CAN ELECTRONICS PICK YOUR MATE?

POPULAR ELECTRONICS

MARCH 1965

50 CENTS

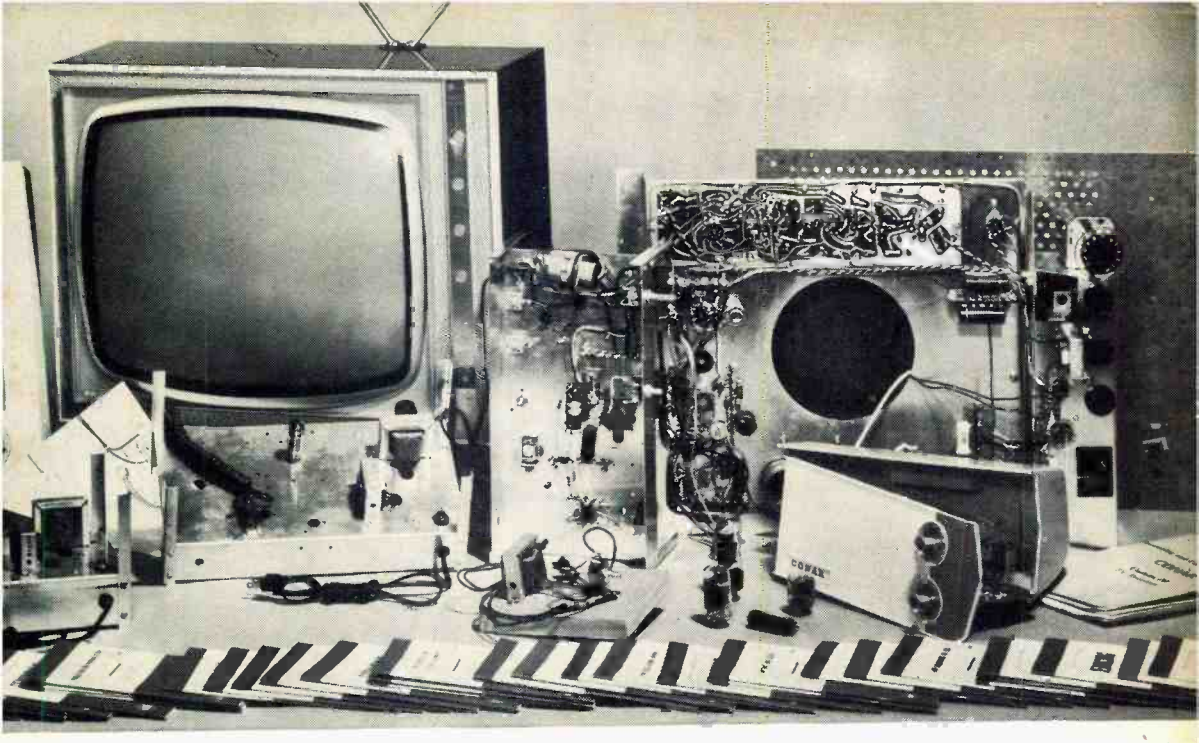
HOBBYIST HARVEST
Experimenters' Kits and Modules
(see page 41)

BUILD A REFLEXOMETER—
See Who's Fast on the Draw

PUT AN AIR BRAKE ON YOUR WOOFER

ETCH YOUR CIRCUITS LIKE A PROFESSIONAL

Breakthrough or Fraud?
SARASOTA "PLASMONICS" MYSTERY



:OMPARE. You'll find—as have tens of thousands f NRI graduates—that NRI training gives you more alue. From the delivery of your first lessons in the emarkable NRI Achievement Kit we send you on nrolling, to "bite size" easily-read texts carefully pro-rammed with custom-designed training kits . . . NRI an't be beat. Text for text, kit for kit, dollar for dollar our best home-study buy is unquestionably NRI. nd NRI training costs you less than one semester's ition at most colleges.)

New Achievement Kit Starts You Fast

The day we receive your enrollment application we nail out your new NRI Achievement Kit. This attrac-ive starter kit is an outstanding, logical way to help ou get an easier, faster start in the training of your hoice. It is the first of a number of special training ids developed in the NRI laboratories to make your adventure into Electronics exciting, meaningful. What's in it? Your first group of lesson texts; a rich, vinyl desk folder to hold your material; the industry's most complete Radio-TV Electronics Dictionary; valuable reference texts; lesson answer sheets; envelopes; pen-cils; pen; engineer's ruler; even postage. No other school has anything like it.

Build, Discover with NRI Equipment

Electronics comes alive with NRI training kits. What better way to learn than by *doing?* NRI pioneered and perfected the "home lab" technique of training at home in spare time. You get your hands on actual parts to build, experiment, explore, discover. NRI in-vites comparison with training equipment offered by any other school. Begin *now* this exciting program of practical learning. Whatever your need . . . what-ever your education . . . there's an NRI instruction plan for you, at low tuition rates. Get all the facts. Fill in and mail the postage-free card today. NA-TIONAL RADIO INSTITUTE, Electronics Division, Washington, D. C. 20016

NOW 10 WAYS to Train at Home with the Leader

1. TELEVISION-RADIO SERVICING—Learn to fix black-and-white and color sets, AM-FM radios, stereo hi-fi, etc. A profitable field for part or full-time busi-ness of your own.

2. COMPLETE COMMUNICATIONS*—Teaches and gives actual practice in operation, service, maintenance of AM, FM, and TV broadcasting stations. Also covers marine, aviation, mobile radio, facsimile, microwave, radar.

3. INDUSTRIAL-MILITARY ELEC-TRONICS—From basic principles to computers. A comprehensive training plan that starts with fundamentals, then covers servos, telemetry, multiplexing, phase circuitry, other subjects.

4. FCC LICENSE*—Specifically design-ed to prepare you for First Class FCC Radiotelephone License exams. You begin with Electronic fundamentals, ad-vance to required subjects covering equip-ment, procedures.

5. MATH FOR ELECTRONICS—A brief course for engineers and technicians who need a quick review of math used in industry, communications, government jobs. Short-cut formulas, digital number systems, much more.

6. BASIC ELECTRONICS — Concise course in modern Electronic terminology and components. Practical, useful in-formation to help you understand the field, give you some technical knowledge of Radio-TV, Electronics.

7. AVIATION COMMUNICATIONS*—Prepares you to install, maintain, serv-ice aircraft equipment like direction finders, ranges, markers, Loran, Shoran, Radar, landing systems. Prepares you for FCC License exams.

8. MOBILE COMMUNICATIONS*—Learn to install, maintain mobile equip-ment and associated base stations. Covers transmitters and receivers used by police, fire departments, taxi companies, etc. Prepares for FCC exams.

9. MARINE COMMUNICATIONS*—Covers transmitters, direction finders, depth indicators, Radar, Sonar, other equipment used on commercial ships and pleasure boats. Prepares you for FCC License exams.

10. ELECTRONICS FOR AUTO-MATION—Not for beginners, but for men with some fundamental knowledge of Electronics who want an understand-ing of Automation. Process control, ultrasonics, telemetering and remote control, etc.

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

All this is yours, from Achievement Kit to TV Set, when you enroll for NRI's Radio-TV Servicing Course. Courses in Industrial Electronics and Communications are equally complete. But NRI training is more than kits and texts. It's many personal services, too. Mail postage-free card.

CHECK AND MAIL THIS POSTAGE-FREE CARD

nri

NATIONAL RADIO INSTITUTE
Washington, D. C. 20016

1-036

Please send me your catalog. I have checked the field(s) of most interest to me. (No salesman will call.) Please PRINT.

- ☐ TV-Radio Servicing
- ☐ Basic Electronics
- ☐ Industrial Electronics
- ☐ Electronics for Automation
- ☐ Complete Communications
- ☐ Aviation Communications
- ☐ FCC License
- ☐ Marine Communications
- ☐ Math for Electronics
- ☐ Mobile Communications

Name_____ Age____

Address_____

City_____ State____ Zip Code____

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

ACCREDITED SCHOOL NHSC NATIONAL HOME STUDY COUNCIL

You get more for your money from NRI—

America's oldest, largest Electronic, Radio-TV home-study school

MAIL POSTAGE-FREE CARD

FIRST CLASS
PERMIT
NO. 20-R
Washington, D.C.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY

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

FREE: RADIO SHACK SOLID STATE ELECTRONIC PROJECT BOOK

With Purchases of $4.95 or More.

SOLID-STATE MODULES

- (A) **Wireless Phono Oscillator Module:** designed to play your phonograph directly through a radio without connecting wires. **27-257** **4.95**
- (B) **Intercom Amplifier Module:** custom-build a modern, convenient intercom system for your home or office. **27-254** **4.95**
- (C) **"Baby-Sitter" Amplifier Module:** gives real peace of mind; even lets you monitor sound of baby's breathing. **27-256** **4.95**
- (D) **Phonograph Amplifier Module:** designed for use with crystal or ceramic cartridge. 2 watts peak power. **27-261** **4.95**
- (E) **Telephone Amplifier Module:** permits "group-listening" to a phone conversation; talk with hands free. **27-260** **4.95**
- (F) **Super High-Gain Amplifier Module:** for use as a hearing aid, audio signal tracer, "eavesdropper", etc. **27-251** **4.95**
- (G) **Power Amplifier Module:** the ideal amplifier to use with tuners, microphones, paging systems, or as signal tracer. **27-253** **4.95**
- (H) **Guitar Amplifier Module:** can be used with guitars or any stringed instrument. 2 watts peak power. **27-255** **4.95**

AC Power Supply Module: converts 115 VAC to 6 VAC, 1 amp. Use with rectifier-electronic filter (below). **27-258** **1.95**

Rectifier-Electronic Filter Module: provides dual DC output from AC power supply. 6 VDC; 24V max., 1 amp. **27-259** **3.95**

Optional Accessories for Modules Above

Cat. No.	Description	Key Letters	Each
27-1430	Loopstick Antenna	A	.59
23-465	"C" Cells (4 required)	A	.14
27-1437	Battery Holder (2 required)	A	.25
23-006	6V Lantern Battery	B, C, D, E, G, H	1.05
27-258	AC Power Supply	B, C, D, E, G, H	1.95
27-259	Rectifier-Electronic Filter	B, C, D, E, G, H	3.95
40-1203	4" Speakers (2 required)	B	1.99
27-1384	4PDT Switch	B	.49
27-066	500Ω Control w/Switch	B	.79
40-219	8" Extension Speaker	C	8.95
27-1264	100-Ft. Speaker Wire	C	2.39
33-100	Lapel Microphone	C, F	1.89
27-212	500K Control w/Switch	D, E, F, H	.79
40-1213	8" Speaker	D, E, G, F	3.99
44-533	Telephone Pickup	E	.99
33-180	Headphone	F	1.98
23-468	Penlight Batteries (2 required)	F	.10
27-1433	Battery Holder	F	.22
33-918	Dynamic Microphone	G	8.95
33-115	Contact Type Microphone	H	1.49

NOW THERE ARE 76 RADIO SHACKS COAST TO COAST!

ARIZONA
Phoenix: 3905 East Thomas Rd.

CALIFORNIA
Anaheim: 507 East Katella Ave.
Bakersfield: 1308 19th St.
La Habra: 1511 West Whittier Blvd.
Long Beach: 3976 Atlantic Ave.
Los Angeles:
Downey: Stonewood Shop. Ctr.
Ladera Shop. Ctr. 5305 Centinela Ave.
Mission Hills: 10919 Sepulveda Blvd.
Reseda: 19389 Victory at Tampa
Torrance: 22519 Hawthorne Blvd.
West Covina: 2516 East Workman Ave.
West L. A.: Pico Blvd. at Overland
Oakland (San Leandro): Bay Fair Shop. Ctr.
Sacramento: 600 Fulton Ave.
San Diego (La Mesa): Grossmont Shop. Ctr.
Santa Ana: Bristol Plaza Shop. Ctr.

COLORADO
Denver: 798 South Santa Fe

CONNECTICUT
Hamden: Hamden Mart. Shop. Ctr.
Manchester: Manchester Shop. Parkade
New Haven: 92 York St.
New London: New London Shop. Ctr.
Stamford: 29 High Ridge Rd.
West Hartford: 39 So. Main St.

ILLINOIS
Chicago: Evergreen Plaza at 95th St.

MAINE
Portland: Pine Tree Shop. Ctr.

MARYLAND
Langley Park: Hampshire-Langley Shop. Ctr.

MASSACHUSETTS
Boston:
167 Washington St.
594 Washington St.
110 Federal St.
Braintree: South Shore Plaza
Brockton: Westgate Mall
Brookline: 730 Commonwealth Ave.
Cambridge: Fresh Pond Shop. Ctr.
Framingham: Shoppers' World
Lowell: Central Shop. Plaza
Saugus: N. E. Shop. Ctr.
Springfield: 1182 Main St.
West Springfield: Century Shop. Ctr.
Worcester: Lincoln Plaza

MINNESOTA
St. Paul: 473 North Snelling

MISSOURI
St. Louis: 1125 Pine St. (Walter Ashe Div.)

NEW HAMPSHIRE
Manchester: 1247 Elm St.

NEW MEXICO
Albuquerque: 6315 Lomas, N. E.

NEW YORK
Binghamton (Vestal): Vestal Shop. Plaza
Buffalo (Clarence): Transitown Shop. Ctr.
New York: 1128 Ave. of the Americas
Schenectady (Rotterdam): Shopporama Ctr.
Syracuse: 3057 Erie Blvd. East

OHIO
Cincinnati: 852 Swifton Ctr.

OKLAHOMA
Oklahoma City: Mayfair Shop. Ctr.
Tulsa: 2730 South Harvard

OREGON
Portland: 1928 N. E. 42nd St.

PENNSYLVANIA
Philadelphia:
2327G Cottman Ave., Roosevelt Mall
1128 Walnut St.

RHODE ISLAND
Cranston: 1301 Reservoir Ave.
East Providence: Shoppers' Town

TEXAS
Abilene: 2910 North First St.
Arlington: Collins at Park Row
Brownsville: 847 S. E. Elizabeth St.
Dallas:
1601 Main St.
Medallion Center
125 Wynnewood Village
Plymouth Park Shop. Ctr.
Fort Worth:
1515 So. University Dr.
900 East Berry St.
3524 Denton Highway
2615 West 7th St.
Houston:
8458 Gulf Freeway
322 Northline Mall
Bellaire: 4759 Bissonnet
San Antonio: 150 Wonderland Shop. Ctr.
Sherman: 1620 Highway 75 North
Waco: 1016 Austin Ave.

VIRGINIA
Arlington: Washington-Lee Shop. Ctr.

WASHINGTON
Seattle:
2028 Third Ave.
837 N. E. 110th St.

MAIL TODAY to NEAREST RADIO SHACK STORE

☐ *Please send FREE 1966 Radio Shack Catalog!* PE-3-66

Please send me the modules and accessories I have listed below. ☐ My order totals $4.95, so include my FREE copy of your $2.00 Solid-State Electronic Project book. I enclose $_____, which includes 50¢ to cover postage and handling anywhere in the U.S.A.

Name (please print)_____

Street_____

City_____ State_____ Zip_____

CIRCLE NO. 28 ON READER SERVICE PAGE

POPULAR ELECTRONICS

POPULAR ELECTRONICS is indexed in the Readers' Guide to Periodical Literature
This month's cover photo by Bruce Pendleton

VOLUME 24 MARCH, 1966 NUMBER 3

Special Feature

Electronic Construction

Communications

Other Features and New Developments

Departments

POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company at 307 North Michigan Avenue, Chicago, Illinois 60601. March, 1966. Volume 24. Number 3. (Ziff-Davis also publishes Skiing, Flying, Business/Commercial Aviation, Popular Boating, Car and Driver, Popular Photography, Hi-Fi Stereo Review, Electronics World, Modern Bride, Skiing Trade News and Skiing Area News.) One year subscription rate for U.S., U.S. Possessions and Canada, $4.00; all other Foreign, $5.00. (Schedule for payment in foreign currencies may be found elsewhere in this issue.) Second Class postage paid at Chicago, Illinois, and at additional mailing offices. Authorized as second class mail by the Post Office Department, Ottawa, Canada, and for payment of postage in cash.

SUBSCRIPTION SERVICE: All subscription correspondence should be addressed to POPULAR ELECTRONICS, Circulation Department, Portland Place, Boulder, Colorado 80311. Please allow at least six weeks for change of address. Include your old address as well as new—enclosing if possible an address label from a recent issue.
EDITORIAL CONTRIBUTIONS must be accompanied by return postage and will be handled with reasonable care; however, publisher assumes no responsibility for return or safety of art work, photographs or manuscripts.

Faulty, fragile, filament failures.

Phooey.

Yes, phooey to filament failures and costly tube replacements. CB radios should be solid state to take the bumps and knocks of mobile use.

That's why *all* Amphenol Citizens Radios are solid state. We don't believe in thin filaments that heat up and short or snap. Or in fragile glass enclosures. Or in tubes at all, when transistors have more than ten times the life and warm up instantly. That's why Amphenol has the broadest line of solid state equipment available today.

Take the new Spokesman 650 for example. This ten crystal-controlled channel receiver is complete with spot button, S and RF meter, squelch control, 23 channel RF tuner, solid state switching (no relay, making it possible to provide communications even at 25°F below zero), and most important, Amphenol dependability.

Remember, when you want the reliability of solid state circuitry, think of the industry's broadest line, Amphenol. See your local Amphenol distributor for more information on Amphenol solid state, and the Spokesman 650, or write us direct.

AMPHENOL DISTRIBUTOR DIVISION
AMPHENOL CORPORATION
2875 South 25th Avenue, Broadview, Illinois 60153

CIRCLE NO. 3 ON READER SERVICE PAGE

POPULAR ELECTRONICS

WORLD'S LARGEST-SELLING ELECTRONICS MAGAZINE

PHILLIP T. HEFFERNAN
Publisher

OLIVER P. FERRELL
Editor

ROBERT CORNELL, WA2HDQ
Managing Editor

JOHN D. DRUMMOND
Technical Editor

WILLIAM GALBREATH
Art Editor

MARGARET MAGNA
Associate Editor

CHRISTOPHER SHERIDAN
Associate Editor

ANDRE DUZANT
Technical Illustrator

NINA KALAWSKY
Editorial Assistant

PATTI MORGAN
Editorial Assistant

H. S. BRIER, W9EGQ
Amateur Radio Editor

M. P. SPINELLO, KHC2060
CB Editor

L. E. GARNER, JR.
Semiconductor Editor

H. BENNETT, W2PNA
Short-Wave Editor

LAWRENCE SPORN
Advertising Sales Manager

ARDYS C. MORAN
Advertising Service Manager

ZIFF-DAVIS PUBLISHING COMPANY

Editorial and Executive Offices (212 ORegon 9-7200)
One Park Avenue, New York, New York 10016

William B. Ziff, Chairman of the Board (1946-1953)
William Ziff, President
W. Bradford Briggs, Executive Vice President
Hershel B. Sarbin, Vice President and General Manager
Philip Sine, Financial Vice President
Walter S. Mills, Jr., Vice President, Circulation
Stanley R. Greenfield, Vice President, Marketing
Phillip T. Heffernan, Vice President
Frank Pomerantz, Vice President, Creative Services
Arthur W. Butzow, Vice President, Production

New York Office (212 ORegon 9-7200)
One Park Avenue, New York, New York 10016
Eastern Advertising Manager, RICHARD J. HALPERN

Midwestern Office (312-726-0892)
307 North Michigan Avenue, Chicago, Illinois 60601
Midwestern Advertising Manager, JAMES WEAKLEY

Western Office (213 CRestview 4-0265)
9025 Wilshire Boulevard, Beverly Hills, California 90211
Western Advertising Manager, BUD DEAN

James Yagi, c/o Sekihara
1, Sakamachi, Shinjuku-ku
Tokyo, Japan

Circulation Office
Portland Place
Boulder, Colorado 80311

MEMBER INSTITUTE OF HIGH FIDELITY INC. MPA AUDITED PAID CIRCULATION ABC

ELECTRONICS

WHERE CAN YOU EQUAL THIS OPPORTUNITY

TO EARN A GOOD PAYING JOB IN A FAST GROWING FIELD?

DeVRY'S "BIG 3" AIDS TO PROGRESS ARE DESIGNED TO SPEED YOU QUICKLY TO A REAL FUTURE IN ELECTRONICS

1. EFFECTIVE TRAINING!
Learn AT HOME in spare time, or day or evening in one of our RESIDENT SCHOOLS.

2. INDUSTRY RECOGNITION!
DeVry programs, prepared with industry's help, are "JOB-AIMED."

3. EMPLOYMENT SERVICE!
for ALL graduates through our contacts with many large, respected companies across North America.

ELECTRONICS is one field that spells OPPORTUNITY in big capital letters for many men 18 to 45. This widespread but FAST GROWING field offers trained men some of today's finest, good-paying job opportunities — or a chance to start a profitable servicing shop!

Even if you don't have previous technical experience or an advanced education, DeVry's "BIG 3" aids to progress may very well be YOUR stepping stones to a BETTER FUTURE. You can learn at home in your spare time, while keeping your present job. Or, in a day or evening program in our U.S. or Canadian resident school, you can develop the very skills needed to make wonderful progress. We even work to get resident students part-time jobs to help with tuition or living expenses, if necessary!

Regardless of how you complete your educational program with DeVry, you can count on **industry-recognized, effective** training aimed directly at providing on-the-job-type "know-how." This is followed by actual EMPLOYMENT SERVICE to help you get started in Electronics. Or, if you are in the field already, remember that a DeVry recommendation has meant plenty of ADDED DOLLARS in income to many who made themselves more valuable to employers.

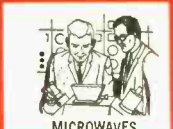
See for yourself how you, too, may prepare for the INCOME, the PRESTIGE and the FINE FUTURE that goes with the title of Electronics Technician. Mail the coupon NOW for facts without obligation.

WE PREPARE YOU NOT FOR ONE JOB BUT FOR JOBS IN MANY DIVISIONS OF THE FASCINATING FIELD OF ELECTRONICS


SPACE & MISSILE


TV — RADIO


RADAR

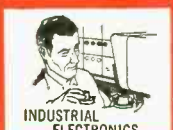

MICROWAVES


AUTOMATION


COMMUNICATIONS


COMPUTERS


BROADCASTING


INDUSTRIAL ELECTRONICS


ELECTRONIC CONTROL

MOVIES, TEXTS AND EQUIPMENT HELP YOU LEARN FASTER

DeVry includes training movies AT HOME, "programmed" texts and many shipments of Electronic parts — to help you learn quickly, remember more.

FREE

Send coupon for these two factual booklets NOW!

DeVry Technical Institute

4141 Belmont Avenue
Chicago, Illinois 60641

Accredited Member of National Home Study Council

MAIL COUPON TODAY!

DeVRY TECHNICAL INSTITUTE
4141 Belmont Avenue, Chicago, Ill. 60641 Dept. PE-3-W

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):

- ☐ Space & Missile Electronics
- ☐ Television and Radio
- ☐ Microwaves
- ☐ Radar
- ☐ Automation Electronics
- ☐ Communications
- ☐ Computers
- ☐ Broadcasting
- ☐ Industrial Electronics
- ☐ Electronic Control

Name_____ Age_____

Address_____ Apt._____

City_____ State_____ Zip Code_____

☐ Check here if you are under 16 years of age.

HOME STUDY AND RESIDENT SCHOOL TRAINING AVAILABLE IN CANADA

2101

LETTERS
FROM OUR READERS

Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS One Park Avenue, New York, N. Y. 10016

SHOCK HAZARD

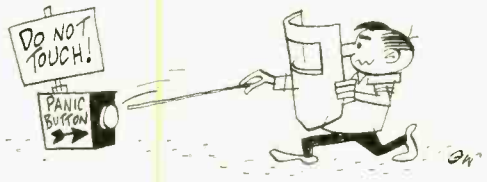
In your "Tape Recorder Remote Switch" installation (December, 1965), a suggestion was made to connect 117-volt motor wires to an existing tape recorder earphone jack. Many such jacks are electrically connected to the tape recorder metal panel or frame, and I believe that such a hookup creates a serious shock hazard. I hope that you will discourage people from building this gadget with anything less than U.L.-approved 117-volt a.c. connectors.

JAMES V. MOLNAR
Parsippany, N.J.

Thanks, James, for the warning. The editor who let this item get by is "shocked." Shock hazard is a very serious matter, and no project is accepted for publication if it is evident that a hazard to life or property is created. However, this does not preclude any experimenter from exercising proper precautions when working with tools and electricity.

FUN WITH "PANIC BUTTON"

I have just finished building the panic alarm ("Don't Panic . . . Push the Button," January, 1966), and I've never had more fun with a project. In place of the time delay switch, which only delayed shutoff 44 seconds, I used a homemade timing relay that



delays shutoff from a variable 5 seconds to 5 minutes. To confuse my prey even more, I added a number of switches in addition to the push-button switch specified--some dummy switches, and some connected to the siren module. Result: one enormous MAD-HOUSE.

JAY COHEN
Bronx, N.Y.

(*Continued on page 8*)

Scott's best solid-state components! Build them yourself and save $160

Now you can enjoy the world's most advanced solid-state engineering, and save up to $160, when you build these Scott solid-state kits. Scott kits give you the same features, performance, quality, and long-lived reliability you've come to expect from their factory-wired counterparts . . . the only difference is, you build them.

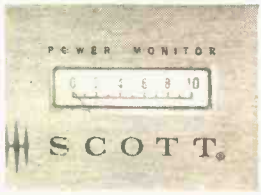
And building them is easy . . . Scott's exclusive kit construction book with full-size, full-color step-by-step diagrams reduces the possibility of wiring error . . . cuts construction time to a minimum. All critical circuits are pre-wired, pre-tested, and mounted on heavy-duty printed circuit boards at the Scott factory. All wires are color-coded, pre-cut and pre-stripped to the proper length. Here is a preview of the exclusive Scott features you'll find in your Scott Kit Pak:

Power-Packed LK-60 120-Watt Stereo Amplifier Kit

Rugged silicon output transistors give full audio frequency performance at high power . . . drive even the most inefficient speakers.

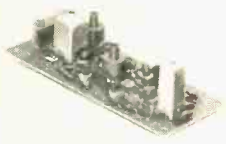
Massive military-type heat sinks keep output transistors running cool . . . assure top performance under high power output conditions.

Rugged pre-wired, pre-tested printed circuit boards greatly reduce the possibility of error . . . stand up under years of strenuous use.

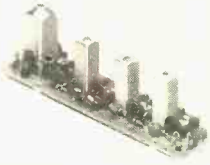


Exclusive Circuit Monitor allows you to set output stage bias and balance for absolutely minimum distortion, without external test equipment.

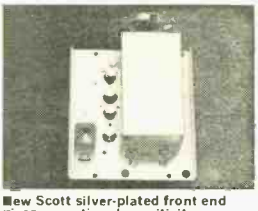
Ultra-sensitive LT-112 FM Stereo Tuner Kit



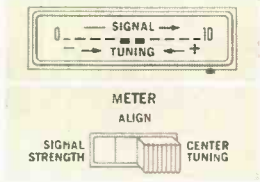
Patented Scott Time-Switching multiplex circuitry insures lowest distortion and best stereo separation. Multiplex section is pre-wired and pre-tested.



Scott silicon transistor IF circuit provides amazing stability, selectivity, and wide bandwidth . . . far superior to germanium transistor performance.



New Scott silver-plated front end gives exceptional sensitivity . . . outperforms and outlasts even the best conventional tube or transistor front ends.



Exclusive "Three-Way" front panel tuning meter serves as a signal-strength indicator, zero-center indicator, or highly accurate alignment meter.

Specifications LK-60: Music Power/Channel @ 4 ohms, 60/60; Frequency Response, 15-30,000 cps ±1 db; Power Bandwidth, 20-20,000 cps. Price, $189.95.
Specifications LT-112: Usable Sensitivity (IHF), 2.2 μv; Selectivity, 4.0 db; Cross Modulation Rejection, 80 db; Price, $179.95.

For complete specifications and features of both Scott solid state stereo kits, fill out this coupon:

Gentlemen:
Please send me complete information on these great Scott kits:

NAME _____

ADDRESS _____

CITY _____

STATE _____ ZIP _____

SCOTT®

H. H. Scott, Inc., 111 Powdermill Road, Dept. 520-03, Maynard, Massachusetts

Export: Scott International, Maynard, Mass. Prices and specifications subject to change without notice. Prices slightly higher west of Rockies.

CIRCLE NO. 32 ON READER SERVICE PAGE

LETTERS

(*Continued from page 6*)

ASTRONOMICAL LEAGUE BELEAGUED

Your article "Radio Astronomy: Surveying the Unquiet Universe" (January 1966) has resulted in your readers, who are interested in radio, electronics, etc., requesting books, periodicals and texts on Radio Astronomy from the Astronomical League. The Astronomical League is a federation of amateur astronomers interested in the science of astronomy, but we do not provide the type of information you apparently have led your readers to believe we distribute. The booklets distributed by the Astronomical League are provided for groups in organizing amateur astronomical societies. These amateurs construct telescopes, observe, maintain programs for student activity in astronomy and the study of this science. To be sure, radio astronomy has become a phase of the science of astronomy and some amateur groups have constructed radio telescopes, but these are in the minority. We would appreciate your clarifying the statement in your recent issue, as we are not able to supply the information suggested therein.

WILMA A. CHERUP
Executive Secretary
Astronomical League
Pittsburgh, Pa.

Naturally, we regret any inconvenience inadvertently caused the Astronomical League by our article on radio astronomy. Apparently the League is able to furnish information about astronomy clubs and does provide assistance to its members, but is not equipped to handle a volume of inquiries on radio astronomy.

REVERSE ENGLISH?

In the article "Reverse Current Keeps Ferry Afloat" (December, 1965), you called Alexis Tellis the designer of the system. This is not so. The United States Navy has been using this exact system to preserve its decommissioned ships for a number of years at all of the Reserve Fleets (one of which is very near Mr. Tellis's ferry). Due to the similarity of his system to the Navy's, do you suppose he may have gotten his idea from this source?

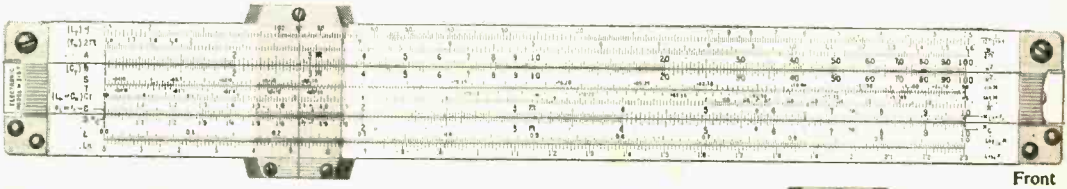
JAMES L. BACHMAN
San Diego, Calif.

James, it's quite possible that designer Alexis Tellis did get the idea from the Navy and that he did not design the reverse current system, but the article doesn't say he did, and it doesn't say he didn't. Perhaps identifying him as a designer created the confusion.

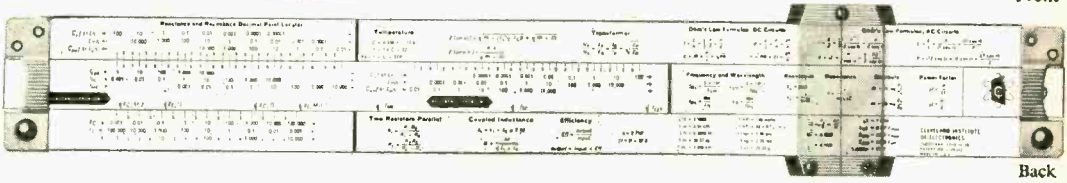
ERRATIC A GO-GO LAMPS

Some additional experiments with the "Hi-Fi à Go-Go Lamps (January, 1966) indicate that C_4 should be changed from 0.001 μf. to

LOOK!
A New Electronics Slide Rule with Instruction Course



Front



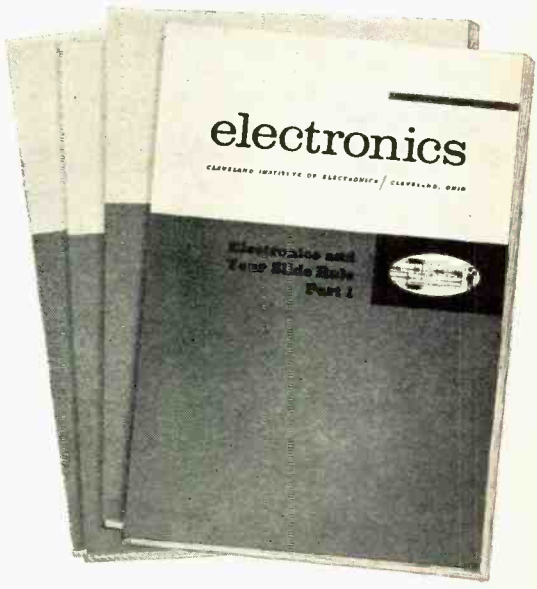
Back

This amazing new "computer in a case" will save you time the very first day. CIE's patented, all-metal 10″ electronics slide rule was designed *specifically* for electronic engineers, technicians, students, radio-TV servicemen and hobbyists. It features special scales for solving reactance, resonance, inductance and AC-DC circuitry problems . . . an exclusive "fast-finder" decimal point locater . . . widely-used formulas and conversion factors for instant reference. And there's all the standard scales you need to do multiplication, division, square roots, logs, etc.

Best of all, the new CIE Slide Rule comes with an Instruction Course of four AUTO-PROGRAMMED* lessons. It includes hundreds of illustrations, diagrams and practice problems. You'll learn ingenious short cuts ...whip through exacting electronics problems quickly and accurately. This course alone is worth far more than the price of the entire package!

Electronics Slide Rule, Instruction Course, *and* handsome, top-grain leather carrying case . . . a $50 value for less than $20. Send coupon for FREE illustrated booklet and FREE Pocket Electronics Data Guide, without obligation. Cleveland Institute of Electronics, 1776 E. 17th St., Dept. PE-118, Cleveland, Ohio 44114.

*TRADEMARK



GET BOTH FREE!

Send coupon today→

Cleveland Institute of Electronics

1776 E. 17th St., Dept. PE-118, Cleveland, Ohio 44114

Please send FREE Illustrated Booklet describing your Electronics Slide Rule and Instruction Course.

SPECIAL BONUS! Mail coupon promptly . . . get FREE Pocket Electronics Data Guide too!

Name_____
(PLEASE PRINT)

Address_____ County_____

City_____ State_____ Zip_____

A leader in Electronics Training . . . since 1934.

CIRCLE NO. 7 ON READER SERVICE PAGE

LETTERS

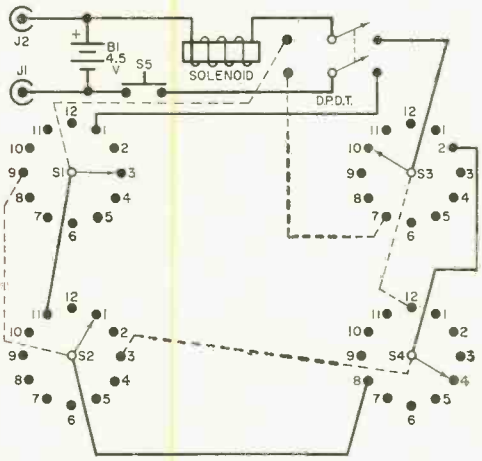
(*Continued from page 8*)

0.005 μf. for better results. Also, it may be desirable to reduce the sensitivity of the unit to provide a full range of light intensities without reducing volume. To do so, you can add a resistor of 5 to 200 ohms in series with the unit's input.

DON LANCASTER
Phoenix, Arizona

DUAL-COMBINATION "ELECTROLOCK"

Having constructed the "Electrolock" by Murray E. Coultes (January, 1966), I found it more "protective" to have two combinations built into the circuit. By adding a hidden d.p.d.t. switch, I was able to wire in



another combination and can instantly select either combination. The schematic shows how.

STEPHEN SMYKA
Washington, D.C.

CQD WAS, SOS IS, QRD—NEVER

"The First License—And Before" (January, 1966) was interesting but contained a couple of errors. "Radio" was used (but not commonly) long before the date Henry Church mentioned it as not having been invented. Also, I'm sure you must be aware that the distress signal Jack Binns transmitted was CQD, not QRD!

CARL C. DRUMELLER, W5EHC
Oklahoma City, Okla.

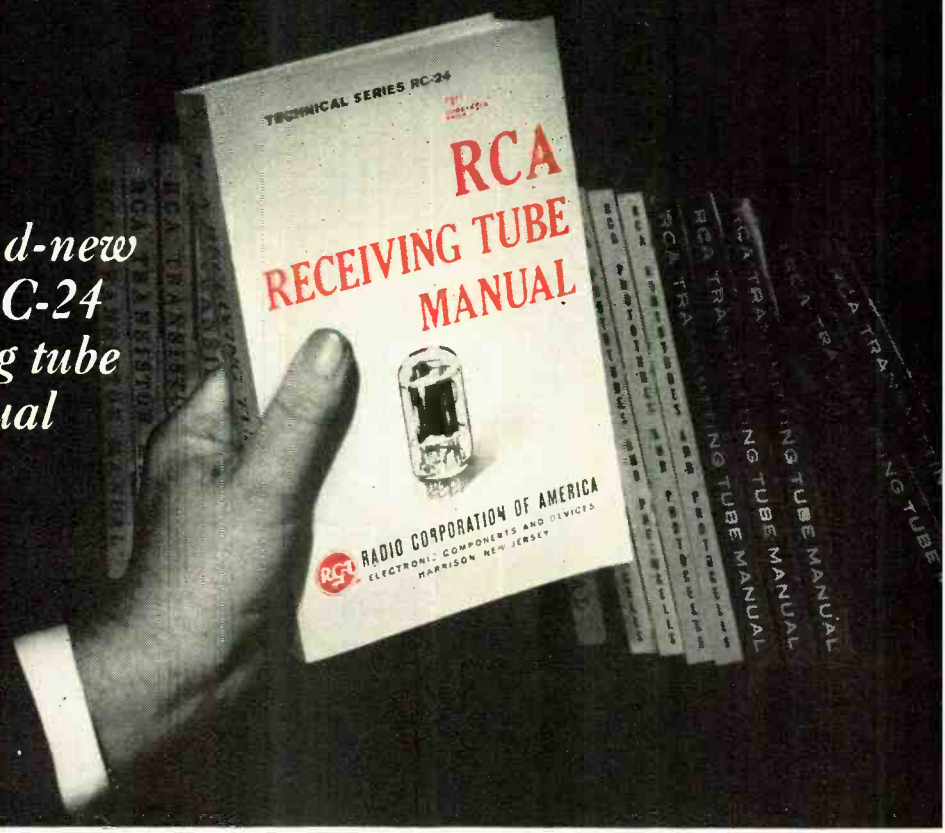
"Q" signals were not invented or developed at the time the "Republic" sank. The first distress signal was CQD.

B. B. JACKSON, W6JF
Dana Point, Calif.

B.B. and Carl, you are quite right about "CQD." There were no Q signals at that time, as is pointed out on page 55 in the article. Unfortunately, the ship sank before we could catch this typo. Carl, the author

Indispensable!

The brand-new RCA RC-24 receiving tube manual



Complete-authoritative
A must in every technical library
A must on every work bench
More compact and easier to read than ever before

Technical design and applications data on more than 1200 receiving tubes. Check these NEW features and improvements not included in previous editions:

- ✓ Additional data on 100 new tube types
- ✓ Revised circuits section with new, simple format
- ✓ Updated picture tube characteristics chart
- ✓ Revised and updated Applications Guide
- ✓ New tube index section for ready reference
- ✓ Data section on active types only. (Discontinued and replacement types appear in a separate section.)
- ✓ Additional text material on TV in the tube applications section

Everyone concerned with electronics needs this manual . . . service technicians, engineers, radio amateurs and hobbyists. Order yours today from your nearest Authorized RCA Distributor.

Only $1.25*
**Suggested Price*

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

The Most Trusted Name in Electronics

LETTERS (*Continued from page 10*)

said the word "radio" had not been "coined"—he didn't say "invented." Aerographers operated the wireless . . . — —

PROPAGANDA FOR SWL'S

Just recently I received a book in the mail from *Radio Portugal.* The name of the book is *Critique Nationaliste.* For what reason did I receive it? I didn't send for it. Actually, I don't mind having it but the problem is that the whole book is written in French and I can't read it. Could you tell me if anyone else received this book, and maybe the reason behind it?

ED GUNDY, WPE6DMD
Campbell, Calif.

Ed, this is one of the pitfalls encountered in asking for verifications. Radio Portugal *has been mailing propaganda to support its African political position to hundreds of SWL's. Have someone interpret the book for you if you're interested, or just throw it away.*

RADIO GHANA RESPONDS AGAIN

I was interested to see Allan Bach's letter (January, 1966, *Letters*) regarding his experience with *Radio Ghana.* I heard *Radio Ghana* on September 11, 1965, and sent my report to them a few days later. I didn't include any International Reply Coupons, but merely sent my report on an Air-O-Gram. I received my *Radio Ghana* QSL approximately two and a half weeks later, along with their program schedule. On the other hand, some friends of mine heard them on the same night and also sent in reports, but they still haven't received any QSL's. Why do some QSL's come faster than others?

RICHARD S. GOLDMAN
Waban, Mass.

Top this *Radio Ghana* response! I sent them my report on August 27, 1965, with no IRC enclosed, and I received my QSL on September 14. That's just a little over two weeks.

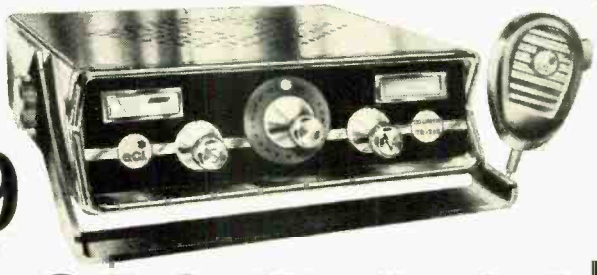
ANDREW CUNEO
Lansdowne, Pa.

I sent in a reception report to Radio Ghana for November 3, 1965, did *not* include any IRC coupons, and received a QSL postmarked November 10, 1965, and an identical one the next day which was postmarked November 12, 1965.

BRUCE KESSELMAN, WPE2OGO
Woodbridge, N.J.

Richard, we don't know why some QSL's come in faster than others; perhaps it's the quality of the report that counts. Andrew, it looks like Bruce topped your response with two cards within one week on one report. Bruce, who do you know? -30-

Only Courier gives you a 23-channel transistor CB rig for $169 and can guarantee it for 10 years!



What do you do for an encore after introducing the industry's finest 23-channel transistorized CB rig for the unheard price of $169? Tag it with a 10 year guarantee!

Silicon-transistors throughout bring the size down to 5¾"W x 6¼"D x 1⅞"H. With big-size performance. Complete, with microphone and a long list of features you want. Illuminated S meter. Illuminated channel selector. All crystals supplied for 23 channels. PA system. Auxiliary speaker jack. Single-knob tuning. Modulation indicator. DC cord. Chrome cabinet. Plus exclusive Courier "Safety-Circuit" to protect against mismatched antenna, incorrect polarity, and overload.

You can see the Courier TR-23S at your nearest Courier dealer. Or use the coupon for all the data on the amazing Courier TR-23S—the CB rig with the ten year guarantee.

PE-63

eci. electronics communications inc.
56 Hamilton Avenue, White Plains, N.Y.

Yes! I'd like to know all about the $169 Courier TR-23S with the 10 year guarantee!

Name_____

Address_____

City_____ County_____ State_____

CIRCLE NO. 46 ON READER SERVICE PAGE

OPERATION ASSIST

Through this column we try to make it possible for readers needing information on outdated, obscure, and unusual radio-electronics gear to get help from other P.E. readers. Here's how it works: Check the list below. If you can help anyone with a schematic or other information, write him directly—*he'll appreciate it. If you need help, send a postcard to Operation Assist,* POPULAR ELECTRONICS, *One Park Avenue, New York, N.Y. 10016. Give maker's name, model number, year of manufacture, bands covered, tubes used, etc. State specifically what you want, i.e., schematic, source for parts, etc. Be sure to print or type everything legibly, including your name and address. Because we get so many inquiries, none of them can be acknowledged.* POPULAR ELECTRONICS *reserves the right to publish only those items not available from normal sources.*

SCHEMATIC DIAGRAMS

Boland & Boyce Model 701 TV picture tube tester. (John Borst, 1034 Dudley Rd., Schenectady, N.Y. 12303)

BC-653-A transmitter and **BC-652-A** receiver, surplus. (S.J. Gradijan, 206 35th St., Barberton, Ohio 44203)

Measurements Model 79B pulse generator. (Noel M. Moss, 5355 Henry Hudson Pkwy., Bronx, N.Y. 10471)

IP-41/ARR-27 radar indicator scope made for U.S. Navy. (D. Hoffman, 208 N. Highland Ave., Springfield, Pa.)

St. Clair Model 451 electronic voltmeter. (Leonard Petrulis, 1414 S. Harvey, Berwyn, Ill.)

Supreme Model 567 VOM. ser. 278, circa 1950. (Keith L. Curtis, 2320 28th St., Santa Monica, Calif.)

RCA Model 158 oscilloscope, circa 1940. Has 7 tubes. (F.M. Crawley, 8 Fulton Ave., W. Long Branch, N.J. 07764)

Motorola Model 101R21 receiver, circa 1940. Tunes BC and s.w. on 3 bands. Has 10 tubes. (Larry Nelson, 4240 N. Francisco Ave., Chicago, Ill. 60618)

Gillfillan Model 119 receiver, circa 1940. Tunes BC to 18 mc. Has 11 tubes. (Lee Sulzner, Box 3551, Beverly Hills, Calif.)

