BUYER'S GUIDE TO SWL RECEIVERS

# ELECTRONICS ILLUSTRATED®

By the Publishers of MECHANIX ILLUSTRATED

JANUARY 1966 • 35¢


## BASIC SCIENCE EXPERIMENTS IN THERMOELECTRICITY

**BUILD**

Low-Low Cost Computer

VOX from the Junkbox

Fail-Safe Slave Flash

Universal Light Dimmer

WHO REALLY SPEAKS FOR CB?

NEW DX AWARDS FOR HAMS & SWLs

CAN YOU RECHARGE ANY BATTERY?

ELECTRONIC SWEEPER FOR CB BAND

BREAKTHROUGH IN FLAT-SCREEN TV

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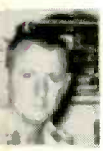
# Join the thousands who gained success with NRI



*"I average $150.-$170. a month in spare time fixing radio and TV sets, and plan to start my own full-time business. I wish it were possible to tell every man of the wonderful opportunities."* WILLIAM L. KING, Yoakum, Texas.

*"I am a Frequency Coordinator for the 11th Naval District. The course I completed was priceless in my work. I was a blue collar worker, now I am a white collar worker."* JOHN J. JENKINS, San Diego, Calif.

*Iany thanks to NRI for the Electronics ining I received. I hold a First Class C License and am employed as a dio and master control engineer/tech- cian with KXJB-TV."* RONALD L. OOD, Fargo, N. D.

*"I am a Senior Engineering Aid at Litton Systems, in charge of checkout of magnetic recording devices for our computers. Without the help of NRI I would still be working in a factory."* DAVID F. CONRAD, Reseda, Calif.

# ELECTRONICS ILLUSTRATED

JANUARY, 1966 A Fawcett Publication Vol. 9, No. 1


## General Features



## Construction Projects



## Radio: CB • Amateur • SWL



## Audio & Hi-Fi



## Theory & Practice



## Regular Departments

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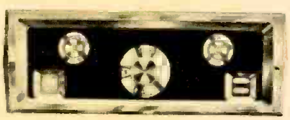
COVER — Ektachrome by R.J. Capotosto. Thermoelectric module by Frigistors, Ltd. Meter by Simpson Electric Co.

# Congratulate yourself for holding out!

# Now from Courier! The world's smallest, most sensitive, most powerful transistor CB line!



## 6 Channels
## *COURIER TR-6

6" W x 6¾" D x 1⅞" H

■ SILICON TRANSISTORS. Illuminated channel selector. Auxiliary speaker jack. 4" oval speaker. Transmit indicator. External channel socket. Top or bottom speaker mount. Channel 9 crystals. **$129**

## 12 Channels
## *COURIER TR-12

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■ SILICON TRANSISTORS. Collins filter. Illuminated S-RF meter. Illuminated channel selector. PA System. Auxiliary speaker jack. Modulation indicator. Channel 9 crystals. **$169**

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## *COURIER TR-23

6" W x 7½" D x 2½" H

■ SILICON TRANSISTORS. All crystals supplied for 23 channels. Illuminated S-RF meter. Illuminated channel selector. PA System. Auxiliary speaker jack. Single knob tuning. Modulation indicator. **$209**

(Delivery, Dec. 15, 1965).

*All units include: Microphone, Mounting Brackets, DC Cord, Chrome Cabinet. PLUS exclusive Courier circuit protection against mismatched antenna, incorrect polarity, and overload.

AC POWER SUPPLY for above units $29.95

**FOR THE ULTIMATE IN BASE STATION OPERATION!**

**RANGE EXTENDER COURIER-23**

■ 23 Channels ■ Dual Conversion ■ Transistor Power Supply ■ Includes all crystals, mounting brackets, power cords and noise-cancelling microphone. STILL **$189.50**

World famous manufacturers of quality CB and BB equipment, including Courier 23, Courier 1M, Courier 30 B, Fleet Courier, Port-A-Lab, Transistorized Power Supply, Linear Amplifier.

**eci. electronics communications inc.**

56 Hamilton Ave.
White Plains, N. Y.

Yes! I'd like to know all about Courier's new 6-12-23 Channel SILICON-TRANSISTOR CB line!

**Name** ______________________

**Address** ______________________

**City** __________ **County** __________ **State** __________

# ELECTRONICS ILLUSTRATED

By the Publishers of MECHANIX ILLUSTRATED





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

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

**ADVERTISING OFFICES:** 67 W. 44th St., New York, N.Y. 10036 (phone 212-661-4000); 612 N. Michigan Ave., Chicago, Ill. 60611 (phone 312-DE 7-4680); 1532 Guardian Bldg., Detroit, Mich. 48226 (phone 313-WO 2-4860); 2978 Wilshire Blvd., Los Angeles, Calif. 90005 (phone 213-DU 7-8258); 681 Market St., San Francisco, Calif. 94105 (phone 415-EX 7-3441); 1430 W. Peachtree St., N.W., Atlanta, Ga. 30309 (phone 404-TR 5-0373); James B. Boynton, 370 Tesquesta Dr., Jupiter, Fla. 33458 (phone 305-746-4847); 123 S. Broad St., Philadelphia, Pa. 19109 (phone 215-PE 5-3636).

**SUBSCRIPTIONS:** $4 for 12 issues in U.S. and possessions and Canada. All other countries $6 for 12 issues. All subscription correspondence, including changes of address (Form 3579), should be addressed to ELECTRONICS ILLUSTRATED, Subscription Dept., Fawcett Bldg., Greenwich, Conn. 06830. Foreign subscriptions and sales should be remitted by International Money Order in U.S. funds payable at Greenwich, Conn.



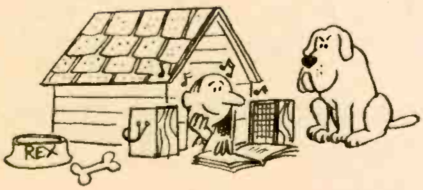


**PRINTED IN U.S.A. BY FAWCETT-HAYNES PRINTING CORP., LOUISVILLE, KY. 40201.** Microfilm copies of current and back issues are available from University Microfilms, 313 N. First St., Ann Arbor, Mich. 48103.

# FEEDBACK
## from our readers

Write to: Letters Editor, Electronics Illustrated, 67 West 44th Street, New York, N.Y. 10036

### ● MINI DE POOCHER




I'm just a poor slob who's doing good to have an FM radio. But this rich buddy of mine who's a stereo nut has gone too far this time. As a lark, he put a pair of your sub-mini speakers in his dog house (SUB-MINI SPEAKER, Nov. '65 EI). I used to envy him —now I've got to envy his dog!

Michael Barnes
Boston, Mass.

*Courage, Mike. Every dog has his day.*

### ● HO HUM

There are a few of us hams who have the know-how for the written exam and the ability to copy 13 wpm. However I broke my wrist and am unable through this to send at over 9 wpm. Do you favor my abolition from the ranks of the amateur radio operator for this infirmity?

L.M.
Riverside, Calif.

*It's not your wrist that needs speed, L.M. It's your ear. And we've never heard of punctured-eardrum appeals to the FCC.*

### ● IN THE GROOVE

Just exactly what is the most desirable (commercially available) size stylus for playing standard 45s?

Craig Bradley
Birmingham, Ala.

*1-mil—same as for mono LPs.*

### ● WASTELAND REVISITED

Your September issue contains an item telling how to build a unit to kill the sound during TV commercials (TV BLAB OFF, Sept. '64 EI). My conception of honesty must be early Victorian because I have never been able to consider such gadgets to be anything less than dishonest. How can a person relax and enjoy millions of dollars worth of entertainment, then object to paying the very, very tiny price the sponsor expects of him? I would feel like a thief to enjoy Bonanza and refuse to listen to the commercial.

Kenneth Z. Turner
Fulton, Ky.

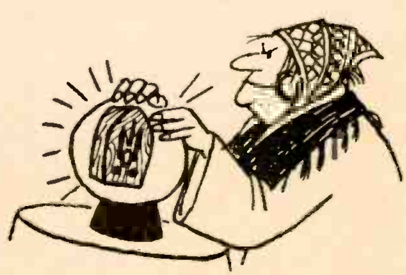
*Last guy we heard of with that much of a guilty feeling was Benedict Arnold.*

### ● SWAPPER

After placing an ad for my VHF-UHF receiver in your Swap Shop column I received over two dozen letters in response and was able to make a favorable exchange of equipment. I thank you very much for Swap Shop and I hope that you will continue its publication.

Stephen Druzak
Wenatchee, Wash.

### ● TUESDAY GAL



I want you to tell your readers how they can get in touch with the *real* ghosts of radio (VISITING THE GHOSTS OF RADIO, Nov. '65 EI). My wife says she still gets One Man's Family sometimes on the radio.

Name Withheld
Magnolia, Ga.

Clip coupon—and take your first big step to real success! I.C.S., Scranton, Penna. 18515

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New! Special Package for Women!

Name of the course in which you are interested__________

Mr.
Miss__________ Age_____ Address__________
Mrs.

City__________ State__________ Zip Code_____ Working Hours_____ A.M. to_____ P.M.

Occupation__________ Employed by__________

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Building Inspector
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Chemical Engineering Unit Operations
Chemical Laboratory Tech.
Chemical Process Control Technician
Chemical Process Operator
Elements of Nuclear Energy
General Chemistry
Instrumental Laboratory Analysis

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Construction Engineering
Highway Engineering
Principles of Surveying
Reading Highway Blueprints
Reading Structural Blueprints
Sanitary Engineering
Sewage Plant Operator
Structural Engineering
Surveying and Mapping
Water Works Operator

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

**ELECTRICAL**
Electric Motor Repairman
Electrical Appliance Servicing
Electrical Contractor
Electrical Engineering (Power option or Electronic option)
Electrical Engineering Tech.
Electrical Instrument Tech.
Industrial Electrical Tech.
Industrial Telemetering
Power Line Design and Construction
Power Plant Operator (Hydro or Steam Option)
Practical Electrician
Practical Lineman
Reading Electrical Blueprints

**ENGINEERING (Professional)**
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Civil
Electrical
Mechanical
Industrial Management for Engineers

**ENGLISH AND WRITING**
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Introductory Technical Writing
Modern Letter Writing
Practical English
Short Story Writing

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High School College Prep. (Arts)
High School College Prep. (Engineering & Science)
High School General
High School Mathematics
High School Secretarial
High School Vocational

**LANGUAGES**
(Edited by Berlitz)
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German
Italian
Spanish

**LEADERSHIP**
Basic Supervision
Industrial Foremanship
Industrial Supervision
Personality Development
Personnel-Labor Relations
Supervision

**MATHEMATICS**
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Mathematics and Physics for Engineering
Mathematics & Physics for Technicians
Modern Elementary Statistics

**MECHANICAL**
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Machine Design
Mechanical Engineering
Quality Control
Safety Engineering Tech.
Tool Design
Value Analysis

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

**PLASTICS**
Plastics Technician

**PLUMBING, HEATING, AIR CONDITIONING**
Air Conditioning
Air Conditioning Maint.
Domestic Heating with Oil & Gas
Domestic Refrigeration
Gas Fitting
Heating
Heating & Air Conditioning with Drawing
Plumbing
Plumbing & Heating
Plumbing & Heating Contractor
Plumbing & Heating Estimator
Practical Plumbing
Refrigeration
Refrigeration & Air Conditioning
Steam Fitting

**PULP AND PAPER**
Paper Machine Operator
Paper Making
Pulp Making
Pulp & Paper Engineering
Pulp & Paper Making

**SALESMANSHIP**
Creative Salesmanship
Real Estate Salesmanship
Sales Management
Salesmanship
Salesmanship & Sales Management

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

**SHOP PRACTICE**
Drill Operator
Foundry Practice
Industrial Metallurgy
Lathe Operator
Machine Shop Inspection
Machine Shop Practice
Machine Shop Practice & Toolmaking
Metallurgical Engineering Technology
Milling Machine Operator
Patternmaking
Practical Millwrighting
Reading Shop Prints
Rigging
Tool Engineering Techn'gy
Tool Grinder
Toolmaking
Turret Lathe Operator
Welding Engineering Tech.
Welding Processes

**STEAM AND DIESEL POWER**
Boiler Inspector
Industrial Building Engineer
Power Plant Engineering
Stationary Diesel Engines
Stationary Fireman
Stationary Steam Eng.

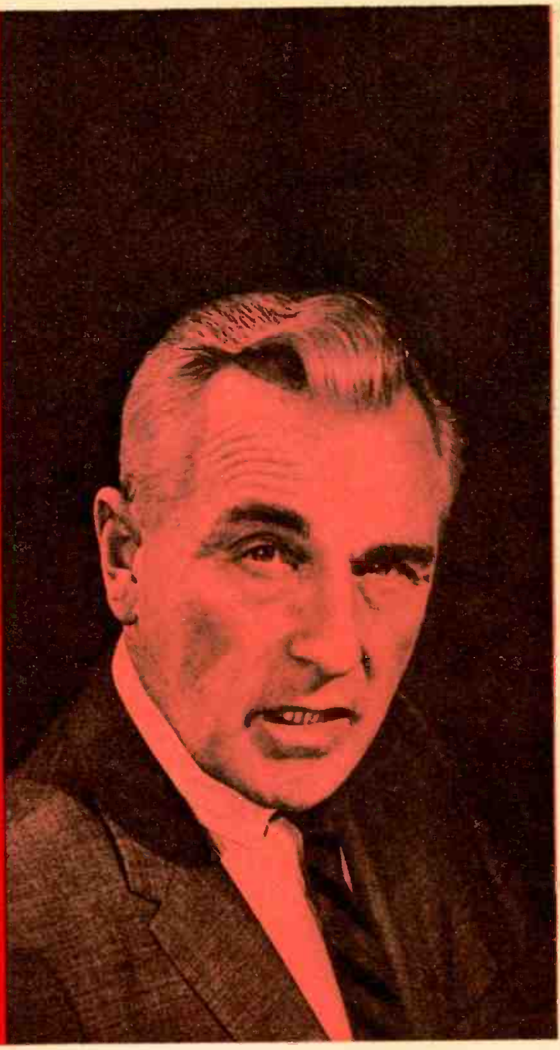
**TEXTILES**
Carding
Carding and Spinning
Cotton Manufacturing
Dyeing & Finishing
Loom Fixing
Spinning
Textile Designing
Textile Technology
Textile Mill Supervisor
Warping and Weaving
Wool Manufacturing

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

**TV-RADIO-ELECTRONICS**
Communications Techn'l'gy
Electronic Fundamentals
Electronic Fundamentals (Programed)
Electronic Fundamentals with Electr. Equip. Tr'n'g
Electronic Instrumentation & Servo Fundamentals
Electronic Principles for Automation
Electronics and Applied Calculus
Electronics Technician
First Class Radiotelephone License
Fundamentals of Electronic Computers
General Electronics
General Electronics with Electronic Equip. Tr'n'g
Hi-Fi Stereo and Sound Systems Servicing
Industrial Electronics
Industrial Electronics Engineering
Industrial Electronics Engineering Technician
Practical Radio-TV Eng'r'g
Practical Telephony
Principles of Radio-Electronic Telemetry
Principles of Semiconductor-Transistor Circuits
Radio Servicing with Radio Equipment Training
Radio & TV Servicing
Radio & TV Servicing with Radio Equip. Tr'n'g
Second Class Radiotelephone License
Sound Systems Specialist
Telephony, Electronics and Radio Communications
TV Receiver Servicing
TV Technician

# "There's no sure way to success in electronics-

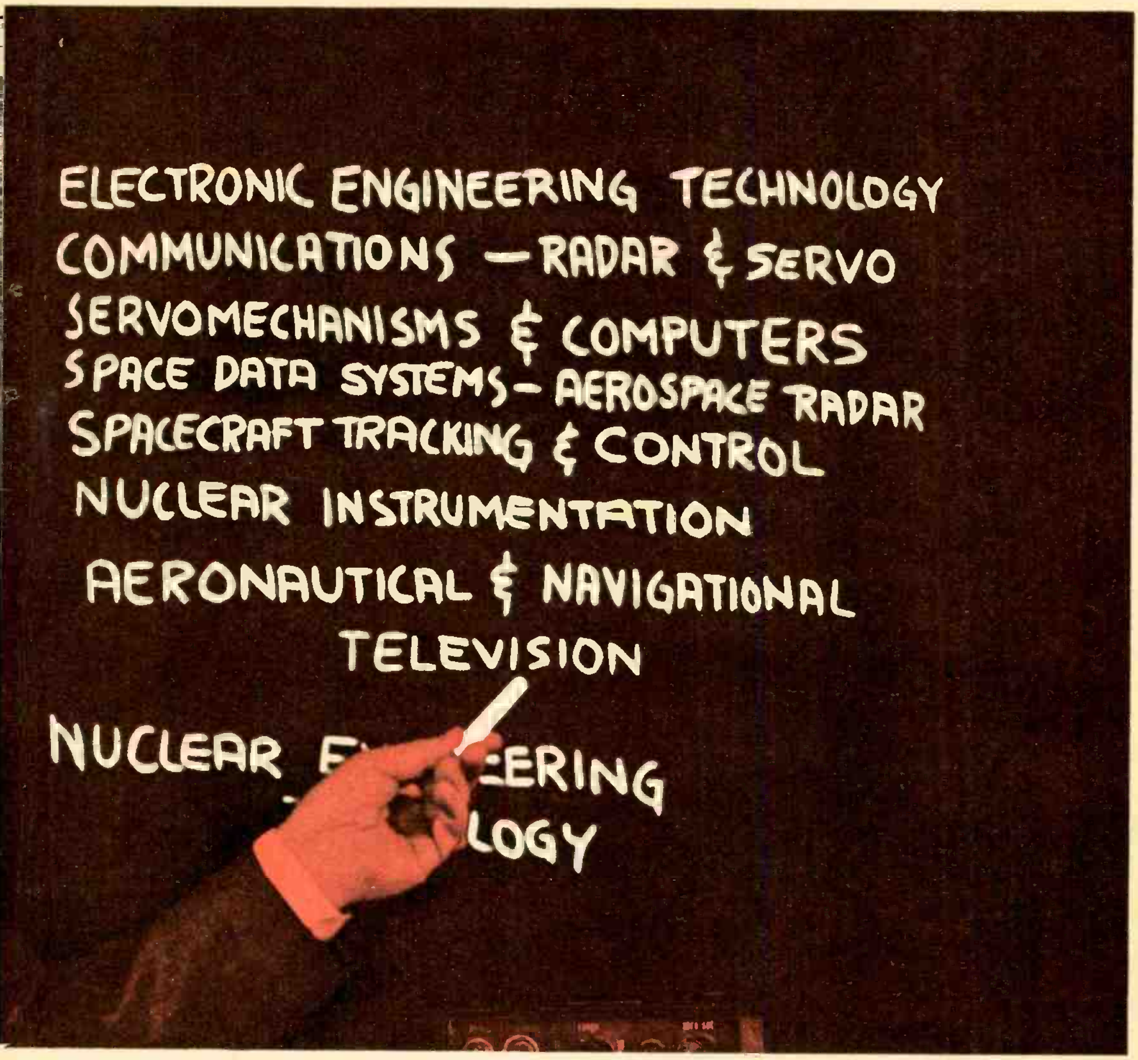
## but I'll put my money on the man who makes himself a specialist in one of these key areas"



**Take the advice** of men who have worked their way to the top in the electronics industry. Make yourself a specialist in one of the key areas of electronics. Then stop worrying how cutbacks, layoffs and contract terminations will affect you and your family. If you have up-to-date, specialized knowledge, you can look forward to security and excellent earnings while men with ordinary qualifications are made obsolete—and unemployed—by advances in technology or by automation.

**But, to become a specialist,** you must supplement your experience in electronics with more technical education. Going back to school isn't easy for a man who holds a full-time job and has family obligations. And few residence schools offer educational programs directly related to current employment requirements in the electronics industry.

**CREI Home Study Programs** offer you a practical way to get the additional education you need without going back to school. You study at home, at your own pace, on your own schedule. And, because CREI Programs are developed and kept up-to-date with the help of engineers and scientists from every part of the electronics industry, you study with the assurance that what you learn can be applied to the job immediately.




Because CREI Programs cover all the areas of electronics that are important now and will be even more important in the future, you're sure to find a program that fits your particular ambitions and career objectives.

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

Name__________ Age____

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City______ State_____ Zip Code_____

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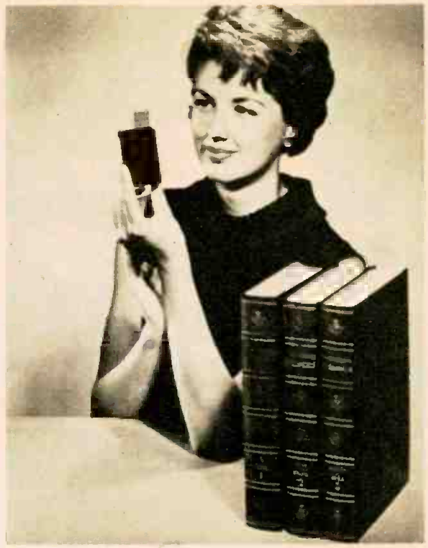
Type of Present Work__________

**PHOTOGRAPHIC MEMORY** . . . Though scientists well may be soldiers in our wars against ignorance and disease, each new advance makes another kind of war on the nation's filing systems. Fact is, papers, reports, magazines and texts flood already over-burdened shelves, and finding one wanted bit takes on all the characteristics of looking for the proverbial needle. Worst thing about our information explosion is that precious days spent digging for needed data frequently cause loss of a good many would-be better mouse traps. But as the people at IBM have proven, there's a way more compactly to store information. Latest method they've devised calls for little plastic cells like the one in the hands of the gal in our photo. So fact-hungry is the system that all 4.5 million words in the three encyclopedia volumes we picture can be stored in just one plastic cell. Photoelectric devices, intermediaries between a computer and the data cells, go into action whenever data is to be stored or retrieved.



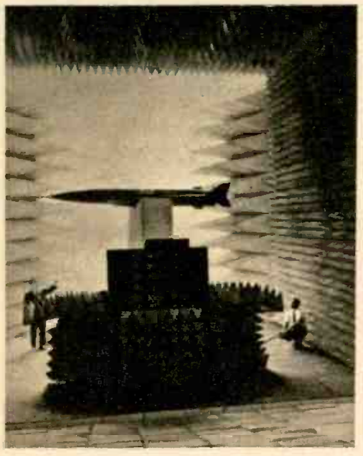
# ...electronics in the news

**Weatherer** . . . If necessity ever mothered an invention, the device in our photo surely would be a favored son. Necessity in this case took the form of an easy and quick method of finding what size and type heating plant ideally should be installed in various buildings. Developed by Honeywell, an analog computer feeds on such pertinent data as the number of rooms and windows in a building, its location and its construction. The answer pops out in a twinkling, the computer meanwhile having anticipated temperature, humidity, wind and sunshine over a simulated time span ranging from 24 hours to 17 years.

**Wind-up Dynamo** . . . The device in our photo might pass for a can of the latest spray paint, but it more likely will be found in the hands of a man of James Bond's ilk rather than one who favors basement workshops and projects with an I-did-it-myself flair. Explanation is that appearances can be deceiving, which is just what they are in this case. Actually a spring-wound dynamo, the unit is readied for action by twisting its two cylindrical sections. But a touch of the button, and presto! The spring uncoils, releasing a surge of up to 75 watts of electrical power from the 38-oz. gizmo. The 007 device initially was developed by Varo, Inc., of Santa Barbara, Calif., for use as an explosives detonator.

## ...electronics in the news

**Space Simulator** . . . Wave-emitting and wave-absorbing devices such as speakers, microphones and antennas operate best in echo-free space, a commodity that is a bit hard to come by. Only way to get round the scarcity of outer space here



on earth is to test these devices in a special sort of room called an anechoic chamber. Our photo shows engineers at Bunker-Ramo Corp. testing an onboard missile microwave antenna in such a signal-absorbing environment to find out how it will work under simulated operating conditions. The king-size egg-crate liners padding the walls, ceiling and test-stand are plastic pyramids designed by B.F. Goodrich to soak up the microwave emissions of the missile antenna.

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**ITEMS** . . . Formica Ltd. of London has dedeveloped a **copper-clad laminate** that should be just what the flexible-printed-circuit-board doctor ordered. Lamination of copper foil between layers of polyester film makes for excellent electrical properties in addition to the bend-it, twist-it feature.

Ghana recently inaugurated a national **television** service with stations at Accra, Kumasi and Sekondi-Takoradi. Among the most modern TV broadcasting system in Africa, the service uses Marconi equipment and covers approximately a quarter of that emerging nation.

Another country with a TV glint in her eye is Israel, though inauguration of **national TV** service still is a tentative year-and-a-half away. In the meantime, Israeli TV viewers will continue to pay a fee of $1,000 to their government for the privilege of watching programs originating in Lebanon and Egypt—a seemingly strange twist in Arab-Israeli relations, considering their long eyeball-to-eyeball standoff.

# ELECTRONIC SWAP SHOP

El's Swap Shop provides a way for readers to obtain equipment they want in exchange for items they no longer have use for. Notices must be from individuals; commercial concerns are referred to El's classified advertising columns. Entries must include your name and address as well as a description of what you now have and what you would like in exchange. Address: El's Swap Shop, ELECTRONICS ILLUSTRATED, 67 West 44th Street, New York, New York 10036.

3RP1A CRT, other components. Will exchange for Heath 2-meter transceiver. Paul Cavnar, 4000 Briggs St., Riverside, Calif. 92509.

KNIGHT R/C tester. Want in-circuit capacitor tester. D. K. Auck, 1774 Spruce St., Des Plaines, Ill. 60018.

SIMPSON AC voltmeter, assorted resistors. Want antique radio or SW receiver. Ed Wright, 8 Shire Ave., Fairfield, N.J.

GLOBE ELECTRONICS 6-meter converter, Sechell Carlson VLF aircraft receiver, Hallicrafters SX-24 receiver, Wurlitzer 65-watt audio amplifier. Interested in EICO and Heath scopes, other test equipment. Dennis Shuck, 1023 D St., Lincoln, Neb.

LAFAYETTE LA-57 integrated amplifier. Will swap for 8-mm movie camera or slide projector. Richard Bandelier, 1626 Wells St., Ft. Wayne, Ind. 46808.

KNIGHT Star Roamer. Make swap offer. Gary I. Chesin, 5747 N. Fairfield Ave., Chicago, Ill. 60645.

BC-342Q. Will swap for Heath VTVM; BC-603D, BC604DM or PE-97A. Thomas A. Rickard, 5410 McBryde Ave., Richmond, Calif. 94805.

CB TRANSCEIVER. Want SW receiver. Ronald Tlachac, 610 Lincoln Ave., Marshfield, Wis. 54449.

LAFAYETTE HE 30 communications receiver. Want 30- to 50-mc FM receiver. Jim Barsuglia, 544 Mayfair Ave., Vineland, N.J. 08360

EICO 706 Code oscillator. Interested in CB walkie-talkies. Joel Kauffmann, Rte. 1, Hopedale, Ill. 61747.

BELL ¼-track stereo tape deck, Audax 12-in. speakers and 3-in. RCA oscilloscope. Want National Criterion AM/FM tuner, University HC-15 or T-50 speakers and Fisher 80-C or 90-C preamp. John Sherrod, 906 14th Ave. N.W., Largo, Fla. 33540.

LAFAYETTE HE55 tube tester, Knight R/C substitution box and antique mike. Want ham transmitter. George S. Hope, Jr., Rte. 3, Westminster, Md. 21157.

LAFAYETTE Explore-Air receiver. Interested in Knight Star Roamer. Jeffrey J. Warshat, 65 Hunter La., Woodbridge, N.J. 07095.

COURIER 12 CB transceiver. Want ham station or general-coverage receiver. Philip Trofimuk, 164 Main St., Franklin N.J. 07416.

NATIONAL NC-57 communications receiver and Craftsman Maestro 10-watt hi-fi amplifier. Will trade for CB transceiver. Joe Boyd, 1313 Avenue P, Anson, Tex. 79501.

KNIGHT KG-4000A CB walkie-talkie. Will exchange for Heath sixer or 6- and 2-meter beam. Glenn A. Miller, WA3DJ1, Rte. 3, Box 297, Coraopolis, Pa. 15108.

NATIONAL NC-57. Will swap for SX-28. Jim Meyer, WN2PCM, 334 S. Webber Dr., Chittenango, N.Y. 13037.

KNIGHT G-100 walkie-talkie. Make swap offer. David A. Staub, 347 High St., Hanover, Pa. 17331.

KNIGHT Ocean Hopper. Will exchange for Ameco AC-1T transmitter or other ham or SWL gear. Gerald Munchel, Box 156, Oldenburg, Ind. 47036.

PERCO FM tuner. Interested in C-555. HE-82 or other CB walkie-talkie. Frank E. Kavenik, Rte. 1, Box 82, Mundelein, Ill. 60060.

WEBSTER 1781R wire recorder. Will swap for ham or test equipment. Forrest Smith, Rte. 5, Box 272, Fayetteville, N.C.

HALLICRAFTERS S-138B receiver. Want CB transceiver. Gregg Fox, 210 Coach Rd., Northfield, Ill. 60094.

SWL receiver. Will swap for CB transceiver. A. J. Palczewski, 2702 Heath Ave., Bronx 63, N.Y.

DEFOREST radio. Will trade for walkie-talkies. Jim Volant, 268 W. Clarkston Rd., Lake Orion, Mich. 48035.

BRIGHTONE transistor tape recorder. Will exchange for 6-meter beam and rotor. Robert Kalvitien, WA1DVR, 36 Columbia Rd., Arlington, Mass.

HEATH IG-102 signal generator and IT-11 capacitor checker. Looking for Heath GW-22A or Knight KG-375. Norman F. Miller, 207 N. Spruce St., Washington, Ill. 61571.

EICO 145 signal tracer, capacitor substitution box, 3-tube broadcaster. Want capacitor checker, circuit boards, SW receiver, signal generator/tracer or VTVM. G. Clemas, 11281 Brockhurst, Garden Grove, Calif.

HEATH V-5 VTVM, transistor SW receiver, CD Geiger counter, speakers, volume controls, capacitors, batteries. Want CB gear and S-meter. Mike Forsyth, 789 Colusa Ave., El Cerrito, Calif. 94532.

KNIGHT Ocean Hopper receiver. Want Ameco AC-1 or other Novice transmitter. Mitch Gyde, 1045 38th Ave., N.E., Salem, Ore.

NAVY TBY transceiver with power supply. Will trade for CB transceiver. Stan Bloom, 571 Western Park Dr., W. Hempstead, N.Y. 11552.

HEATH EA-2 amplifier and FM-4 FM tuner. Will swap for ham equipment. Duane O. Mason, WA4AEU, Box 115, Irmo, S.C.

HEATH GR-91 receiver and AIWA portable tape recorder. Will exchange for anything of equal value. Robert Sweetland, 925 Byford Blvd., Endwell, N.Y. 13763.

PACER CB transceiver. Will trade for kit or wired ham transmitter. Jeff Joseph, 1581 Hawthorne 1, Mayfield Hts., Ohio.

RCA WO-55A oscilloscope, homebrew stroboscope and 420-mc transceiver. Want TV camera and/or microwave equipment. Noel M. Moss, 5355 Henry Hudson Pkwy., Bronx, N.Y. 10471.

LAFAYETTE HA-70 CB transceiver, other items. Will swap for ham-band receiver with BFO. Tim Kaiser, WN8ODW, 17787 Reno St., Riverview, Mich.

CRYSTALS—80, 40 or 20 meters. Will exchange for Heathkit DX-20 instruction manual. Don Hoffman, WN6ONA, 1022 Knickerbocker Dr., Sunnyvale. Calif. 94087.

HAM and test equipment. Will exchange for Regency ATC-1 short-wave converter. Stan Putra. 1429 Lawndale Ave., Racine, Wis.

SIMPSON 715 VTVM. Will trade for 6-meter or CB transceiver. Frank Chalom, WB2MIK, 1437 Ocean Pkwy., Brooklyn, N.Y. 11230.

SURPLUS radar indicator and 10KP7 CRT. Want oscilloscope or CB transceiver. Larry K. Bowman, Rte. 3, Shippensburg, Pa. 17257.

CTI VTVM and oscilloscope. Will exchange for CB transceivers. Dean M. Ravert, 504 Abbott St., Casper, Wyo. 82601.

HEATH GR-91 receiver and surplus Triplet tube and in-circuit tester. Will swap for oscilloscope or transistor capstan-drive tape recorder. Russ Barr III, G-6062 Detroit St., Mt. Morris, Mich. 48458.

PNP & NPN transistors. Will trade for ham equipment. Larry Goldberg, N. Hoosac Rd., Williamstown, Mass. 01267.

AIWA tape recorder. Will exchange for VOM or other kit. Jeffrey Maltz, 59 Stecher St., Newark, N.J. 07112.

EICO signal tracer, signal generator and capacitance tester. Will exchange for communications receiver. George Tidwell, Box 51, Oceano, Calif. 93445.

LAFAYETTE ground plane CB antenna. Will swap for anything of equal value. S. Eamegdool, 107 Lincoln St., Passaic, N.J. 07055.

OLD TUBES—6C6, 6D6, 6K7, 41, 43, 50, etc. Want test equipment. John Melnick Jr., 245 Prospect Ave., Bayonne, N.J. 07002.

TV/FM booster. Will trade for 6-transistor radio or other equipment. Alexander Podstepny, 1652 Dounton St., Philadelphia 40, Pa.

VTVM, power transformer and 6-meter VFO. Will swap for mike or ham equipment. Robert Wilson, WB2SJZ, 56-09 137th St., Flushing 55, N.Y.

HAM and hi-fi equipment. Will trade for 2-meter transceiver or AM/FM radio. Alan S. Owens, WN8PAA, 1859 Country Club Rd., Ann Arbor, Mich. 48105.

ATWATER-KENT 60C TRF receiver. Looking for CB transceiver. Peter Rutenberg, 3252 Revelstoke Dr., Ottawa 10, Ont.

TUBES—RCA, GE and Sylvania. Need CB transceiver. Tom McNall Jr., 39 Meadowbrook Dr., Albion, N.Y. 14411.

KNIGHT T-60 transmitter. Will exchange for tape

[*Continued on page* 16]

# ELECTRONIC SWAP SHOP

*Continued from page 14*

recorder. Edward Whithorne, 1107 E. Farriss Ave., High Point, N.C.

GRC M2G3 Variac. Make swap offer. Rick Radke, 960 Lovell Ave., St. Paul, Minn. 55113.

ZENITH BC radio. Will swap for Knight-kit C-100 transceivers. Steven Karban, Hetland, S.D. 57244.

WEN 100-watt soldering gun and Lincoln headphones. Will trade for Hallicrafters S-120 or WR-1000 receivers. Neil Parks, 22-22 Clintonville St., Whitestone, N.Y. 11357.

WICO 10-watt amplifier. Will swap for 6-9 mc Command receiver. John D. Shoemaker, 14½ W. Dexter, Freeport, Ill. 61033.

1932 Crosley radio. Will exchange for communications receiver. Bert Penhollow, W. Bacon St., Amboy, Ill.

LAFAYETTE KT-135 receiver. Will swap for CB transceiver. Dennis Prock, Rte. 1, Rolla, Mo. 65401.

KNIGHT Ocean Hopper, other items. Want battery-operated tape recorder. Ronald Sharuga, Wabamun, Alta.

KNIGHT Span Master receiver, Ameco CPO, Pierce-Simpson CB transceiver, CB antenna. Will swap for 15- and 2-meter transceiver. S. L. Obritski Jr., 75 Augusta St., Irvington, N.J.

WESTINGHOUSE SR-100 receiver. Want Q-multiplier or antenna tuner. Jerry Linden Jr., Rte. 2, Box 141, Cedarburg, Wis.

HEATH oscilloscope. Looking for CB transceiver. Frank Burnham, Wolverine Trailer Ct., Mattawan, Mich. 49071.

ATHEARN HO trains and equipment. Need test gear. Eric B. Olsen, Rte. 1, Box 4, Kingsville, Ohio 44048.

OLSON AM-260 transistor amplifier. Will swap for CB transceiver. Steven Bender, 1577 E. 17th St., Brooklyn, N.Y. 11230.

WOODWARD-SCHUMACHER 6 & 12V battery charger, other items. Want Heath CR-1 crystal receiver. Chester Heffel, 52 Cliff St., Battle Creek, Mich.

BENDIX MN-26C receiver and CF-3-A telephone amplifier carrier system. Want Bendix MN-26LB direction finder. Greg Winterhalter, 1400 Ross, Plymouth, Mich. 48120.

EIMAC 15Es, Philco UHF/VHF TV tuners. Need Ameco 220-mc converter or Hy-Gain DS-1 Discone antenna. Richard Moore, 703 W. Dayton, Fresno, Calif. 93705.

