V tantalum electrolytic capacitor (Sprague 150D226X9015B2, Lafayette 30 C 3024)
 C6—.002 μ f, 75 V subminiature ceramic capacitor (Lafayette 33 C 6903 or equiv.)
 C7,C9—.01 μ f, 75 V subminiature ceramic capacitor (Lafayette 33 C 6905 or equiv.)
 C8—180 μ f, 500 V dipped silver mica capacitor (Cornell Dubilier CD7F181G500, Allied 43 D 8246. 69¢ plus postage. Not listed in catalog)
 D1,D2—1N914 diode
 L1—High-Q ferrite antenna coil (J. W. Miller 6300, Lafayette 34 C 8705 or equiv.)

L2—30 turns No. 28 or No. 30 enameled wire wound on L1 (see text)
 L3—15 turns No. 28 or No. 30 enameled wire wound on L1 (see text)
 Mic—Miniature dynamic microphone (Shure MC30-J, Newark Electronics Corp., 500 N. Pulaski Rd., Chicago, Ill. 60624. Stock No. 61F134, \$11.76 plus postage. Or, Lafayette tie-clasp microphone Stock No. 99 C 4567)
 Q1,Q2,Q3—2N4123 transistor (Motorola)
 Q4—MPS3646 transistor (Motorola)
 Resistors: $\frac{1}{4}$ watt, 10% unless otherwise indicated
 R1—180,000 ohms R2,R6,R10—4,700 ohms
 R3—15,000 ohms R4,R7,R9—100 ohms
 R5—150,000 ohms R8—10,000 ohms
 Misc.—Litz wire (Belden 8817, Lafayette 32 C 1485. Optional, see text), circuit board, plastic box

small pieces of plastic to each end of the case to support the battery contacts as shown in Fig. 5.

A small spring at one end of the case will insure good battery contact. If you prefer use snap-on battery terminals from a dead 9-V battery. These will snap on each end of the H-177 battery. An ordinary 9-V transistor-radio battery can be used if you don't mind its larger size. If there is room in your case, install a subminiature switch. Our bug is turned off by simply removing the battery.

Slug-tuned coil L1 comes with a threaded tuning shaft. You can leave the shaft on or you can remove it and the metal clip to make the coil shorter. Be sure to cut the brass shaft carefully to avoid cracking the ferrite slug. If you remove the shaft, put a thin layer of

tape on the slug so that it fits snugly in the form. Drill a hole in each end of the plastic case so the slug can be pushed back and forth (for tuning) with a toothpick.

Two additional windings (L2, L3) must be wound on L1. Winding L3 is 15 turns; L2 is 30 turns. Litz wire such as Belden No. 8817 is ideal, though No. 28 or No. 30 enameled wire will work. Space the turns of each winding evenly over the length of the existing winding. L2 and L3 must be wound in the same direction.

Connect one end of L3 to the emitter of Q3. Connect the corresponding end of L2 to the junction of L1 and C8. Connect the other end of L2 to a 3 to 6 ft. length of antenna wire. Leave the loose end of L3 disconnected temporarily.

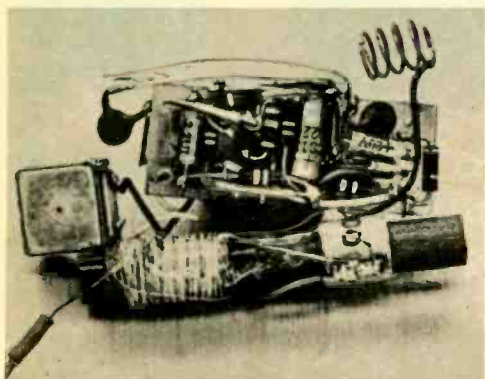


Fig. 4—Circuit before installation in plastic box. Mike is at extreme left. Modified coil is below. Spring at the top right holds the battery in place.

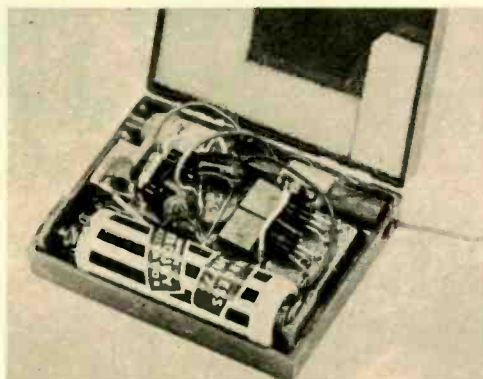


Fig. 5—Ready to snoop. Unless you're familiar with extremely tight construction, we recommend you build your bug in a somewhat larger box.

BUG

Parts layout is not critical though it is important that all component leads be kept very short. Pick a point in the circuit layout and run all ground leads directly to that one point. Arrange the parts on the board where shown in Fig. 1. Don't worry about the location of the parts in Fig. 2 not agreeing with that shown in Fig. 1. Fig. 2 is to be used only as a wiring guide and not for positioning parts.

Any moderate-impedance (1,000-2,000 ohms) dynamic microphone can be used. The Shure MC30-J we used is ideal because of its small ($\frac{1}{2} \times \frac{1}{2} \times \frac{1}{4}$ in.) size. The Shure MC11-J and MC20A-J are somewhat larger, less expensive and are equivalent in performance. A mike, such as the Lafayette No. 99-4567 tie-clasp mike could also be used.

Checkout. After you have completed and checked the wiring, a few other things must be done to insure that everything is working properly. First, measure the voltage from the collector of Q1 to ground. With a fresh battery it should be between 3 and 7 V. Now measure the voltage at Q3's emitter. It should be between 4.5 and 6.5 V. If either of these readings is off, slight changes in the values of R1 and R5, respectively, should be made.

Connect the open lead from L3 to the collector of Q4. (Connect a 50-ma DC milliammeter in series with the battery so current can be measured.) Turn on a radio, tune it to a quiet spot on the dial and place the radio about a foot away from the bug. Turn the volume up slightly. Tune the bug by sliding L1's slug back and forth with a toothpick

or matchstick. If everything is working properly you should hear a loud squeal when the bug is tuned to the same frequency as the radio. This squeal is caused by audio feedback from the radio speaker to the mike. Battery current should be between 5 and 7 ma with a fresh battery.

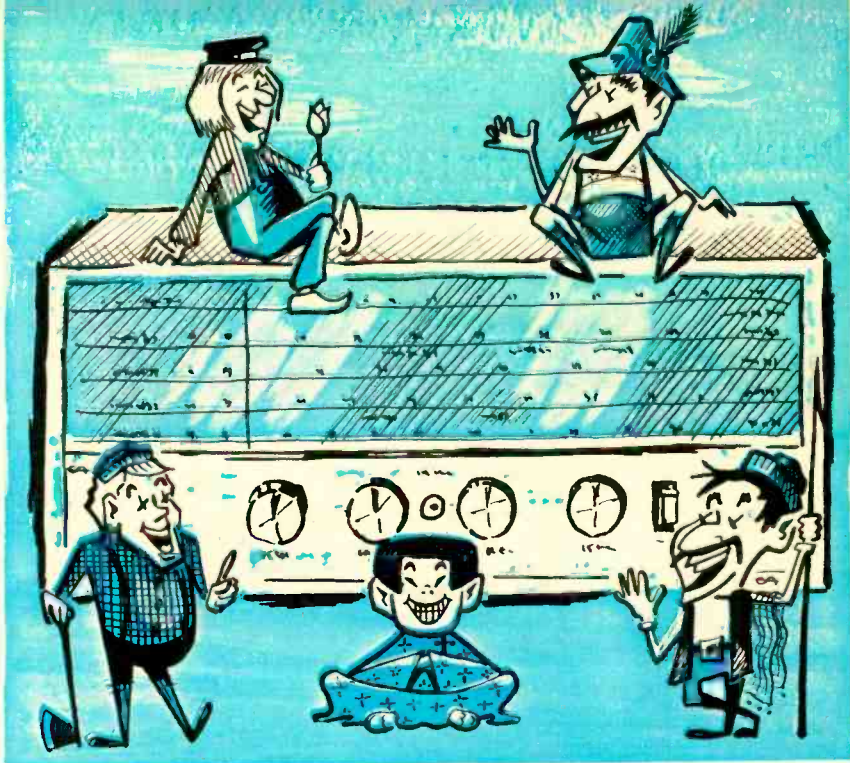
If you don't get a squeal, note the current. If it is less than 5 ma there may be a wiring error or faulty component. If the current is between 15 and 30 ma, L3's leads to Q3 and Q4 should be reversed. If this corrects the problem it is important that L2's leads be reversed also. The bug will work with L2 connected in reverse but the range will be reduced.

Check to be sure the bug will tune over the entire broadcast band. With the receiver very close, the signal will be received at several places on the dial. However, it will be strongest at only one point on the dial.

The bug will continue to work until the battery voltage drops to about 6 V. The circuit will operate continuously for about 35 hours on the battery specified.

The bug makes a good wireless mike to allow a speaker to move about freely and you can use it as a wireless phonograph. Just connect the leads from a magnetic cartridge directly to the microphone input leads.

For maximum range the antenna length can be extended to 12 ft. or more, but at this length it is important that it be kept clear of large metal objects and people. We don't guarantee that you will solve a sensational crime with the bug, but you are guaranteed hours of fun. ♪



LEARN A LANGUAGE VIA SHORT WAVE

By ARTHUR S.
COOKFAIR

THEY say the best way to learn a language is to live in the country where it is spoken. Maybe so. But unless you're free to go globe-trotting when you feel like it you might be better off picking up a second language from the short-wave bands. It's free—and it can be fun.

On the next page you'll find a guide to the courses presently on the international broadcast frequencies. Others have been offered in the past and may return. And more may be expected to come along as time goes by. Pick one and give it a try. You may be surprised how easy it is to learn. You also may be surprised at how much a little knowledge of a second language will enhance your enjoyment of short-wave radio.

One of the most popular language courses is R. Nederland's Dutch by Radio, which is tentatively scheduled from January to June 1968 and November 1968 to April 1969. One 15-min. lesson is broadcast each week. By writing to R. Nederland you can obtain a free text which contains homework assignments that can be mailed back for correction by the station's language experts.

German lessons have been offered by the Deutsche Welle since 1954. Their *Lernt Deutsch* program includes two different beginner courses and two advanced courses. Text material is provided free for the beginner and the first of the advanced courses.

Portuguese by Radio (R. Portugal) offers a free text containing pre-ad-

E'S GUIDE TO SW LANGUAGE COURSES				
LANGUAGE	DAY	TIME (EST)	FREQ. (kc)	BROADCASTER
Dutch	Tues., Sat.	2030	9590	Radio Nederland Box 222 Hilversum, Netherlands
German	Sun.-Thurs. Sun., Tues., Thurs.	2120 2400	6075, 9735 6145, 9735	Deutsche Welle Postfach 344 Cologne, West Germany
Japanese	Sun., Wed.	2100	15105	Radio Japan Overseas Broadcasting Dept. Nippon Hoso Kokai Tokyo, Japan (or Room 3214 220 East 42nd St. New York, N.Y. 10017)
Portuguese	Mon., Thurs.	2100	6025, 6185, 9635	Radio Portugal Rua S. Marcal 1A Lisbon, Portugal
Swedish	Fri.	2045	9705	Radio Sweden Box 955 Stockholm 1, Sweden

LEARN A LANGUAGE VIA SHORT WAVE

dressed mailing cards for submitting homework assignments. In addition SWLs will find materials relating to Portuguese history and geography.

Swedish by Radio is a basic language course that runs for about six months. R. Sweden will send a free textbook.

A bit farther afield—both linguistically and geographically—is Japanese. But the staff of R. Japan's Let's Speak Japanese program has written a textbook that takes much of the effort out of learning the basics of the language, exotic and difficult though it may seem.

Once you've acquired the ground rules of a language the next step is practice. Here's where you can put SW news broadcast to work. The vocabulary and grammar of newscasts are simple and current. They generally are characterized by good pronunciation, well-modulated tones and a speed that isn't too difficult for the beginner to follow. In addition, newscasts include many references to familiar people and places.

Some international broadcasters, such as R. Japan, have newscasts in English, as well. Try listening to both. The content generally will be the same and by comparing them you will be able to pick up many phrases and whole sentences. In selecting news broadcasts for listening practice, choose those that provide the best reception in your area. If you're studying German, for instance, you need not stick to Deutsche Welle. Try the German-language broadcasts of Voice of America or the Canadian Broadcasting Corp.

A tape recorder can be a great help in your language study (see How to Tape From Any Radio or TV, Nov. '65 EI). Taping the lessons will enable you to review at leisure. And you can repeat difficult words and phrases until they are mastered.

The more you put into your language course the more you'll get back, of course, so don't give up easily. But even if you do, you're sure to learn something. If you're a hard-core SWL your progress can be measured by the QSLs that once would have been beyond your reach—either because you couldn't tell what you were listening to or because you couldn't report as effectively on what you heard. And an extra language or two are always a help if the English subtitles fall off the bottom of the screen on the Late Show.

A LAFAYETTE FIRST! NEW HB-525C SOLID STATE MOBILE 2-WAY RADIO

NOW FEATURING



**The Revolutionary Electronic
Miracle of the Space Age**

Why LAFAYETTE Uses Integrated Circuits?

Advanced technological skills have created a revolutionary achievement in electronics . . . the **INTEGRATED CIRCUIT**. Housed in a capsule no larger than a conventional transistor are 5-transistors and 2-resistors. Each encapsulated Integrated Circuit is produced as an exact duplicate of an accurate master through a microphotographic etching process. Hidden circuitry flaws or defects are virtually eliminated. The use of an integrated circuit in the HB-525C provides higher selectivity and sensitivity, superior adjacent channel and impulse noise rejection, with greatly reduced spurious interference.

Designed for High Reliability and Years of Outstanding Service

**D.O.T. APPROVED
FCC TYPE ACCEPTED**



Only 2 3/8" HIGH

149⁹⁵

No Money
Down

Stock No. 99-3156WX

23 CB Channels All Crystals Supplied!

ACCEPTS PRIVA-COM® PLUG-IN PRIVATE TONE CALLER

- ★ 23 Transistors including Integrated Circuitry, 9 Diodes, 1 Thermistor
- ★ Dual Conversion for High Selectivity
- ★ 3-Position Crystal Delta Tune For Accurate Fine Tuning
- ★ Transmit Mode Indicator Light
- ★ Pi-Network for Optimum RF Output
- ★ Mechanical 455 KC Filter for Superior Selectivity
- ★ With "S/PRF" Meter
- ★ Variable Squelch Plus Series Gate Automatic Noise Limiting
- ★ Range Boost Circuitry for Added Talk Power
- ★ Serves as a Public Address Amplifier with External Speaker
- ★ Auxiliary Audio Input Jack
- ★ 12 Volt DC Operation

Send For Free 1968 Catalog 680 Dept. EIL-7

LAFAYETTE RADIO ELECTRONICS CORPORATION • 111 JERICHO TURNPIKE, SYOSSET, L.I., N.Y. 11791



Electronic Voicing for Wind Instruments

By ALAN R. SURPIN

THE clarinetist moves up for a solo. He starts playing, flips a switch and the group instantly has a bass-clarinetist added to it. He throws another switch and adds a contra-bassoonist. It's like having two more men playing.

On the other side of the band the trombonist starts. He hits a switch and the band has a tuba. Three musicians have been added—all electronically.

Although the guitar has held the top popularity position because of electronic amplification, reverb and tremolo; saxophones, clarinets, trumpets, trombones and other wind instruments are now coming on strong. In fact they may push the guitar out of the limelight. New electronic accessories for these instruments do more than just make them louder—they produce additional octavally-related notes.

The two accessories dealt with here are made by the Conn Corp. and H. & A. Selmer, Inc. (both in Elkhart, Ind. 46514). Another accessory is made by the VOX Musical Inst. Div. of Thomas Organ Co., Sepulveda, Calif. Except for the Selmer, they add up to three octaves to the range of wind instruments.

The Conn Multi-Vider (Fig. 1 and the musician at the right, above) is a self-contained unit powered by a 9-V battery. Connected to the Conn Five Hundred amplifier—or any amplifier—it modifies the instrument's sound by



Fig. 1—Conn pickup mike (above) is installed in clarinet. Multi-Vider (right) clips on belt. Two top switches (at left of unit) boost or attenuate treble. Third switch from top adds octave above fundamental. Switch below adds one octave below fundamental. Fifth switch down adds second octave below fundamental. Bottom switch controls power. Top knob sets instrument's basic volume. Other controls set level of added octaves. Solid-state circuitry includes filters and frequency dividers. Unit is powered by 9-V battery and its output can be fed to any high-power musical-instrument amplifier.



amplifying it and boosting or attenuating treble. That's only part of it. The really important feature of the Multi-Vider is its ability to extend the range of the instrument one octave higher and up to two octaves below its normal range.

For instance, suppose you play an A above middle C on a sax. Flip the *soprano* switch and you can add A, exactly one octave higher, to the fundamental. Flip the bass and sub-bass switches. You can add A one octave lower and A two octaves below the fundamental. This gives you the ability to sound four As each an octave apart. Thus, one musician will now sound like a quartet.

The pickup mike, which is similar to the earphone from a transistor radio, is clipped on an adaptor fitted on the neck of the instrument. (On the clarinet the barrel is used, on flutes the cork tuning assembly.) The mike plugs into the Multi-Vider which produces the effects and feeds them to the amp. (Tremolo depth and intensity and echo are

generated in the amplifier.)

The amplifier also has inputs for two additional instruments, such as guitars. Price of the Multi-Vider with mike and cables is \$244.50; the amplifier is \$339.50.

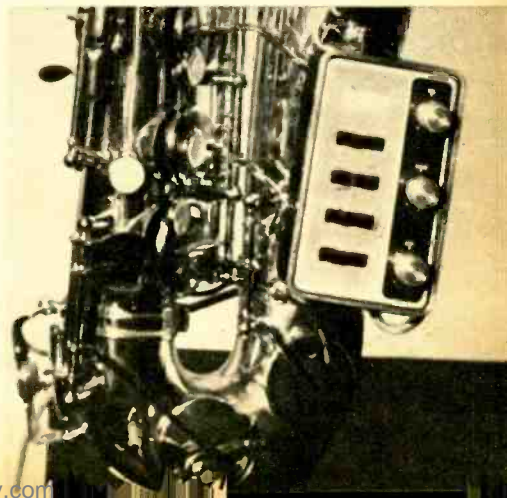
The H. & A. Selmer Co.'s accessory is called the Varitone. It can be used with the saxophone, trumpet, clarinet and the flute.

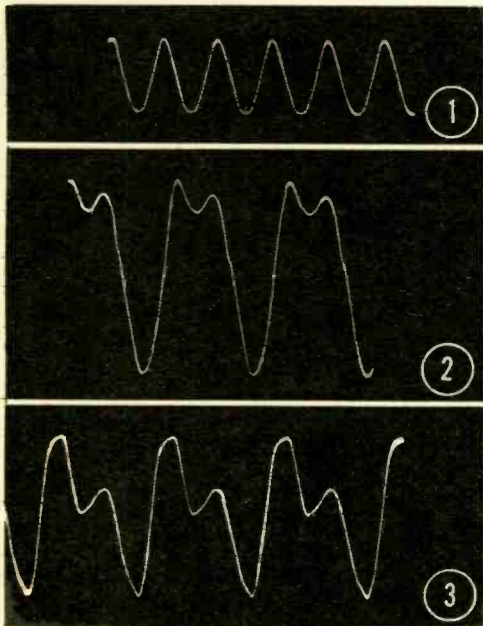
The Varitone's amplifier contains several of the circuits which produce the special effects so no other amplifier can be used. The control unit can be mounted on the lower part of the instrument (see Fig. 2 and our musician's twin—actually, it's the same chap in a composite photo), clipped on the musician's belt or hung around his neck. The pickup is built into the neck of the sax.

The control unit has switches and knobs which enable you to produce the effects. (The tremolo is activated on the control unit but its speed and depth are regulated on the amplifier.)

In addition to amplifying the instrument

Fig. 2—Selmer pickup mike is installed in sax's neck (above). Control unit (right) is installed permanently on this sax but can be clipped on belt or hung around neck. Top switch (on left of unit) boosts treble. Switch under it boosts level of instrument's normal sound. Next switch attenuates treble. Bottom switch turns on tremolo. Top knob is master volume, middle controls reverb, bottom sets level of octave below. Unit must be used with Selmer's amp.





Note produced by saxophone alone is shown in photo 1; it is almost a perfect sine wave. Photo 2 shows output of Varitone when it produces tone one octave lower; some fundamental is still present. Photo 3 shows output which is mixture of octave lower with additional fundamental added.

Electronic Voicing for Wind Instruments

the Varitone lets you boost or attenuate treble and turn tremolo and reverb on or off. Big feature is the Octamatic control which increases the instrument's range by producing a note one octave below the note you play.

There's an interesting effect which can be produced with the Octamatic. You blow a subtone (a light stream of air) through the instrument. This emphasizes a note an octave lower than the fundamental, which is partially suppressed. This gives you the ability to play only a bass line to accompany other instruments. The Varitone can be purchased alone or with an instrument. Alone it has a list price of \$730.

Straight amplification and treble boost and attenuation are easy to achieve electronically. But how is multiplication and division of tones accomplished? Very basically, in the Varitone the note played is amplified, re-shaped and fed to a divider circuit which

[Continued on page 119]

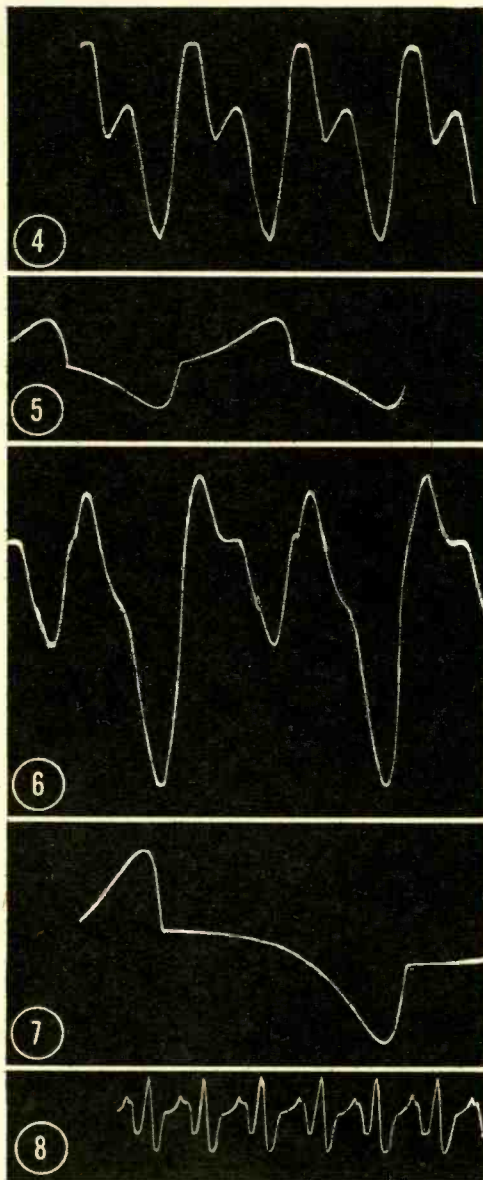
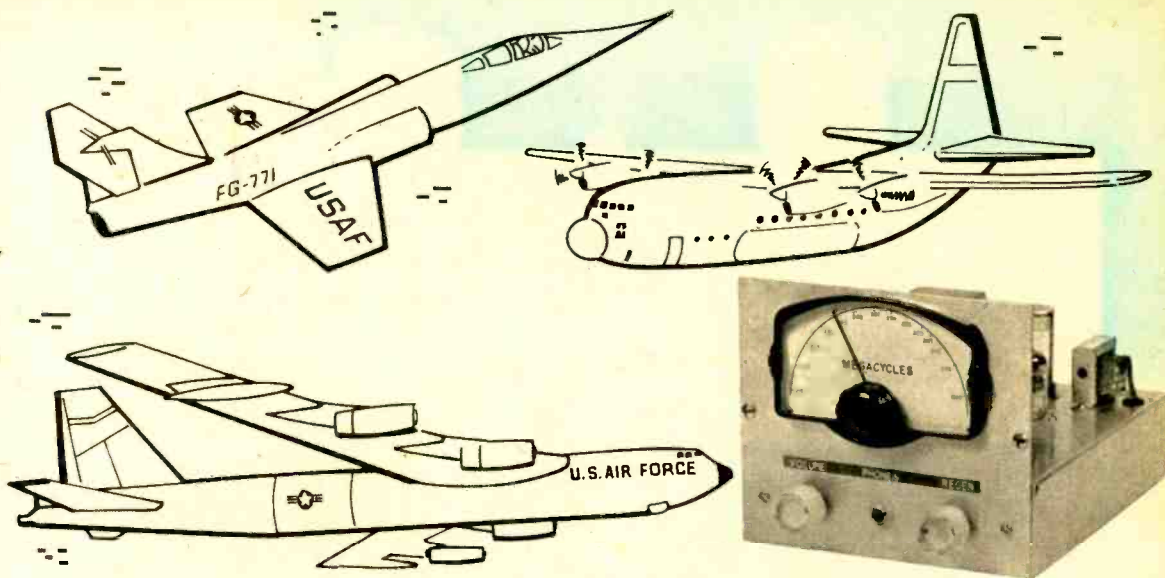


Photo 4 shows complex waveform produced by saxophone. Photo 5 is waveform of octave lower (with fundamental) produced by Multi-Vider. Photo 6 is same with more fundamental. Photo 7 shows note produced two octaves lower (distorted because of fundamental). Photo 8 shows soprano. Fundamental is four major cycles; soprano is four minor cycles between major cycles. The positive peak of every other soprano cycle is mixed with positive peak of the fundamental and, therefore, appears as a distortion of top fundamental peak. If you take four major peaks, add four soprano peaks you get eight peaks—double the frequency. Due to distortion, peaks on photos don't necessarily coincide. For clarity, photos have been retouched.



Eavesdrop on Military Planes

By CHARLES GREEN, W6FFQ

LOOK up at the sky almost any time of the day, anywhere and you see a plane. It may be a small private job or a large passenger jet. And if you own a radio that tunes the 108-128-mc aircraft band, you know what excitement there is in listening to planes and control towers.

But what about those military jets that zoomed by in formation and broke the sound barrier? Were you able to tune them? Chances are you weren't since they operate on much higher frequencies. According to the U.S. Department of Commerce Sectional Aeronautical Charts, military planes operate from 236.6 to 363.8 mc.

With our three-tube superregener receiver, you can tune from about 215 to 280 mc where you'll be able to hear most of the activity of military control towers and aircraft. And you'll also be able to tune the 220 to 225-mc ham band.

If you live near an Air Force base where there's a lot of activity you've got it made. But if you don't, and a military plane passes over only once in a while, it will take patient listening as the band isn't at all as busy as the commercial-aircraft band.

Our receiver features a ground-grid Nuvistor RF stage, a Nuvistor superregen detector and two stages of audio which can drive an external 4-ohm speaker.

The Circuit

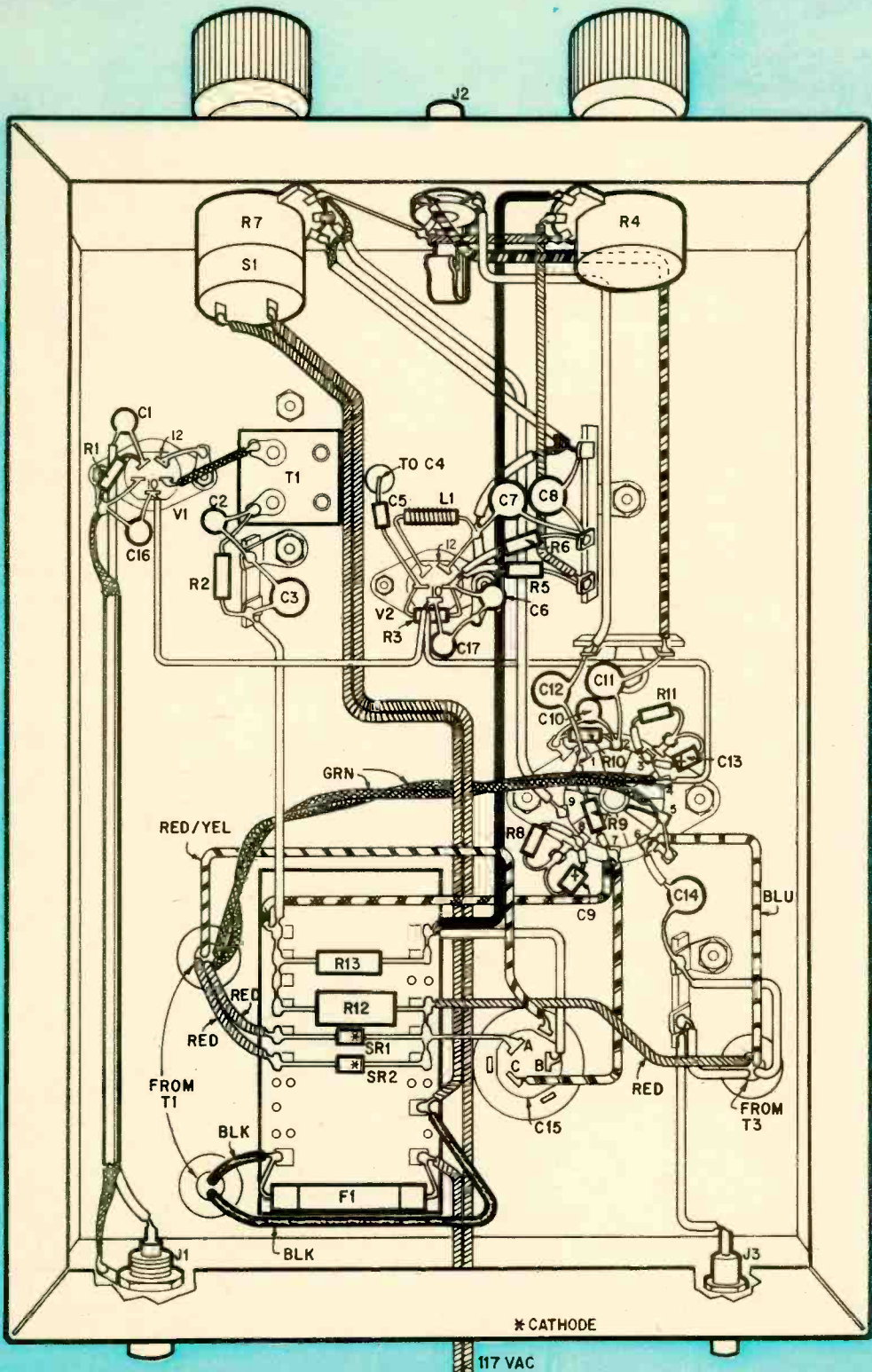
Signals from the antenna, which is connected to J1, are coupled via C1 to grounded-grid amplifier V1 where they are amplified and fed to T1. The secondary of T1 is tapped down and tuned across the band with C4. The tuned signal is detected by superregen detector V2. The audio signal is fed through the low-pass filter circuit (R6-C7) and coupled via C8 to volume control R7 and to audio amplifier V3A. Capacitor C12 couples the amplified audio signal to phone jack J2. Capacitor C11 couples the signal to the audio power amplifier which includes T3. T3 feeds audio to J3 for an external 4-ohm speaker.

B+ power for the receiver is supplied by the full-wave rectifier circuit which consists of T2, SR1 and SR2. Filtering is provided by R12, R13 and C15A,B,C. The B+ to V2 is varied by regen. control R4, which changes the gain of the superregen detector circuit.

High-impedance phones can be plugged in J2, which disconnects the input to V3B. Low-impedance phones should be connected to J3.

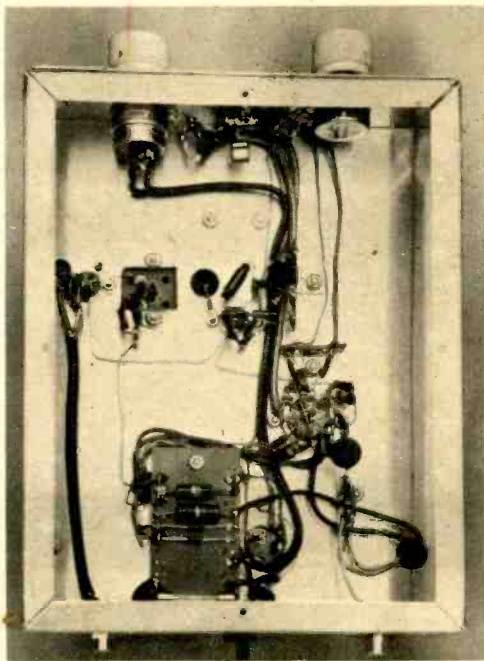
Construction

Our receiver is built on a 9 x 7 x 2-in. aluminum chassis on the front of which is attached a 7 x 5³/₄-in. aluminum panel. If you can't get sheet aluminum heavy enough

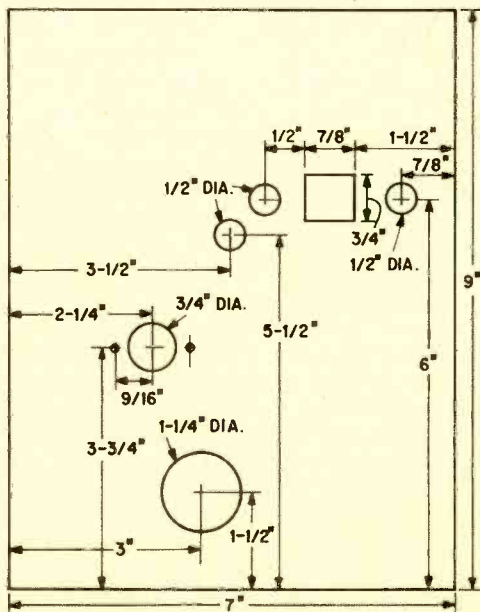


Underside of receiver. Because of high operating frequency, parts layout around V1, V2 and T1 is extremely critical. Keep all component leads short and direct. Note that braid on shielded wire from J1 to V1 is grounded at both ends. Power supply parts are mounted on 1½ x 2¼-in. piece of perforated board.