EICO Model AF-4 stereo amplifier. **Standard Radio** Model SRG 430 receiver. (Troy Lamar, 5965 Primrose Ln., Paradise, Calif. 95969)

Triumph Model 830 oscillograph. (Alphord Hays, 2024 Paradise Rd., Modesto, Calif. 95351)

Supreme Model 599A tube checker. (Donald E. O'Neal, 1 Joans Lane, Berlin, N.J. 08009)

Hycon Model 615 or 615R digital VTVM. (Norman L. Schaller, 39 Lei Drive, Lexington Park, Md. 20653)

Federal Telephone & Telegraph Model 61 receiver. (Nevin Grosjean, 518 South Main, Orrville, Ohio)

RCA 3-FX-671 receiver, ser. U 035181. Tunes 540 kc. to 18.20 mc. Has 5 tubes. (Paul Emch, Box 324, Trabuco Canyon, Calif. 92678)

REMCO receiver. Has 1 200A detector and 2 201A audio tubes. (J. N. Clapp, 1516 Elm St., Davenport, Iowa)

Precision Series EV-20 VTVM and multi-range test set. (George A. Trotter, 402 W. Main St., Cherokee, Okla. 73728)

RCP Model 414 multitester. (Clem Small, 2F University Terrace, Columbia, Mo. 65201)

(*Continued on page* 20)

POPULAR ELECTRONICS
READER SERVICE PAGE

You can get
additional information promptly
concerning
products advertised or mentioned
editorially
in this issue

1

Circle the number on the coupon below which corresponds to the key number at the bottom of the advertisement or is incorporated in the editorial mention that interests you.

2

Mail the coupon to the address indicated below.

3

Please use this address only for Product Service requests.

POPULAR ELECTRONICS
P. O. BOX 8391
PHILADELPHIA, PA. 19101

Please send me additional information about the products whose code numbers I have circled

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

NAME *(Print clearly)* _____

ADDRESS _____

CITY _____ **STATE** _____ **ZIP CODE** _____

VOID AFTER APRIL 30, 1966 3

Why Fred got a better job . . .

I laughed when Fred Williams, my old high school buddy and fellow worker, told me he was taking a Cleveland Institute Home Study course in electronics. But when our boss made him Senior Electronic Technician, it made me stop and think. Sure I'm glad Fred got the break . . . but why him . . . and not me? What's he got that I don't. There was only one answer . . . his Cleveland Institute Diploma and his First Class FCC License!

After congratulating Fred on his promotion, I asked him what gives. "I'm going to turn $15 into $15,000," he said. "My tuition at Cleveland Institute was only $15 a month. But, my new job pays me $15 *a week* more . . . that's $780 more a year! In twenty years . . . even if I don't get another penny increase . . . I will have earned $15,600 more! It's that simple. I have a plan . . . and it works!"

What a return on his investment! Fred should have been elected most likely to succeed . . . he's on the right track. So am I *now*. I sent for my three *free* books a couple of months ago, and I'm well on my way to Fred's level. How about you? Will you be ready like Fred was when opportunity knocks? Take my advice and carefully read the important information on the opposite page. Then check your area of most interest on the postage-free reply card and drop it in the mail *today*. Find out how you can move up in electronics too.

How You Can Succeed In Electronics

. . . Select Your Future From Five Career Programs

The "right" course for your career

Cleveland Institute offers not one, but five different and up-to-date Electronics Home Study Programs. Look them over. Pick the one that is "right" for you. Then mark your selection on the reply card and send it to us. In a few days you will have complete details . . . without obligation.

1. Electronics Technology

A comprehensive program covering Automation, Communications, Computers, Industrial Controls, Television, Transistors, and preparation for a 1st Class FCC License.

2. First Class FCC License

If you want a 1st Class FCC ticket *quickly*, this streamlined program will do the trick and enable you to maintain and service all types of transmitting equipment.

3. Broadcast Engineering

Here's an excellent studio engineering program which will get you a 1st Class FCC License and teach you all about Program Transmission and Broadcast Transmitters.

4. Electronic Communications

Mobile Radio, Microwave, and 2nd Class FCC preparation are just a few of the topics covered in this "compact" program . . . Carrier Telephony too, if you so desire.

5. Industrial Electronics & Automation

This exciting program includes many important subjects such as Computers, Electronic Heating and Welding, Industrial Controls, Servomechanisms, and Solid State Devices.

An FCC License . . . or your money back!

In addition to providing you with comprehensive training in the area indicated, programs 1, 2, 3, and 4 will prepare you for a Commercial FCC License. In fact, we're so certain of their effectiveness, we make this *exclusive* offer:

The training programs described will prepare you for the FCC License specified. Should you fail to pass the FCC examination after completing the course, we will refund *all* tuition payments. You get an FCC License . . . or your money back!

CIE's AUTO-PROGRAMMED™ lessons help you learn faster and easier

Cleveland Institute uses the new programmed learning approach. Our AUTO-PROGRAMMED* lessons present facts and concepts in small, easy-to-understand bits . . . reinforce them with clear explanations and examples. Students learn more thoroughly and faster through this modern, simplified method. You, too, will absorb . . . retain . . . advance *at your own pace.* *TRADEMARK

NEW in 1966

Only CIE offers new, up-to-the-minute lessons in all of these subjects:

- Logical Troubleshooting
- Single Sideband Techniques
- Laser Theory and Application
- Pulse Theory and Application
- Microminiaturization
- Boolean Algebra

Lifetime job placement service for every CIE graduate...at no extra cost

Once enrolled with CIE, you will get a bi-monthly listing of the many high-paying interesting jobs available with top companies throughout the country. Many Cleveland Institute students and graduates hold such jobs with leading companies like these: American Airlines, American Telephone and Telegraph, General Electric, General Telephone and Electronics, IBM, Motorola, North American Aviation, New York Central Railroad, Raytheon, RCA and Westinghouse.

Full accreditation . . . your assurance of competence and integrity

Cleveland Institute of Electronics is accredited by the Accrediting Commission of the National Home Study Council. You can be assured of competent electronics training by a staff of skilled electronics instructors.

Your Future In Electronics Is Up To You.
Make It A Brighter One. Mail Reply Card Today.

CIE **Cleveland Institute of Electronics**

1776 East 17th Street, Dept. PE-38, Cleveland, Ohio 44114

ASSIST

(*Continued from page 14*)

Hallicrafters S-53 receiver, circa 1949. Tunes s.w., 550 kc. to 54 mc. Has 8 tubes. (Kevin Zimmerman, 1363 Summit Rd., Berkeley, Calif. 94708)

TCS-12 surplus receiver. made by Collins Radio. Tunes 1.5-12.0 mc. (James Gross, 1363 Valley Rd., Woodlyn, Pa. 19094)

Islip Radio Model DF-1 receiver; tunes BC and beacons. **Wilcox-Gay** "Recordette" receiver and disc recorder. (C.W. Egglesfield, 18 Laurentian Dr., Sault Ste. Marie, Ontario. Canada)

RCA 8BX6 receiver. Tunes 540-1600 kc. Has 6 tubes. (S. Thurber, 142 Washington Ave.. Kearny, N.J.)

Radiaphone Model 30 receiver. Has 6 tubes. (M. Seidel, 1923 Springfield Ave., Pennsauken, N.J. 08110)

Lafayette Knight VFO. Tunes 80, 40, 20, 15, and 10 meters. Has 1 OA2, 1 EX90/6X4, 1 6BH6, and 1 6AK6 tubes. (John Kuc, 193 Hampshire St., Indian Orchard, Mass. 01051)

Supreme Model 570 signal generator, and Model 542 multimeter. (Michael Hitch, Box 928, Malta, Mont. 59538)

RCA Model 16T4 receiver. Tunes BC, 1.4-4.5 mc. and 6-18 mc. bands. Has 6 tubes. (Barry Steinman, 1930 Berkeley Rd., Highland Park, Ill. 60035)

Fisher "Explorer" transistorized mineral detector. **Relco** Coin-Ranger "Power King" mineral detector. (A. Anderson, 13931 102nd Ave., N. Surrey, B.C., Canada)

Meissner Model 9-1091 AM-FM tuner; has 18 tubes. **Lafayette** Model HE-45A 6-meter transceiver. (John Lennen, Jr., 49 Center St.. Rumson, N.J. 07760)

Freshman "Equaphase" Model G-1 receiver, ser. 44462. Has 6 tubes and power supply. (Phil Swingley, 316 N. Jefferson. Muncie, Ind. 47305)

Howard Model 460 communications receiver. Tunes BC, s.w. to 42 mc. Has 9 tubes. (Robert L. Holden, 701 Franklin Ave., Franklin Lakes, N.J. 07417)

SPECIAL DATA OR PARTS

Truetone Model 686 receiver; tunes BC and s.w. on 3 bands; has 6 tubes. Power transformer and schematic needed. (Fai Chew, 2524 Halls Ferry Rd., Vicksburg, Miss.)

RME Model DB22A preselector. **Millen** secondary frequency standard, circa 1940. Operating manuals needed. (Howard L. Roberts, 2108 E. 12th St., Cheyenne, Wyo. 82001)

Philco Model 37-610 receiver, circa 1930; tunes BC and s.w.; has 5 tubes. Schematic, operating manual, and parts source needed. (Chan Herrington, P.O. Box 367, Alma. Ga. 31510)

Silvertone Model 7056 receiver, ser. 466167, chassis 141 417, circa 1939. Schematic, alignment data, and 6F7 tube needed. (Mike Martin, 710 Colorado, Louisville, Ky. 40208)

TR-1196 surplus receiver, type 25(Can.) made by Northern Electric Co., circa 1942; has 6 tubes. Schematic and power supply data needed. (Bill Eben, 270-49 Ave., Lachine, Quebec. Canada)

Crosley Model 52 receiver. Instruction book and parts needed. (J.N. Clapp, 1516 Elm St., Davenport, Iowa 52803)

Zenith Model 1005 receiver; tunes .55 to 18 mc. Operating manual and knobs needed. (Dan Lightfoot, 509 N. Normandie Ave.. Los Angeles, Calif. 90004)

Heath Model IB-1 impedance bridge. Operating manual needed. (Donald Porter, 230 Merritt Dr., Oradell, N.J. 07649)

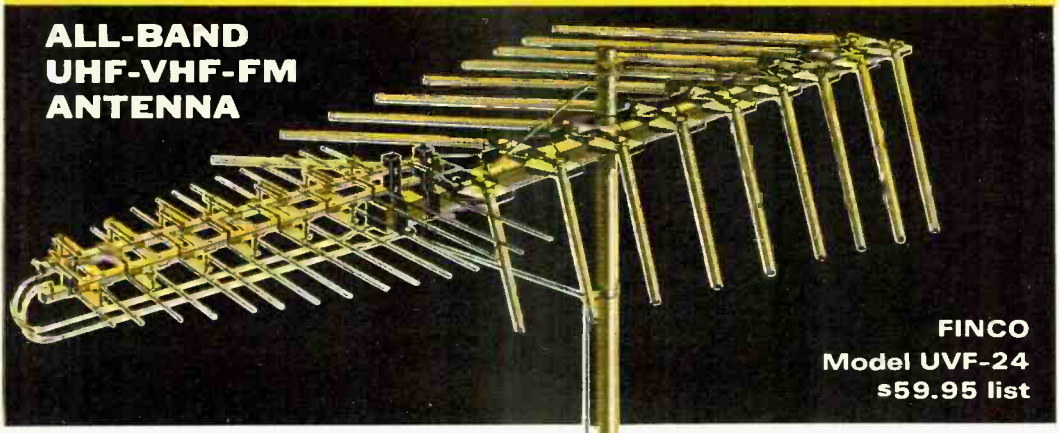
Atwater Kent Model 206 receiver, circa 1927; tunes 550 kc. to 19 mc. on 3 bands; has 5 tubes. Source for tubes and schematic needed. (Thomas Tyler, 7731 Commodore Circle, Huntington Beach, Calif.)

RCA Model RC 415x receiver, 9k 30, circa 1940; tunes 1.6-4.0, 6-18 mc. on 3 bands; has 8 tubes. Alignment instructions, schematic, and antenna information needed. (F. Monacelli, 678 E. 240 St., Bronx, N. Y. 10470)

(*Continued on page 26*)

FINCO COLOR-VE-LOG ANTENNAS
FOR UHF, VHF, FM RECEPTION

ALL-BAND UHF-VHF-FM ANTENNA

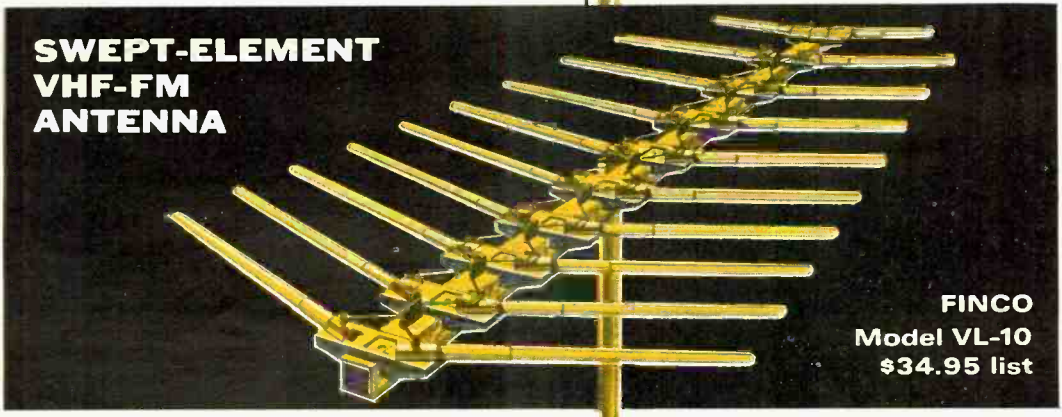


FINCO Model UVF-24 $59.95 list

The one antenna that does the work of 3! Gives startlingly clear black and white pictures and beautiful color on **both** UHF and VHF television channels — plus the finest in stereophonic and monophonic sound reproduction.

FINCO Model UVF-18—$42.50 list
FINCO Model UVF-16—$30.50 list
FINCO Model UVF-10—$18.50 list

SWEPT-ELEMENT VHF-FM ANTENNA



FINCO Model VL-10 $34.95 list

FINCO's Color-Ve-Log challenges all competition! Its swept-element design assures the finest in brilliant color and sharply defined black and white television reception — as well as superb FM monaural and stereo quality

FINCO Model VL-18—$54.50 list
FINCO Model VL-15—$46.95 list
FINCO Model VL-7—$23.95 list
FINCO Model VL-5—$16.95 list

Featuring FINCO's exclusive Gold Corodizing

FINCO COLOR-VE-LOG

Prices and specifications subject to change without notice

THE FINNEY COMPANY • 34 W. Interstate Street • Bedford, Ohio

Write for beautiful color brochures Number 20-322, and 20-307, Dept. PE

NEW PRODUCTS

Additional information on products covered in this section is available from the manufacturers. Each new product is identified by a code number. To obtain further details on any of them, simply fill in and mail the coupon on page 15.

NUTDRIVER SETS IN PLASTIC CASES

Color-coded, solid- and hollow-shaft nutdrivers made by *Xcelite Incorporated* are now being offered in new sets which feature handy, pebble-grain plastic cases with snap-lock lids to keep the tools in good order. Set No. 77 contains seven solid-shaft nutdrivers with hex openings from 3/16" through ⅜", while set No. HS6-18 has ten hollow-shaft-nutdrivers with hex openings from 3/16" through 9/16". The solid-shaft set can be hung—open—on a wall by means of a hole in the lid of the case; molded compartments keep the tools from tumbling out.

Circle No. 75 on Reader Service Page 15

STEREO PREAMPLIFIER

Dynaco, Inc., has announced a new stereo preamplifier in both easy-to-build kit and factory-assembled versions. Replacing the PAS-3 series, without any increase in price, the PAS-3X kit and the PAS-3X/A assembled

unit incorporate a tone control configuration which removes the phase and frequency controlling elements when the control is in the mechanical center of its rotation; advantages of both switch-type control and infinite resolution are claimed. Harmonic and IM distortion are guaranteed to be below 0.05% at 3 volts out in the range of 20 to 20,000 cycles, with up to 10 volts out at less than 0.15% distortion into as little as 10,000-ohm loads.

Circle No. 76 on Reader Service Page 15

PROJECT KITS

Science Fair enthusiasts, take note. Among the new project kits introduced by *Edmund Scientific Co.* is an inexpensive, foam ball molecule kit designed for building open-type molecules containing up to 50 atoms, and a miniature molecule kit with pregrouped atoms for large, complex molecules. Others include a magnet assortment kit which contains 23 magnets of many shapes and compositions, and moire pattern kits—16 patterns are now available in black and white, red, yellow, and blue. Display-and-storage trays of white expended polystyrene for displaying smaller elements of a project exhibit are also available.

Circle No. 77 on Reader Service Page 15

SOLID-STATE 12-CHANNEL CB RADIO

The "PACE II" 12-channel, solid-state, mobile two-way radio is now available from *Pace Communications Corp.* with a back-lighted front-panel S-meter. It's designated as the "PACE II-S." The transmitter is rated at a full 5-watt input and delivers 3½ watts to the

antenna at 100% modulation. The receiver is a double-conversion superheterodyne. Features include a two-position extended noise limiter, external speaker jack with public address facility, and rear panel squelch sensitivity adjustment.

Circle No. 78 on Reader Service Page 15

VERSATILE TUBE TESTER

Fast testing of the newest color, compactron, and other receiving tubes can be accomplished with the *B&K* Model 606 "Dyna-Jet" tube tester. It checks for shorts, grid emission (in a unique 100-megohm sensitive circuit), leakage, gas, and cathode emission under simulated load conditions for more accuracy. Each section of multi-section tubes is checked. The Model 606 comes in a sturdy, leatherette-covered case, and a handy reference index supplied with it contains a complete tube listing.

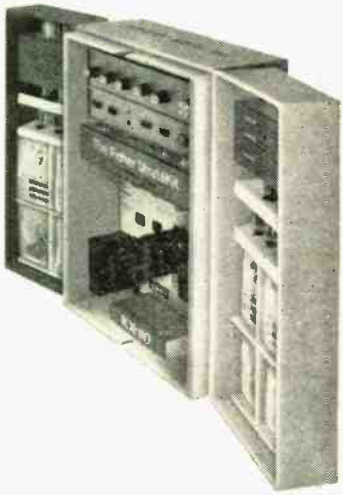
Circle No. 79 on Reader Service Page 15

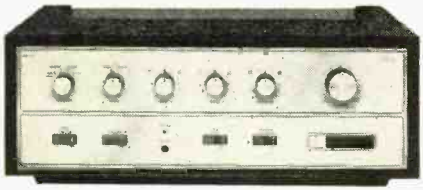
TRANSISTOR/DIODE CHECKER

Known as "TRANSITEST," *Workman Electronic Products'* new transistor/diode checker can be used to test all types of junction transistors and diodes, including both small-signal

Who makes the only great amplifier for $99.50?

You do... with the new Fisher KX-90 StrataKit.





Now, for the first time in high fidelity history, you can own a truly distinguished stereo control-amplifier for less than $100—if you are willing to build it yourself.

Fisher refuses to compromise quality. Therefore, even at $99.50*, the Fisher KX-90 StrataKit incorporates the same basic standard of fidelity as the most expensive Fisher components. Take away its price tag and it would still excite the admiration of the fastidious audiophile.

With 40 watts of clean power, the KX-90 can drive even inefficient speakers to their maximum performance level. Superior output transformers make certain this power will not fall off steeply at the frequency extremes. Advanced preamplifier features, including rocker switches and complete phono/tape facilities, provide unlimited flexibility.

It's all yours if you follow directions. And that's no problem with the exclusive Fisher StrataKit method. No experience is necessary. Assembly takes place by simple, *errorproof* stages (Strata). Each stage corresponds to a *separate* fold-out page in the uniquely detailed instruction manual. Each stage is built from a *separate* packet of parts (StrataPack). Major parts come already mounted on the extra-heavy-gauge steel chassis. Wires are *pre*cut for every stage —which means every page. All work can be checked stage-by-stage and page-by-page, before proceeding to the next stage.

The end result is a Fisher stereo control-amplifier that is fully equal in performance as well as reliability to its factory-wired prototype. Fisher guarantees this. And who should know better than Fisher?

FREE! $1.50 VALUE!

Send for *The New Kit Builder's Manual*, an illustrated guide to high fidelity kit construction, complete with detailed specifications of all Fisher StrataKits.

Fisher Radio Corporation
11-35 45th Road
Long Island City, N.Y. 11101

Name_____

Address_____

City_____

State_____ Zip_____

103

*WALNUT CABINET, $24.95

OVERSEAS AND CANADIAN RESIDENTS PLEASE WRITE TO FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY, N.Y. 11101.

The Fisher

CIRCLE NO. 10 ON READER SERVICE PAGE

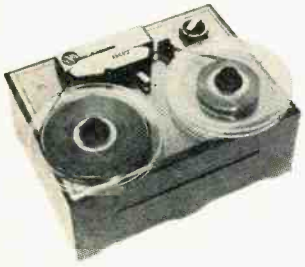
PRODUCTS (*Continued from page 22*)

and high-power types, and germanium and silicon units. The instrument gives an audible indication of transistor or diode condition by means of a SONALERT™ tone signal. Battery-operated, it cannot damage transistors or diodes whose breakdown voltage is 9 volts or more, even if improperly connected. And it will identify a transistor as to basic type (*pnp* or *npn*) provided lead connections are known. It can also be used as a continuity tester and code practice oscillator.

Circle No. 80 on Reader Service Page 15

TAPE PLAYBACK UNIT

You can now enjoy the advantages of prerecorded tapes with the convenience of phonograph records, according to *Viking of Minneapolis*. There are no recording controls or vu meters on the Model 807 "Turntable of the Tape Age." It's strictly a tape playback unit, without electronics, which connects to tape head or magnetic phono inputs of music system amplifiers. A unique head mechanism makes it possible to play full-, half- or quarter-track prerecorded tapes in mono or stereo. A two-motor unit, the Model 807 operates at 7½ and 3¾ ips.



Circle No. 81 on Reader Service Page 15

CRT CHECKER/REJUVENATOR

An updated and improved version of the CR128 CRT checker and rejuvenator has been announced by *Sencore, Inc.* The new CR128A has a variable G2 control (replacing the old three-position G2 switch) which provides for greater checking accuracy. All the necessary sockets are mounted on two permanently attached cables, including a rectangular socket for the 15", 19", 23", and 25" color tubes. An automatically controlled rejuvenation feature (ACR) is said to eliminate worry of damage. Weighing only 10 pounds, the CR128A checks each picture tube for interelement leakage and shorts, emission, gas, and expected tube life.

Circle No. 82 on Reader Service Page 15

AIR-SUSPENSION 3-WAY SPEAKER

Custom-built in England for *Lafayette Radio Electronics*, the Model SK-500 pneumatic air-suspension, 12", 3-way speaker system reproduces all sounds in the 25-20,000 cycle audio range with less than 1% distortion. In addition to the pneumatic air-suspension woofer, it has a dome lens compression - type multicellular radial treble horn and a precisely balanced midrange radiator. Features include built-in 2000- and 5000-cycle crossovers, and high-frequency L-pad control. Free air cone resonance is 22 to 27 cycles. The SK-500 has a power handling capacity of 30 watts and is guaranteed for five years against defects in material and workmanship.

Circle No. 83 on Reader Service Page 15

TWO-WAY PAGING/TALKBACK SYSTEM

The "Plug-in Pager" introduced by *Fanon Electronic Industries, Inc.*, consists of one Model WPT-2 transistorized paging/talkback amplifier, one (or more) Model CO-1 call originators, and two or three speakers, as may be needed. The system permits one or more persons to originate a call, and the paged party can reply by talking in the direction of the speaker. The reply is accomplished "hands-free" since it is unnecessary to press a switch to respond. Said to be suitable for any office, store, or factory where two-way paging is desired but where running cable is impractical, the system merely plugs into a.c. outlets. It transmits on 160 kc. and receives on 225 kc. Anyone can "install" it in minutes.

Circle No. 84 on Reader Service Page 15

"CARTRIDGE CADDY"

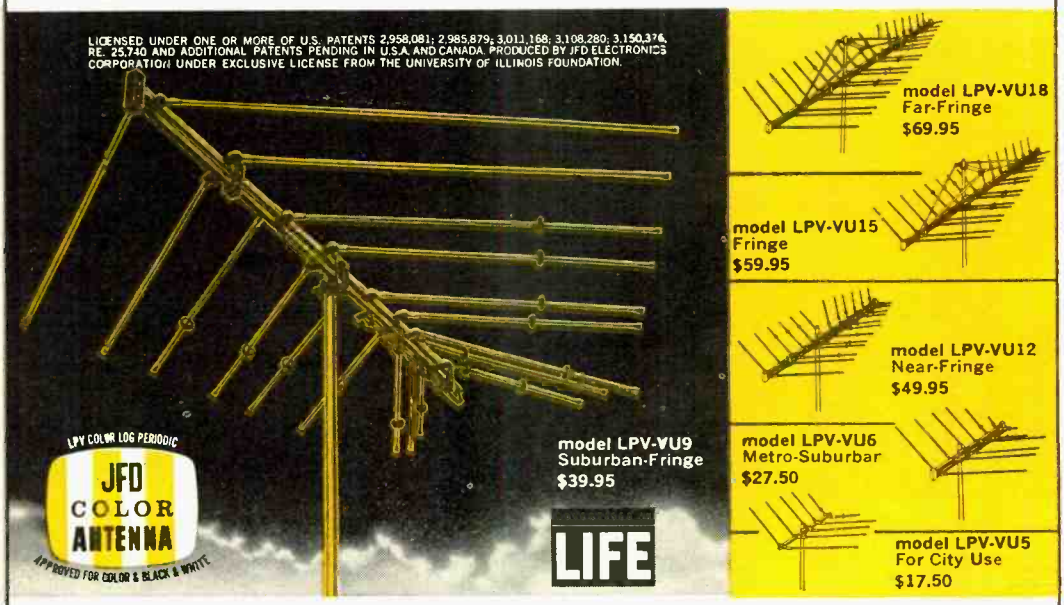
To enable audiophiles to store small and delicate phono cartridges, styli, and other hi-fi accoutrements, *Shure Brothers, Inc.* has introduced a "Cartridge Caddy." It is compartmentalized to hold up to four cartridges and six extra styli, or three cartridges and six extra styli plus pressure gauge, brush, etc. The cartridge compartments were designed to accommodate tone arm heads as well. Finished in black simulated leather with gold leaf tooling, the 12" x 5¼" x 2½" Cartridge Caddy is fully lined with protective plastic foam.

Circle No. 85 on Reader Service Page 15

for brilliant 82-channel TV performance—COLOR or black & white, plus FM/Stereo

INSTALL THE NEW...

JFD® LPV COLOR LOG PERIODIC TV ANTENNA



Now you can enjoy the best reception ever on any VHF, UHF or FM/Stereo station—from one antenna, using one down-lead—with the patented new JFD COLOR LPV Log Periodic.

Why cripple your reception with inefficient antenna "hodge-podges?" Choose a powerful space-age JFD LPV . . . see and hear the spectacular difference!

DON'T BE MISLED BY IMITATIONS—NO OTHER ANTENNA WORKS LIKE THE JFD LPV BECAUSE . . .

- Only the LPV is designed according to the **original** log periodic patented design of the University of Illinois Antenna Research Laboratories.
- Only the LPV combines **frequency-independent** design with **capacitor-coupled** electronic dipoles for . . .
- **Higher**, more **uniform** gain and **narrower** directivity on channels 2 to 83—and FM.

SEE YOUR JFD LPV DEALER TODAY!

JFD ELECTRONICS CORPORATION • 1462 62nd Street • Brooklyn, N. Y. 11219

world's largest manufacturer of TV & FM antennas

CIRCLE NO. 16 ON READER SERVICE PAGE

ASSIST *(Continued from page 20)*

Neutrowound receiver, circa 1928; tunes BC; has 7 tubes. Tube types and schematic needed. (Larry Rowan, 1800 E. 73rd Ave., Crown Pt., Ind. 46307)

Harvey Wells Model T-90 "Bandmaster" transmitter. Operating manual needed. (Jim Sommerville, 1117 E. Hyde Park Blvd., Chicago 15, Ill.)

Gyro Electronics R/C 27.145-mc. transmitter; has 2 tubes, CW-tone switch, tuning controls, and indicators. Parts list and schematic needed. (Robert R. Godwin, 4 Oak St. (N. City), St. Augustine, Fla. 32084)

Majestic Model 90-B receiver, ser. 9B-679413, circa 1928. Source for parts and schematic needed. (William H. Trojanowski, 2306 Andrus, Hamtramck, Mich. 48212)

Heath Model 0-8 oscilloscope. Power transformer part #54-1 needed. (Donald Barber, Box 511. 38 Robert St., Sioux Lookout, Ontario, Canada)

GE Model 62 radio alarm clock. Schematic and speaker needed. (Norman Wald, 9149 Kilpatrick, Skokie, Ill. 60077)

Triplett Model 1213 tube tester. Operating manual and adapters needed. (Brener Rotramel, 4076 Alamo, Riverside, Calif. 92501)

GE CRO-3A oscilloscope, ser. 2254510. Instruction manual or address of manufacturer of power transformer and CRT needed. **Solar** "Exam-eter" Model CF capacitor analyzer, ser. F93946. Instruction manual needed. (Demetrio P. Novicio, Box 338, Wake Island 96930)

Supreme Model 562 "Audolyzer," ser. 2321. Schematic, parts list or address of repair service needed. (E. J. Andrew, 405 Embarcadero Rd., Palo Alto, Calif. 94301)

Simpson Model 315 signal generator. Operating manual needed. (Martin Wulstein, 460 12th St., Cresskill, N.J.)

Philco Model 42-395 receiver, code 121, circa 1945; tunes AM, FM and s.w. on 3 bands. Glass tuning dial needed. (Neil G. Zank, 623 Lyncrest Dr., Lincoln, Nebr. 68510)

ELDICO Model SBA-1 product detector and amplifier. Alignment instructions and schematic needed. (William M. Keiser, Jr., Route #1, Topeka, Kan. 66605)

Simpson Model 210 signal generator, circa 1937. Operating manual and information on probes needed. (George W. Wochek, 1 Fairfield Ave., Danbury, Conn.)

Harvey Wells Model TBS-50 transmitter, circa 1950; tunes 80-2 meters; has 5 tubes. Operating manual and schematic needed. **BC-348-J** surplus receiver, made for Army by Wells-Gardner; tunes 200-500 kc. and 1.5-18 mc. on 6 bands; has 9 tubes. Operating manual and schematic needed. (Gray Frierson Haertig, 13064-39 Ave., NE, Seattle, Wash. 98125)

Superior Instrument "Genometer" Model TV-50 signal generator. Instruction manual needed. (Fred Braun, Jr., 817 Main St., Galena, Kan. 66739)

Radio Receiver Design, Part II, Book II, by K. R. Sturley, published by Chapman and Hall of London or Wiley of New York. (Jakob Dehaan, 5814 Sagewood Dr., Murray, Utah 84107)

CRV 46151 receiver, surplus, made by RCA, circa 1942; tunes 195 kc.-9089 kc.; has 6 tubes. **TCS-15** receiver, surplus, CKP 46159-A, made by Collins, circa 1948; tunes 1.5-12 mc.; has 7 tubes. Instruction or conversion manuals and schematics needed. (J. H. Kroon, 18 Const. Huygensstr., Haarlem, Holland)

Radiosonde modulator and transmitter, surplus; modulator, U. S. Army type MD-147B/AMT-4A; transmitter, type T-304/AMT-4A; both made by Friez Instrument Div. of Bendix. Operating instructions and schematic needed. (Larry Rabin, 2035 Hendricks Ave., Bellmore, L.I., N. Y. 11710)

Vox (Polydor) record #6470, Beethoven's Piano Concerto in E Flat Major, with Paray as conductor, Frugoni, pianist, issued 1955. (Kenneth A. Bush, 122 Vanderburg Ave., Rutherford, N.J. 07070)

BC 348-J receiver, surplus, made for U.S. Signal Corps. by Wells-Gardner; tunes 200 kc. to 18 mc., power supply—dynamotor, input 27.9 volts @ 1.25 amperes, output 244 volts @ 0.070 ampere. Data needed to convert to 117-volt operation. (James W. Halliday, 222 Painter Rd., Kalso, Wash.)

-30-

FALL OUT!

The all-new *Fall* 1965 edition of ELECTRONIC EXPERIMENTER'S HANDBOOK is *out*—available to you right now! 148 pages—30 challenging new projects—complete plans, parts lists, how-to instructions, pro tips and techniques. Scintillating entertainment, sheer fun, sure way to sharpen your skills! Clip out coupon and mail *today!*

NOTE: Electronic Experimenter's Handbook is now published twice yearly—Spring & Fall editions.

$1.25

GET THE DELUXE GOLD EMBOSSED LEATHERFLEX-BOUND EDITION . . . $3

A valuable "first"—a collector's item that belongs in your electronics library.

ZIFF-DAVIS SERVICE DIVISION, Dept. EEH
589 Broadway, New York, N.Y. 10012

Yes! Send me a copy of the Fall, 1965 ELECTRONIC EXPERIMENTER'S HANDBOOK as I've indicated below:

☐ **$1.25 enclosed,** plus 15¢ for shipping and handling. Send me the regular edition. ($1.50 for orders outside U.S.A.)

☐ **$3.00 enclosed.** Send me the Deluxe Leatherflex-Bound edition. ($3.75 for orders outside U.S.A.) Allow three additional weeks for delivery.

name _____ please print PE-36

address _____

city _____ state _____ zip code

PAYMENT MUST BE ENCLOSED WITH ORDER.

How To Have Fun While

New 23-Channel 5-Watt All-Transistor CB Transceiver

Kit GW-14
$89.95

Assembled GWW-14
$124.95

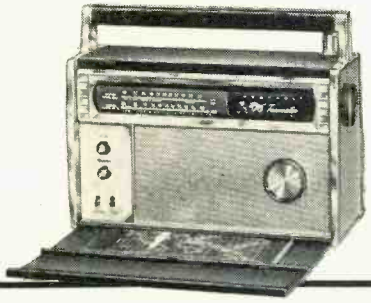
23 crystal-controlled transmit & receive channels for the utmost reliability. Low battery drain . . . only .75 A transmit, .12 A receive. Only 2⅞" H x 7" W x 10½" D . . . ideal for car, boat, any 12 v. neg. gnd. use. "S" meter, adjustable squelch, ANL, built-in speaker, PTT mike, aluminum cabinet. 8 lbs. Optional AC power supply, kit GWA-14-1, 5 lbs. . . $14.95.

New Fully Automatic Electronic CW Keyer

Kit HD-10
$39.95

All-transistor circuitry. 15-60 words per minute. Solid-state switching—no relays to stick or clatter. Convertible to semi-automatic operation. Built-in paddle. Self-completing dashes. Variable dot-space ratio. Built-in sidetone. Keys neg. voltages only, such as grid-block keying. Transformer-operated power supply. Fused. 6 lbs.

New All-Transistor, 10-Band SWL Portable



Kit GR-43
$159.95

10 bands tune longwave, broadcast, FM and 2-22.5 mc shortwave. 16 transistors, 6 diodes, 44 factory-built & aligned tuned circuits. Two separate AM & FM tuners, two built-in antennas, 4" x 6" speaker, battery-saver switch. Operates anywhere on 7 flashlight batteries or on 117 v. AC with optional charger/converter GRA-43-1 @ $6.95. Assembles in 10 hours. 17 lbs.

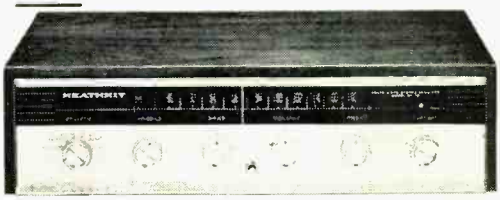
New Deluxe 5-Band SSB Ham Transceiver

Kit SB-100
$360.00

Full SSB-CW transceive operation on 80-10 meters. 180 watts PEP SSB—170 watts CW. Switch select for USB/LSB/CW operation. Operates PTT and VOX; VOX operated CW with built-in sidetone. Heath SB series Linear Master Oscillator (LMO) for true linear tuning. Mobile or fixed operation with appropriate power supply. 23 lbs. . . Accessory mobile mount, SBA-100-1. . . $14.95.

You Save...Build A Heathkit®!

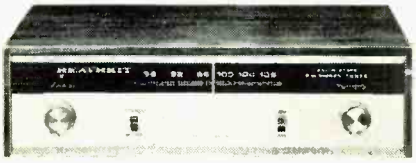
New 30-Watt Transistor FM Stereo Receiver



Kit AR-14 **$99.95** (less cabinet)

31 transistors, 11 diodes for transparent transistor sound; 20 watts RMS, 30 watts IHF music power @ ±1 db, 15-60,000 cps; wideband FM/FM stereo tuner, two pre-amplifiers, & two power amplifiers; compact 3⅞" H x 15¼" W x 12" D size. Assemble in around 20 hours. Mounts in a wall, or optional Heath cabinets (walnut $9.95, beige metal $3.95). 16 lbs.

Best Hi-Fi News of '66 . . . New Low Cost Transistor Stereo Twins!



New Transistor FM/FM Stereo Tuner

Assembles in only 4 to 6 hours! 14 transistor, 5 diode circuit; 5 uv sensitivity; less than 1% distortion; phase control for best stereo; 4-stage IF; filtered outputs; automatic stereo indicator light; preassembled & aligned "front-end". Install in a wall or either Heath cabinet (walnut $7.95, beige metal $3.50). 6 lbs.

Kit AJ-14 **$49.95** (less cab.)

Matching 30-Watt Stereo Amplifier

Assembles in 10 hours! 17 transistor, 6 diode circuit 20 watts RMS, 30 watts IHF music power @ ±1 db from 15-50,000 cps; Handles tuner, phono, auxiliary. No audio transformers . . . assures lower distortion, minimum phase shift. Install in a wall, or either Heath cabinet (walnut $7.95, beige metal $3.50). 10 lbs.

Kit AA-14 **$59.95** (less cab.)

Deluxe 6-Transistor AM Portable!

Kit GR-24 **$28.25**

Surpasses miniatures in performance and economy! Boasts large 4" x 6" speaker for a crisp, bold sound; slide-rule dial; "thumb-touch" controls; smooth vernier tuning; tuned RF stage & double-tuned IF stage for greater sensitivity and selectivity; big ½" diameter rod antenna for distant station pickup; handsome black simulated leather case. Build in 4 to 6 hours. Uses long-life "D" size flashlight batteries (not included). 5 lbs.

FREE 1966 Catalog!

Describes these and over 250 electronic kits . . . world's largest selection. Mail coupon, or write Heath Company, Benton Harbor, Michigan 49022.

HEATHKIT

Heath Company, Dept. 10-3
Benton Harbor, Michigan 49022

☐ Enclosed is $_____ plus shipping. Please send model(s)

_____

☐ Please send FREE 1966 Heathkit Catalog.

Name_____

Address_____

City_____ State_____ Zip_____

Prices & Specifications subject to change without notice. CL-239

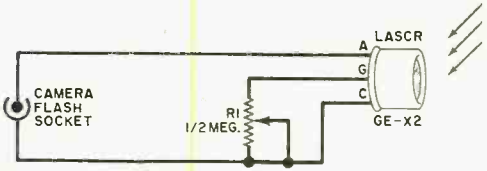
CIRCLE NO. 13 ON READER SERVICE PAGE

PARTS METHODS IDEAS GADGETS DEVICES

TIPS & TECHNIQUES

"PILLBOX" FIRES FLASH UP TO 30 FEET AWAY

Small enough to fit into a pillbox, this slave unit can fire a standard or electronic flash gun at distances up to 30 feet. A General Electric X2A light-activated SCR and a sensitivity control (a ½-megohm potentiometer) are installed inside the box. A small PC socket is mounted on the case cover to connect the flash gun to the light-sensitive mechanism. Before inserting a bulb in the gun, turn the sensitivity control all the way down to prevent the gun from firing. Then advance the control just enough to allow the slave to operate when it "sees" the flash gun on your camera take off.



If you advance the control too much, the slave may take orders from the available light and fire before you want it to.

—*William S. Gohl*

FLASHLIGHT CELLS PROTECTED AND DATED

When flashlight cells are to be stored away for future use, or when they are taken along on camping or fishing trips, they will be protected from water or moisture and quick deterioration if they are kept in readily available plastic pill containers. Some pill containers come with adjustable reminder dials. These can be used to note the time of the year you bought the cells. For example, if you bought the cells in the middle of September, you could set the pointer halfway between 9 and 10.

—*Art Trauffer*

(*Continued on page* 32)

THE MOST COMPLETE AND UP-TO-DATE GUIDE TO THE EXCITING WORLD OF SPECIALIZED RADIO COMMUNICATIONS!

ONLY $1.25

4
FACT-PACKED SECTIONS

Short Wave Listening
Amateur Radio
Citizens Radio Service
Business Radio Service

148 PAGES . . .

All-new and better than ever, the 1966 COMMUNICATIONS HANDBOOK brings you exclusive information on such vital subjects as getting started in SWL—buying equipment and station reporting; establishing your CB station, public service activities; ham license applications procedures, learning the code; typical business radio installations . . .

PLUS a special nation-wide listing of 250 amateur radio clubs offering code and theory courses and a roster of 400 CB clubs—both lists available nowhere else!

. . . and much, much more. Everything you need to know about your specialty is covered by a leading authority in the field—from basic instruction for the beginner through the most advanced data and techniques.

Complete with charts, tables and illustrations galore, it's a big, valuable "encyclopedia" of communications information you'll use all year long.

Just what you've been looking for? Then clip the handy coupon below and send for your copy today!

GET THE EXQUISITE LEATHERFLEX-BOUND EDITION *for just* **$3 POSTPAID!**

The 1966 COMMUNICATIONS HANDBOOK is now available in an attractive, gold-embossed, Leatherflex-bound edition—a superb addition to your library of permanent reference books. This deluxe volume will be mailed to your home, postpaid, for just $3.00, when you check the appropriate box on the order form.

Ziff-Davis Service Division • Dept. CH
589 Broadway • N.Y., N.Y. 10012

YES! Send me a copy of the 1966 COMMUNICATIONS HANDBOOK, as checked below:

☐ **$1.25 enclosed,** plus 15¢ for shipping and handling. Send me the regular edition. ($1.50 for orders outside the U.S.A.)

☐ **$3.00 enclosed.** Send me the Deluxe Leatherflex-bound edition, **postpaid.** ($3.75 for orders outside the U.S.A.) Allow three additional weeks for delivery.

NAME

PE-36

ADDRESS

CITY STATE ZIP CODE

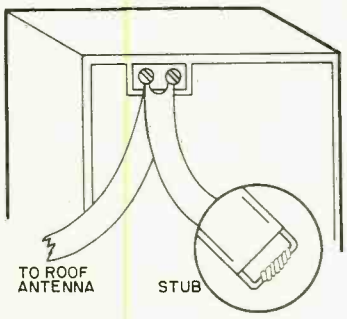
PAYMENT MUST BE ENCLOSED WITH ORDER.

TIPS

(*Continued from page* 30)

MISMATCH STUB CHASES TV GHOSTS

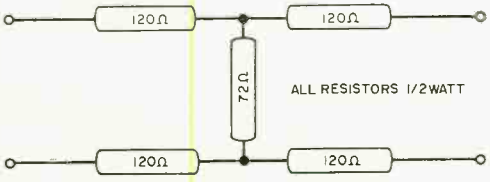
If you're haunted by ghosts on your TV screen due to transmission line mismatch, you can clear up this condition with a mismatch stub. This is simply an extra piece of 300-ohm transmission line connected across your set's antenna terminals to correct for slight amounts of mismatch. First, tune the TV set to the spooky channel. Then connect one end of a 3′



length of lead-in wire across the set's antenna terminals, letting the free end hang loosely toward the floor. Check to see if there's an improvement in the picture. Progressively shorten the stub by cutting into the insulation with a razor blade so as to short out the pair of wires. Cut the lead at the point where the ghost disappears or is substantially suppressed. Then twist the two wires together as shown. —*Warren Todd*

MAKE YOUR OWN TV SIGNAL ATTENUATOR

If you live in a very strong signal area, your TV set may be troubled by too much contrast, picture tearing, multiple images, or an annoying buzz you just can't tone down. You can cure these conditions with a simple attenuator pad inserted between the set and the antenna. The pad attenuates the signal without introducing any side effects such as transmission line mismatch. In the diagram of the



pad shown, the values given are for a 300-ohm line feeding into a TV set with a 300-ohm input. If the especially strong signals appear on one or two channels only, you can add a d.p.d.t. switching arrangement in the circuit to switch the pad in and out of the line as desired. —*Vincent Giscombe*

Is Hallicrafters' new solid-state,
23-channel (they all work),
S-metered, loud-hailer-
circuited, model CB-14 . . .
the ultimate CB transceiver?

See your dealer or
send for complete specifications,
and judge for yourself.
We're prejudiced.

hallicrafters

5th & Kostner Aves., Chicago, Illinois 60624
Export: International Division

Available in Canada through Gould Sales Co.

"Quality through Craftsmanship"

CIRCLE NO. 12 ON READER SERVICE PAGE

"He's a good worker. I'd promote him right now if he had more education in electronics."

NOW! TWO NEW PROGRAMS!

- Industrial Electronics for Automation
- Computer Processing Systems

ELECTRONICS LIBRARY

MATHEMATICS FOR ELECTRONICS

by O. Wolf and C. G. Latterner

This is the second in a series of self-instructional programmed manuals that Federal Electric Corp. intends to publish (the first was on transistors). As opposed to programmed manuals or instruction on radio theory, your reviewer has always been impressed by the potential of programmed math. This book has reaffirmed that conviction, especially since many of us can appreciate a refresher course in algebra. New students can certainly benefit from the well-thought-out programs. Just about everything useful in algebra and applicable to electronics is covered in this manual. Recommended.