TINY TIGER 300 gasoline-driven generator. Make swap offer. M. Polauf, 1857 Madison St., Brooklyn, N.Y. 11227.

LAFAYETTE 18G0145 UHF converter with antenna. Will exchange for Lafayette HA-50 communications receiver. Howard Ziskin, 2232 Leighton Road, Elmont, N.Y. 11003.

ADMIRAL 4-speed record changer with mono cartridge, old spring-driven turntable. Will swap for ham receiver or test equipment. Art Ettore, 827 Huntington Ave., Glendora, N.J.

BULOVA 4-speed stereo record player, 4-transistor tape recorders, Royal typewriter, camera equipment. Will trade for SW receiver and test equipment. Barry Schlosser, 7513 Adventure Ave., Miami Beach, Fla. 33141.

CRTs (3FP7). Need test equipment. Glenn Ward, 1420 W. Florence Ave., Inglewood, Calif.

TAPE RECORDER and 600-amp ammeter. Will swap for ham equipment or CB transceiver. Larry Wren, 1105 S. Anthony, Kennett, Mo. 63857.

AMECO AC1 transmitter. Will trade for Knight Star Roamer or other SW receiver. Dennis Sekutowski, WN8OCK, 7700 Rutland, Detroit, Mich. 48228.

VIKING 75 and 85 tape decks, 21-in. TV set. Will exchange for ATR 100- to 300-watt 12VDC to 115VAC inverter. Dick Donohue, 4212 Round Hill Rd., Wheaton, Md.

SURPLUS BC-348R receiver. Will trade for tape recorder or FM tuner. Charles Copeland, 20 Knights Trailer Ct., W. Lafayette, Ind. 47906.

HALLICRAFTERS SX-140 receiver, Spacemate SM-1000 transceivers. Want 5-channel CB transceiver. Richard Alberts, Rte. 1, Box 23A, Cozad, Nebr.

[*Continued on page* 20]

# ELECTRONIC SWAP SHOP

*Continued from page 16*

LAFAYETTE HE-29C transceivers. Looking for SW receiver or Novice transmitter. Lonnie Moore, Rte. 7, Box 965, Austin, Tex. 78703.

KNIGHT Ocean Hopper receiver. Want Heath Twoer, Sixer, Tener or other ham equipment. Jim Sheetz, 1701 Greenleaf Ave., Des Plaines, Ill. 60018.

RCA AVT-15A transmitter and RCA AVR-20 receiver. Interested in oscilloscope or late-model metal detector. T. J. Kellogg, Rte. 3, Victory Rd., Boise, Idaho.

HEATH scope and signal generator. Will swap for CB transceiver and/or stereo components. Wayne W. Hollister, Box 173, Sunset Dr., Toronto, Ohio 43964.

HALLICRAFTERS S-94. Looking for Hallicrafters CRX-2 or CRX-3. Frank Cirillo, High Point Trailer Pk., Frederica, Del.

KNIGHT Span Master and combination signal generator/signal tracer. Interested in Heath AR-2 SW receiver. Warren L. Meinhardt, 1708 Princeton Dr., Champaign, Ill. 61822.

LAFAYETTE KT-320 communications receiver. Will swap for Heath HR-10 or tape recorder. Steve Gray, 620 Lans Way, Ann Arbor, Mich.

KNIGHT C-100 transceiver and Knight photoelectric relay. Want Knight Span Master SW receiver. Cornelius Du Buse, 109 E. 57th St., Chicago, Ill. 60637.

WEBCOR portable tape recorder. Need SW receiver. George La Belle, 1374 46th Ave., San Francisco, Calif. 94122.

PHILCO 2-band receiver. Will trade for Novice transmitter. Greg DeHoogh, 1523 Dick Dr., Aberdeen, S.D. 57401.

GARRARD RC 121/4D turntable, Knight Star Roamer, CB transceivers. Will swap for FM receiver, CB equipment. Myles H. Marks, 824 Mellon St., Pittsburgh, Pa. 15206.

OLD TUBES—27, 80, CX-345, CX-380, 26s. Want 3-in. CRT (3JP1). Jim Hansen, 501 Kathleen, Des Plaines, Ill. 60016.

MILLEN 90651 GDO. Will swap for 30- 50-mc FM receiver or converter. Tommy Forrest, 101 N. Harding St., Greenville, N.C. 27834.

CB equipment, TV tubes, radios. Want audio sine square generator and Heath test equipment. J. Kozma, 12452 N.W. 5th Ave., N. Miami 68, Fla.

MICROSCOPE, 60-power. Will trade for foreign edition of amateur radio Callbook. Joe Zeldenrust, Box 469, 182nd St., Lansing, Ill. 60438.

LLOYD's battery-powered tape recorder. Make swap offer. Seymour Balsenbaum, 9424 Ave. A, Brooklyn, N.Y. 11236.

HEATH CB-1 CB transceiver. Will trade for Heath AJ-13 stereo-FM tuner. Scott Bidstrup, 650 9th St., Idaho Falls, Idaho 83401.

FLUKE 840A electronic galvanometer, Cenco metered power supply. Will swap for VTVM or VOM and disc or mica capacitors. Ismael Alvarey, 57 Randolph Pl. N.W., Washington, D.C. 30001.

SILVERTONE Spanish guitar. Need tape recorder or SWL gear. Dave Tatum, Drawer D, Grenada, Miss. 38901.

LAFAYETTE HE-10 transceiver with AC adaptor. Want Knight T-60 ham transmitter. Kip Vandenberg, 85 Salzburg Rd., Bay City, Mich.

El's All-Band Preselector. Will swap for ham or CB gear. Lane Robinson, Box 37, Bastrop, Tex.

TESLA COIL transformer. Will trade for anything of equal value. R. Boutwell, 638 Oakdale Dr., Montgomery, Ala. 36105.

ATWATER-KENT 55C console radio. Make swap offer. F. Romeo, 15335 Steel, Detroit, Mich. 48227.

PHILCO 18 and 42-1005 receivers. Make swap offer. Gary Kieffer, Rte. 1, Tecumseh, Okla. 74873.

SQUELCH for CB transceivers. Will trade for anything of equal value. Dr. C. Miller, 920 Frederica, Owensboro, Ky.

TRANSETTE transceiver and BC/SW receiver. Will exchange for CB transceiver and antenna. Randy Vitale, 8632 Riverside, Hollywood, Ill. 60513.

RAYTHEON 1055 radiotelephone, new tubes, other items. Will swap for oscilloscope, stereo tape re-

[Continued on page 114]

# BROADSIDES

Pamphlets, booklets, flyers, application notes and bulletins available free or at low cost.

Basic building blocks of many an electronic circuit include **potentiometers and resistors.** To simplify the job of selecting the right one for a given project, Clarostat makes available a 31-page catalog describing the company's entire line of carbon and wire-wound resistors in both fixed and variable form. Request your copy from Clarostat Mfg. Co., Inc., Washington St., Dover, N.H. 03820.

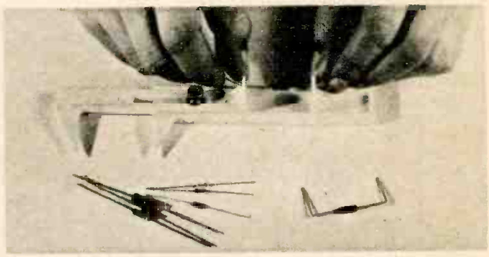
The opening of each new year sees publication of new **electronic catalogs** by parts houses across the nation. And electronic hobbyists now can obtain the 1966 editions simply by dropping a request to Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680; Walter Ashe Radio Co., 1125 Pine St., St. Louis, Mo. 63101; Burstein-Applebee Co., 1012-14 McGee St., Kansas City, Mo. 64100; Harrison Radio Corp., 225 Greenwich St., New York, N.Y. 10017; Harvey Radio Co., 103 W. 43rd St., New York, N.Y. 10036; Heath Co., Benton Harbor, Mich. 49022; Lafayette Radio Electronics, 111 Jericho Tpke., Syosset, N.Y. 11791; Newark Electronics Corp., 223 W. Madison St., Chicago, Ill. 60606; Radio Shack Corp., 730 Commonwealth Ave., Boston, Mass. 02117; World Radio Lab., 3415 W. Broadway, Council Bluffs, Iowa 51501.

A shack full of electronic components does a hobbyist little good if he can't solder one to another. And there are as many types of solder and methods of using it as a circuit has connections. **Solder** and how to use it is the topic of a bulletin titled Anchor Solder Facts, a handy pamphlet which includes detailed data on fluxes as well as an explanation of how to solder aluminum. Copies are free for the asking from Anchor Alloys, Inc., 968 Meeker Ave., Brooklyn, N.Y. 11222.

Lamps till now have been made almost exclusively in the form of screw-in glass bulbs. But if **electroluminescent lamps** catch on, the old vacuum-type light bulb soon may become a thing of the past. GE publication 3-4375-R describes flat lamps only 1/32 to 1/16 in. thick whose areas vary from the size of the O in BROADSIDES (above) to just a mite more than the area of an open copy of EI. The booklet can be obtained from General Electric Co., Dept. 3-4375-R, Nela Park, Cleveland, Ohio 44112.

# ELECTRONIC MARKETPLACE

**NEAT 'N' SPEEDY** . . . The number of strikes a ball player has at bat are about the same as those a hobbyist is allowed when he's trying to center components between holes



in a printed-circuit board. Reason, of course, is that component leads take only a certain amount of bending before they snap. The Davey lead former permits centering to be done neatly, accurately and in less time than it takes to tell. Scheme is, the lockable caliper-like device duplicates hole distances on a built-in jig which holds components as they are being bent into proper shape. $6.95. Davey Products, Box 567, Fairfield, Conn. 06430.

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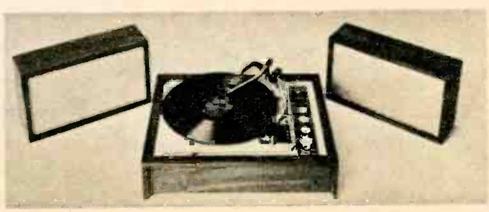
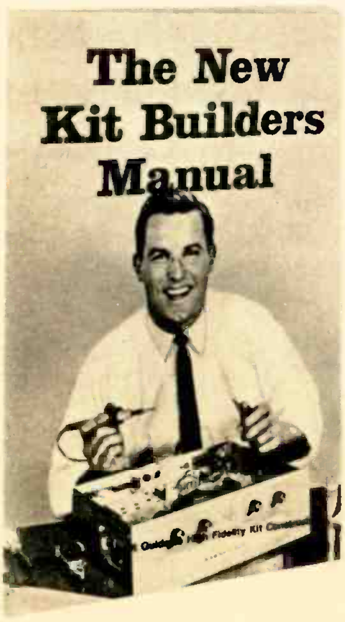
**Melodic** . . . Oiled-walnut cabinetry and a solid-state amplifier team up in the HE-912 stereo phono system for a harmonious blend of form and function. The unit's two KLH speakers can



be placed anywhere a body desires, and its four-speed Garrard changer with diamond stylus and magnetic cartridge promise listeners realistic reproduction at levels of up to 40 watts. Thanks to the full complement of controls provided, stereo buffs have ample opportunity to adjust sound to individual liking. $209.95. Singer Co., 30 Rockefeller Plaza, New York, N.Y. 10020.

# What most people don't know about hi-fi kits could fill a book.

# This one. (And it's free!)




**FREE! $1.50 VALUE! 32 PAGES!** *The New Kit Builder's Manual* is a completely new version of the authoritative Fisher guide to high-fidelity kit construction. It is new in format, twice as long in content, and contains detailed specifications of all Fisher StrataKits. Here is an introduction to kit building presented in a manner so nontechnical and lucid, even your wife will understand it. Included are comprehensive, illustrated articles on every phase of assembly, wiring and soldering. *The New Kit Builder's Manual* is the handiest tool a do-it-yourself audiophile can have: the first thing you need before investing in stereo amplifier, tuner or loudspeaker kits.

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

## The Fisher

# MARKETPLACE

**Communicative** . . . The Comstat 9 offers the hobbyist who enjoys taking soldering gun in hand and saving a bit of the green stuff a smart way to get into CB or to put a second rig on the air. This breadbox-size, 5-watt rig sports nine crystal-controlled channels plus tunable 23-

channel reception and variable squelch. Power can be supplied from 117-VAC or optional 12-VDC sources. In addition, a switch puts the transceiver into a 100-mw mode for the hobbyist who goes in for rag-chewing on the license-free channels. Kit, $59.95. Lafayette Radio Electronics Corp., 111 Jericho Tpke., Syosset, N.Y. 11791.

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**Personal** . . . Many's the audiophile who likes his music served with a heaping portion of decibels. Trouble is, family, relatives and neighbors are anything but fond of indulging 3-a.m. urges to crank up the gain on Bach or the Beatles. The SA-1 Solo-Phone, a stereo amplifier for private listening, puts an end to these


disturbances while permitting hi-fi buffs all the musical mayhem they yearn for. Tuners, tape decks and phonographs plug into the Solo-Phone, whose output goes to a pair of stereo headphones that only the listener hears. $45. Shure Bros., 222 Hartrey Ave., Evanston, Ill. 60202.

THIS IS A MAGNIFICENTLY-DETAILED 1/24th SCALE MODEL

# 1896 ENGLISH LIVE-STEAM TRACTOR

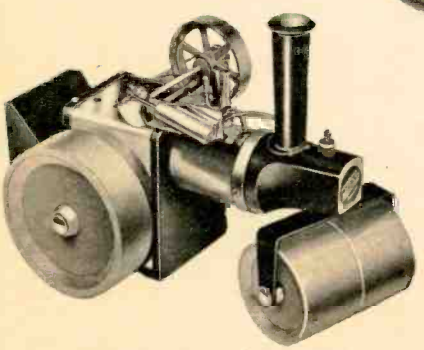
**COMPLETE TO BRASS BOILER, STEEL FIRE BOX, COPPER STEAM PIPES**

**A LIFETIME OF USE**

These are more than just toys — like the originals they copy, they should still be "in use" 50 years from now. Each is $35. For those readers who would like both, they are specially priced at $65.


## Raises steam in 3 minutes, travels 1/3 mile in a 10-minute run, can be used to operate other stationary models

The English traditionally make fine models. This one, beautiful in gleaming brass and copper, has flywheel and other parts in green and red enamel. Everything works as original did in 1896. Brass steam whistle blows, cylinders and pistons are brass, steam pipes are copper, and fire box, scuttle, burner box, front forks, axles and shafts are of steel. You still see the old ones in the English countryside winching timber, hauling hay, and in stationary operations such as driving saws, threshing machines and the like. They were so versatile that specially adapted, they were even used as plowing engines in pairs, one either side of the field, winching the plow to and fro between them; in shipyards, they were fitted with cranes and were in fact the earliest type of mobile crane. It was a brute, and this is some toy! It develops a strong 1/15 hp at 3000 rpm, will haul a good size log, can be used to operate other stationary models. 1 ft. long. Uses alcohol. $35 and worth it!



This is the workhorse companion to the traction engine. In construction and operation it is the same. The polished rollers and rear wheels are aluminum pressure diecastings. Axle caps are spring steel. It also develops 1/15 hp at 3000 rpms, and will also operate other stationary models. It is the forerunner of the present day diesel rollers, and is a real beauty. Made in England, $35.

**MAIL THIS MONEY-BACK GUARANTEE COUPON TODAY!**

**HAMILTON HOUSE,** Dept. 238-L, Cos Cob, Conn. 06807

Enclosed check or m.o. for $______

_____English Live-Steam Tractor @ $35

_____Companion English Live-Steam Roller @ $35

_____Both for special price of $65

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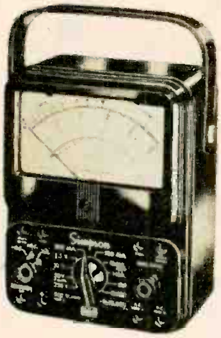
ADDRESS____________________

CITY__________ STATE__________ ZIP__________

# MARKETPLACE



**Transistor-minded** . . . Because of the nature of transistor circuits, a VTVM ordinarily is indicated at testing time. But a VOM is the obvious choice when there's no AC outlet to be found. The 250 VOM fills the bill with better-than-average accuracy. Adequate for most electronics work, current ranges on the unit cause no more than a mere 50-millivolt drop. The 20,000 ohms/volt 250 measures AC and DC voltages to 1,000 V, current to 10 amps and resistance to 20 megohms. Rugged components and a sturdy handle that doubles as an adjustable stand make the 250 well suited for field use. $56.95. Simpson Electric Co., 5200 W. Kinzie St., Chicago, Ill. 60644.

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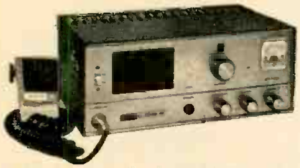
**Upright** . . . Though this piece of furniture well might serve as a pedestal for a work of modern sculpture, the Criterion XL-360's real purpose is to please the ears. Housing five hi-fi speakers, the unit disperses its sound in a circular pattern, thus eliminating need for special seating or speaker placement. The upper portion of the Criterion's cabinet contains four outward-facing, dual-cone, 6x3-in. speakers to handle mid- and high frequencies. The lower portion is fitted with a high-compliance 8-in. woofer to cover the bottom part of the spectrum (a sound diffuser located beneath the woofer causes the unit to radiate its output in a circular pattern through ports in the base of the cabinet). Manufacturer claims a frequency response of 32 to 20,000 cps and a power-handling capacity of 20 watts; nominal input impedance is 8 ohms. Standing 32-in. high and measuring 11½-in. on a side, the walnut-finished Criterion makes an attractive as well as functional addition to most listening rooms. $69.95. Lafayette Radio Electronics Corp., 111 Jericho Tpke., Syosset, N.Y. 11074.

# Be super-critical.

Whether you're looking for the fun and economy of building quality kits or you want ready-to-use factory-wired equipment — before you buy, examine carefully. Compare EICO with anybody else — feature for feature, chassis for chassis, part for part. The more critical you are, the more you'll see for yourself that your best buy is EICO.

**EICO**

Over 3,000,000 EICO instruments now in use! Preferred by engineers, scientists, technicians and students. EICO equipment is available nation-wide through 2500 EICO dealers.

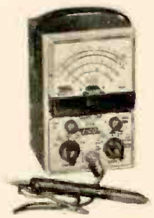


**New Model 779** — Sentinel 23 CB Transceiver. 23-channel frequency synthesizer provides crystal-controlled transmit and receive on all 23 channels. No additional crystals to buy ever! Features include dual conversion, illuminated S/RF meter, adjustable squelch and noise limiter, TVI filter, 117VAC and 12VDC transistorized dual power supply. Also serves as 3.5 watt P.A. system. **$169.95 wired.**

**New Model 712** — Sentinel 12 Dual Conversion 5-watt CB Transceiver. Permits 12-channel crystal-controlled transmit and receive, plus 23-channel tunable receive. Incorporates adjustable squelch & noise limiter, & switches for 3.5 watt P.A. use, spotting, & Part 15 operation. Transistorized 12VDC & 117VAC dual power supply. **$99.95 wired only.**

**New Model 753** — The one and only SSB/AM/CW Tri-Band Transceiver Kit. 200 watts PEP on 80, 40 and 20 meters. Receiver offset tuning, built-in VOX, high level dynamic ALC. Unequalled performance, features and appearance. Sensationally priced at **$179.95 kit, $299.95 wired.**

**New Model 440 Scope.** Lowest-priced quality oscilloscope available. Excellent for electronics teaching and home workshop. Flat 2c-500kc. 3" flat-face new CRT. Compact, light, rugged. **$49.95 kit, $69.95 wired.**



**Model 232** Peak-to-Peak VTVM. A must for color or B & W TV and industrial use. 7 non-skip ranges on all 4 functions. With Uni-Probe.® **$29.95 kit, $49.95 wired.**

**Model 324** RF Signal Generator. 150kc to 435mc range. For IF-RF alignment and signal tracing of TV, FM, AM, CB and mobile. Built-in and ext. modulation. **$28.95 kit, $39.95 wired.**

**Model 667** Tube/Transistor Tester. Dynamic conductance tube tester. 14 combinations of 3 plate and 3 screen voltages and 3 ranges of grid voltage. Interelement leakage readings in ohms. Checks all new tube types. Two step transistor test. **$79.95 kit, $129.95 wired.**

**Model 628** Emission Tube Tester. Checks all new tube types. **$44.95 kit, $59.95 wired.**

**Model 460** 5" Oscilloscope. DC wideband 0-4.5mc for color and B & W TV service and lab use. Push-pull DC vertical amp., bal. or unbal. input. Automatic sync limiter and amp. **$89.95 kit, $129.50 wired.**

**Model 1064** DC Power Supply. For bench testing auto radios, CB, mobile and tone equipment. Voltmeter and ammeter. Low ripple for transistor equipment. 0-8V/0-16V outputs. **$45.95 kit, $54.95 wired.**

**New Model 3566** — All Solid-State Automatic FM MPX Stereo Tuner/Amplifier. No tubes, not even nuvistors. Delivers 112 watts IHF total to 4 ohms, 75 watts to 8 ohms. Completely pre-wired and pre-aligned RF, IF and MPX circuitry, plus plug-in transistor sockets. **$219.95 kit, $325.00 wired with cabinet.**

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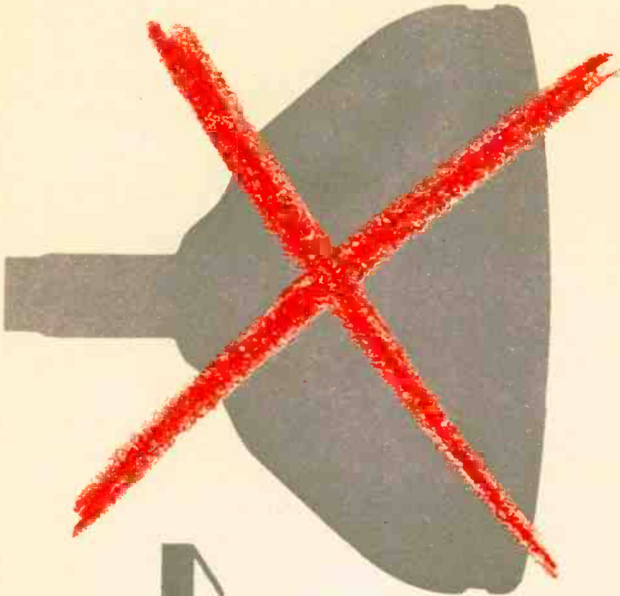
**1945-1965: TWENTY YEARS OF LEADERSHIP IN CREATIVE ELECTRONICS**

ELECTRONICS ILLUSTRATED
JANUARY 1966



# AND NOW... FLAT TV!!!

THIN as a pancake doormat, light as a man-size martini, shows pics in living color. Suburbia's picture window? No, a new-type TV set—the kind you hang like a painting. And this new set wasn't viewed on a crystal ball, either. True, it doesn't exist as yet. But its ultimate availability can be drawn from a web of factors which point to one nail-hard conclusion: the first truly thin TV now is on the brink of practicality.

Among electronics' biggest breakthroughs, flat TV represents a 30-year pursuit by major electronics labs round the world. Early sets, you may remember, were straight from Squaresville: cabinets about as deep as they were wide. Then came slim-TV. Or was it? Cabinet makers created the illusion of a slender piece of furniture . . . until you tried to push it flush against the wall. A rear-poking picture tube emerged to kill that idea cold as a left-over potato.

So engineers attacked the picture-tube neck and managed to lop off inches. To shorten the tube, they came up with bigger deflection angles, causing the electron beam to sweep a wider swath over the screen. TV-set salesmen began to boast about the flat-back set—sounding for all the world like auto dealers touting transmissions on rear-engine cars. Sure there was a small hump, but hardly worth fussing about.

In time, the TV set, along with Murphy beds and mother's oven, headed straight for the wall. And transistors promised to get into the shrinking act. The tiny chips off the semiconductor block surely could end the space waste inside the ponderous TV cabinet. But to set manufacturers, the transistor proved about as popular and useful as anti-missile searchlights in a drive-in movie.

And there were good reasons. Biggest one was, and still is, the picture tube. Unless a cabinet is made like stretch pants, there's ample room inside for standard components. Miniaturization was left to tote-about TV portables. Anyway, building conventional TV sets is a rough economic proposition, so why rock the boat with a lot of costly redesigning?

**But the** dream of flat TV persisted. It not only could bring picture-frame convenience to the home, but enhance other TV applications as well. Pinned to the back of an airline seat, it would eliminate bulky monitors for inflight movies. Blown up big size, it could revolutionize the physical design of theaters.

# FLAT TV!!! • • •

And skinny TVs easily could slip into a picnic bag, taking up little more room than a copy of Monster magazine. In military and space applications, they could streamline visual monitoring in most any quarters, no matter how cramped.

Truth of the matter is, flat TV has so many things in its favor that the old-fashioned, big-bottle variety soon should die the day the flat kind makes its entry. Last consumer holdouts for the slowly vanishing vacuum tube, pic tubes at long last would join the move to solid state. Thing is, at least one impressive authority has uttered the terse and long-awaited verdict: "It—flat TV, that is—is feasible." Translate the cautious words of the physicist into everyday terms, and his guarded statement means the inevitable: flat TV is here!

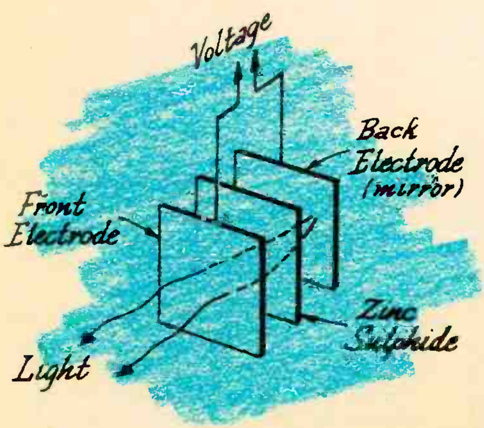



Fig. 1. Basic el sandwich or module consists of two metal electrodes separated by zinc sulphide.

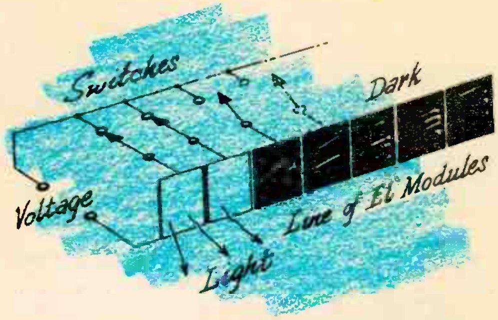



Fig. 2. Simple one-dimensional scanner employs switches to control output from individual modules.

It even looks as though the big names—Westinghouse, Sylvania, RCA—will be caught uncoated. Reason: these giants have been eyeing an evanescent will-o-the-wisp with the wrong bi on their focals. The would-be breakthrough baby is cold light, a little-understood phenomenon that's being applied in experimental room lighting, computer information panels and nite-lites now sold in hardware stores.

But the jackpot for cold light, known in the trade as *el* (for electroluminescence), is the skinny TV tube. (Imagine sliding a whole TV set into a picnic bag, or slinging it from the bedpost, maybe mounting it on the back of every bus, train and airline seat.) Thing is, the industrial bigwigs haven't produced any *el* TV worth mentioning to date. One small Florida outfit has.

The company is Electro-Tec. Not surprisingly, its search for a flat TV screen soon took it north to one of the world's most formidable collections of scientific brainpower: the Massachusetts Institute of Technology. In a university/industry partnership (with Electro-Tec footing the bills), some three years were spent rooting out the problems which confronted everyone in the field. And while you can't make out that image yet, signs of success already glimmer most grandly—so much so that the giant Monsanto chemical company speedily snapped up exclusive license for Electro-Tec's two-axis applications (flat TV to you and me).

**That they're** on to something big is suggested by the secrecy which shrouds the project. Just ask how it functions and you'll get a wan smile coupled to a frigid shrug.

Yet it's possible to piece together a reasonable picture of how flat TV's going to work. Here goes.

Shown in Fig. 1 is a basic *el* module in an exploded view. Nothing more than a thin sandwich, the *el* module claims metal electrodes for its bread, zinc sulphide for its filling. But run voltage on the electrodes and the zinc sulphide begins to glow. Why? No one knows. Theories abound, of course, though physicists still can't agree on whether *el* stems from collision ionization, atom-ion pairs or some such molecular tralala.

In any case, the electric field somehow wondrously excites the *el* substance into shedding photons, or light. And wonderous it is, though even this seems all too tame a descriptive. A regular TV tube gobbles thousands of times its picture in depth just to produce light with an electron beam. The *el* module, in contrast, makes for a twist the other way round with films only thousandths of an inch thick!

One refinement of the module to improve efficiency also is shown in Fig. 1. Since the screen is viewed from only one side, the rear or back electrode is given a mirror-like surface to reflect otherwise lost light back to the viewer. (It's the equivalent of today's aluminized picture tube.) The front electrode is thin enough to permit light to pass through.

So far we've created a flat light source. Constructed small enough, it can serve as one tiny brightness element in a TV image. Its light will vary with electrode voltage and frequency. Now to arrange modules in a row so they can serve as one line of a TV picture (which requires a total of 525 lines).

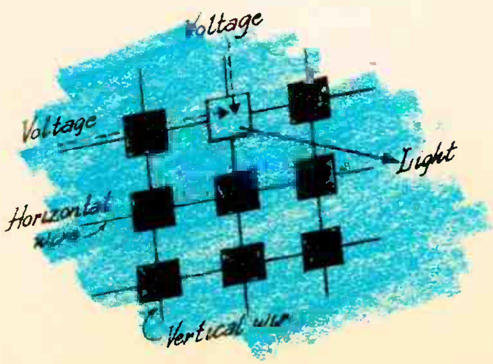



Fig. 3. Two-dimensional scanning can be achieved by stacking el modules, adding suitable voltages.

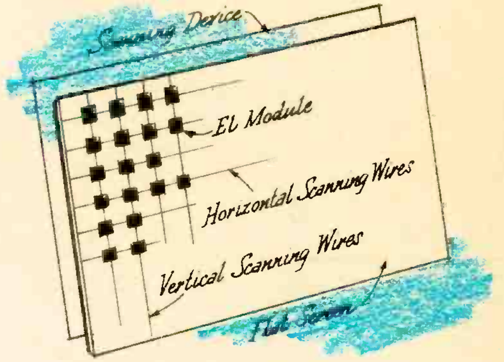



Fig. 4. Top-secret scanning device coupled to modules completes all-solid-state flat-TV screen.

Fig. 2 shows a row of *el* modules connected together. Note that switches are being used to control voltage applied to individual modules. This way it's possible to make light appear to move across the line, like neon arrows beckoning you into a roadside diner. In other words, we now have a form of scanning—the second important function of our flat pic tube (after brightness). Since movement only can occur from side to side, this arrangement is termed a one-dimensional scanner. (A system similar to this is being proposed for the speedometer dial in new cars. The line of *el* modules would be marked in mph.)

But to create a TV picture—which is two-dimensional—it's necessary to build up the *el* modules into a screen, as illustrated in Fig. 3. Note that modules can be viewed along horizontal or vertical lines. And much like operating crosshairs on a rifle, it's possible to zero in on any single module.

**Let's say** we want to illuminate the top middle element. Apply voltages to just two wires—one horizontal, one vertical—and the desired point will be illuminated. Other modules receive voltage, too, though not enough to generate any brightness. Only where voltages intersect and add will electrical force be sufficient to create light. In this system, known as a matrix, it's possible to select among thousands of modules with relatively few electrode wires.

There remains a key function: the scanning device which applies the voltages in correct sequence. Its exact operation, however, is the most carefully guarded secret of all (at this writing it is in the process of being legalesed into patent specifications).

Even so, some angles seem clear. If the scanner is to conform to FCC specs for TV broadcasting, it must cause a spot of light to move from left to right and downward over the 525-line image. And the action must be repeated 60 times per second. Moreover, the spot of light must be modulated; it must grow dark and bright according to light values in the original televised scene. This being the case, the scanner, with *el* modules greatly enlarged, well might look something like the sketch in Fig. 4.

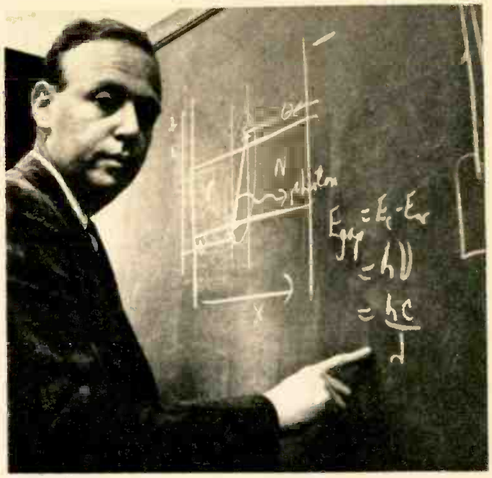
I went to MIT to speak with the man who recently declared that the *el* approach to flat TV now is feasible. He's Dr. Fred Chernow, an authority on *el* materials. His other resources include a squad of cerebral graduate students, and, of course, MIT facilities.

# FLAT TV!!! . . .

"When will it work?", I asked Chernow, hoping to pry some stray bit of intelligence. He couldn't be tempted in an unprofessorial guessing game, but he did offer a glimpse at his approach to *el* and flat TV. And after weaving through the catacombs that connect three MIT labs, he held up the black box used to demonstrate his scanning device. Heart of the scanning system proved so Lilliputian it could fit into a peanut shell with room to spare.

**It goes** without saying that Chernow's scanning system strictly is Top Secret. Since patents yet have to be issued to cover all of flat-TV's breakthroughs, only limited information can be released at this time. Even so, some data of a general nature can be revealed. As shown in our illustration, the scanner likely is a matrix of wires in the screen. Its voltages are fairly low—nowhere near as high as the 20,000 or so volts used in the old-fashioned pic tube. Also, the secret device which funnels signals to the correct points in the matrix is said to be (like many good systems) ridiculously simple.

Fact is, the little box Chernow used to prove the scanning system's effectiveness is as challenging as Pandora's. Just what's inside won't be revealed until patents are completed. But what it does and what it is can be stated in general terms: it accomplishes the job of hundreds of fast-acting switches and it does so in less space than that occupied by a thimble.



**Number-one man in flat-TV research, Dr. Fred Chernow thinks flat-TV purely a matter of time.**

Chernow further explained that since a scanning system now is practical, there remains only the task of improving *el* substances. Here's a box score on where he stands:

● Intensity. Brightness is a crucial factor for creating vivid TV images. But using thin-film techniques, *el* brightness has been improved by from ten to 100 times.

● Life. Early *el* materials lasted only five or six hours. Now the figure has been upped to 500 hours and higher. The life problem, he said, is tied in with processing raw materials. They've got to be extremely pure or else they form undesirable compounds which steal light output. The goal: life in excess of 20,000 hours.

● Response Time. The *el* screen must react fast enough to reproduce a good TV image. Video signals reach frequencies in the 3- to 4-mc range. Here there's room for much improvement. Right now, *el* response time still is down at a few hundred kilocycles. But once the materials are more clearly understood—and they are being assaulted daily—progress is assured.

● Color. No problem here. Just use three *el* modules in place of the one required for black and white. Cause them to glow red, blue and green and there's the basis for color reproduction.

[*Continued on page* 116]

# FAIL-SAFE slave flash

By JIM KYLE, K5JKX

ANY good photographer will tell you that a slave flash is indispensable for getting the pro's touch into pictures. And just as quickly he'll add that using a slave is like playing Russian roulette with your fingers.

Modern slaves are fired by a built-in photocell which trips when its sees the camera-mounted flash go off (cord-connected slaves have become old-fashioned). Trouble with most slaves is false response. If the level of illumination changes or you carry the average wireless slave from indoors to outdoors, it goes off. Should you happen at the time to be putting a bulb in the socket, you come away with broiled fingers—hence, Russian roulette.

But our Fail-Safe Slave Flash operates with no danger to the photo bug when taken from the darkest cave to bright sunlight without the need to adjust a sensitivity control (which it doesn't have). The Fail-Safe slave is designed so it will be triggered only by a *sudden* increase in light without regard to whether the light level initially is dim or bright. There is no such thing as a threshold light level above which it will fire. Almost nothing except the flash from a flash bulb—or perhaps an atomic bomb—will cause the Fail-Safe slave to respond.

When ordinary flash bulbs are used both at the camera and in the Fail-Safe slave, the shutter speed should not be faster than 1/50 second. The reason for this is that the Fail-Safe cannot fire until the camera bulb emits light. When the Fail-Safe slave is located close to the camera light, the initial flare from the primer in the camera bulb will trigger the slave, permitting synchronization to 1/100 second. However, it's best not to count on this happening.

During our tests we found the Fail-Safe slave also could give us an offbeat type of lighting at a shutter speed of 1/250 second. With the camera set for class M synchronization, we found that the bulb at the camera triggered the slave but its own light output fell outside of the shutter's open time. The result was some unusual photographs with the subject being illuminated from the side only (by the slave).