Eavesdrop on Military Planes



Note uncluttered clean layout of underside of receiver. Power-supply components could be mounted on terminal strips instead of circuit board.



To duplicate our layout, use these dimensions (top of chassis) to layout your chassis. Power transformer's lead holes (lower right) are not shown.

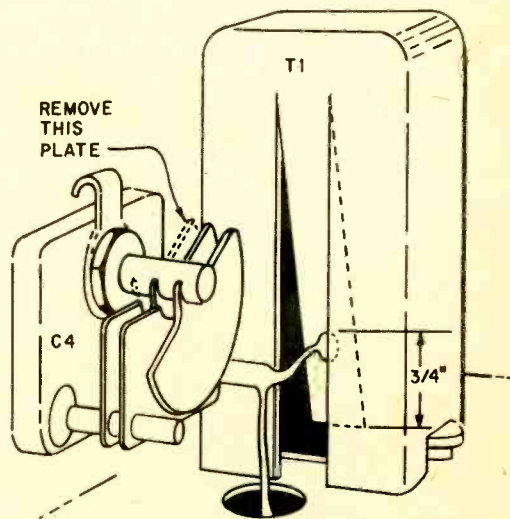
for the front panel, order an extra bottom plate and cut it to size. Because of the receiver's high operating frequency, the critical portion of construction is the positioning of tuning capacitor C4 and transformer T1.

Best way to start is to temporarily mount the front panel on the chassis with two sheet-metal screws and locate the front-panel holes. Position the dial's shaft approximately 1 1/4-in. up from the top of the chassis and locate the dial holes with the cardboard supplied with the dial. Drill pilot holes for the other front-panel controls, then remove the panel and drill and cut all holes.

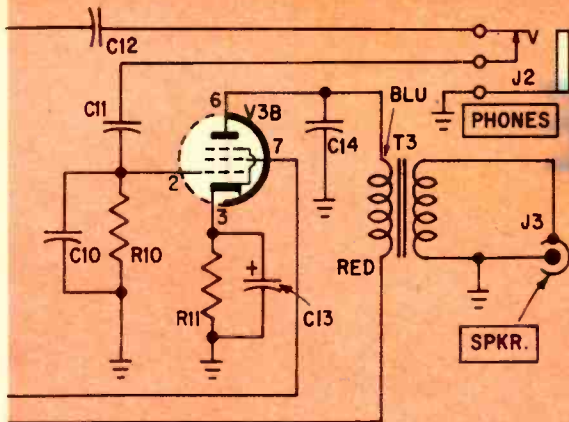
After the panel is remounted on the chassis with the dial, make a 1 1/2 x 1 1/2-in. bracket for C4. Cut a U-shaped notch in the top edge of the bracket for C4 and line the notch up with the dial's shaft. Mount the bracket on the chassis approximately 2 in. back from the panel. Couple the dial to the capacitor with a flexible coupling. Align the shafts as close as possible for easier tuning.

Temporarily position T1 1/4-in. to the right of C4's stator lug and line up the slot in the side of T1 with the end of the stator terminal. Mark the top of the chassis with the outline of T1, and cut a chassis hole for T1's terminals. Of course if you use the dimensions we give for cutting the chassis, it will not be necessary to determine T1's position in this manner.

Cut or drill a 1/2-in. dia. hole directly be-



Before mounting T1, lay it on its side and solder wire on tongue, 3/4-in. from bottom. Remove rotor plate from the front of tuning capacitor C4.



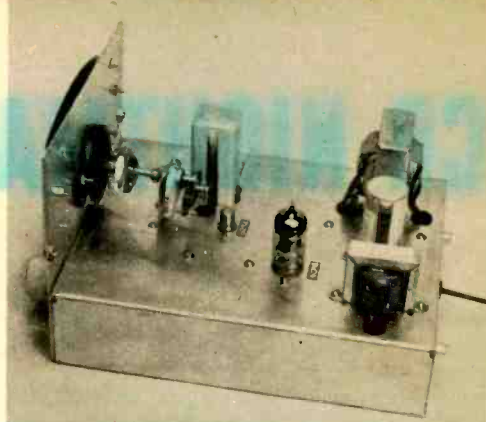
Incoming signals are led to V1, a grounded-grid RF stage, where they are amplified and fed to T1. Signal tuned by C4 is detected by super-regen detector V2. Audio signal is then fed via low-pass filter (R6,C7) to volume control and audio stages. Plug high-impedance phones in J2. Low-impedance phones should go into J3.

vertically or horizontally polarized.

The *regen.* control should be adjusted for best reception of signals over the band as you tune the receiver. FM signals can be received by slope detection by tuning on either side of the carrier. You can either buy commercial antennas for this band or build antennas using the Radio Amateur's Handbook as a construction guide.

The U.S. Department of Commerce, Washington, D.C., publishes a series of Sectional Aeronautical Charts of the United States. These charts, even though they are primarily for private and commercial planes, are filled with information about frequencies.

Frequency (mc)	Activity
236.6	Military Control Towers
241.0	
275.8	
340.2	
360.2	
243.0	Military Emergency
257.8	FAA Control Tower for Military Aircraft
255.4	FSS* for Military Aircraft
272.7	
263.6	Military Approach Control
363.8	
*FSS-Flight Service Station	



Finished receiver. Front panel is 7 x 5 3/4 and can be made from an aluminum chassis bottom plate. Operate the receiver with the bottom plate on.

PARTS LIST

- Capacitors: 1,000 V ceramic disc unless otherwise indicated
 C1,C6—47 μf
 C2,C16,C17—680 μf
 C3,C8—.0047 μf
 C4—2.8-16 μf variable capacitor (Hammarlund HFA-15-B, Lafayette 40 H 2841. Modified, see text)
 C5—33 μf tubular ceramic
 C7—1,000 μf
 C9,C13—10 μf , 15 V electrolytic
 C10—470 μf
 C11,C12—.01 μf
 C14—.02 μf
 C15A,B,C—30/20/40 μf , 150 V electrolytic (Sprague TVL-3438 or equiv.)
 F1—1/2-A fuse
 J1,J3—Phono jack
 J2—Closed-circuit phone jack
 L1—.82 μh RF choke (J. W. Miller RFC-220, Lafayette 34 H 8974 or equiv.)
 Resistors: 1/2 watt, 10% unless otherwise indicated
 R1—220 ohms R2,R8—4,700 ohms
 R3—8.2 megohms
 R4—100,000 ohm linear-taper potentiometer
 R5—47,000 ohms
 R6—100,000 ohms
 R7—1 megohm audio-taper potentiometer with SPST switch (S1)
 R9—220,000 ohms
 R10—1 megohm R11—100 ohms
 R12—1,000 ohms, 2 watts
 R13—15,000 ohms, 1 watt
 S1—SPST switch on R7
 SR1,SR2—Silicon rectifier; minimum ratings: 400 PIV, 750 ma
 T1—110-235 mc RF coil (J. W. Miller 1445, Allied 54-0094. \$3.90 plus postage, not listed in catalog)
 T2—Power transformer; secondaries: 250 V center tapped @ 25 ma, 6.3 V @ 1 A (Allied 54 B 2008 or equiv.)
 T3—Output transformer; primary: 10,000 ohms, secondary: 4 ohms (Stancor A-3879 or equiv.)
 V1,V2—6DS4 Nuvistor tube (RCA)
 V3—6CM8 tube
 Misc.—Vernier dial (Lafayette 99 H 2566), Flexible shaft coupling (Allied 47 B 2405), 7 x 9 x 2-in. aluminum chassis, 7 x 9-in. aluminum chassis bottom plate, 5-pin Nuvistor sockets, 9-pin tube socket, terminal board, terminal strips, RG58/U coax.

CB NIGHTMARE



IN INDIANA

By **ROBERT M. BROWN**
KOD2239

EVERY maga-
zine gets letters
bawling injus-

tics, real or imagined, from readers and non-readers alike. Last spring, EI received such a letter from a young woman in the Chicago area in which she complained about local abuses on the Citizens Band. That hardly could be called news. But there was more.

The writer said her parents had been injured seriously in an automobile accident and had tried to summon help on the transceiver in their car. But their signals were jammed purposely by other Cbers, she said, and the couple had to wait until a passerby found them and called an ambulance. They were on the critical list 30 days after finally reaching the hospital, the letter went on.

The offenders, she said, called themselves Master Control and were practicing wholesale tyranny on the 11-meter band in Lake County, Indiana. They also had spawned bootleg operations in the broadcast band, as well, the letter said. She (and others) had appealed to the local FCC field office, she went on, but there still was no relief in sight.

Wouldn't EI help by telling the story?

That is when this writer was asked to go to Indiana and find out what it was all about.

Some of what I found sounds like a grade-B television plot. A typical incident runs something like this: On instructions from the Grand Dragon, seven CB-equipped hotrods race down the road at close to 100 mph, intent on arriving at a specific target in Cedar

Lake, Ind. Moments later, their cars idling beside a Cber's home, three appointees climb up to an 11-meter beam antenna and reduce it to a pile of metal strips on the ground. Zany Boy arranges the fragments on the grass to spell out MC. As the cars roar again Batman decides it's time to report in. Flipping on the 80-watt linear in his trunk, he announces over channel 9, "Mission accomplished!" Grand Dragon acknowledges.

It's far from fiction. These operations take place (as this one did) in the suburban and semi-suburban communities south and southeast of Chicago. The center of operations is Hammond, Ind. (population, 115,000). Hessville, North Hammond, Woodmar and Robertsdale are all sections of Hammond. Whiting (population, 8,000) is a neighbor on Lake Michigan to the north; Lansing (21,000) is across the Illinois line to the southwest. Cedar Lake is a resort community some 15 mi. south on U.S. Rte. 41, with a summer population of about 9,000.

Within this territory MC carries out its field operations, usually between 11 p.m. and 4 a.m. Targets are Cbers who dare to dispute the authority of Master Control.

Should you, even unknowingly, incur the wrath of Batman, Zany Boy or the Grand Dragon himself you'll find it impossible to operate on CB. Every transmission you make will be jammed with 250-watt carriers, obscene comments, endless hours of music. Your name will be circulated in Master Control by way of high-power broadcast-band



Towns mentioned on Master Control QSL opposite are shown here (clockwise from top): Hessville, Ind.; North Hammond, Ind.; Woodmar, Ind.; Robertsdale, Ind.; Lansing, Ill. Hammond, Whiting and Cedar Lake, all in Indiana, also are sites for Master Control operations.



stations on 1550 kc. Should you continue your attempts to use CB, instructions will be issued over simulcast 160-meter stations that your home is the target of the evening. Consider yourself lucky if the antenna and feed-line are all you lose.

Here are some facts about MC:

- The organization consists of 25 to 30 persons intent on establishing a growing chain of control over *all* radio operations in northwestern Indiana and surrounding areas.

- Membership in MC is tightly controlled. Each active member supposedly has at least four assistants helping to stir things up.

- MC operates three bootleg radio stations in the BCB: WMMO (for Whammo) in Whiting, Ind., WMML (for MC Whammo Link) in Hessville, Ind., WMOL (MC Whammo's Little Sister, the Station for

Naughty Little Boys) in Cedar Lake, Ind.

- Broadcasts, transmitted simultaneously by WMMO, WMML and WMOL, also take place in the 160-meter ham band.

- So far, the FCC has issued illegal-operations citations to three persons alleged to be members of Master Control; each received a six-month license suspension.

In matching information from the area's Cbers with that from FCC citations it becomes apparent that one of the three, calling himself The Grand Dragon, received a six-month suspension of his ham license for unlicensed operation on CB. Apparently he remained active in MC, despite the suspension, using a transmitter belonging to MC's Grand Wizard, whose own CB license was withdrawn when he proved to be under-age. (The latter retained his ham call.)

CB NIGHTMARE IN INDIANA

The Grand Wizard's claim to pre-eminence in MC circles (disputed by many) stems from his use of a 250-watt transmitter on CB channel 9. His boast is that he never went off the air in spite of the FCC suspension. He has been known to play taped music on the band and ignores urgent 10-33s. He also is a key figure in the AM broadcast network.

The third (also suspended as a ham for unlicensed CB operation) calls himself the Joker. He stayed on the air during his suspension and uses his brother's CB call occasionally when he, as he says, "feels like going legal."

Tiger Dan is in charge of recruitment among younger people. He tends to be a wise-guy on the air.

A young friend of his appears to have no license status whatever and seemingly operates without fear of FCC action. He participates in most illegal jammings and similar stunts and is said to be a central figure in MC.

Some other members, although licensed, prefer to operate illegally by playing music and using obscene language on channel 9, employing a legitimate CB call (someone else's, naturally). They adopt this tactic for "getting back at those who would challenge Master Control's authority," as has been explained by the gang. We have specific information on one who operates this way in Creve Coeur, Ill., for instance.

The CB press has not neglected the affairs of MC. One magazine has been passing on all of its considerable correspondence on the subject to the FCC in Washington.

Typical is a letter (on ruled, school-note-book paper) signed by "Tom Kontrol," Whiting, Ind. (home of bootleg station WMMO). It suggests that "Master Control is just a great organization any young CBer wouldn't mind being in. Not everyone is in Master Control but wouldn't mind being in. That's just it . . . so they *say* they are. That's who does the CB signal jamming and uses foul language. Not Master Control." Although he denies any affiliation with MC he says, later in the letter: "We don't cut antennas, though."

A reply to "Kontrol" went unanswered. But on the evening of June 26, 1967, WMMO broadcast the entire text of both letters. The

announcer was careful not to mention "Kontrol's" name or address but simply added that "it was sent to a member station of Master Control." We have a tape recording of this broadcast.

Meanwhile, where is the law? Police in Cedar Lake are well aware of the harassment and particularly the speeding that take place on their highways. Yet they are frequently frustrated in efforts to apprehend the violators because of the CB intercommunication between MC cars.

From what we were told by informants in the area, FCC files in Chicago must be bulging with complaints. Still, they know of only two attempts to monitor MC. The offenders quickly suspended operations, leaving the FCC with nothing to do but issue notices to legitimate CBers in the area for such innocuous items as overmodulation and splatter. So far as we've been able to determine, no FCC investigation has ever been launched into AM bootleg stations WMMO, WMML and WMOL.

Numerous letters from CBers have offered assistance to FCC officials in clearing up the mess. Some have included off-the-air tapes of MC operations—tapes that the FCC, both in Chicago and in Washington, says are useless for their purpose.

One official at the Chicago office offers this advice: "In submitting specific reports, dates, times and *habits* are helpful. We can't always give immediate attention to CB operations and when we are able to do so the violators may not be on the air."

Trying to get further information on the progress of the FCC was frustrating business. Appropriate reports were unavailable or were awaiting action by some other office. One man in the Chicago office would say only: "I'd much prefer you talk to Washington on this." Washington gave the impression that all outstanding matters had been acted on and that anything new would have to come from Chicago. Practically all I netted from several lengthy calls was the information on the three cases already mentioned.

And so Master Control goes on as the Hells Angels of the Citizens Band, enforcing its will on everyone in its area, committing outright crimes, thumbing its nose at the law. It's a shocking case, but one which apparently no one is willing or able to do anything about. —

What In The World's Going On? Find Out With A Heathkit® SWL Radio

NEW! Professional 10-Band Shortwave Receiver... Slices Stations Down To The Last kHz

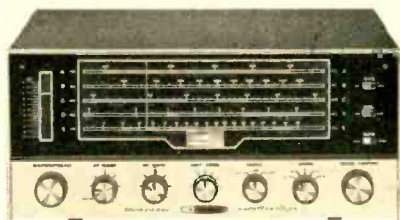
Covers 6 shortwave bands (49, 31, 25, 19 & 16 meters) ... 80, 40 and 20 meter ham bands ... 11 meter CB. Includes 5 kHz crystal filter for AM, SSB and CW listening. 11-tube circuit. 1 kHz dial calibrations — 100 kHz per dial revolution ... no more guessing station frequencies. Crystal-controlled front-end for same rate tuning on all bands. Prebuilt & aligned Linear Master Oscillator. Tuning dial to knob ratio 4 to 1. Calibrated "S" meter. Automatic noise limiter. Separate RF and AF gain controls. Headphone jack. Non-backlash vernier tuning dial. "Sub-pack" packaging for easy 20-hour kit assembly. Modern "low-boy" cabinet styling, plus many more "pro" SWL features. Optional crystal filters for optimum CW & SSB available.

Kit SB-310, 20 lbs.... no money dn., \$23 mo..... **\$249.00**

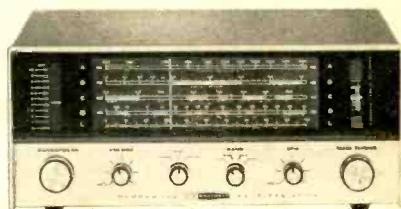


Kit SB-310
\$249⁰⁰
\$23 mo.

(SB-600 8 ohm, 6" x 9" speaker \$18.95)



Kit GR-54
\$87⁹⁵
\$9 mo.



Kit GR-64
\$39⁹⁵
\$5 mo.

For The Seasoned SWL... Deluxe 5-Band Shortwave Receiver

Features 5 bands ... 3 shortwave bands cover 2 MHz to 30 MHz, plus AM broadcast and 180 kHz to 420 kHz aeronautical & radio navigation bands. Tuned RF stage. Crystal filter for sharp selectivity. Separate product detector for SSB & CW. 6 diode, 6 tube superhet circuit. 4" x 6" speaker. Built-in code practice monitor. Switchable BFO, metal cabinet and more. Includes FREE SWL antenna.

Kit GR-54, 25 lbs.... no money dn., \$9 mo..... **\$87.95**

Low-Cost 4-Band AM/Shortwave Receiver

Hear "live" broadcasts from around the globe, ham operators, Voice of America, ship-to-shore, CW, plus local AM on this single receiver. 4 bands ... 3 shortwave bands cover 1 MHz to 30 MHz, plus AM broadcast. 5" speaker for crisp, bold sound. 7" slide-rule dial with logging scale. Lighted bandspread tuning dial. Relative signal strength indicator. BFO control. Headphone jack. Metal cabinet and more.

Kit GR-64, 15 lbs.... no money dn., \$5 mo..... **\$39.95**



Kit GR-43
\$139⁹⁵
\$13 mo.

Deluxe 10-Band AM/FM/Shortwave Transistor Portable

10 bands tune Longwave, AM, FM and 2 MHz to 22.5 MHz shortwave. Separate AM & FM tuners and IF strips. 16 transistors, 6 diodes and 44 factory assembled and pretuned circuits. 4" x 6" speaker. Earphone, time zone map, listener's guide. Build in about 10 hours. Optional converter/charger for AC operation \$6.95.

Kit GR-43, 19 lbs.... no money dn., \$13 mo..... **\$139.95**



Kit GC-1A
\$89⁵⁰
\$9 mo.

Last Call For The "Mohican" Portable 5-Band Shortwave Receiver

Tunes 550 kHz to 32 MHz in 5 bands. Fixed-aligned IF ceramic "trans-filters" for best selectivity. Self-contained for portability, yet can run on 117 v. AC with optional power supply @ \$9.95. 10 transistor, 6 diode circuit. Slide-rule dial, "S" meter, BFO control, electrical bandspread. 4" x 6" speaker, headphone jack, metal cabinet and more.

Kit GC-1A, 18 lbs.... no money dn., \$9 mo..... **\$89.50**

Turn Page For More Heathkit Values!

Instant Gift-Solving Guide From Heath...

Now There Are 3 Heathkit Color TV's To Choose From

Introducing The NEW Deluxe Heathkit "227" Color TV

Exclusive Heathkit Self-Servicing Features. Like the famous Heathkit "295" and "180" color TV's, the new Heathkit "227" features a built-in dot generator plus full color photos and simple instructions so you can set-up, converge and maintain the best color pictures at all times. Add to this the detailed trouble-shooting charts in the manual, and you put an end to costly TV service calls for periodic picture convergence and minor repairs. No other brand of color TV has this money-saving self-servicing feature.

Advanced Performance Features. Boasts new RCA Perma-Chrome picture tube with 227 sq. in. rectangular viewing area for 40% brighter pictures... 24,000 v. regulated picture power and improved "rare earth" phosphors for more brilliant, livelier colors... new improved low voltage power supply with boosted B+ for best operation... automatic de-gassing combined with exclusive Heath Magna-Shield that "cleans" the picture every-time you turn the set on from a "cold" start, and keeps colors pure and clean regardless of set movement or placement... automatic color control and gated automatic gain control to reduce color fade and insure steady, flutter-free pictures even under adverse conditions... preassembled & aligned 3-stage IF... preassembled & aligned 2-speed transistor UHF tuner and deluxe VHF turret tuner with "memory" fine tuning... 300 & 75 ohm VHF antenna inputs... two hi-fi sound outputs... 4" x 6" 8 ohm speaker... one-piece mask & control panel for simple installation in a wall, your custom cabinet or either optional Heath factory-assembled cabinets. Build in 25 hours.

- Kit GR-227**, (everything except cabinet)
 ... \$42 dn., as low as \$25 mo. **\$419.95**
GRA-227-1, Walnut cabinet... no money dn., \$6 mo. **\$59.95**
GRA-227-2, Mediterranean Oak cabinet (shown above).
 ... no money dn., \$10 mo. **\$94.50**



Kit GR-227
\$419.95
 (less cabinet)
 \$25 mo.

Kit GRA-27
\$19.95



New Remote Control For Heathkit Color TV

Now change channels and turn your Heathkit color TV off and on from the comfort of your armchair with this new remote control kit. Use with Heathkit GR-227, GR-295 and GR-180 color TV's. Includes 20' cable.

Kit GR-295
\$479.95
 (less cabinet)
 \$42 mo.



Deluxe Heathkit "295" Color TV

Has same high performance features and built-in servicing facilities as new GR-227, except for 295 sq. in. viewing area (industry's largest picture)... 25,000 volt picture power... universal main control panel for versatile in-wall installation... and 6" x 9" speaker.

- Kit GR-295**, (everything except cabinet), 131 lbs.... **\$479.95**
 \$48 dn., \$42 mo.
GRA-295-1, Walnut cabinet (shown above), 35 lbs.... **\$62.95**
 no money dn., \$7 mo.
 Other cabinets from \$94.50

Kit GR-180
\$349.95
 (less cabinet & cart)
 \$30 mo.



Deluxe Heathkit "180" Color TV

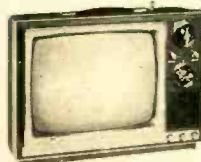
Same high performance features and exclusive self-servicing facilities as new GR-227 (above) except for 180 sq. in. viewing area.

- Kit GR-180**, (everything except cabinet), 102 lbs.... **\$349.95**
 \$35 dn., \$30 mo.
GRA-180-5, table model cabinet & mobile cart (shown above), 57 lbs.... no money dn., \$5 mo. **\$39.95**
 Other cabinets from \$24.95

Deluxe 12" Transistor Portable B&W TV - First Kit With Integrated Circuit

Unusually sensitive performance. Plays anywhere... runs on household 117 v. AC, any 12 v. battery, or optional rechargeable battery pack (\$39.95); receives all channels; new integrated sound circuit replaces 39 components; preassembled, prealigned tuners; high gain IF strip; Gated AGC for steady, jitter-free pictures; front-panel mounted speaker; assemblies in only 10 hours. Rugged high impact plastic cabinet measures a compact 11 1/2" H x 15 1/4" W x 9 3/4" D. 27 lbs.

Kit GR-104
\$119.95
 \$11 mo.

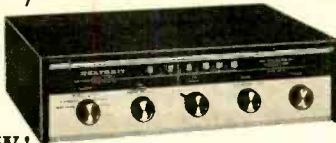


Kit GR-104, 27 lbs.... no money dn.,
 \$11 mo. **\$119.95**

No Money Down On \$25 to \$300 Orders — Write For Credit Form

Turn Page For 11 More Solutions

Enjoy The Sounds Of Christmas With A Heathkit® Stereo System



Kit AR-17
\$72.95
 (less cabinet)
 \$8 mo.

NEW! Lowest Cost Solid-State Stereo Receiver

Features wide 18-60,000 Hz response @ ±1 db at full 5 watts RMS power per channel... 14 watts music power... inputs for phono and auxiliary... automatic stereo indicator... outputs for 4 thru 16 ohm speakers... adjustable phase for best stereo... flywheel tuning... and compact 9 1/4" D. x 2 1/2" H. x 11 1/4" W. size. 12 lbs. Optional factory assembled cabinets (walnut \$7.95, beige metal \$3.50).

Kit AR-17, (less cab.) 12 lbs.... no money dn., \$8 mo. **\$72.95**



Kit AR-27
\$49.95
 (less cabinet)
 \$5 mo.

NEW! Low Cost Solid-State FM Mono Receiver

Features cool, solid-state circuit... 7 watts music, 5 watts RMS power... 18 to 60,000 Hz response @ ±1 db... inputs for phono and auxiliary... outputs for 4 thru 16 ohm speakers... flywheel tuning... front panel controls... preassembled & aligned FM front-end... and 9 1/4" D. x 2 1/2" H. x 11 1/4" W. bookshelf size. 9 lbs. Optional Heath factory assembled cabinets (walnut veneer \$7.95, beige metal \$3.50).

Kit AR-27, (less cab.) 9 lbs.... no money dn., \$5 mo. **\$49.95**



Kit AR-15
\$329.95
 (less cabinet)
 \$28 mo.
 Assembled ARW-15
\$499.50
 (less cabinet)
 \$43 mo.

World's Most Advanced Stereo Receiver ... Choose Kit Or Factory Assembled

Acclaimed by owners & audio experts for its advanced features like integrated circuits and crystal filters in the IF amplifier section; ultra-sensitive FET FM tuner; 150 watts dynamic music power; complete AM, FM and FM stereo listening; positive circuit protection; all-silicon transistors; "black magic" panel lighting; stereo only switch; adjustable phase control for best stereo and many more. 34 lbs. Optional wrap-around walnut cabinet \$19.95.

Kit AR-15 (less cab.), 34 lbs.... \$33 dn., \$28 mo. **\$329.95**

Assembled ARW-15, (less cab.), 34 lbs.... \$50 dn., \$43 mo. **\$499.50**

NEW! Heathkit Stereo Headphone Control Box



Kit AC-17
\$7.95

Now enjoy the convenience of switching from speaker to private headphone listening without leaving the comfort of your favorite chair. Connects to any headphone regardless of power, and has standard jacks to accommodate two sets of any impedance, 3 or 4 connector, stereo or mono headset. Tandem volume and balance controls. About the size of a pack of cigarettes. Includes 20' cable.

Kit AC-17, 3 lbs. **\$7.95**

NEW! Exclusive Heath Hi-Fi Furniture... Fully Assembled And Finished

Contemporary Walnut Stereo/Hi-Fi Cabinet Ensemble Complements Modern Furnishings

Masterfully crafted of fine veneers and solids with walnut finish. Statuary Bronze handles. Equipment cabinet features adjustable shelves to accommodate all makes of hi-fi components, record storage or tape recorder compartment, turntable compartment. Speaker cabinet features special Tubular-Duct Reflex design for matching 8" or 12" speakers, plus slot for a horn tweeter.

Model AE-37, equipment cabinet... no money dn., \$12 mo. **\$125.00**

Model AEA-37-1, speaker cabinet... no money dn., \$6 mo. each **\$59.50**

Early American Stereo/Hi-Fi Cabinet Ensemble

Early American richness with modern component layout. Constructed of specially-selected solids and veneers finished in popular Salem-Maple. Statuary Bronze handles. Equipment cabinet has adjustable shelves to accommodate any make hi-fi component, record storage or tape recorder compartment, turntable compartment. Speaker cabinet can be matched to any 8" or 12" speaker... has slot for horn tweeter.

Model AE-47, equipment cabinet... no money dn., \$13 mo. **\$135.00**

Model AEA-47-1, speaker cabinet... no money dn., \$7 mo. each **\$64.50**

Mediterranean Pecan Stereo/Hi-Fi Cabinet Ensemble

Beautifully constructed of fine furniture solids and veneers with Pecan finish. Statuary Bronze handles. Equipment cabinet has adjustable shelves to house any make hi-fi component, record storage or tape recorder compartment, turntable compartment. Speaker cabinet can be matched to any 8" or 12" speaker... has slot for horn tweeter.

Model AE-57, equipment cabinet... no money dn., \$14 mo. **\$150.00**

Model AEA-57-1, speaker cabinet... no money dn., \$8 mo. each **\$74.50**

Complete Ensemble
\$244⁰⁰



Complete Ensemble
\$264⁰⁰



Complete Ensemble
\$299⁰⁰



Enjoy Widest Kit Selection, Easy Credit,

"Starmaker" Dual-Channel Solid-State Guitar Amplifier



Features 25 watts EIA, 60 watts peak power; two channels, each with two inputs; handles lead guitar, singer's mike; tremolo & reverb; two 12" speakers; line bypass reversing switch for hum reduction; foot switches; black vinyl-covered wood cabinet with aluminum front panel & chrome knobs. 52 lbs.

Kit TA-16 **\$134⁹⁵**
\$13 mo.

Assembled TAW-16 **\$199⁹⁵**
\$19 mo.

NEW! Single-Channel Solid-State Guitar Amplifier



Compare To Amps Costing \$175 & More! Boasts 20 watts EIA, 40 watts peak power; tremolo & reverb; two inputs for lead guitars, singer's mike; 12" speaker; line bypass reversing switch to reduce hum; foot switches; transformer power supply; black vinyl-covered wood cabinet with aluminum front panel & chrome knobs. 35 lbs.

Kit TA-27 **\$89⁹⁵**
\$9 mo.

Assembled TAW-27 **\$134⁹⁵**
\$13 mo.

NEW! Deluxe Solid-State Combo Amplifier & Speaker System ... Choose Kit Or Factory Assembled



Kit TA-17 Amplifier **\$175⁰⁰**
\$17 mo.
(Wired TAW-17, \$275)

Kit TA-17-1 Speaker System **\$120⁰⁰**
\$11 mo.
(Wired TAW-17-1, \$150)

Kit TAS-17-2 Special Combination Offer! 2 Speaker Systems & Amplifier Save \$20 **\$395⁰⁰**
\$40 dn.
\$34 mo.
(Wired TAW-17-2, \$545)

All the "big sound" features every combo wants ... tremolo, built-in "fuzz", brightness, reverb, separate bass and treble boost and more. Delivers a shattering 120 watts EIA music power (240 watts peak power) through two TA-17-1 speakers ... or 90 watts through one TA-17-1 speaker. Features 3 independent input channels, each with two inputs. Handles lead or bass guitars, combo organ, accordion, singer's mike, or even a record changer. All front panel controls keep you in full command of all the action.

Speaker system features two 12" woofers, special horn driver and matching black vinyl-covered wood cabinet with casters & handles for easy mobility.

Save Up To \$500 On This Heathkit®/Thomas "Paramount" Transistor Theatre Organ



Kit TO-67 **\$995⁰⁰**
(including bench)
Write for credit details

All Genuine Thomas Factory-Fabricated Parts. Features 15 manual, 4 pedal voices; instant-play Color-Glo; all solid-state circuit; 200 watts peak power; two separate speaker systems ... 2-speed rotating Leslie plus main system with two 12" speakers; two 44-note keyboards; professional horseshoe console with stop tablets; 28 notes of chimes; 13-note bass pedals; selective repeat & attack percussion; reverb; stereo headset outlet; assembled walnut finish hardwood cabinet and bench; and more. 265 lbs. 7", 33-1/3 rpm demonstration record 50c.

America's Lowest Cost Solid-State Organ

Save Up to \$205! Features instant-play Color-Glo; 10 organ voices; 13-note bass pedals; repeat percussion; two 37-note keyboards; 75 watt peak power; vibrato; matching preassembled walnut cabinet & bench; 5-year warranty on plug-in tone generators. 172 lbs. 7", 33-1/3 rpm demonstration record 50c.



Kit GD-325B **\$394⁹⁰**
\$40 dn., \$34 mo.

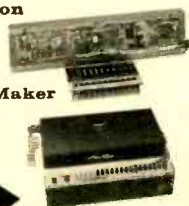
NEW! Heathkit®/Thomas Organ Accessories

Exclusive Band Box Percussion

Automatically or manually adds 10 percussion voices to any Heathkit/Thomas organ. Build & install in 12 hours. Kit TOA-67-1, no money dn., \$14 mo. ... \$145.00

Exclusive Playmate Rhythm Maker

Adds 15 fascinating rhythms to any Heathkit/Thomas Organ. Requires Band Box Percussion (above) for operation. Kit TOA-67-5, no money dn., \$18 mo. ... \$189.90



Order Now! Use The Handy Coupon Opposite Page

Direct-To-You Delivery From Heath



Kit TO-68
\$349⁹⁵

NEW! VOX "Jaguar" Transistor Combo Organ By Heathkit

Save Up To \$150 on the world's most popular combo organ with this new Heathkit version. Features the most distinctive sound of any combo organ. Has a special bass output that gives a brilliant stereo bass effect when played through a separate or multi-channel amplifier, 4 complete octaves, vibrato, percussive effects and reversible bass keys. Includes hand crafted orange and black cabinet, fully plated heavy-duty stand, expression pedal and waterproof carrying cover and case for stand. Requires a bass or combo amplifier like Heathkit TA-17 (opposite page).