Published by Prentice-Hall, Inc., Englewood Cliffs, N. J. 07632. Hard cover. 598 pages. $15.00.

EXPERIMENTS IN ELECTRICITY

by Richard W. Tinnell

Under this title are two separate volumes: one book on *Direct Current* and a second book on *Alternating Current*. Except for subject matter, which ranges from soldering to complex wave analysis, they are identical. Both volumes are laboratory exercise manuals suitable for the first year college student. Experiments are outlined as to objectives and procedures; questions are asked and provisions made for the answers to be filled in. All pages are perforated for easy removal.

Published by McGraw-Hill Book Co., 330 West 42 St., New York, N. Y. 10036. Soft covers. 128 pages (each). $3.25 (each).

VIDEO TAPE RECORDING

by Cris H. Schlaefer
Cedric L. Sulzman & Associates

This book is a "current status" report on video tape aimed at a non-technical audience. Anyone requiring background information on VTR (video tape recording) or some idea of the equipment used will find this volume useful.

Published by Hobbs, Dorman & Co., Inc., 441 Lexington Ave., New York, N.Y. 10017. Hard cover. 104 pages. $12.00. —30—

MESSENGER "100"

new! *Low cost—all solid-state* CITIZENS RADIO TRANSCEIVER

Check the performance features — then take a look at the price tag! You won't find a CB unit on the market that gives you as much value and reliability for your two-way radio dollar. The same highly competent engineering team that designed the famous Messenger III now brings you this low cost, compact, 5-channel transceiver for Mobile, Base or Portable field use! Delivers maximum power from legal input. High performance noise limiting for "whisper quiet" operation. Adjustable "squelch" control. Receiver is both sensitive and selective — unique speech compression circuit prevents overmodulation and delivers a crisp, clean signal without adjacent channel "splatter" . . . boosts average transmitted power for maximum readability at extended ranges.

ADVANCED CIRCUITRY FEATURES OF THE "100" INCLUDE:

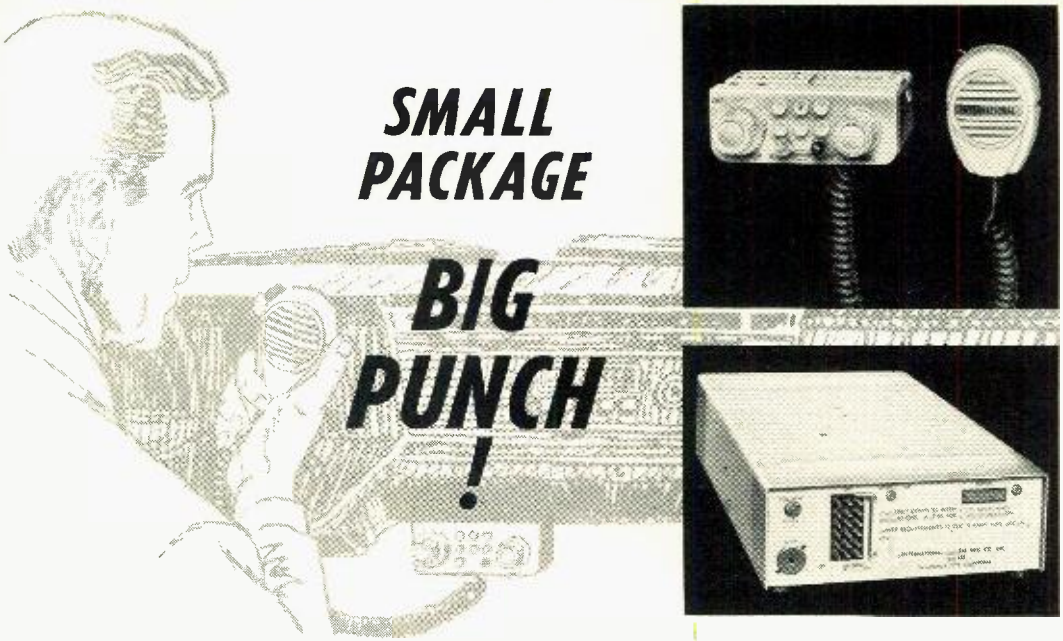
- *Narrow bandwidth receiver* for excellent selectivity!
- *High receiver sensitivity* for maximum range!
- *Unique speech compression circuit* which prevents overmodulation and helps deliver a clean, crisp signal without adjacent channel "splatter"! *Three types of usage* from *one* unit — Mobile, Base or Portable.

$129.95 NET (Mobile Unit)

E. F. JOHNSON COMPANY
2405 10th Ave. S.W. • Waseca, Minn. 56093

See your Johnson distributor or write today for complete details!

CIRCLE NO. 17 ON READER SERVICE PAGE



INTERNATIONAL Model MO TRANSCEIVER
For CITIZENS RADIO SERVICE

- New Compact Size
- New Solid-State Crystal Switching Circuit
- New Photo-Control Volume Circuit
- New Remote Control With Matching Microphone

The International Model MO Citizens Radio transceiver, custom designed for mobile installation, provides instant push-to-talk crystal controlled operation on any 6 channels with full 5 watts power input. The new compact control head provides complete remote controlled operation. All circuits are dc using solid-state crystal switching. The operating channel is indicated by an illuminated button on the control head. Tubes and silicon transistors are combined to provide a rugged trouble-free circuit.

The complete transceiver includes: a remote control head (about the size of a cigarette package), matching white microphone, new compact transmitting / receiving unit which may be conveniently installed in the trunk, and a matching white speaker which mounts under the dash. Operates from 12 vdc negative ground power source. Other power input units are available on special order.

See the "all new" International Model MO at your dealer today.

FCC Citizens Radio license required. All use must conform with Part 95, FCC Rules and Regulations.

INTERNATIONAL

CRYSTAL MFG. CO., INC.

18 NO. LEE · OKLA. CITY, OKLA. 73102

CIRCLE NO. 15 ON READER SERVICE PAGE

COVER STORY

FROM RAGS TO RICHES

The electronics hobbyist/experimenter is now king of the hill

By LOUIS E. GARNER, Jr.

BACK in the not-*too*-distant days when experimenters first started "tinkering" with radio circuits (they didn't even use the word *electronics* then), the average hobbyist had to make many of his own components. True, he could buy earphones, mounted crystal detectors, variable capacitors, and a few hardware items, but, quite often, he wound his own coils on empty oatmeal boxes and mailing tubes.

He made his own carbon resistors out of pencil leads and old dry cell battery anodes, assembled his own fixed capacitors from sheets of thin metal or foil and glass or waxed paper, wound his own audio and power transformers, and created wire-wound resistors by winding nichrome wire on ceramic tubes or mica strips. Sometimes, he even made his own crystal detectors by casting a small piece of galena ore in a lead mold. Mechanical hand tools, and a good assortment of brass screws, copper strips, magnet wire, Bakelite plates, knife switches, glass and porcelain insulators, and varnished cambric were the essential ingredients of the home radio laboratory.

With the advent of early radio broadcasting, the experimenter enjoyed a brief spell of comparative wealth. Manufacturers offered him pre-wound coils, crude vacuum tubes, rheostats, capacitors, resistors, and even complete radio receiver kits. For a time, in fact, the terms "radio experimenter" and "radio owner" were nearly synonymous, for only the very wealthy could afford commercially built receivers. Most receiver owners built their own sets, erected long-wire outdoor antennas, and delighted in bragging about how *their* sets could "pull in" stations nearly a hundred miles away "as clear as a bell."

But the experimenter's wealth was short-lived. As commercial broadcasting spread and the networks were established, mass production techniques came to the radio industry and the prices of receivers plummeted. Factory-built receivers would cost less, retail, than the parts needed to assemble a similar set at home.

For several decades, the radio-electronics hobbyist was left more or less to his own resources. Except for a few mail order houses and a few scattered distributors in large cities who catered to hams and experimenters, the hobbyist had no source of components. True, some items were available . . . but at prices which would seem absurd even by today's easy money standards.

The author—a teen-ager at the time—priced a "two-tube radio kit" a few years before World War II. The kit was offered "complete, less accessories" for only $5.95. But the "accessories," *all* of which were essential for operation, included a set of two vacuum tubes, an antenna kit, a set of plug-in coils, headphones, a set of batteries, a "ground" kit, and a cabinet. All together, the "complete" kit *and* accessories cost near-

Nearly everyone is interested in electronics—to some extent—from the serious student to the office practical joker who built Motorola's "Panic Button."

ly *twenty dollars!* At the time, 5-tube superhet receivers were selling, retail, for *under ten dollars!*

Important Steps Forward. Immediately after World War II, the greatly expanded electronics indutsry turned once more to the production of consumer products. At the same time, tons of electronic components and surplus equipment were released. Tens of thousands of GI's had received technical electronic training during the war, and these GI's, anxious to continue their training either professionally or as a hobby, were a ready-made market for electronic components and kits.

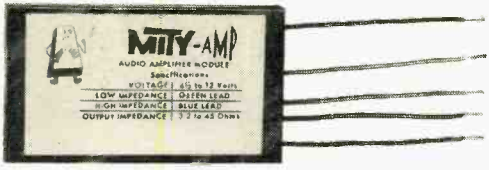
A number of firms, including Heath, Transvision, etc., purchased surplus components and used them in packaging low-cost equipment and television kits for the hobbyist. A complete oscilloscope kit in 1953 was sold for less than the pre-war price of a cathode-ray tube alone! At last, electronics hobbyists, now several hundred thousand strong, were on their way to acquiring status. Their strength and purchasing power were too large for the electronics industry to ignore.

The next important step came when Sylvania published a series of germanium diode circuit booklets. Although aimed at the experimenter, the booklets featured relatively expensive commercial and military diodes. Fortunately, surplus electronics parts dealers were offering similar diodes at extremely low prices. And now, mail order supply houses expanded their catalogs to include more experimenter components, new kit manufacturers entered the field, and a number of local distributors started to cater to hobbyist needs.

Another step forward came in 1953, when Raytheon introduced a low-cost experimenter's transistor: the CK722. Although its original cost of $7.50 seems high according to today's prices, it was then well under the *fifty dollar* price tag carried by other transistors. More important, *a major manufacturer had introduced a component specifically for the hobbyist!*

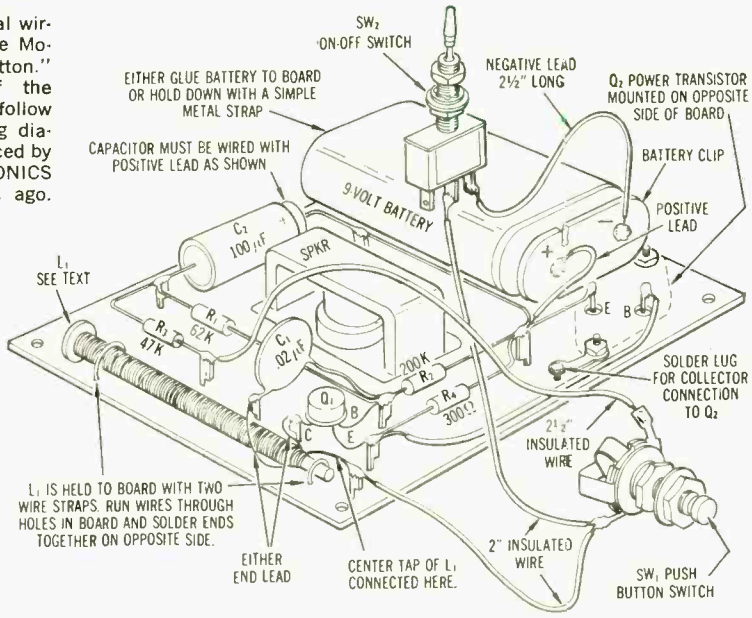
POPULAR ELECTRONICS, first published in October, 1954, gave the electronics hobbyist a new and powerful voice. At that time, there was no single magazine edited by a major publisher *just for* the electronics hobbyist. The other electronics publications were directed towards the needs of the professional technician, the advanced amateur, and the radio-TV serviceman. Other publications were strictly for the licensed amateur (ham) or the professional engineer.

During the past 12 years, more and more eletronics manufacturers have developed products for the experimenter until today even such industrial giants as RCA, Motorola, and GE are offering components and kits to the hobbyist market. Electronics hobbyists, now closer to a million strong, can choose from a wealth of electronic components designed specifically for *their* needs. As shown on the front cover, virtually a



One of the first modules on the market looked like this modern "Mity-Amp." Many experimenters didn't think these amplifiers would work until hobbyist magazines gave the self-contained units an okay.

This is the pictorial wiring diagram of the Motorola "Panic Button." Practically all of the project booklets follow the pictorial wiring diagram style introduced by POPULAR ELECTRONICS about eight years ago.



cornucopia of products and components is now available.

Project Booklets. As you may know from personal experience, the project or circuit booklet is an essential item to the electronics hobbyist. Few hobbyists are skilled technicians. Fewer still are professional engineers. Although many experimenters can modify and adapt circuits to their individual needs, most are unable to design their own circuits "from scratch" and must rely on published designs. Recognizing this need, many component manufacturers are now publishing their own experimenter project and hobbyist booklets. These are sometimes sold separately and sometimes included with component assortments and kits.

Just as today's components differ from those offered in the past, so are today's project booklets different from the earlier publications. Few early booklets included much more than a schematic diagram, a parts list, and a descriptive paragraph or two. In contrast, today's booklets describe bench-tested circuits in considerable detail, with photos, pictorial diagrams, and circuit descriptions comparable to those found in a feature magazine article.

Primarily devoted to SCR applications, RCA's KM-70 "Experimenter's Manual" discusses the theory and operation of solid-state devices, application considerations, and test procedures, then goes on to describe a series of construction projects based on the use of the RCA KD2105 Basic Experimenter's Kit and accessories. Most of the projects described are modifications of one or two "basic chassis" circuits. Project photographs are included, with call-outs to identify individual components. Among the interesting features of this booklet are its "Review Questions."

Now in its second edition, GE's "Hobby Manual" is a 200-page book chock full of information and projects of interest to amateurs, hobbyists, students, technicians, and engineers. Some 43 pages are devoted to fundamental theory, the care and handling of components, safety precautions, troubleshooting, and other useful data. Following the theory section are projects with photos, parts lists, schematic diagrams, circuit descriptions, and construction hints. The projects section is divided into four major subgroups: *Automobile Projects,* which includes such items as a burglar alarm, battery charger, tachometer, and SCR ignition system; *Entertainment Projects,*

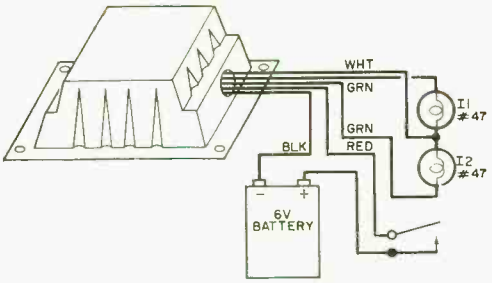
MANUFACTURER'S NAME AND ADDRESS	TRADE NAME	PRODUCTS OFFERED THE HOBBYIST/EXPERIMENTER			
		INDIVIDUAL COMPONENTS	SEMICONDUCTORS	COMPONENT KITS	SEMI-KITS
AMD ELECTRONICS 663 Dowd Avenue Elizabeth, N. J.	—		*	*	*
CARL CORDOVER & CO. 104 Liberty Avenue Mineola, L.I., N.Y.	—		*	*	*
CLAIREX CORPORATION 8 West 30th Street New York, N.Y. 10001	—		*	*	
FENWAL ELECTRONICS, INC. 63 Fountain Street Framingham, Mass.	—		*	*	
GENERAL ELECTRIC Electronic Components Div. Owensboro, Ky.	"X-Line"	*	*	*	*
HOME ELECTRONICS Division of GC Electronics Rockford, Ill.	Audiotex	*	*	*	
INTERNATIONAL RECTIFIER 233 Kansas St. El Segundo, Calif. 90246	IRectronics	*	*	*	*
J. W. MILLER CO. 5917 South Main St. Los Angeles, Calif. 90003	—				
MOTOROLA SEMICONDUCTOR 5005 East McDowell Rd. Phoenix, Ariz. 85008	"HEP Line"		*		
RCA Electronic Components Harrison, N. J. 07029	—	*	*		*
SAXTON PRODUCTS, INC. 215 N. Route 303 Congers, N.Y.	Hi-tron	*			
SEMITRONICS CORP. 265 Canal Street New York, N.Y. 10013	Semitron	*	*	*	*
SYLVANIA ELECTRIC PRODUCTS Div. of General Telephone Emporium, Pa.	—		*	*	
TRANS-TEK MFG. CO., INC. 300 North Ave. Garwood, N. J. 07027	Schemat-A-Kit				*
TRANSISTORS UNLIMITED CO. 462 Jericho Turnpike Mineola, L.I., N.Y.	TUCO	*	*	*	*
WORKMAN ELECTRONIC PROD. Box 3828 Sarasota, Fla. 33578	—	*	*	*	#
The national mail order distributors listed below offer extensive lines of experimenter and hobbyist					
ALLIED RADIO CORP. 100 N. Western Ave. Chicago, Ill. 60680	Knight	*	*	*	*
LAFAYETTE RADIO 111 Jericho Turnpike Syosset, L.I., N.Y.	Argonne	*	*	*	*
OLSON ELECTRONICS 260 S. Forge Street Akron, Ohio 44308	—	*	*	*	*
RADIO SHACK CORP. 110 Federal Street Boston, Mass.	Archer	*	*	*	*

* Currently available. # To be offered in near future.

MODULES	PROJECT BOOKS	REMARKS
*		Booklets included with kits
*		One of the first with a module line
		Photoconductors
		Thermistors
	*	Also offers educational kits
*		Serviceman's line as well
*	*	Also offers educational kits
*		Major coil manufacturer
#	*	May offer complete kits in future
	*	Newest entry with experimenter line
*	*	Extensive line of wire products as well
	*	Offers tools and accessories also
	*	Features photoconductor kit
		Some packages are in "book" form
		Also offers etched circuit boards
#		Also offers test equipment and tools

Items, including proprietary kits, semi-kits and modules.

*	*	Very broad line
*	*	Has a number of local "associate" stores
*		Features periodic tabloid flyers
*	*	Offers items through many local stores as well



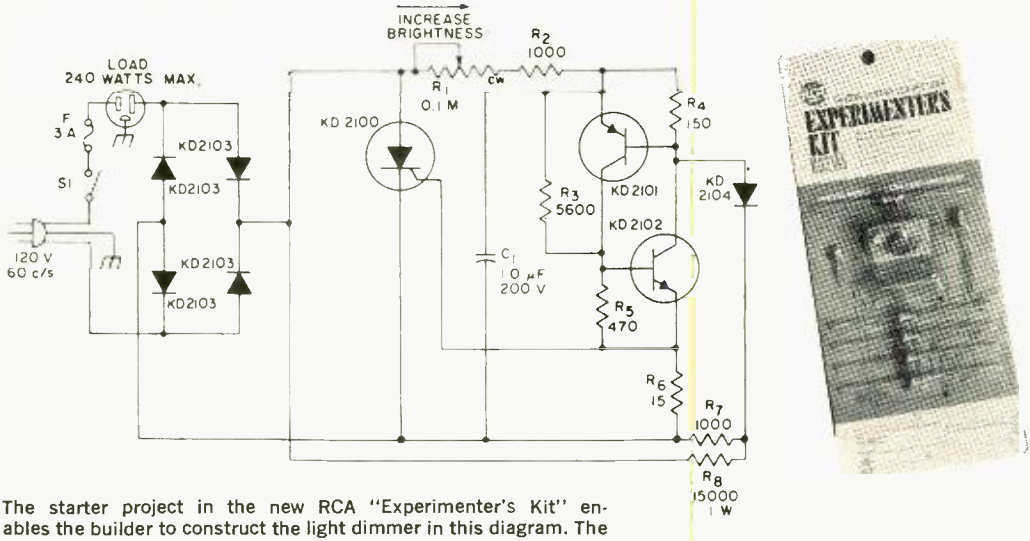
Assembling a project with a module is easy. This dual flasher needs only the module, battery, switch and light bulbs. Hard-core experimenters say that these projects offer the builder no challenge.

which covers a magic lamp, light flasher, unijunction organ, all-band receiver, etc.; *Home or (Camp) Projects,* which describes, among other projects, a night light, speed control for appliances, and a temperature alarm; and, finally, *Workshop Projects,* which includes heat controls, a phototimer, a temperature regulator, a meterless voltmeter, and d.c. power supplies.

The Motorola booklet, "Solid State Projects," devotes a chapter to each construction project, including, quite often, a photo of the completed project in use. Both schematic and pictorial diagrams are presented, and the text covers circuit description, construction and layout hints, plus typical project applications.

A series of smaller booklets as well as several larger reference manuals are offered by International Rectifier. Wallet-sized, the smaller booklets describe projects and circuits featuring specific types of semiconductors, with individual booklets devoted to SCR's, zener diodes, rectifiers, photocells (and sun batteries), and transistors. The larger manuals cover theory and application in greater detail, with major emphasis on engineering techniques and design methods.

But the major manufacturers are not the only firms offering project and circuit manuals. Semitronics, Saxton Products, and others have published useful booklets featuring their own product lines. The Semitronics' booklet, "Electronic Projects," is divided into two parts, each containing some 25 construction projects (50 in all). The first part is aimed at the beginner, and covers relatively simple projects, with semi-pictorials, schematics, and close-up photographs. The second part, for the more



The starter project in the new RCA "Experimenter's Kit" enables the builder to construct the light dimmer in this diagram. The kit contains the semiconductors and heat sink, and nothing else.

advanced hobbyist, emphasizes projects of greater complexity and, in general, features a schematic diagram, photo, parts list, and brief description only.

Experimenter Components. Although some distributors continue to sell individual components in bulk from dirty and, often, mislabeled bins, more and more experimenter components are supplied in sealed "blister" packages. The number and variety of components offered varies from one manufacturer to another. A few firms offer only semiconductor devices. Others, such as Semitronics, limit their lines to the components, tools, and accessories needed for the projects described in their circuit manuals. Still others, such as Workman Electronic Products and GC Electronics, offer broad lines running the gamut from hardware to complete circuit modules.

Quite often, the component package includes a detailed instruction sheet or booklet describing one or more construction projects in which the component can be used. General Electric includes a circuit diagram with each component in its "X-line," while International Rectifier generally features a small project booklet as an integral part of its component packages.

Almost every major semiconductor manufacturer sells low-cost devices suitable for experimenter and hobbyist projects, but several companies have developed specific lines for this market. The GE "X-line" has 20 items in all, including SCR's, diodes, rectifiers, transistors, a zener diode, a reed switch, a thermistor, a UJT, and other useful devices. In Motorola's "HEP" line, there eventually will be 29 categories of semiconductor devices and several project manuals. The International Rectifier line of packaged components runs the gamut of semiconductor devices from simple diodes to a variety of transistors; there are SCR's, zeners, and photocells, as well as heat sinks, mounting kits, and even a low-current, low-voltage motor designed for operation on solar batteries.

Component *kits* are packaged by Fenwal Electronics, Clairex, International Rectifier, Sylvania, Workman, etc. The typical "kit" is an assortment of similar devices suitable for use in a variety of experimental projects. Fenwal offers thermistor kits; Clairex, a photoconductor kit; and International Rectifier, photocell, zener diode, SCR, and transistor kits. Priced well below the total cost of the individual components, such kits are excellent buys for the serious hobbyist, student, and experimenter just stocking his laboratory. In addition to the special kits offered by major manufacturers, many large distributors package their own "bargain" assortments. Distributor-packaged kits may include resistors, capacitors, coils, hardware, volume con-

(*Continued on page* 98)

Are you a flincher? Try your hand at Reflex... an electronic game of skill

BUILD A REFLEXOMETER

By JAMES FISHBECK

THE PERFECT Rx for pooped-out parties or for those rainy evenings when you're looking for something to do is to play "Reflex"—a game of skill which shows your wizardry with electronics, and also shows which of your guests can respond properly and more quickly to a given situation. The situation in this case, is created by certain selected dice throws. All you need to play is a pair of dice, a set of poker chips, a jaw-tight determination to prove how fast your reactions really are, and a "Reflexometer."

Two, three, or four people can play the game.

There's a bonus for you, too; the Reflexometer has other applications both for work and for play, some practical and some not so practical.

Four hand-held push-button responders, each a different color and each manned by a different player, tie man and machine together. The first man to press the button lights a lamp that corresponds to his responder. The lamps are wired through a system of four relays which permit only one lamp to light at a time. Once a lamp lights, it remains lit even after the button is released. Second best is no good: the other lamps cannot be illuminated, at

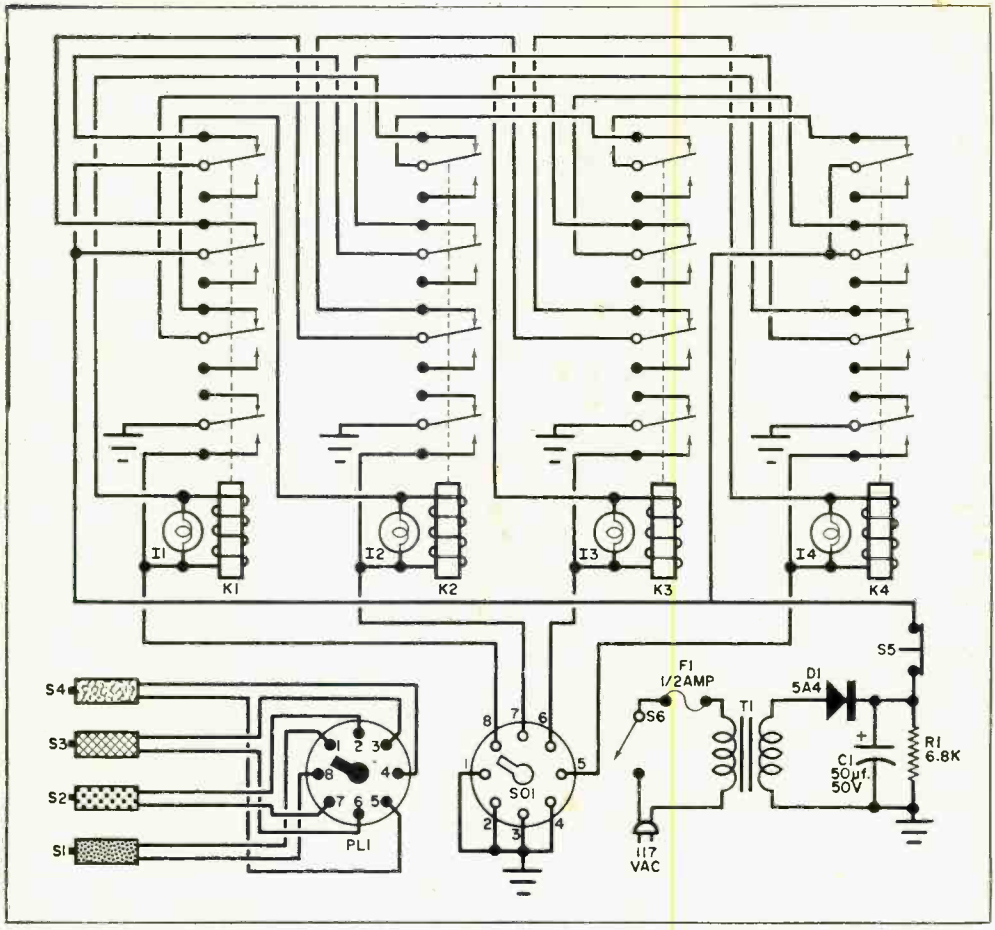


Fig. 1. Responders S1 to S4 can complete only one relay circuit at a time. The first switch closed latches its respective relay, lights its lamp, and disables the other relays until the circuit is reset.

least not until the winner collects, and the reset button is pressed.

How To Play "Reflex." Each player starts with 25 poker chips. All players roll the dice once to see who starts. The one who rolls the highest number goes first. He starts the game by rolling the dice.

Any double or combination of 7, or 11, is a "reflex" roll, and the first person (including the player who rolled the dice) to press his responder switch in response to a reflex roll, wins the round and collects a chip from each of the other players. If no proper reflex action occurs on the throw, the player who rolled the dice does so again until one of the players wins. The dice are then passed to the next player on the left. Of the 36 possible combinations of the dice, 14 (approximately 40%) are reflex rolls.

Sounds simple, doesn't it? But there's a human element to complicate matters. Quite often those who respond first lose; edgy players, those most anxious to register first, are most likely to flinch. A flinch is a false or a premature response that causes the light to come on when it shouldn't. If a player flinches, and his lamp shows that he did, he pays a penalty of one chip apiece to the other players. The dice are not passed on a flinch.

Tension mounts as the game progresses, and if you are a good student of human behavior, you may try some maneuvers such as feigning a flinch to send an anxious player over the hill

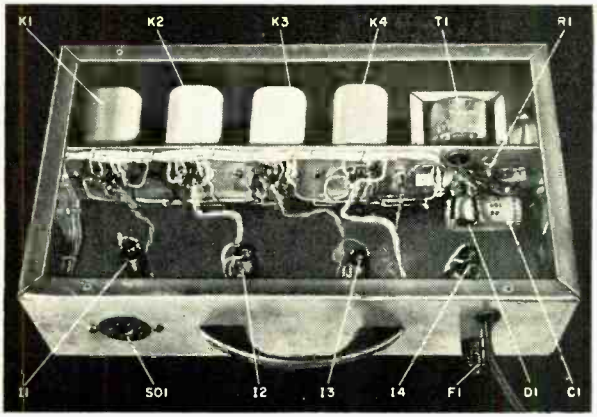


Fig. 2. Construction is simple. Another way to assemble the Reflexometer is to do away with the subchassis and mount the relays on top side of case.

with his nervousness. The player with the most chips, after another player loses all, is the winner.

You can also use the Reflexometer to show which event in a series of actions occurs first, such as in a foot race or a slot-car race. Switches installed on the track and wired to the unit act as impartial judges. (Perhaps, if such a device were available years ago, we would know today which came first—the chicken or the egg.)

How the Reflexometer Works. Each of the four responders, containing one of the switches *S1* to *S4* (Fig. 1), is connected to one of the relays (*K1* to *K4*) and to one of the lamps (*I1* to *I4*). The first button depressed completes a circuit for its associated relay and indicating light. If *S1* is pressed first, for example, *I1* lights and *K1* energizes. When the armature of *K1* pulls in, one of the contacts on the relay completes the relay circuit to ground and, like an electrical latch, holds the relay energized and the lamp lit even after the responder button is released.

The three remaining sets of contacts on *K1* open the B+ leads to *K2*, *K3*, and *K4* to prevent these relays from kicking in on a second-best response. The circuit remains latched until *S5* is depressed. When *S5* is momentarily opened, *K1* de-energizes and the Reflexometer is ready for the next round of play.

Transformer *T1* steps down the line voltage to 24 volts, and *D1* functions as a half-wave rectifier. Capacitor *C1* filters the B+ and *R1* acts as a bleeder and tends to regulate the voltage.

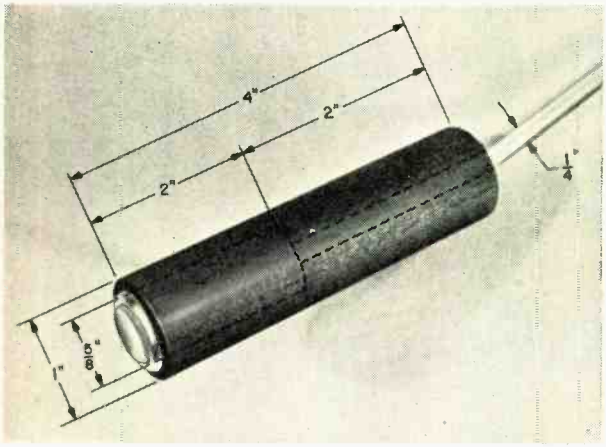


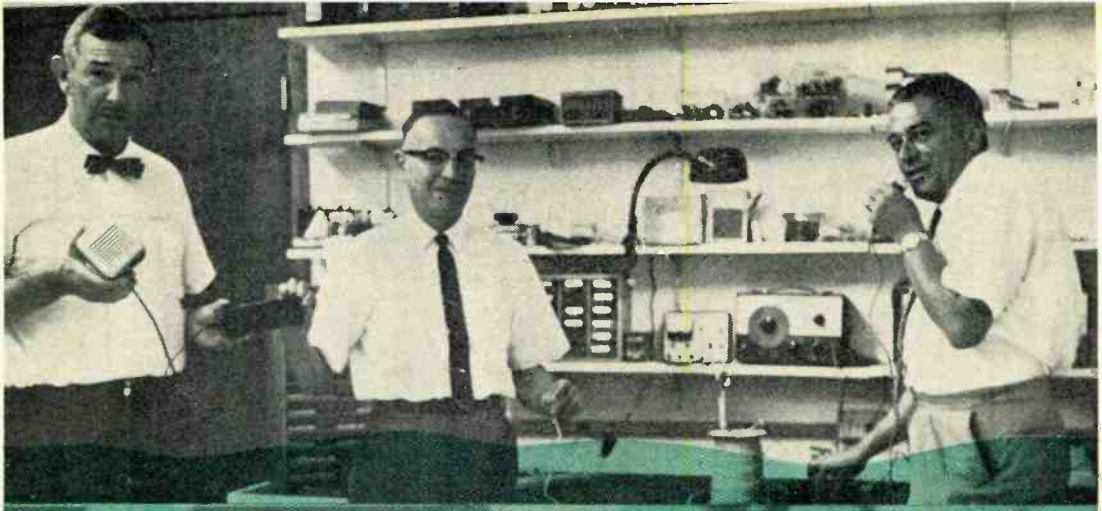
Fig. 3. Switches mounted on one end of wooden dowels make suitable hand-held responders. Any normally open push-to-close type of switch can be used.

Construction. A 12" x 7" x 3" aluminum chassis holds all the parts, except the responders. The four relays and

(*Continued on page 96*)

PARTS LIST

C1—50-μf., 150-volt electrolytic capacitor
D1—5A4 diode (or equivalent)
F1—½-ampere fuse
I1, I2, I3, I4—313 28-volt miniature lamp
K1, K2, K3, K4—Relay, 4-p.d.t., 24-volts, d.c. (Potter & Brumfield KHP17D11 or equivalent)
PL1—Octal plug (Amphenol 86-PM8 or equivalent)
R1—6800-ohm, 1-watt resistor
S1, S2, S3, S4—Normally-open push-button switch (Eagle 188 or equivalent)
S5—Normally-closed push-button switch (Arrow-Hart & Hegeman 3392-AE or equivalent)
S6—S.p.s.t. toggle switch
SO1—Octal socket (Amphenol 88-8 or equivalent)
T1—117-volt to 25.2-volt filament transformer, 1-ampere (Chicago-Stancor P6469 or equivalent)
4—Colored indicator light assemblies (Dialco 931-102, 932-102, 933-102, 935-102)
1—7" x 12" x 3" aluminum chassis (Bud AC-408 or equivalent)
1—7" x 12" aluminum bottom plate (Bud BPA-1595 or equivalent)
1—2" x 13" piece of 20-gauge aluminum
1—Miniature fuse post (Littlefuse 342014 or equivalent)
1—Lamp cord, white vinyl plastic (Knight POT—25' spool)
4—1"-diameter wood dowels
Misc.—Small handle, rubber mounting feet (4), rubber grommets, hardware, hookup wire, etc.



Wallace L. Minto holds a small loudspeaker as he demonstrates the passage of a Plasmonic signal through his associate, Bill Mucher. Another associate, Jack Faber, talks into a microphone connected to the Plasmonic transmitter and the 500-foot coil of wire on the laboratory bench.

THE SARASOTA PLASMONICS?

If this scientist is right, two new terms (Hydronics and Plasmonics) will be added to the electronics lexicon

TWICE, in 1965, a scientist-experimenter named Wallace L. Minto invited observers to a communications demonstration in Sarasota, Florida. On both occasions, the observers left the demonstrations confused, or at least bemused, by what they had seen. According to Minto, a totally new electronic phenomena was being shown: communications via Hydronics and Plasmonics.

In the first demonstration, Hydronics enabled "wireless" voice communication from dockside to a scuba diver. The observers also heard the tone signal from a Hydronics transmitter sealed in a buoy and towed through Sarasota Bay. The transmitters were black boxes, but all other equipment (power supplies, microphones, etc.) were commonly available items. The only distinguishable component of unusual size or shape was a dipole antenna fabricated of Monel metal with a spread of about 10 feet. As Minto put the dipole into the Bay, Hydronics signals could be heard; as the antenna emerged, the signals died away.

Six months later, Minto held another demonstration, only this time it was of Plasmonics—similar to Hydronics but not requiring the dipole antenna. In place of the antenna, a single wire can be used between transmitter and receiver, or a block of metal, or a body of water, or even the earth itself. Shades of Tesla!

Voice transmission via Plasmonics through the single wire was

unaffected when the wire was cut and capacitors, resistors (extremely high values), chokes, or even diodes back to back inserted and the "circuit" completed. The observers saw no return circuit, and any time the wire was cut, the Plasmonic signal took a drastic drop in volume. Observers used their own bodies to "conduct" the Plasmonic signal, grasping the end of the wire in one hand and the input terminal of a Plasmonic black box in the other. Additional bodies made no difference in signal strength—as long as they held hands. The small size of the black boxes seemed—to the observers—to eliminate the chance of capacitive coupling as a tentative explanation of the phenomena.

Who Is Minto? From the time he entered Columbia University in 1938, Minto has been a respectable maverick in the sciences. Reportedly a brilliant chemistry student, Minto went on the War Production Board in 1942 and the famous Manhattan Project in 1944. Following the end of World War II, he ventured into the commercial world and now lives comfortably on royalties from his patents. He is a member of various professional and scientific societies, and has been called a qualified expert witness by Federal Courts in at least nine different subjects. As far as can be determined, Minto is not particularly oriented toward electronics or radio communications.

With a secure reputation, pulling some 50 observers from the

U.S. Navy, a dozen large corporations, and a few university labs to Sarasota was no problem to Minto. The demonstrations were obviously impressive, and none of those present offered a conventional explanation of what they had seen and heard. Various press reports were published and cognizance taken of Hydronics in the Proceedings of the Naval Institute.

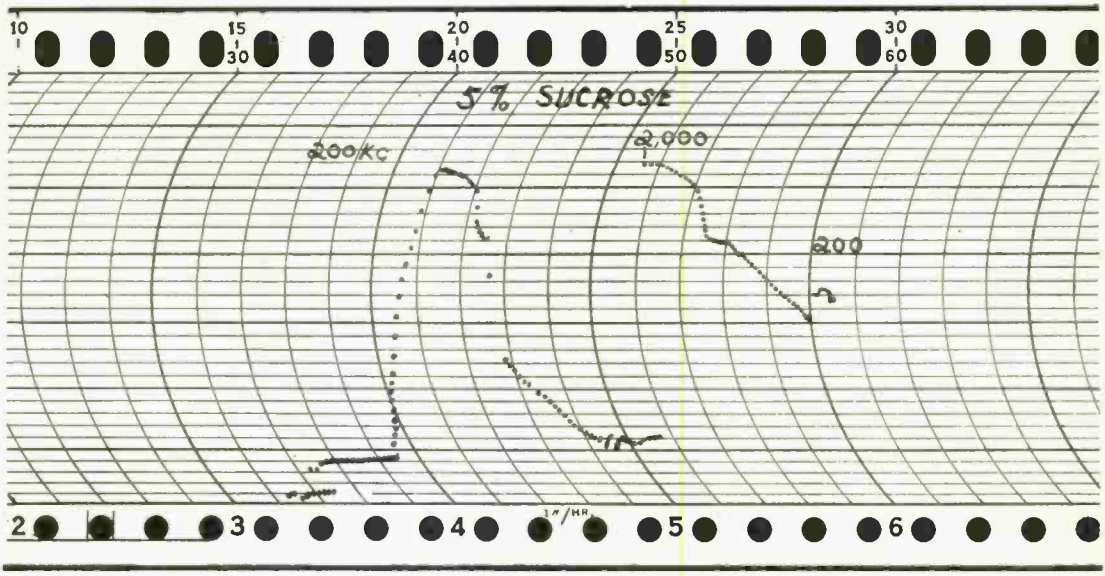
Minto is seemingly a scientist determined to profit from his discoveries. He and his staff will talk about this new wave and its characteristic behavior, but they don't say a word beyond that. Such secrecy is normal in a profit-making venture, although not particularly normal—but absolutely legitimate—for a scientist. Until full defensible patent protection is assured, and until Hydronics, Inc., is satisfied that military security is not involved, Minto and his staff are sitting tight.

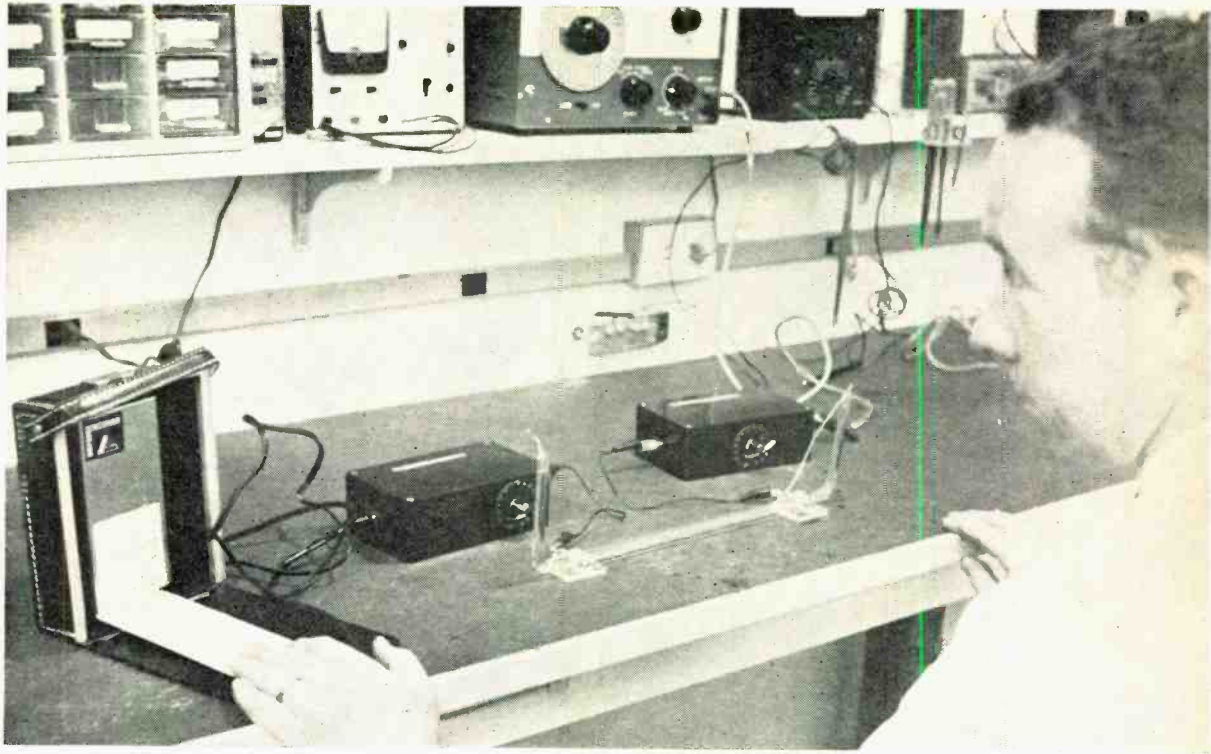
Enormity of the Discovery. If Plasmonics is a bona fide discovery, the potential is so great as to stagger the imagination. Here are longitudinal waves that travel like sonic waves through water, but at speeds that deny their relationship to sonar. Minto has also demonstrated that various materials possess specific characteristics of transmission of Plasmonics waves at various frequencies. Further proof of this particular effect is claimed by Minto in his tape recording of a Plasmonic signal from the nuclear explosion last October in the Aleutian Islands.

Minto and his associates visualize using Plasmonics for standardized spectrum analysis of material in a state of flux—such as molten steel in a crucible. They also look toward the eventual use of Plasmonic hardware to effectively double telephone and telegraphic facilities without stringing more wire. Underwater communication will obviously benefit from the use of Hydronics, and if Minto is only partially correct, the practical aspects of Plasmonics waves are overshadowed by the possibility that these waves may provide information on the missing links between radiation and electron flow.

But for the moment, the scene is confusing. Something has been accomplished—but what? -30-

Using a simple glass tube test rig, Herb Schuessler of Hydronics, Inc., records the transmission spectra of fluids. A sine-wave generator modulates the Plasmonic transmitter (black box at the right) and the signal is propagated down the tube, received by another black box, and the strength recorded. Antennas inserted in the ends of the U-shaped glass tube are made of platinum wire. Below is a typical chart recording of a transmission spectra obtained from this apparatus. Reading from left to right, the audio generator is tuned down from 200,000 to 200 cycles. Plasmonic indications show the "turn on" point to be 21,000 cycles and the main peak response at 1900 cycles. There is a discernible knee at 400 cycles.





HYDRONICS (UNDERWATER TRANSMISSION)

From the meager information released by W. L. Minto, plus what observers could deduce, Hydronics has the following properties:

- Unknown type of radiation (called Plasmonics), similar to radio waves, but only effective under water. Transmissions were interrupted as soon as the antenna was withdrawn from Sarasota Bay.
- Using a dipole antenna, the radiated field pattern is a figure 8, but coaxially aligned with the dipoles, contrary to normal radio wave radiation that would maximize perpendicular to the dipole.
- Velocity of propagation stated to be "at least" 100,000 miles per second—far above sonar range.
- Disturbance or agitation of the water has no effect on Hydronics transmissions.
- Signal strength attenuation said to be according to inverse square law, although one transmission to a distance of 30 miles was claimed.