**How it Works.** The Fail-Safe slave consists of a standard B-C circuit (B1,C2) to which a silicon controlled rectifier (SCR1) has been added to fire the bulb. A photocell and a one-transistor amplifier are used to trigger the SCR.

Operation without a sensitivity control is possible because the photocell is AC-coupled to Q1's base. Steady light on the photocell produces a DC output that can't get through

C1 to Q1. However, a burst of light from the flashbulb at the camera produces a sharp pulse of current. The pulse goes through C1 and turns on Q1.

When Q1 is turned on, current flows from its emitter through the gate of SCR1, causing SCR1 to conduct. When this happens, C2 discharges through SCR1 and the flash bulb, causing the flash bulb to fire.

An on-off switch is not necessary. Until a flash bulb is inserted in the socket, the only drain from the battery is Q1's leakage current, which is a few microamperes. When a bulb is inserted, C2 charges slowly through R3. One and a half seconds later, C2 is charged fully and ready to fire.

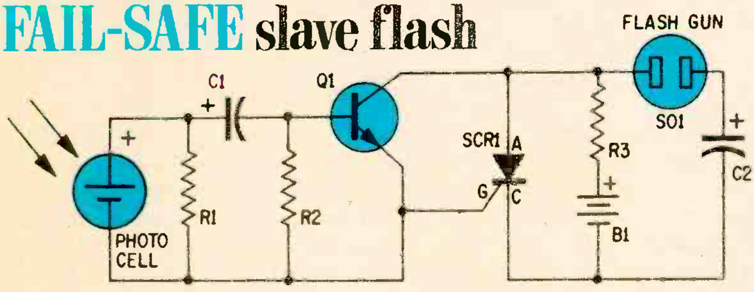
**Let's Build It.** Substitutions should not be made for any parts. Our model is built on a 3 x 2-in. piece of perforated phenolic board. First mount the battery holder, C2 and SCR1, then install the resistors and Q1 by fitting their leads through the holes. Next, connect these components, following the schematic and pictorial.

Drill four 1/8-in.-dia. holes in one of the cabinet's cover plates. Insert 4-40 by 3/4-in.-long machine screws through the holes and

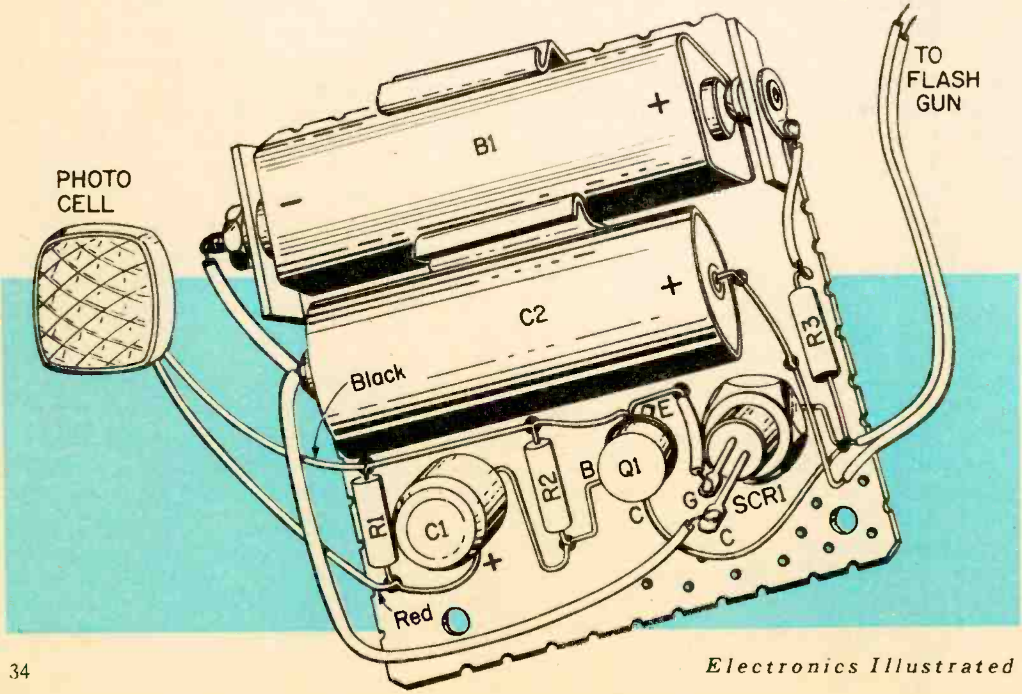
**PARTS LIST**

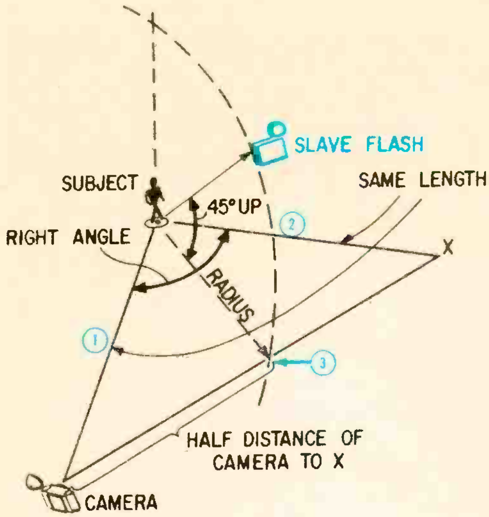
- B1—22½ V battery (Eveready 412 or equiv.)
- C1—100 µf, 6 V electrolytic capacitor
- C2—100 µf, 25 V electrolytic capacitor
- Photocell — Silicon photocell (International Rectifier S4M. Newark Electronics Corp. Stock No. 22F8005; $3.95 plus postage).
- Q1—2N1302 transistor
- R1,R2—27,000 ohm, ½ watt 10% resistor
- R3—15,000 ohm, ½ watt, 10% resistor
- SO1—Socket to match flashgun plug
- SCR1—Silicon controlled rectifier; Sarkes Tarzian 3TCRA (Allied, $2.80 plus postage. Specify manufacturer's number when ordering).
- Misc.—Perforated phenolic board, 4x4x2-in. chassis box (Bud C1793).

## FAIL-SAFE slave flash

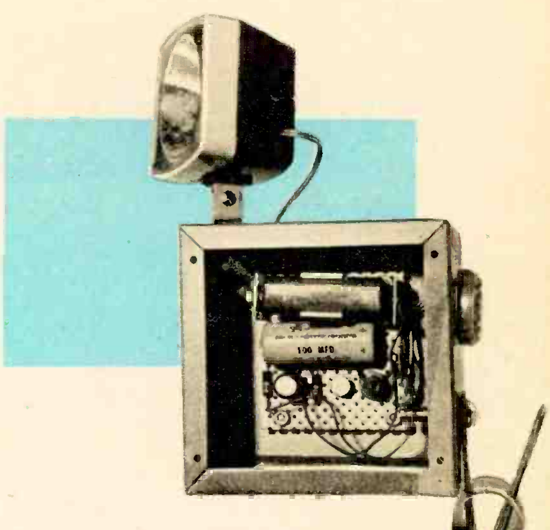



When bulb is put in socket, C2 is charged slowly by B1 through R3 and bulb. Bright flash of light on photocell produces a pulse output which goes through C1, causing Q1 and SCR1 to conduct. C2 then discharges through SCR1 and bulb, firing it. Parts layout on board is shown below.






Triangle lighting: draw line 1 from subject to camera, line 2 from subject to X. Place slave at point 3 and raise so it's 45° above subject.



Circuit board is mounted on one of cabinet's side plates with machine screws. Paper clamp must be large to support weight.

tighten nuts on them firmly. Then place another nut on each screw and thread it on, leaving about ¼ in. of threads exposed. Fit the board on the screws and put four more nuts on the screws to hold the board tight.

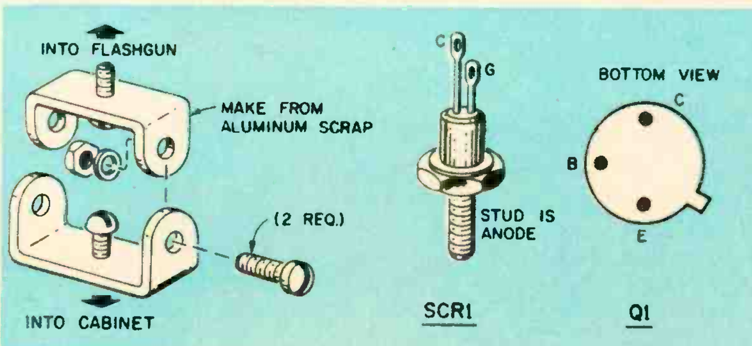
If SCR1's mounting stud shorts to the metal case, remove it and place both the solid washer and the lock washer supplied with it on the top of the board to act as spacers.

Disassemble your flash gun and solder a length of miniature two-conductor zip cord to the bulb socket. Drill a hole in the top of the cabinet for a swivel bracket and connect the cable from the flashgun to the circuit, or plug it into a socket (SO1) connected in the circuit. Glue the photocell on the side of the cabinet and fit its leads through a ¼-in.-dia. grommeted hole. Take care that the positive (red) lead from the photocell connects to the junction of R1 and C1. If you reverse the leads, the Fail-Safe will not fire at the proper time.

To use the Fail-Safe slave you simply clamp it in position, aim it, plug in a bulb, then shoot the picture. However, a few tips on placement may be of some help.

In general, the Fail-Safe slave should be about 45° off the camera-to-subject line and 45° above this line as shown in the diagram. For snapshots of people, you'll get the best results if the slave is on the side of the subject.

When computing flash exposure on a bulb-to-subject-distance basis, use the distance from Fail-Safe to subject rather than from camera to subject. For black-and-white, the difference in exposure will be small. With color film, some experimentation will be necessary.




Make a bracket out of scrap aluminum, as shown at left, to support flash gun and to permit it to be aimed in any direction. Lugs and leads of transistor Q1 and silicon controlled rectifier SCR1 are in diagram at the right.

# Notes from EI's DX CLUB

SHARP-shooting Hank Holbrook (Maryland) is back in the news with a QSL from NALJ. Station, interestingly enough, is aboard the aircraft carrier Wasp, famous for plucking astronauts from the watery deep. Hank heard the vessel on 2716 kc while it was transmitting from Kingston, Jamaica.

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K. G. Scrimgeour (California) is hearing Papua up on 31 meters in the person of VLT9 (operated by the Australian Broadcasting Commission). Station is Port Moresby on 9520 kc; transmissions begin at 2200 PST.

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The New Zealand DX League reports the British Broadcasting Corp. has a new relay station in Liberia on 9555 kc, though no North American SWL yet has reported hearing it. Same source also claims the BBC relay at Ascension Island will be on the air this year with four 250-kw transmitters. If so, tests may begin most any time.

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Possibly the last DXer to get a QSL out of Cable & Wireless, Jamaica, was James Rogers of Massachusetts (see THE LISTENER elsewhere in this issue for reasons behind this development). Jim heard them on 11595, where the call is 6YR52.

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The Canadian DX Club has a new chief editor—ace utility DXer Dave Bennett—and a new address: 926 Diamond Rd., Richmond, B.C.

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R. Ghana has put several new transmitters on the air, apparently regional stations broadcasting primarily in native languages. Locations still are unknown, though William Sparks (California) reports hearing two on 4980 and 4825 kc with sign-on at 2130 PST.

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Windward Islands Broadcasting Service is heard well on 15105 kc, 5 kc up from the old channel to avoid QRM from R. Cairo. New frequency is used from 1500 to 2000 EST.

Watch for rarely-heard R. Athens under R. Canada on 11720 kc around 1800 EST. This proves a considerably better catch than Greece's VOA stations.

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Bob LaRose (New York) notes that Abidjan, Ivory Coast, has moved its 25-meter transmitter down 10 kc and now is on 11810 with English news at 1330 EST. Heavy QRM yet may force another shift in the not-so-distant future.

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New York's Gerry Klink reports bagging the Zambia Broadcasting Corp.'s African Service on 3346 kc at 2258 EST sign-on. Interval signal, apparently for this service only, supposedly is the cry of the fish eagle, though it sounds more like that from a flock of sea gulls.

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Two changes of note: R. Commercial de Angola has moved up to 4795 kc and R. Mogadiscio (Somalia) on 7160 kc now signs on at 2200 EST.

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R. Nacional de Espana has English to North America at 2000, 2100 and 2200 EST. Station's 31-meter outlet now is 9600 kc, though heavy line noise remains. Another station with the same problem (possibly due to a faulty studio/transmitter link) is R. Iran, which continues to hop up and down 25 meters. Last heard on 11730 kc, station has English at 1500 EST.

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*Propagation:* Winter conditions continue with the 21-mc band the upper limit for daylight DX. Openings in the amateur 10-meter band and the Citizens Band will remain sporadic during daylight hours, though there should be more 10-meter openings into Latin America than at any time since late in '62.

At night, best bands will be 6 and 7 mc. Even so, South American openings should be frequent in the 9- and 11-mc bands.

# Experiments in Thermoelectricity

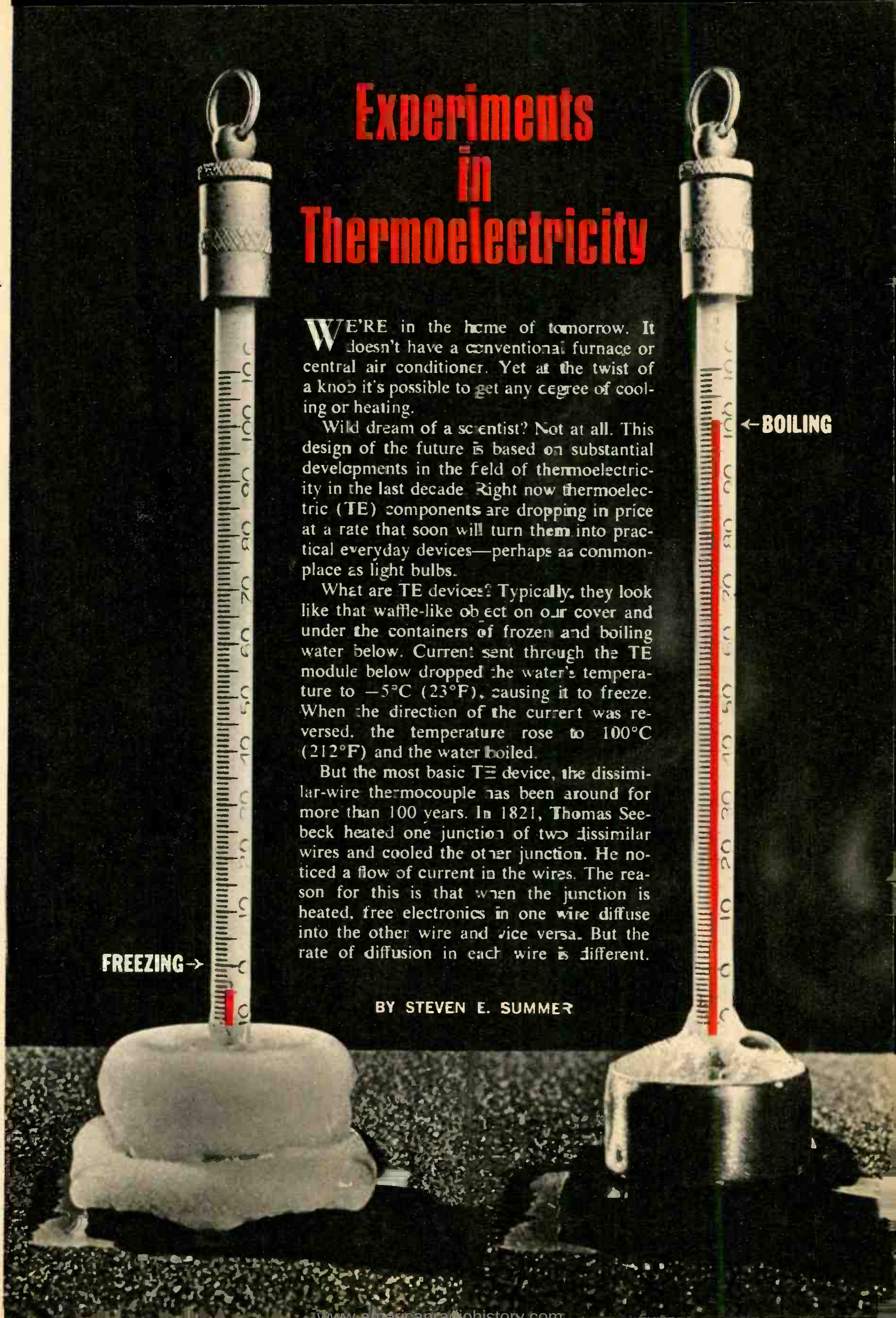
WE'RE in the home of tomorrow. It doesn't have a conventional furnace or central air conditioner. Yet at the twist of a knob it's possible to get any degree of cooling or heating.

Wild dream of a scientist? Not at all. This design of the future is based on substantial developments in the field of thermoelectricity in the last decade. Right now thermoelectric (TE) components are dropping in price at a rate that soon will turn them into practical everyday devices—perhaps as commonplace as light bulbs.

What are TE devices? Typically, they look like that waffle-like object on our cover and under the containers of frozen and boiling water below. Current sent through the TE module below dropped the water's temperature to −5°C (23°F), causing it to freeze. When the direction of the current was reversed, the temperature rose to 100°C (212°F) and the water boiled.

But the most basic TE device, the dissimilar-wire thermocouple has been around for more than 100 years. In 1821, Thomas Seebeck heated one junction of two dissimilar wires and cooled the other junction. He noticed a flow of current in the wires. The reason for this is that when the junction is heated, free electronics in one wire diffuse into the other wire and vice versa. But the rate of diffusion in each wire is different.

BY STEVEN E. SUMMER



# Experiments in Thermoelectricity

That is, more electrons go from one wire to the other. This makes one wire negative and leaves the other positive. The result is a flow of current (see Fig. 2).

Years later, Jean Peltier did the reverse. When he sent a current through two junctions of dissimilar wires, one junction got hot and the other junction got cold. The reason for this is that when a current flows through the wires, the electrons going from one wire to the other at one junction gain energy and cause the junction to heat up. Energy in the form of heat is drawn from the surrounding air at the other junction, causing the junction to get cold.

To observe the conversion of heat energy to electrical energy, you can make a simple thermocouple with copper and steel wire. Take 18-in. lengths of copper and steel wire and clean the ends with steel wool.

Tightly twist one end of each of the wires and squeeze the junction in a vise. Mount the wire on a wooden holder (see Fig. 1) with staples and connect the wires to a 20,000-ohms/volt VOM set to the lowest current range. Now hold the junction in the flame of a butane torch and heat it red hot. The output won't pin the needle but you'll get an indication of current flow.

This thermocouple will last only for a half hour or so because the wires become oxidized. A copper- and chromel-wire thermocouple will produce higher voltage. You can boost the output voltage or current by connecting several thermocouples in series or

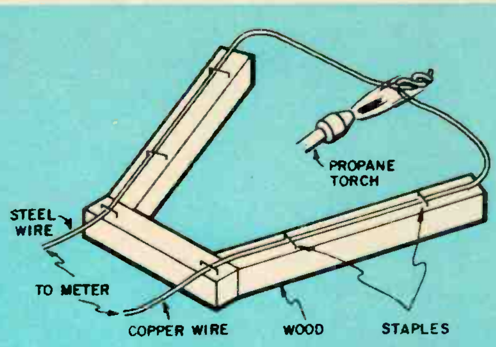



Fig. 1—To demonstrate the Seebeck effect, twist the ends of steel and copper wire and heat red hot. Output current could be up to about 25 ma.

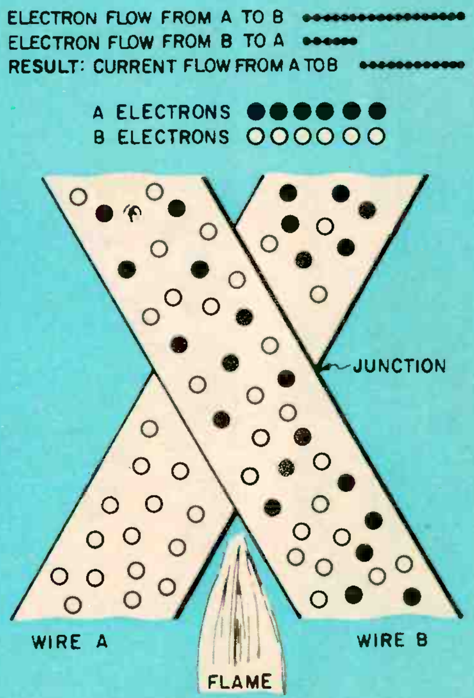



Fig. 2—Heating of wires causes diffusion of free electrons. As more go from A to B than from B to A, there's constant electron flow from A to B.

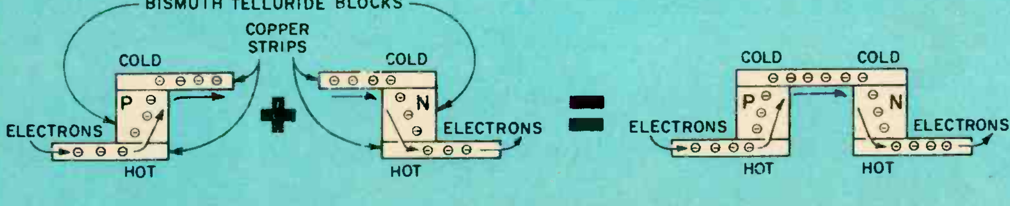



Fig. 3—Frigistor is made of couples which consist of P- and N-type bismuth-telluride semiconductor blocks connected in series with copper strips. Electrons crossing PN junction through strips absorb heat energy from air, and side gets cold. When going through NP junction, electrons give up heat energy.

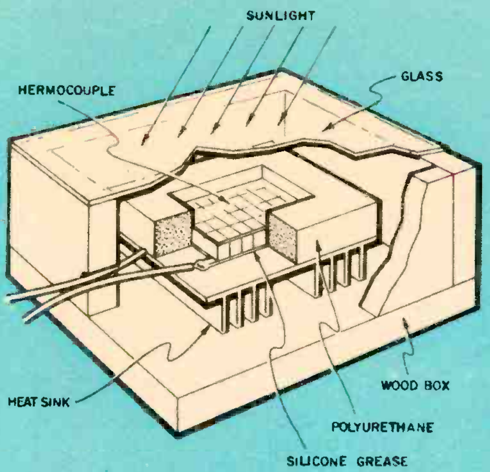



Fig. 4—To demonstrate ability of Frigistor to convert sunlight into electrical energy, mount module on heat sink and enclose in glass-covered box. Put silicone grease on top of heat sink and cover exposed area of heat sink with a piece of polyurethane insulating material.

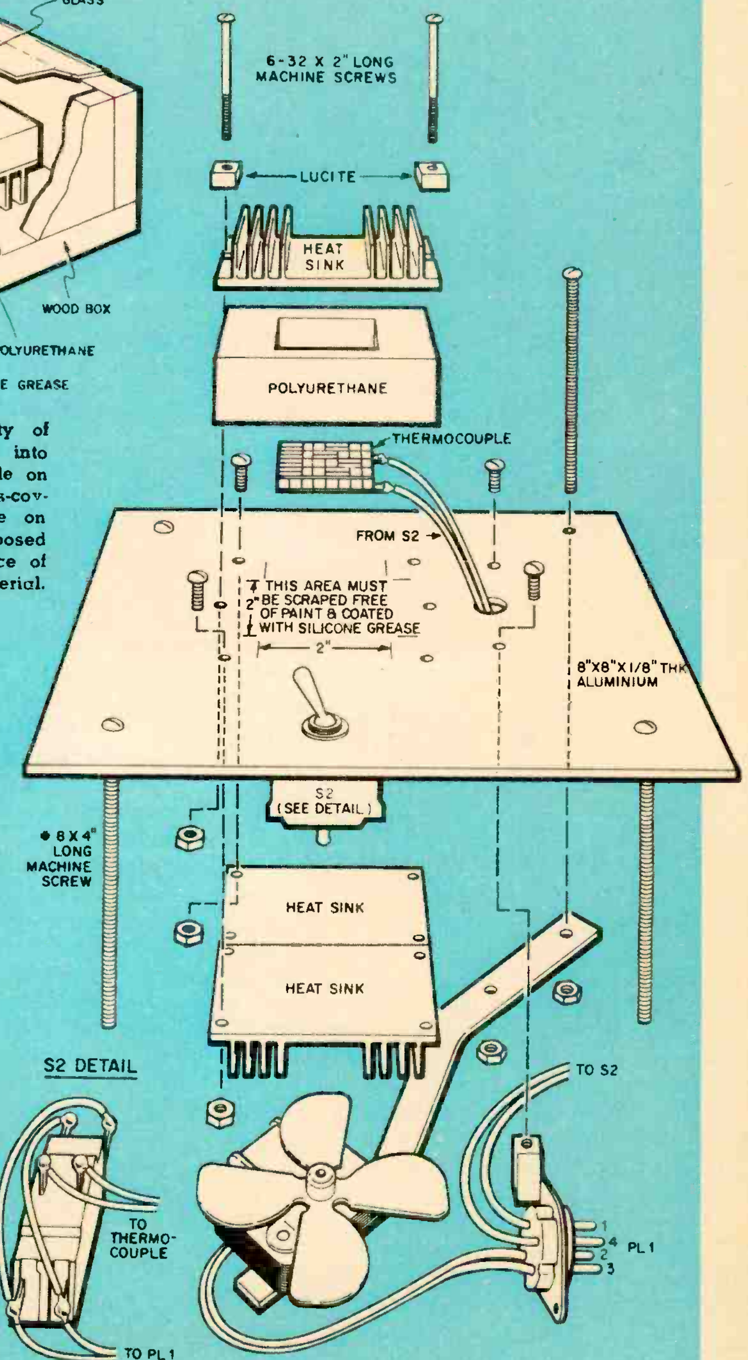



Fig. 5—To use TE module to freeze and boil water as shown on first page of this article, build this setup. Base is made from ⅛-in.-thick piece of aluminum rack panel. Remove paint from 4 x 4-in.-sq. area on bottom of plate and from 2-in.-sq. area on top side. Polish both surfaces with steel wool and smear them with silicone grease. Mount two heat sinks and fan on underside (hot side) to dissipate heat. Container with water can be mounted directly on TE module to boil or freeze water. To build small refrigerator, put 3 x 3½-in. heat sink on top of TE module (cold side) and install cold heat sink inside ½-cu.-ft. insulated box. 2-in.-long machine screws (top of diagram) must not touch cold heat sink. To prevent hot plate heat from being transferred to cold heat sink, put pieces of Lucite under screw heads. Put polyurethane insulation under cold heat sink to prevent heat transfer and tighten 2-in. screws so there is firm contact between surfaces of TE module, cold heat sink and hot plate.

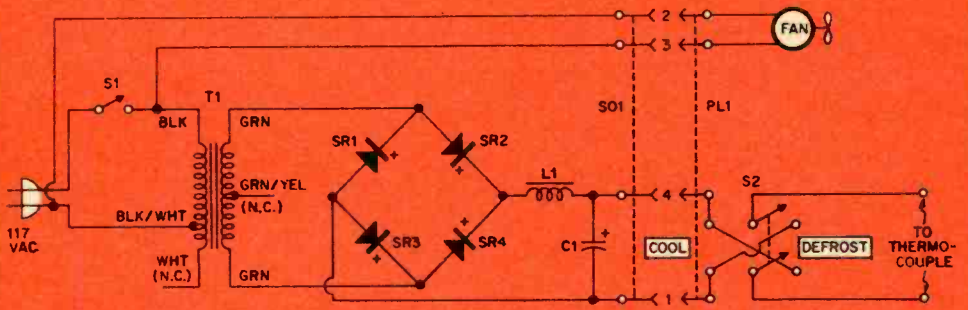



**Fig. 6—Power supply for 32-couple TE module. Do not make parts substitutions as power supply is designed to deliver about 2.7 V @ 10 A. If line voltage is high, use white lead on primary. Do not operate power supply without load as the rise in output voltage will damage C1.**

**PARTS LIST**

C1—36,000 µf, 3 V electrolytic capacitor (Newark Electronics Corp. 26F434)
Fan—Tube cooling fan (Allied 39 U 457 M)
L1—Choke: .01 hy., 12½ A, 0.11 ohms DC resistance (Allied 62 U 341)
PL1—4-prong plug (Amphenol 86-PM4)
S1—SPST toggle switch
S2—DPDT toggle switch; minimum rating: 12 A @ 3 V
SO1—4-prong socket (Amphenol 78-PF4)
SR1-SR4—Silicon rectifier; minimum ratings: 12 A, 50 PIV (Lafayette 19 R 5003)
T1—Filament transformer; 6.3 V @ 10 A (Allied 61 U 418)
THERMOCOUPLE—32-couple module (Frigistors, Ltd. No. IFB-32-015-G1. Allied 6 P 635, $20.80 plus postage. Not listed in catalog)
Misc.—Copper wire, steel wire, chromel wire (Edmund Scientific Co., Barrington, N.J. Stock No. 40,162, 65¢, postage included, for 2 feet), finned heat sinks (six required, Lafayette 19 R 1523), silicone grease (General Cement No. 568), ⅛-in. thick aluminum plate, polyurethane foam insulation, Lucite, hardware

# Experiments in Thermoelectricity

parallel.

Although you can witness the Seebeck effect, the Peltier effect can't be demonstrated easily. Reason is, it takes a lot of current to cool and this calls for heavy wire. Since the heavy wires conduct heat almost as well as current, the heat at the hot junction flows to the cold junction and warms it.

**Semiconductor TE Devices.** In doing research on semiconductor materials for transistors, scientists found that certain materials were well suited for thermoelectric applications. They had high electrical conductivity and thermoelectric efficiency. More importantly, they had low thermal conductivity. The TE module we will use for our experiments is made of N-type and P-type bismuth-telluride semiconductor blocks joined together with copper as shown on our cover and in Fig. 3.

When a heavy current flows through a series connection of blocks and copper strips, the cold side can get up to 50° cooler than the hot side. By keeping the hot side at room temperature, the cold side can be used to cool, refrigerate or freeze. When you reverse the direction of the current, the hot side gets cold and vice versa.

Take a look at Fig. 3 to see how cooling and heating are produced. On each side of the TE module there are several junctions of N- and P-type semiconductor blocks and copper strips. The flow of electrons through a *PN* junction (joined by a copper strip) causes the junction to absorb heat energy from the surrounding air and get cold. The flow of electrons through an *NP* junction (also joined by a copper strip) causes the junction to give off energy in the form of heat.

A detailed explanation of this would require us to go into complicated physics. Suffice it to say that electrons must either lose or gain energy in order to cross what is called a *thermal barrier* at an *NP* or a *PN* junction. To acquire energy, heat is removed from the surrounding air, causing the temperature of one junction to fall. To maintain a balance of energy, the energy picked up at the cold junction is given up as heat at the other junction.

Semiconductor TE modules do have a few drawbacks. They are somewhat expensive, fragile and require a high-current, low-voltage source of operating power. And the power-supply's ripple must be very low because only DC cools. The AC component just causes the cold side of the module to heat up.

Figure 6 is a schematic of a power supply that will deliver about 2.7 V @ 10 A with 1 per cent ripple for a 32-couple Frigistor. For construction details refer to Fig 7.

This power supply and a 32-couple 10 A Frigistor TE module can be the starting point for several thermoelectric projects. Only one more item is necessary, an efficient heat sink to keep the hot side of the Frigistor at room temperature. A setup used to produce cooling and heating (shown on the first page of this article) and a small refrigerator is shown in Fig. 5.

To make a miniature experimental air conditioner, put a heat sink with cooling fins on the cold side of the Frigistor and blow air across it. But don't expect to cool a large volume because this module can pump heat at the rate of only about 100 BTUs an hour.

Just as the Frigistors are more efficient at cooling than are wire thermocouples, they are more efficient in generating electricity. For example, if you heat up a 12-couple module (on our cover) to about 300°F, it will generate about 25 ma at 15 mv. This isn't a lot of power, but the fact that there are no moving parts makes it attractive for space applications use where reliability is important. Such generators could use atomic power as their heat source.

Another heat source is the sun. A simple thermoelectric solar battery can be made as shown in Fig. 4. The sun's rays heat up the air in an enclosed box. One side of a Frigistor is in the box. The other side, coated with silicone grease, rests on a finned heat sink. The portion of the heat sink not covered by the Frigistor should be covered by a piece of polyurethane foam. We generated 15 ma at 5 mv in moderate sunlight.

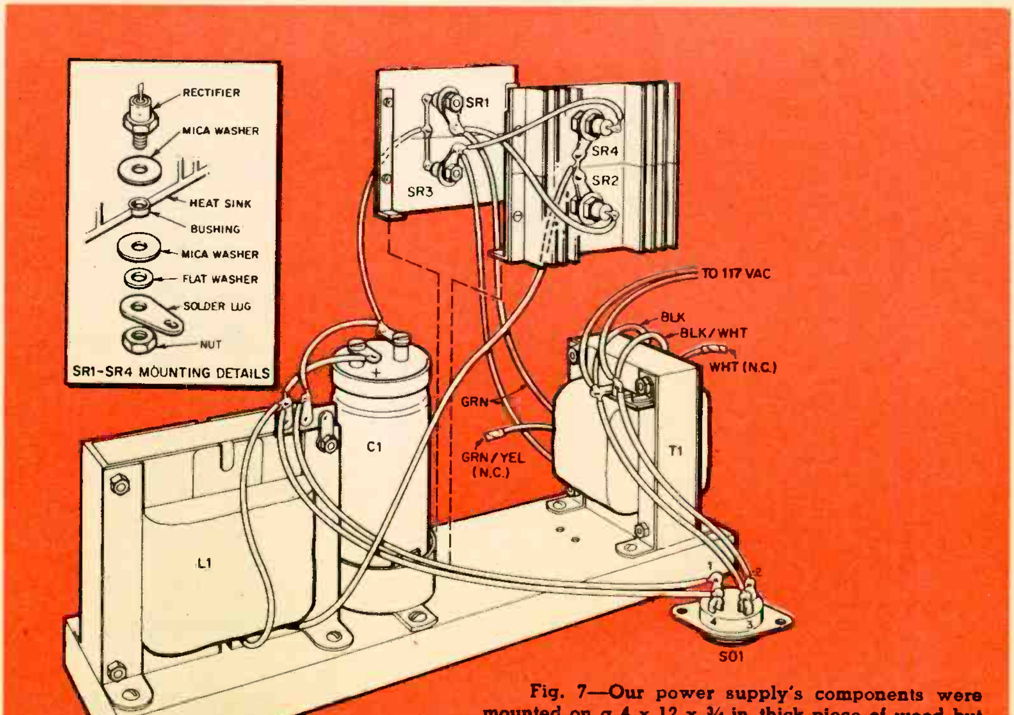



**Fig. 7—Our power supply's components were mounted on a 4 x 12 x ¾-in.-thick piece of wood but you could build supply on a metal chassis. Use heavy wire between terminal strip on L1 and pins 1 and 4 on SO1 as they will carry 10 A. Power switch S1 (on schematic) is not shown in the pictorial.**

# The LISTENER

C. M. STANBURY II

**CANADIAN CAPERS** . . . Though not nearly so spectacular or earth-shaking as the Viet Nam affair, a small-scale revolt nonetheless is going on in Canada. The protagonists are unlikely ever to come to blows but the situation is of interest to BCBers just the same. Here's the story.

Under the British North America Act (Canada's constitution), the Dominion is supposed to be a bilingual nation, conducting its affairs in both English and French. But French-speaking Canadians, seemingly not without justification, claim this hasn't been adhered to and that English has become the dominant language.

A minority (at present) in French-speaking Quebec want that province to secede and become a separate country. In fact, some separatists claim that Quebec already is a sovereign nation, a situation that would delight most DXers (another country added to their count) but not most Canadians.

Needless to say, all this controversy makes Canadian BCB stations even more interesting DX targets. For example, CKTS (900 kc) is an English-speaking station at Sherbrooke, Que., that had its daytime tower toppled by a separatist band (CKTS continued operating with its nightime array). Or take 50-kw CJBC (860 kc) at Toronto, Ont. The Canadian Broadcasting Corp. converted this one to French programming in the interests of bilingualism, thereby bringing out all the English-speaking bigots.

What makes this situation still more interesting for U.S. DXers is that unlike Latin American broadcast operations, Canadian facilities and techniques are every bit as modern as their U.S. counterparts. Complete with helicopter traffic reports and slick disc jockeys, many boast mobile studios for on-location programs. Our photo shows one such mobile, that belonging to CJRN (1600 kc) at Niagara Falls, Ont. Significantly, CJRN's antenna is located about as close to the U.S. border as that of any maple-leaf station, being a mere 10 miles away.