Kit TO-68, 80 lbs. . . \$35 dn., \$30 mo. **\$349.95**

NEW! Amateur Novice CW Transceiver



Kit HW-16
\$99⁵⁰
\$10 mo.

Novices! New Hams! Get on-the-air at lowest cost. Provides CW operation on the first 250 kHz of the 80, 40 & 15 meter bands. 75 watt CW input, up to 90 watts for general class operation. True "break-in" CW operation. Crystal control transmit with VFO receiver tuning. Built-in sidetone. Grid-block keying. Metal cabinet and simple assembly. 25 lbs.

Kit HW-16, 25 lbs. . . no money dn., \$10 mo. **\$99.50**

NEW! Heathkit Jr.[®] Solid-State Portable Phonograph

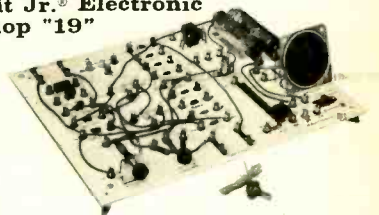
Kit JK-17
\$19⁹⁵



Perfect for the youngster in your family. Plays all 4 speeds, all record sizes. Crystal cartridge with sapphire stylus for all types of records; 4" speaker; built-in 45 rpm adaptor; preassembled turntable and hardboard cabinet. Build in 1 to 2 hours. 117 VAC, 60 Hz operation. 11 lbs.

Heathkit Jr.[®] Electronic Workshop "19"

Kit JK-27
\$13⁹⁵



Ideal gift for any youngster who wants to learn electronics. Contains principles of operation & instructions for building 19 electronic projects . . . PA system, transistor radio, burglar alarm, etc. Spring-type connectors. Safe, flashlight battery operation. 4 lbs.

NEW! Heathkit Jr.[®] Guitar Amplifier



Kit JK-37
\$29⁹⁵
\$5 mo.

Ideal For Youngsters! Build in an evening. All solid-state. 9 watts music power. 8" speaker. Single channel, two inputs. Variable tremolo. Volume & tone controls. Red vinyl-covered wood cabinet with striped grille cloth and carrying handle. 12 lbs.



NEW FREE 1968 CATALOG!

Now with more kits, more color. Fully describes these along with over 300 kits for stereo/hi-fi, color TV, electronic organs, electric guitar & amplifier, amateur radio, marine, educational, CB, home & hobby. Mail coupon or write Heath Company, Benton Harbor, Michigan 49022.

HEATH COMPANY, Dept. 39-1
Benton Harbor, Michigan 49022
In Canada, Daystrom Ltd.

Enclosed is \$ _____ including 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-308

Good Reading

By Tim Cartwright

DIRECTORY OF ELECTRONIC CIRCUITS. By Matthew Mandl. Prentice-Hall, Englewood Cliffs, N. J. 226 pages. \$10.60

Almost every day (particularly when the stock market is looking for glamor electronics issues) we read claims of revolutionary circuitry and electronic breakthroughs. But most electronic design centers on well-known, well-proven workhorse circuits that are as new as the use they're put to.

The Directory presents more than 150 such circuits, analyzed in function and application with component values and basic equations and formulas. Circuit categories include amplifier, bridge and demodulator circuits; filters, attenuators and pads; modulation, gating and combining circuits; oscillators—and many, many others. The presentation is excellent, concise and well-written. Altogether, it's hard to think of a better working reference than this one.

FUNDAMENTALS OF TRANSISTORS: A PROGRAMMED TEXT. Prepared by RCA Service Co. Prentice-Hall, Englewood Cliffs, N. J. 223 pages. \$13

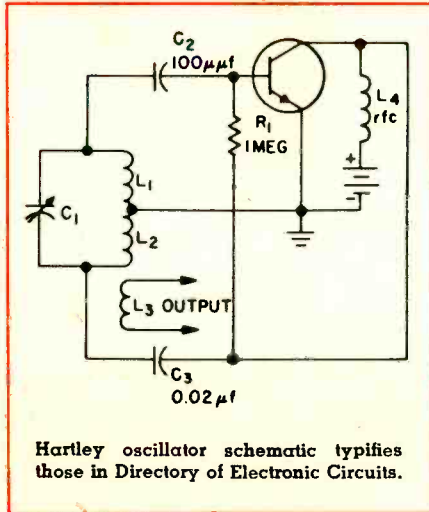
Unless my memory is playing tricks, my first exposure to programmed instruction was through a Prentice-Hall text on transistors that taught me even more than I thought I wanted to know. Good thing, too, because this text, though covering much of the same ground, seems to assume much more previous knowledge of the reader than did its predecessor. So, while I'm not sure I can recommend it to the novice, it may be fine for a technician of the old school or anyone else who wants to retrace his steps and learn transistor theory painlessly.

TRANSISTOR BASICS: A SHORT COURSE. By George C. Stanley, Jr. Hayden Book Co., New York. 102 pages. \$2.75

If programmed learning is not your dish of tea, there's an alternative introductory route to the transistor. Basics offers a highly personal and lighthearted approach that begins by comparing electron storage in a transistor base with air traffic stacking over an airport. The programmed text might give you a more thorough grounding but this one will make the learning easy and pleasant all the way, just like a two-martini flight to Chicago.

ELECTRONIC DESIGNER'S HANDBOOK. By T. K. Hemingway. Business Publications, London. (Distributed in U.S. by TAB Books, Thurmont, Md.) 296 pages. \$8.95

This is a working guide to transistor circuit design. It covers and analyzes some of the same circuits presented in the Directory reviewed in this column. But the orientation is somewhat different and the treatment of some applications even more exhaustive and well-done. This, too, is a valuable addition to any electronics reference shelf.



Hartley oscillator schematic typifies those in Directory of Electronic Circuits.

CATV SYSTEM MAINTENANCE. By Robert B. Cooper, Jr. TAB Books, Thurmont, Md. 193 pages. \$12.95

CATV continues to grow, with its own special set of limitations and problems. This book is a comprehensive guide to day-to-day CATV maintenance procedures with emphasis on eliminating interference and radiation problems: a thorough reference.

And Make Note Of . . .

PROJECTS OF BASIC MAGNETISM. By John Potter Shields. Howard Sams, New York & Indianapolis. 96 pages. \$2.25

ELECTRONIC ENGINEERING MEASUREMENTS FILEBOOK (2nd Edition). Editorial Staff, EEE Magazine. TAB Books, Thurmont, Md. 168 pages. \$9.95



LUNCHBOX HAM STATION

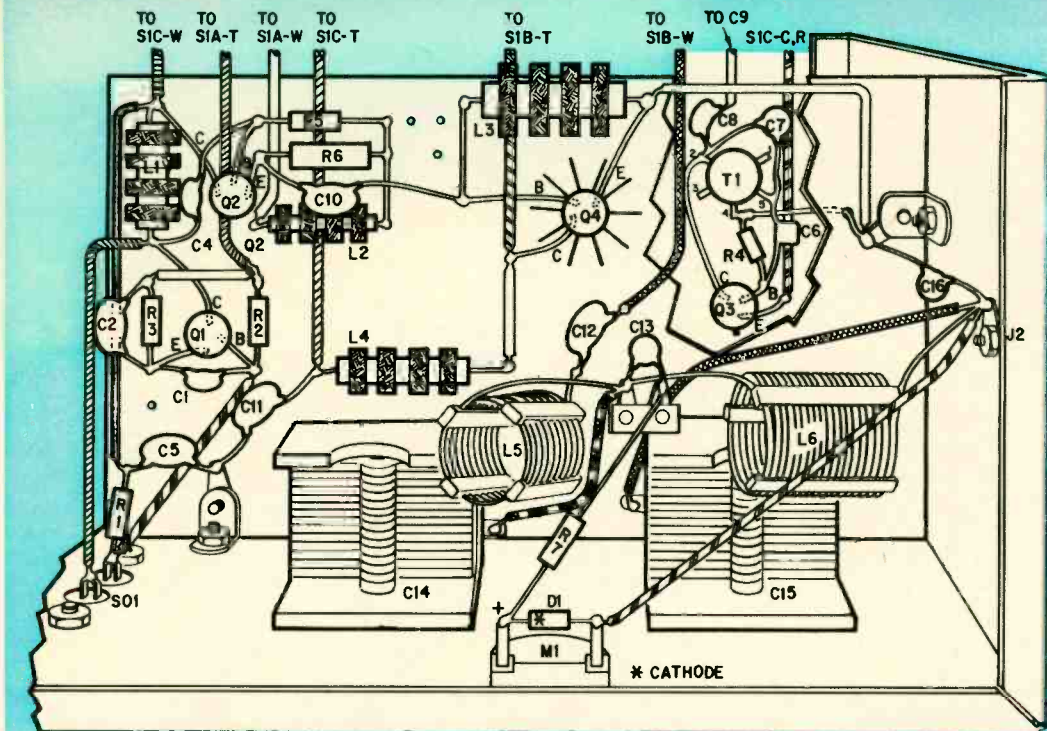
By **LEN BUCKWALTER, K1ODH** VACATION usually means camping and boating—the great outdoors where there isn't a volt of electricity. For the ham who must get on the air every day, being away from the station can bring on acute homesickness and depression. Unless, of course, he has a Lunchbox Ham Station packed along with the fishing tackle and tents.

Two recent developments combine to make our station possible. One is the drop in price of RF power transistors. The other is the trend in transistor radios to include a short-wave band. Our rig includes such a commercially-made transistor receiver. You can operate it just about anywhere. And the radio may be removed quickly and easily restored to normal operation.

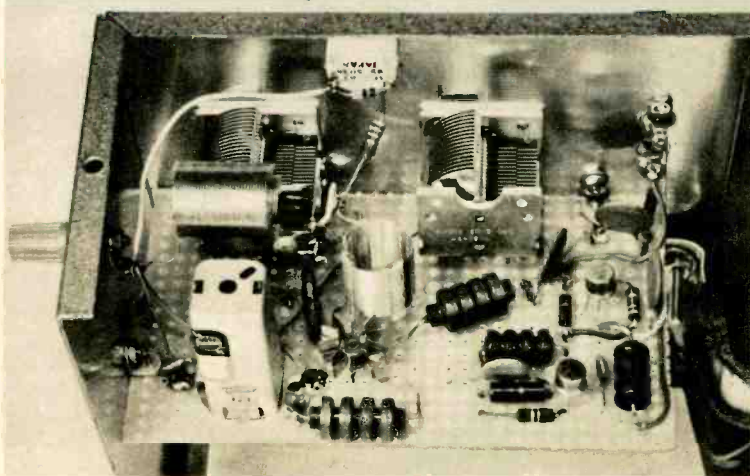
The transmitter is the part you build. It's a three-transistor job for operating CW on the 80-meter band with a General or Novice (3.7-3.75 mc) ticket. Final input power runs about 2.5 watts, which should be enough for local contacts or for longer hauls if there's no pile-up. The output circuit permits you to use a convenient long-wire antenna which also peeps up performance of the receiver. The antenna wire can be tossed out a window, if there's sufficient height, or hung over a tree branch.

The receiver may be any transistor portable that has a short-wave band covering 3 to 4 mc. Sometimes these sets have a dial marked marine band but a closer look usually reveals that coverage is much greater than the 2-3 mc marine frequencies. The ten-transistor radio we used tunes 2 to 6 mc and thus includes the 80-meter ham band.

You say you can't copy CW on one of these radios? This problem is licked



Pictorial above is view looking down into station. Front panel is at bottom. BFO circuit, consisting of C6,C7,C8,R4, T1 and Q3, is mounted under circuit board. Circuit board is 6 x 3¼ in. and is mounted ¾ in. down from top of cabinet. Photo of our model from rear is shown below. Transformer at left of board was used in earlier design. It was replaced by smaller type and mounted under board. Note positions of L5, L6 in photo.



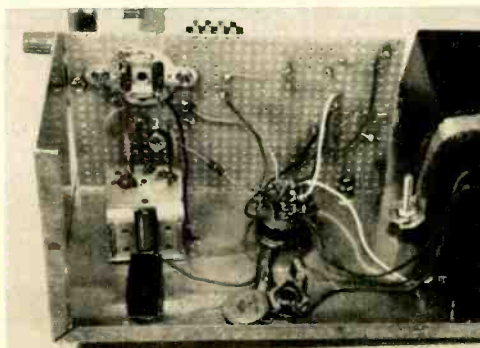
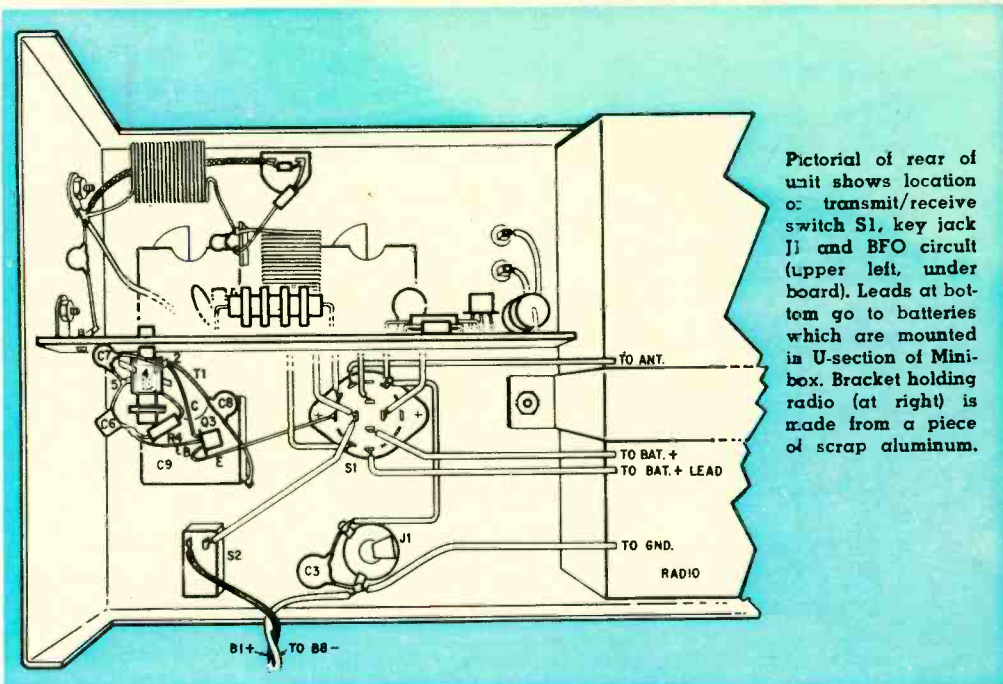
LUNCHBOX HAM STATION

by a BFO we've included. The BFO generates a signal that beats against the incoming RF in the radio and creates a tone. Pitch is varied with a front-panel knob. The only thing missing on the radio is a bandspread dial, but careful tuning makes up for this.

Another feature in the circuit is a calibrate position of the transmit/receive switch. It

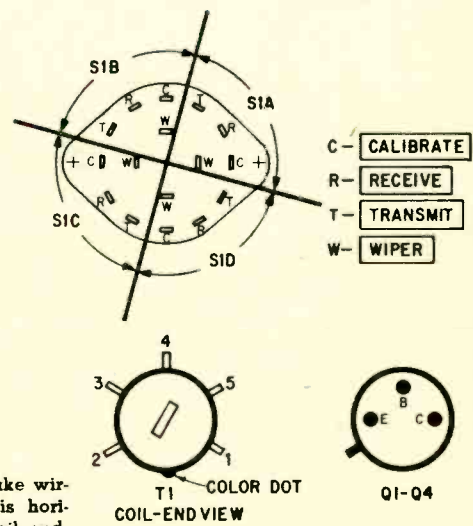
energizes the transmitter's oscillator only so you can spot your signal on the receiver's dial. When you flip the transmit/receive switch to transmit, the antenna is switched from receiver to transmitter and the receiver is muted. Switch to receive and the radio comes on and BFO is energized.

Construction. The transmitter is built on a 6 x 3¼-in. piece of perforated board which is held in the main section of the cabinet by two L-brackets. Solder lugs are used on both brackets to serve as ground points for nearby



View looking up shows underside of board. As early model had different BFO circuit, transformer at upper left doesn't look like type we specify.

Follow diagram of switch S1 at right and you won't make wiring errors; position S1 so line through widest part is horizontal. Lugs of BFO transformer are identified from coil end.

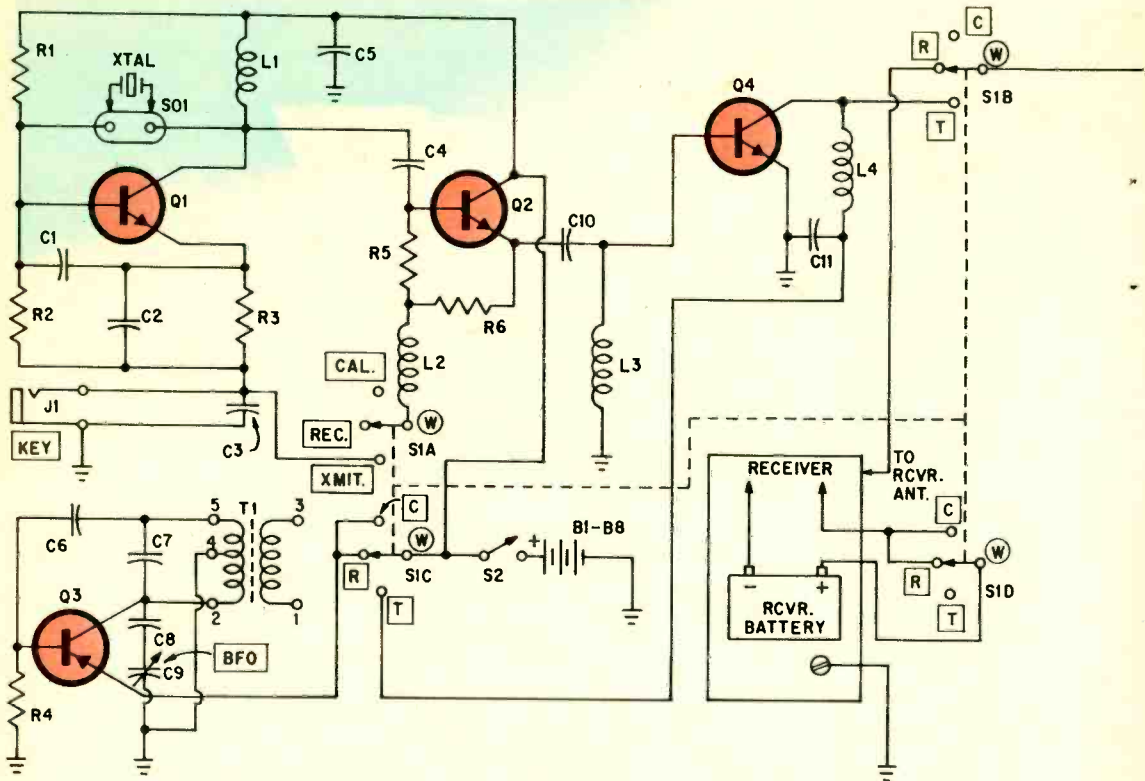


components. Variable capacitors C9, C14 and C15 mount on the front panel. You'll find threaded holes for No. 6 machine screws in the capacitor frames. Caution is needed here since the screws, if too long may easily jam the plates. This is easily prevented by putting a nut under the head of each 1/4 in.-long screw. If there's still a problem, insert a few washers under the screw heads.

Coils L5, L6 and several other parts are

supported by a terminal strip mounted at the back of C15. The strip has two terminals: the left one must not be grounded; the right terminal is also the mounting foot. Solder the foot directly to the rear of the capacitor frame and use it for the ground point for C13 and R7. Both coils are cut from the same length of coil stock mentioned in the Parts Lists.

When rotary switch S1 is mounted, be



LUNCHBOX HAM STATION

certain that the wide part of the switch wafer is horizontal. This puts the lugs into the wiring position shown.

The Receiver. There's only one wire to find in the radio and it's simple to locate. It is the red, or positive, lead that connects to the receiver's battery. Break the lead and splice two wires from the break to switch S1. Tape the splices to prevent shorts. Note that the receiver continues to operate on its internal batteries. It is now turned on and off by S1D.

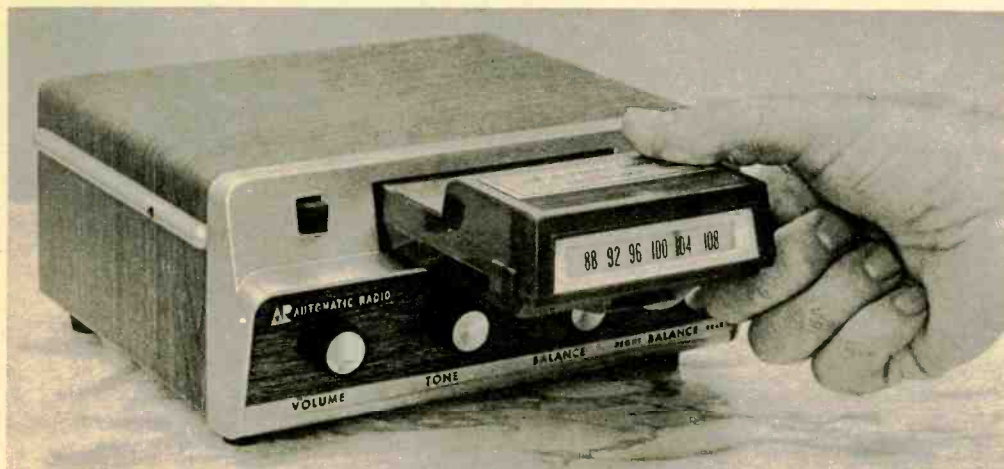
To assure good receiver performance, a connection is needed from the receiver's ground to the metal case. In our radio ground was a screw at the back of the case. But such screws may not be ground potential in other radios. Here's how to check. Touch one probe of an ohmmeter to the screw or other possible ground points. Then, with the receiver turned off, touch the other probe to each of the receiver's battery terminals. When you measure zero ohms, you've found ground.

Next, the antenna connection to the receiver. In our model, there was an antenna jack from which we ran a wire to S1B. Since our whip still could touch the metal case when it was collapsed, its upper sections were unscrewed and removed. If your set has no antenna jack, make the antenna connection to the whip.

Mount the receiver with a length of aluminum strap cut short enough so the two mounting screws draw up the slack when they are tightened. Put some foam rubber or other material under the strap so you won't damage the radio case.

Checkout. To test the transmitter, hook the antenna wire to J2. Although the output network can match short antennas, try to use about 60 ft. String the antenna with as few bends and turns as possible and keep it in the clear.

Check the crystal oscillator first by turning S2 and the receiver's power switch on. Set S1 to cal. (for calibrate). Press the key and tune the receiver until you hear a rushing noise, which should be between 3 and 4 mc.



AM-FM Cartridges for Tape Players

HIGH in popularity among automobile accessories is the tape player. It's great entertainment at first but eventually as you tire of the same music you begin to realize that a big library of cartridges costs money.

If you haven't bought a player (or a car radio) yet, consider the Automatic Radio TapeDek Convertible player (Model GES-6394). Big thing about it is that when you tire of tapes you can slip in Automatic's AM or FM tuner cartridges. As you see above, the FM tuner goes in just like a tape cartridge.

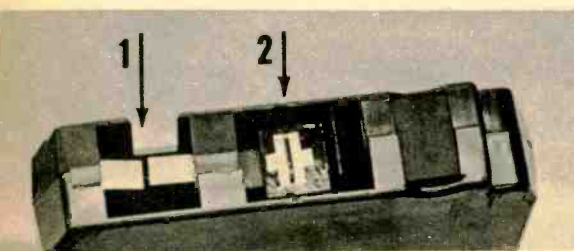
The player has a list price of \$129.95 and is available from distributors such as Olson Electronics and Allied Radio. A \$3.98 adaptor enables it to play four-track tapes. The AM and FM (mono) tuners list for \$29.95 and \$49.95, respectively. Both are tuned by a thumb knob on the underside and

have illuminated dials. The FM tuner has AFC.

At the back of the player there's a connector into which you plug a Y adaptor. You plug the car's antenna and a short jumper from your car radio into the adaptor to feed the antenna to the car radio and the tuner cartridges. The signal goes to either AM or FM tuner via a contact in the player and on the side of the cartridge.

In left photo below, arrow 1 points to two contacts which pick up tuner power from the player. The tuner's output is fed inductively (arrow 2) to the player's tape head.

Accessories include an under-dash bracket in which the player can be locked and from which it can be quickly removed for indoor use. For home listening, Automatic has a \$28.25 AC power supply and \$29.95 (each) walnut bookshelf speakers.



Arrow 1 points to contacts which pick up tuner's power. Arrow 2 points to coil which inductively feeds tuner's output to player's tape head.



AC power supply is at left. Controls on player are volume, tone, balance. Window at upper right (player) shows number of the track being played.



NEW DX AWARD

25 MAJOR CITIES



FOR the Seventh Award Period, beginning with the publication of this issue, EI is offering a brand-new Major Cities Award. This exciting addition to EI's prized series of DX certificates makes a total of eight SWL and six Ham awards available.

To qualify for the Major Cities award you must log any 25 of the 50 most-populous cities in the world.

To apply for this or any of the other DX certificates, use the Official Log at the end of this article. You may apply for as many as you want. (You may receive any Award only once, however.) QSLs may be used for

more than one Award. But if you wish to apply for more you must use a separate copy of the Official Log for each. If you are applying for the DX Century, based on 100 countries, you will also need an additional copy of the Log to enter the second 50 stations.

The easiest way to get extra copies of the Log is, of course, to go out and buy extra copies of this issue. Photostatic copies are entirely acceptable, though. If you can't get a copy by either of these methods you may make a facsimile; but *please* be sure it is identical in layout and size to the accompanying Log.

EI's MAJOR CITIES LIST

CITY & COUNTRY	POPULATION	CITY & COUNTRY	POPULATION
Shanghai, China	12,000,000	Mukden, Manchuria	2,423,000
Tokyo, Japan	8,914,492	Sydney, Australia	2,300,100
London, England	8,171,902	Wuhan, China	2,226,000
New York, N.Y.	7,781,984	Chungking, China	2,165,000
Peking, China	7,000,000	Delhi, India	2,061,758
Moscow, U.S.S.R.	6,427,000	Santiago, Chile	2,049,845
Bombay, India	4,152,056	Philadelphia, Pa.	2,002,512
Cairo, U.A.R.	4,035,000	Budapest, Hungary	1,935,531
Tientsin, China	4,000,000	Nagoya, Japan	1,930,180
Chicago, Ill.	3,550,404	Karachi, Pakistan	1,912,598
Seoul, South Korea	3,424,385	Melbourne, Australia	1,912,055
Jakarta, Indonesia	3,317,562	Canton, China	1,867,000
Berlin, Germany	3,264,000	Hamburg, Germany	1,857,000
Buenos Aires, Argentina	3,226,900	Bangkok, Thailand	1,839,000
Rio de Janeiro, Brazil	3,223,408	Lima, Peru	1,738,800
Osaka, Japan	3,217,321	Madras, India	1,729,141
Mexico City, Mexico	3,192,804	Bogota, Colombia	1,697,311
Sao Paulo, Brazil	3,164,804	Caracas, Venezuela	1,674,728
Calcutta, India	2,927,829	Detroit, Mich.	1,670,144
Leningrad, U.S.S.R.	2,899,955	Vienna, Austria	1,640,100
Paris, France	2,811,171	Yokohama, Japan	1,637,944
Teheran, Iran	2,620,438	Harbin, Manchuria	1,595,000
Los Angeles, Calif.	2,479,015	Lu-ta, Kwantung, China	1,590,000
Madrid, Spain	2,455,302	Milan, Italy	1,582,534
Rome, Italy	2,259,931	Barcelona, Spain	1,557,863

Populations of the worlds largest cities based on the 1967 Information Please Almanac, Atlas Yearbook, published by Simon & Schuster, New York.

NEW DX AWARD 25 MAJOR CITIES

You'd be surprised at the amount of time that is wasted in checking over Award applications when they are submitted on irregular forms. And the Awards have become so popular that the only way we can keep within reason the time required to check them all is to make it a rule to *reject all applications that are not submitted on the Official DX Log or a sufficiently close approximation.*

All entries must be substantiated by a QSL card or letter. Be sure to mark which type of QSL you have received in the appropriate box on the log. **DO NOT INCLUDE YOUR QSLs WITH YOUR ENTRY.** We may ask you to submit them to us for inspection later.

Entries must be postmarked no later than midnight April 30, 1968. All entries postmarked later will not be eligible for this Award Period and will be returned to the sender.

If you want, you can receive a copy of EI's World DX List without charge. It lists all eligible countries, UN member nations and major cities for Award purposes. Send a stamped, self-addressed business (No. 10) envelope to: World DX List, EI's DX Club, 67 West 44th St., New York, N.Y. 10036.

Carefully fill out the DX Log, using either a typewriter or ball-point pen. Be sure to fill in all the required information. Accuracy is important. If your QSLs can't be verified the Award can't be validated. You must fill in *all* columns in the form: dates, times, frequencies, locations, types of QSL. Note that times called for are your local time. This makes more complex our job in checking the listings but it allows novice DXers to keep their logs without having to translate times into GMT.

Pay particular attention to the location of each transmitter you report. More Award applications are rejected because of discrepancies in this column than for any other reason. (See comments on this subject in Notes from EI's DX Club in this issue.)

After completing the log, check it for errors or omissions. Then mail your Award application to:

EI's DX Club
67 West 44th St.
New York, N.Y. 10036

If all required information on your entry is accurate a DX Award similar to the ones shown on the preceding page will be mailed to you. The 8½ x 5½-in. awards are suitable for framing and will make an attractive addition to your listening den or shack.

HANDY GUIDE TO EI'S DX AWARDS

CLASS OF AWARD	TYPE OF AWARD		FREQ. LIMITS	REQUIREMENTS
	SWL	HAM		
General 100 (DX Century)	X	X	None	Reception of or two-way communications with stations in at least 100 different countries.
General 50	X	X	None	Reception of or two-way communications with stations in at least 50 different countries.
Special	X	X	None	Reception of or two-way communications with stations in at least 10 different countries.
BCB Stateside Special	X		535-1605 kc	Reception of stations in at least 25 different states or provinces.
Broadcast Band	X		535-1605 kc	Reception of stations in at least 15 different countries.
All-Continents	X	X	None	Reception of or two-way communications with stations on all six continents.
United Nations-25	X	X	None	Reception of or two-way communications with stations in at least 25 different UN member countries.
Major Cities-25	X	X	None	Reception of or two-way communications with at least 25 of the most populated world cities. (Populations based upon 1967 Information Please Almanac published by Simon & Schuster, New York, N.Y.)

INSTRUCTIONS: PRINT neatly or use typewriter—DO NOT WRITE! Check SWL or HAM to designate type of Award and enter class of Award you are applying for (see chart on opposite page). In listing below, complete all blanks for each entry. Under *Date*, use figures (such as 10-1-64); all log entries must be dated January 1, 1950 or later. Under *Time*, use local standard time and 24-hour clock (0000 to 2359 hours). Make up identical copy of this log if you need more space. Seventh Award Period ends April 30, 1968.

NAME (last name) (first name and initial) HAM CALL

ADDRESS

CITY STATE AND ZIP (or country)

TYPE OF } SWL CLASS OF AWARD DATE
 AWARD } HAM

	DATE (local)	TIME (local)	FREQ. (kc)	STATION CALL	LOCATION (city & country)	QSL
1						card <input type="checkbox"/> letter <input type="checkbox"/>
2						card <input type="checkbox"/> letter <input type="checkbox"/>
3						card <input type="checkbox"/> letter <input type="checkbox"/>
4						card <input type="checkbox"/> letter <input type="checkbox"/>
5						card <input type="checkbox"/> letter <input type="checkbox"/>
6						card <input type="checkbox"/> letter <input type="checkbox"/>
7						card <input type="checkbox"/> letter <input type="checkbox"/>
8						card <input type="checkbox"/> letter <input type="checkbox"/>
9						card <input type="checkbox"/> letter <input type="checkbox"/>
10						card <input type="checkbox"/> letter <input type="checkbox"/>
11						card <input type="checkbox"/> letter <input type="checkbox"/>
12						card <input type="checkbox"/> letter <input type="checkbox"/>
13						card <input type="checkbox"/> letter <input type="checkbox"/>
14						card <input type="checkbox"/> letter <input type="checkbox"/>
15						card <input type="checkbox"/> letter <input type="checkbox"/>
16						card <input type="checkbox"/> letter <input type="checkbox"/>
17						card <input type="checkbox"/> letter <input type="checkbox"/>
18						card <input type="checkbox"/> letter <input type="checkbox"/>
19						card <input type="checkbox"/> letter <input type="checkbox"/>
20						card <input type="checkbox"/> letter <input type="checkbox"/>
21						card <input type="checkbox"/> letter <input type="checkbox"/>

	DATE (local)	TIME (local)	FREQ. (kc)	STATION CALL	LOCATION (city & country)	QSL
22						card <input type="checkbox"/> letter <input type="checkbox"/>
23						card <input type="checkbox"/> letter <input type="checkbox"/>
24						card <input type="checkbox"/> letter <input type="checkbox"/>
25						card <input type="checkbox"/> letter <input type="checkbox"/>
26						card <input type="checkbox"/> letter <input type="checkbox"/>
27						card <input type="checkbox"/> letter <input type="checkbox"/>
28						card <input type="checkbox"/> letter <input type="checkbox"/>
29						card <input type="checkbox"/> letter <input type="checkbox"/>
30						card <input type="checkbox"/> letter <input type="checkbox"/>
31						card <input type="checkbox"/> letter <input type="checkbox"/>
32						card <input type="checkbox"/> letter <input type="checkbox"/>
33						card <input type="checkbox"/> letter <input type="checkbox"/>
34						card <input type="checkbox"/> letter <input type="checkbox"/>
35						card <input type="checkbox"/> letter <input type="checkbox"/>
36						card <input type="checkbox"/> letter <input type="checkbox"/>
37						card <input type="checkbox"/> letter <input type="checkbox"/>
38						card <input type="checkbox"/> letter <input type="checkbox"/>
39						card <input type="checkbox"/> letter <input type="checkbox"/>
40						card <input type="checkbox"/> letter <input type="checkbox"/>
41						card <input type="checkbox"/> letter <input type="checkbox"/>
42						card <input type="checkbox"/> letter <input type="checkbox"/>
43						card <input type="checkbox"/> letter <input type="checkbox"/>
44						card <input type="checkbox"/> letter <input type="checkbox"/>
45						card <input type="checkbox"/> letter <input type="checkbox"/>
46						card <input type="checkbox"/> letter <input type="checkbox"/>
47						card <input type="checkbox"/> letter <input type="checkbox"/>
48						card <input type="checkbox"/> letter <input type="checkbox"/>
49						card <input type="checkbox"/> letter <input type="checkbox"/>
50						card <input type="checkbox"/> letter <input type="checkbox"/>



Bedroom Stereo Control Center

By **WALTER G. SALM** LIKE two automobiles a second TV set is almost as common now as two radios were many years ago. But two stereo systems are another matter. And that's unfortunate because there are often times when you want to listen to stereo, say, when you are in bed—either because of illness or simply because it's more relaxing.