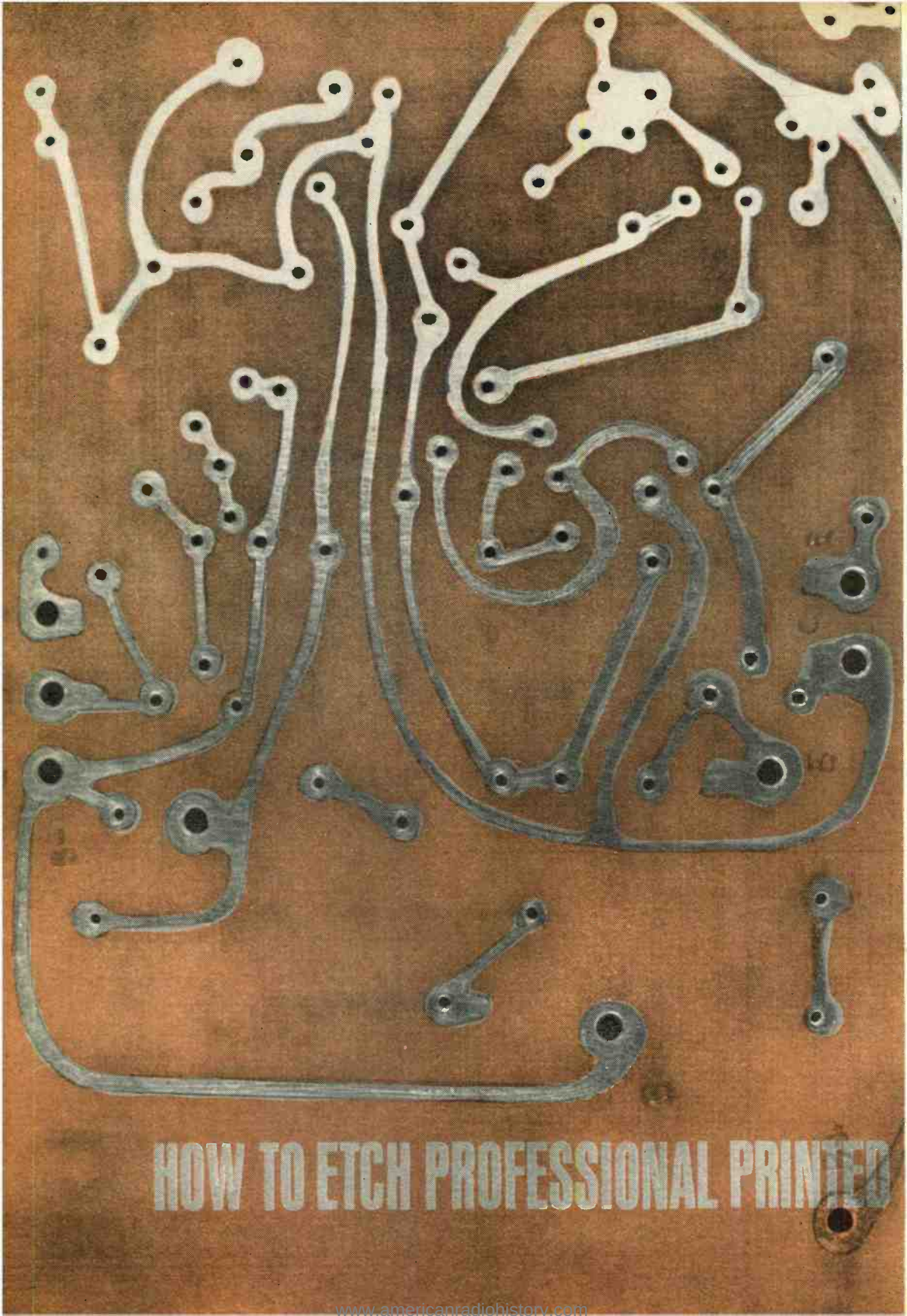
CAN PLASMONICS BE DISCREDITED?

Observers have proposed some of the following tentative pro and con explanations of the Plasmonics phenomenon:

Plasmonics are really low frequency (10-20 kc.) radio transmissions: The unexplainable directivity of the dipole antenna seems to refute this. Also, why are the signals stronger out of the water? It should be the other way around.

Plasmonics is a close-range lab experiment using simple capacitive coupling: Even capacitive coupling has sensitivity as to distance, so why do the observers need to hold hands to couple the signal between transmitter and receiver? If capacity coupling were involved, the observers wouldn't need to touch one another.

Plasmonics is just another gimmicked demonstration: Possibly, but certainly of unbelievable cleverness. Why should a scientist —even as unconventional as Wallace Minto —try to deceive his peers? If it is gimmicked and uses radio waves, one observer tuning from 200 kc. through the FM broadcast band could find no suspicious signals.



HOW TO ETCH PROFESSIONAL PRINTED

Be As Good As The Experts

By JAMES A. GUPTON JR.

CIRCUIT BOARDS

THE HOBBYIST who has totally escaped the era of microminiaturization must live a sheltered life, indeed. For, with the expanded use of transistorized circuits—not to mention monolithic integrated circuits—in everything from toys to television sets, no up-to-date experimenter can stand idly by in the presence of this great technological revolution.

Much of the credit for this rapid change in manufacturing technique belongs to the space-age scientists whose constant demand for more complex instrumentation in the limited space aboard orbiting satellites has revolutionized the electronics industry. Yet, at the heart of every miniaturized circuit stands the "printed circuit," which came into being more than a decade ago.

Printed Circuit Techniques. The general term "printed circuit," or "printed wiring," as it is sometimes called, refers to a laminated board with an insulating base. The base material is usually a phenolic board to which a layer of metal foil is bonded. The foil may be on either one or both sides of the board.

Printed circuits offer many advantages to the experimenter, hobbyist, and engineer. With relatively little practice on the part of the builder, a complete printed circuit can be produced in less time than is required to make a wired circuit, and with a substantial reduction in space requirements. They can be produced by many different processes including etching, stamping, embossing, and plating.

Of the various techniques that can be used, the etching process is by far the least expensive and most popular method. It is also the simplest and most adaptable to the needs of the home builder. The basic materials you will need are described below.

Making an Etched Circuit. An etched circuit is made by masking certain portions of a copper-clad laminate circuit board with an etch resistant ink or tape strips (called "resist") to correspond to specific circuit wiring. Then the entire circuit board is immersed in an etching solution which etches away all unmasked copper, without affecting the phenolic board. After the resist is cleaned off the etched copper, the printed circuit is ready for use.

As a beginner, you'll probably find it both convenient and economical to start with one of the many printed circuit kits which you can buy from most electronic equipment supply houses. The kits contain a variety of materials and parts including etching solution, a glass or plastic tray (or bag) in which to do your etching, printed circuit sockets, liquid or tape resist materials, and an assortment of copper-clad circuit boards. If you plan to do a lot of etching, you'll probably be better off buying just the right material in the amounts needed for a particular job.

Printed Circuit Boards. Most parts distributors carry a large assortment of printed circuit boards. These are of the copper-clad type which provide high conductivity and good solderability. For special applications, other metal foils such as silver or aluminum can be used; these are non-standard materials, however. Copper thicknesses vary from 0.0007 to 0.0094 inch. The circuit board base is usually made from Bakelite, epoxy, silicon, Teflon, fiberglass, or paper-base phenolic material that has been impregnated or coated with a thermosetting phenolic resin and pressed into a hard solid sheet. The phenolic board is by far the most widely used. If you ask your parts distributor for Vectorbord, you are sure to get the right thing.

The sheets are available in thicknesses ranging from 1/64 to 1/4 inch. For most applications, the 1/16"-thick boards (approximately 2 mils) are ideal. The electrical properties of paper-base laminates are set by the National Electrical Manufacturers Association (NEMA), and consist of the following grades: X, XX, and XXX. The letter "P" after the grade designations, as in XXXP, denotes that the material has good punching qualities. The best electrical properties are found in Grade XXXP, while Grade X has the poorest, and costs less.

Etchant Resists. The ink, tape strip, or other materials that are used to mark those areas of the copper laminate that make up the printed circuit, is referred to simply as *resist*. There are many different types of resists on the market; paraffin wax, special types of ink, resists in tubes with ball tips for writing on the copper, and press-on adhesive tape, are among numerous types that can be used.

The recent appearance of a wide assortment of etch-resist transfer sheets with straight lines, circles, ellipses, and dozens of pads with different diameters definitely add a professional touch and tend to obsolete all other types. The designs of one manufacturer, Emi-Tron Associates (North Hollywood, Calif.) are shown in Fig. 1.

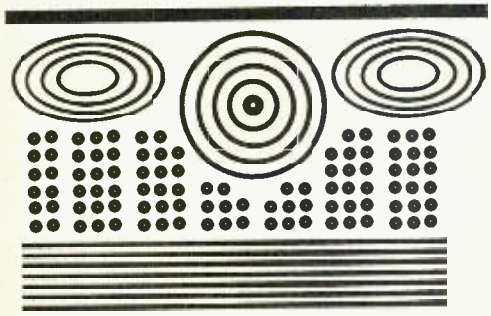


Fig. 1. Once the basic layout is made, you can use tape resist transfer sheets like these to give your circuit board a really professional appearance.

Etchant Solution. For the etchant solution, you have a choice of acids, oxidizers, or corrosive alkali. Of all these, ferric chloride is the most popular. Another widely used etchant is ammonium persulfate, the main advantage of which is that it does not contaminate the insulating phenolic board during the etching process.

Acids are the least desirable since they produce an exothermic reaction when diluted. However, if you do want to use an acid, the cardinal point to remember is that you must add the acid to water when diluting a concentrated solution. *Never* add water to the acid because the heat resulting from the reaction will cause the water to boil and might spatter the acid.

If you use ferric chloride powder, dissolve one pound of the powder into one pint of hot tap water. Slowly pour the ferric chloride into the water, allowing the solution to cool off when it becomes hot before adding additional ferric chloride. If you are using a concentrated solution of ferric chloride, you must first pour the solution into a mixing bowl, and then add water according to the directions that come with the package. When completely dissolved, the ferric chloride will have a dark reddish brown color. A word of caution: watch out for ferric chloride stains on your clothes and hands.

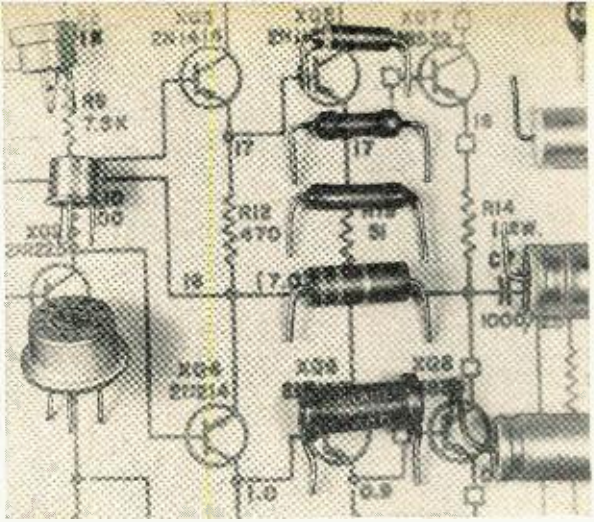


Fig. 2. Carefully redraw the schematic for best layout of components, using the actual parts to determine minimum spread between component leads.

Making a Layout. First you must plan your circuit board layout on paper—preferably on graph paper. This means you must study the schematic diagram carefully and then try to lay out the board to suit the circuit. The trick is to redraw the circuit in such a way that the "wires" don't cross each other, and this is not always an easy task. The characteristic patterns you see on a printed circuit board are largely due to this effort.

Where conductors must cross, as they sometimes will, select a point where a resistor, coil, or other circuit component intersect, and then let that component bridge the gap. If you find you can weave all your circuit paths to keep conductors from being boxed in when they are to continue to another point on the circuit board, you just know you are working like a pro. If—after you have

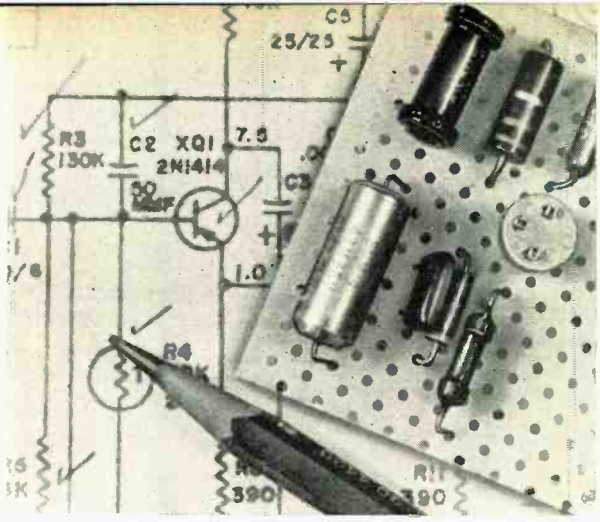


Fig. 3. Mock-up of printed circuit board showing preliminary parts layout. Terminals are interconnected in accordance with circuit schematic diagram.

exhausted all your efforts and skills—you find you are still fenced in, terminate the lead near the crossing point and continue on the other side of the line without touching the conductor being crossed. Later you can drill a hole at each end where the interrupted lead should meet, and then bridge the gap with a jumper wire while you are assembling the circuit.

In general, component and wiring leads can be soldered directly to the copper foil for permanent connections. But if the leads may have to be removed often, plan on using copper or brass eyelets at such points.

Preparing the Board. In addition to the copper-clad board which is going to be etched, secure a piece of unclad perforated circuit board of the same size. The perforated holes should be 1/16" in diameter, and spaced 3/16" between hole centers. You should also have at hand at least one each of the components that will be mounted on the finished printed circuit board.

Cut excess lengths from the component leads, bend the leads to form a right angle, and place them in position on the redrawn schematic diagram as shown in Fig. 2. By doing this you can determine the required distance between terminal connections and see what the final circuit layout will look like.

Once you have checked off, and accounted for, the location of all circuit components, your next task is to make a mock-up circuit board using the perforated board and the actual circuit components. You should bend all leads as close as possible to the component body, and insert leads into the nearest grid holes (Fig. 3). The component and lead spacing must not be closer than specified in Fig. 4. Also, trim each lead length so that at least 3/16" protrudes beyond the back surface of the perforated board.

With components in place on the mock-up board, place a flat surface, such as a piece of cardboard, over the circuit components and flip the assembled perforated board over on its back. Then, using a grease pencil, circle each hole with a component lead protruding through it. Draw the necessary interconnecting lines between circles as shown in Fig. 5. Flip over the circuit board again and remove each component, marking the corresponding reference designation from the schematic (*R1*,

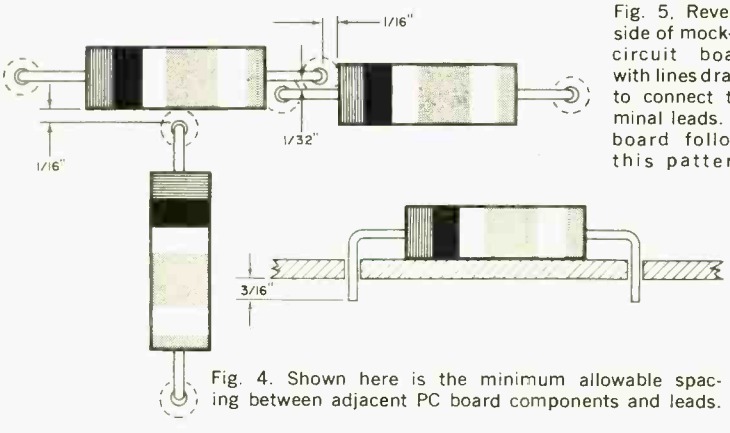
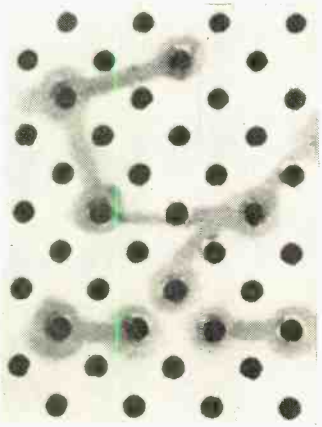


Fig. 4. Shown here is the minimum allowable spacing between adjacent PC board components and leads.

Fig. 5. Reverse side of mock-up circuit board with lines drawn to connect terminal leads. PC board follows this pattern.



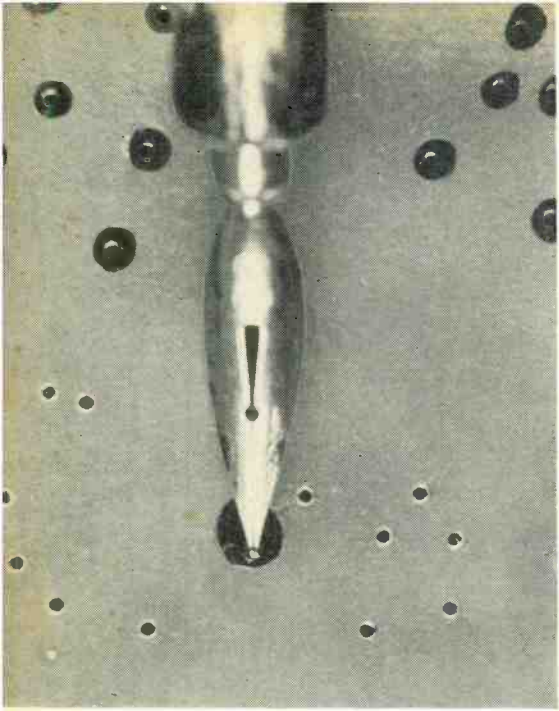


Fig. 6. Use a pen or other applicator to put on liquid resist. After all drilled holes are circled, draw lines to connect them following your sketch.

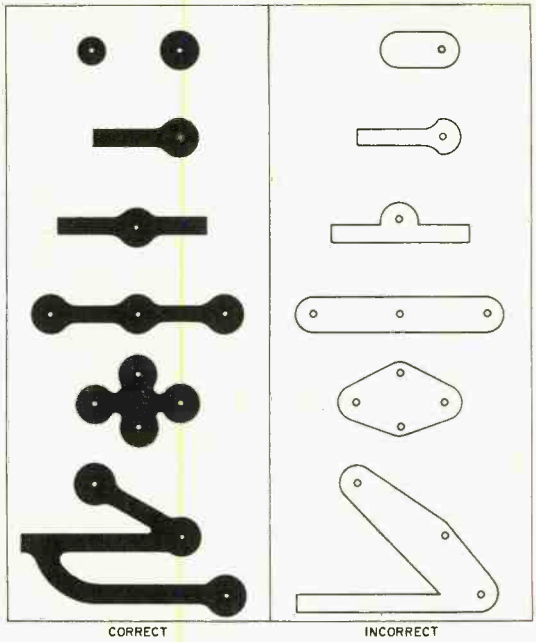


Fig. 7. As you work, be sure that paths are properly terminated as shown here. Incorrect terminations may result in poor etching and circuit arcing.

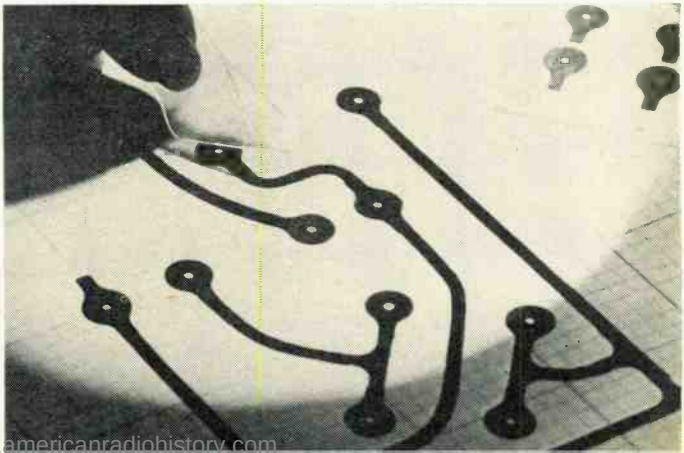
C4, etc.) as each component is removed.

Tape the perforated circuit board to the foil side of the copper-clad board with the marked-up side of the perforated board exposed. Using a #53 bit, drill a hole down through the copper-clad board from each circled hole in the perforated board. After all holes have been drilled, untape and separate the boards. (You may put the perforated board aside for the time being.) Then remove all burrs from the copper foil using No. 000 sandpaper or steel wool.

Thoroughly wash the deburred copper-clad surface using a cleanser, such as Ajax or Comet, to remove grease or other foreign particles. Then rinse with clean water to remove all traces of the cleanser, and dry with a clean, soft rag. From here on out, you should try to avoid touching the copper surface with your hand or fingers.

To etch out a circuit on the copper-clad laminate, you apply a resist to all areas where copper is to remain, and the areas that are not covered with the resist are etched away.

Applying the Resist. Before you apply the resist, you should rough out the interconnecting lines between the holes on the copper foil with a pencil. Use the mock-up perforated board as a guide. Now you are ready to apply the resist.



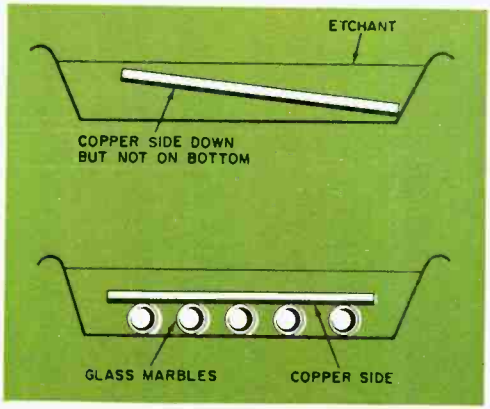


Fig. 9. Place copper surface on glass marbles in a nonmetallic tray with etchant solution at a temperature of 90° to 120°, and agitate frequently.

If you elect to use a liquid resist, circle each hole using a pen or applicator, making sure that the diameter of each circle is approximately four times the diameter of the hole (Fig. 6). The pen, or other applicator, is usually supplied with the resist. After all holes have been circled, draw lines to connect them in accordance with the penciled sketch. The connecting path drawn from each circled hole should be wide enough to carry the current in that circuit.

The table below can be used to figure optimum circuit line width. However, in no case should the path be narrower than 1/64 of an inch. The proper methods for terminating paths are shown in Fig. 7. When all paths have been covered with resist, and the ink has dried thoroughly, you will, at long last, be ready to make your first printed circuit board.

Incidentally, the author prefers, and recommends, the use of tape resist strips that are not only much simpler to apply, but which also give the finished circuit that certain professional appearance. Figure 8 shows "By-Buk" resist

CURRENT CAPACITY IN AMPERES				
Line Width	Thickness of Copper Conductive Pattern			
	0.0015	0.003	0.005	0.0067
1/64"	3	5	7	10
1/32"	5	8	10	13
1/16"	10	15	18	22
1/8"	15	20	25	32
1/4"	23	35	41	48

Fig. 8. Resist transfer sheets being applied. Rub on over desired area and peel back sheet leaving resist on surface.

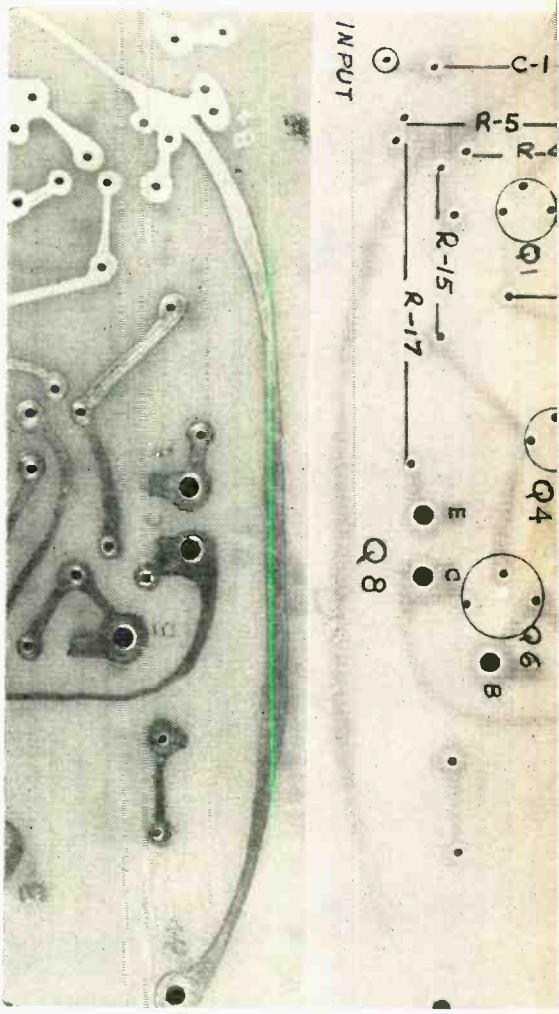


Fig. 10. When the etching process is complete, wash the board to remove all traces of etching solution. Then, before dismantling the mock-up board, mark location of each component with India ink.

strips being applied, and the neat appearance certainly speaks for itself.

To use tape resist, simply place the transfer sheet on which it comes, pigment side down, on the copper surface, and rub the back of the sheet with a pen or pencil to transfer the resist to the copper. Then the sheet is rolled back, and the resist stays stuck to the metal.

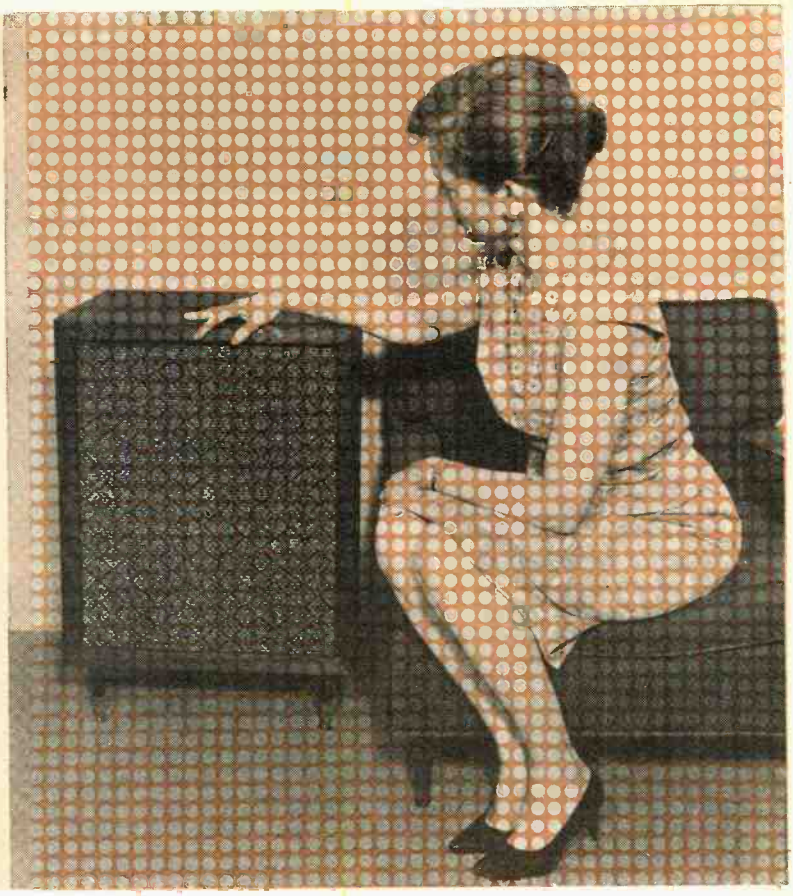
With tape resists such as these, you can make attractive and functional boards without spending a single day in a drafting school. What's more, if you do make an error, you have only to scratch off the resist with a razor blade or pen knife.

(*Continued on page* 91)

PUT AN AIR BRAKE ON YOUR WOOFER

How to get good bass response out of a $5.95 speaker without boom

By DAVID B. WEEMS



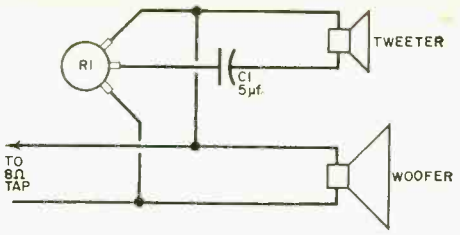
AN INTERESTING development in the evolution of the bass reflex enclosure was "friction loading" as used by Goodmans of England, wherein an "acoustic resistance unit" (A.R.U.) is placed across the open port to reduce the boom effect. While it really worked, it was criticized by some audio designers as a waste of power—the audio equivalent of driving a car with the brakes on—but the concept is ever with us and is gaining more advocates.

Actually, the speaker itself undergoes a kind of braking action to reduce overshoot and distortion. In the case of expensive speakers, the braking action is enhanced by a powerful magnetic field through which the voice coil travels. Low-cost speakers are more likely to suffer from "hangover" due to weak magnets; poor suspensions don't help either. Because the magnets are costly, their weight alone is sometimes a fairly good indication of speaker quality, particularly within a brand line. However, consideration of weight alone can be quite misleading, as different magnet materials have different magnetic strengths per ounce. When it comes to magnets for speakers, the larger the magnetic strength (gauss), the better.

But if the speaker is completely enclosed and vented to provide just enough resistance to the air flow, the restoring force to the cone is quite similar to that obtained from the magnetic field surrounding the voice coil. Therefore, instead of trading dollars for magnets to put on the brakes, when you build an enclosure, you can incorporate the A.R.U. feature.

Air brakes and large magnets are fine, but there is more to a good speaker. In the case of a woofer and its low frequency response characteristic, the lower the cone resonant frequency the

better. The $5.95 speaker used here checked out unusually well in this respect; resonance in "free air" was on the order of 35 to 40 cycles. A separate small tweeter and an L-pad is used to handle and balance the upper portion of the audio spectrum.



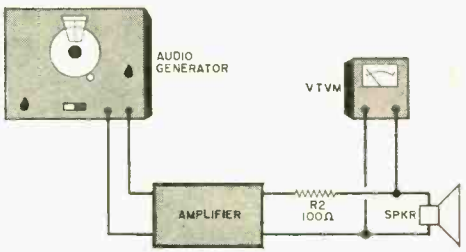
Low and high audio frequencies are separated by C1 and kept in balance by L-pad R1. For best results, the tweeter and woofer must be wired in phase.

Experiments With a $5.95 Woofer. The first experiment saw the woofer mounted in a 1 cu. ft. box similar to the "Cinderella" enclosure (October, 1965). Performance was fairly good, but the 35- to 40-cycle bass resonance of the speaker—when enclosed in the box—moved up to 75 cycles, and so some potential bass response was lost. Turning up the bass control on the amplifier helped, but the overall effect was that of a woofer with a mild case of claustrophobia. The sound was not as satisfying as that produced by the small woofers in the Cinderella system. Evidently, a larger box was in order.

Next, continuing with the infinite baffle concept, a larger enclosure was used. In the new sealed box, the bass resonance dropped to 55 cycles, and the bass response was much better than you would expect from a low-priced woofer—sound was good but not spectacular. Indications were that the size of the enclosure was right, and the time had arrived for the addition of the A.R.U. feature.

Then the tedious part of the experiments began—drilling holes by installments and testing the results of each additional set of holes. The tests clearly demonstrated the inadvisability of just putting any old speaker in any kind of box. So, if you want to adapt this idea to other speakers, and make your own tests, you'll have to use an audio generator and a VTVM connected as shown in the diagram of the test setup.

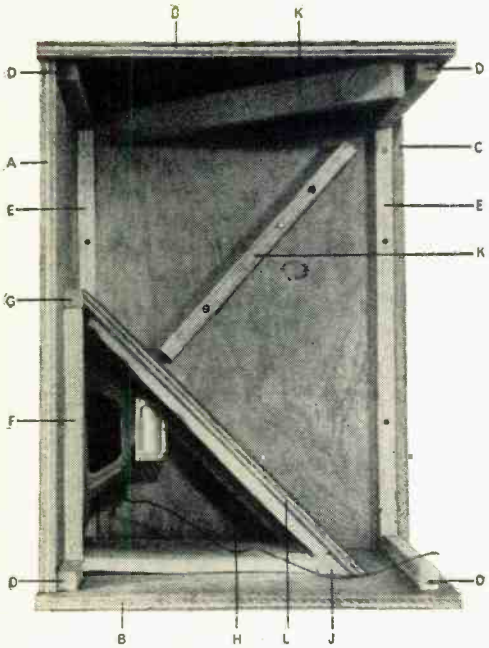
The first batch of holes was drilled in the bottom of the box, converting the system from a sealed enclosure to a bass reflex type. With each series of holes, the voltage across the speaker voice coil was checked as the audio generator signal was varied from 200 cycles down to 20 cycles. The first sweep showed a voltage peak at 70 cycles and another at 25 cycles. Since these peaks were not even close to equal distance from the original peak of 35-40 cycles, it was obvious that the box was mistuned. Going back over the frequency run again showed that the peaks were also greatly unbalanced in amplitude, the lower peak being about twice as high as the upper peak.



Typical test setup required to determine speaker and enclosure resonant frequencies if you use a different speaker or change cabinet dimensions.

Unfortunately, too many holes had been drilled. Tacking two layers of ½-inch polyurethane foam plastic over the holes brought the upper peak down to 60 cycles and lowered the amplitude of the lower peak, which proved that you can tune a bass reflex enclosure with an A.R.U.

After closing some of the bottom holes to obtain better matching, work was begun on the enclosure interior. After all, the original purpose of the box was to try the air brake idea with a resistive compartment around the woofer. Next, 165 ¼-inch holes were drilled into the triangular side piece (*M*) and the sloping back panel (*L*) until the remaining voltage peaks at 54 cycles and 21 cycles were insignificant. That point was reached with 170 holes in the sloping panel. A further frequency run showed dips in sound output at some points—apparently internal reflections were



Except for the front, all inside surfaces of the woofer cage are covered with faom plastic. Loosely pack the woofer cage with a sheet of fiberglass.

BILL OF MATERIALS

A—18" x 22" x ¾" plywood for front and rear (2 required)
B—17½" x 19½" x ¾" plywood for top and bottom (2 required)
C—17½" x 22" x ¾" plywood for sides (2 required)
D—16½" x ¾" x ¾" cleat (4 required)
E—22" x ¾" x ¾" cleat (4 required)
F—11" x ¾" x ¾" cleat
G—11¾" x ¾" x ¾" cleat
H—16½" x ¾" x 1½" cleat
I—11" x ¾" x 1½" cleat (1 side faced 45°)
K—1" x 2" diagonal brace for top, back, and both sides (about 96" required)
L—17½" x 12½" x ¾" plywood
M—11¾" x 11¾" x ¾" plywood (cut diagonally
1—3-sq. ft. sheet of polyurethane foam plastic
1—3-sq. ft. sheet of fiberglass
1—2-yd. piece of cheesecloth
1—24" x 28" piece of grille cloth
4—4" legs (optional)
*1—CTS-10WF 10" woofer**
*1—TS-5051 3½" tweeter**
C1—5-μf., 25-volt capacitor
*R1—8-ohm L-pad (Calrad LP-8 or equivalent)**
Misc.—1¼" x 8 flat-head wood screws (1 box), 2½" x 8 flat-head wood screws (6), glue, plastic, veneer, or stain and varnish, molding, etc.

*Available from McGee Radio Co., 1901 McGee St., Kansas City 8, Mo. (Woofer, $5.95; tweeter, $2.95, L-pad. $1.49. Shipping cost extra.)

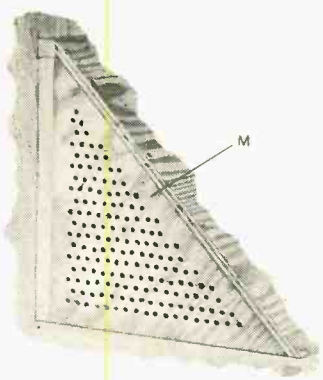
NOTE: Cleats and braces can be made from pine; all other lumber is at least 5-ply wood.

causing cancellations. Foam plastic was stretched over the drilled panels, and the compartment was filled with fiberglass to alleviate this problem.

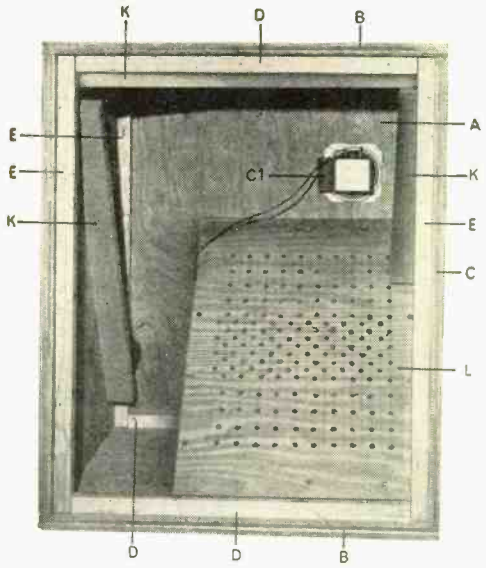
Compared to earlier listening tests, the sound quality was significantly improved. The bass response appeared to be smooth and extended further downward in range from the former limits. However, there was one criticism offered by careful listeners; the low end seemed to be too well damped. Several more sets of holes were drilled in the sloping panel, bringing the total up to 250. This change produced a fuller bass, but still not boomy. However, the lack of boom produced a slight imbalance in favor of the tweeter, and so a tweeter control (*R1*) was added as a further refinement.

Construction. You can cut costs by using the cheapest grade of construction plywood available; such material is satisfactory from a performance standpoint, but for good appearance must be covered. However, a good furniture finish calls for a good grade of lumber.

Except for the diagonal braces (*K*) which are used to stabilize the large unsupported surfaces, and the cage around the woofer, construction of the enclosure is quite ordinary. Strips of ¾" x ¾" pine (*D, E, F,* and *G*) are screwed and glued to the front panel, and cleat *H* is fastened to the side panel in a similar manner, to simplify construction of the woofer compartment. The drilled triangular side panel of the cage (*M*) is fastened to the bottom and front with glue and with six 2½" x 8 flat-head



Cage side cover is held in place by 2½"-long screws fed into front and bottom of cabinet from outside, and by 1¼" screws through piece L.



Location of tweeter is not critical. Cover side away from woofer cage and back with polyurethane foam plastic. Glue and screw all cleats in place.

wood screws. These screws are fed into the cabinet from the outside.

When installing the woofer, run the wires through one of the holes in the side panel. The opening in the front panel for the woofer is 8½" in diameter; its center is 6¼" in from the side and 6¼" up from the bottom. Stretch and tack ½"-thick polyurethane foam plastic over all inside surfaces of the woofer compartment except the front. Wrap some cheesecloth around a strip of 1"-thick fiberglass (about 1' wide and 3' or 4' long) and fold this strip of padding loosely into the woofer compartment. You can then screw the sloping back panel into place.

Location of the tweeter can be any place on the upper part of the front panel. The amount of padding in the outer box is of minor importance. About a ½" layer of foam plastic on the side away from the cage and back will do. The tweeter control can be installed in any convenient location, preferably on the back panel.

You can finish and trim the outside of your enclosure to match the decor of your home. Note that the front panel is slightly recessed to accommodate the grille cloth and permit flush mounting of molding. Legs are optional. -30-

UPCOMING IN THE APRIL ISSUE

(on sale March 17)

BUILD ULTRASONIC OMNI-ALARM SYSTEM

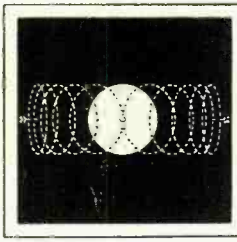
You'll find construction plans for a new burglar alarm system in our April issue. Photoelectric systems can be "seen" and aluminum foil strips can be short-circuited. Ultrasonics provides a foolproof answer, but instead of detecting movement as in devices being sold this system uses an ultrasonic "beam." You can't see the beam and, since the beam can be reflected, it is almost impossible to find the transmitter and receiver. This is one of the most unusual and spectacular projects ever published in POPULAR ELECTRONICS.

TESTING! TESTING! TESTING!

Only a year or so ago, hi-fi test records were so forbiddingly technical that an engineer was needed to interpret the results. But no longer—a new variety of test records has hit the market that enables the hi-fi enthusiast to check out his complete system—from cartridge to speaker—without leaving his easy chair. This detailed article tells all about test records—the very technical ones and the non-technical discs that can do the same job for less money and a lot less trouble.

TOOLS & TEST EQUIPMENT

This is the theme of the April issue. Some of the little known pieces of test equipment you'll find handy in your laboratory are discussed. A separate article tells about some tools you'll be surprised to find available. Complete information on these out-of-the-ordinary items is provided.

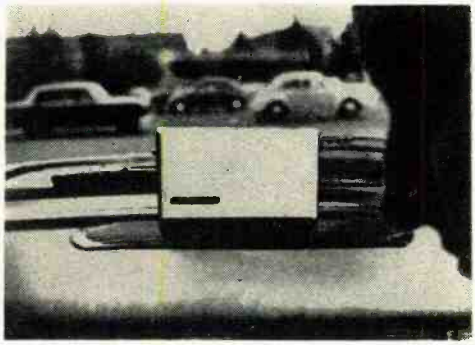


ZERO-BEATING THE NEWS

NOW YOU CAN LISTEN FASTER—A harmonic compressor which allows "speed hearing" of recorded speech at word rates comparable to speed reading (300 to 400 words a minute) has been developed by Bell Telephone Laboratories. Drs. M. R. Schroeder (left) and R. M. Golden (center) of Bell Labs discuss the electronic device with M. R. Barnett, executive director of the American Foundation for the Blind. The instrument permits making recordings of the human voice which can be played back at twice their normal speed while retaining normal voice pitch. It divides in half the frequency components in a voice recording but retains the original syllable rate. By doubling the speed of the recording, the frequency components are restored to their original values, and syllables pour out twice as fast. The high-pitched "Donald Duck" babble that results when an ordinary record is speeded up is eliminated. The unit should greatly benefit the blind.

"HOT ELECTRONS"—Microwave frequencies as high as 12 kilomegacycles have been generated by scientists at NASA's Electronic Research Center (ERC), Cambridge, Mass. This frequency is believed to be twice as high as any previously achieved with semiconductors. The microwaves were generated by means of a phenomenon recently discovered by J. B. Gunn of International Business Machines —the interaction of "hot electrons" in semiconductor material. A low d.c. voltage is applied across a gallium arsenide crystal measuring less than one-thousandth of an inch thick, and is converted to continuous-wave microwave power. This advance in microwave research was made by Dr. Harold Roth, and two associates, W. Deter Straub and John A. Ayer. The new results appear promising for future spacecraft transmitters as they are expected to improve the efficiency of signal transmission. Weak signals from space, said ERC Director Dr. Winston E. Kock, are difficult to process without highly complex equipment. If the vacuum tubes presently required to handle the higher frequencies can be replaced with solid-state generators, an improvement in efficiency is possible.

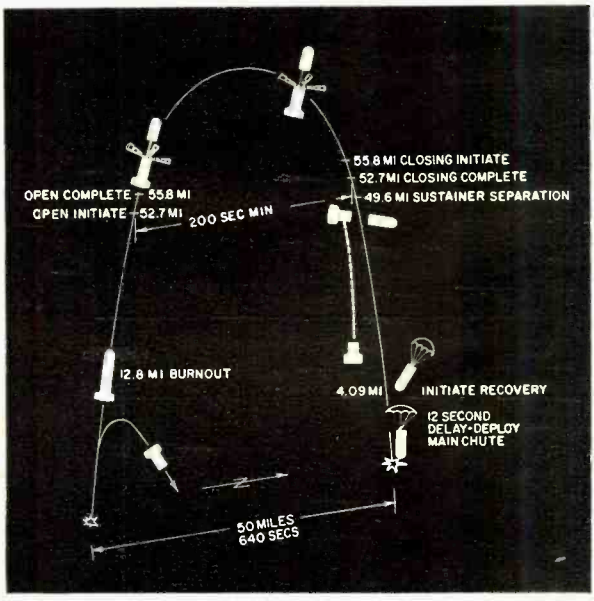
RADIO TRAFFIC WARNING SYSTEM—Small VLF receivers such as that mounted on the dashboard of the auto below are part of a system undergoing tests by Telefunken engineers on a stretch of highway in Hanover, Germany, to warn motorists of driving hazards ahead. The system transmits these warnings via inductive loops buried alongside the highway. As each loop extends for about two miles, it restricts transmitter coverage to the area covered by the loop, and only drivers passing through it hear the broadcast. Consequently, many transmitters can operate in the same vicinity on the same frequency without causing mutual interference. The hearts of the system are inconspicuous cabinets standing away from the highway. Each contains a 40-watt transmitter operating at 70 kc. as well as a multitrack tape recorder which is remotely controlled from a control center. A coded signal switches on the receiver as it passes through the loop. In the event a driver would like a report on the traffic situation when he is approaching the main highway, he can listen in on a VHF receiver.

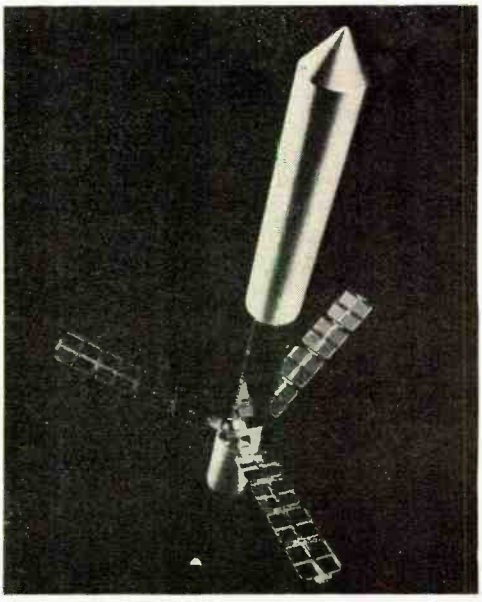


EARTH TREMORS TRIGGER ALARM— The Jolly Green Giant isn't the only creature who shakes the ground when he walks. Everyone does. And engineers at Westinghouse Electric Corp. are taking advantage of that fact to protect life and property. They have developed an automatic alarm system, called "Periguard," which forms a "no man's land" around the perimeter of a protected property. Any intruder who attempts to cross this protective strip of ground generates tiny earth tremors which are sensed by the alarm system. These small vibrations create pressure waves that are picked up by sensitive transducers buried below ground in the strip. The transducers convert the pressure changes into electrical signals which trigger an alarm. Placed around the perimeter of a factory, estate or other property, the system gives notice of any trespasser and pinpoints his location.