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**Phony Clubs** . . . A little less than a year ago we discussed R. Portugal's DX Club, pointing out that it clearly was, and is, an attempt to organize SWLs to serve the propaganda interests of a totalitarian and often anti-American foreign power (THE LISTENER, Mar. '65 EI). What we said must have pricked a little because R. Portugal took time out from its busy propaganda schedule to complain about it.

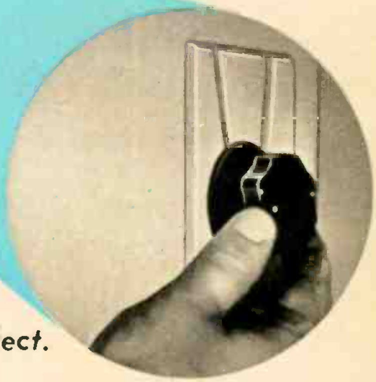
It now appears that other totalitarian powers are copying R. Portugal. Two Communist voices already in the picture are R. Prague (Czechoslovakia) and R. Budapest

[*Continued on page* 116]


With studios in Niagara Falls, Ont., CJRN (1600 kc) frequently goes mobile, originating programs from sites only a stone's throw from U.S. soil. Transmitting tower is located approximately 10 miles from U.S. border, giving station distinction of being one of foreign outlets nearest U.S.

# UNIVERSAL LIGHT DIMMER

By DAVID WALKER



*Remove that old wall switch, put a few modern parts in its box then turn a knob for any illumination level you want. Add a touch of soft music and the setting will be perfect.*

EI's Universal Light Dimmer can be built into *any* wall switch box. You simply remove your existing switch, disassemble it, then build the dimmer on the switch's mounting plate. Connect the dimmer, slip it in the box, put on the cover plate and you're equipped for the very latest—mood lighting.

Unlike some dimmers which provide control up to half brightness then jump to full on, our dimmer permits continuous control from off to full brilliance. It can handle up to 600 watts (resistive load); however, it cannot be used with fluorescent lamps.

**Let's Build It.** Because the dimmer's diodes and transformer core may be difficult to obtain locally or through normal mail-order sources, we have arranged with an electronics distributor to supply complete a package of parts (with the exception of the chassis, knob, wire and hardware). Ordering information is in the Parts List.

First thing to do is disassemble your wall switch to obtain its mounting plate. The plate is kept because it is already threaded and can easily be mounted on the switch box.

Next, make the aluminum chassis in Fig. 1. In addition to holding all parts, the chassis serves as a heat sink for D2. Note that the chassis does not mount flat against the switch plate. Use nuts between the plate and chassis to allow space for R3's large

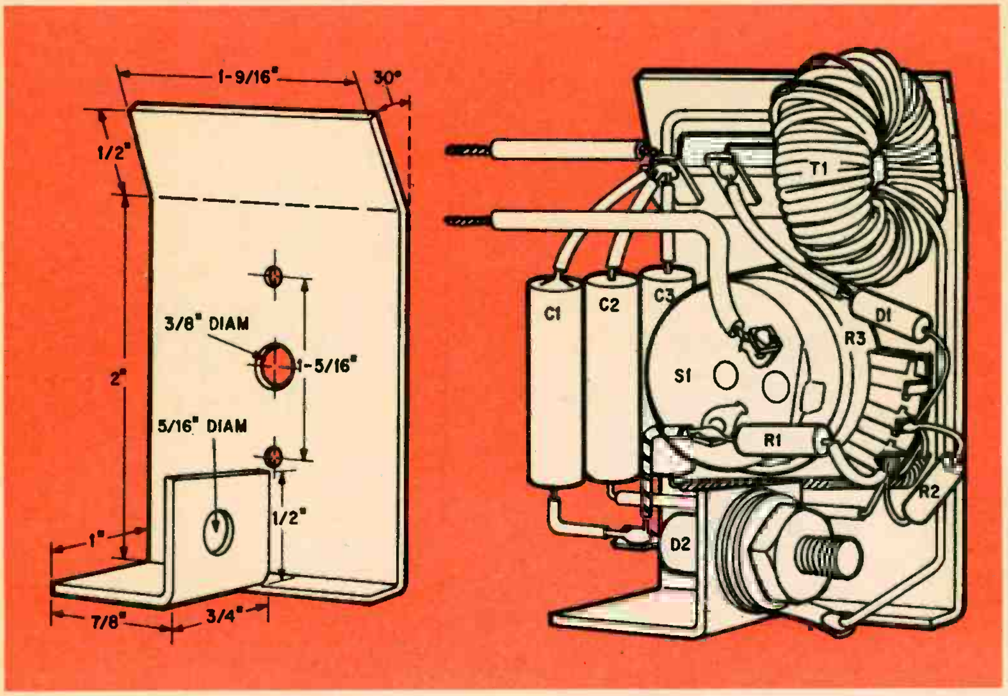



Fig. 1—Dimmer is built on a 3½ x 1 9/16 x 1/16-in.-thick chassis (left) made of scrap aluminum. Mount parts where shown (stack capacitors C1, C2, C3 above each other) so they don't touch switch box.

# LIGHT DIMMER

mounting nut. You can use existing holes in the switch plate for fastening it to the chassis, or drill holes in it to match the chassis holes. Avoid using the cover-plate screw holes.

Diode D2 must be completely insulated from the chassis with the mounting kit supplied with it. First cut a 5/16-in. dia. hole for the ring insulator. Then remove rough edges and burrs from the hole to prevent the mica washers from being ruptured. Coat both sides of the mica washers with silicone grease to improve heat transfer to the chassis. When D2 is in place, apply just enough pressure to get firm compression on the mica washers.

None of the parts is grounded to the chassis; therefore, don't use the terminal-strip mounting foot as a tie point. Spaghetti insulation should be used wherever bare wires come close to metal. After all components except T1 are mounted, check to make sure none of them protrudes beyond the sides of the chassis to prevent a short to the switch

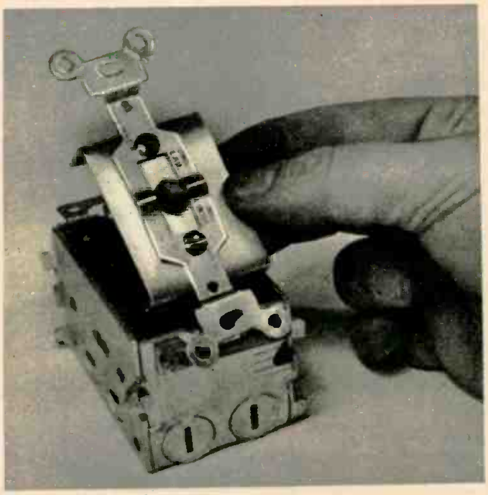


Fig. 2—Your switch plate may not look like ours so a little ingenuity may be necessary to attach it to the chassis. Space chassis and plate ⅛ in.

box and blown fuses.

Construction of transformer T1 is not critical. Begin by winding the secondary with a seven-foot length of No. 18 formvar wire. Formvar is similar to enameled wire but has heavier insulation. Consequently it will be more difficult to scrape the ends clean for soldering. Paint remover and a razor blade

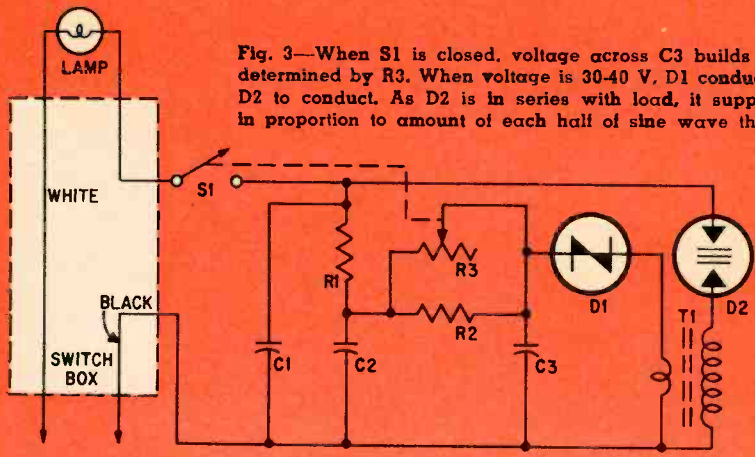



**Fig. 3—When S1 is closed, voltage across C3 builds up at rate determined by R3. When voltage is 30-40 V, D1 conducts causing D2 to conduct. As D2 is in series with load, it supplies power in proportion to amount of each half of sine wave that is used.**

PARTS LIST

C1—.022 μf, 400 V tubular capacitor
C2, C3—.1 μf, 200 V tubular capacitor
D1—Silicon trigger diode. Transitron Electronics Corp. ER-900
D2—Silicon BiSwitch. Transitron TBS20AS
R1—10,000 ohm, ½ watt, 10% resistor
R2—270,000 ohm, ½ watt, 10% resistor
R3—500,000 ohm, linear taper potentiometer (Mallory U-50 or equiv.)
S1—SPST switch on R3 (Mallory US-26 or equiv.)
T1—Transformer (see text). Wound on Ferroxcube Corp. ferrite toroid No. 846T250.
Misc.—3-lug terminal strip (Cinch-Jones No. 54), No. 22 enameled wire, No. 18 formvar wire.
A kit of parts less wire, knob and hardware is available from Milo Electronics Corp., 530 Canal St., N.Y. 13, N.Y. for $10.80 plus 25¢ postage. Order stock No. MK-530.

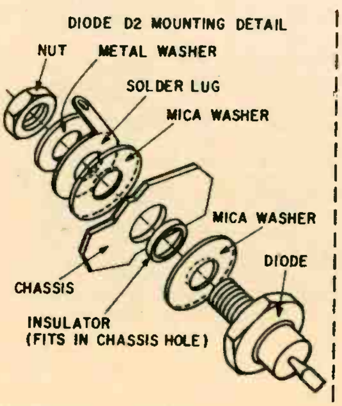
are helpful in removing insulation.

Start winding the secondary as shown in Fig. 4. Insert about 3½ feet through the toroid ring then wind 30 turns in one direction drawing each turn tight. With a one-turn space between turns, you should encircle the toroid once. Now take the other 3½-foot length of wire and wind it around the ring in the other direction filling in spaces left between each of the first 30 turns. (Don't worry if you can't interwind perfectly and if there's some build-up of turns.) Clip off excess wire when you connect T1.

T1's primary winding is two turns of No. 22 enameled wire wound right over the secondary. The width of the turns should be about ⅛ in. It's not necessary to observe polarity on any of T1's leads. After the leads are soldered in place (they support T1), position the transformer so it doesn't touch the chassis.

**Installation.** Connect the completed dimmer to the house wiring as you would a standard switch. The wires formerly connected to the switch (usually black) are spliced to two No. 18 wires from the dimmer. Use either wire nuts or solder the wires then tape them.

Finally, mount the switch cover plate. Do



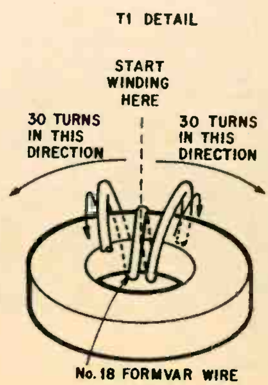




**Fig. 4—Mount D2 with parts supplied as shown at far left. Note in sketch of T1 at right that 30 turns are wound in one direction then 30 turns are wound in the opposite direction.**

# LIGHT DIMMER

not seal the rectangular hole in the plate to allow air to circulate. You can hide the opening by using a knob which is at least an inch in diameter.

Operation of the dimmer is just like that of the volume control on a radio. As the control is turned clockwise, it clicks on to apply AC to the circuit. The controlled light will glow dimly. Advance the control and brightness should increase smoothly until the lamp lights at full brilliance.

**How it Works.** The dimmer is designed around two special solid-state diodes. Unlike conventional diodes, the dimmer's diodes conduct current in two directions—that is, they conduct both halves of a sine wave. However, they don't do so until a trigger voltage is applied to them. The point, or time, at which the trigger voltage is applied during each half cycle determines lamp brilliance.

For example, if the trigger voltage is applied after the beginning of each half cycle as in B of Fig. 6, the lamp will light at almost full brilliance because practically the entire sine wave (shaded area) is utilized. If the trigger voltage is not applied until almost the end of each half cycle of the sine wave, as in D of Fig. 6, the lamp will glow dimly because very little power (shaded area) is supplied to it.

Take a look at the schematic in Fig. 3. Diode D1 is what's called a trigger diode. It does not conduct in either direction until a 30 to 40-V peak-to-peak (P-P) voltage is applied to it.

The other semiconductor, D2, is called a

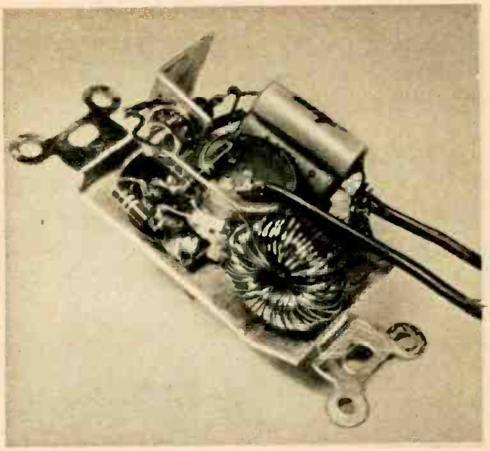


Fig. 5—Completed dimmer ready for installation in switch box. Transformer is supported by its leads. Note stacking of capacitors C1, C2, C3.

BiSwitch. It also conducts current in two directions but not until a 200-V (P-P) pulse is applied to it. What happens is, D1 triggers, or controls, a large current flow in D2.

When AC is applied to the circuit, capacitor C3 begins to charge at the beginning of the first half of the cycle through R1 and dimmer control (potentiometer) R3. These components—R1, R3 and C3—form a time-constant circuit. Depending on the setting of R3, C3 will charge quickly or slowly. If most of R3's resistance is *out* of the circuit, C3 will charge to 40 volts very soon after the beginning of a cycle of input voltage. If all of R3's resistance is *in* the circuit, C3 will take longer to charge to 40 volts. Consequently, D1 will not conduct until the tail end of each half of a cycle. Simply stated, R3 determines how long it takes for the voltage

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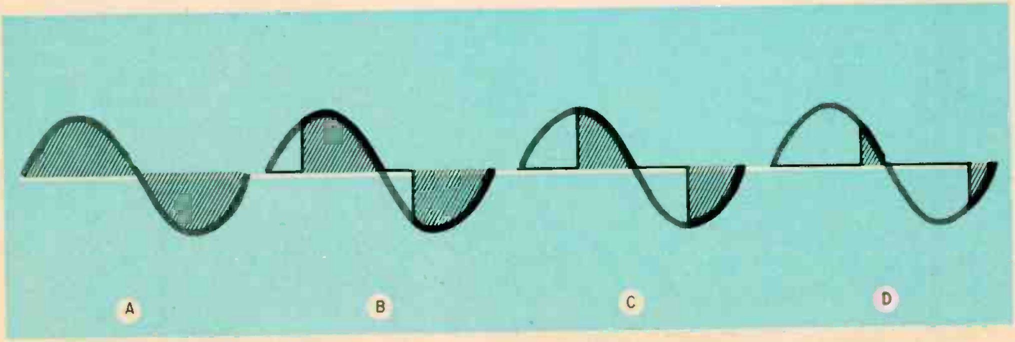
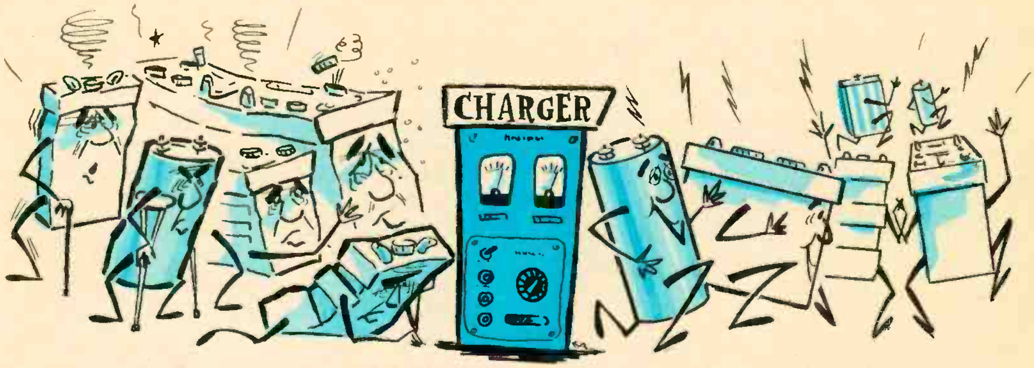



Fig. 6—Shaded area of sine wave, determined by when D1 conducts, represents power supplied to the load.




# Can You Recharge ANY Battery?

*The answer may surprise you, particularly if you read the claims in the ads.*

UBIQUITOUS is the only word for them, since no one can deny they're popping up all over the place—in department stores, newspapers, electronic catalogs, parts wholesalers, auto supply shops. Battery chargers would seem to be having a heyday. Fact is, just name a battery and someone's got a charger for it.

Car battery make like a hibernating bear in cold weather? Yup, there's a charger claimed to bring on spring. Junior burning up flashlight batteries in a zillion toys? Right again—someone's got a charger that's supposed to let him stick with the same batteries clean up to high school. Teen agers gobbling up 66-cent transistor-radio batteries listening to the Animals, the Jerks and the Five Finks? Well, close your wallet. Someone's got a charger that will keep the same battery in the running till the swallows soar back to Capistrano.

But is it true that *any* battery is rechargeable? What about the little would-be Indianapolis speedster who uses a little wonder charger overnight and still faces a dodo-dead car next morning? And how about those flashlight batteries (such as the one in our photo) which clearly state: not rechargeable? Are chargers really the Geritols of the battery world?

**In actual** fact, there basically are two types of batteries: the dry or primary cell and the wet or secondary (storage) cell. In the dry cell, chemical action eats away one electrode, and if there were no other problems the cell theoretically could be used until the electrode was completely destroyed. (The carbon-zinc flashlight battery, the mercury and the alkaline-manganese are examples of primary cells.)

However, during discharge the chemical action forms hydrogen gas or ions—an insulator—around the positive electrode. A chemical called the depolarizer is built into the cell to neutralize the hydrogen insulator. When the depolarizer no longer can neutralize the insulator, the positive electrode cannot pass the required current. The cell appears to have a high internal resistance, its output voltage falls and we say the cell is dead.

In view of the fact that the primary or dry cell depends on a non-reversible chemical action, it logically cannot be recharged—or


"Not rechargeable" reads the label on a standard 1½-volt D cell. But is this claim fact or fiction?

# Can You Recharge *ANY* Battery?

so goes the dope that's been handed out for years by battery manufacturers. But the real truth is that the dry cell *can* be recharged (*rejuvenated* might be a better word). Even the National Bureau of Standards in limited tests indicates that carbon-zinc cells can be recharged—providing certain conditions are met.

For one thing, the charging energy must equal 120% to 150% of the energy removed. For example, if a flashlight battery delivers 100 milliamperes constantly for 20 hours for a total of 2 AH (ampere hours)—current in amperes times time in hours equals ampere-hours—the recharging energy must equal at least 2 AH x 120% or 2.4 AH.

Now the charge rate could be high, say, 2.4 amperes for 1 hour; or low, say, 50 ma for 48 hours. Thing is, when the charge rate is high, internal pressures are developed which could rupture the battery case if it were sealed (as are some mercuries and all alkalines). Also, the heat developed by the high current will dry out the battery, curtailing its life seriously.

While there are optimum charging conditions which usually require laboratory setups, a good general rule is to distribute the charge over a 12- to 16-hour period. For example, if we distribute a 2.4 AH charge over 16 hours, the charging current would be 150 ma (2.4 AH/16 hours). Another guideline is that charging current should not exceed one-half the recommended maximum current for a given size battery.

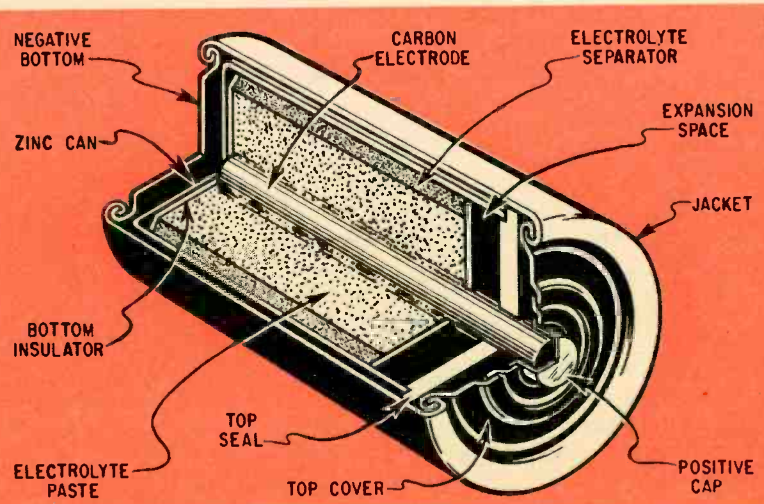
**Contrary** to much battery-charger advertising, not *all* dry cells can be recharged. Old batteries that have been run down and left kicking around the shelf for some time usually cannot be recharged, nor can batteries that have been dried out by the heat of excessive charging current. In the case of the carbon-zinc and alkaline batteries, recharging only is successful if the cut-off voltage—the battery's terminal voltage *while powering equipment*—is above 1.0 volts.

Then, too, recharged dry cells have drawbacks of their own, chief of which is reduced shelf life, which in the case of carbon-zinc and alkaline batteries can be cut as much as 90%. (The mercuries appear to retain their good shelf-life characteristics.) Recharged dry cells, therefore, ideally should be placed in service immediately.

Service periods also are affected by recharging, the nominal service period for recharged batteries being about one-third that of the total service period of a new cell run to exhaustion. Depending on both service and charging conditions, a carbon-zinc nominally can be recharged four to 12 times; an alkaline or mercury nominally 25 to 50 times. Of course, a dry cell that is recharged and then run to exhaustion likely will be suitable only for a paperweight, if that.

**The secondary** or wet cell is a steed from another stable. Here, instead of having a non-reversible construction where chemical action eats away one electrode, energy is de-

**Basic dry cell long has been touted as non-rechargeable, since its action is said to be of a non-reversible chemical nature. Cell goes dead when depolarizing chemical in electrolyte no longer effectively can neutralize hydrogen insulator which forms on carbon electrode.**



veloped through a chemical change which can be reversed by an external electric current. In a sense, energy is poured into the cell and stored for future use, which explains why secondary cells customarily are called storage cells. Typical storage cells are the lead-acid (the auto battery is a breed nearly everyone is familiar with) and the nickel-cadmium (a type used in virtually everything from portable electric drills to walkie-talkies).

The lead-acid furnishes a good example of how the reversible or storage cell works. Its two plates, one of pure lead sponge and one of lead-peroxide, are immersed in a dilute solution of sulphuric acid. Since energ originally is used to convert a lead plate to read-peroxide, the peroxide plate has stored-up energy. As the battery is used, the sulphuric-acid solution combines with the lead plates to form a surface coating of lead sulphate—a substance that will not react with sulphuric acid to produce energy.

When the plates are coated fully with lead sulphate, the sulphuric acid no longer can contact the lead remaining in the plates and the cell is discharged or dead. However, applying a reverse current reverses the chemical action. In time, the cell again is ready to deliver energy.

Obviously, any reversible cell is a storage cell and, therefore, can be recharged. Trick is to realize the maximum energy per cycle without destroying the cell.

In the case of vented cells, such as the auto battery and vented nickel-cad, the object simply is to avoid a charging current such that the cell gasses, since gassing causes the acid in the electrolyte to escape and prevents the battery from being recharged fully. Also, the charging rate must not be so high that the battery's internal connections cannot carry the current—this causes overheating with the result that the internal plates buckle and most probably short-circuit.

**For example,** if a high-current, rapid-charge booster such as used by auto garages isn't shut down in time, charging current in the neighborhood of 75-100 amperes easily could gas out most of the acid electrolyte as well as buckle the plates. True, so long as the internal connections are not overheated, it is permissible to use a high charging current at the beginning of the charge. Severe gassing does not occur until the battery is about 50% charged, at which point the charge current must be reduced.

On the other hand, too low a charge current results in excessively long charge periods and a battery easily can end up being less than fully charged. For example, assume your auto battery is run down, the weather is cold and you only can give the battery an overnight charge of, say, 8 hours from a little-wonder 1-amp charger. Such a charger running for eight hours will give less than 8 AH energy (as with the dry cell you must put in 120% more energy than you take out). And 8 ampere-hours into a run-down car battery hardly will give satisfactory service.

Sealed batteries, such as the nickel-cad and lead-acid used in rechargeable 9-volt tran-

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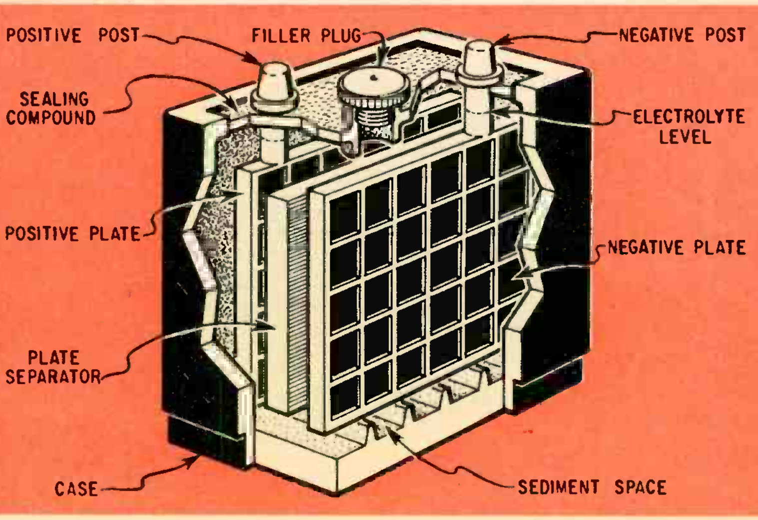



Basic well cell also relies on chemical action for its operation, though activity in this case clearly is of the reversible variety. Cell ceases to function properly when surfaces of both its positive and negative plates are lined with lead sulphate.

KIT EI REPORT

## Music Associated SCA Detector

# Bootleg Music Adaptor

KIT: SCA Sub-Carrier Detector
MANUFACTURER: Music Associated, 65 Glenwood Rd., Upper Montclair, N. J.
PRICE: $49.50 kit; $75 factory wired
CONSTRUCTION TIME: about 8 hours

HIDDEN in an FM signal that you're listening to may be a second program that you can't hear and have no way of knowing about—at least not via your tuner at home. But all over town—in restaurants, banks, hotels, stores, supermarkets, cocktail lounges, bus terminals and other public places—this secret program of commercial-free music fills the air. It's called background music.

The hidden program comes from a background-music company (such as the General Background Music Corp. in New York City), which sends taped music programs to an FM station. The incoming signal frequency-modulates a 67-kc (but it *could* be another frequency) oscillator. The frequency-modulated output of the oscillator plus the station's regular program (mono or stereo) simultaneously modulate the station's main FM carrier.

Public places that pay the background-music company for the service are provided with a single-channel FM receiver which has a built-in adaptor to recover the background-music program. When you tune in the station on your FM receiver at home, you hear only its regular program. To hear the background-music program you must connect an SCA (Subsidiary Communciations Authorization, as the FCC calls it) adaptor, such as this one made by Music Associated, to your tuner.

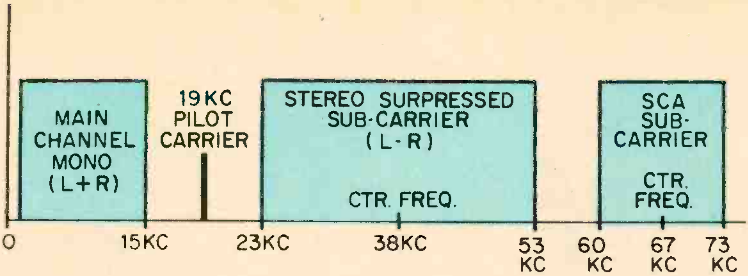
Your FM tuner must have an IF passband sufficiently wide to handle a stereo-FM signal, and then some. An FM tuner whose frequency response doesn't go up to at least 70 kc will have a low output up around 67 kc. This will prevent the adaptor from limiting effectively, thus causing noise. And if the station is broadcasting a stereo signal, there will be crosstalk with the 38-kc stereo subcarrier caused by phase distortion. (Music Associated also sells a single-channel, crystal-controlled FM receiver kit for $169. It's $219 wired.)

You must have a good antenna or the quality of the SCA signal will be affected adversely by multipath signals, as would be a stereo-FM signal.

But don't expect the fidelity to be as good as the regular FM program since background music has a deliberately limited audio-frequency and dynamic range to give it a non-distracting quality.

How legal is such an adaptor? It depends on where and how it's used. You're in the clear if it is for home reception since the program will be used for your personal entertainment and not to make money. However, you may not use the adaptor to provide what would be bootleg music in a public place for the entertainment of others—whether you charge for the entertainment or not. Reason is, you'd be violating a federal law pertaining to the public performance of music for profit. Courts more than once have upheld statutes that say if you play music in a public place it is for profit—period. And you'd also be in Dutch with ASCAP, BMI and the manufacturer of the recordings for not paying royalties.

Basically, the Music Associated SCA de-




Spectrum of signals that could appear at output of detector (before de-emphasis) of FM tuner. SCA program occupies approximately 60-73 kc.

tector is an FM tuner designed to receive a 67-kc frequency-modulated signal. You connect it to your FM tuner at the discriminator or ratio-detector output *ahead* of the de-emphasis network (where you'd connect a multiplex adaptor). You connect the adaptor's output to your preamp. If your tuner does not have a multiplex output jack, Music Associated will tell you where to install one if you give them the manufacturer and model number of the tuner, or if you send them the tuner's schematic.

Although 67 kc is the most common SCA subcarrier frequency, some other frequency may be employed. Music Associated's standard adaptor is for 67 kc; however, they'll supply a kit for a different frequency at no extra charge. Before you order a kit, check the stations in your area that transmit SCA programs to determine the SCA subcarrier's frequency.

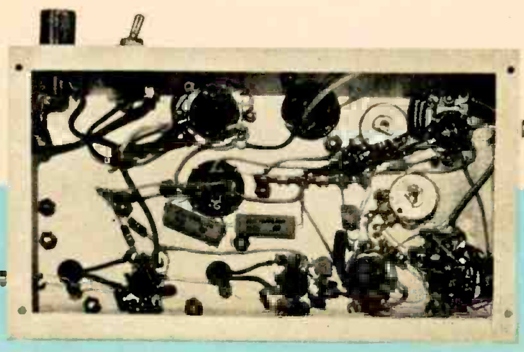
**Putting it together.** Unfortunately, the kit lacks the fancy packaging, well-identified parts, good pictorials and logically organized assembly instructions we are accustomed to getting with a kit. Not for beginners, it is more like a construction project (such as you would find in EI) except that the chassis is supplied drilled and punched.

You're not specifically told, for example, how, where or when to mount such things as tube sockets and terminal strips. A pictorial with parts such as ground lugs (which are mounted with the tube sockets) omitted can be confusing. After we studied and tied together the instructions, parts list and schematic and realized we were going to be pretty much on our own, the kit went together with little trouble. The installation and connection of resistors, capacitors, filters, etc., is explained but you're not told when to solder.

You must follow the schematic and pictorial along with the step-by-step instructions. Reason is, the instructions for connecting to tube sockets refer to V1, V2, etc., but on neither the pictorial nor the schematic are V1, V2, etc., so marked. It took us about eight hours to build the kit but this could vary, depending on what you make of the instructions. Alignment was not necessary since all coils are supplied aligned.

**How it Worked.** After connecting the adaptor to a tuner and amplifier we were quite satisfied with the way the music sounded. However, we found that a high-level input signal from a tuner could overload the adaptor, which doesn't have an input-level control. Result of this was cross modulation from a stereo program's 38-kc subcarrier. When listening to an SCA program from a station broadcasting a mono program, there was no problem. Sensitivity of the adaptor, we found, is adequate for most FM tuners.

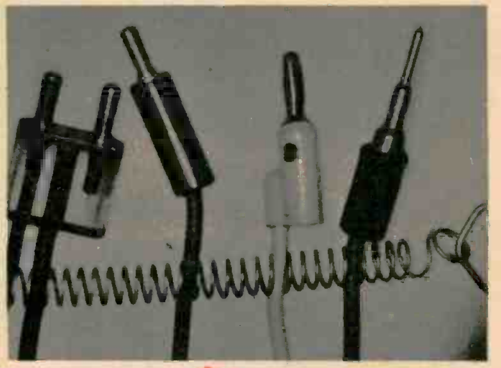
[*Continued on page* 113]



View of underside of completed adaptor shows there's very little crowding. Circuit has six tubes. Polished cans in photo at top of left page are pre-aligned filters.

# Try These

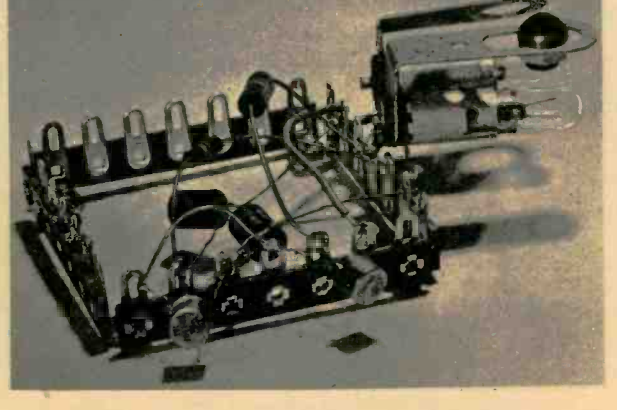
Clean relay contacts mean trouble-free operation. Easy way to keep dirt out is with a glass jar (with a rubber-sealed lid) large enough to cover the relay. Drill holes in the lid for the wires and the relay's mounting screws. Insert a grommet in the hole so it bridges the lead hole in the chassis and the lid. Mount the relay, connect the leads, then put the jar over the relay and screw it on tight.

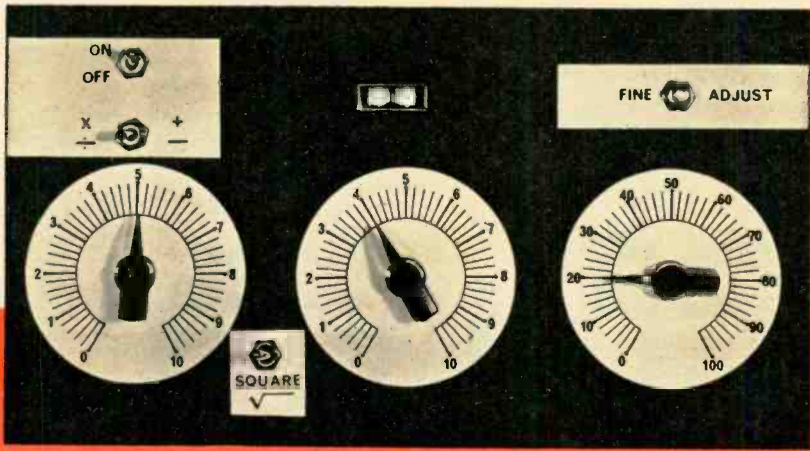


A lot of valuable time often is lost looking for and untangling a rat's nest of test leads. A neat way of storing leads so they can be picked up quickly is to use a screen-door spring. Stretch the spring, mount it and slip the leads in the coils.

Burrs that result from drilling holes in aluminum and other soft metals can cause big troubles in electronic equipment. But even before they get in wrong places, burrs can give you a nasty cut. Best and easiest way to remove them is with a round-shank shallow countersink with knob holder.

A terminal-strip breadboard is a handy accessory for experimenting with semiconductor circuits. Providing test points for every lead, it prevents shorts yet leaves every connection in the open for rapid change and measurements. Though not suitable for VHF circuits, it works satisfactorily up to about 200 kc.






# POT COMPUTER

*Take the sweat out of math with switches, batteries and potentiometers.*

By VERNON SIMMS

UNIVAC take note—here's a Samdiac. Expand those letters and you get subtracting, adding, multiplying, dividing, integrating, analog computer. Unlike its big brothers, Samdiac costs about $8 to build. But don't count on it to do your math homework. It functions like a slide rule, therefore, answers are only approximate.

**How It Works.** The computer consists of two basic circuits. Take a look at Fig. 1 to see how it multiplies and divides. To multiply 5 × 5, you set R1 to 5 on the dial. This is the center of its resistance range. Since the supply voltage is 10 V, the voltage from the arm of R1 to ground is 5 V. The 5 volts goes to R2. Since R2 also is set at its midpoint, the voltage is again divided. That is, 2.5 volts now appears from the arm of R2 to ground. This voltage is the answer to the problem; however, you have to shift the decimal point mentally.

To read out the answer, you would have to use a sensitive voltmeter, such as a VTVM. A less-sensitive voltmeter would draw excessive current from R1 and R2 and adversely affect accuracy. We get around this by adding a third potentiometer (R3) and a zero-center microammeter.