No need to go out and buy another stereo system. All you have to do is add our control center to your existing system. It connects to your amplifier and enables you to control (at bedside) the volume and balance of a pair of speakers or stereo phones in your bedroom, or for that matter, any other room. When you're ready to retire you just flip a switch and your tuner, amplifier, tape recorder or record player are shut off.

How it Works

In our control center, one L-pad (R1) can be switched (with S2) to control either speaker or headphone volume. The other L-pad (R2) is optional and controls the volume of a second pair of headphones.

Note in the schematic that the two 8-ohm L-pads are connected in parallel. This means that the impedance looking into the control

center is 4 ohms. Therefore, if you build the circuit shown, it cannot be used with your main speakers unless they, too, are 4 ohms. You then can connect the control center in series with your main speakers across the amplifier's 8-ohm output. Or, you connect the control center and your main speakers (4 ohms) to a DPDT switch and connect the switch to the 4-ohm output.

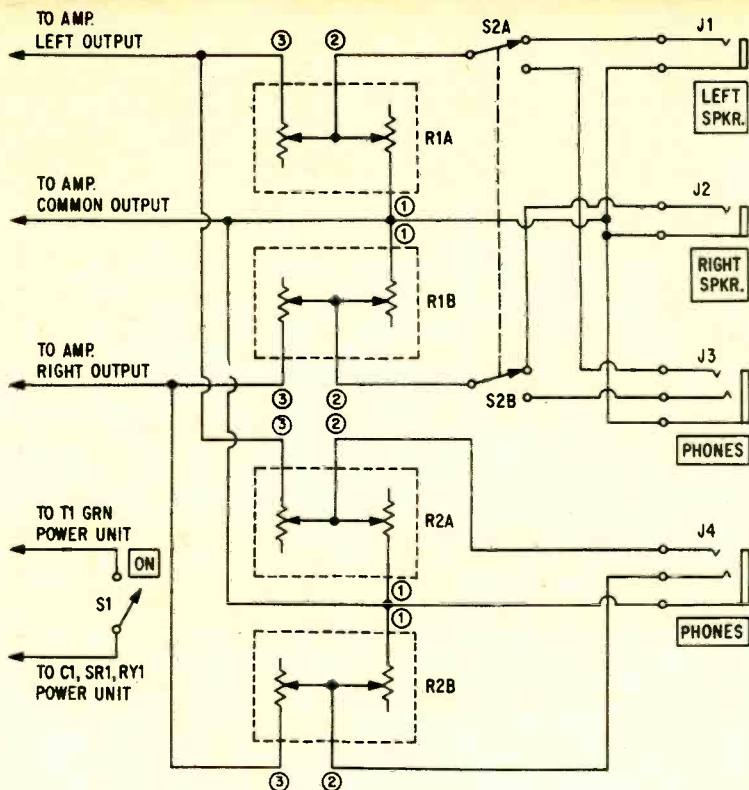
If you eliminate R2 and J4, the impedance looking into the control center is 8 ohms. It can then be connected with 8-ohm main speakers to the amplifier's 4-ohm output. By using a DPDT switch you can connect either your main speakers or the control center to the amplifier's 8-ohm output.

Construction

The control unit cabinet can be smaller than the one we show. The 5 x 7 x 3-in. Minibox we used provides space for future expansion. The control unit includes two L-pads, headphone switch, a remote power switch, two three-conductor phone jacks and speaker output jacks.

The power supply and AC-power relay fit in a 2¼ x 2¼ x 5-in. Minibox which goes near the stereo system. Your stereo system is plugged into SO1 and the box's line cord gets

Because two 8-ohm L-pads (R1A, R2A, for example) are connected to amplifier's left-channel output, connect to amplifier's left-channel output, connect to amplifier's 4-ohm tap. Also connect to the left channel's 4-ohm tap. And use a DPDT switch at the amplifier to connect either the main or remote speakers to amplifier as explained in text. Switch S2 selects either remote speakers or phones; it is shown in speaker position. Signal is always fed to extra phone jack, J4.



Bedroom Stereo Control Center

plugged into an AC outlet.

Diode SR1 provides pulsating DC for the relay. If there is a little relay chatter, stretch the relay spring slightly. The 15- μ f, 25-V electrolytic capacitor across the relay coil filters the DC. You can increase its size slightly if chatter is a problem.

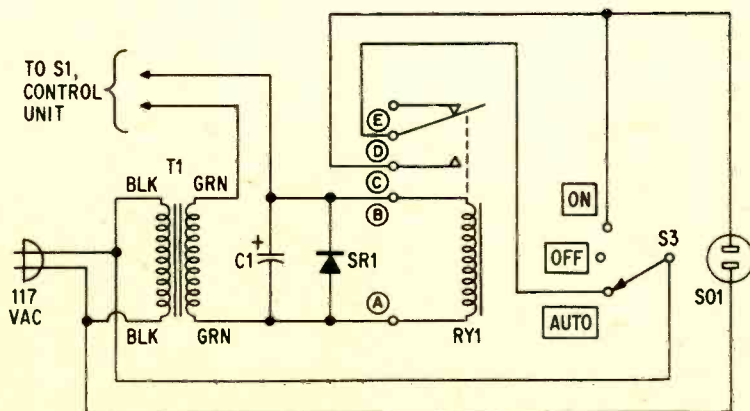
In our model we used a double-pole switch for S3 simply because it was more readily available. One of the unused terminals pro-

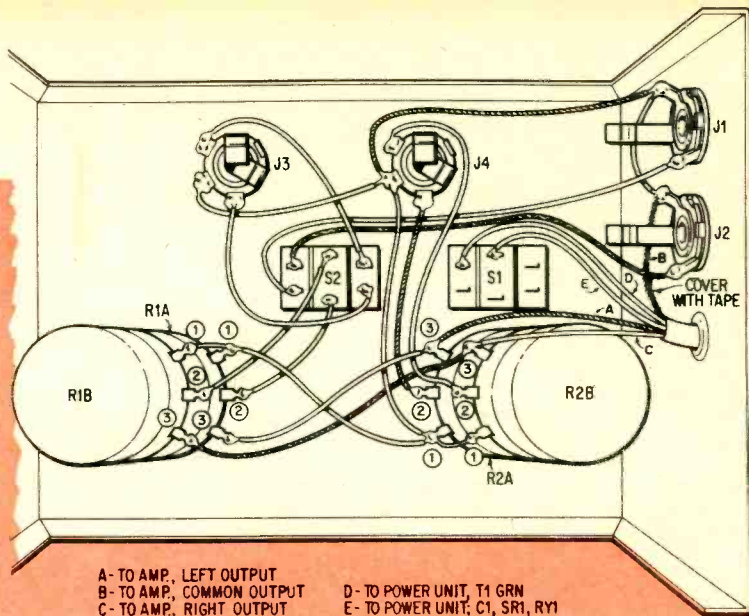
vides a convenient tie point that would otherwise require a separate single-terminal lug strip.

The cable between your stereo system (vacuum-tube amplifier) and the bedroom should have five conductors. A transistor amplifier may require six conductors because of the need for separate left- and right-channel ground connections.

Impedance matching, as we said, is important. Let's consider two of the options you have:

AC power control unit. With S3 in position shown, power will not be applied to stereo system (via SO1) as RY1's contacts are open. When S1 in control unit is closed, power is applied to RY1 causing its contacts to close and to apply power to SO1. When S3 is set to on, power is applied to stereo system regardless of S1's setting.





Inside of control unit. Wire which should be covered with tape is actually a braid in our connecting cable. It goes to ground and should be insulated so it doesn't touch jack J2. Circled numbers on L-pads are actually stamped on lugs. Switch S1 is DPDT as it came from our junkbox.

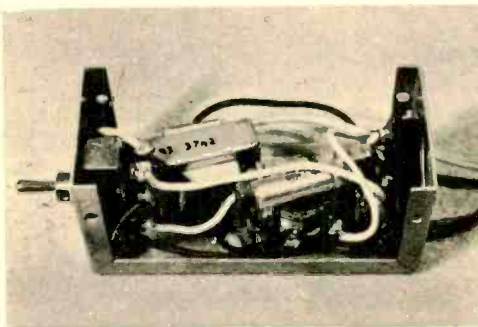
Remote or Main Speakers. Eliminate L-pad R2 and phone jack J4. Install a DPDT switch at the amplifier to connect either your main speakers *or* the control center to the amplifier. Use the amplifier's 8-ohm output.

Remote Speakers Only. Use the complete circuit shown in the schematic and connect the control center to the amplifier's 4-ohm output. Disconnect your main speakers and don't use the DPDT switch at the amplifier.

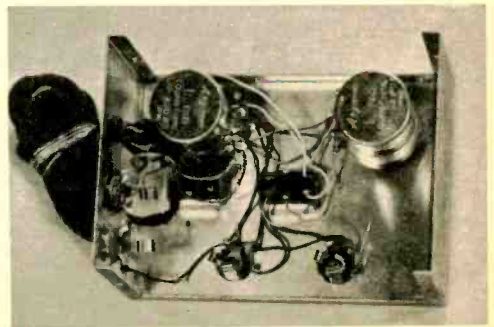
Variations on the basic design are easy to make and the idea lends itself to modifications galore, depending on your particular needs. If you have never bought intercom cable, it may come as a surprise when you discover that it will be the costly part of the project. Nevertheless, the project can be built for less than \$20.

PARTS LIST

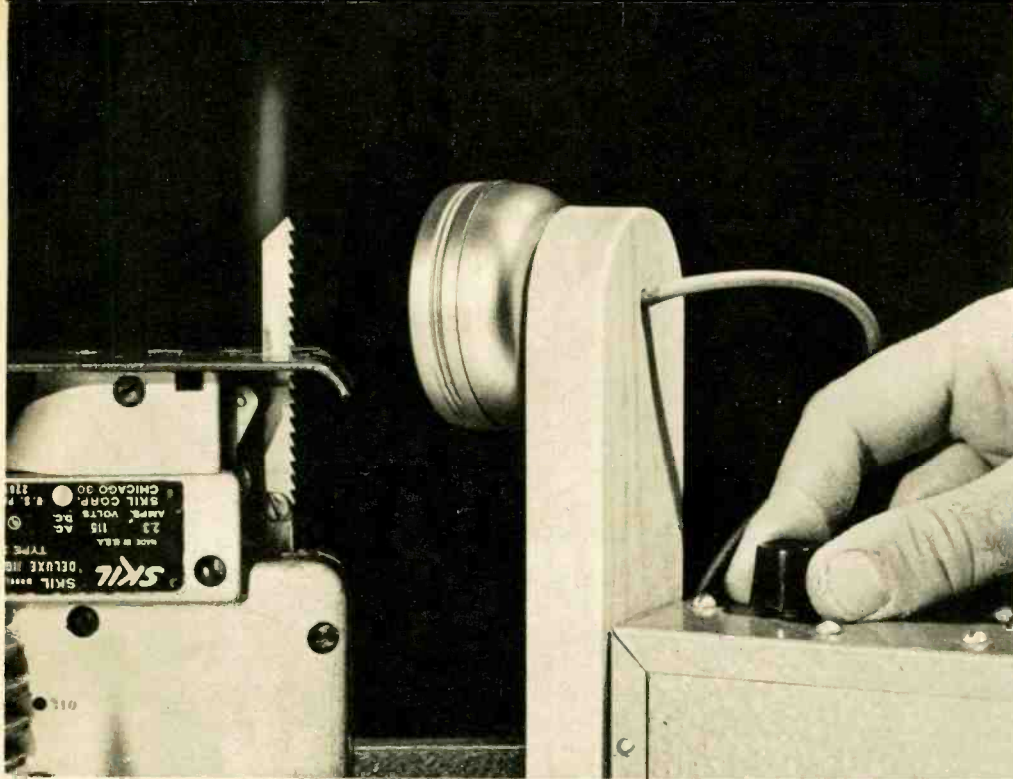
- C1—10 μ f, 25 V electrolytic capacitor
- J1, J2—Two-conductor phone jack
- J3, J4—Three-conductor phone jack
- R1, R2—Dual Concentric 8-ohm L-pad (Lafayette 99 C 6140 or equiv.)
- RY1—SPDT Relay, 6 VDC coil (Potter & Brumfield MR5D or equiv.)
- S1—SPST toggle or slide switch
- S2—DPDT toggle or slide switch
- S3—SPDT center-off toggle switch
- SO1—AC Receptacle
- SR1—Silicon rectifier; minimum ratings: 400 PIV, 200 ma (Lafayette 19 C 5001 or equiv.)
- T1—Filament transformer; secondary: 6.3 V @ 1 A
- Misc.—7 x 5 x 3-in. Minibox, 5 x 2 1/4 x 2 1/4-in. Minibox, 5-conductor cable.



Inside of AC power-control unit. Filament transformer is at left, relay is at lower right. Space is very tight so watch out for shorts when wiring.



Inside of control center. We used large box for future additions to circuit. If you eliminate R2 and J4, you can build circuit in much smaller box.



Pinch-Penny Stroboscope

By **RUFUS P. TURNER** SUPPOSING you have a saber saw whose blade seems to loosen or vibrate erratically when you turn it on. But you can't be sure because your eye is not fast enough to catch the action. There's only one way to be sure of what's happening—use a strobe. The flashing light will freeze regular movements of the blade; any irregular motion becomes apparent immediately.

Or supposing you want to find the true speed of that saber saw. Again, the answer is a strobe—a calibrated one.

A variable-speed flashtube strobe would solve all such problems. But they also would clean out your wallet. That's where our Pinch-Penny Stroboscope comes in. It employs a 2-V pilot lamp instead of an expensive gas-filled strobe tube. There are only seven other parts. Power is supplied by a 9-V battery.

The strobe's maximum speed is about 20 flashes per second and the slowest is about 1 flash per second. This is a wide enough range for you to check rotation, vibration and any other repetitive movement whose speed is up to 1,200 cycles per minute. Typical applica-

tions are checking the speed of motors, fans, record turntables, the balance wheel of a watch, electric razors or an auto-radio vibrator.

Construction details are covered in the pictorial's caption. The circuit is built in a 5¼ x 3 x 2½ in. Minibox. The pilot lamp is enclosed in a transparent plastic container.

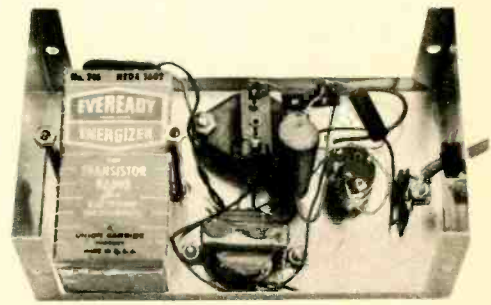
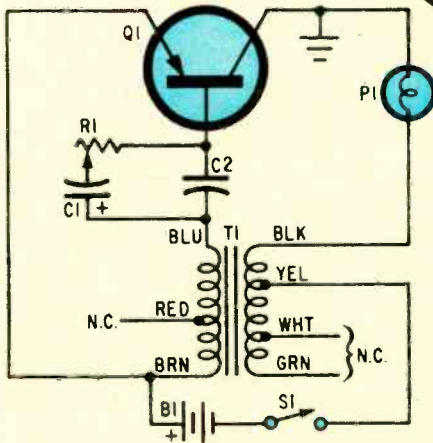
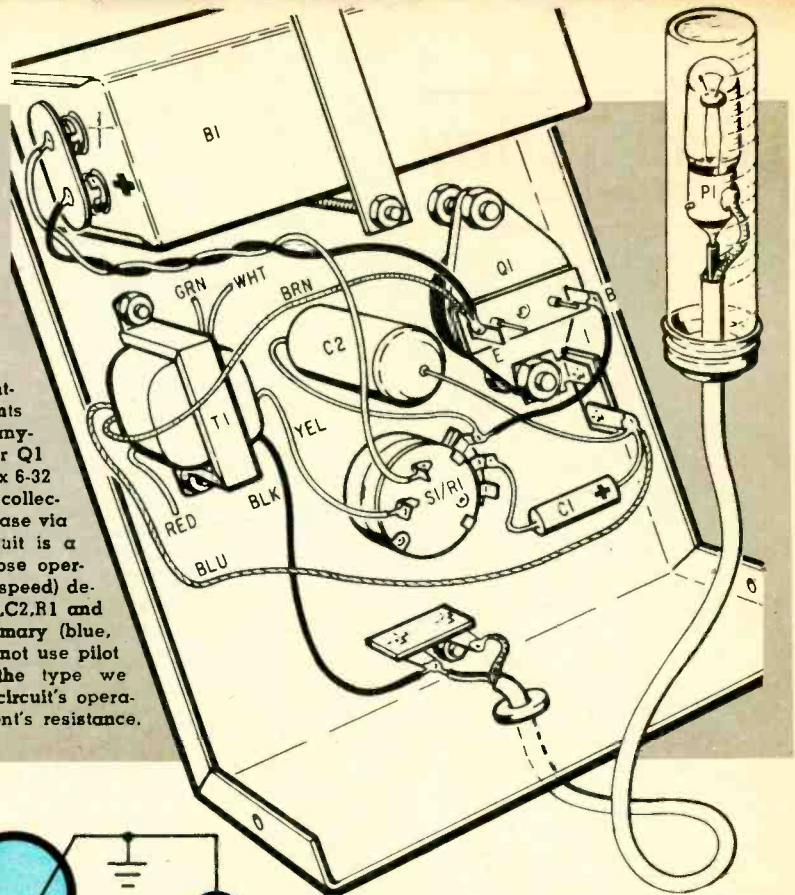
Transformer T1 must be connected exactly as shown or the circuit will not oscillate. The red, white and green leads, which are not used, should be clipped short and tucked out of the way.

Operation. Connect the battery and turn on power. As R1 is turned through its range, the flash rate should vary smoothly. When operated at a speed greater than about 20 flashes per second the lamp filament will not dim completely. The effect of this is that a moving object will appear blurred instead of motionless.

The potentiometer dial can be calibrated to indicate flashes per second or per minute. At low speeds, the best way to calibrate the dial is to use a variable-speed motor and a tachometer. Paint a solid black or white dot on the motor shaft. Then run the motor and

Pinch-Penny Stroboscope

Construction is straightforward and components may be mounted anywhere. Install transistor Q1 upside down with 1-in. x 6-32 machine screws. Q1's collector is grounded to the case via mounting screws. Circuit is a blocking oscillator whose operating frequency (flash speed) depends on values of C1, C2, R1 and inductance of T1's primary (blue, red, brown leads). Do not use pilot lamp different from the type we have specified as the circuit's operation depends on filament's resistance.



- PARTS LIST**
- B1—9 V battery (Eveready 246 or equiv.)
 - C1—10 μ f, 12 V electrolytic capacitor
 - C2—1 μ f, 200 V tubular capacitor (not electrolytic)
 - P1—2 V, 60 ma pilot lamp (No. 48 or 49)
 - Q1—Medium-power power transistor (Lafayette 19 R 1507. Similar to 2N155, 2N176, 2N235.)
 - R1—5,000 ohm miniature potentiometer with SPST switch (Lafayette 32 R 7363 or equiv.)
 - S1—SPST switch on R1
 - T1—Transistor output transformer; primary: 2,000 ohms, center tapped. Secondary: 4, 8, 16 ohms (Allied 64 U 150 or equiv.)
 - Misc.—5¼ x 3 x 2½-in. Minibox, transistor socket, terminal strip, battery connector.

check its speed in revolutions per minute with the tachometer.

Illuminate the spinning shaft with our strobe and turn R1 until the dot appears to stand still. At this point the flash speed is equal to the motor's speed in rpm. Convert rpm into flashes per second by dividing rpm by 60. If you see more than one dot, the flash rate is slower than the motor.

For greater operating convenience and to concentrate the light, install the lamp in the reflector from a discarded flashlight and mount the reflector on the end of the box.

Hi-Fi Today

By John Milder

* Dropping the Bombs

* Receiver Specials

* The All-Dolby Labels

It has happened so quietly. Although the arrival of devices like the IC cause a stir now and then, the basic state of the art in amplifiers and tuners has levelled off over the past two years of solid-statory. More and more manufacturers seem to be taking a common route based on well-known notions of good design.

And suddenly the bad equipment—the bomb that never worked except in the advertisements—is disappearing rapidly from the market. If you think that's a small gain, think again. Amplifiers and tuners may look a bit gray-flannelly these days. But if you hanker for the individuality of yore, just remember the unsound (if, perhaps, ingenious) design that sometimes went with it. Chances are now overwhelming that what you buy will work and keep on working until you *choose* to (not *have* to) trade it in.

There still are some individual (if sound) designs around, though. For instance, it's interesting to see an eminently practical manufacturer like Heath adopt a distinctly different approach to tuner design. The AR-15 is an elegant receiver that uses a combination of crystal filters, FETs and ICs to get an FM section that performs gorgeously. The crystal filters replace conventional transformer design in the IF strip and, together with two ICs, help provide near-ideal limiting and selectivity characteristics. The AR-15 is an expensive product (\$329.50 as a kit, \$499.50 wired), but the performance per dollar seems hard to beat right now.

Another distinctive receiver is K LH's new Model Twenty-Seven which uses separate vernier tuning systems for AM and FM. Aside from performance, the interest here is the really different look. This probably is the first piece of audio gear that looks as if it came straight out of our electronic and computer era, though some Japanese products have suggested it. (The K LH, incidentally,

sells for a mere \$299.95.)

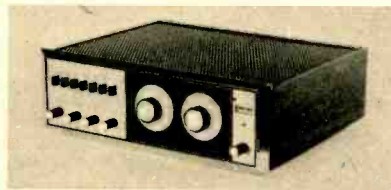
And it's impossible to leave the subject of new receivers without noting that, at long last, Marantz has one. It's huge by comparison with the average—but who would dream of comparing Marantz equipment with the run-of-the-mill stuff? It's also expensive (\$595). Unique feature is a built-in 1-in. scope as a tuning aid, indicating niceties like signal quality that are beyond the capabilities of a simple meter. Another feature of the design is its passive front end. This, says Marantz, bypasses problems of overload in strong signal areas and saves weak signals from swamping by powerful neighbors.

News continues to come in on the Dolby Noise Reduction System that we mentioned

two columns back. Elektra Records, which has made quite an impact on the record business (and quite a bit of money, too) with its low-price Nonesuch label, has just spawned a new one, Checkmate, which will present *only* material originally recorded with the Dolby

system. At least one other major independent label is about to announce a Dolby-only subsidiary. London Records are being made exclusively from here on from Dolbyized master tapes. And both London and Elektra's Checkmate label are combining the Dolby system with half-speed record cutting (running both master tape and cutting lathe at half playing speed) for the best possible resolution of high frequencies.

We usually don't use this column for personal items but we are making an exception to note that Edgar Villchur, former president of Acoustic Research and the man responsible for AR speakers and turntables, has retired from hi-fi to work on hearing-aid design. He'll be missed. (I wonder how long it will be before we start getting word of acoustic suspension hearing aids.)



New look in stereo receivers (the K LH Model Twenty-Seven) is derived from industrial and computer electronics.



Those Cheapie Walkie-Talkies

Cups and string costs less than superregens and may work better.

By E. L. GARRETT

IT takes but a brief look at what you might call the *serious* walkie-talkie scene to realize that the trend is toward design sophistication and higher prices. Modern rigs boast more power (up to 5 watts), features (squelch, limiters, output-power indicators) and far greater operating flexibility (6-channel operation) than were available on the typical 100-mw walkie-talkies of a few years back.

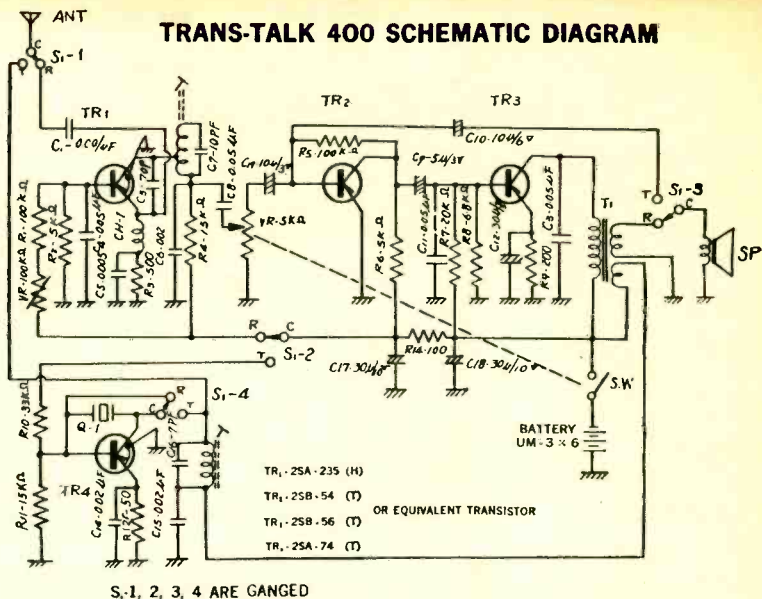
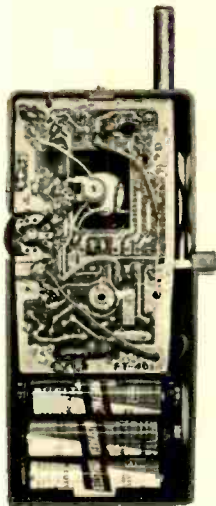
On the other hand, there also has been a big growth in the number of toy-type walkie-talkies—those three- and four-transistor superregen rigs which sell for as little as \$12 a pair.

After hearing negative reports on some superregen walkie-talkies—dead batteries, defective components, short range, units which wouldn't work at all—we decided to investigate.

The majority of walkie-talkies we tested were purchased from mail-order distributors. Others came from discount stores in the New York City area. The transceivers were purchased in pairs and no attempt was made to work one brand with another. The eight we tested represent a fair sampling of what's on the market. As we opened the boxes of the lowest-cost walkie-talkies, we expected minimum performance for this money and in most cases we ended up getting just that. We did include a pair of low-cost superhets to see whether they were worth the extra price. After checking eight superregens, our conclusion is that most really are toys and shouldn't be counted on for reliable communications of more than a few hundred feet—if that. Let's see why.

While superregen receivers have high sensitivity, the front-end is as broad as a barn door. Most of those tested picked up every signal in and around the 27-mc band. This was made even worse by sunspot activity. The sunspot cycle is on the upswing and this means skip is really coming in. Thus, our reception tests were fouled up by code, teletype and other signals on top of the usual babble of CB. Superregen receivers also radiate a broad band of hash, which sounds like squeaks, whistles and hiss through a nearby receiver. This radiation can be suppressed by a well-designed RF stage but such a stage

TRANS-TALK 400 SCHEMATIC DIAGRAM



Schematic and inside photo of Sears, Roebuck Trans-Talk 400. Transceiver has two RF transistors; TR1 is for receiving and TR4 is for transmitting. The circuit features two tuned circuits, two stages of audio and is powered by six penlite cells. The transmit/receive switch (S1-4) is shown in receive mode.

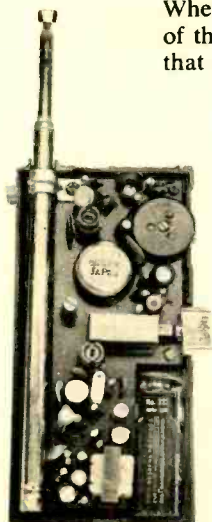
crystal as dummy transistors. In several makes we found crystal cases made of white plastic instead of metal—an unusual practice, though not necessarily either good or bad.

We did not make detailed technical analysis of each unit but some comparative tests were made. Since all transceivers came with batteries we checked to see how they had held up during the long trip from the Orient and possible long storage. We checked all batteries under a 15-ma load.

Current drain during receiving and transmitting was checked, using the same heavy-duty 9-V battery for each unit. Receive current was around 15 ma. Transmitter current ran somewhat higher and the rig that pulled 45 ma in transmit was faulty—though it showed good RF output and was on frequency.

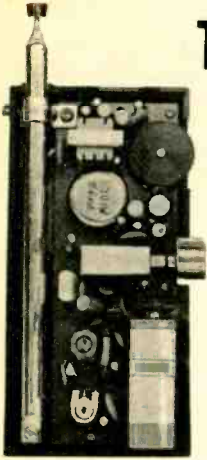
A relative RF output-power test was made, using a field-strength meter about 8 ft. from the rigs. As you see in our table, measurements are all over the lot. Those rigs with low output could be expected to have limited range. Where there is considerable difference between the measurements of a pair of the same brand it could reflect poor tuning or poor-quality transistors. Note that the highest transmit current of a pair doesn't necessarily coincide with best RF output. All rigs were found to be on specified crystal frequency. No attempt was made to troubleshoot or retune any units.

Construction was pretty haphazard: soldering was sloppy and components tended to lean against each other, against the antenna and even against switch frames. It's hard to see why there weren't many shorts. We found problems of intermittent transmit/receive switches, instances where shaking or knocking a unit would change receiver output. Sometimes receive or transmit operation changed radically when a finger touched the metal trim on the case. The receiver in the regens was somewhat sensitive with respect to how they were held. The superhet was locked on frequency by the receive crystal. Let's look at each of the units (listed alphabetically).

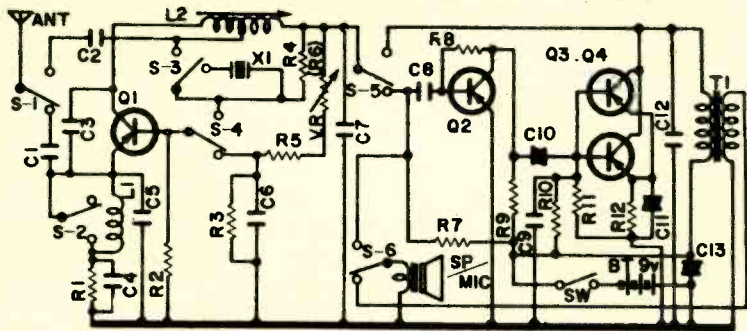


Kensington was advertised as having seven transistors, but two (marked with X and located at left of transmit/receive switch and at left of battery) were dummies. As a schematic wasn't supplied, we couldn't determine functions of other transistors.

Those Cheapie Walkie-Talkies



SCHEMATIC DIAGRAM



Schematic and photo of inside of Lloyd's transceiver. The circuit features one RF transistor, one RF inductor and no antenna loading coil. And there's no volume control, either (that knob at the upper right is only the power switch). The fourth transistor in this transceiver is in the audio-output stage.

Fanon FCB-3A: No volume control; one RF inductor; adjustable series antenna loading coil; only transceiver having the required FCC compliance form *inside* case. Two transceivers with batteries and carrying cases come bubble-packed on large piece of cardboard. Instructions included.

GE Y7040: One RF inductor, no loading coil; three audio stages; battery could be inserted without opening case; both units quit receiving when subjected to moderate heat.

Kensington 5051; Advertised as seven transistors; two were dummies; no schematic but apparently separate transistors and tuned circuits for transmit and receive; three audio stages; no frequency specified; [Continued on page 105]

SUPERREGEN WALKIE-TALKIES—SPECIFICATIONS AND MEASUREMENTS

Name and Model No.	Source	Price (pair)	No. of Transistors	Channel	Battery Voltage	Receive Current (ma)	Transmit Current (ma)	Relative RF Output	Input Power (mw)
Fanon FCB-3A	Shoprite	\$16.89	3	9	8.6,8.7	16,16	21,22	3.0,1.0	
GE Y7040	Grand Way	18.97	4	14	8.9,8.9	11,14	20,23	2.8,4.5	
Kensington 5051	Alexander's	12.99	5 (working)	9	8.6,0.0	17,17	24,26	0.5,2.0	
Lafayette HA-70C	Lafayette	11.98	3	7	9.0,9.1	15,15	23,25	3.0,1.8	80
Lloyd's 7A07B	Allied	15.90	4	9	8.8,8.9	19,19	24,23	1.0,1.0	41
Olson CB-42	Olson	21.00	4	9	8.4,9.2	15,16	25,24	1.8,5.0	
Olson RA-826	Olson	11.92	3	14	9.4,9.4	8,10	16,18	2.8,3.0	
Sears Trans-Talk 400	Sears, Roebuck	16.50	4	14	8.8,8.8	23,24	23,45	0.0,8.5	188

The Ham Shack

By Wayne Green
W2NSD/1



A RECENT CB poll indicated that 46 per cent of those questioned were interested in becoming amateurs. This is heartening. We need more hams and fewer CBers so it's good news all around. Citizens Band, the land of 23 frustrations, is a wonderful way to break into ham radio but it is important to recognize its limitations and to use CB as a stepping stone to better things.