PHONE CALLS A LA CARTE—Busy executives can now mix their crepes suzette at lunch time with phone calls using a "Pocket Fone." Manufactured by the Chromalloy Co., West Nyack, N.Y., a Pocket Fone permits them to take calls up to a half mile away from their office telephone on a small remote unit. The system consists of a base unit which holds a standard telephone, the remote device and a battery charger, and an ear plug for optional use. The call actually comes through to the pocket-sized device which then functions as a cordless extension for normal two-way conversation. As it operates on the 27-mc. Citizens Band, no licensing is needed. A Pocket Fone leases for $20 a month.

RETRIEVABLE ROCKET CATCHES MICROMETEOROIDS—When meteor showers occur, the upper atmosphere contains hundreds of times more tiny particles or micrometeoroids than at any other period. During the annual Leonid meteor shower which took place around the 14th of November, NASA launched a 10'-long retrievable rocket payload from White Sands, New Mexico, with the idea of catching some of these elusive particles. The vehicle, called "Luster" by its builders, Electro-Optical Systems of Pasadena, Calif., a subsidiary of Xerox Corp., has three 5.5' retractable arms with 12 collection pans mounted on them. At approximately 52 miles up, Luster's 7'-long nose section moved forward to expose its three arms. These opened to a position at right angles with the nose cone and remained extended for 200 seconds to catch the particles. The arms then folded closed, the nose cone retracted, and the payload landed by parachute. Flight time was about 11 minutes. NASA scientists, who believe that Luster's successful capture of these particles could shed new light on some hazards of space life, say it'll take six months to analyze and evaluate results.





BROADCASTS FROM AFRICA AND MIDDLE EAST

Prepared by BILL LEGGE

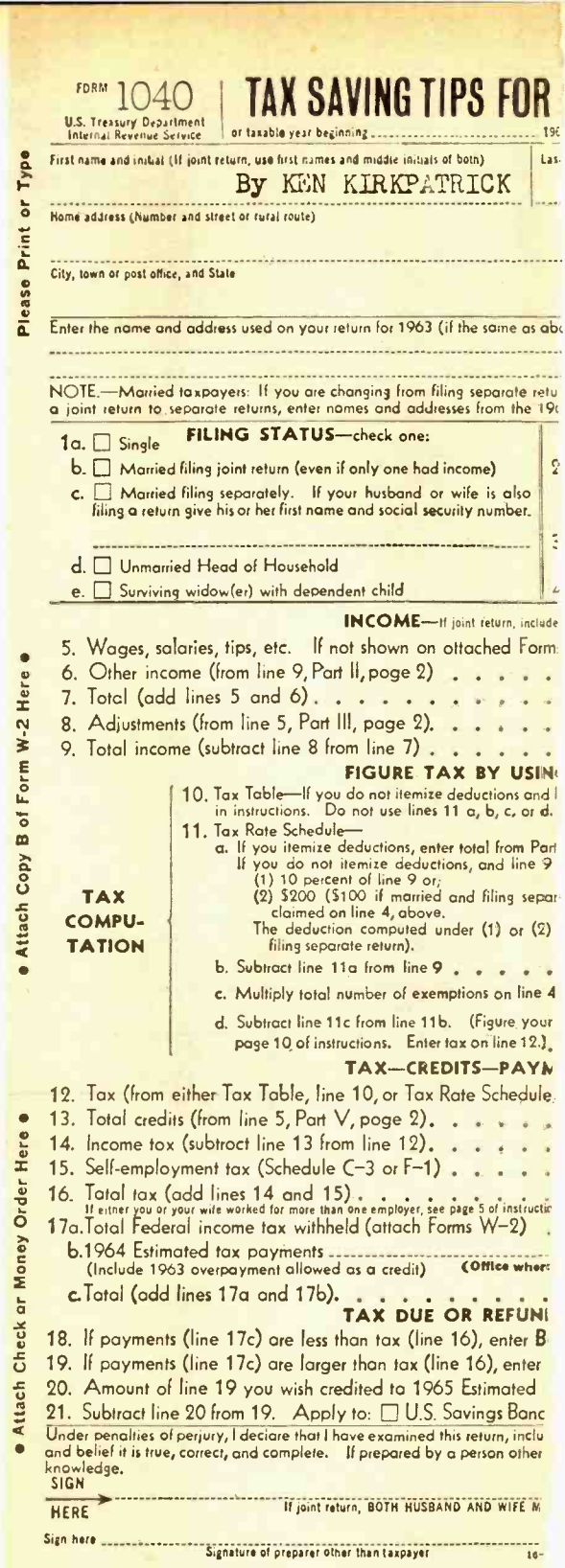
Many countries throughout the world do not transmit broadcasts specifically intended for reception in North America. However, these countries can often be heard in North America if a listener knows on what frequency and at what time to listen. Although some of the broadcasts come through surprisingly well, they are in general more difficult to hear and identify than broadcasts beamed to North America. The following listing gives the best times and frequencies for listeners to tune in countries in Africa and the Middle East which do not have special broadcasts to this area.

AFRICA

COUNTRY	CITY	TIME—GMT	FREQUENCIES (MC.)	LANGUAGES
ALGERIA	Algiers	1200-1700	15.375	Arabic
	"	2000-2200	9.685	French
ANGOLA	Dundo	1800-1930	11.685	Portuguese
	Luanda	0600-0700	4.82, 7.235	Portuguese
CAMEROON	Yaunde	0430-0600	4.972	French
CANARY ISLANDS	Tenerife	0000-0300	11.800	Spanish
CONGO	Elizabethville	1800-2200	11.865	French
	Leopoldville	1800-2200	11.795	French
CONGO REPUBLIC	Brazzaville	1100-1200	15.445	English
	"	1900-2000	15.19	English
DAHOMEY	Cotonou	0500-0645	4.875	French
EGYPT	Cairo	1230-1330	17.92	English
	"	2130-2230	9.475, 11.915	English
ETHIOPIA	Addis Ababa	1330-1400	15.41	English, Tamil
	"	1830-1930	11.875	English
GABON	Libreville	0500-0600	4.777	French
GUINEA	Conakry	2100-2300	9.65	French
IVORY COAST	Abidjan	2130-2300	4.94, 6.015	French
LIBERIA	Monrovia (ELWA)	2115-2145	15.155	English
	" (VOA)	1400-2200	15.36	English
MALAGASY REPUBLIC	Tananarive	1600-1700	15.265	French
MALI	Bamako	0600-0700	4.835	French
MOROCCO	Rabat	1200-1600	15.345	Arabic
	Tangier (VOA)	1400-1830	15.29	English
MOZAMBIQUE	Lourenco Marques	1700-2000	15.295	Portuguese
NIGERIA	Lagos	1700-1900	11.90, 15.255	English
RWANDA	Kigali	2000-2110	11.77	German
SENEGAL	Dakar	2000-2400	9.72	French
SOUTH AFRICA	Johannesburg	0400-0600	4.975	English
SUDAN	Omdurman	0415-0530	9.505	Arabic
TCHAD	Ft. Lamy	0500-0600	4.905	French
TOGO	Lome	0530-0630	5.047	French
TUNISIA	Tunis	1400-1600	11.972	Arabic
UPPER VOLTA	Ouagadougou	0600-0700	4.815	French

MIDDLE EAST

COUNTRY	CITY	TIME—GMT	FREQUENCIES (MC.)	LANGUAGES
IRAN	Tehran	0130-0300	7.065	Arabic
	"	2000-2030	15.11	English
IRAQ	Baghdad	0230-0500	7.18	Arabic
ISRAEL	Jerusalem	2015-2045	9.009	English
SAUDI ARABIA	Jidda	0400-0600	7.085, 9.72	Arabic
SYRIA	Damascus	1600-1900	15.165	English, French
TURKEY	Ankara	2200-2300	15.16	English



FORM 1040
U.S. Treasury Department
Internal Revenue Service

TAX SAVING TIPS FOR

or taxable year beginning 19

Please Print or Type

First name and initial (If joint return, use first names and middle initials of both) — Last

By KEN KIRKPATRICK

Home address (Number and street or rural route)

City, town or post office, and State

Enter the name and address used on your return for 1963 (if the same as abo

NOTE.—Married taxpayers: If you are changing from filing separate retu
a joint return to separate returns, enter names and addresses from the 19

FILING STATUS—check one:

1a. ☐ Single
b. ☐ Married filing joint return (even if only one had income)
c. ☐ Married filing separately. If your husband or wife is also filing a return give his or her first name and social security number.
d. ☐ Unmarried Head of Household
e. ☐ Surviving widow(er) with dependent child

INCOME—If joint return, include

5. Wages, salaries, tips, etc. If not shown on attached Form
6. Other income (from line 9, Part II, page 2) . . . . .
7. Total (add lines 5 and 6) . . . . . .
8. Adjustments (from line 5, Part III, page 2). . . . . .
9. Total income (subtract line 8 from line 7) . . . . . .

FIGURE TAX BY USIN

TAX COMPUTATION

10. Tax Table—If you do not itemize deductions and I in instructions. Do not use lines 11 a, b, c, or d.
11. Tax Rate Schedule—
a. If you itemize deductions, enter total from Part If you do not itemize deductions, and line 9
(1) 10 percent of line 9 or;
(2) $200 ($100 if married and filing separ claimed on line 4, above.
The deduction computed under (1) or (2) filing separate return).
b. Subtract line 11a from line 9 . . . . .
c. Multiply total number of exemptions on line 4
d. Subtract line 11c from line 11b. (Figure your page 10 of instructions. Enter tax on line 12.)

TAX—CREDITS—PAYM

12. Tax (from either Tax Table, line 10, or Tax Rate Schedule
13. Total credits (from line 5, Part V, page 2). . . . . .
14. Income tax (subtract line 13 from line 12). . . . . .
15. Self-employment tax (Schedule C–3 or F–1) . . . . .
16. Total tax (add lines 14 and 15) . . . . . .
If either you or your wife worked for more than one employer, see page 5 of instructio
17a. Total Federal income tax withheld (attach Forms W–2)
b. 1964 Estimated tax payments .....
(Include 1963 overpayment allowed as a credit) (Office where
c. Total (add lines 17a and 17b). . . . . .

TAX DUE OR REFUNI

18. If payments (line 17c) are less than tax (line 16), enter B
19. If payments (line 17c) are larger than tax (line 16), enter
20. Amount of line 19 you wish credited to 1965 Estimated
21. Subtract line 20 from 19. Apply to: ☐ U.S. Savings Banc

Under penalties of perjury, I declare that I have examined this return, inclu and belief it is true, correct, and complete. If prepared by a person other knowledge.

SIGN HERE → ..... If joint return, BOTH HUSBAND AND WIFE M

Sign here ..... Signature of preparer other than taxpayer

• Attach Copy B of Form W-2 Here •

• Attach Check or Money Order Here •

ELECTRONICS MOONLIGHTERS

Did you build, repair or service electronic gear in 1965? If so, take advantage of tax savings

ALTHOUGH few Americans feel so strongly about the income tax that they don't want to pay it, the U.S. Government doesn't want them to overpay, or to neglect to take deductions they are legally entitled to take. Most electronics enthusiasts are unaware that the Government might consider them "moonlighters"—one of several thousand Americans who operate profitable spare-time hobby-businesses.

Here's how to make sure you take every legal deduction that can help you lower your income tax. You may even find that you have overpaid in a past year. If so, you can file a refund claim on *Form 843* within three years and get a refund.

In preparing your tax return, record your business income and allowable expenses on separate *Schedule C* and attach it to your tax return (Form 1040). The income from *Schedule C* that you show on your tax return is your net income or loss after all allowable deductions.

What You Can Deduct. Even if your outside money-making electronic activi-

ty is mostly a hobby, you can deduct costs of any project on which you *intend* to make a profit. Costs you incur for personal pleasure instead of profit are not deductible.

Keeping accurate records is the first step in cutting your income tax. You must record daily all income received and all expenses paid. The simplest way to keep complete records is to buy a bound journal and record your income in one part of the book and your expenses in another. You must be able to list separately at year end your costs for (1) labor, (2) material and supplies, (3) depreciation, (4) repairs, and (5) miscellaneous business expenses.

Always get and keep receipts for money spent. An itemized sales slip listing the materials or equipment bought, date, and purchase price is best.

How to Handle Depreciation. Deductions for equipment depreciation can reduce your income tax payment. You can depreciate equipment used only for business purposes at the rate described below. However, you must depreciate equipment used for both hobby and business purposes according to the percentage of business use.

You must show what percentage of time your equipment is used for business by keeping records of the number of hours the equipment is used for hobby and business purposes. For example, if you use your test equipment 200 hours during the year and 150 of these hours are for personal hobby use, you could deduct only 25% of the depreciation rate. You would then use the same depreciation rate on all your test equipment unless you can prove that the percentage of business use for part of your equipment is considerably more than for other equipment.

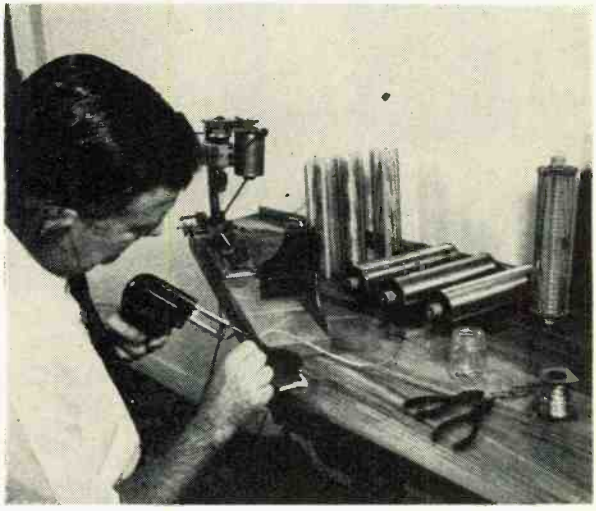
Depreciation Methods Allowed. This yearly deduction can be figured by several methods, but the simplest, most popular one is the straight-line method. Using it, you deduct the cost of the equipment (less its estimated salvage value) in equal yearly amounts during its useful life.

To illustrate, suppose you buy a new typewriter for $150 during the first 15 days of January. Let's assume that its estimated salvage value after its ten-year service life is 10% of cost, or $15. This means that you can deduct as depreciation 1/10 of $135 (cost less $15 salvage value) each year for ten years.

Details of other acceptable methods are supplied in the instruction booklet you get with your income tax form.

Equipment with a useful life of less than one year can be fully deducted as a simple business expense. The useful life of other equipment is the length of time you yourself would use it before replacing it. Guidelines for the permissible useful lives of most types of property are published in *Revenue Procedure 6221* available from the U.S. Government Printing Office.

Deduct depreciation only for the part of the year during which you own the equipment. Equipment bought during the first half of a month is counted for the entire month, while equipment bought during the last half of the month would be counted for the next month. Allow 1/12 of a year's depreciation for each month you own equipment.



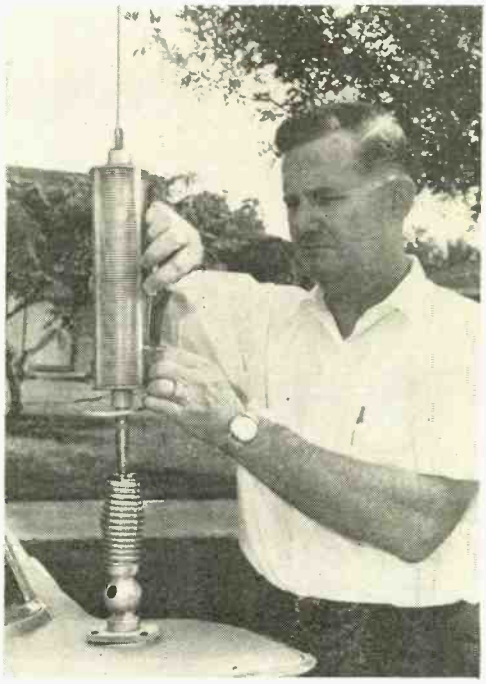
Every month Jack Falloure, owner of the J.W. Falloure Co., Houston, Texas, ships 20 to 30 ham radio loading coils. They are made in his basement shop.

You can also take an "additional first-year depreciation" of 20% of the cost of income-producing equipment with a useful life of six years or longer. This additional depreciation applies to any

property or equipment *other than* buildings or items that become part of a building, such as plumbing, central air conditioning, or structural components.

You can take this entire extra deduction in the year you buy equipment, regardless of what month of the year you buy it, along with regular depreciation for the year.

Deductible Home Expenses. As a part-time businessman, you can deduct part of your home expenses to cover the costs of the space you use for business. The amount of your deductible home costs depends on both the floor space or number of rooms used for business and the percentage of your part-time work devoted to business purposes. For example, if you set aside one room in a rented six-room house as a workroom or office, your allowable deduction for this space will be 1/6 of your rent. If you own your home, you may deduct 1/6 of your costs for insurance, maintenance, taxes, and the mortgage payment on your house (if any). Treat your costs for lights, heat, water, and telephone in the same way, whether you rent or own your home.



Hams snap up these 75-meter loading coils at a price of $15.95 postpaid. Due to this part-time activity, Mr. Falloure gets quite a tax advantage.

If all of your part-time activity is income-producing, you can deduct the full 1/6 of your utility costs and your rent or home ownership costs. If you use the space for both hobby and business purposes, deduct the same percentage you applied on equipment depreciation.

Deducting Transportation Costs. Your business costs for travel or local transportation are also deductible. The simplest way to handle them is to list each trip in your daily expense record, giving the miles traveled and the cost. If you pay transportation fares, list actual costs. If you drive your own car, you may deduct either a flat rate per mile (ten cents per mile for the first 15,000 miles and seven cents per mile after that), or record all automobile costs (including depreciation) for the year and deduct the percentage of these costs incurred for business use.

Costs of meals and lodging are deductible only when you stay away from home overnight. Again, be sure to record the business reason for the trip, places, dates, and the amounts you spend. And remember to get receipts.

Trips that are partly business and partly pleasure are not considered as fully allowable business expenses. Deduct only the costs properly attributed to business. Divide your transportation costs on the basis of the percentage of your time spent for each purpose.

Some Final Suggestions. You may need to complete a *Declaration of Estimated Tax* (Form 1040-ES) and to pay self-employment tax each year. Complete instructions on who must file this simple form and how to file it are included in your income tax instructions.

If your spare-time business earns as much as $400, you must also file a self-employment tax return on Form 1040.

And finally, whenever you have a question about income tax, check with your local Internal Revenue Service office. You will find that helpful IRS agents are almost as anxious as you are to make sure you don't overpay your income tax. -30-

CAN ELECTRONICS PICK

Computerized matchmaking has captured the imagination of millions

NO. 2134 is a not overly handsome 29-year old computer programmer at a west coast data processing center. He has a BS degree in statistics, earns a little less than $12,000 a year and has an abiding interest in his twin vocations: electronics and statistics. In his teens, No. 2134 had "fallen hard for any number of girls," he concedes, and during college and afterwards he dated frequently—but never seriously until the day in May, 1963, when he met No. 576.

Number 576 is a pretty, but not beautiful, 26-year old legal secretary and college grad whose father, a physician, still tends his ham rig with the same affection he shows his patients. Number 576 would have listed "marriage" as her main goal in life, but admits, "Even though I've always dated quite a lot, I'd about given up finding the just-right fellow—until I met (she gives his name) No. 2134."

Today, No. 2134 and No. 576 are happily married—one among hundreds, perhaps thousands, of couples brought together by an electronic computer.

Despite "electronic" backgrounds, Bob and Mary, as we'll call them, are sensitive to the "stigma" of their electronic courtship. In the security of his anonymity, Bob declares, "I am 100% convinced—as both a statistician and electronist—that scientific introduction, such as Mary's and mine, is the wave of the future . . . as, for us, it proved to be the wave of the present."

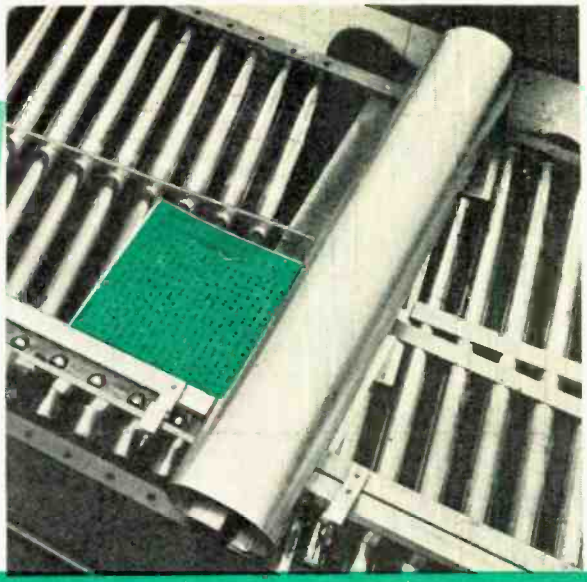
His wife concurs—but with some reservations. "A computer," she smiles, "isn't really Cupid. It is merely a scientific method for bringing together two scientifically 'matched' people—men and women who, their introduction left to chance, would probably never meet."

In the "computer courtship" of Bob and Mary lies startling insight for thousands of "electronists"—for people, like yourself, with more than a little faith in the wonders and achievements of electronics, who've pondered that most controversial question of all:

Can electronics pick *my* mate?

More to the point, can electronics—with better than human objectivity and insight—"match" couples better than they can match themselves?

Declares a leading marriage counselor, "With nearly one marriage in every four ending in divorce, it would seem that almost any scientific method—including an



YOUR MATE?

of single men and women—here's how it works

By JAMES JOSEPH

electronic one—would be preferable to merely letting nature take its course."

Does electronic matchmaking really get results—lasting results?

Candidly concedes an electronic matchmaker, "No 'electronic matching' psychologist or agency, regardless of scientific standing, has been operating long enough—few have been in the "business" even a dozen years, and most not nearly that long—to be able to validate its tests on the basis of proven performance: lasting and happy marriages."

In an era when electronics is probing the depths of the human mind and body, can it go one giant step further: reduce to definables that hitherto undefinable—love?

"Electronics," says one expert, "isn't concerned with love. It's concerned only with *compatibility*. More correctly, with the myriad of psychological factors which gauge and measure compatibility. When a computer "matches" two people, it makes only one claim: insofar as psychological testing can determine, these two are compatible. Psychologically, they're suited for one another. If the chemistry is there—if they also happen to fall in love—the *probability* for a successful marriage is high."

Finally, how advanced are the electronics of matchmaking?

"Technically speaking, the electronics are close to infallible," declares a computer technician. "But that's more than you can say for some of the data fed the computers and punch card sorters. 'Programmed' introductions can be only as good as the programmer . . . and only as valid as the psychological tests used as a basis for programming."

Continues this technician, "For thousands of people, there's big magic in computerized courtship . . . in the very idea that an electronic gadget, sight unseen, can, you might say, deliver up a soul-mate . . . and, just maybe, lifelong love and happiness."

Electronics seems bent on doing just that.

FACTS AND FIGURES

Manhattan's *Scientific Marriage Institute, Inc.*, founded about 10 years ago by two sociologists, Miss Lee Morgan, MA.

and Eric Riss, PhD, now its executive director, claims that about 35% of its clients (as many as 300 new clients apply each week, says Dr. Riss, triple the number of a few years back) find marriage through electronics. "But," warns Dr. Riss, "there's certainly no magic in electronics."

The Scientific Marriage Institute charges about $370 to test mate-seekers and to arrange scientific introductions. As is the case with some other electronic matchmakers, SMI doesn't yet use a computer, although it does employ electronics—an IBM 82 punch card sorter. Your test results, reduced to a punch card, are "matched" by the machine with cards of other marriage hopefuls in SMI's files. If the machine's first pick doesn't turn out to be "Mr. Right" (or "Miss Right," as the case may be), your master card is matched again—and again, an introduction. In all, an applicant can expect about 12 "qualified" introductions for his money (which figures out to about $30 per introduction).

Scientific Marriage Foundation, Mellott, Indiana, is among the oldest (now in its ninth year), most marriage-productive (it claims to have "produced" some 10,000 marriages), and lowest in cost ($25 is all you pay) of computerized matchmakers. Founded by Dr. George W. Crane, an MD, a practicing psychiatrist and author (of the widely read syndicated column, "The Worry Clinic," and textbooks, including "Psychology Applied"), the foundation, in Dr. Crane's words, is "a non-profit social project."

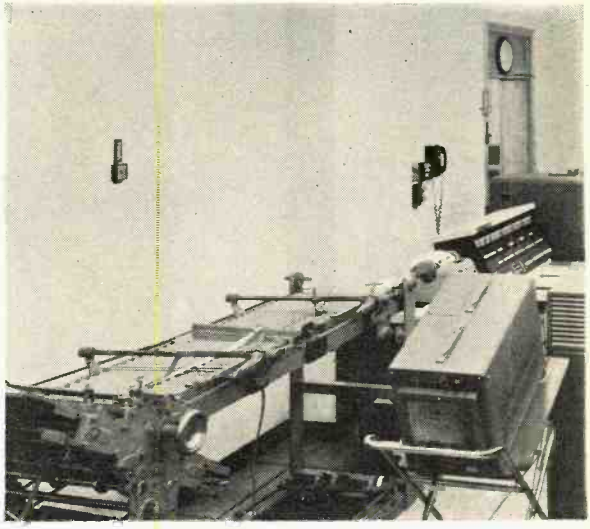
Dr. Crane is plainly proud of results. "Our divorce rate," he told the author, "is only 10—ten divorces after nine years of operation, which means just 1/10th of 1% . . . in contrast to (a divorce rate of) about 30% or even worse for the nation at large."

Scientific Marriage Foundation operates in all 50 states and Canada, relying on some 3000 clergymen (of all major faiths) to "do the personal interviewing of applicants." The resulting data, reduced to 10 "compatibility" factors, is fed to an IBM 101 statistical tabulator. "Matched" couples are introduced by mail and after some correspondence, are encouraged to meet.

Michigan Scientific Introduction Service, Inc., Ann Arbor, Mich., perhaps the third largest of the computerized mate-finders, "pairs" prospective couples much as do the others—by tests and questionnaires, amasses some 150 key facts and from these matches likely marriage partners. Men get the names, addresses and phone numbers of their female compatibles and are supposed to take it from there.

In Germany, where professional matchmaking (with or without a computer) has been popular since the Middle Ages—and more so today, with fraulein vastly outnumbering men—many of Germany's 260 professional matchmakers have turned to electronics. Hamburg's *Altmann Institute,* for example, puts hopeful brides and grooms through a four-page psychological quiz and a personality "color test," then feeds this data to a computer. Altmann charges $50 to $125 for testing and introducing "compatibles," an additional $75 to $150 if an introduction leads to marriage.

Computerized matchmaking has captured the imagination of millions of young Germans, many of whom leave school at 15 and, thereafter, have a hard



Human Inventory, Inc., one of the most scientific of the nation's mate-finders, makes use of the facilities of the National Computer Systems center in Minneapolis, Minn., in matching up couples. Here, raw test scores from its "Pair Test" are electro-optically scanned, put on tape, and fed into a Control Data Corp. computer. This computer, in turn, controls an electronic punch card machine which translates the taped data into punch cards.

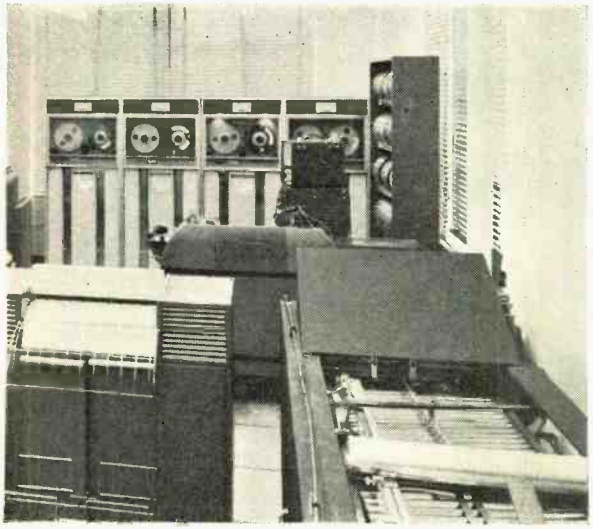
time meeting suitable marriage partners. Whereas U.S. teen-agers and young adults rendezvous at local drive-ins or bowling alleys, a growing number of young Germans head for a computerized matchmaker. German mate-finders say the majority of their husband-hunting clients are in their twenties (often early twenties), the men in their thirties. By contrast, some American electronic "mating" services complain that they're "overloaded with over-40 divorcees and near-50 bachelors."

Moreover, Germany's husband-hungry frauleins seem unromantically hard-headed about the man of their computerized choice. Shrugs one West German marriage broker, "Compatibility and income, more than good looks or even romantic love, are what the average German fraulein seeks when she consults an electronic matchmaker." One 20-year-old German girl who married the first male "sorted" from a computer, scornfully put her feelings this way: "Love . . . is for teen-agers . . . and Frenchmen."

West Germany's marriage brokers (who go by the name "Ehebandsgewerbe," meaning "marriage-initiators") claim to have had a hand, since the end of World War II, in perhaps one marriage out of every ten . . . with electronic "mating" booming to popularity.

PROS AND CONS

A German marriage-initiator states, "There's no stigma to meeting by electronics in this country. How could there be when brokers, often with aid of computers, arrange 60,000 to 80,000 marriages every year?"



By contrast, many "computerized" American couples confess to "embarrassment" at having met by electronics as do Bob and Mary. Hundreds of electronic couples hide the circumstances of their meeting from friends and relatives. "Imagine," blushes Mary, "telling my kids, 'I met your father in a memory circuit.'" Most U.S. "mating" agencies advertise, "All correspondence in plain, white envelopes."

Almost as clandestine are the American computer makers themselves. An IBM spokesman in Los Angeles, squeamish at the use of IBM's thinking machines in courtship, parried all questions with a curt, "Go ask Sperry-Rand." Another computer maker's representative put it just as bluntly, "We don't encourage our computers being put to this use. Our feeling is that whatever the findings, they're far too statistical . . . just a surface reading which misses the mark in psychological depth perception."

Bob and Mary—No. 2134 and No. 576—agree. *Some* computer agencies are worthless. *Some* of the so-called psychological tests they administer have but scant foundation in science—and less in practical psychology. *Some* produce "results" that are ludicrous.

Consider the 26-year old stenographer—pretty and personable by any reckoning—who describes the six men dredged up by a computer as "the saddest collection of misfits and oddballs I've ever met. If *that's* the computer's judgment of me, then I've been overrating myself for years."

Such disheartening results aren't the fault of electronics. The fault lies with the clientele. One electronic matchmaker admits that the "average" age of his female applicants is 38 and that fully "80% have been previously married" (meaning, they're divorcees). The average male on his roster is 40 (and 60% of these males have never been wed).

An "inventory" like that would raise even Dr. Freud's hackles: a legion of divorced, mid-thirtyish (and older) women grasping pitifully for what any psychologist would concede is the last straw—a 40-year old bachelor! If you're in

(*Continued on page* 92)

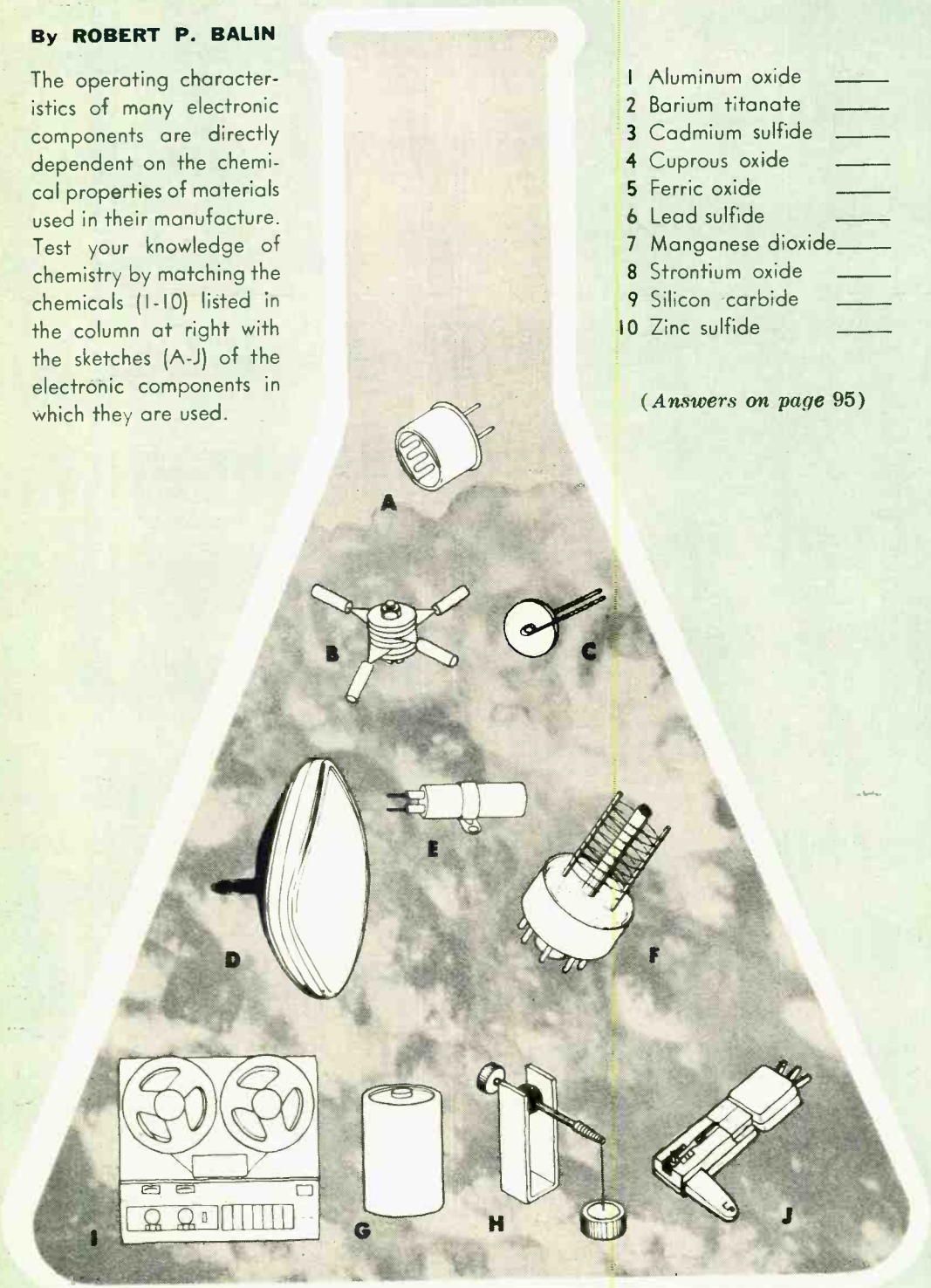
ELECTROCHEMISTRY QUIZ

By ROBERT P. BALIN

The operating characteristics of many electronic components are directly dependent on the chemical properties of materials used in their manufacture. Test your knowledge of chemistry by matching the chemicals (1-10) listed in the column at right with the sketches (A-J) of the electronic components in which they are used.

1 Aluminum oxide ____
2 Barium titanate ____
3 Cadmium sulfide ____
4 Cuprous oxide ____
5 Ferric oxide ____
6 Lead sulfide ____
7 Manganese dioxide ____
8 Strontium oxide ____
9 Silicon carbide ____
10 Zinc sulfide ____

(*Answers on page* 95)



SHORT-WAVE LISTENING

By **HANK BENNETT,** W2PNA/WPE2FT
Short-Wave Editor

DX AWARDS: ARE TRANSMITTER LOCATIONS ACCEPTABLE?

THROUGHOUT the United States there are frequent cases where the transmitter of a given station may be in a different state than the studio and announced location. For example, WCKY in Cincinnati, Ohio, has its transmitter in Kentucky. Station WNEW in New York City and WIP in Philadelphia both have their transmitters in New Jersey. Many DX States Award applicants have asked whether such stations should be counted for the state in which the studio is located or whether the state in which the transmitter is located would be acceptable.

In most award programs conducted by various radio clubs, the state in which the studio is located is the acceptable one. On the other hand, the transmitter location is really the more logical one, since the radio signals do not come from a studio but from a transmitter. For the purposes of our own DX Awards Program, therefore, either location will be acceptable. But you cannot claim one station for two states at the same time. You may claim WNEW for New Jersey if you wish, but do not attempt to claim it for New York as well. It is up to the individual DX'er to claim the states in the manner he prefers. In most cases, we will go along with him.

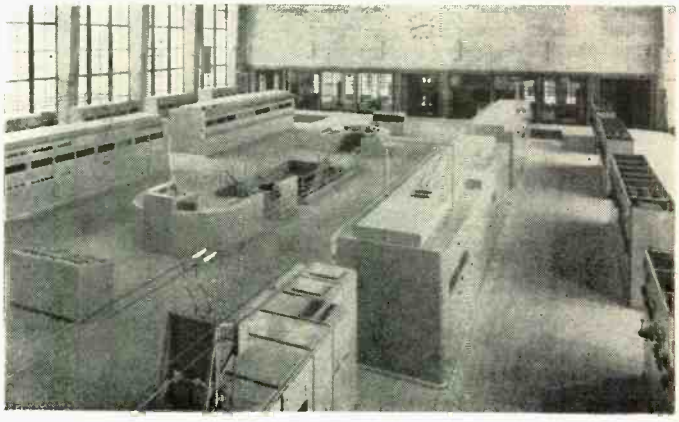
It's a different story so far as the overseas broadcast stations and the Country Awards are concerned. There are very few stations that have a transmitter in a country other than that in which the station itself is located. Therefore, countries should be claimed by their studio locations only. Thus, *Vatican Radio,* with its transmitter in Italy, may be claimed only as Vatican City.

While on the subject of Country Awards, we would like to point out that the British Broadcasting Corporation uses a QSL that has several answers printed on it, only one of which is checked. DX'ers should take care in claiming England, for only the checked notation "Your report has been found to be in accordance with our published schedule" is acceptable. A check on any of the other answers is an indication that the BBC did not feel the report to be accurate or complete enough to warrant confirming.

Attention Ham-Band Listeners. We recently received a letter from an amateur radio operator who complained that a reception report from a listener was little more than a request for a QSL card. The listener wrote merely, "You have a booming signal up here on 75 meters." No date or time was mentioned, the frequency specified left much to be desired, and no return postage accompanied the request.

Ham-band enthusiasts should pay careful attention to the quality of the reports they send out, for a poor report goes a long way towards giving the SWL fraternity a black

(*Continued on page* 108)



These are the transmitters of Radiodiffusion-Television Belge, Brussels, Belgium. Do you have a verification from Belgium yet that you can include in your list for a DX Countries Award? Reports should be sent to 18 Place Eugene Flagey, Brussels.

ON THE CITIZENS BAND

By **MATT P. SPINELLO,** KHC2060, CB Editor

THE blue-uniformed guard walked along a hospital corridor in the small hours of the night. He stopped at a window overlooking a parking lot. He peered out, frowned, took a CB walkie-talkie from his pocket and made a short transmission. Within seconds, several others joined him at the parking lot and converged on two men he had seen creeping away from the hospital with a cardboard box. The box contained a sterilizer belonging to the hospital. The police were called, the thieves were arrested, and the hospital guards went back on patrol in the quiet corridors.

HOSPITAL SECURITY SYSTEM CB-READY FOR PRESIDENT OR PROWLER

The above episode occurred recently at Barnes Hospital, in St. Louis, Mo., which has its own guard system—including 15 walkie-talkies — directed by the hospital's Safety and Security Department. Very few hospitals have such a comprehensive security program as that developed by Barnes, since very few hospitals have the safety and security problems inherent in a complex of buildings which includes 2500 employees, 1019 beds, and 21 acres of floor space.

Edward Thurman, safety and security coordinator at Barnes, has 26 guards on 8-hour shifts around the clock. His department covers Barnes Hospital, McMillan, Maternity, Children's, Wohl, Barnard, and Renard Hospitals, Washington University Clinics, and the new Queeny Tower. Every member of the security system carries a walkie-talkie and Mr. Thurman can summon every guard on duty simply by transmitting a code word. Radio reports of lesser importance begin normally with the assigned call letters KGH4507.

Miss Nancy Craig, Barnes' assistant director and chairman of the safety committee, whose administrative responsibilities include housekeeping as well as safety and security, recalled the myriad details of arrangements made before President Johnson's visit to open the city's Bicentennial celebration last fall.

"For one thing," she said. "we had to make sure a suite was available and necessary housekeeping chores done. That seems minor but it would be silly to have everything else ready and then discover there's no room. We had to find out his blood type and be sure the blood bank had plenty of blood and donors available. The elevator and corridor routes were selected and orderlies were standing by. One person would have a key to the chosen elevator so it could be run non-stop.

"All this was done in as much secrecy as possible," Miss Craig pointed out. "Only those directly concerned knew about it. A lot of people, of course, would love to stand around and watch if anything happened. The more people involved, the more confusion."

Security guards cleared the parking area where a helicopter could land, if necessary, and were ready to clear corridors in the hospital complex at an instant's notice. St. Louis policemen were stationed outside the hospital and were in direct radio con-

Walkie-talkie in hand, Barnes Hospital (St. Louis, Mo.) security guard James Placher watches as a patient is brought into the emergency entrance of the hospital. He is one of 26 guards employed by the Barnes Security and Safety Department to protect hospital property and patients 24 hours a day.

tact with the presidential party at all times. A policeman receiving word that an emergency had occurred would notify Miss Craig immediately and she would notify Harry E. Panhorst, hospital director, to set the planned procedure in motion.

A minor fire broke out in Queeny Tower, then under construction, on the day of President Johnson's visit. Miss Craig recalled with horror. It was quickly extinguished, however, and the presidential alert was not affected.

Mr. Panhorst mentioned that the extreme precautions taken before President Johnson's visit undoubtedly were triggered by the assassination of President Kennedy in Dallas. Barnes stands ready to meet any future requests from the Secret Service and police to prepare for similar VIP visits, he said.

Our thanks to the *St. Louis Globe-Democrat* for an interesting story depicting an unusual and most important use of CB radio. Thanks also to staff writer Sue Ann Wood and Mrs. Martha K. Moyer of Mosley Electronics, Inc., Bridgeton, Mo., for bringing this story to our attention and doing some of the leg work.

Project "Interview" Report. On December 15, your CB Editor again met with hostess Jane Neubauer on WREX-TV's "Tete A Tete," a daily television information program. (For details on the first meeting, see our November, 1965, column.) The second interview was the fourth in a series of radio and TV broadcasts designed to enlighten an uninformed public as to the beginning of CB, its growing pains, and its principal uses today.

Photo by Greg Cook

Television director Guy J. Fiorenza, KLJ8486, Jane Neubauer, and CB Editor Matt Spinello go over preparations prior to videotaping the program "Tete A Tete" at WREX-TV, Rockford, Illinois.

The initial broadcasts covered such areas as how CB radio came about, licensing procedure, rules and regulations, personal and business uses, and equipment. The December TV interview was devoted to the emergency and public service use of the Citizens Band by the Radio Emergency Associated Citizens Team (REACT), the Highway Emergency Locating Plan (HELP), and the thousand-plus CB clubs across the country.

Several photos submitted by CB clubs engaged in emergency action were used this time, as well as a 60-second sound/film explaining HELP, and a film strip that told the REACT story. And several new types of CB transceivers being marketed for emergency and general use by members of HELP, REACT, and the highway traveler were shown and discussed.

Globe-Democrat photos by Ed Meyer

The office of Edward Thurman is headquarters for the Barnes security system. A transceiver on a desk is home base for the walkie-talkies, and a wall of alarms keeps watch for fires. Alarms also are linked to the "oxygen bank," set to go off if the oxygen supply dips low, and to the narcotics vault.

FCC Takes Charge. On October 26, 1965, Richard P. Greenside of the Mattapan (Boston) area was found guilty in the Federal District Court at Boston, Mass., of transmitting obscene, indecent, and profane language over a Class D Citizens Radio station in violation of the U. S. Criminal Code, Section 1464. On November 15, Greenside was sentenced to one year in jail.

The United States Attorney's office and the Boston office of the Federal Communications Commission's Field Engineering Bureau announced that this was the first trial, conviction, and sentencing in the New England area for such radio transmissions, and was the first step in an intensive en-

(*Continued on page 106*)

SOLID STATE

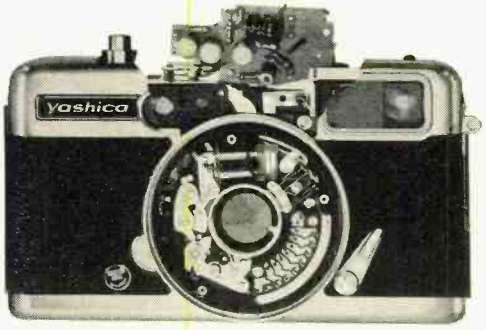
By **LOU GARNER,** Semiconductor Editor

SO YOU'RE not a camera bug. But chances are you have a friend, relative, or neighbor who is one. For photography is, perhaps, the most popular of all hobbies. If you're wondering what photography has to do with semiconductors, well, let's put it this way: photography and electronics go together like hand and glove, for many "shutter bugs" dabble in electronics and many electronic experimenters consider photography their second love.