Note that R3 also is across a source of 10 V. When R3's arm is set to select 2.5 V, the voltage at the right side of the meter is exactly the same as the voltage at the left side. Since the meter merely indicates balance at zero, it draws little current from the circuit. You read the answer from R3's dial. To use the circuit for division, you set up the problem on R3 and R2 and read the answer from R1's dial.

Fig. 2 is the basic circuit for addition and subtraction. Instead of dividing voltages, the circuit adds them. Let's add 3 and 2. Note that R1 takes 2 V from one 10-V source and passes it to R2. R2 takes 3 V from its 10-V source. The two voltages are added and 5 V goes to the meter. The balance and indicator circuits work the same way as before.

In the practical circuit (Fig. 5) two 1.5-V batteries are the voltage sources. However the voltage relationships are exactly the same. Construction details are covered in the captions for Figs. 3 and 4.

**Operation.** Set S4 to square, $\sqrt{\phantom{x}}$ *only* for square and square root problems to be described later. Never press *fine-adjust* switch S2 until the problem has been set up.

● Multiplication. Let's say you want to

# POT COMPUTER

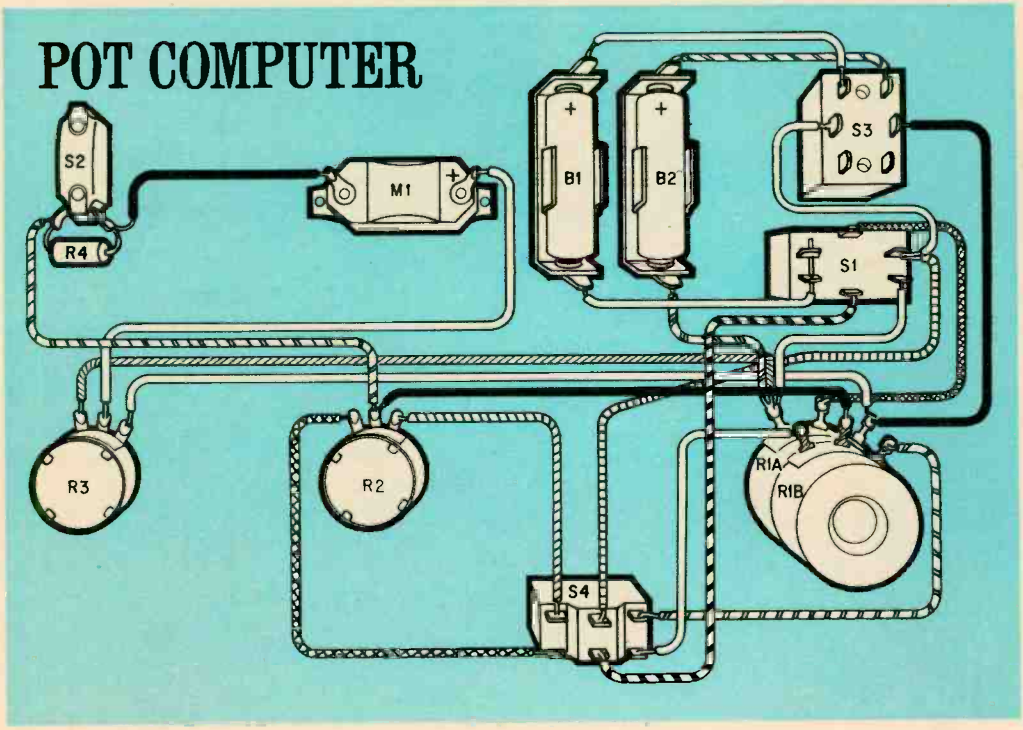



Fig. 3—Our computer is built on a 15 x 8 x ¼-in-thick piece of plywood. Overall size is determined by diameter of dials for R1, R2 and R3. The location of batteries and switches is not important.

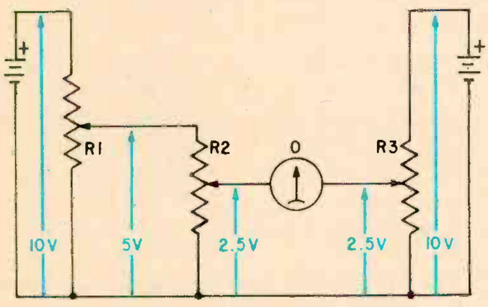



Fig. 1—Multiplication, division. R1 feeds part of 10 V to R2, which feeds part of voltage to M1. M1 zeros when voltages from R2 and R3 are equal.

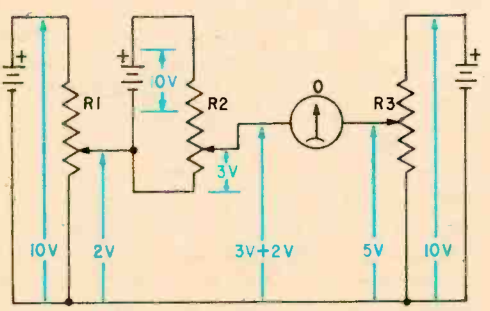



Fig. 2—Addition, subtraction. Part of voltage from R1 is connected in series with voltage from R2. M1 zeros when voltages from R2, R3 are equal.

multiply 5 x 8. Set S3 to *on* and set S1 to × ÷. After dialing the problem—R1 (left knob) to 5, R2 (middle knob) to 8—adjust R3 (right knob) until M1 indicates zero. Then press S2 and adjust R3 for zero again. Read the answer, 40, from R3's dial. With higher numbers you'll have to do some thinking to determine where the decimal place goes.

Accuracy is poor when *both* knobs which set up the problem are on numbers below 3. Accuracy improves when either knob is higher than 3 and is best when *both* knobs are higher than 3.

● Division. Set the right knob to the number to be divided (dividend) and the middle knob to the dividing number (divisor). Zero M1 with the left knob, read the answer (quotient) from its dial and determine the position of the decimal point. If it is impossible to zero M1 (for example, when you divide 80 by 5) shift the 80 on the right dial down to 8.

● Addition. Set S1 to + − and set up the problem on the left and middle dials. You read the answer on the third dial after M1 is

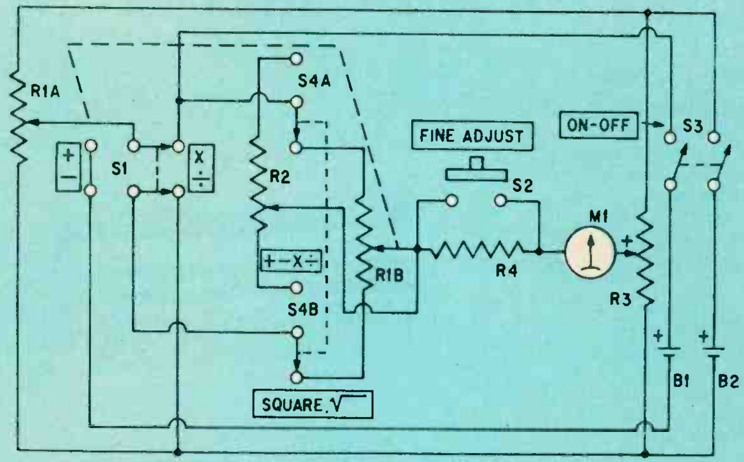



Fig. 5—Complete schematic of computer. To square or get the square root of a number, the left (R1) and middle (R2) potentiometers would have to be set to the same number. To make sure they are, we use another potentiometer, R1B (which is the same resistance as R2 and is mechanically coupled to R1A) instead of R2. When S4 is set to square/square root, R1B is connected in circuit instead of R2. Therefore, when left knob is set to, say, 6, R1A and R1B (the equivalent of R2) are both set to 6 automatically.

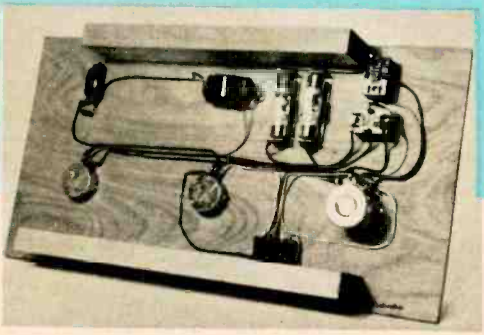


Fig. 4—Rear view of computer. The strip of wood at the top of the board should be higher than the strip at the bottom to tilt the board upward.

**PARTS LIST**

B1, B2—1.5 V penlite cell
M1—Zero-center balance meter, ± 100 μa. (Lafayette 99 R 5034 or equiv.)
R1A, R1B—50/500 ohm dual wirewound linear taper potentiometer. IRC-CTS WPK-50 (Lafayette 33 R 4453 and WM-500 (Lafayette 33 R 4526)
R2—500 ohm wirewound linear taper potentiometer
R3—5,000 ohm wirewound linear taper potentiometer
R4—47,000 ohm, ½ watt, 10% resistor
S1, S4—DPDT toggle or slide switch
S2—SPST push-button switch
S3—DPST toggle or slide switch
Misc.—Battery holders, 2-in. pointer knob (Allied 44 U 176)

zeroed. When you find M1 cannot be zeroed when *both* knobs are set above 4 at the same time, shift the knobs down to the equivalent sub-divisions. For example, to add 9 and 8, place the left knob one-half division below 1, and the middle knob one division below 1.

● Subtraction. To subtract, reverse the adding process. The larger number is set with the right knob, the smaller number with the middle dial. The answer appears on the first knob's dial after it's used to zero M1.

● Squaring and Square Roots. Set S1 to × ÷ and S4 to square, √‾ . Turn the left knob to the number to be squared. Zero M1 with the right knob and read the answer on its dial. (The middle knob is not used.)

For square roots, turn the right knob to the number whose square root you want to determine. Next, turn the left knob until the meter is zeroed. Read the answer from its dial.

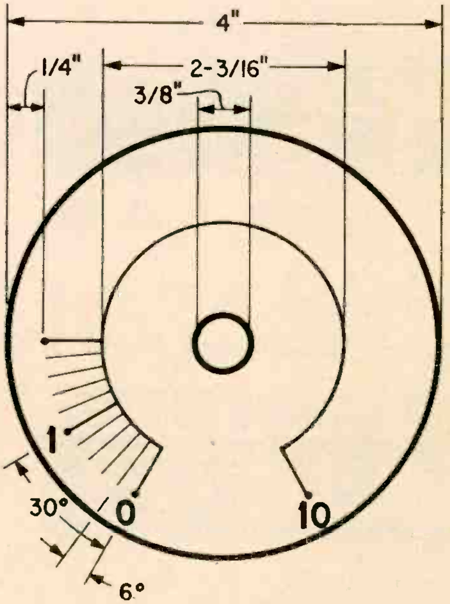



Fig. 6—Dial dimensions. Mark right dial 0-100.

# New Ideas For Christmas Giving

## A Gift Everyone Wants . . . New Heathkit 10-Band Transistor Portable!

**Travel The Airwaves Of The World** . . . with this new "go anywhere" 10-band portable. 7 bands tune 2-22.5 mc shortwave, marine and amateur stations. Longwave (150-400 kc) receives aircraft and marine broadcasts. 88-108 mc brings you the relaxed listening of FM. And the 550-1600 kc AM band keeps you posted on the latest news, weather and sports.

**16 Transistors, 6 diodes, 44 Prebuilt & Aligned RF Circuits** . . . your assurance of instant operation, superior performance and easy, 10-hour assembly. Two separate AM & FM tuners are preassembled & aligned, ready to drop into place. FM tuner and IF strip are same components used in deluxe Heathkit FM stereo gear for the finest FM ever heard in a portable!

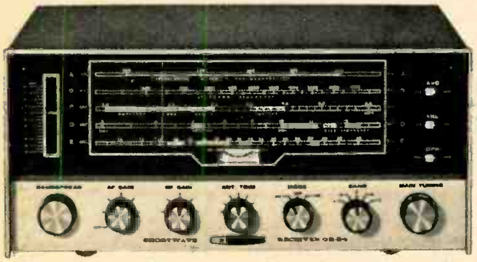
**Two Built-In Antennas** . . . a large ferrite rod in the carrying handle for AM and longwave, plus a 5′ telescoping whip for FM and longwave.

**More Deluxe Operating Features** . . . like the battery-saver switch that cuts battery drain up to 35% for indoor listening, or provides full power for strong, outdoor reception; rotating tuning dial; nighttime dial light; 4 simple controls for tuning, volume, tone, AFC and band switching; 4″ x 6″ PM speaker; earphone & built-in jack; time zone map and "listener's guide." Runs on 6 "D" and 1 "C" flashlight batteries (not included). Also operates on 117 v. AC as it "float" charges batteries with optional converter/charger, GRA-43-1 $6.95, 17 lbs.

**Kit GR-43**

**$159.95**

## New Deluxe Shortwave Radio . . . For The Seasoned SWL!

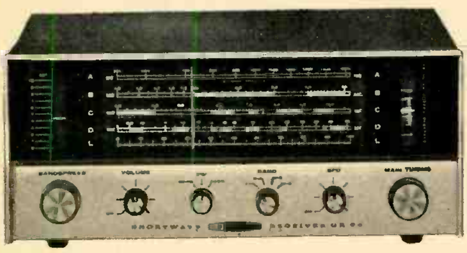


**Kit GR-54**

**$84.95**

**Compare It To Sets Costing $150 And More!** 5 bands cover 200-400 kc, AM, and 2-30 mc. Tuned RF stage, crystal filter for greater selectivity, 2 detectors for AM and SSB, tuning meter, bandspread tuning, code practice monitor, automatic noise limiter, automatic volume control, antenna trimmer, built-in 4″ x 6″ speaker, headphone jack, gray metal cabinet, and free SWL antenna. Assemble in 15 hours. 25 lbs.

## Explore The Exciting World Of Shortwave With This Low Cost Receiver!



**Kit GR-64**

**$37.95**

**Hear Live Broadcasts From Hundreds Of Foreign Countries** . . . pick up the Voice of America, Radio Moscow, government stations . . . tune in hams, ship-to-shore radio, weather and popular AM stations . . . all on this versatile new receiver. Covers 550 kc to 30 mc—includes AM plus 3 shortwave bands. 5″ speaker; lighted bandspread tuning dial; relative signal strength indicator; 7″ slide-rule dial; BFO; 4-tube circuit plus 2 rectifiers; AM antenna; metal cabinet. 15 lbs.

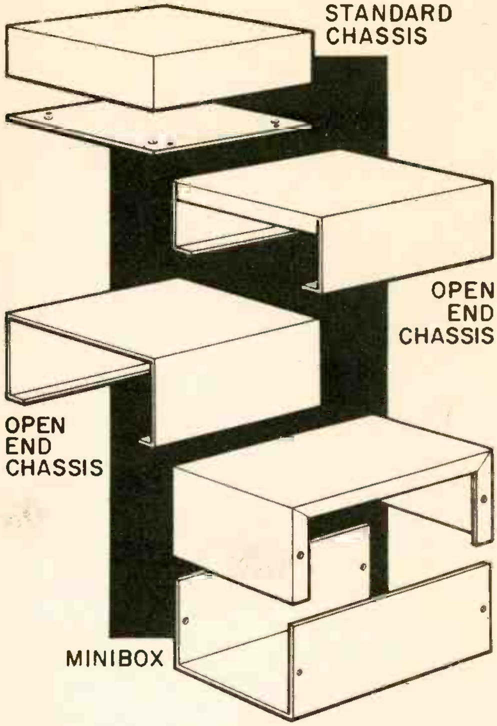
# HOW DO YOU DO IT?

By CHARLES GREEN, W3IKH

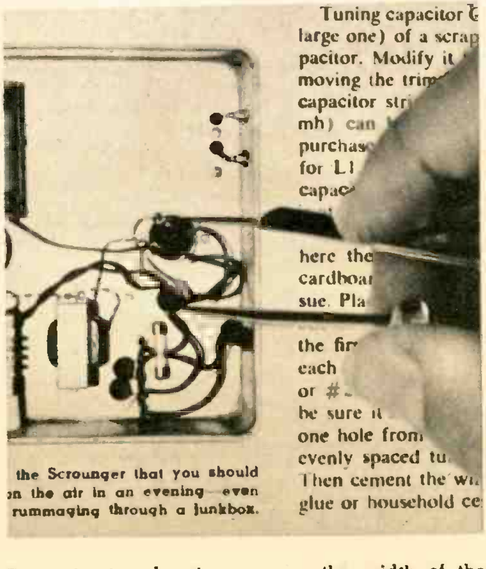
*Why let sloppy-looking projects embarrass you when the touch of the pro is but six steps away?*

THE man who said, "Whatever is worth doing at all, is worth doing well," could have had construction projects in mind. It takes only a little more effort, but think of the feeling of pride you'll get from a well-built project like that amplifier above. The expert's look is just a matter of planning ahead with these steps in mind:

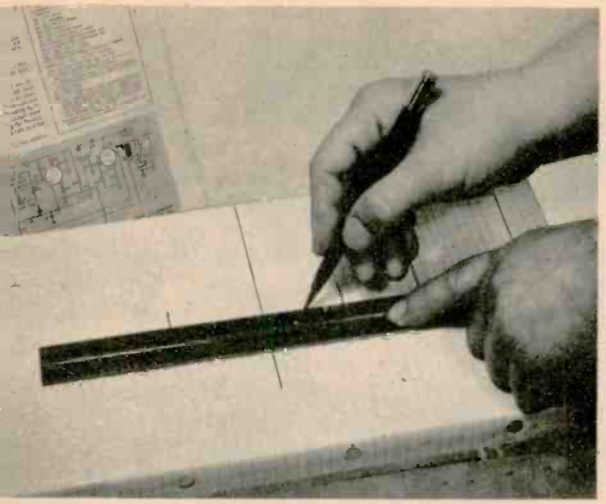
- Layout the chassis
- Cut the holes
- Make brackets and shields
- Mount the components
- Wiring
- Mark the chassis.



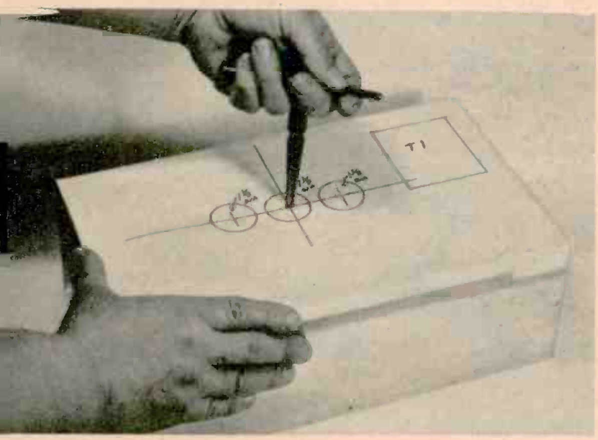

Four basic chassis are available in unpainted aluminum or gray hammertone. The standard (available in steel for heavy projects) has four sides and bottom plate. Open-end chassis have side access. Miniboxes are best for small projects.



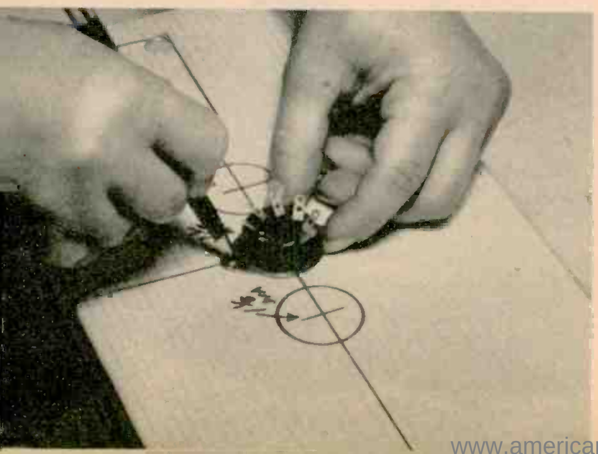

To scale the chassis, measure the width of the photo (dividers and ruler) and the chassis. If the photo is 2-in. wide and the chassis is 6-in. wide, multiply all of the photo dimensions by 3.



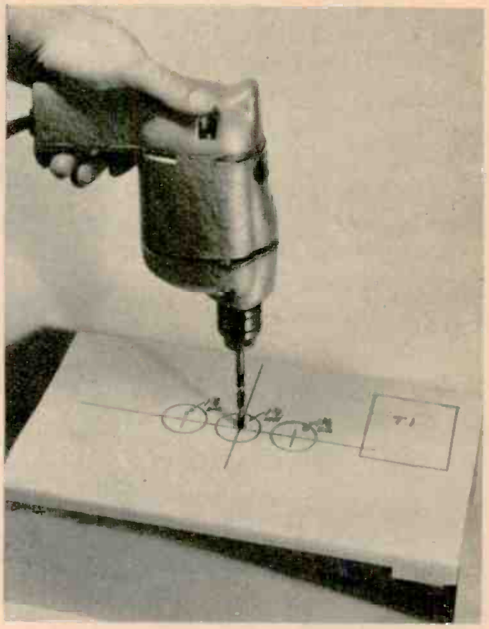
Tape graph paper on the chassis then layout center lines for all holes and identify the hole diameters. And it's a good idea to use a compass to draw circles the same size as each of the holes.

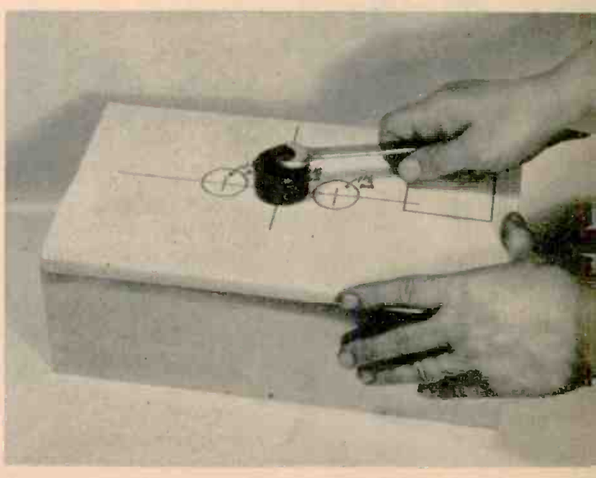


After drilling all holes, use a taper reamer to enlarge the tube-socket holes to ⅜-in. dia. for the socket-punch lead screw. Use the reamer for potentiometer and variable capacitor holes, too.



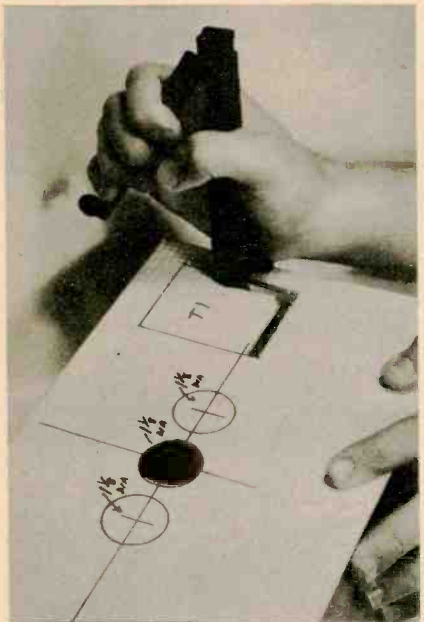
Use a centerpunch before drilling and you'll find the job a lot easier. Always start off with a small bit and work your way up. A block under the chassis will prevent the metal from bending.

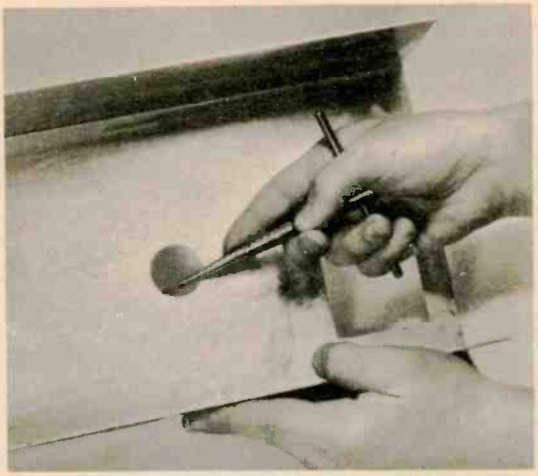




Socket holes should be cut without removing the graph paper. You have to put a lot of muscle into the wrench so hold the chassis firmly. Use 1⅛-in., ¾-in. and ⅝-in. dia. socket punches, respectively, for octal, 9-pin and 7-pin sockets.

Socket mounting holes can be located by using the socket itself as a template. Place all other components on the chassis then mark their mounting holes on the graph paper. Do not mount any of the parts until all holes have been drilled.

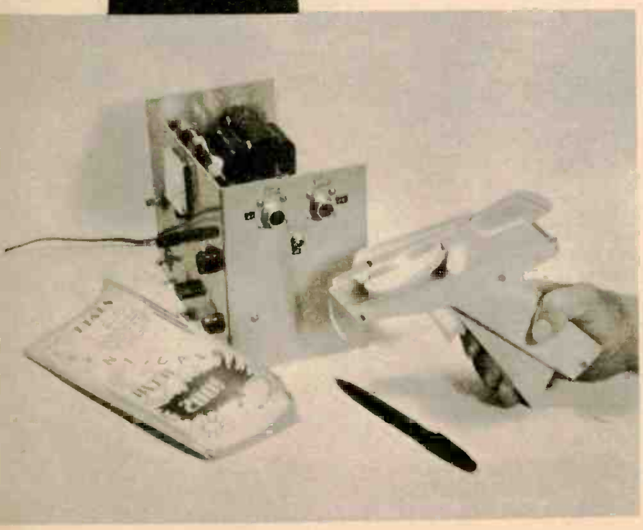




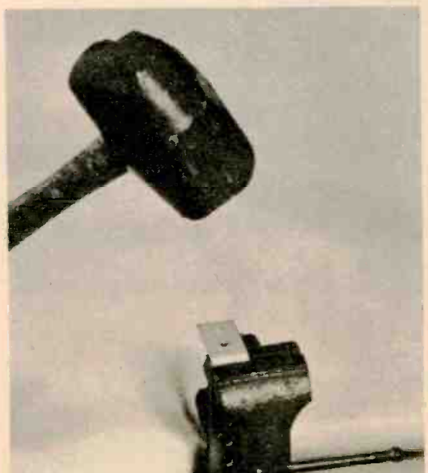
Remove burrs from all holes with either a tapered reamer, a triangular or a half-round file. Grasp the tool loosely and slant it in hole. Then clean up the edge of the hole on both sides of the chassis.

Large holes can be cut easily with a nibbling tool. If such a tool isn't available, back up the chassis with a wood block and drill a series of small holes. Then use a chisel or hacksaw blade to remove metal between the holes.

## HOW DO YOU DO IT?



Chassis lettering can be done easily with a labelmaker that prints on strips of adhesive plastic. You can also use decals or dry transfer lettering sheets.



Small brackets and shields can be formed by using a heavy mallet and a vise. Drill all mounting and component holes before bending. And make sure that you use untempered metal that will bend without cracking.

CB CORNER
BY LEN BUCKWALTER KBA4480

# Two for the money

THE smell of the grease paint, the roar of the crowd. Pure show biz, you say? Hardly, for the phrase also has plenty to do with CB if what happened in Omaha, Nebr., is any sign. It all began when several Midwest clubs decided against an annual beer-'n'-pretzels picnic. What the area needed, they figured, was no good-time-Charlie affair but something substantial like a show and convention. There'd be displays by important CB manufacturers, talks by recognized authorities and social activities in copious though considered measure. In short, said event would enable a CBer to take home more than a hangover.

A fine idea it was. Not only would it make serious CB talk palatable, but it perhaps also might throw off a little cash for the clubs' coffers. But good as it was, the idea well could have died a-borning as many are wont to do. It didn't, however. For as our title suggests, the CBers in Omaha ultimately bought more than a show with their money. They also bought insurance in the form of a showman, and therein lay a world of difference as well as good example for other groups bound for a bout with a show.

Showman by profession, Bill Baker recently commandeered a Midwest CB show. See text for details.

First obstacle proved to be a local hotel where the show could be held. Hotelmen told them simply that clubs themselves couldn't put on and run a show. See the Chamber of Commerce, they said. It was good advice. For here CB club officials were linked with Bill Baker (the man in our photo), a professional showman right down to cuff links fashioned from a pair of silver dollars.

As it happens, Baker runs exhibitions in the auto, hobby, beauty and antique fields. And his advice for running an exhibition proved to date way back to Teddy Roosevelt: "Plan your work, work your plan." He argues that only one man should be show boss and explains that he doesn't get ulcers in his panic-ridden business simply because he gives them to others.

With Baker heading the operation, the show took off. His professional touch truly worked magic: Washington asked the local FCC man to speak, exhibitors began to rent booths, placards and other promotions began to appear. Baker even managed to land hotel space at no cost (the hotel thought it would stimulate business).

Baker's stake in the venture, of course, was profit. But in return for the opportunity to run the show each year—and it well could turn out to be a major regional show—he extended some attractive plums to the CB groups (who acted with legal counsel). Baker financed the show, then offered to split the profit with participating clubs.

Result of this alliance was a well-run, professional show. Nearly 20 exhibitors displayed their wares. More importantly, the three-day programs included numerous clinics on such topics as crystals, modulation, CD and the like, rounded out by a talk by the FCC official. All in all, it was a far cry from willy-nilly conventions we've attended in the past.

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**Two-fer-One** . . . Asking about Business Band radio is like saying "Whatever hap-

[*Continued on page* 112]

# WHO SPEAKS

LABOR has its American Federation of Labor (AFL) . . . broadcasters their National Association of Broadcasters (NAB) . . . doctors their American Medical Association (AMA) . . . hams their American Radio Relay League (ARRL). Fact is, there likely is a national organization for the Betterment of Butterfly Collectors (BBC—which, come to think of it, perhaps does better by those initials than the old British Broadcasting Corporation itself). Reason, of course, is that all of us in the Great Society seem to have been seized by a little something called joinitis. All but CBers, that is.

To be sure, Citizens Band operators, now numbering almost one million, also are joiners. And they themselves have organized upwards of 1,000 *local* clubs and also have come up with a goodly number of so-called national clubs. But do any really speak for CB as a whole? Who, if anyone, rightly can be said to represent the largest single group of radio licensees in the world?

CB clubs, on a local basis, came into being almost as soon as the FCC opened the service back in 1958. Interestingly enough, there probably are as many inactive and completely defunct clubs as there are active ones. And though some of the active clubs claim as few as 10 members, others—particularly those in large metropolitan areas—can boast a roster of as many as 300 members.

The typical CBer joins one of these clubs to meet other CBers on a strictly social basis. And most such operators strangely are unconcerned about the national aspects of CB. Matter of fact, they frequently don't know or even care whether there is a CB club in a neighboring community, much less what neighboring CBers may or may not be up to.

**Even so,** there are operators who nevertheless are aware of the broader scope of the situation. And these are the CBers who joined groups such as the American Citizens Band Association, the National Association for Citizen Band Radio, the National Citizens Radio League, the Interstate Citizens Band Association of U.S.A., the International Citizen Band Association and other so-called national clubs. Most such clubs have come on the scene with a very strong pitch—united we stand, divided we fall; all for one, one for all . . . that sort of thing.

But while fine so far as it's gone, the movement toward formation of a national CB club hasn't gone very far. In actual fact, it clearly has proven the most horrendous flop since Betsy Rocker proclaimed her kitchen-tested instant $H_2O$ (just add water and mix).

At least one would-be national club collected just enough members to enable its founder to retire with a reasonably tidy bankroll. Others ultimately degenerated into agencies for selling novelties to members (though many still promise to achieve a series of minor miracles with hard-nosed FCC officials, who just might be about as aware of the current national CB club crop as of a lone backwoods mosquito playing solitaire). Toss in the fact that local clubs don't amount


to a hill of crystals in the national CB scene, and the situation becomes all the more chronic.

Since the Citizens Band and its inhabitants would seem to be unique in their lack of a national spokesman, the big question is why? After all, there certainly is *need* for a loud and clear voice to represent the million-odd citizens who call themselves CBers . . . or is there?

**When you** come right down to it, there aren't a million CBers—as such. Instead, there is a three-armed giant who scarcely knows which arm is doing what. Point is that CB actually claims three distinct factions—the would-be hobbyists, the personal users and the commercial licensees. And uniting these groups in a single body to date has proven tougher than mixing three parts oil and any part water.

Looking at the situation from another angle—the one which says, "ham operators have the ARRL, so CBers should be able to whip together a similar organization"—perhaps reveals more of the crux of the matter. The ARRL is an organization composed of hams from every corner of the country. And because they can converse with others of their own kind throughout the U.S. (and the world), hams frequently are known coast to coast and border to border. Most active operators on a particular ham band well are aware of other regulars after only a few weeks or months on the air.

CBers, on the other hand, have created only local heroes, largely because the very nature of their service makes it primarily local in scope. Such heroes may be king of the mountain in their own region but unknown outside of their immediate area. Then, too, CBers, unlike hams, lack the common denominators—technical prowess, interest in DXing, even feeling of togetherness—that lead to nation-wide causes and nation-wide goals. In short, because CB *is* CB, it plain doesn't have what it takes to make a CBer's ARRL feasible.

**Result?** Nobody speaks for CB on a national scale. The Citizens Band from a political viewpoint is precisely what it is on good ol' 27 megacycles—a million screaming voices, each trying to be heard above the throng.

Discouraging as this may seem, there well may be a way that CBers *can* form some sort of national organization which still would be effective. Judging from past failures, it would appear that hope for a successful national CB group might lie along the lines of a national congress of local CB clubs. Much like the original 13 colonies, the nation's local CB clubs may be unwilling to support a strong national club with Federalist overtones. Nonetheless, a loose confederation of clubs—much on the order of the 13 colonies under the Articles of Confederation—might be just the ticket to set CB's national ball to rolling.

In such a loose confederation, each local

[*Continued on page* 113]

# HI-FI TODAY

By John Milder

## Wickets & thickets & things
## Twirling tweeter is thweeter?

THE subject of amplifier power ratings always has been a sticky wicket in the hi-fi thicket. Reason is, there's more than one way to measure the output power of an amplifier and we just don't have complete agreement on how it should be done.

Most conservative approach is to measure the amount of continuous (rms) power an amplifier can supply for a given bandwidth and a specified percentage of distortion. But another way (and one approved by the Institute of High Fidelity) is to measure music power—the amount of short-term power the output stage(s) of an amplifier can deliver for demanding musical material which, generally, will be a minimum of 20% above the rms figure. And then, of course, there is the split-second peak power an amplifier can put out—which is exactly twice the rms figure.

Newest addition to the power powwow stems from the transistor. Thing is, transformerless transistor output stages deliver different amounts of power into different speaker impedances—more power as impedance goes down, less as it goes up. Most manufacturers rate their solid-state units for the 8-ohm speakers that predominate on the market, though some also give figures for 16- and 4-ohm speakers. Others may present a figure with little or no indication of how it may be affected by different loads.

But what's bothering me is that some reputable manufacturers (including Fisher and Scott) have just begun to advertise a stereo music-power figure based on a 4-ohm speaker impedance. All things being equal, this gives an output roughly 20% above that at the 8-ohm tap. In other words, a 10-rms-watt-per-channel unit checks in with 30 watts stereo music power or 50 watts peak power!

Whatever excuse there may be for advertising the highest figure obtainable under usual operating conditions, I don't see the point of giving a figure that can be reached only with three speakers I know of. In fact, to give some connection with reality, I strongly favor making 8 ohms the standard for all power measurements.

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**First annual** Hi-Fi Today award for sheer novelty hereby is given to the new line of Circle-O-Phonic speakers. For hidden inside the Circle-O-Phonic cabinets is a motor (see our photo) that rotates the system's tweeter—and in some models a mid-range speaker as well—to provide what the manufacturer calls 360-degree sound.

Though omnidirectionality is much desired at high frequencies, this is the most far-out approach to the problem I yet have seen. The sound that results has what might be called a super preponderance of presence but the idea merits a careful listen just the same.

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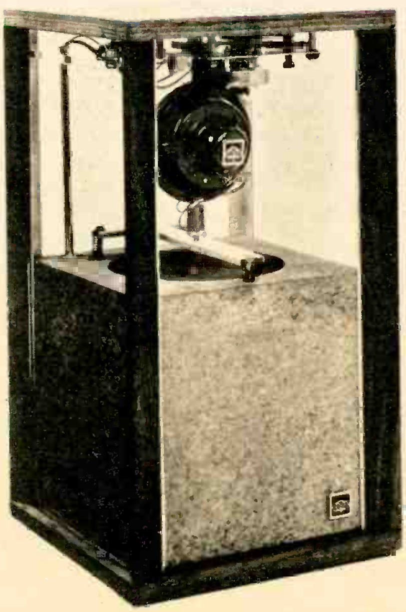
**Another** unorthodox item I've come across is the tape guide Uher is supplying on its Model 9000 stereo recorder. Instead of ma-

[*Continued on page* 116]



Cutaway view of new Circle-O-Phonic speaker system reveals motor-driven mid/hi speaker above woofer (in infinite-baffle). Mid/hi unit rotates at approximately 50 rpm.