Admittedly, the ham bands are not all milk & honey. But they sure should come as a great relief after an apprenticeship on CB. There are plenty of spots in our bands where you can sit and talk to your friends for as long as you like with absolutely no interference. And you aren't limited to fellows around your part of town, either. You can choose from just about anywhere in the world.

The Novice license is a bit limited, to be sure, but it has the benefit of being ridiculously easy to get. In two or three days most people can memorize the code well enough to pass the required 5-wpm test. That is only 25 characters per minute or about two seconds per letter. Once you have the code memorized you can just about sort out the dashes and dots in that time. Sorry about that code—but international regulations require it, even though you plan to use phone.

Perhaps I should clue you in on a secret. There is something fascinating about CW and even though about 80 per cent of us do use phone, about 65 per cent are active on CW as well. You, too, may find you're getting a kick out of CW. Keep an open mind, anyway.

How do you get code practice? Well, if you don't have a buddy or a neighborhood ham who will give you the time you could invest in one of the recorded code courses. A few minutes a day and you'll be way past the 5-wpm level. If you have a receiver that covers the Novice bands you can get your practice from the slower Novices. This will prepare you for the many strange fists you'll run into later on the air. I like the records be-

cause they are available at any time and without all that interference from other stations.

Since you are supposed to be able to send code as well as receive it you will do well to invest in a small code-practice oscillator and hand key. Sending is simple to learn; it is receiving that takes practice. Pity, because sending is a lot more fun!

You'll be expected to pass a simple theory and regulation exam. There isn't much to it, really. The ARRL License Manual (50¢) is available at just about every radio parts distributor and all mail-order houses like Allied, Lafayette, etc. This manual has the complete FCC amateur radio regulations and a question-and-answer approach to all classes of amateur license. It is, in fact, a crib sheet for ham exams. The League seems positively clairvoyant about any changes in the questions and the memorizer has little to fear.

CB equipment, I'm sorry to say, is not going to be much use to you as a Novice. Comes the day when you get the General license you can start thinking about changing the CB rig over to the amateur 10-meter band. But in all probability you'll keep the CB set for use as CB now and then.

Once you get your General license you'll go out of your mind. In the middle of writing this column I tuned the 20-meter band and had a short contact with a chap in the South Orkney Islands. Next I talked with a chap in the Seychelles. Then a friend of mine in Newfoundland called me from his car and I talked with him while he drove up to the site of Marconi's first transatlantic radio tests. The world truly gets small on the amateur bands.

Then there is always the enjoyment to be had in returning to your old neighborhood on, say, channel 7 and meeting the old gang again—the ones that couldn't cut the mustard to be hams.

For that matter, it wouldn't hurt at all for every ham to make it a point to get on the CB every now and then and see if he can interest any of the fellows in coming over to see his station and stay for a short code-practice session. How about it fellows?

EDITOR'S NOTE: Wayne wrote the foregoing column before news broke of the FCC's approval of incentive licensing rules for amateur radio. He's sure to have something to say on the subject in his next column. In the meantime, you'll find a rundown of the new format for hamming elsewhere in this issue.

You can earn more money if you get an FCC License

and here's our famous CIE Warranty
that you will get your License
if you study with us at home

NOT SATISFIED with your present income? The most practical thing you can do about it is "bone up" on your Electronics, pass the FCC exam, and get your Government license.

The demand for licensed men is enormous. Ten years ago there were about 100,000 licensed communications stations, including those for police and fire departments, airlines, the merchant marine, pipelines, telephone companies, taxicabs, railroads, trucking firms, delivery services, and so on.

Today there are over a million such stations on the air, and the number is growing constantly. And according to Federal law, no one is permitted to operate or service such equipment without a Government FCC License or without being under the direct supervision of a licensed operator.

This has resulted in a gold mine of new business for licensed service technicians. A typical mobile-radio service contract pays an average of about \$100 a month. It's possible for one trained technician to maintain eight to ten such mobile systems. Some men cover as many as fifteen systems, each with perhaps a dozen units.

Coming Impact of UHF

This demand for licensed operators and service technicians will be boosted again in the next 5 years by the mushrooming of UHF television. To the 500 or so VHF television stations now in operation, several times that many UHF stations may be added by the licensing of UHF channels and the sale of 10 million all-channel sets per year.

And there are other exciting opportunities in the aerospace industry, electronics manufacturing, telephone companies, and plants operated by

electronic automation. Inside industrial plants like these, it's the licensed technician who is always considered first for promotion and in-plant training programs. The reason is simple. Passing the Federal Government's FCC exam and getting your License is widely accepted proof that you know the fundamentals of Electronics.

So why doesn't everybody who "tinkers" with electronic components get an FCC License and start cleaning up?

The answer is: it's not that simple. The Government's licensing exam is tough. In fact, an average of about 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 every 10 CIE graduates who take the exam pass it. That's why we can afford to back our courses with the ironclad Warranty shown on the facing page: you get your FCC License upon completion of your course or your money back.

There's a reason for this remarkable record. From the beginning, CIE has specialized in electronics courses designed for home study. We have developed techniques that make learning at home easy, even if you've had trouble studying before.

In a Class by Yourself

Your CIE instructor gives his undivided personal attention to the lessons and questions you send in. It's like being the only student in his "class." He not only grades your work, he analyzes it. And he mails back his corrections and comments the same

CIE **Cleveland Institute of Electronics**
1776 E. 17th St., Cleveland, Ohio 44114



Senior Transmitter Operator for Radio Station WBOE. Says Matt Stuczynski, "I give CIE credit for my FCC License. Your lessons make Electronics easy. I now have a good job in studio operation, transmitting, proof of performance, and equipment servicing. I enjoy my work and am on my way up."



Opens His Own 2-Way Radio Business. "Since completing my CIE course," says Donald E. Breidenbach, "I've passed the 2nd Class FCC test and have opened my own 2-way mobile-radio shop. We have one of the best-equipped shops in northern Oklahoma and have a real fine business and income."



Local Telephone Equipment Supervisor. "There's no doubt about it," says Glenn Horning, "I owe my FCC License to CIE. Your FCC License course really teaches theory and fundamentals. Do I use this knowledge? You bet. We're installing more sophisticated electronic gear all the time and what I learned from CIE sure helps."



Business Grows by Leaps and Bounds. "Ours is a four-man operation," says August E. Gibbemeyer. "Before enrolling with CIE, we were in TV and radio repairs. Since getting the 1st Class 'ticket,' our marine and 2-way radio business has grown by leaps and bounds. We hope to enter the radar maintenance field next year."



"Swamped with Job Offers." Thomas E. Miller, Jr., trained with CIE and won his 1st Class License while in the Navy. On his discharge, he says, "My only problem was to pick the best offer, and I did—engineer with Indiana Bell Telephone. CIE made the difference between just a job and a management position."

CIE helped these men win their FCC Licenses...now they have jobs others envy

A few years ago, the men shown here had only limited prospects in Electronics. Most had no training beyond what they'd gotten on the job or in the service; one had completed only 6 weeks of high school algebra. The better jobs, they realized, were closed to them—reserved for others who had more training to offer.

But instead of complaining about their fate, these men decided to do something about it. They

studied with CIE for the FCC License exam.

Today, as a result, all are licensed electronics experts—holding exciting, important jobs with salaries to match. And they are just a few of the thousands CIE has helped to success in Electronics.

If you'd like to join their ranks, see for yourself on the preceding pages how easily you can train for an FCC License the CIE way. Then mail the postpaid card for two FREE books.



Associate Customer Engineer for IBM. "Before getting out of the Air Force," says Raymond Ott, "I enrolled with CIE. The day after leaving service, I passed my FCC exam. Now I'm with IBM, working as an Associate Customer Engineer. I repair and perform preventive maintenance on computers and related electronic equipment."



Bell Telephone Office Manager. Daniel J. Smithwick studied with CIE for his FCC exam. "I was really amazed by CIE's course," he says. "I had never seen lessons so easy to understand." Within four months of winning his License, he was promoted to manager of a Bell Telephone office—"a very fast promotion."



"Theory Man" at General Dynamics. Harry J. Remmert III passed his 1st Class License exam less than 11 months after enrolling with CIE. Since then, he's had two pay raises within 10 months. And he adds, "I'm getting to be known as a theory man in my job with General Dynamics Research and Development Division."



Inspector for North American Aviation. Eugene Frost was "stuck" in \$1.50-an-hour TV repair work before studying with CIE. But after completing his course, he was quickly hired by North American Aviation. Now he's an inspector of electronic systems, and says, "I'm working 8 hours a week less and my hourly wages have more than doubled."



Designs Equipment for Smith Electronics. Ted Barger took his supervisor's advice and trained with CIE for his FCC License. "Passed it on the first try!" says Ted. "I'm now designing and building all kinds of electronic equipment and I also do a lot of field testing. It's interesting, challenging work."



Scott LT-112B

FET STEREO TUNER

A FEW years ago many so-called solid-state FM tuners actually were hybrid designs. That is, the circuits included tubes and transistors. Tubes were used in the front-end because of overload and crossmodulation problems which resulted from using conventional transistors in the front-end.

The present generation of tuners uses field-effect transistors (FETs) in the front-end. Such semiconductors have solved the aforementioned problems and perform even better than the tube predecessors.

An outstanding example of solid-state tuner design and performance is the \$189.95 Scott LT-112B stereo FM tuner kit. The circuit includes 23 transistors, three of which (in front-end) are FETs. Metal and walnut cabinets are extra. (The latest model is identified as the LT-112B-1 because of a change in the design of the front panel. Electrically it is the same as the LT-112B.)

Let's take a look at some of the LT-112B's important features. Stereo switching is automatic. That is, when the selector switch is in the *auto-stereo* position the tuner will switch into the stereo mode automatically and a front-panel light will come on when you tune in a stereo station.

The tuning meter is used for four functions, depending on position of a selector switch. In one switch position the meter indicates relative signal strength; you tune for highest indication. Set the switch to another position and the meter indicates approximately the multipath signal. (The manual has a lengthy discussion of multipath signals as well as sections on theory of operation, troubleshooting and instrument alignment.)

A third function of the meter is to indicate tuning to the center of the FM channel. The fourth meter function is as an alignment indicator.

At the back of the tuner there are three pairs of output jacks. One pair could feed a tape recorder or high-impedance phones. An-

THE LT-112B AT A GLANCE

THE LT-112B AT A GLANCE			
Sensitivity:		2.1 μ v at 92 mc	
Total harmonic distortion (1,000 μ v input)	Mono	Left Channel	Right Channel
	0.2%	0.62%	0.54%
Signal-to-noise ratio (total noise)	Better than 65db	Better than 65db	Better than 65db
Frequency response (cps)			
50	-1db	-0.5db	-0.5db
100	0	0	+0.5
200	+0.5	0	+1.0
400	+0.5	0	+1.0
1 kc	0	0	0
10 kc	-1.0	+1.0	-3.0
15 kc	-2.0	+1.0	-5.0
Residual 19 kc and 38 kc multiplex components	---	-43db	-34db
Channel separation			
40 cps	---	32db	34db
400 cps	---	31	37
1 kc	---	29	34

other feeds the amplifier. The third pair is for connection to an oscilloscope for multipath indication. The manual contains a number of photographs of oscilloscope patterns indicating various multipath-reception conditions.

Although no mention is made of it in the manual, the tuner can be fed with either 72-ohm coax or 300-ohm twinlead without an external matching transformer.

The LT-112B is what we would consider luxury kit-building. Instructions are beautifully clear, precise and in full color. Scott, in fact, has done everything to encourage hi-fi buffs with little experience in kit building to tackle this one. Three printed-circuit boards and the front-end are supplied assembled and mounted on the chassis. The circuit boards are the IF strip, multiplex adaptor, and audio output. (On one board, two resistors had to be removed and three capacitors added.) Hookup wire is cut to

length and stripped. It and other parts are doled out in eight numbered plastic bags, keyed to progressive assembly steps.

There were no errors in our kit. Although the power-supply filter capacitors seemed to be the wrong value, those supplied appeared on the parts list as alternates. Otherwise, our builder never had to refer to the parts list.

Don't take too literally Scott's statement that the kit can be assembled in six hours. Our builder took about twice that long. He felt that it could have been finished in six hours by an experienced builder but our man's deliberate way of working paid off. When he turned on the tuner it worked perfectly except for one meter function. A quick inspection turned up the trouble—a transistor lead pulled out of its socket, probably during assembly.

Alignment of the tuner does not require test instruments. It is accomplished using the tuner's meter as an indicator and interstation noise (white noise) as the signal source. As the tuner's front-end, IF strip and multiplex adaptor are supplied prealigned, alignment is actually just touch-up.

The first step is to adjust the slugs of the first IF transformer (on the front-end) for maximum meter indication. This is followed by adjustment of the slugs of the remaining IF-transformers for maximum indication on the meter.

Following the peaking of the IF transformers, you proceed to the ratio detector. To align it you use the meter as a center-

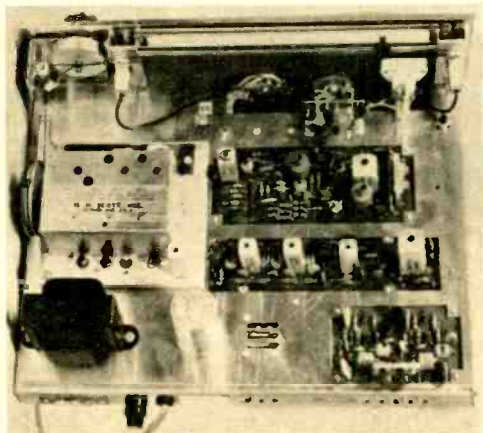
tuning indicator and adjust one of the transformer's slugs for center-scale indication. After this you install the bottom plate.

The manual states that although the multiplex section is prealigned, you may wish to touch it up to increase the stereo separation. Instructions for doing this using a stereo station's test signals are included in the troubleshooting section of the manual. We did not go through this procedure. Total alignment time was about 30 minutes.

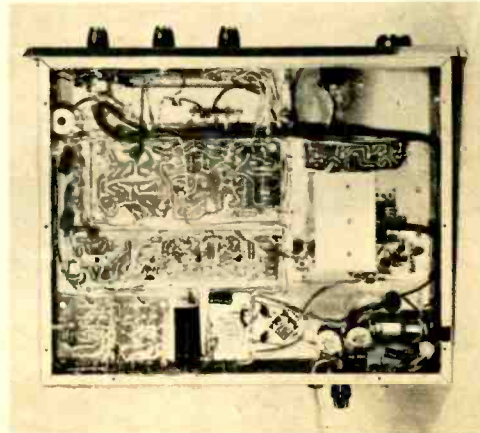
How did the LT-112B check out after being aligned by our builder? Quite well. IHF sensitivity was $3.8 \mu\text{V}$ and total harmonic distortion (THD) was 1.1 per cent. Further touch up without instruments improved the sensitivity and got the THD down to 0.8 per cent.

We next instrument-aligned the tuner. As our chart shows, we improved the sensitivity to $2.1 \mu\text{V}$ at 92 mc, and the THD was reduced to 0.2 per cent in the mono mode, 0.62 per cent in the right channel and 0.54 per cent in the left channel. The signal-to-noise ratio was better than 65db in the mono mode and better than 65db in the stereo mode.

But figures don't tell the whole story. You must hear the sound of this tuner to really appreciate it. Distortion is so low, and consequently the sound is so clean, you would think you're listening to music through an open door at a live concert. We feel the LT-112B is a kit which will give you just about the highest performance you could expect for your money.



Top view of tuner. Front-end is at left. Multiplex adaptor board is at top. IF strip is below it and output board is in the lower-right corner.



Underside of tuner. As circuit boards and front-end are wired and installed, remaining work is on switches, power supply, interconnecting wiring.

earn more. These company earnings are based on B&W TV service charges. Color-TV service has already boosted these figures.

While not everyone can expect to achieve these levels, no qualified repair man need suffer. The average experienced service tech earns, in my opinion, between \$5 and \$10 thousand a year, depending on locale. The paychecks tend to be largest in metropolitan areas.

The paid employee, on balance, earns less than the self-employed tech with a successful operation. As a beginner you can expect about \$80 a week. Until you find a niche you will help out in all the areas of service—answering the phone, helping at the bench and on outside calls, picking up parts, checking inventory, etc. Once you are familiar with the company's routine, opportunities will start presenting themselves to you.

For instance, there are certain house calls every day that require a simple adjustment or some other obvious troubleshooting. Some of the calls might be off a road man's regular route. You would be assigned some of these jobs. When you run into trouble you can't handle you would call the service manager for

A CAREER AT THE SERVICE BENCH FOR YOU?

advice. As you begin doing house calls your salary would rise to about \$100 a week. Little by little, you take more responsible house calls and your salary starts climbing slowly toward about \$130 a week. Then, when road calls are slow, you begin to help out on the bench. At first you simply pull apart, put together and check out completed repairs. Then you start attacking easy repairs with the backup of the regular bench man. This work brings you up to \$150 a week.

As time goes by, you find you are completing repairs that looked impossible to you previously. People are starting to consider you as an expert technician even though you feel you aren't quite that yet. Your paycheck is approximately \$175. When you find you can complete every bench repair you tackle and you are doing as many house calls and bench repairs as the other journeyman techs you should be getting about \$200 each week.

That is about tops as an employee. While it's a good living, some people are never satisfied. If you are one of these you will decide you want to join the ranks of the self-employed. It requires a shop and an investment—anywhere from \$500 to \$10,000. The more competition there is in the area where you want to work, the more capital you will need to sink into equipment and parts in order to stand the comparison.

And it requires business ability. This, especially, is a tall order but if you have the stuff you can break through the \$200-a-week level.

Despite all rationalizations and attempts to alter the situation, the service business remains exactly what the name implies—a *service* business. Unfortunately, fully 50 per cent of TV service requests are made after 4:00 p.m. or on Saturday. This means a TV service store must be open and taking house calls evenings and Saturdays in addition to the regular business hours if it doesn't want to risk losing half of its business.

It's true that lots of shops, large and small, close evenings and Saturdays. They are mindful of the loss, however. Some simply don't care; others are service organizations handling some type of specialized work that does not require evening or week end availability.

I'd say you should be prepared to work any or all hours, however. If you are a nine-to-five man this work is not for you if you want to be a success. This goes for all skilled employees—particularly if you want to be your own man.

In order for you to be a successful electronics serviceman, you must be able to produce a completed repair job and sell it at a profit. So you will need

technical training to produce the completed repair, salesmanship training to sell the job to a customer and business training to be sure you are making a profit. If you fall down on any of these three items, you fail.

Assuming you are a high-school graduate (almost a universal requirement), what more do you need? If you can afford the luxury of being in no particular hurry to start earning a salary, the best approach is to enroll in a good college-level technical school. One good example is Temple Technical Institute.

Work toward an Associate of Technology degree and stay put in school until graduation. During the last two semesters of the six-semester course (as long as your grades are satisfactory) recruiters from all sorts of electronics companies will approach you with job offers. On graduation, you'll have your pick.

On the other hand, if you want to get on a payroll immediately you'll have to scratch. Get in a good, humble frame of mind and canvass the TV sales and service companies, large and small, for a job. Disregard hours, starting salary, supervisors' personalities and working conditions. The green youth has no choice; somehow, you must rack up experience. Meanwhile, in your spare time, you should enroll in a good accredited correspondence course or join an evening class in electronics at a nearby technical school. Between the schooling and the concentrated training forced on you on the job, you'll discover after a few years that you are a journeyman troubleshooter.

A third approach (and probably the best one) is to become connected with an apprentice training program. The National Electronic Association, Inc. is in the beginning stages of what they hope will become a well-known, nationwide, accredited TV troubleshooter apprentice program. They are working in conjunction with the U.S. Labor Department—at present in Columbus, Ohio and Wichita, Kansas, where they have training courses with 20 apprentices in each. The recruits are working toward a certificate as an Electronic Technician. This takes four years. The trainee works on the job in an authorized service shop and must complete 144 hours of classroom work each year as well.

Another apprentice-style approach is to apply for on-the-job training programs at RCA or any other large concern in the TV repair business. If you qualify they will provide good training and a subsequent job.

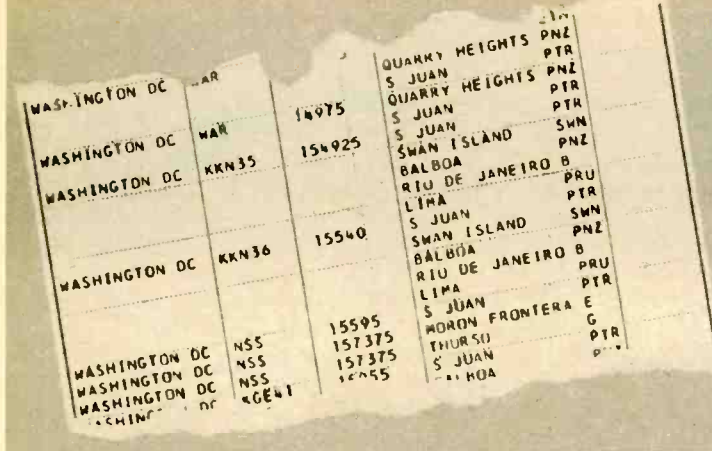
Your business training is something else again. It may surprise you but selling the job at a profit is harder than making a repair in the first place. It's a subtle difficulty and, even though it spells the difference between success and failure, the business end of TV repair is often neglected. People who are mechanically oriented are not usually business oriented. Yet to be a success you must acquire business skills.

Let's stop a moment to talk about the business end of electronics servicing. Minimum charge for a house call these days runs around \$5 to \$6 in most areas. A more reasonable figure might be \$10 but that would scare off business even if you reduced charges for parts and other services. The problem is to balance your prices so that they will seem reasonable to your customers, bear comparison with your competition and still give you a profit. It will do that only if it pays off all your costs—and then some.

The catch is in figuring *all* your costs: rent, parts, payroll, insurance, advertising, utilities, supplies, depreciation, and so on. There are many items in the list that are difficult to figure or easy to overlook altogether if you are not business-oriented.

Once you have passed this hurdle you must still convince your customer that your charges are reasonable. If he has seen ads offering long lists of tubes at 39¢ each, for instance, he will want to know why you charge \$4.50 for one that looks perfectly ordinary. To deal with him so that he remains a satisfied customer will take both salesmanship and a certain amount of emotional maturity.

Even while you're working on the set you must [Continued on page 108]



KKN35 and KKN36 are among stations curiously unidentified on Berne Lists, of which this is a portion. Note that both are listed as being in communication with Swan Island. WAR stations are operated by the U.S. Army, the NSS stations by the Navy.

EAVESDROPPING ON BIG BROTHER

the past few years (as reported by a number of DXers to club bulletins).

The probable CIA stations have transmitters listed by the ITU as being in Washington, D.C. They are, in fact, about the only stations in Washington whose ownership cannot immediately be ascertained by simple checking and deduction. The next unusual thing shown by the ITU is the list of places with which the stations communicate—Swan Island, for one, where the major industry is Radio Americas (See Radio Americas and the CIA, Sept. '67 EI).

When these stations are monitored they are heard using call-signs other than that assigned to their particular frequency. The stations they are heard calling are, likewise, mysteriously missing from the ITU's records. So far, most monitored transmissions have consisted of CW or teletype broadcasts of repeating identification tapes.

A station list for the network appears on this page. You will note that the oldest of the stations made its initial appearance on Nov. 6, 1947—less than two months after the CIA was created.

When the FCC was asked about the ownership of the stations (including the unlisted ones) it confirmed that they were U.S. Government radio stations, but said "the identity of the operating agency is either classified information or available on a need-to-know basis."

Next, let's examine the exact geographic locations of the stations: 38° 52' N., 77° 30' W., also shown in the Berne Lists. Both the U.S. Coast and Geodetic Survey and the Department of the Interior pinpointed this as

being in the cloverleaf where U.S. Route 1 joins Interstate Highway 95, about ½ mi. southeast of the Pentagon Building.

This seems to be more than a coincidence. Coordinates for the Pentagon would come out at that spot if you rounded them off to the nearest whole minute. If the stations are operated by the CIA the transmitters undoubtedly are *not* at CIA headquarters in Langley, Va. Interference might disturb the huge monitoring operation that runs dozens of sensitive receivers in the same building.

All this, and more, you can figure out from lists that anyone can order by mail. But don't ask Uncle Sam about the stations—they're all classified!

E.I.'S GUIDE TO PROBABLE CIA STATIONS				
Freq. (kc)	Assigned Call	Former Call	Announced Call	First On Air
6924.5	?		KKN50	?
7470	KKN33		KKN50	Oct. 12, '56
10470	?		KKN50	?
11095	KKN42	KGA61	KKN50	Mar. 14, '52
12022.5	KKN43	KGA62	KKN50	Mar. 14, '52
12112.5	KGA59		KKN50	Sept. 27, '55
13715	?		KKN51	?
14772.5	?		KKN51	?
15492.5	KKN35			Sept. 27, '55
15540	KKN36		KKN51	Sept. 27, '55
17390	KKN39			Sept. 27, '55
17662	?		KKN50	?
18525	KGA60	KGA65	KKN50	Nov. 6, '47
18972	KKN47		KKN50	May 18, '59
20365	KKN48	KGA67		May 4, '50
23442.5	KGA61			Oct. 12, '56
23862.5	KKN51			May 17, '57
23975	KKN49	KGA68		Mar. 14, '52
23982.5	KKN52			May 17, '57
26760	KKN50	KGA71		Mar. 14, '52

The above stations heard calling or in communication with stations KBF70, KCA30, KIA20, KWX72. These four stations do not appear in any ITU list. Stations shown with question marks are not listed with ITU.

EI TESTS THE POPULAR AUDIO TAPES

By ROBERT ANGUS



HOW do you choose your recording-tape brand? Was it recommended by someone whose judgement you trust? Was it praised in a magazine article? Did the salesman tell you it was the best on the market?

Most tape recordists are, by now, pretty well aware of the shortcomings that can plague the bargain tapes. But we got to wondering how much difference there really is between the name brands. More particularly, could we detect any difference in sound between one quality brand and another?

To find out, we ran a comparison test. We went out and bought samples of every name-brand tape we could find on the shelves of dealers in the neighborhood. All the best-known names were there—and a few that are not so widely known. (RCA would probably have been in the list, too, if they had not been in the middle of a strike at their coating plant at the time.)

In order to eliminate as many variables as possible we limited ourselves to 1-mil polyester base and standard coatings—no low-noise, high-output or other special-purpose jobs. We ended up with 11 brands: American L-18M, Ampex 941, Audiotape 1861, BASF LGS-35, Brand Five 10D7M, Capitol 742, Irish 241, Reeves Soundcraft

Plus-50, Robins 10A7M, Scotch 150, Sony PR-150.

To test sound reproduction qualities we made up two test tapes. The first contained 15-sec. lengths of tape from each reel, spliced together to form a 2¾-min. tape on which we recorded a single selection (keeping careful tally of the order in which the brands were spliced together). The second included 3-min. samples of each tape, spliced together in a different order and separated by 5-sec. leaders. Next, we recorded on each tape—straight through with a single selection on the tape containing the 15-sec. samples; with 11 repeats of another selection on the tape containing the 3-min. samples.

In order to show up any differences between tapes we wanted music that was fairly familiar and included a wide dynamic range from soft to loud with as much variety of instrumental color as possible. For the longer samples, particularly, we wanted to see how the tapes would treat individual violins or flutes or bassoons as well as groups of instruments and full orchestra. For this purpose we finally chose the overture to Smetana's *The Bartered Bride*, as recorded by the Prague National Theatre Orchestra on Artia ALPOS-80. For the shorter samples we used

EI TESTS THE POPULAR AUDIO TAPES

the overture to Verdi's *La Forza del Destino* by the Czech Philharmonic on Parliament PLPS-622.

The test would only be valid for our readers, we felt, if we used equipment similar to what they, themselves, might use. The records were played on a Benjamin Miracord B40A automatic turntable equipped with a Shure V-15II stereo cartridge. The signal was transferred via a Scott 344B stereo receiver to a Roberts 997 tape recorder, cleaned and demagnetized for the occasion but otherwise left innocent of special treatment. Consistent with common home practice, we chose to limit the tape speed (and therefore quality) to 3¾ ips.

Once we had the sound on the tape with what we thought could be considered good home quality, however, we wanted to give our test listeners every opportunity to hear whatever differences there might be on the tape. That meant we would need really superior equipment for playback. We also wanted to get a room large enough to allow about a half dozen people to listen in conditions that would approximate living-room acoustics.

The playback problem was solved very neatly for us by the Asco Sound Division of Sonocraft, a Manhattan dealer in audio equipment. Asco has a penthouse listening room designed, like those in many hi-fi salons, for A/B comparison of hi-fi components, with plenty of high-quality gear to choose from. We finally picked a Revox G-36 tape recorder, a Sony stereo preamp and power amplifier and a pair of Altec Lansing speaker systems.

The next problem was to choose our listening panel. Professional musicians or audio engineers might be expected to respond most readily to subtle differences in sound. But was that what we wanted? Might they not bring to the test a set of prejudices about what constitutes good and bad sound that would be quite different from those we would expect of most of our readers?

We finally chose two panelists with musical connections: one describes himself as an inactive composer who still plays the piano,

the other is an EI editor who periodically moonlights as a saxophonist. Another panelist is a hi-fi-loving housewife. The remaining two are audio-oriented EI editors—one also an amateur organist, the other has worked in recording and broadcast studios.

We quickly found that the tape with the shorter sample lengths did not make an adequate test. A quarter-minute just doesn't give you enough time to form a clear impression of the properties of the sound you are hearing unless there is something seriously wrong with it. In addition, whenever the splices were less than perfect (some of ours were) the sound was altered far more by the splice itself than by the relatively minute differences from one tape to the other. So we ended up using only the tape with the 3-min. samples.

The panel was asked to score each tape on a scale from 1 to 4. A rating of 1 would indicate particularly good sound, 2 would be only acceptable, 3 would be substandard and 4 unacceptable.

The results, as you can see from our chart, were startlingly non-uniform. There was far more difference between panelists on any given tape than there was between tapes when an average value was taken for each. For this reason, we conclude that average values are virtually meaningless. Two brands seem to separate themselves out as being of lower sound quality than the others, in the opinion of the panel, but the rest of the findings make it clear that with so small a sampling it would be foolish to draw any conclusions from overall figures.

The test proves a point, however—and does so dramatically. If five listeners of above-average audio sophistication can differ so widely in their evaluation of these 11 brands and hear so much difference between them, they could not possibly make meaningful tape-brand recommendations for each other—or for anyone else.

A clue to why this is so showed up in the written comments that the panelists added to their reports. On one test the housewife wrote, "Too strident." Of the same tape, the saxophonist said, "Poor bass, annoying hiss, highs good." Both were hearing the same thing but evaluating it entirely differently.

Comments for another sample ran like this: "Best of the lot; fine pickup in all ranges." "Woodwind highs a bit fuzzy. Good strings (cellos and violas), good tutti."

Panelists differed so widely in scoring tapes (1 for particularly good, 2 for acceptable, 3 for substandard, 4 for unacceptable) that average values for any given tape would be meaningless. The ear that listens, it appears, makes more difference than the tape being tested so long as all are brand-name tapes.

LISTENER TEST RATINGS						
PANELISTS:	A	B	C	E	F	
American L-18M	1	2	1	3	3	
Ampex 941	3	1	3	1	1	
Audiotape 1861	1	2	3	2	2	
BASF LGS-35	2	2	2	2	2	
Brand 5 10D7M	3	4	4	2	4	
Capitol 742	3	1	2	2	2	
Irish 241	2	1	2	2	2	
Robins 10A7M	4	4	4	2	4	
Scotch 150	2	2	2	2	3	
Sony PR-150	2	1	3	1	1	
Soundcraft Plus-50	2	2	3	1	1	

"Somewhat dull." "Weak highs." And remember that all the panelists were hearing the same recording on the same tape played through the same equipment at the same time. Each evaluated the sound in terms of whatever was important to him.

If the tests had been run with several recorders or several recordings, the results would undoubtedly have turned up additional differences. Likewise, differences between speakers or phono cartridges or microphones or even listening rooms can affect the sound, emphasizing or hiding the qualities a particular listener wants to hear—or wants not to hear.

The most important of these variables for tape testing is the tape recorder. The coatings on our test tapes, though called standard and therefore all similar to the classic Scotch 111 coating, are not identical. For one thing, not all are designed for the same tape recorder bias setting—an element in the equation that can be critical. Likewise, tape recorder manufacturers do not all provide the same bias in the record circuit. On some of the more expensive recorders it may be corrected for the specifications of the tape you are using; more often it is awkward or impossible to adjust.

In addition to the standard coatings we tested, there are a host of special-purpose tapes developed in recent years to solve particular recording problems. Low-print tape, one of the earliest of these formulations, was designed to minimize the effect of one layer of tape on its neighbor in the reel. High-output tapes allow you to record at a higher level without increased distortion so

that noise level is lower, with respect to the signal, on playback. Low-noise tape has a similar result but produces it through more careful oxide milling to reduce the noise inherent in the tape. Slow-speed tapes are designed for increased high-frequency response at low playback speeds.