Electronics is playing an increasingly important role in photography, even at the engineering level. This is not surprising since the photographic industry has always been quick to adapt new technological developments. Prime examples are the use of transistors and related solid-state components in ever-increasing numbers in timers, enlarger controls, electronic flash units, exposure meters, and other equipment.

Now the transistor is being used as an automatic light controlling device in a new electronic shutter which makes it virtually impossible to over- or under-expose. The shutter is featured on a new 35-mm. camera put out by Yashica. Unlike more familiar cameras whose shutter settings are made to vary with light intensities, the camera also sets exposure time, automatically, for the existing light conditions, even if these light conditions are changing while an exposure is being made.

On the outside, the camera looks pretty much like an ordinary 35-mm. camera. On the inside, however, there's a big difference. Here you see an innocent looking leaf-type shutter controlled by a highly sophisticated transistorized circuit mounted above it. Figure 1 is a functional diagram of the shutter system which includes a cadmium sulphide (CdS) photocell, a storage capacitor, a transistorized detection, comparison, and amplification circuit, a time control device, and a solenoid.



The leaf-type shutter is held open by the solenoid for the time required to charge the storage capacitor through the CdS photocell to a voltage level predetermined by the lens opening. The charging period is a function of the photocell's resistance which, in turn, is inversely proportional to the light reflected from the subject scene.

Thus, when the subject is brightly lit, the photocell's resistance is low and the charging time is short. Conversely, when the light level is low, the photocell's resistance is high, and the charging time is longer. Once the predetermined voltage charge is reached, the capacitor discharges. This de-energizes the solenoid, and the shutter closes.

In practice, the exposure time is infinitely variable from a fast 1/500th of a second to

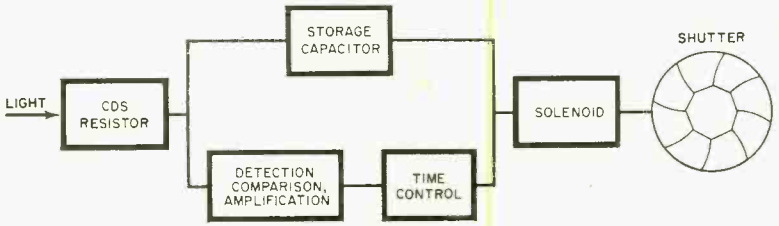


Fig. 1. Shutter system adjusts automatically for right amount of light and produces perfect exposure every time shutter is clicked.

a full two minutes. Should the light level change during the exposure time, the circuit will automatically compensate for this change by making an appropriate correction in the exposure time.

The camera is designed for half-frame exposure on standard 35-mm. film, thus doubling the number of shots you can take with any given roll. Because of this feature, the unit is dubbed, appropriately, the "Electro Half" camera.

In addition to its electronically controlled shutter which can be locked out for flash shots, the "Electro Half" features a self-timer, an automatic exposure counter, and warning lights to tell you when there is too much light (requiring a resetting of the diaphragm), too little light for hand-held shots (due to required long exposure time), and poor battery condition. The camera comes equipped with a Yashinon/DX 32-mm. 4-group, 6-element f/1.7 lens in a focusing mount with settings from 2.5 feet to infinity. The manual diaphragm has aperture settings to f/16. A 5.6-volt mercury cell provides operating power.

The "Electro Half" camera is available from Yashica dealers for less than $90, plus case.

They Finally Made it. Back in our January, 1962, column we predicted that a medium-priced transistorized oscilloscope would be introduced on the market that year. We struck out on this prediction since no such instrument in this price range has made its appearance on the market till now—so far as we know.

Put out by Allied Radio (100 N. Western Ave., Chicago, Ill.), the new 3" oscilloscope is a solid-state instrument that weighs only

16 pounds. Identified as the Knight Model KN5005 scope, it boasts a flat frequency response within ± 3 db, from d.c. to 6 mc., and has a vertical sensitivity of 0.05 volt/division. Its horizontal circuit provides linear sweep from 1 microsecond/division to 50 microsecond/division, ± 10%, with a sweep as fast as 0.2 microsecond/division when its built-in multiplier is used.

The KN5005 scope is ideal for advanced TV and hi-fi amplifier servicing, and has applications in school, industrial, and laboratory work. It is priced at only $425 (compared to the one thousand plus dollars being asked for some transistorized units), has 25 transistors, 18 diodes, 1 nuvistor, and a CRT. Measuring only 8¾" x 6" x 14", the instrument consumes 15 watts at 110-120 volts, 50-60 cycles.

Reader's Circuit. You don't have to be a fireman, policeman, or ambulance driver to find use for the electronic siren shown in

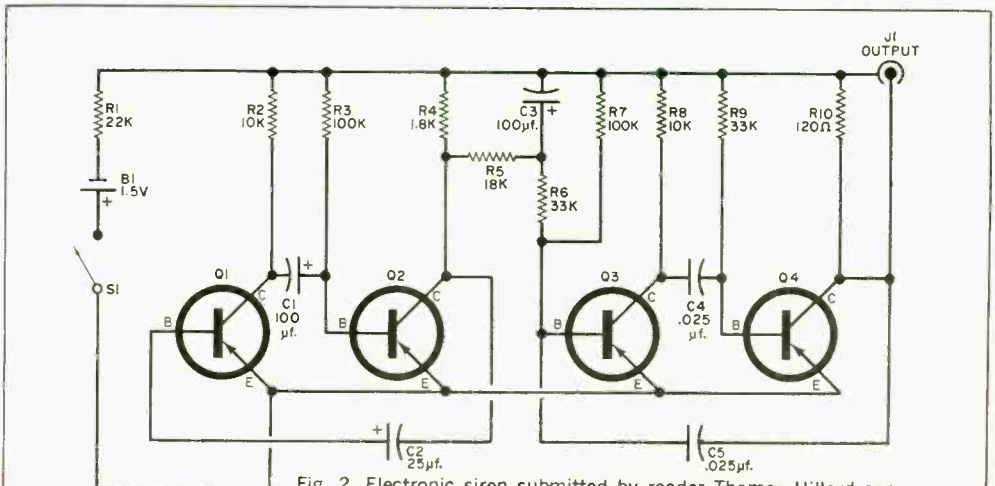


Fig. 2. Electronic siren submitted by reader Thomas Hillard contains two multivibrators operating at widely different frequencies.

Fig. 2. You can build and use this device to carry out educational experiments, to exhibit at Science Fairs, or merely to amuse your friends. Submitted by reader Thomas Hillard (314 N. Beach Ave., La Grange Park, Ill. 60528), the electronic siren uses four low-cost *pnp* transistors and works with any audio amplifier.

The circuit consists of two multivibrators operating at widely different frequencies. Transistors *Q1* and *Q2* make up the low-frequency unit while *Q3* and *Q4* comprise the high-frequency unit. The low-frequency stage is coupled by *C1*, and the high-frequency stage by *C4*. Feedback loops for these stages are provided by *C2* and *C5*, respectively.

Transistor *Q1* is operated without external bias while *Q2* is biased by the drop across *R3*. Transistor *Q3*'s base is biased initially by the drop across *R7*. But when *Q2* conducts, the charge on *C3* varies with the signal voltage which, in turn, changes the bias on *Q3* through *R5* and *R6*. Transistor *Q4* is biased by the drop across *R9*.

As *Q2* in the low-frequency multivibrator switches from an *off* to an *on* state, the voltage drop across its collector load, *R4*, varies, thus varying the bias on *Q3*'s base. This causes the frequency of the high-frequency unit to vary, producing a wailing sound.

Tom used the old reliable 2N107 transistors in his design, but you can employ newer a.f. types such as 2N1393's, 2N1436's, or 2N1754's, if you wish. Stay away from the un-numbered bargain types for this application. All of the resistors are half-watt types; capacitors *C1*, *C2*, and *C3* are electrolytics, rated at 3 w.v.d.c., minimum, and *C4* and *C5* are tubular paper types rated at 100 volts. Jack *J1* is a standard phono type and *S1* can be any s.p.s.t switch. The battery, *B1*, is a standard flashlight cell.

When assembling the siren, be sure to observe the polarities indicated in the schematic, and follow good wiring practices.

After the circuit has been fully assembled, its operation can be checked by connecting an 8-ohm speaker at the output jack (*J1*). For most practical applications, however, the siren will be used to drive a separate audio amplifier coupled to *J1* through a shielded cable.

Manufacturer's Circuit. According to some authorities, a single watt of audio power delivered to a properly matched and efficient speaker system is enough to practically deafen the average person listening in a small room. Others disagree, claiming that one watt, while ample for some applications, is totally inadequate for a listener wishing to enjoy fine music. These "experts" insist that you must have from 20 to 30 watts or you have nothing. But regardless of your personal feelings about this question of audio power, General Motors has an amplifier with so much power that it can shatter your neighbor's windows or burst your eardrums. See Fig. 3.

The amplifier, described in General Motors' Delco Radio Division's Application

(*Continued on page* 90)

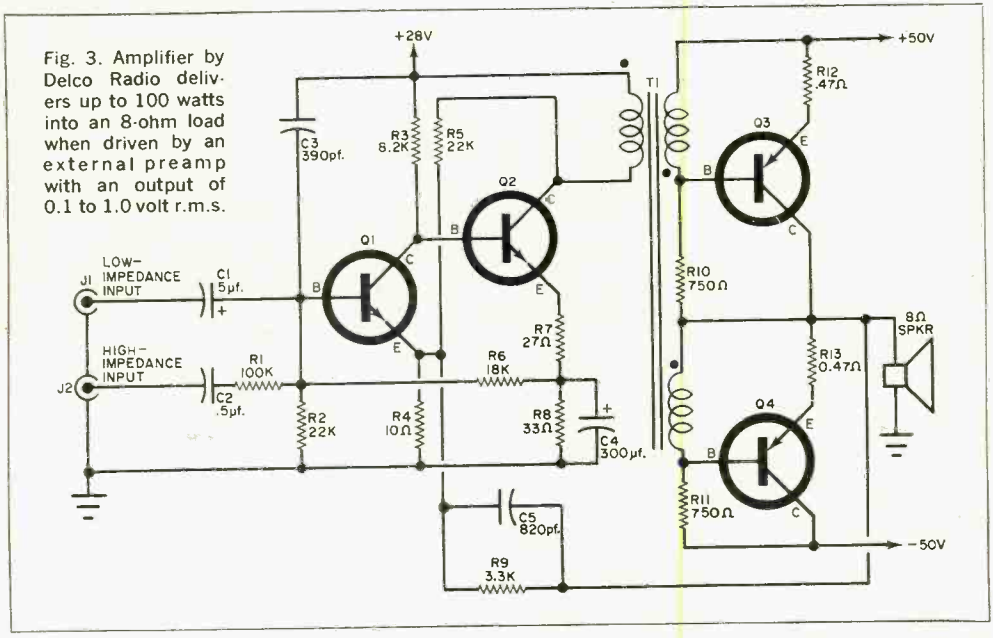


Fig. 3. Amplifier by Delco Radio delivers up to 100 watts into an 8-ohm load when driven by an external preamp with an output of 0.1 to 1.0 volt r.m.s.

AMATEUR RADIO

By **HERB S. BRIER**, W9EGQ
Amateur Radio Editor

EXTENDING THE RANGE OF UHF/VHF SIGNALS WITH REPEATER STATIONS

THE MOST FAMOUS amateur radio repeater station or transponder was the one in OSCAR III, which, last spring, simultaneously received and re-transmitted 2-meter signals while the satellite was orbiting the earth. But unrealized even by many UHF/VHF operators is the number of ground-based repeater stations in the United States. Like the more-sophisticated OSCAR transponder, these repeater stations pick up signals transmitted on one frequency and simultaneously retransmit them on another frequency with the aim of increasing the communications range of the UHF-VHF's. Many of these repeaters operate in the 2-meter band.

One successful 2-meter repeater station is WA9ORC, operated by the Chicago FM Club, Inc. The transmitter is located in a downtown Chicago office building and delivers 60 watts of power to a 400'-high omnidirectional vertical antenna. WA9ORC is reputed to be the only amateur repeater station which is located in the center of a large city. Usually they are outside of the city on a mountain, but there are no mountains near Chicago.

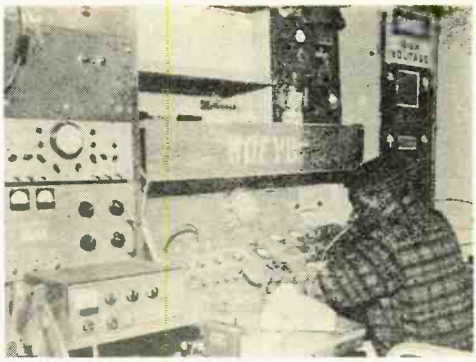
Having the repeater in the city puts it in the center of the greatest activity, but it also introduces serious reception problems. All Chicago TV and FM broadcast transmitters and other high power commercial transmitters are located in the same area. The cross-modulation, harmonics, hash, and spurious signals generated by the concentration of so many high-power signals in the area makes satisfactory VHF reception impossible.

To circumvent these receiving problems, the two WA9ORC receivers are 14 miles apart. One receiver is seven miles north of the transmitter and has a 350'-high antenna. The other receiver is seven miles south of the transmitter and has a 250'-high antenna. All transmitting and receiving antennas have an estimated gain of approximately 6 db. As this report is being written, the receivers and the transmitter are linked together by leased telephone lines. But the members of the Chicago FM Club are now

AMATEUR STATION OF THE MONTH

John Casazza, WB2MCH, Staten Island, N.Y., roams both the low- and high-frequency amateur bands using Techcraft transmitters on 50 and 144 mc. and a Knight-Kit T-60 on the lower frequencies. A National general-coverage receiver aided by converters does the receiving. John is proud of tracking and recording the OSCAR III satellite last spring using a converted 2-meter beam. For more prosaic work, he has a combination 6- and 2-meter beam and a 40-meter dipole antenna. WB2MCH will receive a one-year subscription for submitting this winner in our Amateur Station of the Month contest. If you would like to enter the contest, send us a clear picture of your station with you at the controls, accompanied by some details on your ham career and on the equipment you use. Entries go to: Amateur Photo Contest, c/o Herb S. Brier, W9EGQ. P.O. Box 678, Gary, Ind. 46401.

It took Joe Hahomes, WØFVB, Topeka, Kansas, five years to assemble his dream station (right). With it, he can operate phone, CW, or radioteletype at power inputs up to 1000 watts. Joe's antenna farm sprouts two 65' crank-up towers and six antennas.



Below is John Myers, WA9NVS, West Lafayette, Ind., at the controls of his Novice station, with which he worked 26 states. John celebrated getting his General license by buying a Hammarlund HQ-170A receiver to replace the Lafayette KT-320.

working on 432-mc. radio links in order to eliminate the $55-per-month charge for the leased lines.

Here's how the WA9ORC repeater works. If club member "A," say in his automobile within 50 miles of Chicago, wants to contact club member "B" via the repeater station, he presses the push-to-talk button on his microphone. This turns on his transmitter on 146.82 mc., the frequency monitored by the WA9ORC receiver, and automatically transmits a short, coded tone signal. The tone signal turns on the WA9ORC transmitter which automatically retransmits the received information on 146.64 mc. At the conclusion of his call, operator "A" listens on 146.64 mc. for the reply of operator "B." Of course, operator "B" will also be transmitting on 146.82 mc. and listening on 146.64 mc. These frequencies were selected so that both Novice and Technician members of the Chicago FM Club, Inc., could use the repeater.

The average mobile station can communicate reliably with the repeater at distances up to 50 miles. This distance can be increased by at least another ten miles if the mobile operator carefully chooses his spots. Thus, mobile stations on opposite sides of the repeater up to 120 miles apart can talk to each other via the repeater—quite an improvement over the normal, mobile-to-mobile range of possibly ten miles. Naturally, fixed stations can communicate via the repeater over far greater distances.

In addition to actuating the repeater transmitter, the initial tone signal actuates a tape recorder which records the time and the first minute of each transmission. The recorder is a standard machine modified for the purpose and operates for a week on a single tape.

Also in Chicago is the See Far repeater which receives on 147.5 mc. and automatically retransmits on 147.75 mc. When the United Airlines 727 jet crashed into Lake Michigan near Chicago last August 16, none of the rescue groups could establish radio communications with their Chicago bases because of a high bluff overlooking the lake at this point. George Ulm, W9EVT, was on the scene, and with his 2-meter "walkie talkie" became the sole radio communication link between the disaster area and Chicago via the See Far repeater.

You can contact William S. Knopp, WA9ERC, 4850 Greenwood, Skokie, Ill. 60076, if you would like to have more information on the Chicago FM Club's repeater, and George Ulm, W9EVT, 1555 N. Dearborn Parkway, Chicago, Ill. 60610, for information on the See Far repeater.

FCC News. According to the FCC's current interpretation of its rules, when an amateur operates another licensee's station and the licensee is not present and in control, the visitor must operate under his own call-sign as a "portable" station. To clarify the effects of this interpretation on the operation of multi-operator stations in DX contests and on Field Day, we queried the Commission on the matter. Here are the official answers:

"Where several amateurs combine their operating talents to keep one well-equipped amateur station on the air continuously or for most of the period of an amateur operating activity, such as a DX contest or Field Day, the same call-sign may be used provided the station licensee remains on the premises during such activity.

"With regard to Field Day operation, the same call-sign may be used to cover operation of more than one transmitter at the

(*Continued on page 100*)

A PUBLISHING FIRST

. . . THE ONLY COMPLETE GUIDE FOR SERVICEMEN AND HOBBYISTS TO EVERY MAJOR PHASE OF CONSUMER ELECTRONICS SERVICING!

For the progressive serviceman who wants to find out how to service better and faster . . . how to expand his business by handling a wider variety of electronics equipment —

For the "do-it-yourself" hobbyist who wants to save hundreds of dollars by installing and repairing his own equipment —

The 1966 ELECTRONICS INSTALLATION & SERVICING HANDBOOK has arrived! The only comprehensive and authoritative guide to every major phase of consumer electronics servicing. There's nothing like it anywhere!

A handy, on-the-bench reference volume containing 128 pages—over 150 illustrations, charts and tables—on how to spot, analyze and correct trouble . . . quickly, efficiently and economically!

Complete, in-depth coverage of: the fundamentals of servicing • servicing b/w & color TV • AM-FM household radios • stereo/hifi • CB equipment • intercoms and PA systems • antennas • transistorized ignition systems.

Hundreds of money-saving techniques and shortcuts. Every up-to-date method and procedure. All in easy-to-understand language for the novice . . . yet thorough enough to answer the professional's most complex question!

You'd have to purchase several expensive manuals to equal this kind of incisive, all-inclusive coverage. But now you get it all in the 1966 ELECTRONICS INSTALLATION & SERVICING HANDBOOK. A small investment that will pay for itself many times over with just one practical application. **only $1.25**

GET THE EXQUISITE
LEATHERFLEX-BOUND EDITION
for just $3 POSTPAID!

The 1966 ELECTRONICS INSTALLATION & SERVICING HANDBOOK is also available in an attractive, gold-embossed, Leatherflex-bound edition — a superb addition to your library of permanent reference books. This deluxe volume will be mailed to your home, postpaid, for just $3.00, when you check the appropriate box on the order form.

FILL IN, CLIP & MAIL THIS FORM TODAY!

Ziff-Davis Service Division • Dept. IS
589 Broadway • New York, N.Y. 10012

YES! Send me a copy of the 1966 ELECTRONICS INSTALLATION & SERVICING HANDBOOK, as checked below:

☐ $1.25 enclosed, plus 15¢ for shipping and handling. Send me the regular edition. ($1.50 for orders outside the U.S.A.)

☐ $3.00 enclosed. Send me the DeLuxe Leatherflex-bound edition, postpaid. ($3.75 for orders outside the U.S.A.) Allow three additional weeks for delivery.

name *please print*

PE-36

address

city *state* *zip code*

PAYMENT MUST BE ENCLOSED WITH ORDER.

ENGLISH-LANGUAGE BROADCASTS TO NORTH AMERICA

Prepared by ROBERT LEGGE

TO EASTERN & CENTRAL NORTH AMERICA

COUNTRY	CITY	TIME—EST	TIME—GMT	FREQUENCIES (MC.)
		MORNING BROADCASTS		
AUSTRALIA	Melbourne	7:15–8:15 a.m.	1215–1315	9.58
CANADA	Montreal	7:15–8:15 a.m.	1215–1315	5.97, 15.32
DENMARK	Copenhagen	7:30–8 a.m.	1230–1300	15.165
FINLAND	Helsinki	7:15–7:45 a.m.	1215–1245	15.185 (Tues., Sat.)
GREAT BRITAIN	London	10:30 a.m.–12:30 p.m.	1530–1730	15.30, 17.81
		EVENING BROADCASTS		
ALBANIA	Tirana	7–7:30 p.m.	0000–0030	7.265
BULGARIA	Sofia	7–8 p.m.	0000–0100	6.07
CHINA	Peking	8–10 p.m.	0100–0300	11.86, 11.945, 15.06
CUBA	Havana	8–11 p.m.	0100–0400	6.17
CZECHOSLOVAKIA	Prague	8–9 p.m.	0100–0200	5.93, 7.115, 7.345
ECUADOR	Quito	9–11:30 p.m.	0200–0430	9.745, 11.915, 15.115
GERMANY	Berlin	8–9 p.m.	0100-0200	5.97, 6.16
	Cologne	8:30–9:50 p.m.	0130–0250	6.075, 9.64
HUNGARY	Budapest	8:30–9:30 p.m.	0130–0230	7.165, 9.833
ITALY	Rome	8–8:20 p.m.	0100–0120	5.96, 9.63
JAPAN	Tokyo	7–8 p.m.	0000–0100	11.78, 15.135
JORDAN	Amman	8:15–8:45 p.m.	0115–0145	9.557
NETHERLANDS	Hilversum	8:30–9:20 p.m.	0130–0220	9.59 (Bonaire relay)
PORTUGAL	Lisbon	9–9:45 p.m.	0200–0245	6.025, 6.185
RUMANIA	Bucharest	8:30–9:30 p.m.	0130–0230	5.98, 9.57
SPAIN	Madrid	8–9:45 p.m.	0100–0245	6.13, 9.615
SWEDEN	Stockholm	8:45–9:15 p.m.	0145–0215	5.99
SWITZERLAND	Berne	8:15–9:15 p.m.	0115–0215	6.08, 6.12, 9.535
U.S.S.R.	Kiev	7:30–8 p.m. (Mon. & Thurs.)	0030–0100 (Tues. and Fri.)	7.12, 7.31
	Moscow	5–5:30 p.m. and hourly to 12–1 a.m.	2200–2230 and hourly to 0500–0600	7.15, 7.31, 9.685
VATICAN	Vatican City	7:50–8:10 p.m.	0050–0110	5.985, 7.25, 9.645

TO WESTERN NORTH AMERICA

COUNTRY	CITY	TIME—PST	TIME—GMT	FREQUENCIES (MC.)
ARGENTINA	Buenos Aires	7–8 p.m. (Mon.–Fri.)	0300–0400 (Tues.–Sat.)	9.69
AUSTRALIA	Melbourne	5–7:45 p.m.	0100–0345	15.22, 17.84
BULGARIA	Sofia	8–8:30 p.m.	0400–0430	6.07
CHINA	Peking	7–9 p.m.	0300–0500	9.457, 11.82, 15.095
	Taipei	6:50–7:50 p.m.	0250–0350	9.72, 11.825, 15.345
CUBA	Havana	9–10 p.m.	0500–0600	6.135
GERMANY	Cologne	9–9:40 p.m.	0500–0540	6.145, 9.72
GHANA	Accra	7:30–8:30 p.m.	0330–0430	6.11
JAPAN	Tokyo	7–8 p.m.	0300–0400	11.78, 15.135
KOREA	Seoul	7–7:30 p.m.	0300–0330	11.925
PORTUGAL	Lisbon	7:45–8:30 p.m.	0345–0430	6.025, 6.185
SWITZERLAND	Berne	8:15–9:15 p.m.	0415–0515	6.12
THAILAND	Bangkok	8:15–9:15 p.m.	0415–0515	11.91
U.S.S.R.	Moscow	7–10:30 p.m.	0300–0730	7.255, 9.54, 9.64

Due to space limitations, it is not possible to include here all broadcasts beamed to North America. The broadcasts listed above are the ones expected to be heard best.

NEW LITERATURE

Two new pocket-size screwdriver sets designed to simplify service and assembly work involving Scrulox square recess screws are described and shown in a single-page bulletin just published by Xcelite Incorporated, Orchard Park, N.Y. 14127.

Acoustic Research, 24 Thorndike St., Cambridge, Mass. 02141, is offering a free brochure of instructions for building a wall-mounted shelf to house hi-fi components. The shelf does not require any brackets; it hooks over a single strip that can be attached to studs in the wall.

A beautifully presented, full-color, 16-page brochure put out by Tandbergs Radiofabrikk A/S, Oslo, illustrates and describes the Tandberg tape recorders, loudspeakers, microphones and accessories. Emphasis is placed on the "Huldra 8" stereo receiver which incorporates two 10-watt transistorized hi-fi amplifiers, an FM tuner, and preamplifiers suitable for low output magnetic pickups—plus an AM radio with four wavebands, including the long waves. You can get a copy of this brochure from any Tandberg dealer.

Exact replacements for approximately 5000 semiconductors are featured in the enlarged edition of the "Semitron Semiconductor Replacement & Interchangeability Guide." Included in the 8-page, 2-color booklet are replacement guides for six new categories of semiconductors. The "Guide" is available free from your Semitron dealer, or for 25 cents from Semitronics Corp., 265 Canal St., New York, N.Y.

Howard W. Sams & Co., Inc. (Dept. A/S, 4300 West 62nd St., Indianapolis, Ind. 46206) has a lot of goodies to dispense: (1) a book list covering current titles on electricity, radio, TV, amateur radio, hi-fi, computer technology, and electronics math; (2) Audel list of authoritative handbooks on nearly all the skilled trades; (3) "Skillfast Library" list of books containing practical information about the mechanical and electrical devices of our modern life; and (4) a catalog on the "PHOTOFACT" Instrumentation Trainer.

Hundreds of tape, phono, and audio accessories manufactured by the Consumer Products Division of Robins Industries Corp., Flushing, N.Y. 11356, can be seen in Catalog #659C, including 64 new products. Among the accessories described are the TK-9 Tape Editing Workshop and the PK-10 Phono and Record Care Kit. —30—

SOLID STATE

(*Continued from page 80*)

Note No. 35, delivers up to 100 watts into an 8-ohm load. It features a pair of Delco's low-cost DTG-110B *pnp* power transistors, and has a flat response within ± 1 db from 20 cycles to 20 kc. at full rated power. Total harmonic distortion is less than 0.25% at 1 kc. from minimum to maximum power output, and IM distortion is on the order of 1.0%. The amplifier must be used with an external preamplifier that can deliver a signal of 0.1 volt r.m.s. into a 10,000-ohm load, or 1.0 volt r.m.s. into a 100,000-ohm load.

The driver section consists of direct-coupled stages, *Q1-Q2*. The base of transistor *Q1* is biased by the voltage drop across *R8*, bypassed by *C4*, in *Q2*'s emitter circuit. This bias voltage is applied through *R6*. The driver stage is then transformer-coupled to power output stage *Q3-Q4* through impedance-matching transformer *T1*.

The output stage is powered by an above-ground 50-volt d.c. power supply to insure that d.c. is kept out of the speaker voice coil. Base bias for *Q3* and *Q4* is supplied through *R10* and *R11*, respectively, while unbypassed emitter resistors *R12* and *R13* provide degeneration to improve fidelity and to prevent thermal runaway.

Except for output transformer *T1*, which is a Triad type TY-160X, standard components are used in the design. Transistors *Q1* and *Q2* are a 2N3391 and 2N3405, respectively, while *Q3* and *Q4* are both DTG-110B's. Capacitors *C1* and *C4* are 50-volt electrolytics, *C2* is a 200-volt tubular type, and, finally, *C3* and *C5* are ceramic disc types. Resistors *R1* through *R9* are ½-watters, while *R10* through *R13* are 5-watt units. Jacks *J1* and *J2* are standard phono jacks.

According to Delco, the amplifier's high power and exceptional sensitivity make good layout a must—it is not a suitable project for a beginner. All signal leads should be kept short and direct, and care must be taken to avoid ground feedback loops. Delco recommends the use of an etched circuit board for the driver stages. Insulated and protected (caged to avoid shocks) heat sinks should be provided for the power transistors (*Q3* and *Q4*). Depending on the layout and lead dress used, the values of input capacitor *C3* and feedback capacitor *C5* may have to be changed for optimum frequency response and best stability.

The power output stage requires a balanced (to ground) d.c. source capable of supplying plus (+) and minus (—) 50 volts at 3 amperes, while the driver stages require an isolated, well-regulated 28-volt d.c. supply. If the preamp with which the amplifier is used has a high-impedance output, it should be connected through a suitable shielded lead to jack *J2*; if it has a low-impedance output (under 10,000 ohms), it should be connected to *J1*.

Transitips. Paraphrasing Shakespeare, "to heat sink or not to heat sink (when soldering semiconductor devices), that is the question!"

Semiconductor manufacturers and a majority of engineers recommend that heat sinks be used to avoid possible damage to heat-sensitive semiconductor devices. The heat sink may be of the spring-loaded type, an ordinary alligator clip to which a piece of felt is soldered and dampened before use, or a pair of long-nose pliers (the lead being soldered is grasped between the body of the device, and the point at which the soldering iron is applied.)

But have you tried to use a heat sink when mounting a transistor close to a printed circuit board? It isn't easy.

In actual practice, it is not always necessary that a heat sink be used, *provided the proper soldering technique is employed.* Your Semiconductor Editor has never used a heat sink for this application—and has damaged only one device, (a tunnel diode) out of thousands installed in various projects.

The "trick" is proper preparation and *quick* work. First, make sure that the point at which the device is to be soldered is clean and will accept solder quickly; pretin, if necessary. Second, cut the device's lead no shorter than absolutely necessary. Third, use a clean, *very hot*, medium-tipped, low-power (15-30 watt) soldering iron or gun; if possible, brush off the tip just before applying it to the joint and apply a drop of fresh solder to the tip. Fourth, make sure that the device's lead is clean and ready to accept solder; if dull, indicating the formation of oxide, scrape clean. And finally, attach the lead to the terminal point and apply the solder and soldering iron tip almost simultaneously, making sure that the flat side of the tip is in good contact with *both* the lead and terminal. Remove the iron or gun almost immediately.

While the above procedure seems long, it is really quite fast—and relatively safe. But *speed* is essential. If you hold the soldering iron in place too long, you may have to kiss the device goodbye!

That does it for now, fellows. Keep your soldering irons hot, your transistors cool, and your batteries charged. Until next month . . .

—Lou

PRINTED CIRCUIT BOARDS

(*Continued from page 59*)

The Etching Process. The only thing we have to do now is mix the solution and etch away. Unless the etching solution provides instructions to the contrary, you will have to measure the circuit board surface area in inches to determine the amount of solution required. A good rule to follow is to use a pint of etchant for every 100 square inches of copper area.

Drop a few glass marbles into the etching container to keep the circuit board from laying flat on the bottom. Then immerse the circuit board in the solution as shown in Fig. 9. Rock the container back and forth to agitate the solution until the excess copper has completely disappeared.

The etching process will require approximately 20 to 30 minutes to complete and can be accelerated by heating the solution to approximately 150 degrees Fahrenheit. However, too rapid etching will produce serious undercutting below the resist.

When the etching process is complete, the circuit board is washed to remove all traces of the etching solution. Varsol can be used to remove the resist, and the completed circuit is then burnished with fine steel wool to provide a clean copper surface for soldering. Your finished circuit board should look like Fig. 10, or better, if you used tape resist.

Installing Components. To facilitate installation of the components, the location of each component is usually marked on the component side of the circuit board with India ink and identified by the reference designation of each part.

When the marking is complete, the circuit board is ready to accept the components for mounting and soldering. Each component should be soldered in place individually even where two or more terminals join in a common land.

Be careful when soldering etched circuit boards as the copper will lift from the surface of the board if too much heat is applied to it. -30-

PICK YOUR MATE?

(*Continued from page 73*)

your mid-20's and looking for a sweet and presumably innocent 21-year old, you'd find slim pickings in an "inventory" loaded with second-husband hunters.

The author—for kicks (and an electronic jolt)—asked one agency to give him a quickie analysis, throw his punch card into a computer's maw—and see what happened. What came up was a 35-year old divorcee, with not only a master's degree (good) but also two dependent children (not so good) who, on her application, had stated she didn't smoke but wouldn't object if her husband (presumably me, a pipe smoker) did.

Against this background, witness the enthusiasm of Bob and Mary (and many couples like them) for the psycho-electronic system which brought them together. "Without electronics, we'd simply never have met," Bob says with conviction. His view is shared by a growing number of researchers, one of whom declares, "There is no doubt as to the scientific validity of the psycho-electronic technique—providing there is validated psychological testing and equally valid programming."

If you're a potential candidate for marriage—or just "looking"—consider the following facts:

In the whole span of ten years, and often less, during which most people normally seek partners in marriage, it is doubtful whether your possible selection will range much over a few hundred or so potential "choices." Normal—and usually narrow—social contacts drastically limit your choice. So does geography. Odds are against your meeting, much less marrying, a girl living much farther than 100 miles from your home. This applies no matter where you live—small town or large. Yet, across the whole sweep of the U.S. (and overseas, as well) are literally thousands of potential partners with whom, tests would show, you are psychologically "compatible."

But you might as well face it: You'll never meet them. Certainly you won't if you depend on mere chance and the whims of geography. Some inkling of what you're missing—the widest possible choice of scientifically attuned-to-you potential mates—comes when you analyze a typical marriage situation.

Say you live in Town A and fall in love with a local girl, X, marry her and forever swear she's "the only girl for me." Nonsense, say psychologists. More correctly, of the thousands of potential compatibles, you happened to meet just one—and married her. For, had you lived in Town B, and never met X, you would have found another mate, Y—and probably come to the same unfounded conclusion (that in all the world she's the only girl for you).

Statistically, she is likely but one in thousands of "just right" potential mates. By sheer luck your paths crossed. Those lacking even this hit-miss good luck wind up as statistics: among the more than 400,000 marriages which each year end in divorce.

Psychology decrees that across the length and breadth of the nation are literally thousands of girls who'd make just as compatible a mate. All that electronic matching can hope to do is to bring together the widest possible choice to arrange introductions *not* by blind chance, but by scientific selection. ". . . people with a high degree of interpersonal compatibility," explains Dr. Richard R. Stephenson, vice-president of Los Angeles' *Human Inventory, Inc.*, the electronic matchmaker that brought together Bob and Mary.

THE "PAIR" TEST

Human Inventory Inc., though a comparative newcomer to psycho-electronic matchmaking (it is now in its fourth year), claims an "inventory" of well over 4000 clients (all potential mates) and, undisputably, is among the nation's most studiously scientific of mate-finders.

HI's basic psychological screening is a thorough-going 500-item true-false personal audit: the "Pair Test" (which stands for "*P*sychological *A*udit for *I*nterpersonal *R*elations"). Devised by Dr. Stephenson, who received his Ph.D. from the University of Minnesota and taught at both Minnesota and the University of Iowa, the "Pair Test" measures applicants on 20 separate "scales" which

weigh compatibility factors in marriage.

Six of the "scales" measure basic personality factors— for example, whether a person possesses a low or high degree of "dominant leadership" or, its opposite, "dependent suggestibility." Six others delve deeply into behavioral factors—a person's rating in such matters as "Order and Routine" and "Intellectual Control." Four of the "Pair Test's" scales measure attitudes—among them attitudes toward "family," "money" and "social status."

Some scales seek out "likenesses" which make for compatibility. Others seek to pinpoint critical differences which for true compatibility, are as essential as likenesses. Thus. a high degree of "dominant leadership" in one partner (presumably the male) demands, for compatibility, just the opposite in his mate: a high degree of "dependent suggestibility."

Human Inventory's tests (including some designed to spot cheaters: those who might attempt to fake their answers) go far beyond even this complex "interpersonal" appraisal. Applicants are asked (on a separate and carefully calculated form) to rate themselves, a "self-descriptive" audit which often—when correlated with their "Pair Test" ratings—is vastly revealing. Applicants also state their preference of partners as to age, height, weight, religion, education, race and other factors. As yet another cross-check, HI asks applicants to supply what psychologists term a "peer rating": a check list on which a friend or relative confidentially checks any of 100 items. . . . as descriptive of the applicant (samples: he's a "social climber," "impulsive," "likes parties," "spends wisely").

These tests may take anywhere from one to four hours. "Hardly," grins Bob, "the kind of thing you'd go through for a quick date." As a matter of fact, even after test results have been reduced to master punch cards, computed and sorted —and compatibles "matched"—the applicants still know one another only by number and, initially, correspond through HI's Los Angeles office.

"One day," Bob explained, "HI's pink (for female) "Client Referral" slip arrived in the mail. It listed only Mary's code number—and a dozen bits of data;

her education, marital status, occupation, and some others. She received my code number—and a similar description. For four solid months we corresponded by number, addressing letters to HI's office ("from No. 576 to No. 2134"), before we exchanged names and addresses. It was another month before we arranged a personal meeting."

Bob and Mary were unique. Their eventual meeting (and marriage) was the product of HI's initial "electronic sorting." Many mate-seekers correspond with upwards of a dozen "compatibles" before meeting or, in fact, even learning the other's name. Some never meet. Something in the tone of one or the other's letters kills the romance before it has ever begun.

Not surprisingly—in view of the scrupulously scientific approach—Human Inventory's "inventory" is top-heavy with professional people, men as well as women. HI claims that 60% of its male applicants hold college degrees and that 10% of these have advanced degrees (many are doctors, lawyers and PhD's). Engineers, says Dr. Stephenson, comprise about 30% of the male inventory.

"But machines do not replace or eliminate romance," points out Dr. Stephenson. "They merely provide a better-risk selection of acquaintances with whom a person can 'fall in love'."

Even though years of preparation have gone into his "Pair Test," Dr. Stephenson is quick to acknowledge that as yet he has no long-term validation in terms of marriage success. "Psychological tests of the kind we've devised require years for correlation and validation," he explains. "It takes time—10 years, perhaps even 20 years—before the variables in such complex test scales can be precisely weighed against the others . . ."

Electronically, Human Inventory makes use of the facilities of the famed National Computer Systems center in Minneapolis, Minn. Here, at one of the nation's largest test scoring labs, the raw test scores from the "Pair Test" are electro-optically scanned by NCS's document reader (5000 sheets an hour) which puts the information on magnetic tape. The tape feeds a Control Data Corp. 160G computer which, in turn, con-

trols an electronic punch card machine that translates taped data into some ten punch cards. In this basic card form, data can either be programmed through computers (to turn out various statistics aimed at validating test results against marriage results), or returned to HI's Los Angeles office where the cards are often electronically sorted 45 or more times to narrow to "finite compatibility" the matching of potential mates.

After weeks of testing and scientific matching, electronics has done as much as it can be expected to do. The rest is up to chemistry—the catalyst of love and marriage.

But one thing has changed: the odds. And no couple proves it better than Bob and Mary. -30-

QUIZ ANSWERS

(*Quiz appears on page* 74)

1 — E	The ALUMINUM OXIDE which forms on the aluminum electrode in an electrolytic capacitor serves as the dielectric material.
2 — J	BARIUM TITANATE is the piezoelectric material used in the manufacture of ceramic phonograph cartridges.
3 — A	CADMIUM SULFIDE is one of a number of materials used to make photocells.
4 — B	CUPROUS OXIDE serves as the P-type semiconductor in copper oxide rectifiers.
5 — I	FERRIC OXIDE (or iron oxide) particles are used as the magnetic material in recording tapes.
6 — H	LEAD SULFIDE crystals were used in the manufacture of galena signal rectifiers for early crystal receivers.
7 — G	MANGANESE DIOXIDE is used as the depolarizer in the common flashlight cell.
8 — F	A mixture of STRONTIUM OXIDE and barium oxide forms the electron emitting coating on the cathode of receiving tubes.
9 — C	SILICON CARBIDE is used in the manufacture of varistors—voltage-sensitive resistors—used as voltage regulators and lightning arresters.
10 — D	ZINC SULFIDE is used with a silver activator as a type P-4 (medium-short persistence) phosphor in cathode-ray tubes.

REFLEXOMETER

(*Continued from page 49*)

power supply components are mounted on a subchassis or shelf built from a 2″ x 13″ piece of aluminum. Form a ½-inch flange on each end of the shelf. A 24-volt d.c. power supply and relay system is used to permit the selection of surplus and other easy-to-get four-pole, double-throw relays.

Assemble and wire the subchassis before mounting it inside the main chassis. To cut down costs, the relays can be held in place with sheet metal straps, and you can solder the connecting wires directly to the relay pins.

Mount the four pilot light assemblies, power switch, reset button, fuse holder, octal socket, and a handle on the main chassis. Use dome-type lens caps instead of jeweled lenses to be able to see the light better at wider angles. A low-cost way to mount the pilot lights is stick them through rubber grommets attached to the cover, and solder the appropriate wires directly to the center contact and base of the lamps. Paint each bulb a different color.

If you happen to have on hand four identical relays that require a different working voltage, such as 6 or 12 volts, you can use them, but be sure the power supply and lamps are rated accordingly.

Responders. Prepare four 4″-long, 1″-diameter wood dowels by drilling a ⅝″ hole lengthwise about halfway, then a ¼″ hole for the remainder of the way through each of them. Paint each dowel an identifying color to correspond to each of the different colored lamps. Pass one end of a 4′ length of lamp cord through the ¼″ hole and tie a knot in it about 3″ from the end to serve as a strain relief. Then connect the leads on this end of the lamp cord to the screws on the switch and force-fit the button assembly into place. The responders can be connected to the relays directly, or to an octal plug (*PL1*) as shown.

Cover the bottom of the chassis, add four rubber feet to the cover, and invite your friends over. —30—

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

ALL radio listeners interested in furthering the hobby of SWL'ing—regardless of whether you DX on the BCB, VHF, TV, SW, or FM bands—are eligible to apply for a POPULAR ELECTRONICS "Certificate of Registration." You must have verified (have QSL cards from) a minimum of five radio stations, of which one was outside the borders of the United States. There is no age limit, or special equipment qualification; the only requirement is that the applicant have a sincere interest in radio communications.

All certificates are filled in and lettered before mailing; they are mailed flat and unfolded. If you want to register and receive your WPE identification sign, fill in the application blank below. Mail with 50 cents in coin (or stamps) to: MONITOR, P.O. Box 333, Cherry Hill, N.J. 08034. (Personal checks will not be acceptable). Canadians should use their own currency, and other applicants not in the U.S.A. should use 10 International Postal Reply Coupons. Allow 4-6 weeks for processing.

(Please Print) (Do not fill out)

Name . . . . . .

Street, City and Zone . . . . . .

State and Zip . . . . . .

Receivers in use Make . . . . . Model . . . . . .

Make . . . . . Model . . . . . .

Age Occupation . . . . . .

Ham/CB call-letter assignment(s) . . . . . .

I listen mostly to SW Broadcast Hams CB BCB VHF VLF . . . . . .

I use the following antennas . . . . . .

I have QSL cards and countries verified. Check if subscriber to P.E. . . . . .

Signature Date . . . . . .

FROM RAGS TO RICHES

(*Continued from page 46*)

trols, and vacuum tubes, as well as semiconductor devices.

Differing from the component kit, the *semi-kit* includes a variety of components suitable for one or two specific projects. The RCA KD2105 Experimenter's Kit is a typical semi-kit. It includes a SCR-heat sink assembly, two transistors, and five rectifiers. The KD2105 is for use in assembling the projects described in RCA's "Experimenter's Manual." The hobbyist must furnish additional standard components, such as resistors and capacitors, as may be needed for individual projects.

Other semi-kits are Sylvania's PCK-10 Photoconductor Kit, which includes three photoconductors, sensitive relay, mounting bracket resistor, and 52-page circuits booklet, as well as the entire line of "Schemat-A-Kits" offered by Trans-Tek. Of these, the "Schemat-A-Kits" are perhaps the most complete, with resistors, capacitors, volume controls, and even hookup wire included in some of them and only such items as heavy transformers, loudspeakers, and handkeys omitted from the packages.

Modules. Borrowing a technique from computer manufacturers, AMD, Cordover, Home Electronics, International Rectifier, Saxton, and Workman now offer self-contained circuit modules. Prewired and sealed or encapsulated, these modules contain a complete electronic circuit suitable for one or more specific equipment application.

Currently available modules include light flashers, sirens, preamplifiers, audio power amplifiers, stroboscopes, wireless microphones, control circuits, alarm circuits, radio tuners, and power supplies. They can be used to assemble radio receivers, intercoms, power megaphones, fire and burglar alarms, electronic "baby-sitters," record players, p.a. systems, code practice sets, metronomes, walkie-talkies, guitar amplifiers, remote controls, and a host of other projects.

Generally speaking, circuit modules are used with such accessory items as speakers, relay, transformers, micro-

phones, phono cartridges, sensors, lamp bulbs, and external power supplies. As an example, the Saxton Model HDF "Dual Flasher" module is wired to a pair of #47 pilot lamps, a s.p.s.t. switch, and a 6-volt lantern battery to assemble a warning flasher, as illustrated in the drawing on page 45.

Two or more modules can be used in a single project. In International Rectifier's "IRectronic" line, for example, there are AM and FM tuner modules, audio amplifier modules, and a line-operated d.c. power supply module. The tuner, amplifier, and power supply modules can be interconnected and mounted in a cabinet with a speaker to make a complete radio receiver.

All modules are supplied with color-coded leads or easily identified terminals and clear interconnection diagrams. Thus, final equipment assembly and wiring is a relatively simple task, requiring a minimum of hand tools, little skill, and virtually no technical knowledge. As a result, circuit modules are a great favorite with beginners and non-technical "do-it-yourself'ers" who want to assemble a specific piece of equipment at minimum cost.