# ALL-CONTINENTS AWARD FOR HAMS & SWLs!

ELECTRONICS ILLUSTRATED DX CLUB

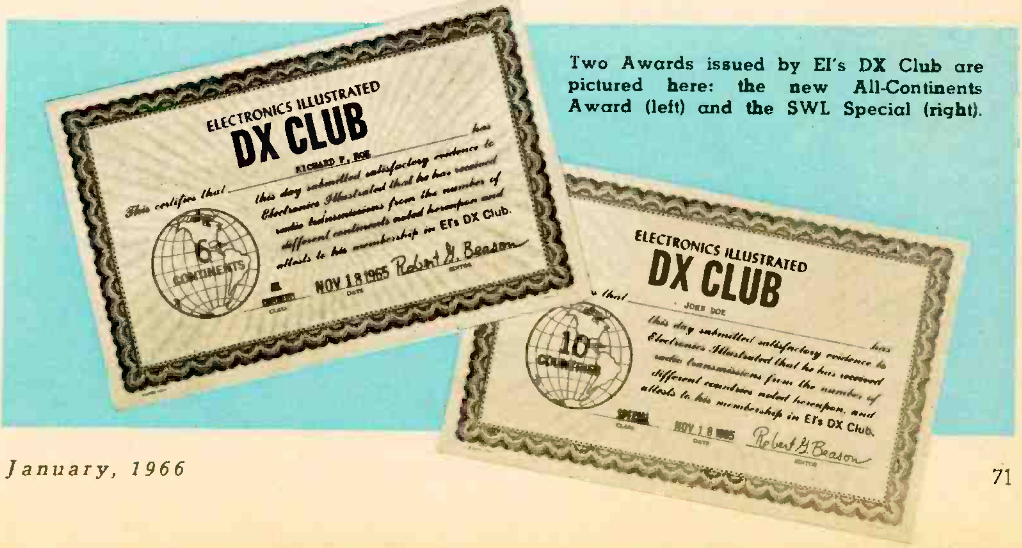
HAMS and SWLs now can set their sights on a brand-new All-Continents Award, latest in the highly coveted series of certificates issued by EI's DX Club. The new award can be earned by hams who possess documented proof of having conducted two-way communications with stations on all six continents and, similarly, by SWLs who can verify having received transmissions from stations on all continents. For the purposes of this award, the continents are North America, South America, Europe, Asia, Africa and Australia.

Announcement of this new award also signals the opening of the DX Club's fifth annual Award Period. As readers who have followed the club's activities know, awards are issued only during the time when a specific Award Period is open. The Fifth Award Period now is open and will continue through April 30, 1966. All applications for awards must be submitted during the Award Period. *Applications postmarked later than midnight April 30 will be rejected.*

For those who are not familiar with the club, our chart on the following page lists the various classes of awards which currently are issued. Note that SWLs may apply for all of the awards while hams may apply for all but the Broadcast Band and the BCB Stateside Special. Frequency limitations explain why hams are not eligible for these two certificates since both are limited to stations operating on the broadcast band. An applicant may apply for as many awards as he is qualified for but he may not receive any award a second time.

**Regarding** frequency limitations, it is well to bear in mind that there are none whatsoever for any of the SWL awards, save the two mentioned above. Stations operating on long-wave, medium-wave or short-wave are equally acceptable for any SWL certificate with the obvious exception of the two BCB awards. Ham awards, on the other hand, *are* subject to real frequency limitations. Since hams can operate only on the various bands assigned them, communications obviously must take place on one or more of these bands—chiefly, 80, 40, 20, 15, 10, 6 and 2 meters.

In view of the fact that the bulk of the SWL awards are not subject to frequency limitations, the term SWL might be considered




Two Awards issued by EI's DX Club are pictured here: the new All-Continents Award (left) and the SWL Special (right).

FREE COUNTRIES LIST

EI's Official Countries List, first published in the March '65 issue, now has been updated to include all political changes that have occurred since. A copy may be obtained by sending a stamped, self-addressed, business-size (No. 10) envelope to Countries List, EI's DX Club, 67 West 44th St., New York, N.Y. 10036.

a misnomer. In actual fact, this type of award better might be termed a Listener's or DXer's Award since reception need not necessarily take place on the short-wave bands. As stated previously, stations transmitting on any frequency are acceptable for all but two of the SWL awards, which means that none of these awards necessarily is for the short-wave listener (SWL). However, because the term SWL is accepted to mean most any person engaging in the DXing hobby, the club has elected to use it. A better designation would be the *distant listener* or perhaps DXL.

Before applying for any award, a prospective applicant must possess documented evidence of having received transmissions from stations in the required number of countries, states or continents (in the case of the SWL) or of having conducted two-way communications with stations in the required number of countries or continents (in the case of the ham). Such evidence necessarily will be in the form of QSL cards or letters.

**Entry form** is the EI DX Club Official DX Log, which appears on the following pages. This log is designed to accommodate applications for all awards except the General 100 (DX Century). Applicants applying for this award require a supplemental log in order to list the additional 50 stations. They should either purchase a second copy of this issue of EI or get a photostat of the Official DX Log shown elsewhere in this issue.

Should this not be feasible, an exact duplicate of the Official DX Log may be prepared on white bond paper. However, it is imperative that the duplicate be of precisely the same dimensions as the official log. Because of changes in format, logs published in previous issues may not be used during this or any future Award Period.

All logs must be completed with a typewriter or ball-point pen and accuracy, neatness and completeness are of the utmost importance.

By accuracy, we mean that all information supplied must be correct. Date, time, frequency, station call, location and type of QSL for each entry must stand up to careful scrutiny if an application is to win an award.

By completeness, we mean that every blank for every entry must be completed in full. (This especially applies to the column headed *QSL*, where it is necessary to check either *card* or *letter* to indicate which form of verification you have in your possession.) Do not, incidentally, enclose your QSL cards or letters with your log. However, keep them on hand in the event that you are requested to submit one or all of them for inspection.

For those awards which require reception of, or two-way communications with, stations in a certain number of countries, applicants should refer to the Club's Official Countries List, which appeared in the March '65 EI.

After carefully double-checking your log for accuracy and completeness, place it in an envelope and mail it to

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

If your application is accepted, your attractive DX Award, suitable for framing, will reach you after processing.

## HANDY GUIDE TO EI'S DX AWARDS

| CLASS OF AWARD | TYPE OF AWARD SWL | HAM | FREQ. LIMITS | REQUIREMENTS |
|---|---|---|---|---|
| General 100 (DX Century) | X | X | None | Reception of or two-way communications with stations in at least 100 different countries. |
| General 50 | X | X | None | Reception of or two-way communications with stations in at least 50 different countries. |
| Special | X | X | None | Reception of or two-way communications with stations in at least 10 different countries. |
| BCB Stateside Special | X | | 535-1605 kc | Reception of stations in at least 25 different states or provinces. |
| Broadcast Band | X | | 535-1605 kc | Reception of stations in at least 15 different countries. |
| All-Continents | X | X | None | Reception of or two-way communications with stations on all six continents. |

ELECTRONICS ILLUSTRATED DX CLUB

# OFFICIAL DX LOG

**INSTRUCTIONS:** PRINT neatly or use typewriter—DO NOT WRITE! Under *Type of Award*, check SWL or HAM to designate type of Award you are applying for. Under *Class of Award* print class of Award you are applying for (see our chart on opposite page). In tabular listing below, be certain to complete all blanks for each entry. Under *Date*, use figures (such as 10-1-64); all log entries must be dated January 1, 1950 or later. Under *Time*, use local standard time and 24-hour clock (0000 to 2359 hours). Make up identical copy of this log for second 50 countries. Fifth Award Period ends April 30, 1966.

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

ADDRESS ........................................................................

CITY ........................................ STATE AND ZIP ........................................
(or country)

TYPE OF AWARD } ☐ SWL ☐ HAM CLASS OF AWARD ........................................ DATE ....................

| | DATE (local) | TIME (local) | FREQ. (kc) | STATION CALL | LOCATION (city & country) | QSL |
|---|---|---|---|---|---|---|
| 1 | | | | | | card ☐ letter ☐ |
| 2 | | | | | | card ☐ letter ☐ |
| 3 | | | | | | card ☐ letter ☐ |
| 4 | | | | | | card ☐ letter ☐ |
| 5 | | | | | | card ☐ letter ☐ |
| 6 | | | | | | card ☐ letter ☐ |
| 7 | | | | | | card ☐ letter ☐ |
| 8 | | | | | | card ☐ letter ☐ |
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| 20 | | | | | | card ☐ letter ☐ |
| 21 | | | | | | card ☐ letter ☐ |

| | DATE (local) | TIME (local) | FREQ. (kc) | STATION CALL | LOCATION (city & country) | QSL |
|---|---|---|---|---|---|---|
| 22 | | | | | | card ☐ letter ☐ |
| 23 | | | | | | card ☐ letter ☐ |
| 24 | | | | | | card ☐ letter ☐ |
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| 26 | | | | | | card ☐ letter ☐ |
| 27 | | | | | | card ☐ letter ☐ |
| 28 | | | | | | card ☐ letter ☐ |
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| 46 | | | | | | card ☐ letter ☐ |
| 47 | | | | | | card ☐ letter ☐ |
| 48 | | | | | | card ☐ letter ☐ |
| 49 | | | | | | card ☐ letter ☐ |
| 50 | | | | | | card ☐ letter ☐ |

# the ABCs of RADIO

**By JOHN T. FRYE, W9EGV**

## PART 3: TRAPPING THE SIGNAL

A GOOD trapper studies the habits of the varment he's after before he sets out to ensnare the creature. By the same token, before we try to grab a radio signal out of the air we should do a little studying to insure that we have a clear picture of precisely what that signal is doing when it zips past our receiving station.

An RF signal, say one from a broadcast station operating on 1000 kc, will be zooming along at 186,000 miles per second. Further, its traveling fields *as viewed from a stationary position* will seem to be alternating back and forth through a million complete cycles every second as the signal sweeps past. Let's use our imagination to try to understand how this invisible, fast-as-lightning signal appears to an antenna that's about to intercept it.

Imagine we've erected a kind of screen perpendicular to the direction the radio signal is traveling. Imagine, too, that while this screen doesn't hinder the passage of the wave, it does possess the rare property of making the arrested magnetic and electric fields visible to the eye. The electric field shows up on the screen as parallel lines of colored arrows. The way the arrows point indicates the instantaneous polarity of the field and their brilliance its strength. Similar rows of arrows (but at right angles) portray the magnetic field. These arrows point the way a compass needle would be made to point at that instant by the field, and their brilliance is representative of the strength of the magnetic flux. Since the broadcast signal is vertically polarized, the arrows representing the electric field are vertical while the ones representing the magnetic field are horizontal. Finally, suppose we put a slow-motion hex on the radio wave and brake it down so all its motions are only 1/1,000,000th as fast as before. Wild, huh?

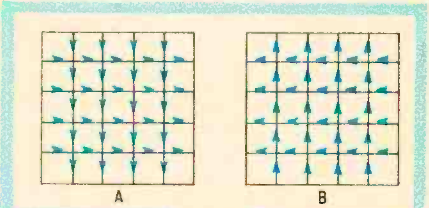


Fig. 3-1

When we first glance at the screen from the back side—the one away from the transmitter—suppose both groups of arrows are starting to glow very dimly. Remember: electric-field arrows point to the right; magnetic field ones, down. The arrows brighten until they reach a maximum brilliance a quarter of a second later (see Fig. 3-1A). Then the equally-bright sets of arrows start to dim, and they disappear entirely at the end of another quarter-second. They reappear a split-second later with a new look: now the dim electric-field arrows point to the left and the magnetic-field ones point up. During the remaining half-second, the lines increase their brilliance to a maximum (Fig. 3-1B), die away to extinction and immediately reappear with the arrows pointing the way they did in the beginning.

Our sifted-out fields have gone through complete in-phase cycles of waxing-waning-reversing-waxing-waning power while the puttering carrier slid 980 feet of its continuous length through the screen. That 980 feet, by the way, is the distance at this frequency from any point on one wave to the identical point on a succeeding wave—in short, a *wavelength*.

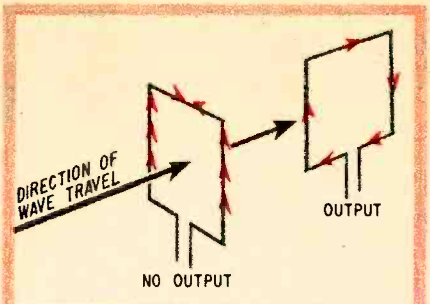


Fig. 3-2

Now suppose we have a vertical wire right in the center of our screen and that we remove the hex from the wave so that it returns to its blinding speed in all its movements. As each wave of the carrier sweeps past this wire, the pulsing, reversing electric field will drive the electrons first to one end of the wire and then to the other. Since movement of electrons is what constitutes a current, we'll have an alternating current in the wire that goes through one complete cycle for every wave that sweeps past. Our carrier, you'll recall, has a frequency of 1,000,000 cps. Therefore, fully 1 million waves will whoosh past in a second, and the frequency of the current generated in the wire by their passage also will be 1,000,000 cps—exactly the same frequency as the RF current in the transmitting antenna radiating the carrier.

Ordinarily, the magnetic and electric field work together to drive the electrons first one way and then the other. However, it's interesting to see that even if the antenna is enclosed in a wire cage that short-circuits the electric field—this actually is done with some loop antennas—the magnetic field alone can set currents oscillating in the wire. You remember—or should—that when a conductor is cut by a moving line of magnetic force a current is produced in the wire whose direction depends on the direction the line of force is moving through space with respect to the wire *and the direction the force is exerted along the line*. While the magnetic field continues to move in only one direction—away from the transmitter—the force-direction of that field reverses with the passage of each half-wavelength of the carrier. Consequently, the effect of our unaided waxing-waning-reversing magnetic field is to produce an oscillating current in our receiving antenna just as did the electric field or both fields acting in unison.

Speaking of loop antennas, they usually consist of several turns of wire wound either in a large-diameter loop or a small-diameter helix on a ferrite core. Since voltages induced in each turn of such a loop effectively are added (the output from each turn is added to that from the next, much in the same manner as the voltages from a group of cells connected in series), we need only to consider a single turn, such as that shown in Fig. 3-2, to study loop-antenna action. When the radio wave is traveling at right angles to the plane of the loop, it reaches both vertical sides of the loop at the same instant. Fields of the wave produce identical currents in both sides that move up or down simultaneously.

The two completely out-of-phase currents—one is trying to go around the loop in one direction while the other is trying to go around in the opposite direction—buck and cancel each other's movements like two matched billy goats trying to pass through the same narrow gate from opposite directions at the same moment. Neither billy goat is going to allow the other to pass, and the same thing is true of our two equal but opposing currents. There clearly can be no output current from the loop under these conditions.

Let the plane of the loop be parallel to the direction of wave travel, how-

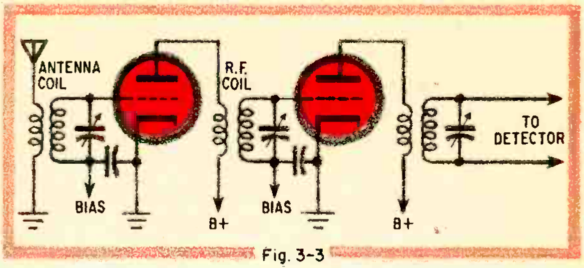


Fig. 3-3

ever, and the wave will strike one vertical side *before* it does the other. Result is that up-and-down currents in the near side get a little jump on similar currents produced in the far side by the passage of the same portions of the wave. The difference in timing prevents complete current cancellation, so we will have a 1000-kc alternating current going back and forth through the turns of the loop. Now you know why loop antennas are directional!

The signal radiated by a transmitting antenna can be compared to light from a point-source illuminating uniformly the interior of an expanding sphere. The larger the sphere grows, the less light there is per square foot of surface. Keeping in mind that any receiving antenna has a limited *capture area* from which it can extract any signal that may be present, you see why a powerful transmitted signal can produce only a few millionths of a volt across the input terminals of a receiver a hundred or so miles away. We must operate on this signal to remove the modulation, but first the patient must be built up so we'll have something substantial enough to operate on. And there is another thing: our 1000-kc signal is only one of hundreds of signals of different frequencies sweeping past our antenna and producing alternating currents in it. We, therefore, must have some way of zeroing in on the signal we want and by-passing all others.

Fortunately, both of these operations—amplifying and selecting—can be combined in a single circuit such as the one shown in Fig. 3-3. This is a skeleton diagram of two *cascaded stages of tuned-radio-frequency amplification.* The two tube circuits are identical, except that the input for the first is from the antenna and the input for the second is from the plate circuit of the first. RF currents in the antenna circuit induce similar currents in the secondary of the antenna coil (actually a transformer). This secondary is tuned to 1000 kc in the circuit in our illustration, and synchronized nudges from the induced currents keep much heavier currents oscillating back and forth through the coil. You might say the effect of the coil is very similar to what happens when someone pumps a swing. Pumping at precisely the right moment with every oscillation makes the swing go higher and higher.

Assuming we do have the right kind of pumping at exactly the right moments, our swing will continue to oscillate and even labored pumping at the wrong moments—pumping not timed to the natural pendulum frequency of the swing—will not produce as great an oscillation. By the same token, a signal on a different frequency, say, 1070 kc, will produce much weaker currents in the coil and much less voltage across the tuning capacitor. But if we change the setting of the capacitor to resonate the secondary at 1070 kc, this signal will produce a much higher voltage and voltage from the 1000-kc signal will fall off. The *response curve* of a tuned circuit, such as that shown in Fig. 3-4, tells the story. The resonant frequency—in this case 1000 kc—applied to the circuit produces the greatest current. Raising or lowering the frequency of the applied signal makes the voltage fall off rapidly. This explains how a variable tuned circuit provides us with a means of favoring a signal on a particular frequency and discouraging other signals on different frequencies.

RF voltage produced by the signal across the secondary of the antenna transformer is applied to the grid of the first amplifier tube. We know from

Part I that this AC grid voltage will produce synchronized variations in the plate current flowing through the primary of the RF transformer and induce RF currents in the tuned secondary that are Big-Brother versions of the signal currents in the antenna. The whole process simply is repeated in the second amplifier tube and the second RF transformer (commonly known as an RF coil).

As a signal goes through successive tuned circuit resonated to the same frequency, more and more rejection is applied to signals removed from that frequency. A little thought shows why. Suppose our wanted, 1000-kc signal and our unwanted, 1070-kc signal are of precisely the same strength. In the first tuned circuit, the 1070-kc signal can produce only half the current that the 1000-kc signal can. Entering the second tuned circuit, the 1070-kc signal already is down some 50 per cent and here it finds itself subjected to another 50 per-cent reduction. It therefore will leave the second with only a quarter of the strength of the undiminished 1000-kc signal. Skirts of the response curve of Fig. 3-4 grow narrower and steeper as the signal passes through successive tuned circuits.

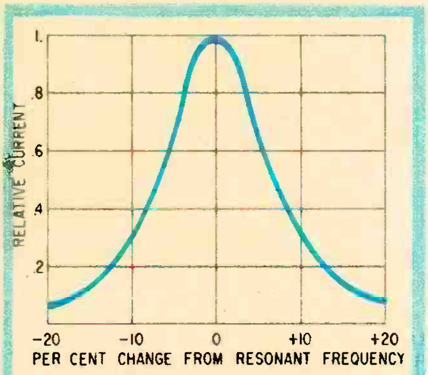


Fig. 3-4

By the time the signal reaches the detector stage it has passed through three tuned circuits and has been stepped up in strength by three transformers and the amplifying action of two vacuum tubes. A signal of microvolt-strength in the antenna has grown until its amplitude can be measured in volts. At the same time, all other signals present in the antenna have been filtered out.

That's the way a radio front-end looked until the early 1930s. Then a better way of selecting and amplifying a radio signal became popular, and the circuit for this improved front-end remains unsurpassed in this day. To be sure, the older, less talented circuit—called a tuned radio frequency or TRF for short—occasionally is used in inexpensive receivers where its poor sensitivity and selectivity are accepted solely to keep costs down. But the circuit's shortcomings are so numerous that it long ago took back seat to a more sophisticated arrangement developed by the great Edwin H. Armstrong during the first World War. So superior is its performance to that of any other circuit yet devised that it now almost universally is used in all receivers of any kind.

**NEXT ISSUE: THE SUPERHETERODYNE**

# THE HAM SHACK

BY ROBERT HERTZBERG W2DJJ

**KEEPING POSTED** . . . "What's an FM broadcast receiver doing on your operating table?" That's the question visitor after visitor to our shack has posed, with the result that we now are thinking of taping our answer. But for the record, it always runs something like this: "The set furnishes news and weather reports, frequent time checks and pleasant background music while we're adding, removing or shifting ham gear."

Fact of the matter is, a BC set of any kind can keep an operator informed of local events that might concern him. We know of one chap, an active member of RACES and CD groups, who missed out completely on an exciting hunt for a boy who had wandered into the woods from a summer camp. Seems this OM intently was working 15 and 20 meters at the very time the search parties were busy on 2 meters mobile. Thing is, if he'd caught only one of the many bulletins flashed by the broadcast stations in the area he could have gotten into the act himself.

**Space Man** . . . Hams and ex-hams turn up in so many high places that we weren't surprised to learn of yet another incidence. Seems the man responsible for the sensational spacecraft pictures of Mars is a former member of the fraternity. He is Dr. William H. Pickering, director of the California Institute of Technology's Space Propulsion Laboratory in Pasadena, Calif.

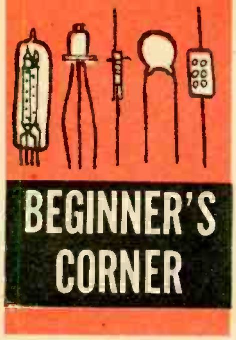
An active brass-pounder of an early age, Dr. Pickering spent his boyhood in Wellington, New Zealand, where he was born in 1910. The technical experience he acquired in this period stood him in good stead when he was steered into Cal Tech in the 20s by an American uncle. We understand he's been a U.S. citizen himself since 1944.

**False Economy** . . . Why do some hams spend thousands of bucks on a kilowatt station and then fail to spend only five more for a Call Book? The answer escapes us, for to our way of thinking it plain doesn't make sense. As it happens, most of these same characters also seem to be ardent QSL collectors. But the next time one of them asks us to spell out our name and address we just may reply, "Sorry, old man, your signal dropped into the soup during that last transmission. 73 for now."

**USB vs. LSB** . . . When several signals on the high end of 20 meters just wouldn't clear up, in spite of the most careful tuning, we were resigned to digging into the chassis for the cause of the trouble. Then came a flash of inspiration. We turned the mode selector from USB to LSB and the monkey chatter

[*Continued on page* 116]

Heathkit GR-21 FM set (top left) seems strangely out of keeping with W2DJJ's Collins SSB gear, and outsiders often question its place in a ham shack. Explanation is it enables W2DJJ to keep in touch with what's what on the local scene whenever he's not on the air.




# LIP FLOP FLIP FLOP FLIP FLOP FLIP FLOP FLI

TAKE two transistors, add a half dozen or so standard parts and you have what's called a flip-flop—the building block of computers. On a more down-to-earth level, flip-flops are used to lock your TV picture in with the signal from the transmitter. To see how one works, we're going to build a flip-flop audio generator and light flasher.

The first flip-flop we'll talk about is called an astable (not stable—it operates continuously after power is applied) or free-running multivibrator. Basically it is an electronic see-saw in which two transistors work like a pair of switches—when one is closed or on, the other is open, or off. But before we discuss how our flip-flop works, let's review a few fundamentals of transistor operation.

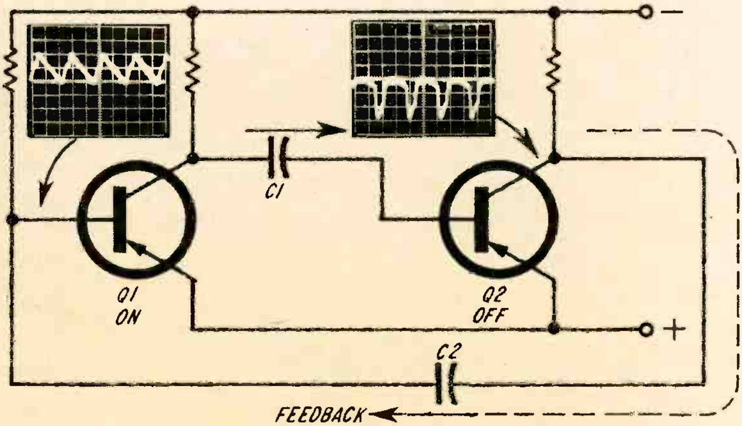
The first is that a negative signal on the base of an NPN transistor becomes a positive signal at the collector. A positive signal on the base becomes a negative signal at the collector. An NPN negative signal applied to the base of a PNP transistor turns it on and a positive input signal turns it off.

Take a look at Fig. 1, a simplified schematic of a flip-flop along with oscilloscope photos of signals. When you connect the battery a negative transient signal appears on the base of Q1. Q1 is now turned on and it sends a positive signal to the base of Q2. This turns Q2 off. And as this happens, Q2 sends a negative signal through C2 back to the base of Q1. Everything is reinforced, that is, Q1 is driven further into conduction and Q2 is driven further off. When Q1 is fully on, the voltage at its collector is a steady negative DC. All this happens very quickly, then the action of the circuit comes to an abrupt halt.

Things don't stay off for long. Eventually, C1 and C2 come into action again. Remember, capacitors C1 and C2 block DC but will pass a rapidly-changing signal. Such a signal exists when Q1 and Q2 are turning on or off. However, C1 and C2 have been charged by the voltage at the collectors of Q1 and Q2. After Q1 and Q2 have switched, C1 and C2 begin to discharge and reverse the on-off state of Q1 and Q2.

Consider C2. After Q2 is completely off, C2 begins to discharge and the positive charge, or voltage, on its left plate is applied to the base of Q1. This turns Q1 off which subsequently turns Q2 on. The circuit then goes through the same cycle again. Q1 and Q2 switch on and off at a frequency determined by the value of the components.

Fig. 1—Schematic of basic flip-flop (astable multivibrator). Pulses on base of Q1 (photo at left) are positive because they're from left plate of C2 when it discharges. Waveform at collector of Q2 is collector voltage. Flattened part near the horizontal axis is due to the saturation of Q2 when it is in the full-on condition.



Use large capacitors or increase resistance in the base circuit, and you'll reduce the speed.

**Build** the flip-flop on a piece of perforated circuit board or masonite as in Fig. 3. Note the values to use for R1, R3, C2 and C3 in the chart below the schematic in Fig. 2. When power is turned on, you should hear about a 400-cps tone. The tone sounds considerably fuller than that of a sine-wave oscillator because it is rich in harmonics.

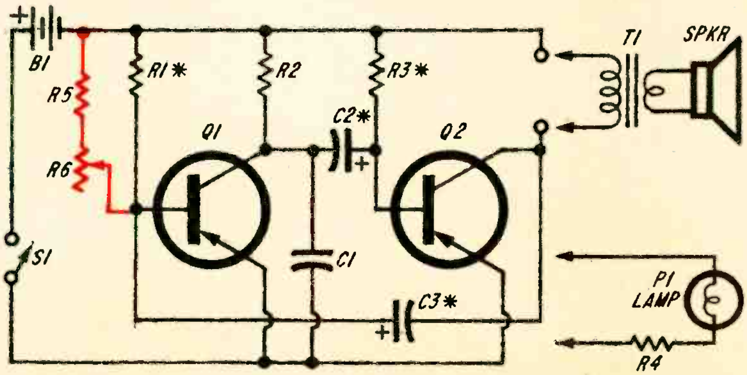
You can produce a lower or higher-frequency tone by installing a 1-megohm potentiometer (R6) in place of R1. Also install a 4,700-ohm resistor (R5) in series with R6 to limit Q1's collector current.

To convert the circuit to an electronic timer, just put a 30 μf electrolytic capacitor in parallel with C3 with the polarity shown. This, in conjunction with R6, slows down the speed to about a tick every 30 seconds.

To make a flasher, remove the speaker and connect the lamp (P1) and R4 as shown in the schematic. (Also change components indicated in the chart in Fig. 2.) When power is applied, the bulb will flash on and off. To vary the speed, use a higher-value resistor for R1. (If R1's resistance is too low, the lamp

**PARTS LIST**

B1—9 V battery (Burgess 2U6 or equiv.)
C1—.1 μf, 200 V tubular capacitor
C2—.02 μf tubular capacitor or 10 μf, 15 V electrolytic capacitor (see chart)
C3—.01 μf tubular capacitor or 30 μf, 15 V electrolytic capacitor (see chart)
P1—No. 49 pilot lamp (2 V, 60 ma) and holder
Q1, Q2—2N408 transistor
Resistors: ½ watt, 10% unless otherwise indicated
R1—270,000 ohms or 10,000 ohms (see chart)
R2—10,000 ohms
R3—150,000 ohms or 10,000 ohms (see chart)
R4—100 ohms, 1 watt
R5—4,700 ohms (see text)
R6—1 megohm potentiometer (see text)
S1—SPST toggle or slide switch
SPKR—3.2-ohm speaker
T1—Output transformer, primary: 2,000 ohms; secondary: 3.2 ohms (Lafayette 33 R 3701 or equiv.)
Misc.—No. 14 tinned copper wire, perforated phenolic board (7 x 4 in.) flea clips, alligator clip

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| OPERATION | R1 | R3 | C2 | C3 |
|---|---|---|---|---|
| SPEAKER | 270K | 150K | .02μf | .01μf |
| LAMP | 10K | 10K | 10μf | 30μf |

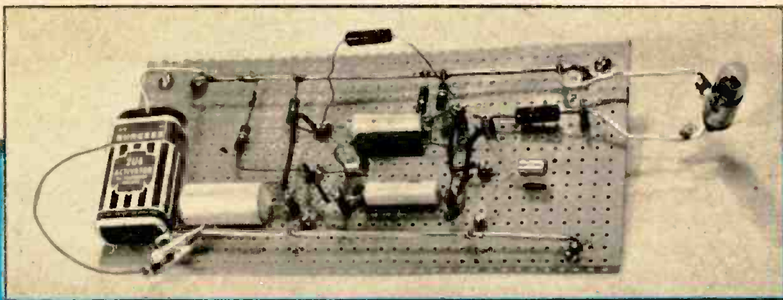
Fig. 2—Schematic of flip-flop audio generator or light flasher. Values of starred parts depend on whether circuit is to be flasher or audio generator. To vary audio frequency, install R5, R6 instead of R1. R5 limits Q1's current when all of R6's resistance is out of circuit.

will remain on since its filament cannot cool off between flashes.)

**Monostable Multivibrator.** Another important flip-flop is the monostable. When a pulse is applied to the circuit Q1 and Q2 go through one on-off cycle then just sit there waiting for another pulse. The monostable responds to nearly any triggering signal and is valuable where such signals may differ in strength or duration.

You can observe this type operation with the lamp circuit and with C3 removed. Removing C3 opens the closed feedback loop between Q1 and Q2 and prevents continuous operation. When power is applied to the circuit, the lamp should remain on. Now disconnect the end of R1 that goes to the negative power buss. Tap the free lead of R1 against the negative power buss to apply a triggering signal to Q1. You'll see that no matter how you tap the resistor lead—for a long or short time period—the lamp goes from on, to off, to on again. And it repeats this in a manner relatively independent of how you apply the trigger signal.

*—H. B. Morris*



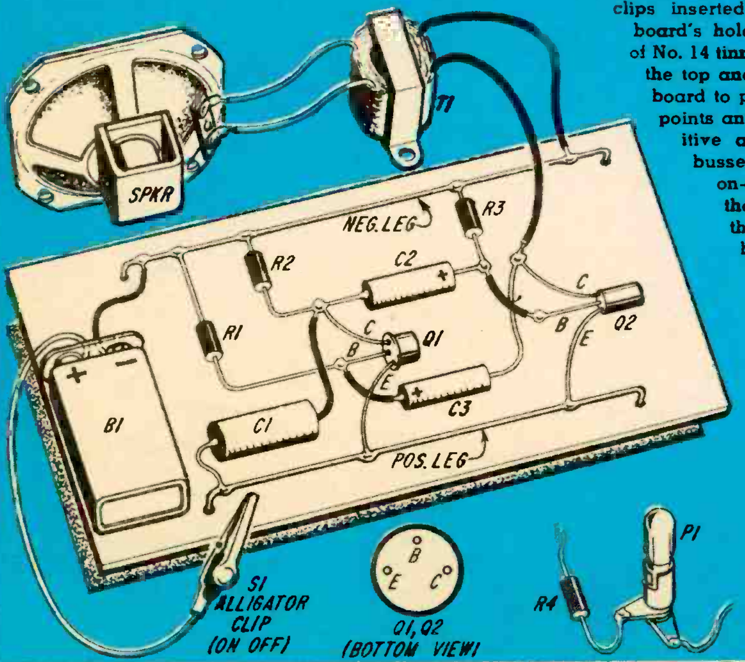
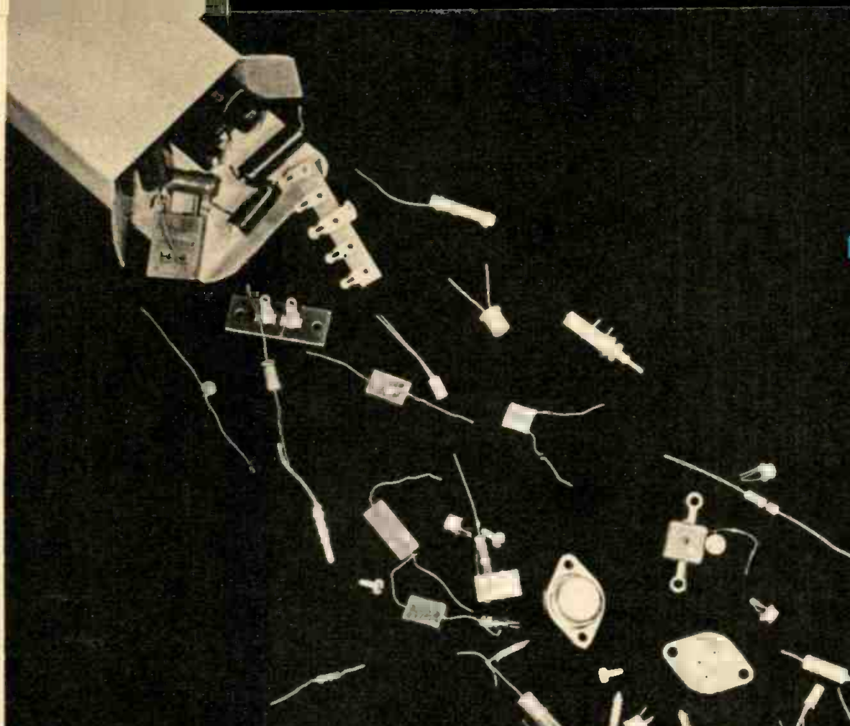
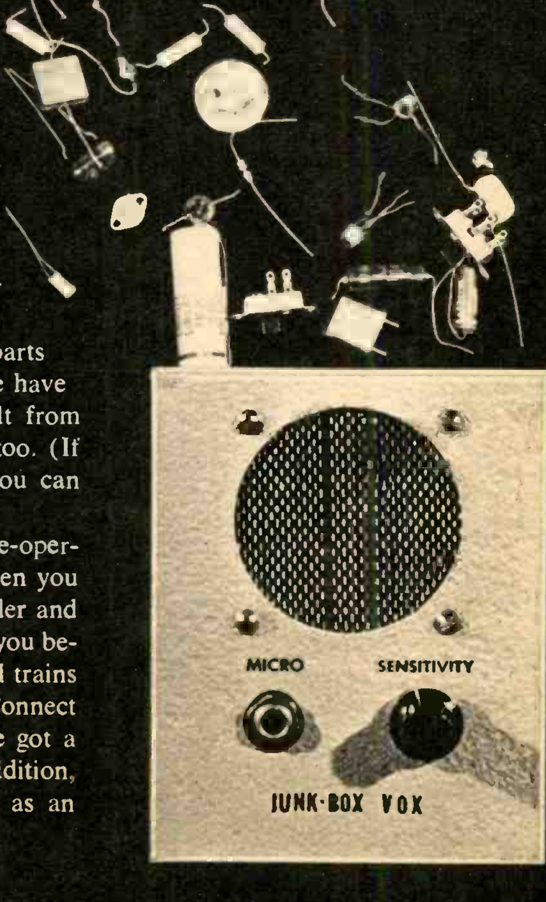



Fig. 3—Parts can be soldered to flea clips inserted into the perforated board's holes. Install two pieces of No. 14 tinned copper wire along the top and bottom edges of the board to provide convenient tie points and to serve as the positive and negative voltage busses. We didn't use an on-off switch. Simply clip the positive lead from the battery to the lower buss to apply power.