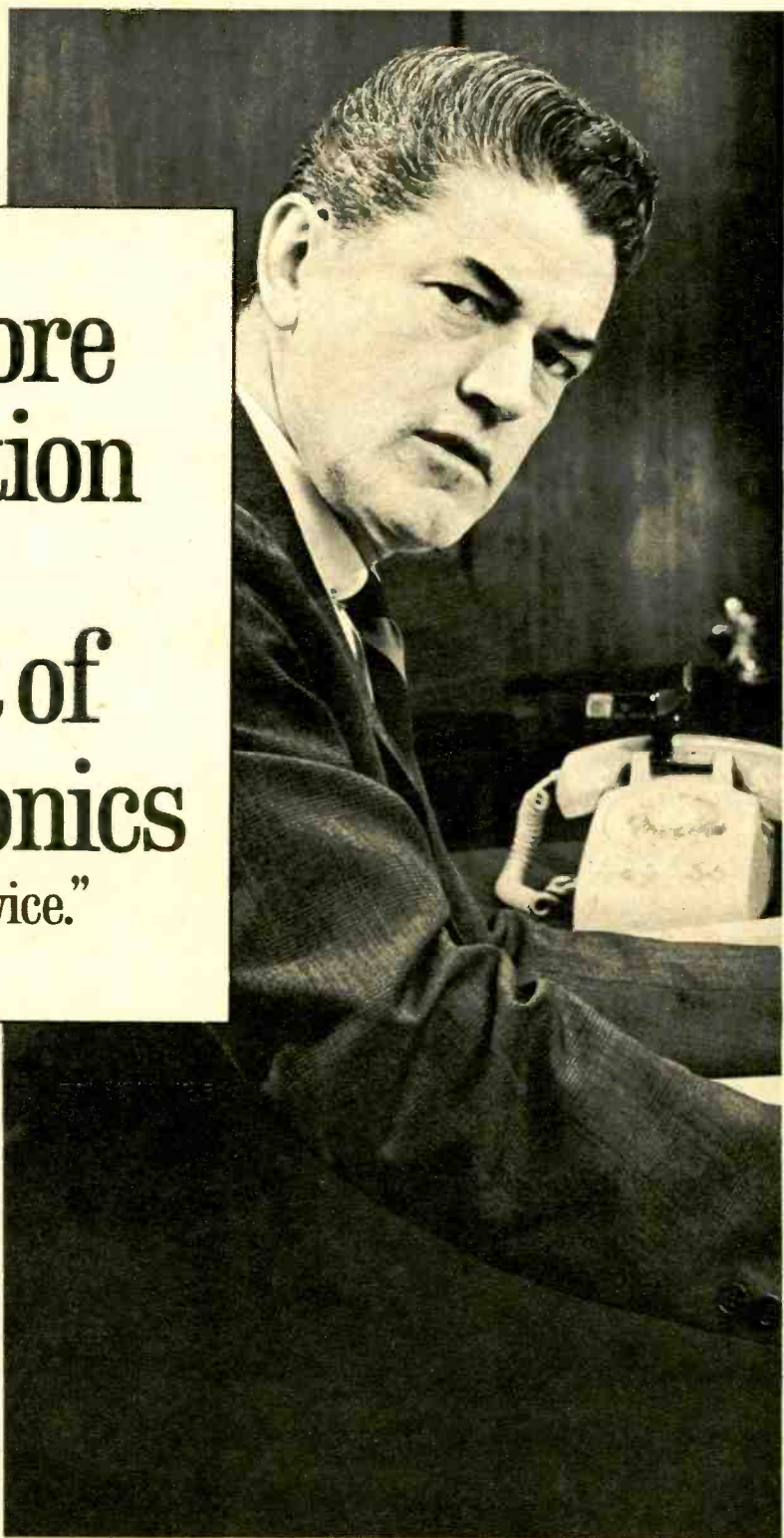
Even the backing material influences tape performance. The limper the backing, the more closely the tape will wrap itself around the heads—as long as it remains strong enough to withstand the mechanical demands of the transport mechanism. The more intimate the contact between tape and head, of course, the more accurately the recorded signal will be reproduced.

Well then, how do you choose a recording-tape brand? Our answer would be: Test it. Since it's obvious that the brand that will do the best job for you will be the one that produces the results *you* want on *your* equipment no one else's tests can ever be really valid for your purposes. And a listening test is not hard to set up.

Get small reels of the type of tape you think you will need (standard or special-purpose) and make up your own test reel the way we did. If you're handy with a splicer you may want to try mixing the tapes together without intervening leader and recording straight across them. Remember our experience, though, and keep your samples at least 1 min. long. Use several samples of each brand, changing the order in which they fall so you get a direct comparison in as many combinations as possible.

But, above all, don't let a magazine article tell you what brand to buy

**“Get more
education
or
get out of
electronics
...that’s my advice.”**





Founded 1937
CREI
 Accredited Member
 of the National Home Study Council

Ask any man who really knows the electronics industry.

Opportunities are few for men without advanced technical education. If you stay on that level, you'll never make much money. And you'll be among the first to go in a layoff.

But, if you supplement your experience with more education in electronics, you can become a specialist. You'll enjoy good income and excellent security. You won't have to worry about automation or advances in technology putting you out of a job.

How can you get the additional education you must have to protect your future—and the future of those who depend on you? Going back to school isn't easy for a man with a job and family obligations.

CREI Home Study Programs offer you a practical way to get more education without going back to school. You study at home, at your own pace, on your own schedule. And you study with the assurance that what you learn can be applied on the job immediately to make you worth more money to your employer.

You're eligible for a CREI Program if you work in electronics and have a high school education. Our FREE book gives complete information. Air-mail postpaid card for your copy. If card is detached, use coupon below or write: CREI, Dept. 1701G, 3224 Sixteenth Street, N.W., Washington, D.C. 20010.



The Capitol Radio Engineering Institute
 A Division of McGraw-Hill, Inc.
 Dept. 1701G, 3224 Sixteenth Street, N.W.
 Washington, D.C. 20010

Please send me FREE book describing CREI Programs. I am employed in electronics and have a high school education.

NAME _____ AGE _____

ADDRESS _____

CITY _____ STATE _____ ZIP CODE _____

EMPLOYED BY _____

TYPE OF PRESENT WORK _____ G.I. BILL

I am interested in Electronic Engineering Technology
 Space Electronics Nuclear Engineering Technology
 Industrial Electronics for Automation
 Computer Systems Technology

APPROVED FOR TRAINING UNDER NEW G.I. BILL

CB Corner

By Len Buckwalter, KQA5012

Onward and Upward with the Pros

ALTHOUGH it took nearly a decade to happen, the CB industry is gathering its resources to help decide CB's future. About a dozen manufacturers have welded themselves together under the banner of the EIA—the prestigious Electronic Industries Association, a Washington-based organization that speaks with a mighty voice for much of the electronics industry. A big task of the EIA is setting technical standards on everything from amplifiers to zener diodes.

The EIA's Citizens Radio Manufacturers Section isn't new but it's beginning to sound off on some of CB's pressing problems. Plumping for channel 9 is one example. It also favors type acceptance for all CB equipment. (The proposal now before the FCC would make the manufacturer—as well as user—open to punishment and fines for technical violations.)

In another move, the group took aim at a congressional committee and argued that more of the \$8 CB license fee should go back into FCC coffers. This would quicken license processing and boost FCC efficiency. The CB manufacturers also are forming an engineering group to set up standards, keep the FCC up to date on the state of the art and tinker with other technical problems.

Are these developments something to cheer about? May well be! Pressure groups aren't new to CB but few have lasted long enough to dent FCC thinking. The EIA group, on the other hand, is performing like a bunch of old pros. Of course the manufacturers are taking understandable steps to safeguard their own interests. But their goal might also coincide with that of their customers—a healthy, growing CB service.

Stretching a Line . . . A reader asks if it's possible to run an antenna line as far as

300 or 400 ft. without losses in the coax that will eat up the signal before it reaches the antenna or without paying fancy prices for low-loss cable.

Among the best cable for long runs is open-wire line (also called ladder type). A huge air space between wires keeps losses extremely low. Trouble is that open line will not match the CB transceiver—or any standard CB antenna. CB rigs are almost always rated at about 50 ohms output, *unbalanced*. The open wire (Lafayette 32 H 3613, or equiv.) is a much higher—450 ohms or so impedance—and it's *balanced*. There'd be serious power losses if rig or antenna are connected to an open line.

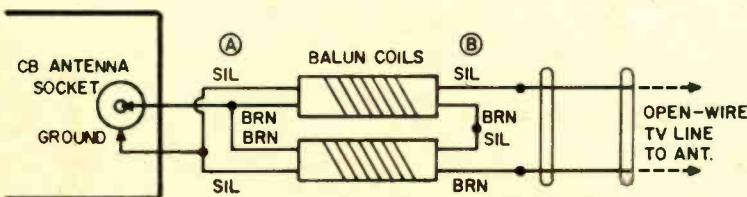
There is, however, an inexpensive device that makes everything fit together nicely. It's called a *balun* (short for balanced-unbalanced). It's nothing more than a specially-wound coil that tidies up the electrical differences between rig, line and antenna.

We ordered several baluns to test the theory (Lafayette 18 H 7701, 89¢ a pair). They're really intended for TV sets but our tests proved they work on 27 mc for CB.

The hookup is shown in the illustration. Connect side A to the antenna socket on the CB rig; side B goes to the antenna through any length of open-wire line. Note that each coil has two wires on each end. Those wires are poorly marked on the actual coils but you can easily find the right ones by tracing silver and brown wires on the coil.

Up at the antenna, you'll need another pair of balun coils—but here side A connects to the antenna terminals, side B to the line. Put the baluns in a plastic box at the antenna so they won't suffer from the weather.

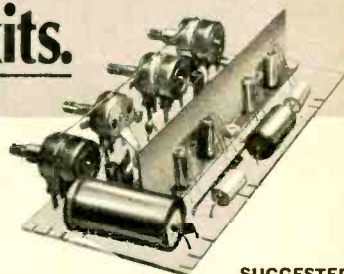
With this system, you can put your antenna on a hilltop and still operate efficiently from down in the valley. ●



Baluns, connected as shown here, match output of CB rig to open-wire line for distant antenna. Same configuration is used at other end but in reverse: A connects to antenna and B to open-wire line.

Now...18 different professional-quality amplifiers, tuners & preamps

- completely assembled...
- solid state, printed circuits...
- priced lower than kits.



There are so many ways you will use these easy-to-install, printed-circuit assemblies; in hi-fi equipment, ham gear, P.A. and intercom systems, or as guitar and organ amplifiers. Employing the most advanced Complementary-Symmetry transistorized designs, these assemblies provide the ultimate in economical circuitry for reliable audio applications from one watt to twenty. They have already become the design standard for a large group of audio equipment manufacturers, as well as a basic teaching tool in many educational institutions.

TYPE	DESCRIPTION	SUGGESTED LIST PRICE
PCA-1-9	1W, 9V D.C. 4 Transistor Amplifier	\$7.20
PCA-1-14	2W, 14V D.C. 4 Transistor Amplifier	7.00
PCA-2-9	3/4W, 9V D.C. 3 Transistor Amplifier	5.90
PCA-2-14	1W, 14V D.C. 3 Transistor Amplifier	5.90
PCA-3B-18-1	4W/Channel Stereo Amplifier with Bass, Treble, Volume and Balance Controls	19.20
PCA-4-9	1W, 9V D.C. High Gain, 4 Transistor Amplifier for Radio, Ceramic or Crystal Phono Cartridge, etc.	8.30
PCA-4-9A	Same as PCA-4-9 with Tone Control Circuit	9.20
PCA-4-14	2W, 14V D.C. High Gain 4 Transistor Amplifier for Radio, Ceramic or Crystal Phono Cartridge, etc.	8.30
PCA-4-14A	Same as PCA-4-14 with Tone Control Circuit	9.20
PCA-4-18A	3W, High Sensitivity, 4 Transistor Amplifier with Volume and Tone Controls for use as Guitar, Radio or Phono Amplifier	9.52
PCA-5A-14	2W/Channel 14V D.C. Stereo Amplifier with Balance, Tone and Volume Controls	15.80
PCA-6A-25	8-10W/Channel Stereo Amplifier with Preamp for Ceramic Phono Cartridge and Bass, Treble, Balance, and Volume Controls	30.10
PCA-6A-25SCS	Same as PCA-6A-25 with Separate Control Assembly	31.80
PCA-7B-18	Tape Cartridge Stereo Preamp with Level Set Controls	12.00
PCA-7C-18	Same as PCA-7B-18 without Level Sets; 4 Transistor	9.50
PCA-8-36	20W Mono Basic Amplifier	18.85
PCA-9-18	3W/Channel, 10 Transistor Stereo Tape Playback Amplifier with Volume, Tone and Balance Controls	25.30
PCR-1-9	9V 2 Transistor AM Tuner	11.30

For brochure containing complete technical data on all 18 assemblies and for name of distributor nearest you, write: Amperex Electronic Corporation, Distributor Sales Dept., Hicksville, New York 11802.

Amperex®

TOMORROW'S THINKING IN TODAY'S PRODUCTS

WALKIE-TALKIES' — ROCKY ROAD

ON February 3, 1966, the New York Times ran a story under the byline of its radio and TV editor, Jack Gould, reporting that the FCC was planning to remove Part 15 (unlicensed) walkie-talkies from the 27-mc Citizens Band. He said the plan was to put them on a new band between 49 and 50 mc and reduce output power and antenna length in an effort to cut transmitting range.

For the public and the trade alike there had been no word of warning. Now, the way Gould reported it, millions of the little transceivers would be forced off the air within a year after the FCC's new regulations were approved. It would be almost impossible to convert 27-mc sets for operation on the new band and the technical specifications proposed for 50 mc would mean a substantial rise in the cost of the sets. Millions of dollars spent on these units would be wasted; dealers would be stuck with inventories of the sets; manufacturers and importers would be left without a salable product.

When the Times story came out there was reaction from equipment manufacturers and CBers alike. Many called FCC offices only to be told that such a plan, if it did exist, never had been mentioned to any of the district offices. Those who called the FCC's Washington office were given varying answers, depending on the staff member they happened to reach. Some said such rules were being considered. Others called the story an out-and-out hoax. A few disclaimed any knowledge one way or the other.

Within a few days at least one manufacturer was claiming that a \$1 million walkie-talkie order from a large chain had been cancelled. Dealers were trying to return the sets they had on hand, users were wondering where they stood and the FCC was doing a slow burn.

By February 16 the FCC had been so thoroughly inundated with questions that they issued a memorandum claiming that "the Commission staff is continually at work in anticipating problems, working with problems as they develop and making plans for new contingencies. In respect to walkie-talkies, difficulties had developed because of the operation of the unlicensed transmitters in the same band as Citizens Radio stations. We have been studying a number of proposals designed to help resolve the situation. We want to stress the words proposal and study. We have not gone beyond this stage."

The following day, the FCC held a Washington meeting for CB manufacturers. James Barr, FCC's Safety and Special Services Chief, acting as its primary spokesman, was emphatic in saying that much was being made of nothing. The 50-mc frequency mentioned was only one of *several* possibilities being tossed about among FCC personnel, he continued, and some of their informal notes might have gotten out of the FCC, been misinterpreted by people who didn't know any better and blown up out of perspective.

Barr himself had been quoted in the original Times story as acknowledging that the Commission was considering the rules. At the February 17 meeting he stated, "There is no such proposal." (A few months later, FCC attorney Richard Everett explained, "When the word was out on this prematurely, nothing had been decided. . .")

In the Times story, Gould had identified as his source of information an article being prepared for the March issue of S9, a CB magazine (whose editor, Tom Kneitel, writes Uncle Tom's Corner for EI). When the March S9 came out, the story contradicted much of what the FCC had said, stating that the

TO 50 MC

By ROBERT LONG

change already existed in a formal document sent to the Interdepartment Radio Advisory Committee (IRAC) for approval. IRAC is a group of representatives from governmental agencies and the military. Their task is to issue frequency allocations to the radio services.

S9 claimed that walkie-talkies were to be shifted to five specific 50-mc channels (any given set to operate on only one channel), that input power would be reduced from 100 mw to 60 mw, that the antenna length would be slashed from a 5-ft. maximum to 2 ft., that superregenerative receivers would be outlawed and that all equipment was to be FCC type-approved.

Then, on April 13, the FCC issued Public Notice Number 98917. Without making reference to recent events, it spelled out a plan to move Part 15 walkie-talkies to 50 mc, almost exactly as it had been reported earlier. The one major difference was that present users of walkie-talkies on CB channels would have *seven* years to vacate, rather than only one.

FCC Commissioner Kenneth A. Cox shortly after the issuance of the Public Notice put out a strongly-worded statement against the proposal. "Spectrum space is far too valuable to waste the 50-mc band on walkie-talkies," Cox said. "The 50-mc band would be far superior to the 27-mc band for . . . serious uses since long-distance interference problems are much less severe in this band," he added. And equipment prices would be much higher. His alternative plan was to establish a walkie-talkie channel around 27.53-mc—above the present CB channels but still within the operating capabilities of present walkie-talkies.

The Electronic Industries Association of Japan quickly agreed, followed by the Raytheon Co. Both organizations are closely involved in the manufacture and sale of the low-cost units. The EIAJ said that, while most of the cheap sets shipped here are toys, "thousands of Americans earn substantial portions of their income directly from the importation and marketing" of Japanese walkie-talkies—\$70 million worth in 1966. And the EIAJ added that it would be "impossible to produce such a device which could operate within the radiation limits of Part 15 while functioning at 49-50 mc."

Today the plan is still being considered by the FCC. Nobody in or out of the FCC seems willing to speculate on the reasons for the FCC's denial of the original Times/S9 story. Certainly the plan was no more controversial than many other moves of the FCC. And it seems evident that it had been formulated even before the story appeared.

We have learned that on January 13, 1966 a letter from the FCC asked IRAC to place on "an early IRAC agenda for appropriate consideration" a "Notice of Proposed Rule Making in the matter of Amendment of FCC Rules, Part 15, Subpart E—Low Power Communication Devices, to delete the band 26.97-27.27 mc and substitute therefore the band 49.9-50.0 mc." Attached to the letter was an eight-page document that spelled out in great detail the FCC's plan to establish the five 50-mc channels, reduce power to 60 mw, shorten antennas, and tie the whole thing to a one-year expiration date for 27-mc use by unlicensed walkie-talkies.

This sounds like something more serious than the in-house notes described by Barr. Was the FCC interested only in sounding out IRAC reaction to this one of several plans then under consideration? Unfortunately, this is one of those situations where the more answers we get, the more questions we have. —

The Latest on DXing Apollo

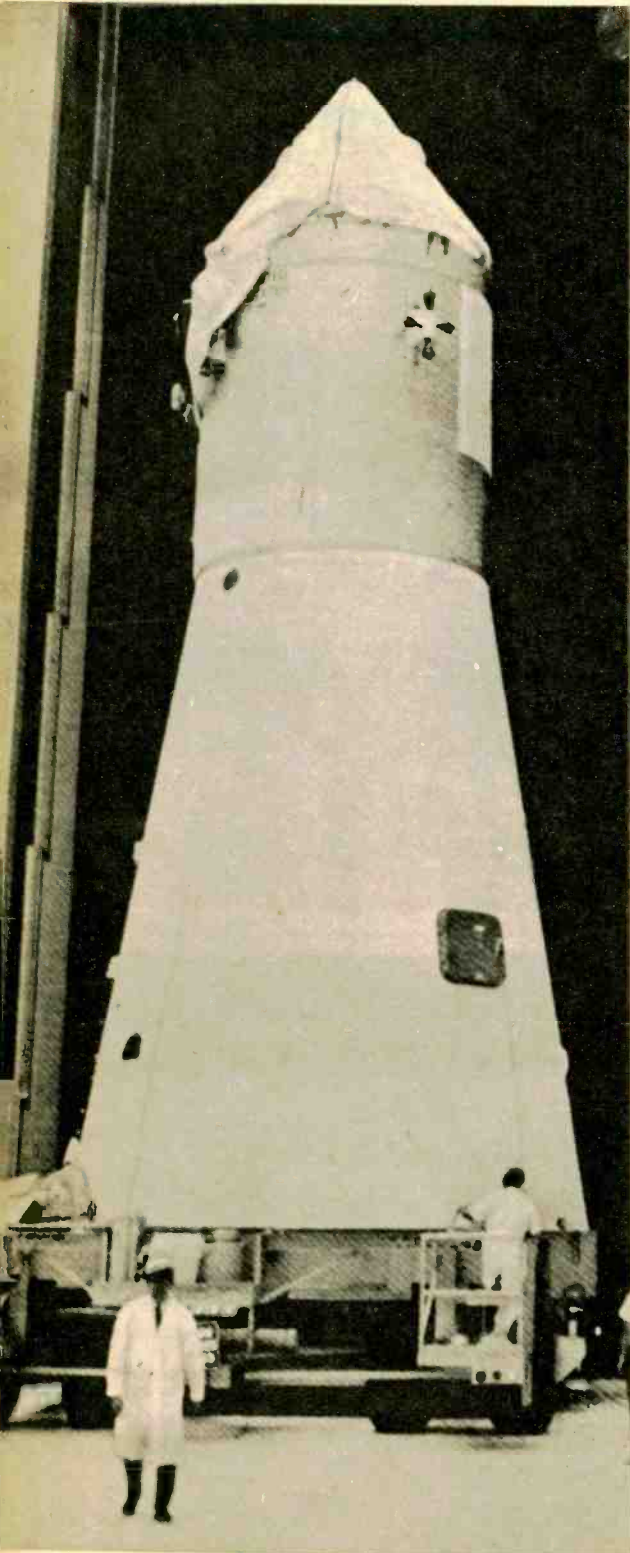
THE Apollo receiver being designed by our engineer will actually be a converter, as we stated in our previous report.

As the range it must tune is from 2090 to 2120 mc, its local oscillator will have to operate from 2236 to 2266 mc. Its output will be fed to a balanced mixer. The 146-mc output of the mixer will be fed to a conventional 2-meter (144 mc) ham converter whose 14-18-mc output can be fed directly to the antenna terminals of a communications receiver. To date, construction has only been accomplished on the local-oscillator chain.

Because of the 30-mc tuning range (greater than the total coverage of a conventional communications receiver) the 2236-2266-mc local oscillator will be tunable. The local oscillator (it will consist of a crystal oscillator followed by frequency multipliers) will actually operate at around 200 mc. For the sake of simplicity, our engineer is going to attempt to do all of the frequency multiplying in one stage. He hopes to accomplish this by operating a 200-mc transistor oscillator at a relatively high power level (several watts). This oscillator will then drive a PIN (positive-intrinsic-negative) diode multiplier.

The output frequency of the multiplier will be 10 times higher. This arrangement yields only a few milliwatts output at 2200 mc. However, this will be sufficient to drive a balanced mixer which will use the newer-type mixer diodes.

But the design hasn't been finalized. Our engineer is considering feeding the output of the 2-meter converter into a TV set or an FM receiver. This is because a conventional high-frequency receiver has a very narrow bandwidth. And the information from the Apollo LM (Lunar Module) and its mother ship will be frequency modulated. More on Apollo in a later issue. ❖



Cheapie Walkie-Talkies

Continued from page 76

no instructions; operation changed when one unit was shaken—big change in receive volume, also increased hand sensitivity; one battery dead, the other weak.

Lafayette HA-70C: Good instruction book with schematic; only one transistor and tuned circuit for both transmit and receive; two audio stages; one unit had poor volume control; other unit would not receive until transmit/receive knob was adjusted (its movement was restricted when case back was on).

Lloyd's 7A07B: Small but complete instruction book with schematic; full parts list with RCA transistor equivalent for Japanese transistors; single RF inductor, no loading coil; two-stage audio output with two transistors in parallel; no volume control.

Olson CB-42: No channel specified; no schematic; separate inductors for transmit and receive; two audio stages; one unit had defective transmit/receive switch when in receive mode; neat construction.

Olson RA-826: Blister packed on small card; instructions but no schematic on back;

no volume control; single tuned circuit for both transmit and receive; fixed antenna loading coil.

Sears Trans-Talk 400: One unit had no transmit output at all, the other had abnormally high transmit current; separate receive and transmit transistors and tuned circuits; only transceivers which used six penlite cells; both units had relatively high receive current; schematic on instruction sheet.

As noted previously, field-tests of units in receive mode were complicated by countless CB signals, as well as by skip interference from code, teletype, short-wave phone and other signals. Thus, our tests were not really reliable in evaluating operation for most of the units at more than about 200 ft. range.

We concluded that, even as toys, super-regens are of extremely limited value except under ideal conditions. And we can't imagine where you could find such conditions. We feel it's worthwhile to spend a few extra dollars for even the simplest superhet. And beware of high transistor count and low price. If you can possibly do so, check both transmit and receive operation before buying. Also check the batteries packed with most sets.

What's best for POL-123 ... is best for KLN-9449



Model ASP-543 130-174 Mc police antenna.



Model M-176 27-Mc citizens band antenna.

Police communicators *demand* all the things CBers *want* in their mobile antennas: Maximum range. Ruggedness. Reliability. Long life. *That's why 9 out of 10 police vehicles in America use antennas made by The Antenna Specialists.*

Antenna Specialists' CB antennas are literally made from the same mold. Except for the length of the whip, they are *identical with their professional counterparts.*

Shouldn't you put John Law's experience to work in your mobile?

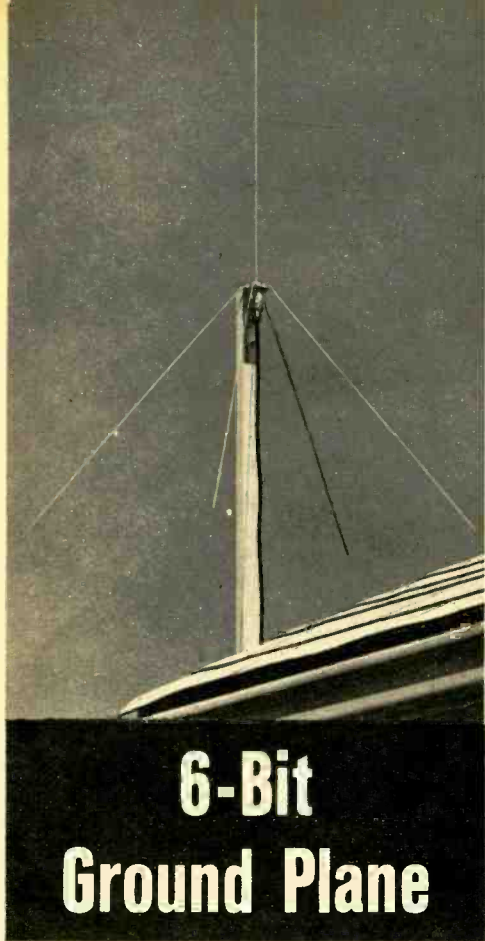
More communicators use Antenna Specialists brand antennas—mobile and base—than use the next five brands combined.

the antenna specialists co.

Export: 64-14 Woodside Ave.
Woodside, N.Y. 11377

Div. of Anzac Industries, Inc., 12435 Euclid Ave., Cleveland, Ohio 44106





6-Bit Ground Plane

ONE of the best antennas for 6- and 2-meter hams is the quarter-wave ground plane. It is cheap and can be built easily from junk-box parts. And it is ideal for those SWLs who monitor aircraft and police calls in the 108-174-mc range.

The heart of the antenna is an Amphenol Type 83-1R (SO-239) chassis-mount coax connector, available from electronic parts distributors for about 50¢. The only other material you will need is heavy copper wire. If you haven't any of this use coat hangers. But be sure you can solder to the wire before you waste time cutting it to length. Clean the wire thoroughly with steel wool or emery cloth before applying solder to it.

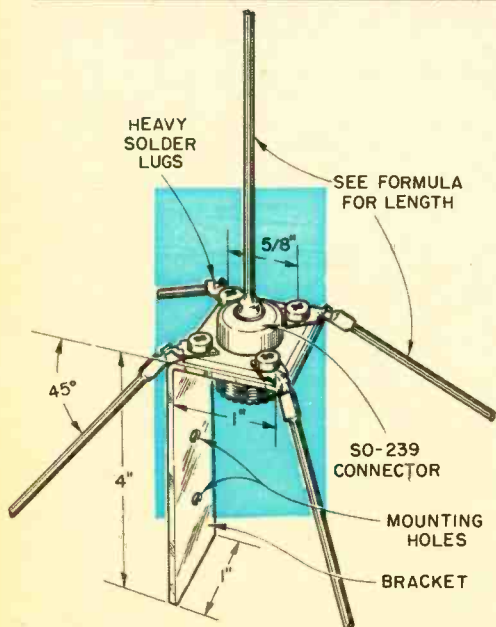
First thing to do is decide what frequency you want to construct the antenna for. Let's say it is 52 mc. Using the formula, $length \text{ (in inches)} = 2808 / frequency \text{ (mc)}$, you get an answer of 54 in. This is the length you should cut five pieces of wire. Suppose you want to design the antenna for 118 mc (around the middle of the aircraft band). Using the formula again, we get $2808 / 118$, which equals 23.7 in. For middle of the 2-meter ham band you would divide 2808 by 146. This answer is 19.2 in.

Next thing to do is solder one piece of wire in the center lug of the connector. Then attach four heavy solder lugs to the corners of the connector so when you look down on them the center lines of diagonally-opposite lugs are on a straight line (90° between lugs). Be sure to use lockwashers so the lugs won't move. Put the remaining pieces of wire in each lug, crimp the lug and apply solder generously. Then bend each of the elements down 45°. This angle is somewhat critical. Change it to, say, about 35° and you'll change the antenna's impedance to 50 ohms.

Last thing to do is to make a small mounting bracket. Ours was made from a 5 x 1-in. piece of scrap aluminum. Drill a 5/8-in.-dia. hole at one end for the connector, then bend that end 90°. Attach the bracket to a strong piece of wood, such as a 1 x 2, then fasten the wood to the highest point you can reach on your roof. Be sure the antenna is mounted so the drooping radial arms are away from metal, such as gutters. This is important because nearby metal will detune the antenna.

The feedline to use is 73-ohm coax, such as RG59/U; terminate it with a PL-259 connector to match the SO-239 connector.

—Stephen E. Maziarz



Antenna consists of SO-239 coax connector with vertical element soldered in center lug. The arms are spaced 90° and have a droop angle of 45°.

Incentive Licensing Is Back

Continued from page 83

charts and the Novices' loss of 2-meter phone, all other ham bands remain exactly as they are right now. The original proposal to create special incentive sections on 2 meters has been scrapped.

At 12:01 on the morning of November 22, 1969, the full impact of the new rules will be felt. Most affected parties will be those remaining Generals who have not passed higher class exams. They will be cut to one half of the present low-band DX phone bands and lose a significant chunk of the hot CW frequencies.

And what about class-coded call-signs in all this? Nary a word. The concept had threatened to split amateur radio once and for all by isolating hams into opposing camps. Thousands of hams renounced membership in the ARRL because of their role in proposing special calls and went over to Wayne Green's newly-formed IoAR (Institute of Amateur Radio).

But the FCC claims that hams can be relied on to police themselves in keeping unqualified operators off the limited-use frequencies. And so the present calls will stay. (Unofficially, the publishers of Radio Amateurs' Callbook have let it be known that they will help by adding the license class to future U.S. listings. If it does nothing else, the move is going to embarrass the Technicians who have been posing as Generals.)

From a business standpoint, the industry generally feels that after an initial slowdown (beginning right about now) has been weathered, sales of ham gear will rise to dizzy heights. The ham press solidly backs the rule-making—if for no other reason than because there finally is a decision.

For just about everybody involved, the new rules constitute a program that is not quite what they wanted but is, at least, shorn of the most offensive elements of the earlier proposal. It is, in other words, a compromise. How good a compromise remains to be seen. Even the FCC hedges to the extent of saying they may revise special frequency allocations depending on how much use they get.

What Does *electronics* Mean To You?

As you know, this is the "electronics age." And electronics technology is changing so rapidly that the average technician's store of knowledge is highly obsolescent. He must get more education or get out of this field! He must understand *fundamental principles and concepts*. Only on the basis of such understanding can he easily adapt to the swift changes now occurring.

The technician who knows only the "how" of electronics is left behind again and again by new designs and techniques. But by comprehending the "why," he remains an *expert* — well paid and respected — in his field.

Earn Your Associate Degree

Grantham strong-foundation training in electronics engineering technology leads to non-obsolescent skills — to skills which are based more on reasoning than on merely doing — and leads to the degree of *Associate in Science in Electronics Engineering* — the A.S.E.E. degree. As many as three semesters out of the five-semester degree program may be completed by correspondence, and the remainder of the curriculum in residence.

Grantham School of Electronics

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

Telephone:
(213) 469-7878

Telephone:
(202) 298-7460

Get Your FCC License

An F.C.C. operator license is U.S. Government evidence of your knowledge in electronics. In the Grantham associate degree curriculum, you are more than prepared for your first class radio-telephone license and radar endorsement by the time you complete the first two semesters. However, if you are interested in a shorter course designed specifically to prepare you for F.C.C. license exams, ask for information about the Grantham F.C.C. License Course — an 88 lesson highly-effective correspondence course.

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. Just mail the coupon (below), or write or telephone us for full information.

Grantham School of Electronics

1-68-EI

1505 N. Western Ave., Hollywood, Calif. 90027

Please send me free literature describing Grantham courses in electronics.

Name _____ Age _____

Address _____

City _____ State _____ Zip _____

I am interested in: F.C.C. License Course
 Associate Degree Curriculum

FREE!