Today and Tomorrow. The increasing interest in circuit modules shows that a "new breed" of electronics hobbyist has been born—a breed more concerned with overall equipment operation and performance than with circuit details. This new type of hobbyist is analogous to the modern "systems engineer" who works with block diagrams, each assigned a specific function, rather than with detailed schematics.

Looking to the future, we can expect an increase in the number of hobbyists as scientific and technical equipment becomes an ever more important part of our daily lives. While many hobbyists will prefer to work with modules, there will be an increasing number who prefer to assemble their own circuits. However, regardless of the outcome of any battle between modules vs. component kits vs. semi-kits, the hobbyist experimenter has gained new recognition. Today he is rich, and able to pick and choose. Hobby electronics has made a full circle. —30—

AMATEUR RADIO

(Continued from page 82)

site provided the station licensee is in attendance at the activity."

Miscellaneous Items. The Niles North Radio and Electronics Club transmits code practice each Monday night at 0100 GMT (7 p.m., CST) on 21.1 mc. Speeds are 5, 8, 10, 13, and 16 wpm. Ten minutes are devoted to each speed, and the text is from past issues of POPULAR ELECTRONICS. Each practice session is introduced by the call "QST QST QST DE WA9MUP (or WA9QJW)."

The November, 1965, issue of *The Bison* of the Indiana Radio Club Council stated that 16 amateurs cooperated with the Michigan City, Ind., Police Department to set up a Halloween Patrol—which was commended by the police chief for its effectiveness. In fact, so effective was the work of these amateurs in covering suspected activities that some of the Halloweeners thought they were being trailed by the patrol cars.

According to the California State FM Association *Frequency Directory,* there are at least ten 2-meter repeater stations in California. The directory lists their frequencies, as well as the 50-, 144-, and 450-mc. frequencies (so far as they are known) of all active California nets and groups on these bands. Send a stamped, business-size return envelope to the California State FM Association, c/o Douglas E. Decker, Jr., WA6TAD, Secretary, 5901 Streamview Drive, Apt. 3, San Diego, Calif. 92105, if you can use this information.

U.S. servicemen in Vietnam had an opportunity to send messages home during the Christmas season last year due to the installation of seven new Military Affiliate Radio System (MARS) radio stations in the area. The portable MARS stations were flown to Vietnam to supplement over-taxed commercial telephone facilities.

News and Views

Dennis Grindrod, WA1EHF, 1133 Central Ave., Bridgeport, Conn., just went from Novice to General. Operating on 40 meters only, Denny has 35 states. Canada, Germany, and Venezuela worked. Taking advantage of the surplus market, he uses a modified ARC-5 transmitter now running 100 watts and a Navy TCS-5 receiver in combination with a 100' end-fed antenna about 30' high . . . **Glenn Gibson, WB2JGD,** 16-10 Berdan Ave., Fair Lawn, N.J., knows how to squeeze contacts out of his gear. With a Hallicrafters HT-40 transmitter and an S-20 receiver feeding a 40-meter dipole, Glenn worked the 50 states on 40 and 15 meters and has a WAS certificate to prove it. His new goal is DXCC—he is halfway there with 50 countries worked—and he spends most of his time on the air

chasing new countries on 20-meter CW . . . The Ontario Teen Age Net meets every Saturday at 1400 EST: NCS is **Bob Wood, VE3GBW,** Box 67, Tillbury, Ontario. Ontario teen-agers are invited to join the net to rag-chew. Each transmission should be limited to three minutes and sent at a speed of about 10 wpm.

Ricky Lewis, WA4YXN, 415 Iroquois Rd., Knoxville, Tenn., really hit the 6-meter band in full overdrive. With a Technician license and a 1000-watt transmitter, both three months old, Ricky has worked 13 states and Cuba on 6 meters. A Hammarlund HQ-110C receiver processes incoming signals before delivering them to the loudspeaker. But Ricky gave no clue as to what kind of an antenna he uses . . . **Roy Lincoln, WA4DOU/4,** 602 Southard St., Key West, Fla., can verify the difficulty that rolling stones have in gaining moss. Because he has moved four times and each time more than 25 miles from his last address, he has had to start over on his WAS search four times. But he has hopes of making the grade from Key West. In three and a half months there, he has worked 45 states and has cards from 38 of them. And Roy hasn't passed up any DX either: he has 42 countries worked from Key West to make his DXCC total 49. All this has been done with a Knight T-60 crystal-controlled transmitter using three crystals at a power input of 60 watts. He operates mostly on 20 and 15 meters but does make an occasional excursion to 40 meters. Roy's antennas are 15- and 20-meter dipoles, and his receiver is a Hammarlund HQ-129X. He will sked anyone for any reason on 14.070 kc. and hopes an Asian will eventually hear him for his Worked All Continents award . . . **William Ewing, WAØKAQ,** Route 2, Lyman, Nebr., got 32 states as a Novice and now has 40 states and four Canadian provinces worked. Bill's Heathkit DX-60 transmitter runs 85 watts to feed a variety of dipole antennas on the phone and CW bands between 80 and 15 meters. He receives on a Mosley CM-1.

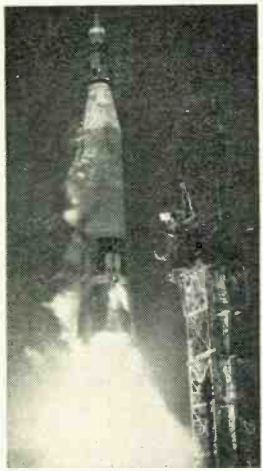
Keith Prior, VE3GCJ, R.R. 6, Simcoe, Ontario, Canada, made 22 states and one VE3 in his first 25 days on the air. He was using a Conar 1-tube, 25-watt transmitter and the matching Conar receiver in conjunction with a 65' dipole made of house wire. Keith now has a pair of Italian "Geloso" 75-watt transmitters and is apparently still receiving on the Conar. Dropping down to 20 meters, Keith knocked off 23 countries in less than two weeks; then he put up a home-brew 20-meter beam . . . **George Faust Jr., WN7CPL,** 3851 Desert Steppes Dr., Tucson, Ariz., was momentarily expecting his General Class license to arrive when he wrote in. Checking the records, George's Novice logbooks show 49 states worked and confirmed, and five continents—four confirmed. Although the log also shows 30 Japanese stations and many other DX stations worked, George rates an LU3 (Argentina) on 40 meters with a RST589 report as his best DX. The WN7CPL "power house" includes a Johnson "Navigator" transmitter running 10 watts input to excite a vertical antenna. The receiver is a Hallicrafters SX-111 . . . In a year on the air, **Dave Fox, WA9MZW,** Box 126, Milford, Ind., has earned WAS and WAC and has 50 countries worked. A Drake TR-3 transceiver feeding dipoles for 80 and 40 meters, and a 3-element Yagi beam, or a 2-element quad antenna, made most of the contacts on SSB. The latest addition to Dave's ham shack is a Heathkit SB-200 linear amplifier.

Clyde Mason, KØGJE/WPEØJN, 855 S. West Ave., Springfield, Mo., is doing his best to dispel the idea that you need high power and a big antenna farm to work DX. Starting his ham career with a 10-watt, crystal-controlled transmitter, a long-wire antenna, and a 10-meter ARC-5 transmitter, Clyde worked all states and 52 countries in two years. He then went high power—to an EICO 720 running 90 watts—and installed a 11'-long vertical

(*Continued on page* 106)

Choose Your Tailor-Made Course in N.T.S. "PROJECT METHOD" ELECTRONICS

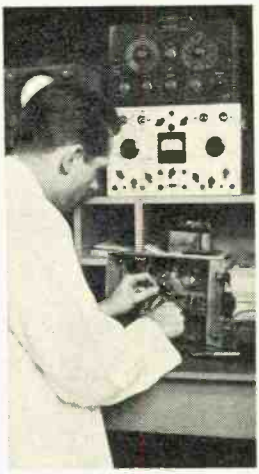
Now! N.T.S. — one of America's oldest leading home-study and resident technical schools—offers you GREATER CAREER OPPORTUNITIES IN ELECTRONICS.



You can install and maintain electronic circuitry in missiles and rockets . . . specialize in microwaves, radar, and sonar.

You can succeed in TV-Radio Communications . . . prepare for F.C.C. License, service advanced satellites for industry and defense.

You can service and repair the electronic "brains" of industry — computers, data processing and other automation equipment.



You can become a highly-paid TV-Radio Technician, an electronics field engineer, or succeed in your own sales and service business.

CHOOSE YOUR FIELD—INSURE YOUR FUTURE!

1 ELECTRONICS-TV-RADIO SERVICING AND COMMUNICATIONS

A basic course thoroughly covering fundamentals of electronics, radio, TV servicing and communications.

2 MASTER COURSE IN ELECTRONICS-TV-RADIO, ADVANCED TV AND INDUSTRIAL ELECTRONICS

Qualifies you as a Master Electronics Technician — the Man in Demand.

3 FCC LICENSE COURSE

Preparation for this government license essential for many interesting jobs in radar, radio, television, communications, guided missiles, many others. Upon completion of this course, if you do not pass the FCC exam, your tuition will be refunded in full.

4 RADIO SERVICING (AM-FM-TRANSISTORS)

Train for radio sales and service with dealer or distributor.

5 TELEVISION SERVICING (INCLUDING COLOR)

Covers installation, adjustment, repair and servicing of black and white and color television . . . prepares you for your own sales and service business.

6 STEREO, HI-FI AND SOUND SYSTEMS

A growing field. Prepares you to build, install and service modern sound equipment for home or industry.

7 BASIC ELECTRONICS

Gives you the fundamentals you must know to build on for a future Electronics career. Also offers an excellent background for Salesmen, Purchasing Agents, and others in Electronics.

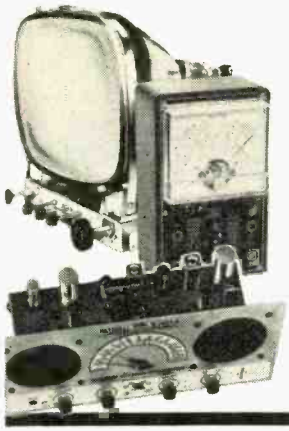
8 ELECTRONICS MATH

Simple, easy-to-follow instructions in the specialized math you need in many electronics jobs.

INDUSTRY WELCOMES N.T.S. STUDENTS AND GRADUATES

N.T.S. HOME TRAINING: QUICK, PRACTICAL WAY TO HIGHER PAY, LIFELONG BENEFITS

N.T.S. "Project Method" Courses can help you get a new and better job — or move up to higher pay in your present one.



N.T.S. "Project Method" home training lessons are shop-tested in the Resident School in Los Angeles. You work on practical job projects, learn to use shop manuals and schematics. Your N.T.S. training is individual. You proceed at your own pace. The Schools' practical methods plus more than 60 years of experience have helped thousands of students all over the world to successful careers.

Most courses include Equipment Kits. There are no Kit Deposits. Everything included in your low tuition.

HIGH SCHOOL AT HOME

Learn easily. New modern method. National also offers accredited high school programs for men and women. Take only subjects you need. Study at your own pace. Latest approved textbooks — yours to keep — everything included at one low tuition. Check High School box in coupon for information.

MAIL REPLY CARD OR COUPON FOR FREE BOOK AND SAMPLE LESSON In Field of Your Choice

You Enroll by Mail — and Save Money.
No Salesmen: This means lower tuition for you.
Accredited Member N.H.S.C.

CLASSROOM TRAINING AT LOS ANGELES

If you wish to take your Electronics-TV-Radio training in our famous Resident School in Los Angeles — the oldest and largest School of its kind in the world—write for special Resident School catalog and information, or check coupon.

NATIONAL TECHNICAL SCHOOLS
WORLD-WIDE TRAINING SINCE 1905
4000 S. Figueroa St., Los Angeles, Calif 90037

BENEFIT NOW AND ALL YOUR LIFE WITH N.T.S. HOME TRAINING

The personal guidance you receive during your training can be very helpful to your progress. Many N.T.S. students are able to earn more money within a few months. You can pick and choose your career. Work in industry or go into business for yourself.

Your services will always be in demand wherever you go — and you can pick your spot!

N.T.S. Graduate Advisory Service can help you answer technical questions in establishing your own business and in countless other ways after you've completed your training.

NATIONAL TECHNICAL SCHOOLS
4000 S. Figueroa St., Los Angeles, California 90037

Please Rush FREE Electronics "Opportunity Book" and actual sample lesson on course checked below:

- ☐ Electronics-TV-Radio Servicing and Communications
- ☐ Master Course in Electronics-TV-Radio Advanced TV and Industrial Electronics
- ☐ FCC License Course
- ☐ Radio Servicing (AM-FM-Transistors)
- ☐ Television Servicing (Including Color)
- ☐ Stereo, Hi-Fi and Sound Systems
- ☐ Basic Electronics ☐ Electronics Math

Dept. 205-36

Name _____ Age _____

Address _____

City _____ State _____ Zip _____

☐ Check here if interested ONLY in Classroom Training at L.A.

☐ Check here for High School Department Catalog only.

whip antenna. This combination, plus a Hallicrafters SX-99 receiver, has made over 1000 DX contacts in 150 countries!

We welcome your "News and Views," pictures, and club bulletins. Send them to: Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Ind. 46401.

73, *Herb, W9EGQ*

ON THE CITIZENS BAND

(*Continued from page 77*)

forcement campaign to combat the use of improper language by Class D Citizens Radio stations in that region. The trial and conviction, as well as other pending actions, resulted from investigation and monitoring efforts on the part of the FCC Field Engineering Bureau office and the Federal Bureau of Investigation at Boston.

Similar enforcement efforts are being conducted by the other Commission Field Engineering Bureau offices and monitoring stations.

Emergency Assist In The Air. There's one pilot who can truthfully say he was "S-metered" to safety recently. At 6:45 one morning, Leland Roeewold, KLI0415, Senca, Nebr., put out a "Mayday" call with his "1-watt walkie-talkie" on channel 11. He was airborne, caught up in a ground fog, and unable to determine his location.

REACT team member Robert Vincent, Sr., KLE2703, at Julesburg, Colo., gave an immediate reply and went to work to get the pilot safely back on the ground. By orienting his antenna, Vincent determined that the plane was either due north or due south of him, and by watching his S-meter drop was able to "see" that the plane was flying away from him. Since the pilot reported a 180° compass heading, and the airport was about 25 miles northwest of Vincent's station, the pilot was instructed to turn around and assume a northwesterly course.

Vincent moved to channel 9 and asked the area base station, 15Q0832, to switch to channel 11 and assist the pilot further. He then contacted the airport for a weather forecast. The airport took the number of the aircraft and asked if the pilot had any other radio equipment on board. A negative reply left airport authorities unable to help.

Using S-meter readings, Vincent and five other CB stations that were monitoring kept the pilot on course. Finally, Vincent spotted an opening in the clouds and asked the pilot if he could see it. Following the longest ten seconds in his life, the pilot radioed back, "I see it, I see it!"

The story of the guidance of pilot Roeewold and his plane to a safe landing was reported by National REACT Director Henry B. Kreer. The REACT base stations that assisted in the emergency included Jess Smith, 15Q0832, Big Springs, Nebr.; Robert Vincent, Jr., KNE0656, Lodge Pole, Nebr.; and Ralph Talich, 15Q0226, also at Lodge Pole.

1966 OTCB Club Roster. The clubs listed here are associations reporting to the "On the Citizens Band" column for the first time.

Gainesville, Georgia. Lanierland Communicators of Hall County. This group publishes a clean-cut, informative newspaper, *Channel Chatter,* which is jam-packed with informative news and views. Club officers: Jim Dobbins, 6Q6117, president; Chas. Sexton, KKM4181, vice president; W. O. Sexton, 6W6239, secretary/treasurer. The newspaper editor is Chas. E. Sexton; his assistant, Jim McManus.

Machias, Maine. Club has 24 members, most of them affiliated with the county Civil Defense group. They participated in emergency communications during a forest fire last August, and were commended by State and County CD directors. Officers: Mrs. Harry Johnson, KKA7344, president; Mrs. Pat Clemons, KMA2542, vice president; Mrs. Donald Drisko, KKB1534, secretary; Mrs. Frederick Johnson, KMA4079, treasurer; and Mr. Walter Bagley, KKB3705, publicity. (Walt evidently got so shook up with all those women officers around, he forgot to give us the name of the club! How about that, Walt?)

Malden, Massachusetts. Malden REACT. Organized last September to help in times of disaster, to assist worthwhile charities, and to assist stranded motorists. Monitoring channel: 9. Officers: Wm. Olsen, KBD0286, captain; David Fullerton, KKA7962, first lieutenant; James Foley, KMA7096, operations lieutenant; Brian Mulligan, KKB2355, lieutenant adjutant; Earl Laughton, KMA5055, lieutenant treasurer; Steve Shear, KMA2668, president of the board of directors; Jos. Martinelli, KMA4568, director; and Murry Silver, operations sergeant.

Mount Horeb, Wisconsin. Blackhawk Citizens Band Radio Club. Fred Schwierske, KNK3627, reports that this club monitors channel 9, and meets the last Sunday of each month. Officers: Al Bendickson, KNJ0955, president; Milford Thousand, KLK1585, vice president; Dick Wells, KLK7605, secretary/treasurer; and John Waldvogel, KLK8091, Grant Turner, KLJ9406, and Robert Mueller, KNJ6430, board of directors.

I'll CB'ing you.

—Matt, KHC2060

SHORT-WAVE LISTENING

(*Continued from page 75*)

eye. Be sure that your report gives the impression that you actually did hear the station. List the date, the time, a reasonably close aproximation of the frequency, the call letters of the station being contacted, and give a brief resume of the conversation.

And don't forget that return postage. Ham operators are not subsidized by anyone, and the postage they have to pay for a card back to you comes out of their own pockets.

Broadcasts Station News. A number of test transmissions will be made by *Radio Inter Red Cross*, Berne, Switzerland, on 7210 kc. during 1966. Tune for them at 1130-1230, 1500-1600, and 2100-2200 on March 21, 23, 25; May 9, 11, 13; July 4, 6, 8; September 19, 21, 23; and November 21, 23 and 25.

The Fiji Broadcasting Commission (Suva, Fiji Islands) has announced expansion plans. A new 500-watt transmitter, VRH6, will operate on 5980 kc. with regular daily transmissions in three languages. In addition, VRH7, 6005 kc., will also be brought into service. The new schedule, therefore, will read: English on VRH6, 5980 kc., at 2330-0345, and on VRH12, 3935 kc., at 1800-2330 and 0400-1030. Native-language will be aired on VRH7, 6005 kc., at 2100-0400, and on VRH13, 3980 kc., at 1800-2100 and 0400-1030. On Saturdays all transmissions will be extended to 1100.

CURRENT STATION REPORTS

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Greenwich Mean Time (GMT) and the 24-hour system is used. Reports should be sent to SHORT-WAVE LISTENING, P.O. Box 333, Cherry Hill, N.J., 08034, in time to reach your Short-Wave Editor by the fifth of each month; be sure to include your WPE identification, and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Albania—*R. Tirana*, evidently with a powerful new xmtr. now broadcasts to N.A. at 0000-0030 on 7265 kc. and at 0630-0700, 2000-2030, and 2200-2230 on 7265 and 9390 kc.

Bolivia—Rarely heard is CP75, *La Cruz del Sur*, La Paz, 4985 kc., at 0030-0055 with a religious exhortation in Spanish, an ID at 0100, then an orchestral version of Bach's "Toccata and Fugue in D Minor." This one is extremely difficult to read through an RTTY station and marker station WKA24.

Brazil—Another seldom-heard station is ZYU60,

Porto Alegre, 15,335 kc. Look for it, possibly with sporting events, on Sundays from 2045.

Burma—Station XZK4, Rangoon, 7120 kc., was monitored at 1203-1233 with Far Eastern music and native-language anmts. Two gongs at 1230 made up the IS during the station break.

Cambodia—*R. Cambodge,* Phnom-Penh, is noted at 1305-1324 on 9699 kc. with native music and vocalizing, and with some native-language anmts. The signal is very weak.

Cape Verde Islands—Station CR4AB, *R. Clube Mindelo,* Cao Vincente, 4719.5 kc., has a strong carrier but weak audio from 2150 in Portuguese; s/off is at 2000 with "A Portuguesa."

Colombia—The station reported here last month on 6117 kc. evidently is *R. Centro Populare, La Voz del Guainia.* It's heard best around 0230.

England—The BBC has reported that its news is no longer being relayed in Southern Rhodesia.

France—*Radiodiffusion-Television Francaise,* Paris, was noted on 9525 kc. with s/on and "La Marseillaise" at 2300 to the Antilles and Guiana. Strong at first, it rapidly deteriorated until fade-out at 2340. The program was mostly news and jazz music. Paris plans to construct relay stations in French Somaliland, New Caledonia, and French Guiana, according to an overseas source.

Germany (East)—*R. Berlin International's* current schedule (as of March 1) reads: to N. A. East Coast at 0100-0130 and 0230-0300 on 9560 and 9650 kc., and to the West Coast at 0345-0415 and 0445-0515 on 9600 and 9650 kc.

Germany (West)—*Deutsche Welle,* Cologne, transmits "Newsbeat" to N.A. at 1045 on 9605 and 6075 kc. and at 2050 on 9735, 9655, and 6145 kc. A letter received from Mr. Hans-Joachim Felbick of the technical staff reads in part: "We are very much interested in observations of the frequency 9640 kc. from 0130 to 0250 as we receive much more favorable reception results from other parts of the U.S. These better results are most probably to be attributed to a higher coverage of these areas by our directional antennas. By the way, we are planning another relay station in the Caribbean area . . . it would change the reception situation within the U.S. completely to the better."

Greenland—*Gronlands Radio,* Godthaab, 5980 kc., is very weak but sometimes in the clear at 2204-2235 with straight talking in Greenlandic and some high-pitched chimes thrown in at times. East Coast DX'ers might well hear this station; it has been heard as far west as Indiana, according to reports.

Guatemala—Station TGDZ, *Transmite Radio-Centro Americana de Guatemala,* 6090 kc., features Latin American vocal-instrumental music, fanfares, and frequent anmts at 1700-1800.

India—*All India Radio,* Delhi, has been found on 9575 kc. with signature tune at 1258, s/on at 1300, and to 1415 with native-language programs.

Iran—*R. Tabriz* has moved from 6210 kc. to 6223

Robert Siemion, WPE8GWQ, Detroit, Mich., recently received a 25 Countries Award. His receiver is a National NC-105, his antenna an 80' long-wire.

kc. where it has been heard until 1830 close-down, with best reception after 1700.

Jordan—Amman has a talk in Arabic at 1225-1315. and chanting—with a woman announcer—to 1330. This is on 11,970 kc.

Korea (North)—*R. Pyongyang* has changed frequencies for its N. A. broadcast. After a silence of several weeks, it has reappeared on 11,740 kc. with Korean at 1700-1800 and Eng. at 1800-1900. The Eng. portion generally consists of news. commentary, and music in what might best be described as a "Radio Peking" format. Another xmsn. as yet not positive, may be on 9935 kc. at 0000-0027; it opens with a seven-note IS given twice, a short anmt, a march, then native-language news followed by Oriental music.

Malaysia—Kuala Lumpur, 6175 kc., continues in Eng. at 1115-1215 with Eng. news and recordings, dual to 11,900 kc. The BBC Far Eastern Station, Singapore, 11,830 kc., has been noted at 0000-0015 with IS of bells, s/on, and then news, dual to 9570 kc.

Mexico—Station XEUMT. listed as having a xmtr at Sisoguichi, Chihuahua, and a mailing address in Mexico City, is noted on 5960 kc. weekdays, daytime only, with s/off at 1830. They broadcast educational programs for the Sierra Tarahumara, an Indian region in northern Mexico.

Is XEUDS. University of Sonora station. still on the air? Recent tunings on 6115 kc. indicate a station with a call-sign of XHUS, a different ID slogan, a statement that it is testing, and s/off at 1930. several hours before the XEUDS time. No Eng. was noted. The only requests made were for telephone calls from nearby areas telling the signal strength of the station.

Morocco—Rabat, 15,375 kc., was noted at 1645 with singing, at 1657 with short anmts. and at 1659 with a talk; s/off was at 1738, no closing anmts. This was an all-Arabic xmsn.

Mozambique—*R. Clube Mozambique,* Lourenco Marques, can be heard on 3260 kc. around 0115-0135 with music; an Eng. ID is given at 0130.

Netherlands—*R. Nederland,* Hilversum, has replaced 15,425 kc. with 9525 kc., dual to 11,730 kc., for its 2030-2050 twice-weekly ("European Review" on Tuesdays, "Trans-Atlantic Profile" on Fridays) network link with WUOM, Ann Arbor, Mich.

Pakistan—Karachi has dictation-speed news in Eng. at 1335-1350 on 17,948 kc.

Peru—Station OAX7A. *R. Cuzco,* Cuzco, is heard on 6247 kc. from 0115 to 0220 with many commercials and a variety of tropical music. There is a time check at 0130 for 2030 Peruvian time. This xmsn is listed for 6252 kc. and was last reported on 6265 kc.

Poland—The Polish Pathfinders Union Broadcasting Station, *Rozglosnia Harcerska,* now operates on weekdays except Mondays at 1200-1800 on 6850 kc., and on Sundays at 1000-1800 on 7306 kc., both with 300 watts The new station manager is anxious to establish close relations with listeners. and if there is enough demand, programs in Eng. and French will be initiated. Reports go to Konopnickiej 6, Warsaw.

Rwanda—The new relay station for *Deutsche Welle (Voice of Germany)* in Kigali has been heard on 17,855 kc. at 1810-1830 with Eng. news; on 17,805 kc. to W. Africa at 1745-1830 in Eng. and at 1830-1915 in Hausa; on 11,905 kc. at 0630-0645 (unreadable by 0645) with music and Eng. anmts: on

DX COUNTRY AWARDS PRESENTED

To be eligible for one of the DX Country Awards designed for WPE Monitor Certificate holders, you must have verified stations in 25, 50, 75, 100, or 150 different countries. The following DX'ers recently received their awards.

ONE HUNDRED COUNTRIES VERIFIED

Winston Klontz (WPE6EYO), Culver City, Calif.
Clifford Cardwell (WPE5LU), Fort Worth, Texas
Ralph Hartman (WPE9CR), Naperville, Ill.

SEVENTY-FIVE COUNTRIES VERIFIED

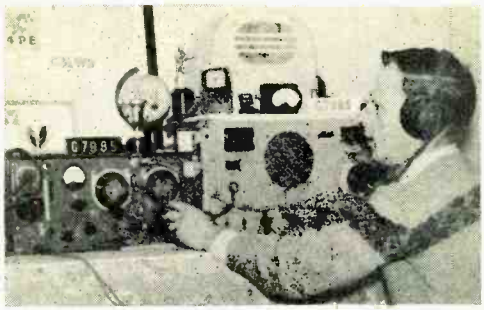
Robert Brickner (WPE3FYF), Pittsburgh, Pa.

FIFTY COUNTRIES VERIFIED

Tim Kerfoot (VE3PE1TH), Toronto, Ont., Canada
Patricio McGrath (6Y5PE1A), Kingston, Jamaica
William Kilroy (WPE3FOB), Washington, D.C.
Robert Crowell (WPE4HKO), Fort Walton Beach, Fla.
Kenneth Rosen (WPE8HSZ), Detroit, Mich
Aldridge Salisbury (WPE4HLD), Falls Church, Va.

TWENTY-FIVE COUNTRIES VERIFIED

Walter Witek, Jr. (WPE2OIW), Buffalo, N. Y.
L. D. Unkefer (WPE8UJ), Alliance, Ohio
Bob Gordon (WPE3FWH), Clairton, Pa.
Eddie Jaworski (WPE2NEP), Richmond Hill, N. Y.
Larry Swanson (WPE4AZC), Winter Park, Fla.
Blake Wilson (WPE2KDA), Glen Rock, N. J
Parks Redwine (WPE4HCO), Fayetteville, Ga.
Donald Christensen (VE2PE1DF), Montreal, Quebec, Canada
Richard Lauhead (WPEØDTX), Elwood, Nebr.
Stephen Rollin (WPE3GIX), Philadelphia, Pa.
Stephen Cramer (WPE2NSE), Rockville Centre, N. Y.
Russell Rzemien (WPE1FNJ), Pawtucket, R. I.
James Kobus (WPE7CGW), Ferndale, Wash.
Jonathan Lisenco (WPE2MAC), Flushing, N. Y.
Gene Bond, Jr. (WPE2JHW), Moorestown, N. J
Patrick Chick (WPE8DZK), Mayfield Heights, Ohio
Joseph Castonguay (KZ5PE1I), Curundu, Canal Zone
Jim Ritter (WPE8ICY), Willowick, Ohio
Drew Kalman (WPE8ILL), Dearborn, Mich.
Don Falle (VE2PE1IB), Beaconsfield, Quebec, Canada
Norm Szydlowski, Jr. (WPE9HEL), Hammond, Ind.
William Bound (WPE5EGV), Kilgore, Texas
Ronnie Andrzejewski (WPE3GLK), Swoyersville, Pa.
Mike Scott (VE2PE1IY), Roxboro, Quebec, Canada
Thomas Kent (WPE8ETL), Shaker Heights, Ohio
Larry Zigrang (WPE9HLM), South Bend, Ind.
Steven Levine (WPE1GKI), West Hartford, Conn.
Paul Henning (WPE9HLC), Hartford, Wis.
Lyle Lunsford (WPE3GGK), Baltimore, Md.
Stanley Mayo (WPE1GMF), Portland, Maine
Robert Hurwitt (WPE2NYP), Plainview, N. Y.
James Sorber (WPE2KGU), New Hyde Park, N. Y
Pete Glenn (WPE2JMT), Morristown, N. J.
David Molnar (WPE9EPC), South Bend, Ind.
Paul Silver (WPE1GPY), Providence, R. I.
Richard Albright (WPE6ERT), Merced, Calif.
Perry Brainin (WPE2KVK), Bronx, N. Y.
George Begera (WPE4IJS), Titusville, Fla.
Elias Coulouras (WPE1GKW), Cambridge, Mass.
Larry Bennett (WPE2NEU), Forest Hills, N. Y.
Vincent Kravec, Jr (WPE1FZG), Bridgeport, Conn.
Dennis Eksten (WPE9DT), Loves Park, Ill.
James Drost (WPE2NEH), Hempstead, N. Y.
Richard Langley (VE3PE2CA), Scarborough, Ont., Canada
Gene Staton (WPE9CNA), Kokomo, Ind.
Harry Smith (WPE8IHZ), Springfield, Ohio



An overseas listener, S. D. Wright, of Dronfield, Sheffield, England, has a variety of receivers identified as models R109A, RGD, R208, and ZA-10083. To date, he has 28 countries confirmed.

11,770 kc. at 2000-2110 with concert music and talks, mostly in German, and some direct relays; and on 6030 kc. at 0400-0445 with French and music.

The following schedule for this new station was just received: 6045 kc. to Eastern Africa at 0315-0500 (Eng. at 0430-0500) and to Central Africa at 0515-0615; 7290 kc. to Central Africa at 1630-1730; 9695 kc. to Eastern Africa at 1515-1615 (Eng. at 1545-1615); 9735 kc. to Eastern Africa at 0945-1045 (Eng. at 1015-1045) and to Central Africa at 1100-1200; 11,855 kc. to Eastern Africa at 1430-1500; 11,905 kc. to Western Africa at 0630-0830 (Eng. at 0630-0715); 17,765 kc. to Western Africa at 1215-1415 (Eng. at 1215-1300); and 17,805 kc. to Western Africa at 1745-1945 (Eng. at 1745-1830).

Saudi Arabia—Riyadh, 9720 kc., comes through well at times despite the nearness of Brazzaville and Dakar; tune for it around 1645 in Arabic. This frequency has replaced 11,950 kc.

Somali Republic—*R. Mogadiscio*, 7120 kc., has Eng. news nightly at 0315-0330 and continues with pop U.S. recordings and some native-language anmts. Reports indicate that this station is well received in many areas.

South Africa—The new 250-kw. xmtr for the Overseas Service of the South African Broadcasting Corporation is being used on 4975 kc. at 1600-2115 in the Africa Service and is heard well in many parts of the world (although one Eastern U. S. report shows Kampala, Uganda, on 4976 kc. with only 8 kw., to be far stronger). During 1966 the SABC plans to have two 100-kw. xmtrs at Bloemfontein in operation to beam the domestic service to S. W. Africa. In addition, by June, 1966, a N. A. service is expected to commence as follows: 2330-0025 to Canada (Eastern, Atlantic, and Newfoundland); 0030-0125 to U. S. (Eastern & Central zones); 0130-0225 to Canada (Mountain and Central zones); and 0230-0325 to the U. S. (Mountain and Pacific zones) and Canada (British Columbia).

The present schedule for the Africa Service reads: 0300-0400 on 6150 and 7270 kc., 1000-1710 on 15,220 and 17,805 kc., 1710-1845 on 11,900 and 15,220 kc., 1800-2115 on 4975 kc., 1845-2000 on 9525 and 11,900 kc., and 2000-2115 on 7270 and 9525 kc. The 7270-kc. channel is well heard in the Commercial Service at 2230-2300 with the usual music and commercials, some in Eng., the remainder in Afrikaans.

Uganda—Kampala, 4976 kc., is very strong at times with native music at 2040-2100. Eng. news at 2100, more music at 2104. Instead of the usual s/off, they paralleled 5026 kc. for some kind of special event in Eng. and native language to at least 2145.

U.S.S.R.—*R. Kiev*'s current schedule, effective at least through April, reads in part: to N. A. (Mondays and Thursdays) at 0030-0100 on 9680, 7330, 7310, 7280, 7140, and 7120 kc., and at 0430-0500 on

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	QRM—Station interference
BBC—British Broadcasting Corporation	R.—Radio
Eng.—English	SABC—South African Broadcasting Corporation
ID—Identification	s/off—Sign-off
IS—Interval signal	s/on—Sign-on
kc.—Kilocycles	xmsn—Transmission
kw.—Kilowatts	xmtr—Transmitter
N.A.—North America	

7330, 7310, 7290, and 7180 kc.; to Europe (Mondays and Thursdays) at 1900-1930 on 9640 and 6020 kc. Reports indicate that best reception is on 7280 kc. around 0030.

Venezuela—An unusual xmsn is noted from YVMG, *R. Popular*, Maracaibo, 4810 kc., on Sundays at 2345-0002 when they broadcast in Arabic, and from 0002 in Spanish.

Vietnam (North)—Hanoi, 15,045 kc., has been heard around 0000 with station break and anthem. This signal is very weak and tuning it in requires skill and patience.

Vietnam (South)—Saigon, 9620 kc., is fair at 1305 in Vietnamese but with QRM on the high side from a Russian xmtr.

Clandestine—We have received a report that we have been unable to confirm as yet concerning a *Radio Electra—9VK7*, supposedly located in Angilla in the Leeward Islands and operating on 777, 2331, and 4661 kc. at 2300-0300 (daily), 2000 (Saturdays) to 0500 (Sundays) and 1700 (Fridays) to 0700 (Saturdays). Some DX'ers feel that this may be a hoax. Your Short-Wave Editor would appreciate it if SWL's located in the southeastern states would check the listed channels and advise of any possible operations. —30—

SHORT-WAVE CONTRIBUTORS

Warren Peabody *(WPE1GGI)*, Marblehead, Mass.
Paul Harig *(WPE2GCX)*, Auburn, N. Y.
Robert Holbrook *(WPE2LQP)*, Lake Placid, N. Y.
Kenneth Coyne *(WPE2LSI)*, Long Beach, N. Y.
Marvin Jacobson *(WPE2MAO)*, Brooklyn, N. Y.
Thomas Holowach *(WPE2MIR)*, Oneonta, N. Y.
Robert Kaplan *(WPE2MJR)*, Bronx, N. Y.
C. N. Coombe *(WPE2MOB)*, Trenton, N. J.
Reiner Dieg *(WPE2MPF)*, Elmira, N. Y.
Alexander Dydula *(WPE2NLD)*, Clark Mills, N. Y.
Ronnie Tamagni *(WPE2NUK)*, Vineland, N. J.
Anthony Rossi, Jr. *(WPE2NXS)*, Albany, N. Y.
Mike Hinnicutt *(WPE3GQV)*, Washington, D. C.
Grady Ferguson *(WPE4BC)*, Charlotte, N. C.
John Brunst *(WPE4BQ)*, Neptune Beach, Fla.
Tom Palmer *(WPE4GEL)*, Monterey, Calif.
Richard Allen *(WPE5BZO)*, Billings, Okla.
Del Hirst *(WPE5CFU)*, Snyder, Texas
Gary Kieffer *(WPE5DZD)*, Tecumseh, Okla.
Jimmy Davis *(WPE5EHL)*, Lawton, Okla.
Paul Coleman *(WPE5EKF)*, Port Neches, Texas
John Callarman *(WPE5JH)*, Pampa, Texas
Shaler Hanisch *(WPE6BPK)*, Pasadena, Calif.
Trev Clegg *(WPE6FAF)*, Fresno, Calif.
George Schnabel *(WPE8EMO)*, Brooklyn, N. Y.
R. D. Palmer *(WPE9AST)*, Decatur, Ill.
Ray Fansler *(WPE9COC)*, Fairfield, Ill.
John Arendt *(WPE9DX)*, Aurora, Ill.
Gerry Dexter *(WPE9HDB)*, West Bend, Wis.
A. R. Niblack *(WPE9DX)*, Vincennes, Ind.
John Beaver, Sr. *(WPEØAE)*, Pueblo, Colo.
Clarence Wahl *(WPEØEQI)*, Wichita, Kan.
Bert Pestor *(VE3PE9L)*, Sudbury, Ont., Canada
David Alpert, Morton Grove, Ill.
Leo Alster, Rahway, N. J.
Roy Cohen, Plainview, N. Y.
Joe Esser, Arlington, Va.
Carl Harden, Cliffside Park, N. J.
Glenn Hauser, Albuquerque, N. M.
Bob Hill, Washington, D. C.
George Simmons, Warren, R. I.
Sweden Calling DX'ers, Stockholm, Sweden

ELECTRONICS MARKET PLACE

COMMERCIAL RATE: For firms or individuals offering commercial products or services. 90¢ per word (including name and address). Minimum order $9.00. Payment must accompany copy except when ads are placed by accredited advertising agencies. Frequency discount: 5% for 6 months; 10% for 12 months paid in advance.
READER RATE: For individuals with a personal item to buy or sell. 55¢ per word (including name and address). No Minimum! Payment must accompany copy.

GENERAL INFORMATION: First word in all ads set in bold caps at no extra charge. Additional words may be set in bold caps at 10¢ extra per word. All copy subject to publisher's approval. Closing Date: 1st of the 2nd preceding month (for example, March issue closes January 1st). Send order and remittance to: Hal Cymes, POPULAR ELECTRONICS, One Park Avenue, New York, New York 10016.

FOR SALE

FREE! Giant bargain catalog on transistors, diodes, rectifiers, SCR's, zeners, parts. Poly Paks, P.O. Box 942, Lynnfield, Mass.

MESHNA'S TRANSISTORIZED CONVERTER KIT $4.50. Two models converts car radio to receive 30-50 mc or 100-200 mc (one mc tuning). Meshna, Lynn, Mass. 01901.

ELECTRONIC Ignition Kits, Components. Free Diagrams. Anderson Engineering, Epsom, New Hampshire 03239.

GOVERNMENT Surplus Receivers, Transmitters, Snooperscopes, Radios, Parts, Picture Catalog 25¢. **Meshna,** Nahant, Mass. 09108.

CB WPE QSL Cards. Samples Free. Radio Press, Box 24, Pittstown, New Jersey.

ROCKETS: Ideal for miniature transmitter tests. New illustrated catalog, 25¢. Single and multistage kits, cones, engines, launchers, trackers, technical information, etc. Fast service. Estes Industries, Penrose 18, Colorado.

"SPECIALI WPE-SWL-CB-QSL cards, 3 colors, $2.50 per 100—Free Samples, Garth, Jutland, New Jersey."

CANADIANS—GIANT Surplus Bargain Packed Catalogs. Electronics, Hi-Fi, Shortwave, Amateur, Citizens Radio. Rush $1.00 (Refunded). **ETCO,** Dept Z., Box 741, Montreal, **CANADA.**

WEBBER Labs. Transistorized converter kit $5.00. Two models using car radio 30-50 Mc or 100-200 Mc, one Mc spread. Easily constructed. Webber, 72 Cottage, Lynn, Mass.

JAPAN & Hong Kong Electronics Directory. Products, components, supplies. 50 firms—just $1.00. Ippano Kaisha Ltd., Box 6266, Spokane, Washington 99207.

CANADIANS, TRANSISTORS AND PARTS. Free catalogue contains reference data on 300 transistors. J. & J. Electronics, Dept. PE, Box 1437, Winnipeg, Manitoba.

TRANSISTORIZED CONVERTER 26-200 MC. Receive signal from 26 to 200 MC (1 MC spread), on broadcast band using car radio, crystal control or tuneable (1 MC spread). Kit $11.00 pp. Wired $20.00 pp. Webber Labs, 72 Cottage St., Lynn, Mass.

CITIZEN BANDERS! Get base station Performance with your mobile units. No modifications or soldering necessary. Proven performance. Send for free details or send ($15.00) to: T. Francis. 15 Park Row, N.Y. 38, N.Y.

TRANSISTORS—Miniature Electronic Parts. Send for free Catalog. Electronic Control Design Company, P. O. Box 1432K, Plainfield, N.J.

INVESTIGATORS, FREE BROCHURE, LATEST SUBMINIATURE ELECTRONIC SURVEILLANCE EQUIPMENT, ACE ELECTRONICS, 11500-L NW 7TH AVE., MIAMI, FLA. 33168.

CONVERT any television to sensitive, big-screen oscilloscope. Only minor changes required. No electronic experience necessary. Illustrated plans, $2.00. Relco Industries, Box 10563, Houston 18, Texas.

NEW Supersensitive transistor locators detect buried gold, silver, coins. Kits, assembled models. $19.95 up. Free catalog. Relco-A33, Box 10563, Houston 18, Texas.

ACHTUNG! Das machine is nicht fur Gerfingerpoken und mittengraben. Is easy schnappen der Springenwerk, blowenfusen und poppencorken mit spitzensparken. Ist nicht fur gerwerken by das Dummkopfen. Das rubbernecken sightseeren keepen hands in das pockets. Relaxen und watch das Blinkenlights. This attractive, brass metal plaque only $2.00 each, ppd. Southwest Agents, Dept. P, 8331 Hwy. 80 West, Fort Worth, Texas 76116.

WALKIE-TALKIE. Construct 2"x1"x½" transistorized, long range, 100 milliwatt marvel for $10. Plans, FREE GIFT, $2.00. Baker Electronics, R.R. 3, Greencastle, Ind.

TELEPHONE VOICE SWITCH: (LS-500). ACTUATES AUTOMATICALLY AND UNATTENDED ANY TAPE OR WIRE RECORDER. PICTORIAL INSTALLATION INSTRUCTIONS INCLUDED. $23.75. POST PAID USA, WJS ELECTRONICS. 737 NORTH SEWARD, HOLLYWOOD, CALIF. 90038.

INVESTIGATORS: KEEP IN STEP WITH ADVANCEMENTS IN THE ART OF ELECTRONICS FOR THE PROFESSIONAL. SEND $1.00 FOR EQUIPMENT BROCHURE. WJS ELECTRONICS, 737 NORTH SEWARD, HOLLYWOOD, CALIF. 90038.

BUG DETECTOR: WILL DETECT AND LOCATE SURREPTITIOUS TRANSMITTING DEVICES IN CONFERENCE ROOMS, HOME AND OFFICES, ETC. WRITE FOR DETAILS. WJS ELECTRONICS, 737 NORTH SEWARD, HOLLYWOOD, CALIF. 90038.

SAFEGUARD PRIVACY! New instrument detects electronic 'bugs,' wire-tapping and snooping devices. Free information. Dee Equipment, Box 7263-E7, Houston 8, Texas.

CB-WPE-QSL CARDS. Same High Quality, Beautiful, Glossy multi-color cards. New **LOW PRICES. 26 SAMPLES,** 25¢. Dick, W8VXK, 19QA0625, Gladwin, Mich. 48624.

"GREAT BUYS" Catalog 10¢. Multimeter Speciai $9.95, VHF Transmitter, Stepping Switch, Torroid Assemblies, UHF Grounded Grid, VHF Transistorized Amplifiers, Variacs 5a-10a, Mercury Relays. Fertik's, Ninth Tioga, Phila., Pa. 19140.

ELECTRONIC "CRACKAJACKS," transistors—photocells—relays. Guaranteed prize box $1.00 plus 15¢ pp. **DART ELECTRONICS,** Box 214, Jericho, N.Y.

LOWEST Prices Electronic Parts. Confidential Catalog Free. **KNAPP,** 3174 8th Ave. S.W., Largo, Fla.

BUILD A "LIVE" TV CAMERA CHEAPER THAN EVER! Simplest 5 tube circuit to date. **EXCELLENT PERFORMANCE** acclaimed by hundreds of constructors all over the country. Circuit specifically designed to use maximum number of standard, readily available parts—most can be obtained from "junkbox" or discarded TV sets. We furnish only the hard-to-find components and **EASY-TO-FOLLOW PLANS.** Choose from 6 different kits (including printed circuit models). Prices start as low as $16.95! Plans included **FREE** with each kit or available separately for $3.—refundable with later order of any kit. **PERFECT FOR HAMS, EXPERIMENTERS, SCIENCE FAIR STUDENTS.** Check our unbelievable prices. **RUSH** 10¢ **FOR INFORMATION PACKED CATALOG.** Box 396P, **ATV RESEARCH,** South Sioux City, Nebr. 68776.