# JUNK BOX VOX

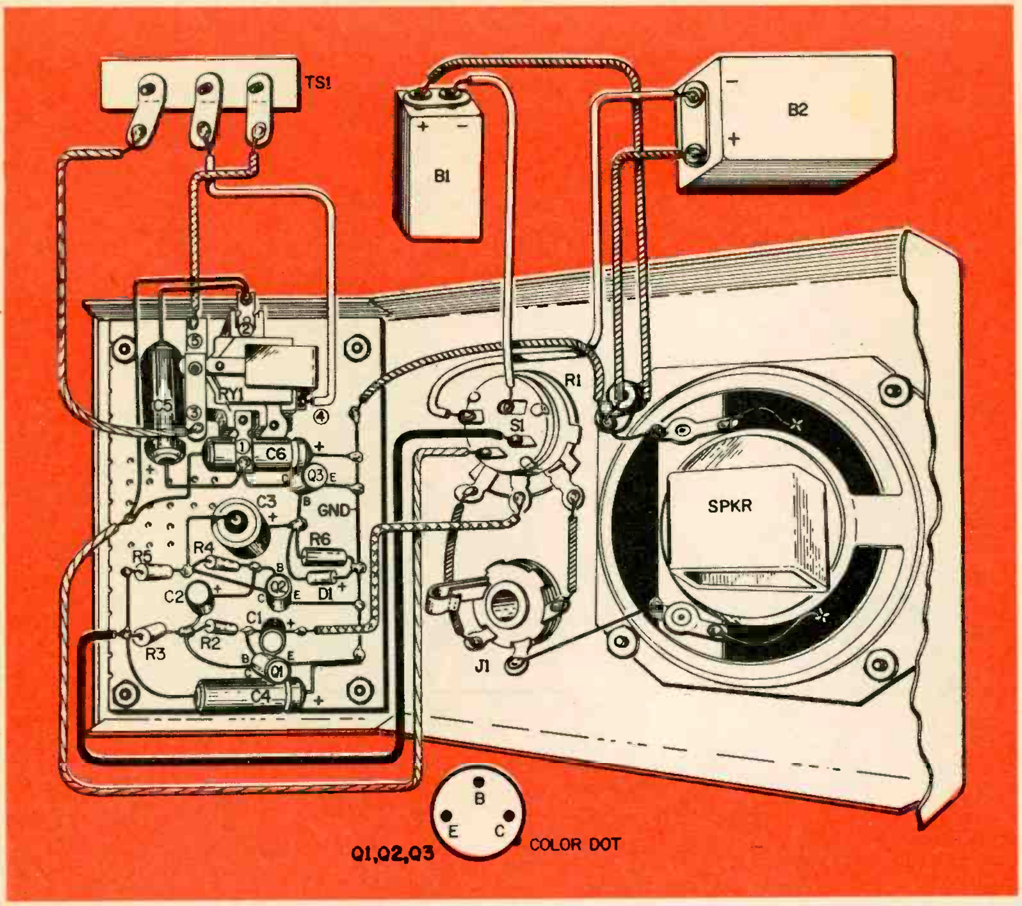
By
AL TOLER




MOST every electronics experimenter has the proverbial well-stocked junk box which is supposed to contain enough parts to build practically anything. But like old Mother Hubbard's cupboard, the box always seems to be bare when you start looking for specific components for a project.

We aren't about to give you a list of parts to purchase to fill a junk box. Instead, we have a project that we guarantee can be built from almost anything—and it's mighty useful, too. (If you don't happen to have a junk box you can buy the parts new for about $10.)

Called the Junk-Box Vox, it's a voice-operated relay that turns devices on or off when you start speaking. Connect it to a tape recorder and the machine will start automatically when you begin dictating. Or you can use it with model trains to start or stop them when you speak. Connect it to a ham or CB transmitter and you've got a voice-actuated push-to-talk switch. In addition, the vox can be used as a baby sitter or as an




# JUNK BOX VOX

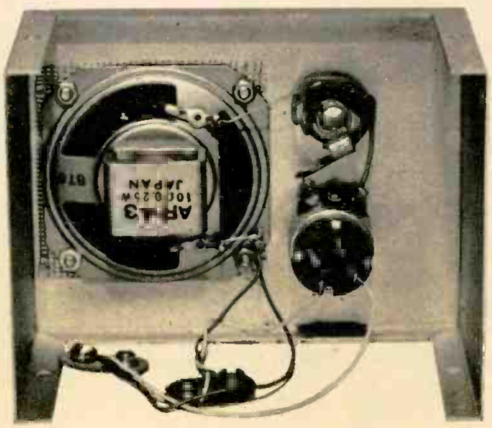
intruder alarm.

The vox's sensitivity can be made so high it will trip when a doorknob is turned. The circuit shown in fig. 4 is for the intruder alarm/baby-sitter version. The only difference between this model and a basic vox is the cabinet-mounted speaker.

If the vox has an external speaker-mike, a sound input will trip relay RY1, which will release one-half to two seconds after the sound ceases. When the speaker is mounted in the same cabinet, the click RY1 makes as it opens will be picked up by the speaker. This may cause RY1 to trip again and again until power is turned off. A bulb or buzzer and battery connected to the vox will blink or buzz until power is turned off. Set up in a child's room, a cough, cry or fall out of bed will set the alarm into continuous operation. Placed in the basement or a backroom, the vox will sound off when someone enters.

Fig. 1—Before mounting perforated-board subassembly, install the speaker, R1 and J1 on 4 x 5-in. side of main section of Minibox. Put spacers under the board to keep it away from the cabinet.

Fig. 2—Cabinet before installation of board. Connect wire from ground buss on circuit board to solder lug on one of speaker's mounting screws.



**Construction.** The unit shown is built in a 3x4x5-in. Minibox. The amplifier/relay circuit is built as a subassembly on a 2⅜x 3½-in. piece of perforated board. Flea clips are used for tie points. Parts layout isn't critical.

Transistors Q1, Q2 and Q3 can be a general-purpose type such as the RCA 2N217. Even the three-for-a-buck variety transistors will do. For super-sensitivity use high-gain 2N2613 transistors. With 2N217s the vox will be tripped by a moderate-level voice two feet from the speaker-mike. With 2N2613s a whisper will trip the vox at four feet. Intermediate sensitivity can be obtained using general-purpose transistors and a 500-ohm to 3.2-ohm output transformer (T2 in the Parts List) connected between the speaker-mike and sensitivity control R1.

Resistors can be up to double the specified values. Except for C3, capacitors can range in value from half to twice the values listed. However, C3's value is somewhat critical as it partially determines RY1's hold-in time. The specified value of 100 μf will hold RY1 in for full sentences with a loud voice two feet from the speaker-mike. For a longer hold-in time, or for lower input levels, C1 should be increased to 200 μf to 500 μf (with high-gain transistors 100 μf is generally adequate). For a shorter hold-in time, say, complete words or syllables, C4's value should be reduced.

Any SPDT relay can be used as long as its coil resistance is from 150 to 400 ohms and the pull-in current is 10 to 20 ma. Two

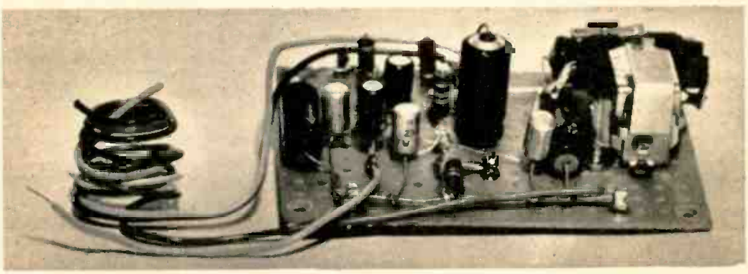


Fig. 4—To increase the gain without adding another transistor, connect a 500 to 3.2-ohm transformer between J1 and R1. The 500-ohm winding goes to R1.

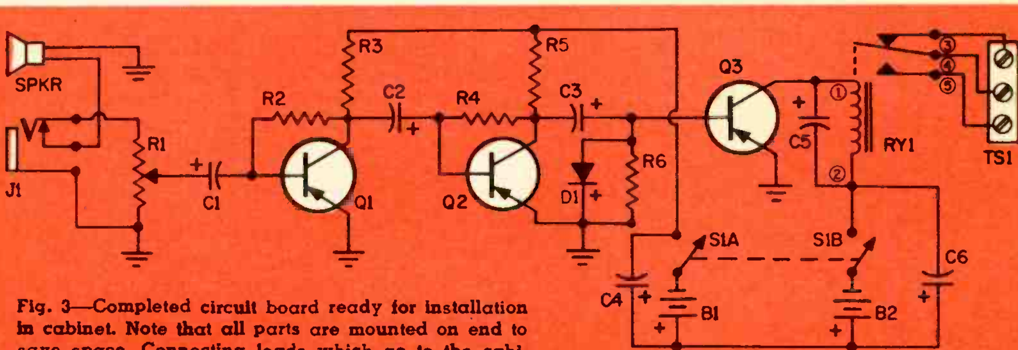



Fig. 3—Completed circuit board ready for installation in cabinet. Note that all parts are mounted on end to save space. Connecting leads which go to the cabinet-mounted components should be soldered to the circuit board before installing board in the cabinet.

**PARTS LIST**

B1—9 V battery (Eveready 2U6 or equiv.)
B2—9 V battery (Eveready 246 or equiv.)
Capacitors: 15 V electrolytic unless otherwise indicated
C1,C2—10 μf, 6 V
C3—100 μf (see text)
C4,C6—50 μf
C5—100 μf
D1—1N34A diode
J1—Closed-circuit phone jack
Q1,Q2,Q3—2N217 or 2N2613 transistor (see text)
Resistors: ½ watt, 10% unless otherwise indicated
R1—5,000 ohm, audio taper potentiometer
R2—33,000 ohms
R3—4,700 ohms
R4—180,000 ohms
R5—10,000 ohms
R6—22,000 ohms
RY1—SPDT relay, 250-335 ohm coil, Sigma 11F-250-G/SIL or Potter and Brumfield RS5D
RY2—DPDT relay, 117 VAC coil (Potter and Brumfield KA11AY)
S1A,S1B—DPST switch on R1
S2—Normally-closed push-button switch
SPKR—8 ohm speaker
T1—Transistor output transformer, primary: 500 ohms, secondary: 3.2 ohms (Lafayette 99 R 6123). See text
TS1,TS2—3-lug screw type terminal strip (Cinch-Jones 17-3 or equiv.)
Misc.—perforated board, flea clips, 3x4x5-in. Minibox, knob, battery connectors.

Fig. 5—To use the vox to control a tape recorder (left), connect RY1's normally-open contacts in series with motor. To switch a CB or ham transmitter (right), connect the normally-open contacts in parallel with the PTT switch in transmitter.

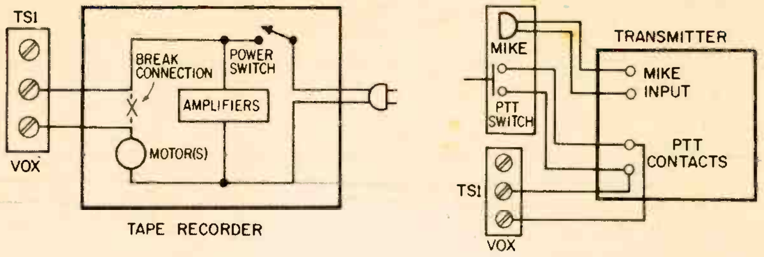
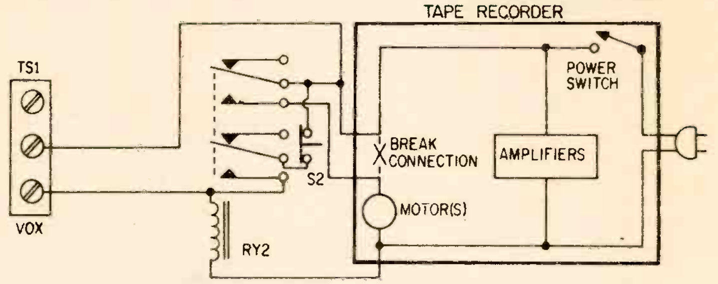



Fig. 6—To obtain continuous operation of recorder after vox is tripped, another relay, RY2, must be used. Recorder is restored to normally-off by pressing S2, a normally-closed push-button switch. Relay RY2 is a 117 VAC DPDT type.




# JUNK BOX VOX

batteries *must* be used. Battery B1, which powers Q1 and Q2, can be an ordinary transistor-radio battery. B2 must be no smaller than an Eveready No. 246 or equivalent.

**Using The Vox.** The vox will not work with a crystal or dynamic microphone. You must use a speaker. Reason is Q1's low input impedance will load any other microphone and reduce its output. Because RY1 closes as soon as power is applied (it opens a second later), don't hook the vox to the equipment to be controlled until the vox is turned on or the power-on pulse will trip the controlled equipment.

There are two ways to control a tape recorder. The first method starts and stops the recorder's motor (or the capstan motor if the machine has more than one motor) in step with the input signal. When a sentence is complete, the motor stops. Fig. 5 shows how it's done. Trace the leads which go to the capstan motor and open one lead. Then connect the opened leads to RY1's normally-open contacts. The only difficulty with this method is that a time delay of a second or so needed to allow the motor to come up to speed. It is best to activate the vox by clearing your throat first to allow the motor to get up to speed.

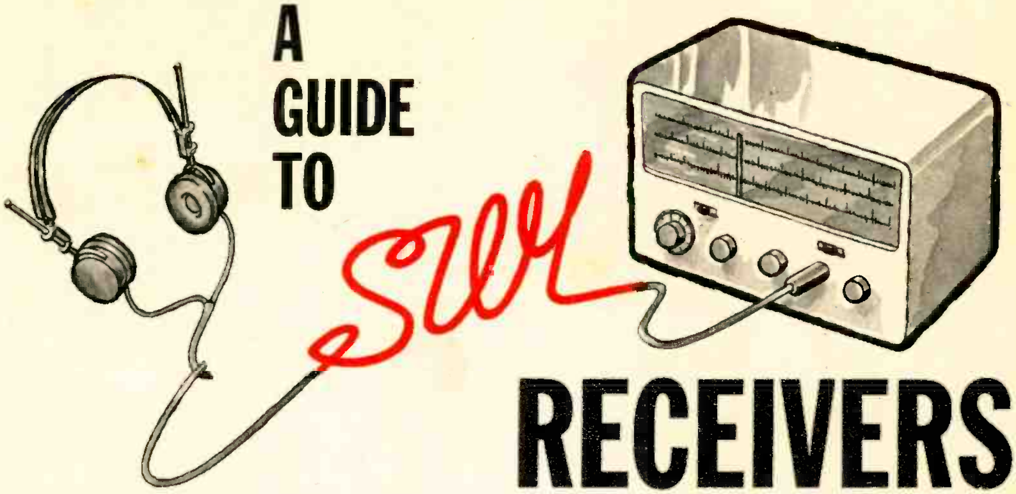
The second method gives continuous operation once the vox is tripped. Open the motor leads but now connect the relay circuit shown in Fig. 6. When RY1 closes, power is applied to relay RY2. One set of RY2's contacts starts the motor and the second set of contacts applies a holding voltage to RY2's coil to keep it closed after the vox releases. The recorder is stopped by pushing S2.

To use the vox to control a CB transceiver or ham transmitter, connect RY1's normally-open contacts across the rig's push-to-talk leads as shown in Fig. 5. Place the vox's speaker-mike alongside your regular mike and adjust R1 so RY1 holds in for complete sentences.

In the intruder-alarm version, rotate R1 just enough to turn power on, then slowly turn R1 fully clockwise. The slightest vibration to the cabinet or even a footstep will be enough to trip the vox.

If the vox fails to trip, check Q1's collector voltage; it should be 4 to 6 volts with respect to ground. If it isn't, select a value for R2 which produces 4-6 volts. Similarly, try other values for R4 to get 3 to 5 volts at Q2's collector.

# A GUIDE TO SWL RECEIVERS



By **HERB FRIEDMAN, W2ZLF** SOONER or later most electronic hobbyists are bitten by the short-wave-listening bug. Transmissions from rescuers at sea, newly orbited satellites, even good old Radio Moscow provide front-row-center seats before a global stage. But where do you start in this quest to tune in on the world? What type of receiver do *you* need? More importantly, how much should you spend and precisely what will you be getting for your receiver dollar?

To begin, an SWL receiver is a *communications* receiver, not a table radio or a transistor radio with a short-wave band or two thrown in as a sales gimmick. The distinction is bold as TV's white charger. A table radio with added SW coverage can pick up a few of the more powerful stations—the Voice of America and the BBC, say. But a communications receiver is designed specifically to reach way down into the noise and snatch up the weakest of signals.

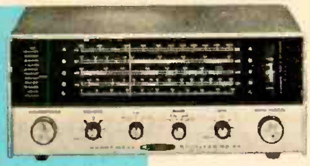
Thing is, communications receivers aren't alike. To be sure, they all do the same thing—receive radio signals. But how well they perform this task is spelled out by their sensitivity, selectivity, stability and a handful of other features. And it's qualities such as these that determine whether a receiver sells for \$40 or \$400.

Of course, there are short-wave receivers going for less than \$40. These are the so-called *regens* using regenerative or superregenerative circuits. And while quite sensitive, such receivers may suffer from excessively broad tuning and, therefore, can be subject to interference from stations far removed from the desired frequency. They also tend to be unstable, are prone to frequency drift and usually are not calibrated accurately. Normally supplied in kit form, regens may be all right for beginners but are not best for the serious SWL in view of the fact that a superheterodyne communications receiver costs but a few bucks more.

**Sensitivity.** How well a signal is received (and whether it's received at all) is reflected in the *sensitivity* or signal-to-noise specification. All receivers generate internal noise and a received signal is subject to masking by this noise. A receiver's sensitivity ordinarily is expressed in microvolts ($\mu$v) and the usual standard of reference for sensitivity is 10db above internal noise. In other words, a given sensitivity rating indicates the amount of signal required at the antenna terminals to produce an output 10db above the internal noise *when added to the internal noise level itself.* Thus a typical receiver spec might read: Sensitivity = 2 $\mu$v for 10db S + N to N.

Keep in mind that sensitivity specs are meaningful only when referred to some reference—the usual reference being noise. A spec such as 0.3 $\mu$v sensitivity means nothing—0.3 referred to what? Does 0.3 mean a signal of this magnitude will be noise-free? Or does it mean that a 0.3-$\mu$v signal can be recognized as a signal rather than a noise—unintelligible but recognizable? Clearly, it is the sensitivity referred to noise that is meaningful.

Another point to remember, particularly if you intend to go for a set selling for more than \$150, is that an unqualified sensitivity spec doesn't tell you much about perform-



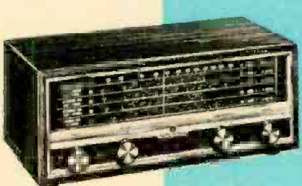
Heath GR-64

Knight Star Roamer

Lafayette HA-226

Knight R-55A

Lafayette HA-63



Hallicrafters S-200

ance at all frequencies. A manufacturer frequently will measure a receiver's sensitivity only on its hottest band, much as a novice musician makes like the virtuoso by repeatedly rendering the only tune he knows. Even so, quality receivers generally will be rated on all bands.

As a case in point, consider a budget-price receiver as opposed to one going for $200. The budget receiver often is no more than a short-wave version of a table radio with the antenna connected directly to the converter tube. While this arrangement in conjunction with other less-than-optimum designs will give fair performance up to about 13 mc, it will pull a fast fade above this general area. Matter of fact, above 20 mc or thereabouts it likely simply will sit and stare at you. But the $200 job will deliver good performance clear up to 30 mc (though even it may prove less able on the higher bands).

In general, good all-band sensitivity can be expected when an RF amplifier or preselector has been incorporated between antenna and converter. Since an RF stage can add from 6db to 12db (one to two S-units) of gain, it can mean the difference between hearing a signal and hearing nothing but noise. It also frequently determines whether the set will perform at all at frequencies above 20 mc.

**Selectivity and Images.** Selectivity is a receiver's ability to reject signals immediately adjacent to the desired signal. And it primarily is determined by the IF frequency in a single-conversion receiver or by the last IF section in a double- or triple-conversion receiver. Higher selectivity can be obtained in several ways: through low-frequency IF amplifiers such as 455 kc, 262 kc, 100 kc, 85 kc, etc.; multiple (cascaded) IF stages; crystal and mechanical filters, or Q-multipliers.

As a general rule, an indication of a receiver's selectivity can be found in the spec which gives the bandwidth 6db down the IF passband (for example, 6 kc at 6db—somewhat broad—or 500 cps at 6db—razor sharp). Important point here is that the narrower the passband, the greater the selectivity. And while the 6db bandwidth isn't the best of selectivity specs, it's the best we have. Reason is that few manufacturers state the passband at the 60db points, which is more representative of actual performance. A passband of, say, 5 kc at 60db down would indicate *real* selectivity.

In general, the higher a receiver's price, the greater its selectivity. Whereas a budget receiver might deliver only a single, strong station within 10 kc of a given frequency, a highly selective receiver might split the same 10 kc well enough to reveal both a strong station and a weak one. Explanation is that the relatively broad selectivity of a budget receiver tends to merge signals within a given frequency range. Its output will be either a jumble of signals or the strongest one alone.

Any superhet can deliver a so-called image, though its inclination to do so can be reduced substantially by good design. Images occur when a receiver's RF stage(s) passes signals which unluckily happen to be at twice the IF frequency above or below the desired signal.

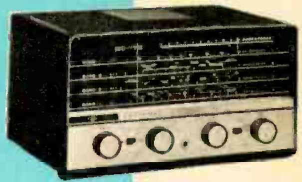
For example, assume a receiver with a 455-kc IF is tuned to a signal on 3540 kc. To produce the 455-kc IF, the local oscillator in the receiver must be set to 3995 kc (the difference frequency—the IF—is the difference between 3995 kc and 3540 kc, or 455 kc). But should a signal on 4450 kc also be coming through the front end, the local oscillator will beat against it as well. And since the difference again is 455 kc, this signal—the so-called image—also will be fed through the IF amplifier and will come out mixed with the desired one.

Only way to reduce images is to attenuate them at the front of the receiver. Once the image signal gets to the converter the IF amplifier cannot distinguish between the image and the desired signal.

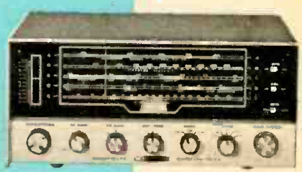
An RF stage or preselector attenuates images since only part of the image frequency gets through to the IF amplifier. Conversely, a budget receiver without an RF stage is prone to image interference unless the IF frequency is high—on the order of 1300 kc to 1800 kc. Disadvantage is that selectivity then is poor and budget receivers, therefore, most often are a compromise between image response and selectivity.

A better method of image reduction is double or triple conversion (and multiple conversion is used primarily to reduce images—not to improve selectivity). By using a high first-IF frequency, the image signal is placed outside the passband of the last IF amplifier. For example, if the first-conversion IF frequency is 2 mc, the image frequency when tuned to 3500 kc is 7500 kc. And 7500 kc has about as much chance of getting through the second, low-frequency IF strip as Castro has of becoming mayor of Miami.


Hallicrafters S-120


National NC-77X


Lafayette HA-230


Heath GR-54


Heath GC-1A


Zenith M-660A

Knight R-100A

Hallicrafters S-118

Lafayette HA-225

Hallicrafters S-108

Hallicrafters SX-110

Hallicrafters SX-130


Hammarlund HQ-100A

**Beat-Frequency Oscillator.** All communications receivers are equipped with a beat-frequency oscillator (BFO), an essential for copying code (CW) and single sideband (SSB). A receiver with a fixed-frequency BFO often is a nuisance because the pitch or tone of a CW signal can be altered only by adjusting the tuning dial. It often happens that tuning the receiver to obtain a more pleasing pitch also brings in an interfering signal. For this reason, an adjustable or variable BFO pitch control ordinarily is to be preferred.

However, budget receivers often sport a fixed BFO for economy's sake; and if you have only $40 to spend, a fixed BFO is better than none at all. In addition, some high-priced, excellent receivers use a fixed BFO to insure optimum reception of SSB signals. And, when combined with the superior selectivity of such sets, a fixed BFO can be an outstanding performer.

BFO stability is extremely important if you intend any serious monitoring of SSB or if a receiver is capable of high selectivity. The slightest drift of the BFO can turn SSB into unintelligible garble or lose the beat of a CW signal. Similarly, since local oscillator stability is analagous to BFO stability, the oscillator, too, must be rock-steady for good SSB and CW reception. Usually the stability of both circuits goes hand-in-hand with price.

**Antenna Trimmer.** Except for certain high-performance receivers, connecting an antenna effectively detunes the RF input circuit. However, incorporation of an antenna trimmer (a variable capacitor) enables the user instantly to align the RF input circuit. Proper adjustment of this trimmer often can make the difference between hearing a booming signal or nothing at all.

**Noise Limiting.** Whether man-made or atmospheric, noise always accompanies the signal from an antenna. And like a receiver's internal noise it masks the signal, only more so (man-made noise easily can jam an S-9 signal). The lowest-price receivers generally use a simple diode noise limiter which just about takes the edge off the noise pulses. Higher priced receivers may use complex noise limiters or blankers which go to work on noise itself. If you live in a location known for severe noise—perhaps originating in power lines, generators or even oil burners—a good noise limiter should head the list of desired features.

**The Calibrator.** Receivers frequently come equipped with a crystal calibrator or incorporate provisions for adding one. A calibrator generally produces a signal every 100 kc on all bands, thereby providing means for an accurate dial calibration. Output from a calibrator also can be used for interpolating intermediate points on the dial as well as for checking receiver alignment.

**Bandspread.** Bandspread is a means for turning a hairline-wide section of the main tuning dial into several revolutions of a secondary tuning knob. While most receivers have calibrated bandspread for the ham bands, all have an 0-100 logging scale which permits the SWL to preset the receiver to a desired frequency. Some SWL receivers substitute a high main tuning ratio for bandspread (this is acceptable), while some of the latest rock-bottom-price receivers have eliminated bandspread to reduce costs (this is not acceptable).

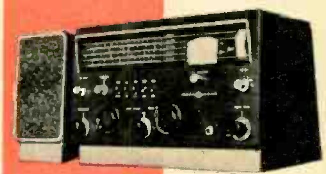
**Transistors and Short Wave.** A necessary distinction here is between transistor radios and solid-state communications receivers. For many years the transistor radio—also known as the personal portable—frequently has featured added short-wave coverage, usually the marine frequencies from the top of the broadcast band to about 4000 kc. Some portables even include the weather-FAA frequencies below the BCB.

These portables, however, cannot be considered SWL receivers since their short-wave coverage simply is added on to BCB coverage. Further, they have none of the features common to even the lowest-cost budget receiver.

Solid-state (i.e., transistorized) communications receivers, on the other hand, boast all the features common to tube receivers. And the major advantage of solid-state design is that it allows the power supply to be reduced to a handful of flashlight batteries. It also results in sharply reduced weight and size and it, therefore, is possible to have high performance in a truly portable receiver.

For many years the Heath Co. was the only manufacturer producing a solid-state communications receiver for consumer use, though the Hallicrafters Co. now has joined the parade. (Others can be expected to follow suit shortly.) The slight extra cost of solid-state receivers is justified when portability is desired or necessary (they're great for vacation). Outside the consumer field, for professional applications, there is National's all-solid-state receiver which employs a digi-

Hallicrafters WR-3000

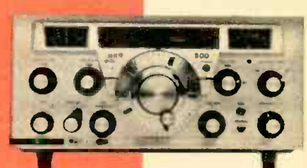


National NC-190

Hallicrafters SX-122

Hammarlund HQ-180A

Hallicrafters SX-62A



National HRO-500

tal readout instead of the usual dial. (Its $1,295 price tag takes it out of the SWL class.)

**Frequency Coverage.** Excluding receivers calibrated only for the amateur bands, the average communications receiver covers the frequency range from the bottom of the broadcast band to 30 mc. A few receivers also cover the weather-FAA frequencies from 150 kc to the broadcast band, while others extend coverage to include all or part of the 30- to 50-mc public-service band or the 6-meter amateur band. Minimum requirement for any communications receiver is that it tune 540 kc to 30 mc.

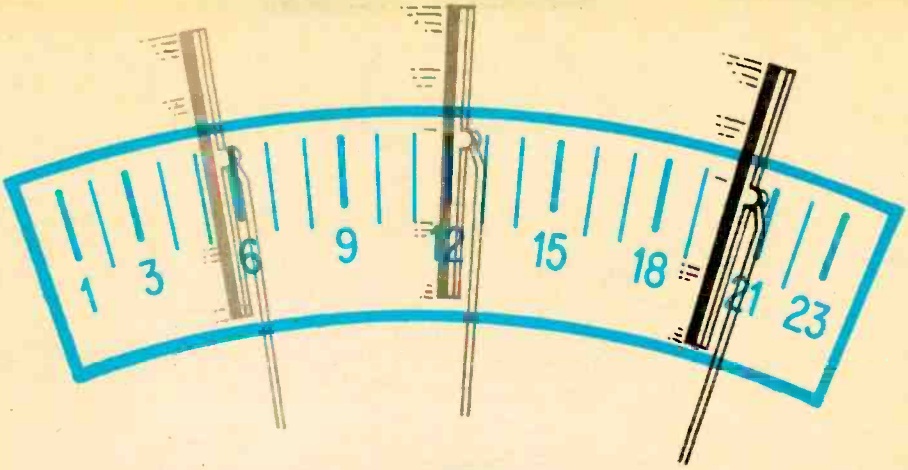
**Making the Purchase.** More often than not the final choice is a compromise between desired performance and budget considerations. And unless you don't care about cost or having to effect a trade almost as soon as you unpack the receiver, buying too much or too little performance must be avoided. If the receiver is to be used for occasional monitor-

[*Continued on page* 112]

## EI'S READY REFERENCE TO SWL RECEIVERS

| Price | Manufacturer | Model | Freq. range mc | Variable BFO or SSB | Bandspread | RF amplifier (s) | Q-multiplier, crystal or mechanical filter | Built-in speaker | Antenna trimmer | Built-in or optional calibrator | S-meter | Solid-state | Available wired | Special notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $37.95 K | Heath | GR-64 | .55-30 | x | x | | opt. | x | | | x | | | |
| $39.95 K | Knight | Star Roamer | .2-.4<br>.55-30 | | x | | | x | x | | x | | | |
| $39.50 K | EICO | 7.11 | .55-30 | | x | | | x | x | | x | | $69.95 | |
| $49.95 | Lafayette | HA-226 | .55-30 | | | | | x | | | | | | |
| $59.95 K | Knight | R-55-A | .55-30<br>47-54 | x | x | | | x | x | x | | | | |
| $59.95 | Lafayette | HA-63 | .55-30 | | x | x | | | x | | x | | | |
| $59.95 | Hallicrafters | S-200 | .55-15.5 | | | | | x | | | | | | |
| $69.95 | Hallicrafters | S-120 | .55-30 | | x | | | x | | | | | | |
| $69.95 | National | NC-77X | .55-30 | | x | | | x | | | | | | |
| $79.95 | Lafayette | HA-230 | .55-30 | x | x | x | x | | x | | x | | | Kit KT-340K $67.95 |
| $84.95 K | Heath | GR-54 | .2-.4<br>.55-30 | x | x | x | x | x | x | | x | | | |
| $89.50 K | Heath | GC-1A | .55-32 | x | x | x | x | x | x | | x | x | $125.00 | |
| $89.95 | Zenith | M-660A | .15-.4<br>.5-30 | x | | | x | | | | | | | |
| $99.95 K | Knight | R-100A | .54-30 | x | x | x | x | | x | x | x | | | |
| $99.95 | Hallicrafters | S-118 | .8-.42<br>.5-31 | | x | | | x | | | | | | |
| $139.50 | Lafayette | HA-225 | .15-54 | x | x | x | x | | x | x | x | | | No BC band |
| $139.95 | Hallicrafters | S-108 | .5-34 | x | x | x | | x | x | | | | | |
| $169.95 | Hallicrafters | SX-110 | .54-34 | x | x | x | x | | x | | x | | | |
| $169.95 | Hallicrafters | SX-130 | .53-34 | x | x | x | x | | x | | x | | | |
| $189.00 | Hammarlund | HQ-100A | .54-30 | x | x | x | x | | x | x | x | | | |
| $199.50 | Hallicrafters | WR-3000A | .5-23 | | x | x | | x | | | | x | | |
| $239.95 | National | NC-190 | .54-30 | x | x | x | x | | x | x | x | | | |
| $274.95 | Hallicrafters | SX-122 | .5-34 | x | x | x | x | | x | | x | | | |
| $439.00 | Hammarlund | HQ-180A | .54-30 | x | x | x | x | | x | | x | | | |
| $525.00 | Hallicrafters | SX-62B | .5-109 | x | x | x | x | | x | x | x | | | |
| $1295.00 | National | HRO-500 | 5 kc-30 | x | x | x | x | | x | x | x | x | | |

*NOTE: LETTER K AFTER PRICE INDICATES KIT*




# CB BAND SWEEPER


*Flip a switch, sit back and your transceiver will be tuned automatically and continuously from the low to the high end of the band. It's the easy way to listen in on every CB channel.*

**By R. L. WINKLEPLECK**

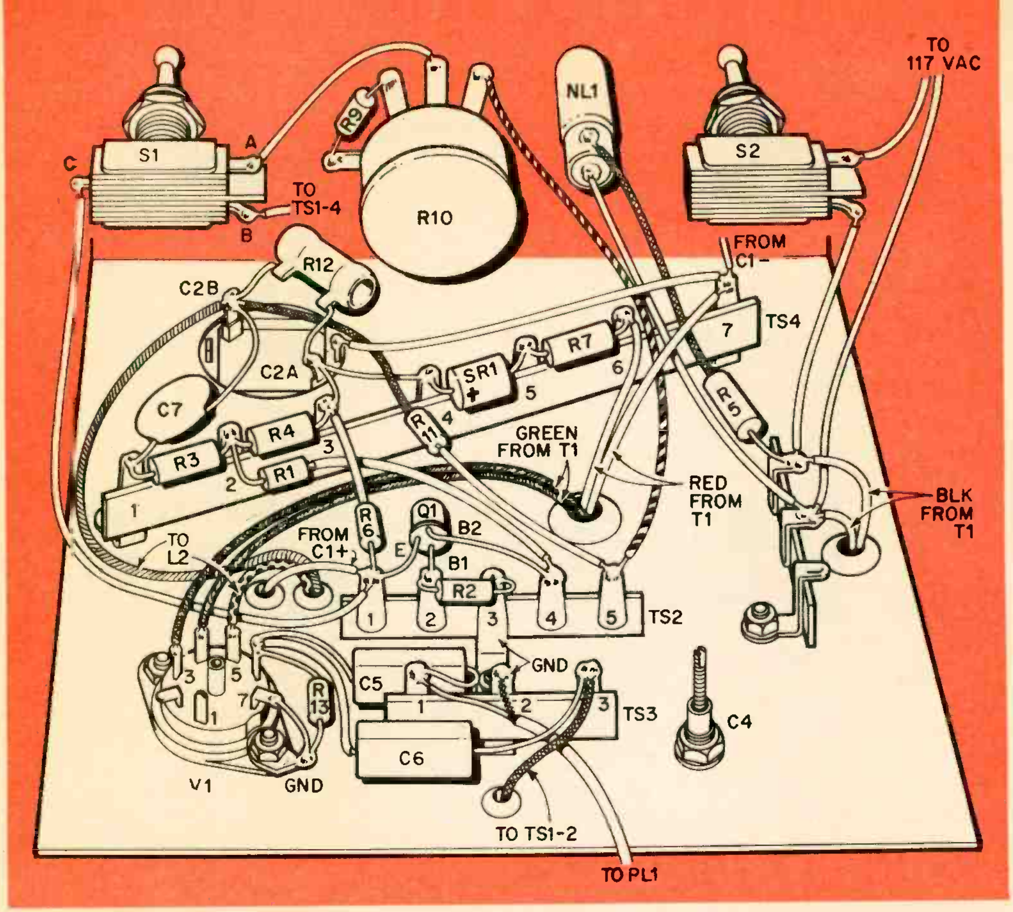
CITIZENS BANDERS have come up with a new form of the twist that doesn't have a trace of hip action. Every bit as frantic, their version involves a fast back and forth twisting of the wrist as they turn their transceiver's channel-selector knob to hear who's on each channel and what they're talking about. A cure hasn't been found yet but the twisting can be greatly reduced by the CB Band Sweeper.