BRAND NEW FALL AND WINTER RADIO-TV ELECTRONICS CATALOG



YOUR BUYING GUIDE
FOR: • Stereo & Hi-Fi
Systems & Components
• Tape Recorders • Elec-
tronic Parts, Tubes, Tools
• Phonos & Records
• Ham Gear • Test In-
struments & Kits • Cam-
eras & Film • PA • Citi-
zens Band • Radio & TV
Sets • Musical Instru-
ments

MAIL TODAY TO:

BURSTEIN-APPLEBEE

Dept. EIM, 1012 McGee, Kansas City, Mo. 64106

Name _____
Address _____
City _____
State _____ Zip Code _____

A Career At The Service Bench

Continued from page 89

not lose sight of the business implications of what you're doing. This is not a time for puttering; nor is it a time for leaving well enough alone. You must find *everything* that needs fixing in the set and find it quickly. Otherwise the bill will not be large enough to pay for the time you have spent.

So it is absolutely necessary to get training that includes salesmanship, retail merchandising, bookkeeping and administration. Without this type of training you can never be more than a successful troubleshooter.

And don't forget (silly though it may sound at first) physical fitness. When you find yourself replacing a Nuvistor at the top of a 15-ft. tower in a cold drizzle or lugging a 200-lb. color TV up three flights of stairs you'll know what I mean. These physically-demanding jobs are part of the regular routine. You can't be adverse to sweating and getting your hands dirty. Troubleshooting is no desk job.

Let's see what an actual job might be like for an outside TV repair man. You are given

a route of four calls to start off a rainy day.

The first call is in a trailer park. You slosh through some mud to get to the right trailer. The gentleman who admits you has a 23-in. B&W with sound but no brightness. A look at the tubes reveals that the damper tube is out cold. You change it. Brightness returns but the picture is shrunk and washed out.

The customer says, "It never looked like that before. What did you do to it?"

You replace four more tubes and each replacement does more to restore the picture until the set is playing like new. You write up the bill. It's over \$20. The customer moans, "I never expected it to be that much!" However, he pays you and you go on back out into the rain.

The next call is in a small apartment house with no elevator—and the set owner lives on the fourth floor.

You puff up with tube caddy in hand and knock on the door. An older woman opens the door, apologizes for not having her teeth in and takes you into the bedroom. There are about ten cats on the bed and the room smells. The TV is 21-in. table model about five years old, mounted in the wall. The picture is shrunk in on the sides. You extricate it from its perch, place it on the floor, get down on your hands and knees and begin testing tubes. They are good and you decide the TV will have to be repaired on the bench.

You advise the customer and she gives you the okay to take the set to the shop. Now you begin to work. It takes two trips before the TV and your equipment are in the truck.

The next call is a mansion. A well-groomed woman ushers you to a paneled den and turns on the TV. There is snow in the picture. You substitute your rabbit-ear antenna for the outdoor-antenna lead-in. The snow clears. This indicates the trouble is not in the TV but in the antenna system. You climb out a second-story window onto a porch roof. The antenna is mounted atop a chimney and you see that the twinlead has come loose from the antenna. You become a combination monkey and steeple jack and reattach the wire. You charge \$7.50 extra for the 15 minutes of dangerous work.

The fourth call is in a modest ranch-style home. The TV is a two-year-old color set. There is no light on the screen. You've run into this trouble many times before. You remove the back, change the 3A3, the 6JE6

and the 6BK4. The picture is restored. The people are thrilled at the good service. You write up the bill and go out to the truck. Then you phone the shop for the next four calls.

Now let's suppose you are the bench man. You arrive at work in the morning and find about 20 TVs and radios awaiting your expert presence.

You begin on a 19-in. portable with a suspected flyback. You attach your flyback tester and the meter indicates a short. Just then the phone rings. The dispatcher answers and yells over to you, "How is Mrs. Jones' TV?" It's one you finished yesterday. You answer, "All done." You pull a replacement flyback off the shelf. The phone rings again and is answered again. You keep on working and hear a customer come in the front door. The dispatcher waits on the counter. Meanwhile you are wiring in the new flyback. The dispatcher yells back, "What's a replacement for a 6EA8?" You answer, "A 6U8."

And so it goes. You must work with one ear tuned to your assistant who answers the phone, waits on the counter and countless other things.

That's a quick glance look at the career. It can be wild, hectic and profitable. It's certainly never dull and in my view it's great. You feel wanted, even needed, and at a premium all the time.

The only sour notes are the individuals who get into this business strictly for a fast buck without any real liking for electronics. Naturally everyone wants to earn as much money as possible but you must do it ethically or society descends upon you.

Every few years TV repair is singled out by a magazine or newspaper for an exposé. During the publicity, every unhappy customer you get runs to the Better Business Bureau with a complaint. All you have to do is answer the complaints and settle the situation fairly. In fact, when you do answer complaints in this way you build a reputation. For if a wary customer calls the BBB to inquire about you they'll say, "There are no unanswered complaints." That in itself is a recommendation.

You can't be too sensitive about complaints. Every business large or small is plagued by them. It's part of being in business. Just do the job right and ethically and your recommendations will swamp any complaints.



**NEW
HOLLOW
SHAFT**

nutdriver set

with Locknut/Screw adjusting feature

Speeds, simplifies setting of combination lock-nut/slotted screw adjustments on rheostats and similar controls used in a wide variety of electrical and electronic equipment.

Handle is drilled so you can run an 8" screwdriver blade right through its center and down through the hollow nut-driver shaft.

Ideal for all-round production, maintenance, and service work, this new HSC-1 Set contains eight interchangeable hollow nutdriver shafts in the most popular hex opening sizes from $\frac{3}{16}$ " thru $\frac{1}{2}$ ".



Really compact! Set is small enough, light enough to carry in your hip pocket. Sturdy, see-thru, plastic carrying case doubles as a bench stand.

XCELITE

XCELITE, INC. • 16 BANK ST. • ORCHARD PARK, N. Y. 14127

Send Bulletin N867 with information on HSC-1 Hollow Shaft Nutdriver Sets.

name _____

address _____

city _____ state & zone _____

In Canada contact Charles W. Pointon, Ltd.

Notes from EI's DX Club

THE ARRL has refused to credit the DXpedition of W9WNV and K1IMP to Navassa Island (among other places). Since their presence on the island is not disputed, however, the EI DX Award rules will count K1IMP/KC4 QSLs as Navassa.

During the new Award Period, announced elsewhere in this issue, remember that R. Nederland's transmission to North America on 9590 kc at 2030-2120 EST is actually carried by a Trans World Radio transmitter at Bonaire, Netherlands Antilles. It therefore counts as South America—not Netherlands (Europe). This was the most common mistake during the last Award Period.

And correcting the second-most-common mistake, R. Moscow counts as *European* Russia unless you actually can prove the transmitter you heard was located elsewhere. Meanwhile, R. Eriven (Armenian S.S.R.) has a new transmission for the West Coast of North America every Wednesday, Thursday, Saturday and Sunday in Armenian and English at 2130-2230 EST (1830-1930 PST). Frequencies are the same as those R. Moscow uses for the West Coast. For both, the transmitters are located in Siberia (Asia) and QSLs will be credited as such.

Bob Conder (North Carolina) reports that R. Nacional de Columbia (4955 kc and other frequencies) has an interval ID consisting of three loud beats on a gong and chimes.

TIRICA (La Voz de La Victor) at San Jose, Costa Rica, has returned to the international bands. William Sparks (California) has noted strong signals on 9615 kc around midnight EST (2100 PST). This one also is heard often at 625 kc on the BCB.

R. Pyongyang, North Korea, now is using an off-band channel at 16028 kc for Spanish transmissions to Latin America around 1825 EST.

Bob LaRose (New York) reports that R. Nigeria has been testing in the 13- and 16-meter bands. Frequencies noted at 1700 EST include 21455, 21690 and 17805 kc. Tests

are conducted in cooperation with Nigerian External Telecommunications, Ltd., which provides test tapes. The new transmitter reported on 4932 kc (sign-on at midnight EST) is a Midwest regional relay at Benin.

R. Togo has moved to 90 meters where they have surprisingly good signals at 0030 EST (2130 PST) sign-on. Frequency for this one is 3220 kc. They will have a lower-power transmitter on the old 5047-kc channel.

Seems YVQE (4860 kc) uses two different IDs. They call themselves both R. Mundo and R. Maracaibo. Sign-off is at 2300 EST.

What may be the V. of Kenya's new high-power transmitter is being heard on 4915 at 2230 sign-on preceded by a flute interval signal.

The many protests received by the VOA following its announcement that QSLs no longer would be sent to U.S. residents seem to have been effective. Americans once again are treated like everyone else.

Look for R. Exitos, Santiago, Dominican Republic, on 3365 kc until midnight sign-off. As a new station, it may give special attention to reception reports.

Charles Milhans (Washington) reports reception of R. Nepal on 7105 kc at 0530 PST. According to R. Sweden, this may be a new high-power transmitter.

Propagation: Daytime conditions will continue good to excellent throughout the forecast period, with DX openings possible from 15 to 28 mc. The 10- and 11-meter bands (ham and CB) will remain open and the seldom-used 25.1- to 26.1-mc international SW band (principally used by the BBC and VOA) will be open from early morning to around midday, local time.

At night, DX will be possible from 6 to 15 mc over paths passing through the southern hemisphere, with best DX below 11 mc. BCB DX will also be good to very good during night hours with frequent openings from Europe throughout the period. —

Swap Shop

Individual readers (not commercial concerns) may swap electronic gear by sending one listing, name and address to Swap Shop, ELECTRONICS ILLUSTRATED, 67 West 44th Street, New York, N.Y. 10036. Space is limited; only most interesting offers are published.

AMATEUR RADIO

HEATHKIT code oscillator. Will swap for 7JP4 picture tube. Dave Heller, KPN0580, 308 Cleveland Ave., Defiance, Ohio 43512.

HALLICRAFTERS HT-9 transmitter. Will swap for ham gear. Mike Gipe, WA3GAU, 1120 Green Acre Rd., Towson, Md. 21204.

HAMMARLUND HQ-145 general-coverage receiver. Will swap for Eico 753 SSB transceiver, power supply or similar. Russ Stein, WA0PYU, 1600 S. Eudora St., Denver, Colo. 80222.

CODE-PRACTICE SET. Will swap for best offer. T. G. Ireland, 79 Shdrt Beach Rd., Branford, Conn. 06405.

MARK II transceiver, 2-8 mc and 230-240 mc, accessories. Will swap for CB transceiver. Mike Baker, 283 N. Poplar St., Manteno, Ill. 60950.

GLOBE Scout 680 transmitter. Will swap for VHF gear or best offer. Bruce Hildebrand, 6090 Upland Ter., Seattle, Wash. 98118.

SURPLUS, BC-610-I transmitter, accessories. Will swap for best offer. Al Lopez, WB6CPG, 4896 Dewey Ave., Riverside, Calif. 92506.

HEATH AT-1 transmitter. Will swap for stereo amplifier. James Wolhuis, 2831 Ellamrie Dr., Kalamazoo, Mich. 49007.

SHORT-WAVE LISTENING

HALLICRAFTERS S-200 receiver. Will swap for 30-mc receiver, tape recorder or best offer. T. G. Williams, 3120 Waco St., Memphis, Tenn. 38114.

KNIGHT Span Master receiver, headphones. Will trade for Knight R-55A or Heath GR-54. Lyle Kruchenberg, RR 2, Hazen, N.D. 58545.

LAFAYETTE HE-200. Will swap for Hallicrafters SX-100 or similar. Mike Hollis, WN4GJE, 2127 Hemlock Cir., Rt. 7, Russellville, Ala. 35653.

SURPLUS BC-454 receiver, power supply. Make swap offer. Tommy Quertermous, RR 1, Creal Springs, Ill. 62922.

HALLICRAFTERS SW-500 receiver. Will swap for Conar 500 receiver. Glen Jenkins, MOQ 2307, MCB, Camp Lejeune, N.C. 28542.

KNIGHT R-55A receiver. Will swap for signal generator or capacitor checker. Dan Sheley, 2208 Fiesta Dr., Troy, Ohio 45373.

HALLICRAFTERS S-20R. Will swap for Heath Twoer or other 2-meter gear. William L. Lundy, WN0RMH, 223 E. 19th St., Lork, Nebr. 68467.

KNIGHT Star Roamer. Will trade for CB transceiver or R/C gear. J. E. Downey, 7832 Sunset Dr., Elmwood Park, Ill. 60635.

HALLICRAFTERS S-120. Want novice transmitter or amateur band receiver. Mike Mochizuki, 2365A Palolo Ave., Honolulu, Hawaii 96816.

KNIGHT Star Roamer. Want PA amplifier, 35-70 watts. L. Lindenbaum, 10320 Haywood Dr., Silver Spring, Md. 20902.

HALLICRAFTERS S-38 receiver. Will swap for ham gear. John A. Poplawski, 10 Ave. C, Bayonne, N.J. 07002.

HEATH GR-64 with Q-multiplier. Want Lafayette HA-350 or Heath HR-10. Kevin J. Hansen, Fleming Rt., Aitkin, Minn. 56431.

SURPLUS BC-969A VLF receiver, 15-150 kc. Will swap for 1-watt walkie-talkie or tape recorder. Edward R. Perkins, Rt. 4, Taylorsville, Ky. 40071.

SURPLUS BC-348Q receiver. Will trade for Hammarlund HQ-100AC or Drake SW-4. Gerald Ano, 2480 Rolling View Dr., Smyrna, Ga. 30080.

HALLICRAFTERS S-20R receiver. Will swap for ham transmitter. W. C. Small, 2F University Ter., Columbia, Mo. 65201.

[Continued on page 113]

Introducing the world's first 5-channel, solid state, Citizens Band Radio with a Class B push-pull audio amplifier, super-sensitive receiver, and full-powered transmitter, that comes with either palm microphone or telephone handset at no extra cost.

Total weight: 3 pounds. Total price: \$99.90.

How can anyone put so much into one radio, for so little, without cutting corners?

Anyone can't. Pearce-Simpson can.

In simple, unvarnished terms, Pearce-Simpson makes more marine radio telephones than anyone in the world. Period.

Which means that Pearce-Simpson buys more components for radio telephones than anyone in the world. In other words, because we buy in such quantity, we save money when we buy our components.

You save money when you buy our radios.

And because we have our own plastics factory and make our own telephone handsets, our own cabinets and many of our own parts, we know we start out with quality.

You know you end up with quality.



The Sentry II

Nobody can make a better radio for \$99.90. Not even Pearce-Simpson.

Important: Full year warranty. 4-watt power output 0.5 uv opens squelch adjacent channel 50 db down cross modulation 80 db down no close range blocking noise limiting circuit that virtually eliminates ignition and alternator noise.

F.C.C. type acceptance pending.

Pearce-Simpson, Inc./P.O. Box 800/Biscayne Annex
Miami, Florida 33152 EI-168
Gentlemen: Please send complete information on your new CB Radios and a list of dealers nearest me.

Name

Address

City

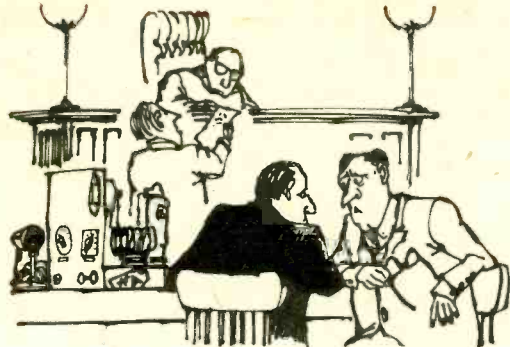
State

Zip

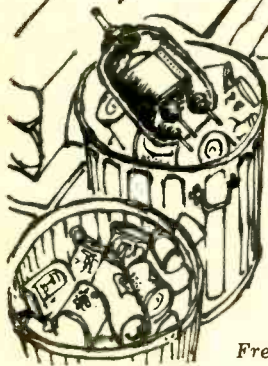
Overseas military personnel may write for special price list.

Over and Out

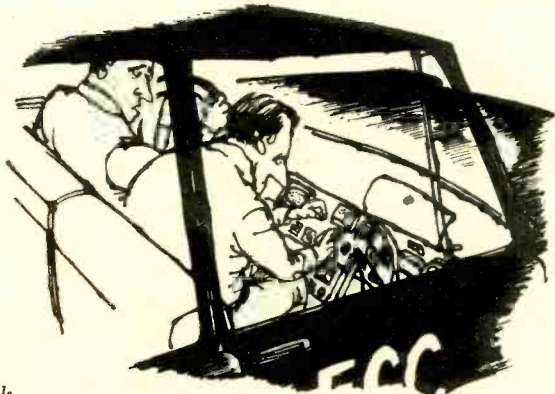
Rodriguez



"I'll build our defense on the one thing we've got going for us—you were crystal controlled."



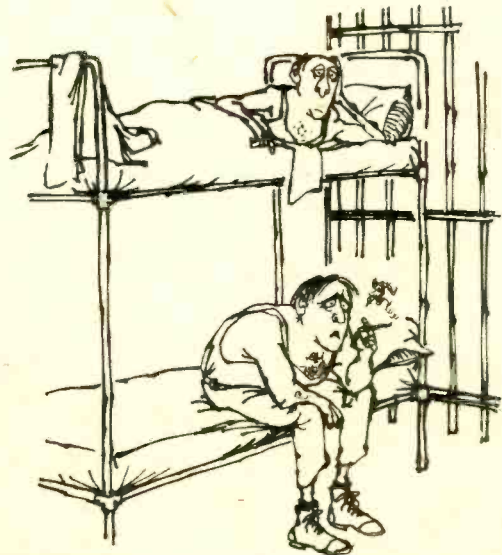
"Joe, I think I've got a lead on Powerful Freddy the Phantom."



"Gee, how can you get mad at a guy who signs off with a hymn and our national anthem?"



"You're right. I use bad language, I don't have a license, I'm running 60 watts with an illegal antenna. And we're 1,200 ft. inside Mexico."



"They wouldn't have caught me if I hadn't sold \$4,300 worth of commercials."

Swap Shop

Continued from page 111

AUDIO & HI-FI

BOGEN MU-15A PA amplifier, mike. Will swap for stereo tape recorder. Dennis Adam, 657 Stewart Ct., Whiting, Ind. 46394.

THREE-WAY co-ax speakers, 12-in. Will swap for signal generator or ham gear. Bill Lee, 218 Sergeant, Joplin, Mo. 64801.

STEREO recorder, 4-track. Will swap for Lafayette or Lettine 6-meter ham gear. Vincent R. Manzione, 23 Lawrence St., Yonkers, N.Y.

ROBINS VU meters, brand new. Will swap for U.S.-made microphone or snare drum with cymbal. Kelly Quan, 1249 Green St., San Francisco, Calif. 94109.

EICO RP-100 stereo tape deck. Make swap offer. R. Smucker, Box 42, Huntingdon, Pa. 16652.

AMPRO 731 stereo tape recorder. Will swap for ham gear of SW receiver with BFO. Michael A. Lee, 272 Fairbourn Rd. N.W., Atlanta, Ga. 30331.

REALISTIC Four record changer. Will swap for best offer. J. S. Collins, 2307 Lacinda, Perry, Iowa 50220.

ELECTRO-VOICE 600D dynamic microphone. Will swap for centrifugal clutch for 1/2-in. shaft. Bobby Ross, Jr., 1609 Acadia St., Durham, N.C. 27701.

CITIZENS BAND

FANON FCB-3 walkie-talkie. Will trade for transistor tape recorder or best offer. Richard Crutcher, Box 1, Chapel Hill, Tenn. 37034.

LAFAYETTE HA-70C walkie-talkie. Want Hallcrafters S-53 or National NC-33 receiver. J. Dean, 406 40th St., New Orleans, La. 70124.

LAFAYETTE HE-75 1-watt walkie-talkie. Want Knight T-60. Joseph Connelly, 407 51st St., West New York, N.J. 07093.

BASE TRANSCEIVER. Will swap for SW preamplifier. John W. Lockhart, Jr., 2348 Hillside Ave., St. Paul, Minn. 55108.

KNIGHT Ten-2 CB tester. Will trade for 1-watt walkie-talkie (Heath GW-52, Knight KN-400A or similar). Clarence A. Nelson, Rt. 2, Owensboro, Ky. 42301.

LLOYDS 100-mw walkie-talkie. Will swap for 40-meter crystal. Ricky Miller, RR 1, Box 267, Tripoli, Iowa 50676.

MIDLAND walkie-talkie. Will swap for SW receiver or best offer. Charles T. Smith, 211 Lewis Ave., Lawrenceville, Ill. 62439.

CITI-FONE 5-channel transceiver. Will swap for walkie-talkie. John Posa, 8158 Hartwell Ave., Detroit, Mich. 48228.

OTHER EQUIPMENT

AUDEL Electric Library, eleven volumes. Will trade for Hallcrafters SW receiver or similar. Vernon Kemplin, RR 2, Mansfield, Ill. 61854.

KNIGHT coil and flyback checker. Will swap for CB ham gear or best offer. Hershel Harmon, RR 1, Paris, Miss. 38949.

SURPLUS telephone carrier amplifier. Will swap for VTVM or cartridge tape recorder. Donald Foret, 805 N. Bradford Ave., Tampa, Fla. 33609.

EICO 722 VFO. Make swap offer. Ned Sebring, WABOWL, 1083 N. Ball St., Owosso, Mich. 48867.

HEATH VTVM. Want 25-watt PA and wide-range audio generator. Roy A. Babylon, 558 Dexter Ave., Mobile, Ala. 36604.

NAVY SURPLUS OS-8/U oscilloscope. Want photo enlarger, darkroom equipment. Tom Watkins, 1118 SW 2nd Ave., Gainesville, Fla. 32601.

RF PLASMA TORCH, power supply. Will trade for infrared snooper, test gear or best offer. Edward A. Miller, Jr., 12010 Telegraph, S. Rockwood, Mich. 48179.

LAFAYETTE MPI-6 intercom. Will swap for amplifier, 25 watts or more. Thomas Galetto, 104 Panorama Way, Los Gatos, Calif. 95030.

BALDWIN type C polarized headphones. Will trade for VOM or SW receiver. D. Landesberg, 179 Marcy Ave., Brooklyn, N.Y. 11211.

HEATH Q-multiplier. Want SW preamp or best offer. Brad Swaney, 2118 H. St., Belleville, Kan. 66935.

[Continued on page 119]

HERE'S The Place To Buy Your Electronic Components!



LOOK FOR...
**ERIE'S
ELECTRONIC
COMPONENTS
STATION**

Every Component
Neatly Packaged and
Clearly Identified...
Ready to Use in
Your Circuit

112 QUALITY COMPONENTS



CERAMIC DISC CAPACITORS

Voltages — 12, 25, 200 and 1000 V.
Capacitance — 5 pF thru 220,000 pF
(.22 μ F)

CERAMIC TUBULAR CAPACITORS

Voltages — 100 V. and 500 V.
Capacitance — 1 pF thru 1000 pF (.01 μ F)

MYLAR FILM CAPACITORS

Voltages — 200, 400, and 600 V.
Capacitance — .01 pF thru .1 μ F

TRIMMER CAPACITORS (Variable)

Ceramic — Plastic — Glass
Ranges to suit your needs

RECTIFIERS and DIODES

Industry's Most
Popular Types

ERIE
TECHNOLOGICAL
PRODUCTS, INC.



Erie, Pennsylvania

FREE 6-PAGE COMPONENTS CATALOG



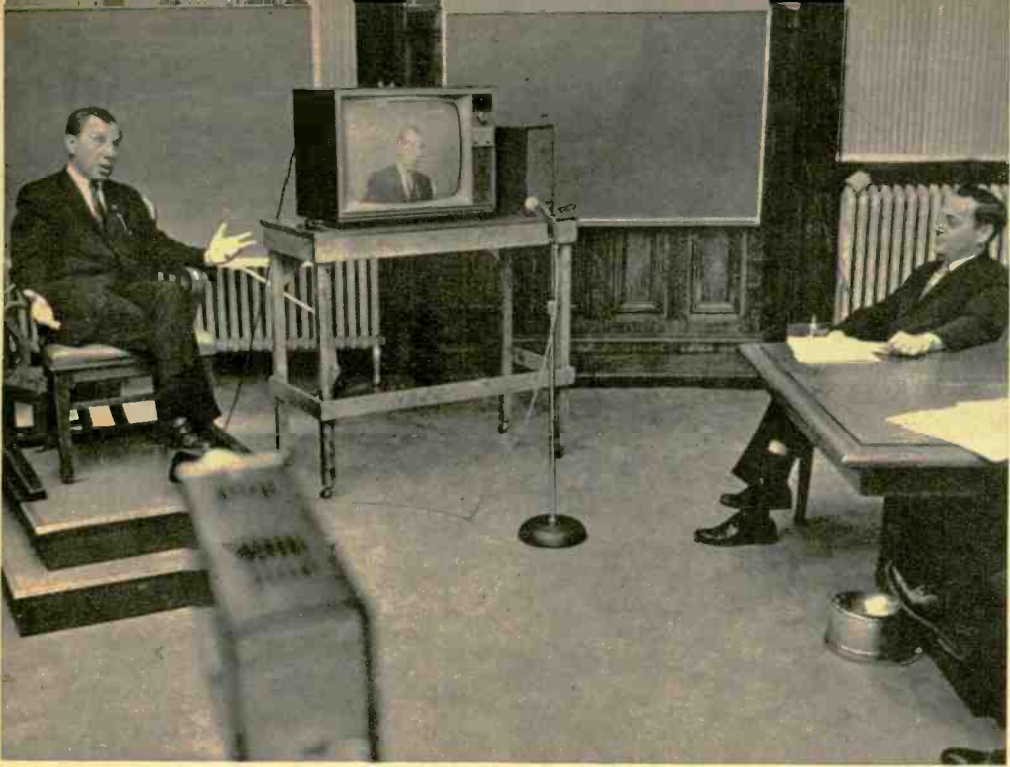
Send To:
ERIE TECHNOLOGICAL PRODUCTS
Distributor Sales Dept. E1-1
644 WEST 12TH STREET, ERIE, PA.

PLEASE SEND ME YOUR FREE CATALOG LISTING ALL 112 COMPONENTS ON THE ERIE ELECTRONIC COMPONENTS STATION.

NAME _____

STREET _____

CITY _____ STATE _____



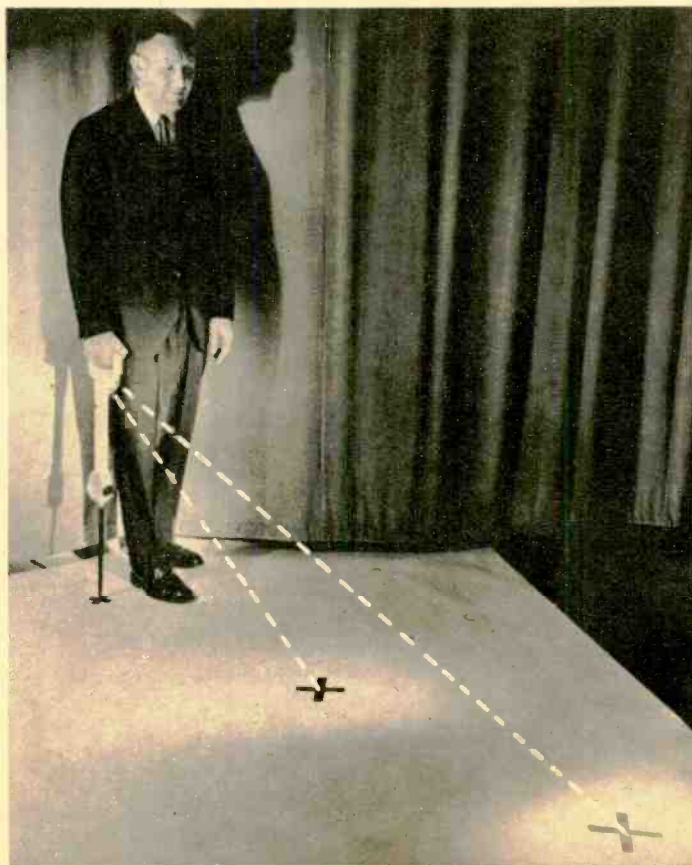
LEGAL EYE. . . No, it's not a new Perry Mason series. This is a real-life courtroom in Akron, Ohio, where court officials are trying out a plan to allow professional men (doctors, for instance) to give their expert testimony in advance of a trial, saving them the delays of court procedure. The closed-circuit TV equipment, set up by Olson Electronics, will be used to make test recording for evaluation by Bar Association and court officials.

Electronics in the News

In Depth. . . The stereopticon is back—but now it's been computerized. Geometric model, stored in the memory unit of this IBM System/360 at Brown University, produces visual display representing the subject from two slightly different viewpoints—one for each eye. The figure can be moved back and forth, up and down or revolved. Buttons control motion, the device in programmer's right hand makes changes in the object being represented.



Hideout. . . Harman-Kardon calls it an environment simulator. (Aw, come on, fellas!) You also could call it a cop-out coop wired for stereo. Or ducted for stereo, since the built-in speakers that provide stereo sound for its environment are located under the chair and horn-coupled to ports at ear level. Level controls and stereo separation (blend) control are located on the chair, fed by a stock H-K compact music system (at the left). It's not the first stereo chair but it's certainly the most enveloping to date. (Price for chair and ottoman is \$995. Music system and its pedestal are extra.)



IR Eye. . . RCA is working on a walking stick that will use low-energy pulsed infrared solid-state lasers to tell the blind what lies ahead. Pulses from the two lasers are diffused by smooth ground and scattered back to photocells in the cane, keyed to the frequencies of the lasers by narrow-band filters. When an obstruction or a hole falls in the path of the laser the photocell no longer picks up the scattered infrared. When this happens, vibrating projections (one for each laser) under user's hand stop moving. Problems caused by obstructions too far to the side or too high to come within narrow laser beams remain to be solved.

EI's 1967 Index EI's 1967 Index

C—Construction Project
 F—Feature Article
 TP—Theory & Practice
 Name following title is author.
 Page number follows the date.