TEST TRANSISTORS using your multimeter, Tester $2.98, 3 S Electronics, P.O. Box 501, Mundelein, Ill. 60060.

R.F. CONVERTERS $10 up. World's largest selection. Also CCTV cameras, transmitters, etc. Lowest factory prices. Catalog 10¢. Vanguard 196-23 Jamaica Ave., Hollis, N.Y. 11423.

LASER: Hobbyists, experimenters, amateur scientists. Build your own coherent-light optical laser. Complete instructions, drawings, schematic diagrams and parts list. $6.00. Same as above, diode laser, $3.00. Technical Writers Group, Box 5501, State College Station, Raleigh, N.C. 27607.

REVERBERATOR (ECHO) UNIT: Build your own. Complete plans, drawings, schematic and parts list. $3.00. Use with automobile radio, home radio or record player. Technical Writers Group, Box 5501, State College Station, Raleigh, N.C. 27607.

RADAR: Build your own ultrasonic doppler radar. Detect motion of people, automobiles, even falling rain drops. Transistorized, uses standard small 9-volt battery. Complete plans, drawings, schematic diagrams and parts list. $4.00. Technical Writers Group, Box 5501, State College Station, Raleigh, N.C. 27607.

TV CAMERA: Build your own. The real thing—no rotating disc. Uses 5 tubes plus videcon tube. Output: 72 ohms, and also any channel 2 to 6. Receive on any TV set without modification. Excellent circuit—good picture. Complete plans, drawings, schematic and parts list. $6.00. Technical Writers Group, Box 5501, State College Station, Raleigh, N.C. 27607.

WE SELL CONSTRUCTION PLANS. Telephone Equipment: $40 Answering Machine, $15 Bell System Type Speaker Phone, Phonevision $10 Legal Telephone Connector, Telephone Extension in your cars, $25 Automatic Dialer, Central Dial System. Television Equipment: $50 Camera, $30 3DTV Converter, $35 All Electronic Color Converter, Video Recorder. Hobbyist: $50 Ultrasonic Dishwasher, Transistorized Teletype, $75 Electron Microscope, Electronic Tranquilizer, Private Eye Tail Transmitter, Police Radar Detector plus Legal Jammer, **ALL ELECTRONIC TYPEWRITER.** Plans $4.95 each. Air Mail Service 50¢ each. **SUPER HOBBY CATALOG** 10¢. Don Britton Enterprises, 7906 Santa Monica Blvd., Hollywood, Calif. 90046.

FREE ELECTRONICS (new and surplus) parts catalog. Bigelow Electronics, Bluffton, Ohio 45817.

SECURITY ELECTRONICS introduces its **NEW** 1966 line of **SURVEILLANCE EQUIPMENT.** Improved **NEW** designs for maximum performance and greater value. **FREE DETAILS.** Security Electronics-PE, 11 East 43rd St., N.Y., N.Y. 10017.

COMPONENTS? Kits? Hardware? For catalogue write Trans-Vu-Pacs, Box 267, Chelsea, Mass. 02150.

DETECTIVES GO or no **GO** in **HIGH QUALITY LOW COST** Electronic Surveillance Equipment **SILMAR MAKES** the **DIFFERENCE.** Write Today! **SILMAR ELECTRONICS,** 3476 N.W. 7th Street, Miami, Fla. 33125.

DIAGRAMS for repairing Radios $1.00. Television $2.50. Give make model. Diagram Service, Box 1151 PE, Manchester, Connecticut 06042.

110VAC 60cy 350 Watts. From car generator. Easy conversion. Plans $2.00. **TEDCO,** P.O. Box 12098, Houston, Texas 77017.

MINIATURE Relays Half-Size DPDT 24 Volt Coil $3.98, Crystal Cans $2.75. Write For Literature. Radco, POB 10473, San Diego, Calif. 92110.

IT'S SUPERCALIFRAGILISTICEXPIALIDOCIOUS, Free information on Kit-of-the-Month Club and new catalog of etched circuit boards and radio books. Many exclusive items. Leader Enterprises, Box 44718KP, Los Angeles 90044.

SURVEILLANCE EQUIPMENT—Hottest on market today. Complete Kits. Brochure—$1.00. Tri-Tron, Inc., P.O. Box 3183, Albuquerque, N.M. 87110.

GIANT TESLA COIL—FORTY-INCH SPARKS! Complete plans, photo $5.00; details 30¢. Huntington Electronics, Inc., Dept. A, Box 9, Huntington Station, Shelton, Conn. 06486.

CIRCUIT Boards, Parts for "Poptronics" projects. Free catalog. **DEMCO,** Box 16297, San Antonio, Texas 78216.

MOISTURE METER electronically determines moisture content of soil. Tells when to water lawn, etc. Plans $1.50. Holiday, 2614 Fillmore, El Paso, Texas 79930.

DIAGRAMS—SENT AIRMAIL—TELEVISION $3.00. RADIO 1919-1965 $2.00. GIVE MODEL. DIAGRAMS, BOX 55, WILLIAMSPORT, PA. 17704.

DETECTIVES: ELECTRONIC SURVEILLANCE DEVICES. LOW COST. SIMPLE OPERATION. FREE BROCHURE. TROL ELECTRONICS-P, 31 West 8th Street, New York, N.Y.

INVESTIGATORS—DETECTIVES—INDUSTRIAL SECURITY OFFICERS: New 1966 line of Electronic Surveillance Devices. Incorporating most advanced subminiature design. Greater range; lower battery drain; unique sophisticated circuitry; extremely durable. **HIGH QUALITY PROFESSIONAL EQUIPMENT AT ROCK BOTTOM PRICES.** Foolproof wireless units are extremely **SIMPLE TO USE!** You **DO NOT** have to be an engineer to get **PROFESSIONAL** results with **THIS** equipment. **TROL** 1966 models ready **NOW!** Take advantage of Special Introductory Offer. Don't delay! For **FREE** details write **TROL ELECTRONICS-PE,** 31 West 8th Street, New York, N.Y.

NEED RESISTORS? Brand new, **FAMOUS NAME,** ½ watt 10% standard carbon. Any regular 10% value from 10 ohms to 2.7 megohms, $.05 each. Postpaid. Any quantity assorted. Pick your own values. Minimum order $1.00. Immediate delivery. **TEPCO,** Box 508, Tullahoma, Tenn.

LEARN Binary Logic—Free Information. Printco, Box 382, Lockport, New York.

WORLD'S TINIEST RAD'OS. Recorders, Transceivers, AM/FM/SW Portables. Free Catalog. Minitronics 365, 1983 Via Del Rio, Corona, Calif. 91720.

RESISTORS, Kit of 100 standard ½ watt 10%. Four each of 25 different values 10 ohms to 1 megohm $3.95 postpaid. Palomar Instrument Co., 563 Country Club Dr., Escondido, Calif. 92025.

COLOR TV Novelty, changes black/white to color. Only $2.98, state size screen. Delecto Electronics, 4725 45th N.E., Seattle, Wash. 98105.

10 DISTANCE CRYSTAL set plans—25¢; 20 different—50¢. Includes Transistor experiments, catalog. Laboratories, 993-L, Redwood City, Calif. 94064.

DIAGRAMS, service information, Radio $1.00, Television $1.50. **BEITMAN,** 1760 Balsam, Highland Park, Ill. 60035.

WHOLESALE: Resistors 3¢, Microphones 89¢, Electrolytics 8¢. Hundreds of items. Buyers only. Catalog 25¢. **ROYAL,** Box 2591, El Cajon, Calif. 92021.

HEATHKIT 'MOHICAN' Transistor SWL receiver. Factory aligned. Spotless. $65.00 and postage. Boghos Saatjian, 5612 Marburn Avenue, Los Angeles, Calif.

GOVERNMENT COST OVER $350.00——1 Sensitive Relay, 14 0.01 Microfarad Capacitors, 2 Power Resistors. All enclosed in a 4" x 8" x 7" Aluminium Box with cover. $6.50 prepaid, Continental USA. No COD's. **ALPHATRONICS,** P.O. Box 31127, Aurora, Colo. 80011.

CRASH! BANG! Police!! Fire!! Sheriff!! Radios!! For Home, Auto, Batteries. Write Today, Wholesale Prices. Mar-Ko Dist. 3015 Monroe, Toledo, Ohio.

HIGH FIDELITY

"LOW, Low quotes: all components and recorders. HiFi, Roslyn 9, Penna."

HI-FI Components, Tape Recorders, at guaranteed "We Will Not Be Undersold" prices. 15-day money-back guarantee. Two-year warranty. No Catalog. Quotations Free. Hi-Fidelity Center, 239 (P) East 149th Street, New York 10451.

FREE! Send for money saving stereo catalog #P3E and lowest quotations on your individual component, tape recorder, or system requirements. Electronic Values, Inc., 200 W. 20th St., New York, N.Y. 10011.

NEW Mfrs. B.S.R. record changers, UA15 model with stereo cartridge $13 each. Parts guaranteed or units exchanged. Quantity discount. CHANGERS, Box 144, Jerome Avenue Station, Bronx, N.Y. 10468.

WANTED

CASH Paid! Unused tubes, electronic equipment. Barry, 512 Broadway, N.Y.C. 10012.

QUICKSILVER, Platinum, Silver, Gold. Ores Analyzed. Free Circular. Mercury Terminal, Norwood, Mass.

GOLD, Silver, Platinum (any form) Diamonds Bought, Information Free. Wilmot's, 1067V Bridge, Grand Rapids, Mich. 49504.

HAM EQUIPMENT

CBers, HAMS, SWL's! 3-30 MC Preselector kit, $18.98. CB booster Kits. Novice transceiver kit, $29.95. Free catalog. HOLSTROM, Box 8640-E, Sacramento, Calif. 95822.

TUBES

BEFORE You Buy Receiving Tubes, Transistors, Diodes, Electronic Components and Accessories . . . send for Giant Free Zalytron Current Catalog, featuring Standard Brand Tubes: RCA, GE, etc.—all Brand new Premium Quality Individually Boxed, One Year Guarantee—all at Biggest Discounts in America! We serve professional servicemen, hobbyists, experimenters, engineers, technicians. Why Pay More? Zalytron Tube Corp., 469-E Jericho Turnpike, Mineola, N. Y. 11502.

TUBE Headquarters of World! Send 10¢ for Catalog (tubes, electronic equipment) Barry, 512 Broadway, N.Y.C. 10012.

RADIO & T.V. Tubes—33¢ each. Send for free list. Cornell, 4213 University, San Diego, California 92105.

TUBES "Oldies", latest. Lists free. Steinmetz, 7519 Maplewood, Hammond, Indiana 46324.

FREE Catalog. Electronic parts, tubes. Wholesale. Thousands of items. Unbeatable prices. Arcturus Electronics ZD, 502-22 St., Union City, N.J. 07087.

TAPE AND RECORDERS

BEFORE Renting Stereo Tapes try us. Postpaid both ways —no deposit—immediate delivery. Quality—Dependability —Service—Satisfaction—prevail here. If you've been dissatisfied in the past, your initial order will prove this is no idle boast. Free Catalog. Gold Coast Tape Library, Box 2262, Palm Village Station, Hialeah, Fla. 33012.

RENT Stereo Tapes—over 2,500 different—all major labels—free brochure. Stereo—Parti, 1616-PE Terrace Way, Santa Rosa, California.

STEREO TAPES. Save up to 60% (no membership fees, postpaid anywhere U.S.A.). Free 60 page catalog. We discount batteries, recorders, tape accessories. Beware of slogans "not undersold," as the discount information you supply our competitor is usually reported to the factory. SAXITONE, 1776 Columbia Road, Washington, D.C.

TAPE RECORDER SALE. Brand new, latest models, $10.00 above cost. Arkay Sales, 1028-C Commonwealth Ave., Boston, Mass. 02215.

AUTOMATIC telephone connection for transistorized Concord, Panasonic, Craig, Aiwa and other brands. Also SURVEILLANCE Devices and accessories. Free Details. Security Electronics—PER 11 East 43 St., N.Y. 10017.

TAPE Recorders, Hi-Fi, components, Sleep Learning Equipment, tapes. Unusual Values Free Catalog. Dressner, 1523PE, Jericho Turnpike, New Hyde Park 11, N. Y.

TAPE-MATES now offers ALL TAPES—ALL LABELS at TREMENDOUS SAVINGS plus FREE Tape-Mates membership. For FREE brochure write TAPE-MATES, 5280-PE W. Pico Blvd., Los Angeles 90019.

HARD-TO-GET TUBES IN STOCK

BRAND NEW—1 YR. GUARANTEE

Type	Price	Type	Price	Type	Price	Type	Price	Type	Price
00A	3.50	6AG5	.89	6J7GT	1.49	7Q7	1.85	14Q7	1.95
01A	2.75	6AG7	1.95	6J7G	1.50	7R7	2.25	14R7	2.35
01D	.75	6AH4	1.19	6J8	2.50	7S7	1.79	14S7	1.95
1A7	1.05	6AK5	1.49	6K6GT	.90	7V7	1.65	14W7	1.85
1AX2	.75	6AL3	.99	6K7	1.69	7W7	2.39	14X7	1.75
1B3	.92	6AL7	1.95	6L6G	.98	7X6	1.35	14Y4	1.75
1H5	2.59	6AM8	1.25	6L6GC	1.61	7X7	2.75	19	1.00
1L6	2.60	6AN8	1.35	6L7M	2.49	7Y4	2.35	2050	1.25
1LA4	1.30	6AQ7	1.37	6N7M	1.75	7Y7	1.79	22	1.15
1LA6	1.49	6AR5	.91	6P5	2.50	7Z4	2.25	24A	1.35
1LC5	1.05	6AS5	.92	6Q7	1.95	8AU8	1.39	25C5	.65
1LC6	1.80	6AS7	2.85	6S7	1.95	8BQ5	.99	25CD6	1.94
1LD5	1.95	6AT6	.58	6S8GT	1.50	8CG7	.80	25DN6	1.95
1LE3	1.25	6AT8	1.39	6SA7M	1.49	8FQ7	.94	25L6	.77
1LH4	2.69	6AU4	1.19	6SB7Y	2.19	8GJ7	1.31	25Z5	1.50
1LN5	2.25	6AU5	1.55	6SD7	1.49	8GN8	1.29	25Z6	.94
1N5	1.85	6AU6	.62	6SF5	1.08	8JV8	1.32	26	1.40
1P5	2.00	6AU8	1.38	6SF7	2.19	9A8	1.33	27	1.60
1R4	.80	6AW8	1.25	6SG7	1.55	9U8	1.05	30	1.25
1R5	.99	6AX4	.89	6SH7	1.05	10DE7	1.14	32	1.15
1S5	.99	6AX5	1.05	6SJ7GT	1.49	10DR7	1.49	32ET5	.80
1T5	.80	6AX7	1.25	6SJ7M	1.72	12A8	2.95	33	1.15
1U4	.99	6B4	5.95	6SK7	1.30	12AH7	1.89	34	1.15
1U5	.97	6B7	2.75	6SK7M	1.38	12AT6	.59	35A5	1.94
1V	1.85	6B8	2.46	6SL7GT	1.19	12AT7	1.03	35L6	.78
1V2	.79	6BA6	.60	6SN7GT	.89	12AU6	.71	35W4	.35
2A3	3.50	6BA8	1.27	6SQ7GT	1.25	12AU7	.83	35Y4	1.62
2A5	2.50	6BE6	.74	6SR7	1.42	12AV6	.56	35Z3	1.54
2A6	4.50	6BH6	.89	6SS7M	1.88	12AX4	.85	35Z5	.72
2B7	1.95	6BH8	1.24	6T8	1.15	12AX7	.87	36	1.50
2X2A	1.95	6BK5	1.25	6U5	2.35	12BA6	.59	37	1.10
3A3	1.18	6BK7	1.14	6U8	1.12	12BE6	.59	38	1.10
3A5	1.10	6BQ6	1.45	6V6GT	.74	12BH7	.96	39/44	.95
3AU6	.57	6BQ7	1.33	6W4	.83	12BQ6	1.53	41	1.40
3B7	2.39	6BX7	1.75	6W6GT	.98	12BR7	1.08	42	1.98
3BN4	1.05	6C4	.54	6X4	.56	12BY7	1.09	43	2.85
3BZ6	.79	6C5M	1.63	6X5GT	.72	12CU5	.84	45/2A3	3.25
3CB6	.79	6C6	2.00	6X8A	1.05	12K7	2.25	46	.95
3DQ4	1.25	6C8G	2.95	6Y6GA	1.45	12K8M	2.95	47	3.00
3DT6	.74	6CA7	1.95	6Z4/84	1.22	12L6	1.18	48	4.00
3Q5	2.00	6CG7	.75	7A4	2.25	12L8	.50	49	3.50
3V4	.85	6CG8	.95	7A5	1.95	12Q7	1.50	50	1.75
4BQ7	1.30	6CL6	1.15	7A6	2.25	12SA7	1.49	50A1	2.60
4BU8	1.19	6CL8	1.19	7A7	2.35	12SC7	1.89	50A5	2.10
4BZ7	.40	6CM7	.94	7A8	2.75	12SF5	.30	50C5	.55
4CB6	.79	6CQ8	1.15	7AD7	1.25	12SF7	2.23	50L6	.81
5AM8	1.30	6CS7	.98	7AF7	2.10	12SG7	1.54	50X6	1.96
5AN8	1.35	6CW4	1.59	7AG7	2.85	12SH7	1.75	50Y6	1.49
5AQ5	.76	6CX8	1.42	7AH7	1.95	12SK7	1.40	50Y7	1.42
5AS8	1.50	6CZ5	1.48	7AU7	.83	12SK7	1.35	53	3.50
5AT8	1.27	6D4	1.75	7B4	2.35	12SL7	1.28	55	2.75
5AZ4	1.85	6D6	2.50	7B5	2.75	12SQ7	1.29	56	1.25
5BQ7	1.35	6DA4	.98	7B6	1.25	12SR7	1.79	57	1.50
5BR8	1.25	6DN6	2.54	7B7	2.50	12V6	1.15	58	1.50
5CG8	1.12	6DN7	1.21	7B8	2.00	12W6	1.15	59	3.00
5J6	.96	6DQ4	.91	7C4	1.15	13GF7	1.70	70L7	1.25
5U4	.70	6DQ5	2.75	7C5	1.19	13J10	1.83	71A	1.25
5U8	1.14	6DQ6	1.39	7C6	2.69	14A4	1.45	75	2.62
5V4	1.29	6E5	1.74	7C7	2.23	14A5	1.35	76	1.50
5W4	1.75	6F4	4.75	7E5	2.00	14A7	1.85	77	1.50
5X8	1.20	6F5GT	1.72	7E6	1.25	14AF7	1.85	78	1.65
5Y3	.59	6F6G	1.95	7E7	1.95	14B6	1.85	80	1.25
5Y4	1.45	6F7	3.95	7F7	2.59	14B8	1.95	83	1.75
5Z3	1.30	6F8	3.08	7F8	3.00	14C5	1.75	5881	2.05
5Z4	2.75	6GJ5	1.75	7G7	1.99	14C7	2.19	6146	2.50
6A7	2.90	6GK5	1.39	7H7	1.65	14E6	1.39	6336	4.75
6A8M	2.39	6GK6	.98	7HG8	1.29	14E7	1.39	6550	3.25
6AB4	.76	6HZ8	1.85	7J7	2.50	14F7	2.95	807	1.00
6AB7	2.10	6J5G	1.10	7K7	2.96	14F8	2.23	809	3.75
6AC5	2.12	6J5M	1.25	7L7	1.99	14H7	1.95	EL84/6BQ5	.85
6AC7	1.75	6J6A	.67	7N7	2.61	14J7	1.95	5AR4	1.50
6AF3	.99	6J7	1.69			14N7	1.95	KT-88	4.95

MINIMUM ORDER $5.00
ADD POSTAGE

SEND FOR COMPLETE TUBE CATALOG

UNITED RADIO CO.
P.O. BOX—1000 A4 NEWARK, N.J.

CIRCLE NO. 39 ON READER SERVICE PAGE

RENT 4-TRACK STEREO TAPES—When narrowed down TRIMOR becomes the wide choice—Goodbye to partial satisfaction. Service and Dependability our keynote—ALL MAJOR LABELS—FREE CATALOG (48 states)—TRIMOR Company, P. O. Box 748, Flushing, N.Y. 11352.

KNIGHT KG415 (Viking 88RMQ), never used. Must sell. Snider, 224 Esplanade, Lebanon, Ind.

TOOLS

TOOL Catalog send 25¢. Silvo Hardware, 107 Ziff Walnut, Phila., Penna. 19106.

PLANS AND KITS

SENSATIONAL LISTENING, SENSITIVE, POCKET V.H.F. POLICE RECEIVER, Easily Assembled, Plans $2.00. Ottawa Sales Company, Box 627, Holland, Mich. 49424.

REMOTE CONTROL DEVICE small hand held transmitter controls lamps, TV, anything electrical—Full plans and parts information $2.00—Electronic Specialists, Box 9339, Rochester, New York 14604.

ELECTRONIC DEVICES—Kits or assembled. For CAR, HOME and BOAT. Catalog Free. EARN MONEY selling these useful items. Write for details. Electronic Products Company, Dept. A, Box 8485, St. Louis, Mo. 63132.

REPAIRS AND SERVICES

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 51C, Bloomington, Indiana.

ELECTRONIC KITS wired—rewired. Professional Service. Free information. Kit Service, Box 33138A, Cincinnati, Ohio 45233.

SHORTWAVE LISTENING

SWL GUIDE, English programs listed by the hour. **1966 EDITION,** $2.00. SWL Guide, 218 Gifford, Syracuse 2, N.Y.

MAPS BEAUTIFUL 7 COLOR 38 x 50 in. Map of World, Europe, North America, U.S.A. Each 50¢. Varco Gifts, P.O. Box 3142, Wilmington, Delaware 19804.

EQUIPMENT

McGEE Radio Company. Big 1966 Catalog Sent Free. America's Best Values. HiFi-Amplifiers—Speakers—Electronic Parts. Send name, address and zip code number to McGee Radio Company, 1901 McGee Street, Dept. EG, Kansas City, Mo. 64108.

FREE electronics catalog. Tremendous bargains. ElectroLabs, Department C-656D, Hewlett, New York 11557.

CLUBS

COUPON BOOK, special offers from various firms. Latest Membership Benefit of Electronic Experimenter's Club. Dues $2.00. Further Information **FREE.** Box 5332Q, Inglewood, Calif. 90310.

PATENTS

INVENTIONS; Ideas developed for Cash/Royalty sales. Raymond Lee, 130-G West 42nd. N.Y.C. 10036.

GOVERNMENT SURPLUS

"GOVERNMENT SELLS".—Surplus Electronics; Oscilloscopes; Transceivers; Test Equipment; Radar; Walkie-Talkies; Boats; Jeeps; Aircraft; Misc.—Send For—"U.S. Depot Directory-Procedure"—$1.00—Service, Box 425 (ZE), Nanuet, N.Y.

GOVERNMENT Surplus. Complete Sales Directory $1.00. Surplus Publications, Box 45781E, Los Angeles 45, Calif.

JEEPS FROM—$52.50, Typewriters From—$4.15, Cars From—$31.50, Walkie-Talkies, Guns, Airplanes, Boats. Typical "As Is" Bid Bargains From Uncle Sam. Tremendous Variety. Exciting Free List. Write: Enterprises, Box 402-B4, Jamaica, New York 11430.

JEEPS Typically From $53.90 . . . Trucks From $78.40 . . . Boats, Typewriters, Airplanes, Electronics Equipment, Photographic Equipment, used. 100,000 Bargains Direct From Government. Complete Sales Directory and Surplus Catalog $1.00 (Deductible First $10.00 Order). Surplus Service, Box 820-J, Holland, Mich. 49424.

AUTHORS' SERVICES

AUTHORS! Learn how to have your book published, promoted, distributed. FREE booklet "ZD," Vantage, 120 West 31 St., New York 1.

WANTED WRITERS! Short stories, articles, books, plays, poetry. Will help place, sell your work. Write today, free particulars! Literary Agent Mead, Dept. 37A, 915 Broadway, New York 10, N.Y.

POEMS or New Songs Wanted. Tin Pan Alley, Inc., 1650 Broadway, New York, N.Y. 10019.

CLASSIFIED ADVERTISING ORDER FORM

Please refer to heading on first page of this section for complete data concerning terms, frequency discounts, closing dates, etc.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25
26	27	28	29	30
31	32	33	34	35

_____ Words { @ 55¢ (Reader Rate) / @ 90¢ (Commercial Rate) } = $_____

Insert _____ time(s) Total Enclosed $_____

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Signature _____

WORD COUNT: Include name and address. Name of city (Des Moines) or of state (New York) counts as one word each. Zone or Zip Code numbers not counted. (Publisher reserves right to omit Zip Code if space does not permit.) Count each abbreviation, initial, single figure or group of figures or letters as a word. Symbols such as 35mm, COD, PO, AC, etc., count as one word. Hyphenated words count as two words.

PE-366

INSTRUCTION

LEARN While Asleep, hypnotize with your recorder, phonograph. Astonishing details, sensational catalog free! Sleep-Learning Association. Box 24-ZD, Olympia, Wash.

FCC License in 6 weeks. First Class Radio telephone. Results Guaranteed. Elkins Radio School, 2603B Inwood, Dallas, Texas.

HIGHLY—effective home study review for FCC commercial phone exams. Free literature! Cook's School of Electronics, Craigmont, Idaho 83523.

REI First Class Radio Telephone License in (5) weeks Guaranteed. Tuition $295.00. Job placement free. Radio Engineering Institute, 1336 Main Street, Sarasota, Fla.

ELECTRONICS—F.C.C. License Training—Correspondence, or resident classes. Free details. Write: Dept. 3, Grantham Schools, 1505 N. Western, Hollywood, Calif. 90027.

LEARN ELECTRONIC ORGAN SERVICING at home all makes including transistors. Experimental kit—troubleshooting. Accredited NHSC, Free Booklet. **NILES BRYANT SCHOOL,** 3631 Stockton. Dept. A, Sacramento 20, Calif.

BEGINNERS CODE THE FIVE METHOD 5 wpm solid, Guided sending, **NO HELP NEEDED.** Key-Oscillator transmits to radio or speaker connect. (3) 12" 33⅓ records or 3¾ capstan tapes. Rim drive available. (write for details) **MONEY BACK TRIAL** $14.85. Postpaid. **PAGE ELECTRONICS INSTITUTE,** 1158 **West** 54 **Street, LOS ANGELES** 90037.

DRAFTING (Electronic, Mechanical, Architectural, Art). Home Courses $25.00. Send $2.00 first lesson. Prior, Inc. 23-09 169 Street, Whitestone 57, N.Y.

FCC LICENSE THROUGH TAPE RECORDED INSTRUCTION. Bob Johnson Audio-Visual Training, 1060D Duncan, Manhattan Beach, Calif. 90266.

REPAIR TELEVISION RECEIVERS quickly, easily. Write, specifying black/white, or color. National Technical Research Laboratories, 6440 S. Western Ave., Whittier, Calif.

INVENTIONS WANTED

INVENTIONS wanted. Patented; unpatented. Global Marketing Service, 2420-P 77th, Oakland 5, Calif.

INVENTORS. We will develop, help sell your idea or invention, patented or unpatented. Our national manufacturer clients are urgently seeking new items for outright cash sale or royalties. Financial assistance available. 10 years proven performance. For free information, write Dept. 41, Wall Street Invention Brokerage, 79 Wall Street, New York 5, N.Y.

INVENTORS! Sell your invention for cash or royalties! Our client manufacturers eagerly seek new items. Patented. Unpatented. Financial assistance if needed. 25 years proven performance. For free information, write Dept. 20, Gilbert Adams, Invention Broker, 80 Wall St., New York 5, N.Y.

INVENTORS! Outright cash sale or royalties for your inventions. Patented. Unpatented. Active demand from our client manufacturers. Financial assistance available. Write Dept. 35, United States Invention Brokerage, 78 Wall Street, New York 5, N.Y.

INVENTORS! Don't sell your invention, patented or unpatented, until you receive our offer. Eagle Development Company. Dept. P. 79 Wall Street, N.Y. 5, N.Y.

PATENT Searches including Maximum speed. full airmail report and closest patent copies, $6.00. Quality searches expertly administered. Complete secrecy guaranteed. Free Invention Protection forms and "Patent Information." Write Dept. 9, Washington Patent Office Search Bureau, 711 14th Street. N.W., Washington 5. D.C.

INVENTORS Needing Help with any problem, financial, development, securing manufacturer, obtaining patent. Write the organization that delivers action and results—not promises. Pioneer Invention Service, Dept. 79, 150 Broadway, New York 38, N.Y.

IMMEDIATE cash, for Patent Applications, free Patent Searches. Write for details, Universal Patents, 184-X, Marion, Ohio.

INVENTORS! Don't sell or license your Invention for cash or royalties until you receive our offer. Financial assistance available. For Free Information, write: Dept. 71, International Invention Institute, 17 Park Row, New York 38, N.Y.

FREE help! New patent law! Flipper, Dept. Z-D, Geneva, Ill. 60134.

INVENTORS Complete Guide Book lists needed inventions; tells how to develop and patent your idea; how to market your invention and hundreds of other facts for inventors. Free brochure. Castellazzo, 3257-PE Kansas, Oakland, Calif. 94602.

PROTECT your invention, legal forms 4/$1.00. Research, Box 334, Cape Canaveral, Fla. 32920.

BOOKS

PAPERBACKS, Lafayette Hill. Pa. 19444. Catalog 10¢. Paperback books, records, tapes, stationery.

FREE LIST. Servicing Books. Thomas Garber, 104 Ashley St., Korn Krest, Wilkes-Barre. Pa.

FREE Book. Prophet Elijah Coming Before Christ. Wonderful Bible Evidence. PE Megiddo Mission, Rochester, New York 14619.

FREE Catalog Aviation Electronics Space books. Aero Publishers, 329PE Aviation Road, Fallbrook, Calif. 92028.

ELECTRONICS HANDBOOK. Packed with information. Useful charts, definitions, formulas, etc. $1.50. General Research, P.O. Box 545, Warrenton, Virginia.

MUSICAL INSTRUMENTS

ACCORDIONS, GUITARS, BAND INSTRUMENTS! Save to 50%. Terms. Trades. Free trial. Free catalog. Mention instrument. MUSIC MART, 5535-PE Belmont, Chicago 60641.

RECORDS

DISCOUNT Records, All Labels—Free List. Write Cliff House, Box 42-P, Utica, N.Y.

DISCOUNTS ON ALL LP's. Free details. Citadel Record Club, 545 Fifth Ave., Dept. PE, New York 17, N.Y.

RECORD jackets. Replace old, torn, dirty LP covers with clean, glossy, pure white jackets. Inner sleeves available. Free details or send 50¢ for samples. Cardboard Co., Room 604, 89 East Woodruff, Columbus, Ohio.

MUSIC

ENJOY "Music-Only" programs now available on the FM broadcast band from coast to coast with M.A.'s sub carrier detector used with your tuner. Kit $49.50 Wired $75.00. Music Associated, 65 Glenwood Road, Upper Montclair, N.J. (201) 744-3387.

POEMS wanted for new songs. Nashville Music Institute, Box 532-E, Nashville, Tennessee.

RUBBER STAMPS

RUBBER ADDRESS STAMP $1.00. Signature $2.88. Offset printing. Free catalog. Jackson Products, 1433 Winnemac, Chicago, Ill. 60640.

HAMS! SWLS! Pocket Rubber Stamp. Call or Name with Address $1.00. Both $1.25. Address Labels same price. Wagner Co., 6200-A Whitewood, Library, Pa. 15129.

PHOTOGRAPHY—FILM, EQUIPMENT, SERVICES

MEDICAL Film—Adults Only—"Childbirth"—1 reel 8mm $7.50—16mm $14.95. International-E, Greenvale, L.I., New York.

SCIENCE Bargains—Request Free Giant Catalog "CJ" —148 pages—Astronomical Telescopes, Microscopes, Lenses, Binoculars, Kits, Parts. War surplus bargains. Edmund Scientific Co., Barrington, New Jersey.

EDUCATIONAL OPPORTUNITIES

LEARN While Asleep. Remarkable, Scientific, 92% Effective. Details Free. ASR Foundation, Box 7021, Dept. e.g., Lexington, Kentucky.

B.Sc. DEGREE (Engineering) or College Entrance by home study. Send $1 for 1966 Prospectus. CIST, Suite 694, 263 Adelaide St. W., Toronto, Canada.

HYPNOTISM

FREE Hypnotism, Self-Hypnosis, Sleep Learning Catalog! Drawer H400, Ruidoso, New Mexico 88345.

HYPNOTIZE UNNOTICED! PATENTED new hand device makes you a Hypnotist first day or refund! Hypnotist's Handbook included! $2.00 Hypnosis Foundation, Box 487, La Mesa 9, California.

HYPNOTIZE secretly, cleverly, one glance . . . or money back. $2. Eltons, Box 18223-PE2, Indianapolis, Indiana 46218.

PERSONALS

INVESTIGATORS, FREE BROCHURE, LATEST SUBMINIATURE ELECTRONIC SURVEILLANCE EQUIPMENT. ACE ELECTRONICS, 11500-K NW 7th **AVE., MIAMI, FLA.** 33168.

BORROW $1,233 **AIRMAIL!** Repay $54 for twenty-nine months. State licensed. Postal Finance, Dept. 84-M, Kansas City, Kansas 66117.

"HYPNOTIZE . . One word . . One fingersnap," on stage. Satisfaction—or refund. $2.00. Hypnomaster, Box 9309-E8, Chicago 90.

DO-IT-YOURSELF

SAVE! Build Transistorized Treasure Finder. Details Free. Del Research, Box 347E, Alden Manor, Elmont, N.Y.

REAL ESTATE

FLORIDA WATER WONDERLAND—Home, cottage Mobilsites. Established area. $590 full price, $9.00 a month. Swimming, fishing, boating. Write: Lake Weir, Box KG38, Silver Springs, Fla. AD 6-1070 (F-1)

CANADIAN VACATION LANDS: Full price $385.00. 40 acres, $10 month. Suitable cottage sites, hunting, fishing, investment. Free information, Land Corporation, 3768-P, Bathurst, Downsview, Ontario, Canada.

FREE!—SPRING CATALOG Giant 180 pages! Thousands of properties described, pictured—Land, Farms, Homes, Businesses—Waterfront, Recreation, Retirement. Selected Best Buys from The World's Largest. 489 offices. 36 states Coast to Coast. Mailed **FREE! STROUT REALTY**, 60-ZD East 42nd St., N.Y., N.Y. 10017.

FREE! 152-page **SPRING** catalog! Over 1800 **PICTURES!** Farms, Ranches, Homes, Businesses, Vacation and Retirement Properties in 29 states coast to coast! **UNITED FARM AGENCY**, 612-EP West 47th St., Kansas City, Mo. 64112.

BUSINESS OPPORTUNITIES

INVESTIGATE Accidents—Earn $750 to $1,400 monthly. Men urgently needed. Car furnished. Business expenses paid. No selling. No college education necessary. Pick own job location. Investigate full time. Or earn $6.44 hour spare time. Write for Free literature. No obligation. Universal, CZ-3, 6801 Hillcrest, Dallas, Texas 75205.

VENDING Machines—No Selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, 715PE Ensor Street, Baltimore 2, Md.

ELECTROPLATING Equipment and supplies. All types for home workshops and industrial. Send $1.00 (refundable) for equipment guide formulas, operating data, catalog. HBS Equipment Division 90, 3543 East 16th, Los Angeles, California. 90023.

I MADE $40,000.00 Year by Mailorder! Helped others make money! Start with $10.00—Free Proof. Torrey, Box 3566-N, Oklahoma City, Oklahoma 73106.

PIANO Tuning learned quickly at home. Tremendous field! Musical knowledge unnecessary. Information free. Empire School of Piano Tuning. Dept. PE, Box 327, Shenandoah Station, Miami, Florida 33145. (Founded 1935.)

FREE Book "990 Successful, little-known Businesses." Work home! Plymouth-945W, Brooklyn, N.Y. 11218.

SELL CB EQUIPMENT—Dealerships available to aggressive people who can sell Citizens Band Radio full or part time. Knox Electronic, Dept 194, Galesburg, Ill. 61401.

FREE Report, "Businesses You Can Launch At Home." Immediate earnings! Wyman Enterprises, B-18, Congers, N.Y. 10920.

ARNOLD PALMER OFFERS YOU unequalled opportunity to profit from tremendous popularity of golf and power of Palmer. Highly profitable exclusive Palmer Golf Franchises available. Complete national program. Hefty Profits—minimum investment. Write for details. Arnold Palmer Enterprises, Dept. CD, Pleasantville, N.J. Tel. 609-646-3500.

EARN BIG MONEY! Learn Electric Appliance Repairing at home in your spare time. How to use Christy Electronic Trouble Tracer to make repairs. Make $5-6 per hour in kitchen or basement. Pay later. Send for **FREE BOOK. CHRISTY TRADES SCHOOL,** 3214 W. Lawrence, Dept. A-2814, Chicago 60625.

MAILORDER LAWS $2.00. Kelvin Kahn; Attorney, 4504 Pine, Philadelphia,Pa.

EARN extra money selling advertising book matches. Sample kit furnished. Matchcorp, Dept. MO-36, Chicago, Ill. 60632.

OPERATE Restaurant or diner. Free booklet reveals profitable plan. Write Restaurant Business School, Dept. BAC-36, 1920 Sunnyside, Chicago, Ill. 60640.

FREE ADVERTISING in 100 Electronic Magazines, Details 10¢. Dee, Box 211, Beverly Hills, Calif.

FREE "Franchise Profit Letter" tells how unique NFR service is helping thousands seeking profitable businesses. Write today. National Franchise Reports, D-528, 333 North Michigan, Chicago 60601.

EARN $240.00 a Month at home, spare time, doing only two $5.00 Invisible Mending jobs a day. Big money paid for service that makes cuts, tears disappear from fabrics. Steady demand. Details free. Fabricon, 1572 Howard, Chicago 26, Ill.

PHOTOGRAPHS

PHOTOGRAPHS and transparencies wanted, to $500.00 each. Valuable information free—Write Intraphoto-PE, Box 74067, Hollywood 90004.

REMAILING SERVICE

MIAMI Remails 25¢. Monthly Rates. Marle, (Dept. E) Box 1266, Coral Gables, Fla. 33134.

MAGNETS

MAGNETS—Alnico—Ceramic—Flexible—Assemblies. What you need, we have. Special—Two 7" long "pick-up" magnets, $1.00. Maryland Magnet, 5412-H Gist, Baltimore, Md. 21215.

EMPLOYMENT INFORMATION

FOREIGN Employment. Construction, other work projects. Good paying overseas jobs with extras, travel expenses. Write only: Foreign Service Bureau, Dept. D, Bradenton Beach, Florida.

EMPLOYMENT Resumes. Get a better job & earn more! Send only $2.00 for expert, complete Resume Writing Instructions. J. Ross, 80-34 Kent St., Jamaica 32, N.Y., Dept. PE.

FREE Meals and lodging save your pay, Technicians needed, Caribbean Island Tracking Stations. Also Cape Kennedy Information. $1.00. Research, Box 334K, Cape Canaveral, Fla. 32920.

STAMPS AND COINS

500 DIFFERENT, $1.00. Approvals. Smith, 508E Brooks, College Station, Texas 77840.

VALUABLE UNITED STATES STAMPS—Only 10¢! Scarce genuine centennial postage stamp, picturing first USA (issued in 1847!); Collection all-different United States—Ancient 19th Century, $1.00 stamp, etc.; Collection beautiful commemoratives: American Revolution, Wild West, 1893 Columbian, many others. Plus Collector's Guide; other fine stamps from our approval service returnable without obligation; Complete new profusely illustrated USA Catalog. Send only 10¢! **H.E. HARRIS,** Dept. C-38, Boston, Mass. 02117.

100 FOREIGN Coins Representing Over 25 Different Countries Only $3.95 Free Mexican Silver Dollar with every order. Van's Coins, Walworth B#1, Wisconsin 53184.

STAMPS FREE! New issues—New Countries—Triangles—**ROCKETS—OLYMPICS—SCOUTS—BIRDS—FLOWERS—ANIMALS—ALSO** Old Canadian and U.S. Stamps. Plus complete illustrated Canadian Stamp Catalog. Send 10¢ for mailing. **GRAY STAMP CO.,** Dept. P3, Toronto, Canada.

VALUABLE Collectors' Item! Genuine Fifth Anniversary Commemorative Envelope picturing historic Kennedy Inaugural ceremony, postmarked officially with highly-prized January 20th Anniversary Cancellation! Only 35¢ for this scarce cover to introduce you to the World's Most Rewarding Hobby. We'll also send fine stamps from our approval service returnable without obligation; plus **FREE** magnificent U.S. Government Document inscribed with JFK's immortal Inaugural Address—a masterpiece of graphic art in two colors measuring 15½" x 22" ready for framing! Send today: Kenmore, Milford IP-934, New Hamp. 03055.

450 FINE MIXED U.S. 15¢. Wright, Box 753X, Hagerstown, Md.

MISCELLANEOUS

BEERS, PEACH BRANDY, WINES—Strongest Formulas, $2.00. (Complete brew supplies—hydrometers catalog 10¢)—Research Enterprises, 29-D Samoset Rd., Woburn, Mass.

WINEMAKERS: Free illustrated catalog of yeasts, equipment. Semplex, Box 7208, Minneapolis, Minn. 55412.

ROTARY QSL HOLDER STORES, PROTECTS 600 CARDS. Easy "Flip-Viewing." Nordlund, 7635 Irving Park, Chicago 60634.

STAMMER—Stutter—No More. (Dr. Young). Write: Gaucho, Box 9309-E8, Chicago 90.

HYPNOTIZE secretly, cleverly, one glance . . . or money back. $2. Eltons, Box 18223-PE2, Indianapolis, Indiana 46218.

MONKEYS, $10.00 up. Mammals, Birds, Reptiles, Confidential Wholesale List $1.00. Dale Logston, Box 682, Saint Joseph, Mo. 64502.

POPULAR ELECTRONICS

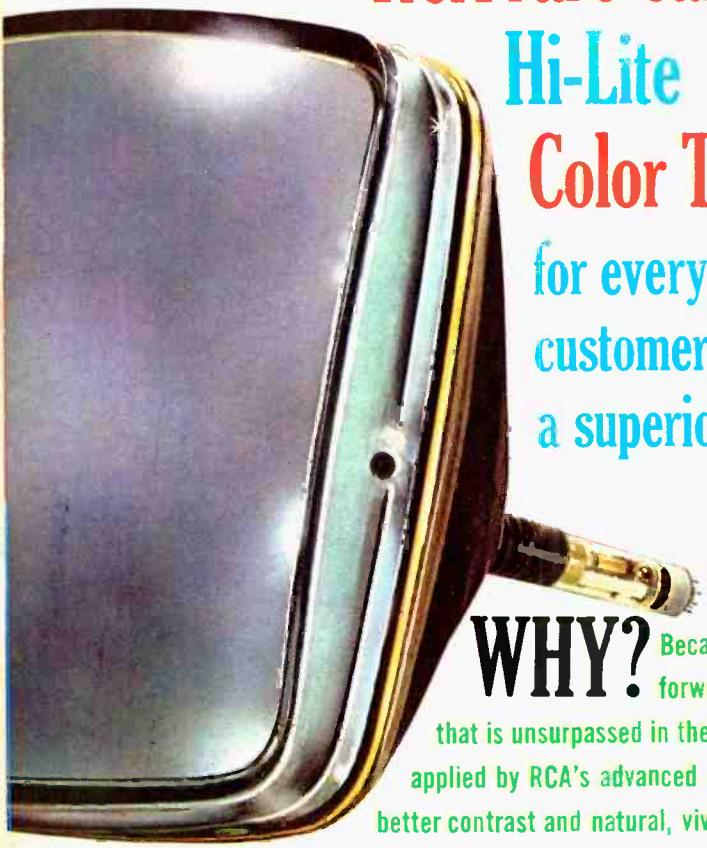
March 1966

ADVERTISERS INDEX

PRINTED IN U.S.A.

RCA rare-earth Hi-Lite Color TV Picture Tubes

for every smart customer who wants a superior color picture



WHY? Because RCA's Hi-Lite line represents a big step forward in color picture brightness—brightness that is unsurpassed in the color TV industry. Rare-earth phosphors applied by RCA's advanced screening methods create brighter reds, better contrast and natural, vivid colors . . . Everything the smart customer wants. Are you ready to service your smart customers? Keep posted. See your RCA Distributor today.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

RCA **The Most Trusted Name in Electronics**

CIRCLE NO. 34 ON READER SERVICE PAGE

PICK ANY NUMBER FROM 1G3GT TO 19AU4 AND YOU'RE A WINNER!

1G3GT/1B3GT	4HA5	6BZ6	6GW8	8CW5
1X2B	5HG8	6CB6A	6HA5	9A8
3BZ6	5U8	6CG7	6HG8	10CW5
3CB6	6AL5	6DT6	6S4A	12AT7
3GK5	6AU4GTA	6EH7	6SN7GTB	12AU7A
3HA5	6AU6A	6EJ7	6U8A	12AX4GTB
4BL8	6AV6	6GB5	6U9	12AX7A
4EH7	6AX4GTB	6GJ7	6X9	15CW5
4EJ7	6BA6	6GK5	6Y9	16A8
4GK5	6BL8	6GK6	8BQ5	19AU4

...AND ON AND ON. FOR THE COMPLETE LIST, WRITE:
AMPEREX ELECTRONIC CORPORATION, HICKSVILLE, L.I., NEW YORK 11802.

CIRCLE NO. 2 ON READER SERVICE PAGE