AMATEUR RADIO

Antennas:			
Antenna Switcher, Remote	White	(C)	Nov. ....66
Law: Wanna Bet Your Antenna Is Legal?	Copeland	(TP)	Sept. ....50
Tower Mount, Sloping-Roof	Hertzberg	(C)	Jan. ....102
Award for Hams & SWLs, UN-25	Friedman	(F)	Jan. ....79
Crystal Calibrator, 1-mc	Friedman	(C)	Nov. ....57
FM Hams—The New Breed	Lincoln	(F)	July ....87
Field-Strength Meter, Super-Sensitive	Herman	(C)	Jan. ....60
Ham Radio Habit, How I Kicked the	Rosa	(F)	Sept. ....95
Medicine: Radio's Invisible Doctor	Lo Bello	(F)	July ....93
Mobile: 40 Meters on 2 Wheels	Green, Clare	(F)	Mar. ....118
Oscillator, Gate-Dip	Green, Clare	(C)	May ....31
Propagation: Sunspots, An Expert Looks at the New Look in	Leinwoll	(TP)	May ....116
QSLs, Cute, Quaint, Kook	Pyle	(F)	Mar. ....122
Receivers:			
80 Meters, 3 Transistors for	Green, Charles	(C)	Nov. ....45
160-Meter Ham Station	White	(C)	July ....29
Transmitters:			
40 Meters, I-Bottle			
Xmitter for	White	(C)	Mar. ....100
160-Meter Ham Station	White	(C)	Sept. ....67

AUDIO, STEREO & HI-FI

Mixer, All-Purpose Audio L-L-L-L-LP, An	Toler	(C)	Mar. ....65
Phonograph, Transistorize Your	Morris	(TP)	Nov. ....87
Speakers:			
Twin Fin	Kell	(C)	Sept. ....105
EI-8x	Kolbe	(C)	Jan. ....103
	Kolbe	(C)	Nov. ....91
Tape Recording:			
Monitor Head to Your Recorder, Add a Pocket Tape Recorders, Consumer Report on Tapes Last Longer, How to Make	Glenn	(C)	May ....114
Tape Splicer, Wanted: a Good	McEntee	(F)	July ....71
Test Records: What Do They Really Test?	Angus	(F)	Sept. ....84
VU Meter: The Amazing Rubber Ruler	Friedman	(F)	Mar. ....57
Wattmeter, Direct-Reading Audio	Angus	(F)	Jan. ....87
	Glenn	(TP)	Mar. ....128
	Richards	(C)	Nov. ....80

CITIZENS BAND

Accessories, The Surprising Truth About CB	Friedman	(F)	Mar. ....103
CB Dying, Is?	Simms	(F)	May ....41
CB in Your Car, The Easy Way to Install	Toler	(C)	May ....58

Clubs:			
CB Clubs, The Truth About	Levesque	(F)	May ....71
Emergencies, Setting Up Your CB Club for	Levesque	(F)	Sept. ....38
Control Console, CB Converter, Pocket CB	Buckwalter	(C)	July ....98
	Green, Charles	(C)	Sept. ....47
	Foulkes	(F)	May ....62
DXing for CBers; Legal FCC, Wanna Get in	Karlin	(F)	July ....38
Trouble With the? Field-Strength Meter, Super-Sensitive	Herman	(C)	Jan. ....60
HELP on the Way, Is?	Levesque	(F)	Nov. ....112
Mobile Noise, Stamp Out	Stephens	(C)	May ....68
Mod/Power Meter for CB, In-Line	Friedman	(C)	Nov. ....38
Modulation Scope, Vest-Pocket	Friedman	(C)	May ....49
Oscillator, Gate-Dip	Green, Clare	(C)	May ....31
Output Meter for Solid-State CB Rigs	Mann	(C)	Jan. ....49
Walkie-Talkies:			
Easy Repairs for Walkie-Talkies	Davidson	(TP)	Jan. ....94
Win-Tenna for Walkie-Talkies, The	Blechman	(C)	Mar. ....96

KIT REPORTS

CB Transceiver (Knight-Kit Safari III)		Nov. ....102
Engine Analyzers (Eico 888, Knight-Kit KG-375)		Mar. ....94
FM Receiver, Stereo (Heathkit AR-14)		Jan. ....90
Guitar, Electric (Heath TG-36)		July ....75
and Amplifier (Heath TA-16)		Nov. ....95
Keyer, Electronic (Eico 717)		May ....56
Power Supply, Experimenter's (Viking PZ-121)		May ....89
Speaker System, Bass Reflex (Lafayette Lowboy)		Sept. ....30
Short-Wave Receiver, Budget All-Band (Eico 711)		Sept. ....60
Tape Deck, Stereo (Heath/Magnacord AD-16)		

SERVICING

Audio Wattmeter, Direct-Reading	Richards	(C)	Nov. ....80
Batteries, Char-Analyst for	Mann	(C)	July ....83
Capacitor Checker, Micro	Mangieri	(C)	Sept. ....31
Crystal Calibrator, 1-Megacycle	Friedman	(C)	Nov. ....57
Field-Strength Meter, Super-Sensitive	Herman	(C)	Jan. ....60
Oscillator, Gate-Dip	Green, Clare	(C)	May ....31
Output Meter for Solid-State CB Rigs	Mann	(C)	Jan. ....49
Scope, Primer on the SW Signal Generator, Crystal-Controlled	Buckwalter	(TP)	May ....74
Signal Tracer Built in a Probe	Glenn	(C)	July ....67
TV Traps, Beware of Your Own	Green, Clare	(C)	Mar. ....74
Walkie-Talkies, Easy Repairs for	Margolis	(TP)	Nov. ....103
	Davidson	(TP)	Jan. ....94

SHORT-WAVE LISTENING

Antennas:			
Mini Vertical for SWLs, A	Buckwalter	(C)	Sept. ....92
Wanna Bet Your Antenna is Legal?	Copeland	(F)	Sept. ....50
Award for Hams & SWLs, UN-25		(F)	Jan. ....79
Crystal Calibrator, 1-Megacycle	Friedman	(C)	Nov. ....57
DXing:			
Africa, The Many, Many Voices of	Bower	(F)	Mar. ....115

EI's 1967 Index

EI's 1967 Index

Apollo Signals From the Moon, DX of the Century	Ellington	(F)	July	....25
Apollo, The Latest on DXing		(F)	Nov.	....114
Long-Wave Broadcasting, The Forgotten World of Middle East, How to DX Intrigue in the South Pacific DX Vietnam and Its Neighbors, DXing	Bower & Levins	(F)	Nov.	....96
Propagation: An Expert Looks at the New Look in Sunspots	Bower	(F)	May	....38
QSLs, Cute, Quaint, Kook Radio Americas and the CIA	Bower	(F)	Sept.	....74
Radio Swan Hoaxer, Confessions of a Receivers:	Bower	(F)	Jan.	....92
All-Bander, I-Tube Jet Eavesdropper				
VHFer, Band-Switched				
Short-Wave Schedule, 24-Hour	Leinwoll	(F)	May	....116
Signal Generator, Crystal-Controlled SW	Pyle	(F)	Mar.	....112
	Kneitel	(F)	Sept.	....27
	Kneitel	(F)	May	....98
	Green, David	(C)	Jan.	....65
	Green, Charles	(C)	Mar.	....111
	Green, Charles	(C)	May	....85
		(F)	Mar.	....77
	Glenn	(C)	July	....67

SPECIAL CONSTRUCTION PROJECTS

Antenna, For Super TV Try a Rhombic	Walker		Mar.	....38
Audio Wattmeter, Direct-Reading	Richards		Nov.	....80
Batteries, Char-Analyst for Capacitor Checker, Micro Crystal Calibrator, I-Megacycle	Mann		July	....83
Dimmer, In-A-Socket	Mangleri		Sept.	....31
Field-Strength Meter, Super-Sensitive	Friedman		Nov.	....57
Musical Instruments: Bongos, Electronic Guitar Amp, Go-Go Guitlar Broadcaster, FM Reverb for Guitar, Go-Go Oscillator, Gate-Dip	Mann		May	....27
Output Meter for Solid-State CB Rig	Herman		Jan.	....60
Phone Beeper	Maynard		Mar.	....25
Phonograph, Transistorize Your	Mann		Mar.	....45
SW Signal Generator, Crystal-Controlled	Glenn		Jan.	....38
Signal Tracer Built In a Probe	Saville		Sept.	....56
Teaching Machine, Build Your Own	Green, Clare		May	....31
Telephone Answering Set, Automatic	Mann		Jan.	....49
Tele-Spy, 008	Crowhurst		Nov.	....72
	Kell		Sept.	....105
	Glenn		July	....67
	Green, Clare		Mar.	....74
	Maynard		Nov.	....29
	Blechman		July	....41
	Toler		Jan.	....83

SPECIAL FEATURE ARTICLES

Antennas: No Room at the Top	Salm		July	....102
Automotive: Car Radios Get, How Much Better Can?	Walker		Nov.	....75
Electric Cars, The Secret of the New	Locke		Mar.	....41
Aviation: A Collision-Avoidance System for Planes	Buckwalter		Nov.	....49
Battery: The Low-Down on Those Low-Cost Chargers	Friedman		Jan.	....74

Careers: GI Bill, Q & A About the New	Dillard		Mar.	....92
Medical Electronics for You, A Career in?	Hill		Nov.	....41
Radio Operators Wanted	Surpin		Nov.	....70
Dominoes, Electronic	Carlson		Sept.	....43
Electron Microscope, The Small, Small World of the Ham Radio Habit, How I Kicked the	Busse		Sept.	....102
Hertz, Will Success Spoil Heinrich?	Rosa		Sept.	....95
L-L-L-L-L-LP, An	Cartwright		Mar.	....98
Medicine: Bifemeter, Mosquito-Powered	Morris		Nov.	....87
Quacks, The Shocking Facts About	Levine		Jan.	....110
Electronic	Kaplan		May	....93
Radio's Amazing Medicine Man	Althouse		Mar.	....61
Radio's Invisible Doctor	Lo Bello		July	....93
Military: Amazing Marvels from Ft. Huachuca, The Press Wireless: The Farm of the Shy Giant	Locke		Jan.	....29
Propagation: An Expert Looks at the New Look in Sunspots	Buckwalter		Jan.	....56
Radio Americas and the CIA	Leinwoll		May	....116
Radio Swan Hoaxer, Confessions of a	Kneitel		Sept.	....27
Tape: How to Make Tapes Last Longer	Kneitel		May	....98
Pocket Tape Recorders, Consumer Report on	Angus		Sept.	....84
Tape Splicer, Wanted: a Good	McEntee		July	....71
Test Records Really Test, What Do Those?	Friedman		Mar.	....57
Transistor Radio Scandal, The	Angus		Jan.	....87
TV Splitters, How Good Are?	Gregory		July	....56
	Held		July	....108

THEORY & PRACTICE

ABCs of Color TV: Part I: Fundamentals	Frye		Jan.	....41
Part II: Colorimetry			Mar.	....29
Part III: Color Picture Tube			May	....79
Part IV: Transmitting Color			July	....61
Part V: Color Receiver			Sept.	....77
Antennas: Rhombic Antenna, For Super TV Try a Skyhook, Flying	Walker		Mar.	....38
Wanna Bet Your Antenna Is Legal?			Mar.	....137
Beginner's Corner: The Thermistor	Copeland		Sept.	....50
The Case of the Buried Treasure	Morris		Jan.	....107
Less Noise—More Signal			Mar.	....119
Car Radios Get, How Much Better Can?			May	....107
Electric Cars, The Secret of the New	Walker		Nov.	....75
Scope, Primer on the Teaching Machine, Build Your Own	Locke		Mar.	....41
TV Repair Traps, Beware of Your Own	Buckwalter		May	....74
TV Splitters, How Good Are?	Maynard		Nov.	....29
VU Meter: Amazing Rubber Ruler, The Walkie-Talkies, Easy Repairs for	Margolis		Nov.	....103
	Held		July	....108
	Glenn		Mar.	....128
	Davidson		Jan.	....94

A Real Jewel Among Swiss-made Watches

WORLD FAMOUS

Pilot's Chronograph \$12⁹⁵

COMPLETE WITH 6 DIALS, 5 HANDS AND
2 PUSHBUTTON CONTROLS



- Register Speed
- Measure Distance
- Check Parking Meters
- Time Athletic Contests
- Check Production Figures
- Use As Regular Stop Watch

This is a gem, first made famous by World War II pilots who found it not only an absolutely accurate timepiece, but a piece of equipment more valuable than a boxful of instruments—and it still is. Whether you like to fly, or drive sports cars, record your average speed per mile, or time the number of beers consumed in an hour, this will do the job. All 5 hands are machine-calibrated in Switzerland where the complete works are neatly turned out in two different factories, then assembled in a third. It is shock-resistant, antimagnetic, has an unbreakable mainspring, big sweep second hand, luminous dial and hands, gold-colored die-cast case, and a leather strap. No matter how you look at it, that's a big hunk of watch for only \$12.95 plus 65¢ postage and handling. And it's fully guaranteed for 1 year! In every way, a solid buy!

----- USE MONEY-BACK COUPON TODAY! -----

© C-D, 1966

HAMILTON HOUSE, Dept. 59E-1, Cos Cob, Conn. 06807

Rush me _____ Pilot's Chronograph Watches.
I understand that if I am not completely
satisfied, I can return it for a full refund.
I am enclosing check or m.o. for \$ _____
Each watch is only \$12.95 plus 65¢ postage
and handling.

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Swap Shop

Continued from page 113

HEATH KW Kompact linear, AC power supply. Will swap for Johnson kw matchbox or best offer. Gerald Blakeslee, WB2VUC, 209 Boulevard Ave., Pitman, N.J. 08071.

LAFAYETTE mechanical filter. Want Q-multiplier. Forrest Holland, Rt. 2, Effingham, Ill. 62401.

EICO 720. Want oscilloscope, sweep generator. O. D. Scarbrough, 708 Paulin Ave., Calexico, Calif. 92231.

MISCELLANEOUS equipment. Will trade for pre-1926 radios, parts, literature. Alan Douglas, Box 225, Posasset, Mass. 02559.

HEATH HG-10 VFO. Will swap for Heath Twoer or antenna rotator. Mike Baugh, WA7EKQ, Box 191, Roy, Utah 84067.

TELEVISION service equipment. Will swap for Garrard changer. C. A. Lougee, 38 Main St., Frances-town, N.H. 03043.

SUPRO Guitar amplifier. Will swap for quality microphone or best offer. G. Horton, 1403 15th Ave. SE, Decatur, Ala. 35601.

MARINE RADIOTELEPHONE. Will exchange for CB, ham or other electronic gear. Les Zoltan, 4097 MacKenzie St., Montreal 26, Que., Canada.

KNIGHT YTVM. Will swap for SW receiver. John W. Rater, Fontanello, Iowa 50846.

HY-GAIN 18-v vertical antenna. Swap for low-pass filter, 52 ohm. Martin A. Perry, K9HVS, 3 Indiana Ave., Danville, Ill. 61832.

HEATH IT-10 transistor/diode tester. Will swap for Knight LC-1 code oscillator or similar. Mike Wierzbowski, 31 Francis St., Cheektowaga, N.Y. 14212.

TESLA COIL, 10,000-V RF output. Will swap for Knight Star Roamer, Heath GR-64 or Heath Sixer. Mark Gutekunst, WA3HMW, 27 Rorer Ave., Hatboro, Pa. 19040.

HOME-BREW 35-watt guitar amplifier. Make swap offer. Larry Finley, WB60FR, 197 Cherry Ave., Porterville, Calif. 93257.

METAL LOCATOR, transistorized. Will swap for tape recorder or best offer. Terry Ensminger, 444 Belknap Pl., Keokuk, Iowa 52632.

ASSORTED TUBES. Will swap for 7199, 6AK6 6U8 tubes or best offer. Gordo Stewart, 346 Old Willets Path, Smithtown, N.Y. 11787.

INDUSTRIAL relays, mountings. Will swap for Sony 900A tape recorder or best offer. James Williams III, RD 1, Spring Grove, Pa. 17362.

HEATH HD-11 Q-multiplier. Will swap for record changer. Rick Gregory, 712 Suffolk Dr., Owensboro, Ky. 42301.

EICO 324 signal generator. Make swap offer. Tadd Bueb, 126 Navarra Dr., Santa Cruz, Calif. 95060.

Electronic Voicing

Continued from page 40

halves its frequency (octave lower).

As we did not have a service manual for the Multi-Vider, we were unable to analyze its circuit. We would venture a guess that the principle of operation is similar. To produce the octave above the note being played, there would be a filter circuit whose harmonic output (an octave above) is also fed to the amplifier.

The waveshape of the higher or lower tones is not the same as the waveshape produced by the instrument. On the third page of this article we have oscillograph photos which show waveforms produced by the instruments alone and the synthesized tones.

SPECIAL FOR GIVING!

The original wedge-type screwdriver

QUICK-WEDGE

The Indispensable
SCREW-HOLDING SCREWDRIVER

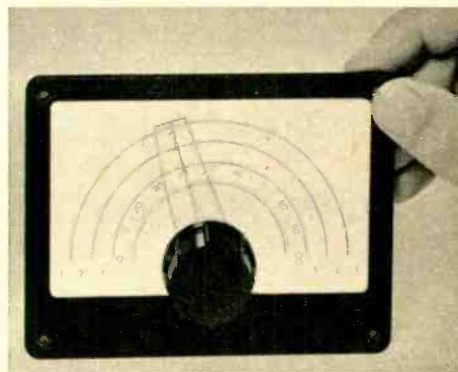
Delight your craftsman with this boxed, matched set of 4 basic sizes to fit most screws.

FREE! Aluminum Rack

At your dealer or order direct. Cash with order saves C.O.D. and postage costs.

Unconditionally guaranteed.

KEDMAN COMPANY, P.O. Box 267, Salt Lake City, Utah 84110



Low Cost 6:1/36:1 Vernier Dial

Model MD-4 vernier dial permits fast tuning at 6 to 1 ratio over entire dial range with fine tuning at 36 to 1 ratio over any 6-division portion of the scale. Dial has 4 scales; measures 4 1/2" W x 3 3/4" H; escutcheon extends only 1/8" in front of panel; net price \$7.50.



J. W. MILLER CO.

5917 So. Main St., Los Angeles, Calif. 90003
AVAILABLE NATIONWIDE FROM
DISTRIBUTORS AND MAIL ORDER HOUSES

ELECTRONICS ILLUSTRATED

Classified Ads

Your advertisement can reach this mail-buying audience for only 50¢ per word . . . payable in advance (Check or M.O. please) . . . minimum 10 words. Closing dates are the 20th of 4th preceding month i.e. copy for the May issue must be in our office by January 20th. Mail to ELECTRONICS ILLUSTRATED, 67 West 44th St., New York 36, N. Y. Word count: Zipcode number free. Figure one word: Name of state (New Jersey), name of city (New York); sets of characters as in key (14-D); also abbreviations as 35MM, 8x10, D.C., A.C.

SAVE MONEY • ORDER BY MAIL

• • • FOR SALE

STOP THROWING Away Money On Transistors! Fabulous new book reveals how to use nickel-and-dime transistors in over 100 interesting projects. Explains amazingly simple methods for testing and identifying unmarked transistors. You get plans for ingenious breadboard to make building a breeze. Extra: Huge reference section gives inside story on over 3000 transistor types. You must save \$\$\$ with this 132-page goldmine of information or money cheerfully refunded. To prove it, we'll send one valuable transistor Free (yours to keep) if you order now. Rush \$3.00 to Capstone, 9 Danbury Rd., Wilton, Conn. 06897. Ask for "How to Use Bargain Transistors E-117." You'll be delighted.

MAGNETS. ALL Types. Specials—20 disc magnets, or 2 stick magnets, or 8 assorted magnets, or 10 small bar magnets, \$1.00. Maryland Magnet Company, 5412-F Gist, Baltimore, Maryland 21215.

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-A19, Box 10839, Houston, Texas 77018.

CONVERT ANY television to sensitive, big-screen oscilloscope. Only minor changes required. No electronic experience necessary. Illustrated plans, \$2.00. Relco A-19, Box 10563, Houston, Texas 77018.

POLYSTYRENE CAPACITORS airmailed to buyers. 5-5000 pF US\$25, 5001-10000pF US\$35 per thousand. 33-630VDC. Quantity discounts to distributors and factories. Free samples upon request. Astron Electronic Manufacturing, P.O. Box 5170, Kowloon, Hong Kong.

CANADIANS—GIANT Surplus Bargain Packed Catalogs. Electronics, Hi-Fi Shortwave Amateur Citizens Radio. Rush \$1.00 (Refunded). ETCO, Dept. E1, Box 741, Montreal.

MOS ICS, Jfets, Mosfets—Mos Nand, Nor gates \$1.00, P Mosfet 75¢, N Jfet 75¢, P Jfet 50¢. Minimum order \$3.50. Fet Fl, Box 593, Cupertino, Calif. 95012.

• • • GOVERNMENT SURPLUS

GOVERNMENT SURPLUS. How and Where to Buy in Your Area. Send \$1.00. E.I. Surplus Information, Headquarters Bldg., Washington 6, D. C.

• • • PRINTING, MULTIGRAPHING, MIMEOGRAPHING

BUSINESS STAMP Printer. To four lines. Self-inking case. Send \$1.00. Ames, 100-E South Main, Eureka, Kansas 67045.

• • • BUSINESS OPPORTUNITIES

INVESTIGATE ACCIDENTS: Earn \$750 to \$1,000 and more a month in your own business. Work spare time with average earnings of \$5 to \$8 per hour. No selling. Send for free booklet. No obligation. No salesman will call. Universal Schools, CEE-2, 6801 Hillcrest, Dallas, Texas 75205.

MAKE THOUSANDS Yearly sparetime, with home Mailorder Business using tested, proven plan! Complete details Free! Service Products, P. O. Box 17276-D, San Diego, Calif. 92117.

VENDING MACHINES—No selling. Operate a route of coin machines and earn high profits. 32-page catalog free! Parkway Machine Corp., 715E1 Ensor St., Baltimore 2, Md.

• • • EMPLOYMENT OPPORTUNITIES

GUARANTEED EMPLOYMENT Opportunities. Men, Women, Students, Teachers. Foreign, U.S.A. Fulltime and Summer jobs. All occupations and trades. Send \$3.00 (Refundable) for Application Forms and Compendium. World Continental Employment, P.O. Box 475, Dept. 40-2, Lodi, California 95240.

PRINTING — ADVERTISING Salesmen. Excellent moneymaking sideline selling Decalcomania Name Plates. Advertising Specialties. Sign Letters, Automobile initials. Free Samples. Ralco-EI, Box L, Boston, Mass. 02119.

• • • EDUCATION & INSTRUCTION

HIGHLY EFFECTIVE Home Study Course in Electronics Engineering Mathematics With Circuit Applications. Earn Your Associate in Science Degree. Free Literature. Cook's Institute of Electronics Engineering, P. O. Box 36185, Houston, Texas 77036. (Established 1945)

ASSOCIATE DEGREE in Electronics, earned half by correspondence and half in residence. Free catalog. Grantham Electronics Institute, 1505 N. Western Ave., Hollywood, Calif. 90027.

TOP PAYING Jobs—Guidance Manual \$1. Canadian Institute of Science & Technology, 263F Adelaide St. W., Toronto.

• • • BUILD IT-DO IT YOURSELF

HOBBYISTS, EXPERIMENTERS, Amateur Scientists, Students . . . Construction Plans—All complete including drawings, schematics, parts lists, prices, parts sources . . . Laser—Build your own coherent-light optical laser. Operates in the pulsed mode, in the visible light range—\$6.00 . . . Diode Laser—Invisible light (infrared) can be continuously modulated—\$3.00 . . . Reverberator (Echo) Unit—Build your own. Use with your automobile radio, home radio or hifi, electric guitar, etc.—\$3.00 . . . Radar—Build your own ultrasonic doppler radar. Detect motion of people, automobiles, even falling rain drops. Transistorized, uses standard small 9-volt battery—\$4.00 . . . Long-Range "Sound Telescope"—This amazing device can enable you to hear conversations, birds and animals, other sounds hundreds of feet away. Very directional. Transistorized. Uses 9V battery—\$3.00 . . . Or send 25¢ coin or stamps for complete catalog . . . Technical Writers Group, Box 5501, State College Station, Raleigh, N. C. 27607.

PORTABLE ORGAN Builders Manual \$3. Reverb \$2. Other projects. Free folder. Solotron, 29641 Gilchrist, Farmington, Mich. 48024.

• • • **TAPE RECORDERS**

RADIO YESTERYEAR. Complete broadcasts of all the old favorites. One hour sample tape \$5, catalogue \$1 (refundable), sample page 10¢. G. Charmer, Box Eleven, Highbridge Station, Bronx New York 10452.

RENT STEREO Tapes—over 2500 different—all major labels—free brochure. Stereo-Parti, 1616-AY Terrace Way, Santa Rosa, California.

LEARN WHILE Asleep with your recorder, phonograph or amazing new "Electronic Educator" endless tape recorder. Details free. Sleep-Learning Research Association, Box 24-El, Olympia, Washington.

• • • **RADIO & TV**

POLICE RADIO. Hear all police calls, fire departments, Sheriffs, taxis, ambulances, Highway Patrol. New 5 band portable radio and direction finder. Free booklet. NovaTech, Dept. 233, Redondo Beach, Calif. 90278.

"**DISTANCE CRYSTAL Set Construction**" Handbook—50¢. 10 Crystal plans—25¢. Catalog. Laboratories, 12041-K Sheridan, Garden Grove, Calif. 92640.

"**AMATEUR RADIO: Its Effect On Society.**" Masters research paper \$2.00. Gauthier, Box 216, Lynwood, Calif. 90262.

RADIO & T.V. Tubes—33¢. Free List. Cornell 4213-15 University, San Diego, Calif. 92105.

POLICE—FIRE—Aircraft—Marine—Amateur Calls on your broadcast radio with Tunaverter! Tune The Band! Economical! Guaranteed! Salch Company, Woodboro El, Texas 78393.

TV TUNERS rebuilt and aligned per manufacturers specification. Only \$9.50. Any make UHF or VHF. We ship COD. Ninety day written guarantee. Ship complete with tubes or write for free mailing kit and dealer brochure. JW Electronics, Box 51K, Bloomington, Indiana.

FREE CATALOG. Electronic parts, tubes. Wholesale. Thousands of items. Unbeatable prices. Arcturus Electronics EL, 502-22 St., Union City, N. J. 07087.

FREE! GIANT bargain catalog on transistors, diodes, rectifiers, SCR's, zeners, parts. Poly Paks, P. O. Box 942El, Lynnfield, Mass.

• • • **INVENTIONS & INVENTORS**

PATENT SEARCHES including maximum speed, full airmail report and closest patent copies \$6.00. Quality searches expertly administered with complete secrecy guaranteed. Free Invention Protection forms and "Patent Information." Write Washington Patent Search Bureau, Dept. 20, 711 14th St. N.W., Washington 5, D. C.

INVENTORS! HIGHEST cash sale or royalties for your inventions. Patented-Unpatented. Urgent demand from our client manufacturers. Financial Assistance available. Write Dept. 45, United Invention Brokerage, 78 Wall Street, New York 5, N. Y.

INVENTORS! WE will develop, sell your idea or invention, patented or unpatented. Our national manufacturer-clients are urgently seeking new items for highest outright cash sale or royalties. Financial assistance available. 10 years proven performance. For Free information write Dept. 59, Wall Street Invention Brokerage, 79 Wall Street, New York 5, N. Y.

• • • **ROCKETS**

ROCKETS: IDEAL for miniature transmitter tests. New illustrated catalog 25¢. Single and multistage kits, cones, engines, launchers, trackers, rocket aerial cameras, technical information, etc. Fast service. Estes Industries, Penrose 13, Colorado 81240.

• • • **PERSONAL**

SELF-HYPNOSIS FOR self-improvement many ways. Safe, effective. Tape or record. Free literature. McKinley, Dept. T-10, Box 3038, San Bernardino, California 92404.

• • • **MISCELLANEOUS**

BEERS, PEACH Brandy, Wines—Strongest Formulas, \$2.25. (complete brew supplies hydrometers catalog included)—Research Enterprises, 29-B5 Samoset, Woburn, Mass.

TREASURE, GOLD, Silver, Relics. New 1967 detectors now available. Free information. Rayscope, Dept. 1-L, Box 715, North Hollywood, California 91603.

FOR SPEEDY SERVICE

1102171 647 98 24 0664
T M BROWN
5936 23rd PARKWAY
WASHINGTON, D. C. 20031

WE'RE LOST WITHOUT THIS LABEL

Well, not really lost—but we can do things faster for you if you send along the **ADDRESS LABEL** from your magazine any time you write to us about your subscription.

CHANGE OF ADDRESS

If you're moving, please let us know six weeks before changing your address. Better still, attach the magazine address label to this form, and print your new address here.

name _____
street _____
city _____ state _____ zip _____

attach label here

ELECTRONICS ILLUSTRATED Sub. Dept., Greenwich, Conn. 06830



NEW MOSLEY NOVICE

A completely Do-it-Yourself beam for 15 meters. Priced to fit your budget. X-15 rated for Full Power (Novice or General). Readjust for 10 meters, if desired, when you become a General.

Please send **FREE** info. on X-15 Beam.

Name _____

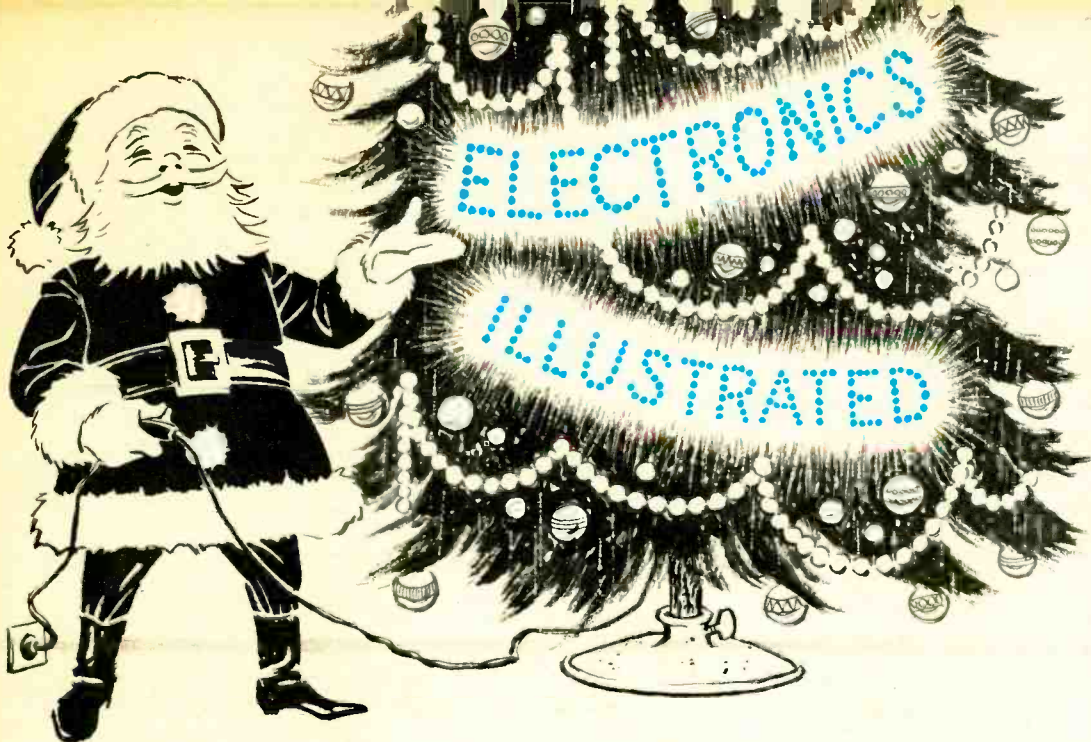
Address _____

City/State _____

Zip Code No. _____

Mosley Electronics, Inc. # 121

4610 N. Lindbergh Blvd. Bridgeton Mo. 63042



BRIGHTEST GIFT IDEA THIS CHRISTMAS!

Special Low Gift Rates Now In Effect

ELECTRONICS ILLUSTRATED is the brightest idea of the year for your Christmas gift list. The magazine is packed with ideas for every electronic hobbyist — all year long! Your buddies will *use* issue after fascinating issue. They'll find valuable how-to information and expert analyses of theory and practice *plus* special regular features like the Electronic Swap Shop and Electronic Marketplace shopping guides. Be they hams, Cbers, SWLs, hi-fi buffs or experimenters, they'll be delighted with a year of EI — and they'll appreciate your thoughtfulness, too! We'll send an attractive card, signed in your name, announcing your gift. And here's another bright idea: now you can enter *your own* subscription to EI at these special low rates. Just fill in and mail the attached Christmas Gift Order Card, *today!*

Special Christmas Gift Rates

ONLY \$2.50 each for two or more
1-year subscriptions

Single 1-year subscription	\$3.00
Single 2-year subscription	\$4.50
Two or more 2-year subscriptions	\$4.00

(ea.)

In U. S., possessions & Canada



MERRY CHRISTMAS!

ELECTRONICS ILLUSTRATED

Fawcett Building
Greenwich, Conn. 06830

Electronics Illustrated

NTS project method:

The sure, simple way to a high-paying, solid career in electronics.

Project-Method training from National Technical Schools: For the man who wants to *move up* fast. It's the sure way to a career that *pays big*. Project-Method builds everything you need to know around practical kit experiments. It's faster, easier to learn. It not only teaches you the *how* and *why*

of electronics, you get actual experience using the same equipment you work with on the job. And, NTS sends you this equipment at *no extra cost*. That's the Project-Method. NTS produces the kind of trained men that industry wants and will pay for.

ALL NEW KITS! ALL NEW COURSES!

More big kits than ever offered for training anywhere! A big 25" Color TV, a desk-top computer, solid-state radios. Now for the first time Training kits with integrated circuits. New test equipment, too, including Signal generator, VTVM, and tube checker. They're all you need to begin troubleshooting work. NTS shows you how to use them early in your training. You earn money repairing TV sets and electronic equipment even before you've completed the course. Brand new color catalog describes in detail all the exciting equipment that comes with each course.



GET THE FULL STORY! SEE ALL THE EXCITING NEW KITS YOU CAN GET FROM NTS!
CUT OUT AND MAIL REPLY CARD FOR NEW COLOR CATALOG AND SAMPLE LESSON!

You enroll by mail, we have no salesmen. That means lower tuition for you!

CLASSROOM TRAINING AT LOS ANGELES:

You can train at our resident school in Los Angeles. NTS occupies a city block with over a million dollars in facilities devoted to technical training. Check special box in coupon.

HIGH SCHOOL AT HOME:

NTS offers accredited high school programs. Take only the subjects you need. Study at your own pace. Everything included at one low tuition. Check special box in coupon for free catalog.



Accredited Member,
National Home Study Council
Accredited Member,
National Association of Trade
and Technical Schools

NATIONAL TECHNICAL SCHOOLS

World Wide Training Since 1905
4000 S. Figueroa Street
Los Angeles, California 90037

APPROVED FOR VETERANS

ACT NOW! **9** TRAINING PROGRAMS TO INSURE YOUR FUTURE
DON'T DELAY!

Please rush new Color Catalog and Sample Lesson plus information on course checked below. No obligation. No salesman will call.

- | | |
|---|--|
| <input type="checkbox"/> MASTER COURSE IN COLOR TV SERVICING | <input type="checkbox"/> FCC LICENSE COURSE |
| <input type="checkbox"/> COLOR TV SERVICING | <input type="checkbox"/> INDUSTRIAL & COMPUTER ELECTRONICS |
| <input type="checkbox"/> MASTER COURSE IN TV & RADIO SERVICING | <input type="checkbox"/> STEREO, HI FI & SOUND SYSTEMS |
| <input type="checkbox"/> PRACTICAL TV & RADIO SERVICING | <input type="checkbox"/> BASIC ELECTRONICS |
| <input type="checkbox"/> MASTER COURSE IN ELECTRONIC COMMUNICATIONS | <input type="checkbox"/> High School at Home |

Dept. 213-127

Name _____ Age _____
Address _____
City _____ State _____

Please fill in Zip Code for fast service

- Check if interested in Veteran Training under new G.I. Bill
- Check here if interested ONLY in Classroom training in Los Angeles



Now, you may earn
double-time pay
without working
over-time.



National Technical Schools makes it easier to *double* your income. All you need is your own ambition. The *NTS Project Method* simplifies your training... makes it easy for you to enter Electronics... a whole new world of opportunity.

YOU can have a solid career and probably *double* your present earnings. Start moving *up* today. In Color TV. Or in computer and industrial electronics. Or in communications and aerospace. It's easier than you think.

NTS will show you how!

(see inside cover for more information)

NATIONAL



SCHOOLS

World Wide Training Since 1905
4000 So. Figueroa St., Los Angeles, Calif. 90037

APPROVED FOR VETERANS

Accredited Member,
National Home Study Council
Accredited Member,
National Association of Trade
and Technical Schools



FIRST CLASS
Permit No. 3087
Los Angeles,
Calif.

VIA AIR MAIL



BUSINESS REPLY MAIL

No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY

NATIONAL  **SCHOOLS**

4000 South Figueroa Street
Los Angeles, California 90037