The Sweeper is an electronic tuning adaptor that you plug into one of the receive crystal sockets in your rig. The frequency of the Sweeper's oscillator changes constantly to tune the rig automatically from the low to the high end of the band. In about 1½ minutes you listen briefly to every channel—1, 2, 3, etc. up to channel 23. Then the receiver jumps back to channel 1 and the cycle repeats. Without effort on your part, you can listen in on a portion of every conversation on the band. When you hear something of more than passing interest you just flip the mode switch from *auto* to *manual* and tune in the channel manually on the Sweeper.

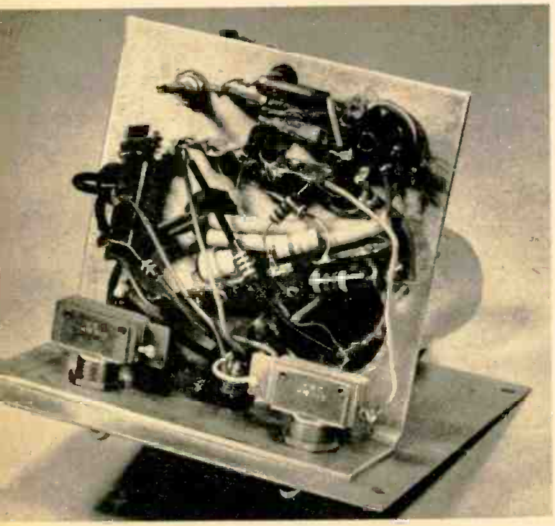
**Construction.** To be on the safe side, duplicate the layout of our model, which is built in a 4 x 5 x 6-in. aluminum utility box. The components are mounted on an L-shaped chassis, made of scrap aluminum, which is held to the front panel by S1 and S2.

Since the RF oscillator (V1) operates around 27 mc, placement of parts associated with it is critical and can affect its operating frequency. However, the wide range of frequency adjustment provided by piston capacitor C4 permits you to compensate for some minor changes in layout. Short and direct leads and good grounds are a must.

Coils L1 and L2 are made from a single




# CB BAND SWEEPER



Our Model's 3¾ x 4-in. chassis is made from a 5¼ x 4-in. piece of scrap aluminum. It is held to the cabinet's front panel by S1, S2. R9 (pictorial) connects to ground strap on R10's mounting bushing.

Barker and Williamson Miniductor coil form. Unwind a turn from one end for a connecting lead and leave five turns intact for L1. Cut the next wire and unwind a half turn in each direction for the inner leads of L1 and L2.

Leave three more turns for L2, then unwind one more turn for L2's final lead. Cut away the remainder of the coil stock. The plastic supports can be cut with a hot razor blade. Note that the four plastic wire supports are used to space L1 and L2 exactly one turn apart. Mount the two-coil assembly on terminal strip TS1 and use additional terminal strips where shown for other components.

A short length of RG59/U coax should be used to connect the Sweeper to the transceiver. On one end of the cable install a plug made from an old CB crystal to match the crystal socket in your rig. The plug must be polarized; that is, the shield of the coax from the Sweeper must go to the grounded side of the crystal socket in the transceiver.

**Adjustment and Calibration.** After the wiring is completed and checked, a few preliminary tests should be made. Turn on power and let the Sweeper warm up. Using a VTVM, measure the voltage at pin No. 5 of V1. It should be 140 to 150 volts. If V1 is oscillating there should be a slight negative voltage on pin 6. If V1 is not oscillating reverse L2's leads.

Set S1 *manual* and measure the voltage across D1 to see whether it can be varied by R10 from approximately 2.5 to 7 volts. Then set S1 to *auto* and check to see that the sweep oscillator (Q1) is supplying a varying 3- to 6-volt sawtooth voltage to D1.

If all is satisfactory, put the Sweeper's plug into a receive crystal socket in your transceiver. Set the transceiver's channel-selector switch to the appropriate position and put S1 in the *manual* position. R10 should be at about half rotation.

Set another nearby rig to one of the center channels, such as 11 or 12, and put it in the transmit mode. Slowly adjust C4 until you pick up the signal.

During this adjustment you may find a couple of settings of C4 where the S-meter will deflect but you won't hear the signal. This means the Sweeper's oscillator is operating at your rig's IF frequency (or a harmonic of it). Ignore this. Or you may pick up high- or low-end-of-the-band channels. Ignore these, too, since if the Sweeper is centered on them, it won't sweep across the entire band.

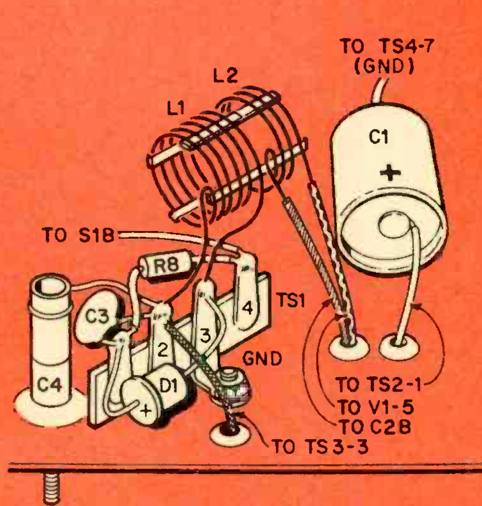
Continue to adjust C4 carefully and slowly until you finally locate the channel on which the second rig is transmitting. There will be two points where this signal can be found. Note the quality and strength of each and continue adjusting C4 until you tune in the *strongest* signal. Alignment is now completed.

It should now be possible to tune from one end of the band to the other with R10. When S1 is in the *auto* position, the Sweeper should tune from the low to the high end of the band in about 1½ minutes. This should be long enough for you to tell what's going on on every channel and to spot the vacant ones. The sweep can be speeded up by making either R6 or C1 smaller. If either component is increased in value, the sweep will be slower.

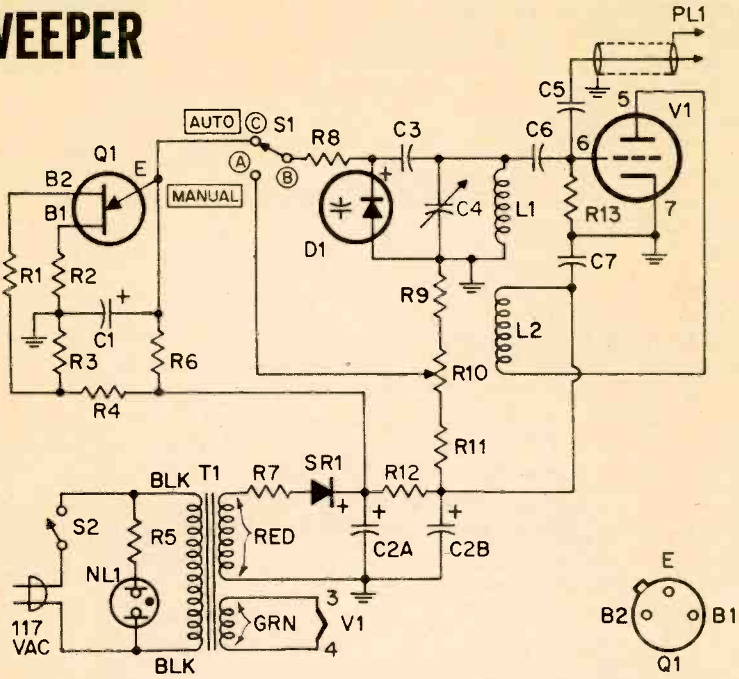
**How it Works.** The Sweeper's RF oscillator is a modified Armstrong. It replaces the crystal-controlled oscillator in the rig and supplies the local oscillator signal to produce the IF signal. To make the oscillator sweep

**Rear view of Sweeper. Note the way coils L1 and L2 are mounted. Potentiometer R10 should be mounted on front panel before transformer and electrolytic capacitor can are installed on the chassis.**

**Detailed sketch shows what coils look like and how they're mounted. Since parts on terminal strip TS1 are in RF-oscillator circuit, position them where shown and keep the leads short.**



# CB BAND SWEEPER




**Sawtooth voltage generator consists of unijunction transistor Q1, C1, R6 and associated components. When S1 is in auto position, sawtooth voltage developed across C1 is applied to varactor diode D1, causing its capacitance to change. Since D1 is part of RF oscillator's (V1) tuned circuit (D1, C4, L1), it changes operating frequency of RF oscillator in step with the sawtooth voltage. Output of Sweeper is fed to mixer stage in CB transceiver via crystal socket, causing receiver to tune from the low to the high end of band. To calibrate R10's dial, have a friend use another rig to transmit on each channel while you tune in and mark dial.**

back and forth so the set tunes from channel 1 to 23, a capacitance diode (D1, a varactor) is connected in parallel with L1 (D1, C4 and L1 form the oscillator's tuned circuit). A varactor is a special silicon diode that can be used as a capacitor. The capacitance between its leads is a function of the reverse-bias voltage across it. When a varying voltage is applied to D1, D1's capacitance changes in step with the voltage. This changes the RF oscillator's frequency, which causes the transceiver to tune from the low to the high end of the band. (The transceiver also can be tuned manually with R10, which varies D1's voltage from about 2.5 to 7 volts.)

The varying voltage which is applied to D1 is produced by a unijunction-transistor relaxation oscillator. After power is turned on, capacitor C1 begins to charge slowly through R6. When the voltage across C1 (and D1) reaches about 6 volts (the rig will be tuned to channel 23), the emitter-base (B1) junction of Q1 conducts, causing C1 to discharge through R2 to ground. This abruptly reduces the charge on C1 (and the voltage across D1) to about 3 volts. This tunes the transceiver back to channel 1. The charge/discharge cycle repeats continuously.

**PARTS LIST**

C1—200 µf, 15 V electrolytic capacitor
C2A, C2B—40/40 µf, 150 V electrolytic
C3—.001 µf, 500 V ceramic disc capacitor
C4—5-50 µµf piston-type trimmer capacitor JFD VC55C (Newark Electronics Corp., 223 W. Madison St., Chicago, Ill. 60606. Stock No. 19F1949; $1.95 plus postage.)
C5—68 µµf, 500 V silvered mica capacitor
C6—100 µµf, 500 V silvered mica capacitor
C7—.01 µf, 500 V ceramic disc capacitor
D1—3-30 µµf voltage-variable capacitor (International Rectifier Corp. Semicap No. 6.8 SC20. Newark Electronics Corp. Stock No. 21F999 $1.10 plus postage)
L1—Coil: 5 turns Barker & Williamson No. 3007 Miniductor (Lafayette 40 R 1616)
L2—Coil: 3 turns Barker & Williamson No. 3007 Miniductor. (part of L1)
NL1—NE51H neon lamp
PL1—Plug made of discarded CB crystal
Q1—2N2160 Unijunction transistor (GE)
Resistors: ½ watt 10% except R3, R10, R12
R1—470,000 ohms
R2—39 ohms
R3—8,200 ohms, 1 watt
R4—47,000 ohms
R5—100,000 ohms
R6—8.2 megohms
R7—22 ohms
R8—2.2 megohms
R9—680 ohms
R10—1,000 ohm wirewound potentiometer
R11—33,000 ohms
R12—2,000 ohms, 5 watt wirewound
R13—47,000 ohms
S1—SPDT toggle switch
S2—SPST toggle switch
SR1—Silicon rectifier: 500 ma, 400 PIV
T1—Power transformer; secondaries: 125 V @ 15 ma, 6.3 V @ 0.6 A (Lafayette 33 R 3405)
V1—6C4 tube

# GOOD READING

By Tim Cartwright

*FUNDAMENTALS OF DIGITAL COMPUTERS. By Seymour M. Weinstein and Armand Keim. Holt, Rinehart & Winston, New York. 163 pages. $4.95*

The four-square title of this little volume might lead one to believe that it's another of those dry-as-dust treatises on computers. Far from it. The fundamentals are there, all right, but in literate and legible form.

Clue to the book's unusual and appealing approach can be found in the first chapter, which ends with a reasonably spirited defense of the notion that computers *do* think. And from the introduction onward, the general tack is that there's nothing about computer principles that the intelligent layman can't understand—providing he's not snowed under by engineering jargon or oversimplified and cute terminology.

All in all, this is a book of surprising liveliness. It's recommended for anyone who wants a good introduction to the world of computers.

*THE RADIO AMATEUR'S V.H.F. MANUAL. Published by the American Radio Relay League, Newington, Conn. 318 pages. $2*

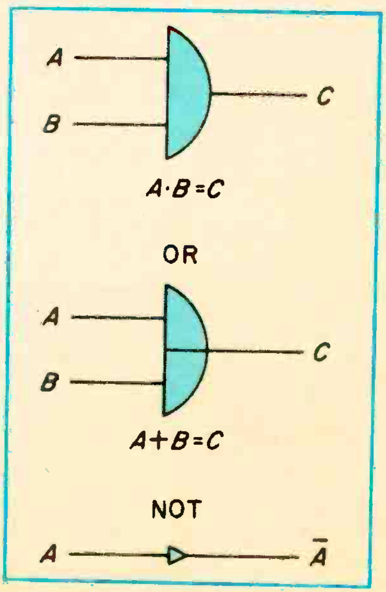
As Edward Tilton points out in his chapter on the history of VHF, most hams think of the world above 50 mc as a new frontier. Could be—so far as the challenge involved is concerned. But there has been an awful lot of headlong pioneering in the VHF region over the past 30 years and a lot of markers exist to help the would-be frontier hunter find his way.

The ARRL has put the bulk of these markers together in what's sure to be a best-selling book in the ham field. Here is everything—on propagation, receivers, converters, transmitters, antenna and feed systems, test equipment—that conceivably could be of help to the VHF-minded ham.

*A DICTIONARY OF SCIENCE TERMS. Edited by G.E. Speck and Bernard Jaffe. Hawthorn Books, New York. 272 pages. $4.50*

The past few years have brought a raft of specialized scientific dictionaries for those who work in or around the field. This book, however, is for the reader who isn't in the business—the interested man who just would like to keep up with at least some of the advances in the scientific realm.

This volume offers reasonably accurate, thumbnail definitions of terms used in all current branches of the sciences. It's an unpretentious, yet informative book, with good illustrations of exactly the kind of things likely to fascinate a layman—whether it's a picture of the earth's atmosphere or of how a carburetor works.




Taken from the book on digital computer fundamentals discussed above, our illustration shows commonly-used symbols for AND, OR and NOT circuits (usually referred to as GATE circuits).

*BUILDING THE AMATEUR RADIO STATION. By Julius and Jack Berens. John F. Rider, New York. 136 pages. $3.45*

Needless to say, there's a sizable group of new recruits every year to whom the whole subject of amateur radio is a fascinating and uncharted wilderness. And so there definitely is a continued need for new and up-to-date introductions to the field in the form of books like this.

Relentlessly methodical, this handbook begins with an illustration of the tools needed around a ham shack and goes on to give a blow-by-blow description of building a Novice class rig and a General class station. It winds up with a long and handy glossary [Continued on page 114]

# Is COAX Really Better for TV?

By LEN BUCKWALTER, KBA4480

TOP banana since the early days of TV has been a flat brown ribbon called twinlead. Truth to tell, it's so popular you'd almost think there was no other type of lead-in. Fact is, there is one—called coax—though it currently is used almost exclusively by hams and CBers who have known about it for years.

Rumor has it that coax may be better than twinlead in TV antenna systems. Could be, but it depends on many things—whether or not you're planning on getting a color TV set, the quality of your present black and white picture and your budget.

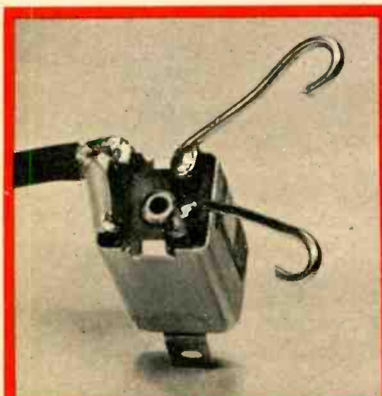
Regular 300-ohm twinlead, generally acceptable for black and white, may botch up color reception. Reason is, twinlead can be affected by its surroundings. Rain or nearby metal may change twinlead's electrical characteristics and cause standing waves. Or auto ignition noise and interference from electrical appliances may be picked up along its length.

Standing waves can cause multiple signals on the line which produce ghosts. Though somewhat tolerable on a black and white set, a color picture will be ruined because the ghosts can be different colors.

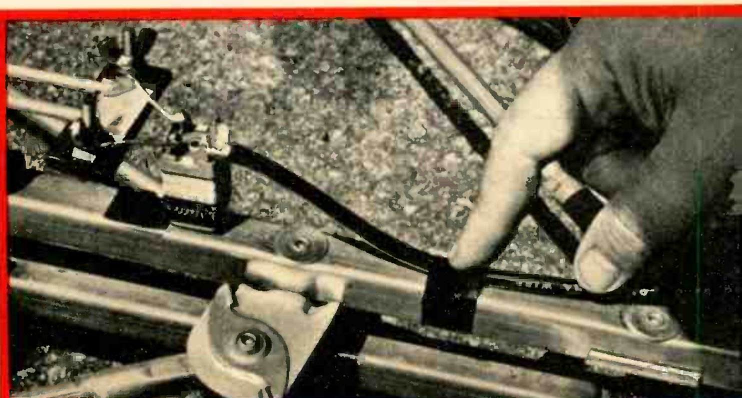
Even if you just watch black and white, there is something to be said in favor of coax. (It's the standard for master- and community-antenna systems.) Since coax isn't affected by its environment, ghosts can't be generated along its length. Coax can be run inside walls, through conduit, along metal rain gutters, and even underground. Since coax is shielded, it keeps out noise. And insulating standoffs aren't needed to keep it from touching things.

Any disadvantages? Cost of coax is somewhat higher (about 5¢ per foot vs. about 2¢ a foot for twinlead). But coax will last many times longer than twinlead. Loss of signal in coax is higher than it is in twinlead. However, if the run is less than 100 feet, the loss is small.

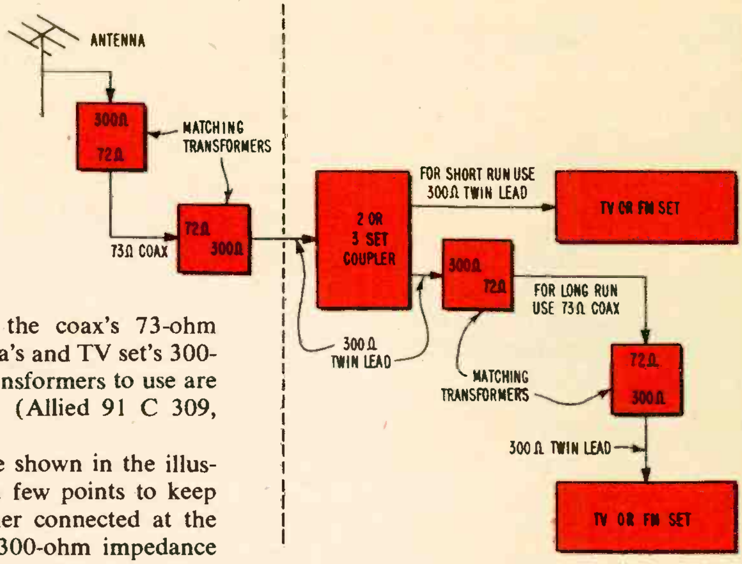
To convert a TV antenna system to coax (73-ohm, RG59/U), you need a pair of



Solder heavy wires, spread to fit antenna terminals, on transformer's 300-ohm lugs. Keep coax's shield short.



To keep moisture out of transformer, mount it (heavy wires to antenna terminals and taped coax) as shown on underside of antenna's boom. Lugs will aim down when antenna is erected.




**Setup for connecting one antenna to several receivers. Use coax and transformers between antenna and multi-set coupler. For short run to TV or FM set, use twinlead. For longer runs, use coax and two additional transformers.**

transformers to match the coax's 73-ohm impedance to the antenna's and TV set's 300-ohm impedance. The transformers to use are J. W. Miller No. 6162. (Allied 91 C 309, $1.76 plus postage).

**Installation** details are shown in the illustrations, but there are a few points to keep in mind. The transformer connected at the antenna transforms its 300-ohm impedance to 72 ohms. For this reason, be sure to connect the 300-ohm transformer lugs to the antenna. At the TV receiver, the 300-ohm side of the other transformer goes to the TV set's antenna terminals.

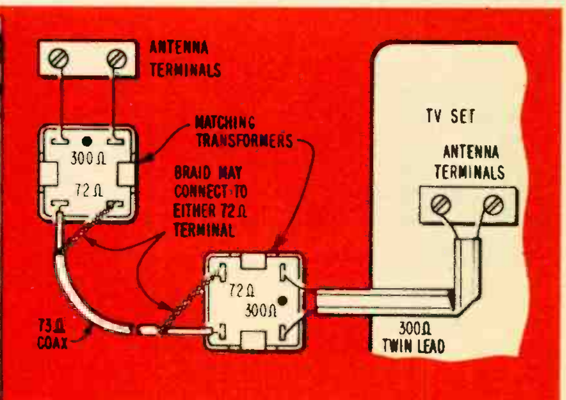
Be certain that the transformer on the antenna is mounted with its lugs aiming downward to keep moisture out. (The case is designed for outdoor use, and will shed water.) The antenna transformer does not have to be attached to the antenna boom. The short, heavy pieces of wire on the 300-ohm side anchor it in place. Avoid putting strain on the transformer lugs by taping the coax to the mast or boom as shown in the photo.

In many cases you may want to use a single antenna to feed more than one TV set, and possibly an FM tuner. For such an installation use a multi-set coupler.

In such installations, the coupler must be connected with 300-ohm twinlead. Run twinlead from the matching transformer in the house to the coupler to keep impedances matched. Lines running from the coupler to the TV and FM sets should be twinlead. Using twinlead here is not a disadvantage if the lines are short and protected from weather. But if you must make a long run from the coupler, use coax.

There's another bonus in coax in that it also benefits stereo-FM reception. As with color TV, stereo-FM signals will be deteriorated by standing waves on the line. This can cause poor channel separation.

**Other transformer is fastened to rear of TV set. Short length of twinlead goes from set's terminals to 300-ohm lugs on the transformer.**




**Setup for connecting antenna to one TV receiver. Be sure to use correct lugs on transformers. 300-ohm twinlead must be connected to lugs marked with a color dot.**

# EI's 1965 Index


# EI's 1965 Index


C – Construction Project
F – Feature Article
TP – Theory & Practice
Name following title is author.
Page number follows the date.

# EI's 1965 Index

EI's 1965 Index



## SHORT-WAVE LISTENING



## THEORY AND PRACTICE



## SPECIAL FEATURE ARTICLES



## SPECIAL CONSTRUCTION PROJECTS

# DO TUBES REALLY AMPLIFY?

By WALTER S. ANDARIESE, W2WLJ

THOUGH vacuum tubes perform more tricks than a tank of dolphins, their shenanigans perplex many hobbyists. Even amplification, by far the most common of all tube functions, proves a misnomer when subjected to scrupulous scrutiny.

Since both load impedance and power supply are basic to any amplifier circuit, let's first look at the circuit of Fig. 1. The power-supply voltage in this circuit remains constant (or nearly so, depending on regulation) at all times. Likewise, the load impedance is of a fixed value and does not change. Therefore, it would appear that the tube is amplifying the input signal. But is it?

In actual fact, the vacuum tube acts as a variable resistance during amplifier operation, as Fig. 2 suggests. The exact value of its resistance depends on the instantaneous value of signal voltage on its control grid.

**Thing is,** the combined voltage across the tube (Eb) and the load impedance (Ebb—Eb) is held constant. Thus, if the resistance of the tube changes, the voltage across it (by Ohm's law) also must change. But along with the voltage change across the tube, the voltage across the load impedance also must change and in such fashion that the two changing voltages always add up to the unchanging power-supply voltage (Ebb)!

Point to remember is that amplification consists of more than putting a small signal into a tube and getting a large signal out. Because of its ability to control current flow, the vacuum tube controls the DC voltage which the load impedance feeds to it. All output signal voltage originates in the DC power supply.

Now that the true nature of an amplified signal is known, the old argument that the output signal simply rides a DC carrier readily becomes believable. Matter of fact, it actually is necessary to isolate the signal from its DC carrier by passing it through a coupling capacitor, such as C1. Further, since the output signal in reality is a portion of the DC power-supply voltage, its peak-to-peak value never can exceed the magnitude of the power-supply voltage.

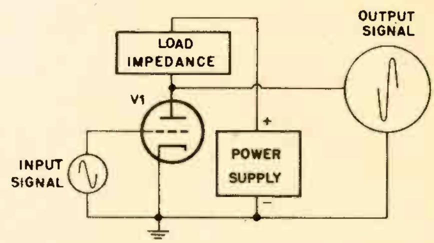



Fig. 1—Basic vacuum-tube amplifier circuit. V1 can be triode, tetrode or pentode.

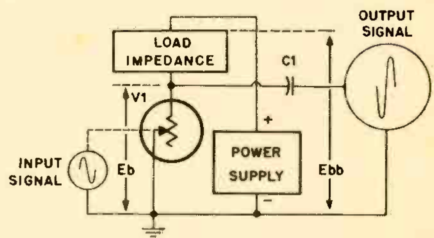



Fig. 2—Depicting tube as rheostat helps reveal true nature of its circuit function.

# DX CLUB AWARD WINNERS

4th AWARD PERIOD (NOVEMBER 15, 1964-APRIL 30, 1965)

## HAM

### GENERAL CLASS

100 Countries • DX Century Awards

George Tucker, VO1AU, St. John's, Nfld.
Earle T. White, VA6UZB, Milpitas, Calif.

50 Countries

James Alley, WA4CAJ, Troutman, N.C.
Myron L. Braun, K8IQB, Bellevue, Ohio
Steve C. Cook, WA5HZY, Houston, Tex.
Michael DeCheff, K9PTW, Belleville, Ill.
Charles Derowitsch, W2RBR, New Providence, N.J.
John J. Dezina, W8NNR, Maple Heights, Ohio
Charles P. Dillaman, WA8AIL, Shinnston, W.Va.
Casey Douglas, VE2ADV, Montreal, Que.
Kenneth J. Doyle, WA2QMC, Queens Village, N.Y.
William E. Gotwalt, K7TNY, Las Vegas, Nev.
Bert Richard Hays, K4TQR, Birmingham, Ala.
Robert E. Lightfoot, VE3ELL, Malton, Ont.
Mark A. Luhrman, WA4SVO, West Palm Beach, Fla.
Robert T. McDonough, K4HHW, San Francisco, Calif.
Michael J. McGirr, WB2JYN, Union, N.J.
Raymond H. McClure, W8CNL, Battle Creek, Mich.
Paul M. Nance, W4YDD, Verona, Va.
Ken B. Orton, VE3CCB, London, Ont.
James L. Parker, KP4BPG, Caparra Heights, P.R.
Eddy E. Pollock, W6KHS, Aptos, Calif.
Leroy G. Porch, WA2KDT, Millville, N.J.
James E. Rounds, W1SXX, Foster, R.I.
John Sikora, K8KPM, St. Clair Shores, Mich.
James R. Stewart, K2PIU, Pennsville, N.J.
Oscar A. Trochez, HR1AT, Tegucigalpa, Honduras
John J. Uhl, WA5CST, Harvey, La.

### SPECIAL CLASS

10 Countries

Joseph Adelman, W2SIL, Bayside, N.Y.
Craig D. Anderson, WB2JQC, Ridgewood, N.J.
Clarence R. Applin, WA2YVA, Dansville, N.Y.
Don R. Barba, WA2HVS, Brooklyn, N.Y.
Eddie L. Berkowitz, WB2HWH, West Orange, N.J.
Hayden Bowers, WA4CXZ, Mocksville, N.C.
Perry D. Bradshaw, WAØBGU, Kirksville, Mo.
James R. Briles, K4DSX, Burlington, N.C.
Cabrillo College Communicators, WB6JOD, Aptos, Calif.
Arthur F. Cacella, Jr., WB2OHK, East Brunswick, N.J.
Eugene W. Carlson, K9PXC, Andover, Ill.
Richard F. Charpentier, Jr., F7CR, APO, N.Y.
Michael John Clarke, VE1AMI, Halifax Co., N.S.
Craig E. Cobb, WA2ZVN, Sackets Harbor, N.Y.
Allen P. Collier, WA4OPB, Wetumpka, Ala.
Thomas M. Colyard, Jr., WN2PFD, Belmar, N.J.
Leonard G. Dorfman, WB2IPH, Brooklyn, N.Y.
Leroy F. Duvall, Jr., K9PYO, Highland, Ind.
Jack R. Ekstrom, K9BQL, North Aurora, Ill.
James R. Erbe, WAGNIF/VP9, APO, N.Y.
Ronald L. Evans, WA5BQI, Jonesboro, Ark.
Gary J. Felser, K3ZKX, Baltimore, Md.
Henry O. Feltman, WB2MSH, Woodbury, N.J.
Edward S. Fox, WA2VPG, Franklin Square, N.Y.
Ernest Garcia, WA2TBQ/6, San Fernando, Calif.
George W. Gehres, WA4JJX, Jacksonville, Fla.
Thomas Giacopelli, WB2FSM, Tuckahoe, N.Y.
James A. Glasscock, KØRTH, St. Louis, Mo.
William A. Gode, WN9NHQ, Northbrook, Ill.
Steven M. Gorenbein, WB6MIO, Van Nuys, Calif.
Robert M. Grasing, WB2JWA, Cranford, N.J.
Martin Greenbaum, K2HTO, New York, N.Y.
Alan Grinberg, WB2BSQ, Bethesda, Md.
Rodger B. Hallen, WB6BOW, Tujunga, Calif.
Brian G. Hayek, WA9FAB, La Crosse, Wis.
Stanley Hirsh, WB2FGQ, Island Park, N.Y.
Ronald J. Honick, WA4KUI, Norfolk, Va.
Richard T. Howard, K7DVK, Portland, Ore.
Roberto L. Jimenez, WP4CLB, Roosevelt, P.R.
Earl N. Johnson, K1SRD, Otis AFB, Mass.
Robert F. Kapalo, WB2MHI, Somerset, N.J.
Albert L. Kemmesies, FL8AK, APO, New York, N.Y.
Mark K. Leavitt, K7OLZ, Tucson, Ariz.
John J. Linzmayer, WB2CBV, Little Silver, N.J.
John M. Lipski, WA8FIO, Toledo, Ohio
Jan Marcus, WB2MRM, Westbury, N.Y.
Robert W. Merdler, K8AQA, Saginaw, Mich.
Frank Micallef, VE3FNO, Toronto, Ont.
Thomas R. Mortimer, WA0HPC, Omaha, Nebr.
Malcolm S. Mullen, VE1ACE, Weymouth, N.S.
Heyman J. Nievwendaal, WA4KKG, Tampa, Fla.
Thomas E. Plictha, K9OHI, St. Charles, Ill.
Henk Prins, PA0HEN, Santpoort, Netherlands
Douglas Raskin, WB2MDH, Lindenhurst, N.Y.
Cecil M. Rasnake, K4CPQ, Hampton, Va.
David J. Relland, WA9IQN, Wisconsin Rapids, Wis.
James C. Robb, Jr., W6OUL, Lompoc, Calif.
Andre J. N. Robillard, VE2AIL, Iberville, Que.
Larry F. Rose, WB6IEX, San Diego, Calif.
Sidney L. Ross, K5LRR, Lafayette, La.
Paul M. St. John, WA6UAV, Concord, Calif.
Doyle W. Simmons, WA4FMX, Taylors, S.C.
Hugh E. Smith, WB2MLV, Millville, N.J.
Walter V. Smith, WA6HOA, Whittier, Calif.
Bill Stankiewicz, WA9DLH, Maywood, Ill.
Frank Stankiewicz, Jr., WA9DLI, Maywood, Ill.
Milton P. Stanley, K9VJH, Morton, Ill.
Steven M. Stern, WB2ICH, Highland Park, N.J.
Charles Stokes, K5ROB, Midland, Tex.
John E. Talipsky, K3LSX, Bristol, Pa.
Richard F. Tassone, DL4TX, New York, N.Y.
Michael A. Toneri, VE3FGU, Toronto, Ont.
Daniel Turkisher, WB2FVD, White Plains, N.Y.
Bert P. Vandenberg, WB6FKL, Fullerton, Calif.
Edward G. VanOverloop, WA2UGT, Parkridge, N.J.
Alfred J. Vasko, W8FRD, Swanton, Ohio
Victor M. Walz, WA4TLB, Charleston, S.C.
Frank E. Wargocki, WA3AYW, Philadelphia, Pa.
Donnie R. Weems, K5BJN, Eureka Springs, Ark.
Robert H. Williams, Jr., WA4DYK, Rockmart, Ga.
Howard R. Wise, W8OZZ, Columbus, Ohio
Richard J. Wolf, K2PYX/7, Klamath Falls, Ore.

## SWL

### GENERAL CLASS

100 Countries • DX Century Awards

Chuck C. Edwards, Fort Lauderdale, Fla.
Gerry Klinck, Buffalo, N.Y.
Nathan Rosen, New York, N.Y.
Douglas S. Waller, Richmond, Va.

50 Countries

Hagop A. Afarian, Beirut, Lebanon
E. M. Aiston, Carleton Place, Ont.
Greg A. Benadom, San Francisco, Calif.
Cecil Bray, Cornwall, England
David C. Brown, Woodland Hills, Calif.
Ovide M. Brudo, Methuen, Mass.
Anthony Chesler, Cape Town, South Africa
Bruce W. Churchill, WA4RSZ, Virginia Beach, Va.
Sheldon C. Cleaver, W3RGQ, Nescopeck, Pa.
Bobby Conder, Winston-Salem, N.C.
Philip E. Cutler, Barrington, Ill.
Robert G. Davis, San Antonio, Tex.
Michael Diers, Brooklyn, N.Y.
Daniel Dravel, Montreal, Que.
Colin R. Forbes, Durban, Natal, South Africa
Dennis Freeman, Mt. Shasta, Calif.
Robert H. French, Bellaire, Ohio
Marcus P. Frutchey, Winter Park, Fla.
Thomas J. Giacopelli, WB2FSM, Tuckahoe, N.Y.
William G. Graham, Binghamton, N.Y.
Richard H. Grab, Elmhurst, N.Y.
Tom A. Hamp, Brantford, Ont.
George Hemingway, Taftville, Conn.
Delbert D. Hirst, Snyder, Tex.
William O. Holscher, Webster Groves, Mo.
Ray L. Hood, Indianapolis, Ind.
Robert A. Howell, East Lansing, Mich.
Robert C. Jacobs, New York, N.Y.
Ingolf Kapelrud, Trondheim, Norway
Norman L. Kiel, Bronx, N.Y.
P. Robert Knarr, Elmira, Ont.
John H. Kroon, Haarlem, Netherlands
Bruce M. Lane, Bedford, Mass.
Robert LaRose, Binghamton, N.Y.
Frank X. Lynch, Cape May Court House, N.J.
Robert G. McArthur, WAØFLL, Kansas City, Mo.
Charles McGeorge, Fontana, Calif.
Edward M. Madej, Indian Orchard, Mass.
Jose Montoya, Arequipa, Peru
Jirair M. Moughamian, Beirut, Lebanon
Jim D. Pruitt, Silver Creek, Wash.
Albert T. Quaglieri, Albany, N.Y.
David L. Reddy, K2BUI, Buffalo, N.Y.
Aldridge Salisbury, Falls Church, Va.
Fred C. Sawyer, Milford Bay, Ont.
Martin Schneider, Watertown, N.Y.
Ernest Sisak, Oshawa, Ont.
David C. Skinner, Belleville, N.J.
Wade M. Smith, Wayne, Pa.
Larry G. Standley, Gastonia, N.C.
Douglas W. Stark, WA3CGE, Bethesda, Md.
Jeff Tallent, Louisville, Ky.
Steven B. Teleky, Brooklyn, N.Y.
David L. Thompson, Suisun, Calif.
Lawrence David Thompson, Cincinnati, Ohio
Edward J. Tompkins, Toronto, Ont.
Wayne G. Winston, Chicago, Ill.

### BROADCAST-BAND CLASS

15 Countries

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Frank E. Curran, Wayne, Pa.
Richard M. Daniel, Jr., Swarthmore, Pa.
Robert F. Leamy, Erie, Pa.
Marvin E. Robbins, Broomfield, Colo.
Robert P. Ronai, Castlecrag, Australia
Gary G. Sanford, Beaverton, Ore.
Gray Scrimgeour, La Jolla, Calif.
Mike Tilbrook, Pittsburgh, Pa.
Julian F. Zwolski, Dayton, Ohio

### SPECIAL CLASS

10 Countries

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Ilbeyi Agabeyoglu, Ankara, Turkey
Robert E. Akaye, Toronto, Ont.
Eugene D. Aker, Riverside, Calif.
Paul R. Akers, Hartford, Conn.
Gordon A. Allan, Lively, Ont.
Clark W. Allen, Absecon, N.J.
Edward Allen, Hantsport, N.S.
Mike E. Allen, Wichita Falls, Tex.

Our Fourth Award Period, which closed last April 30, brought the total number of hams, DXers and SWLs who are members of EI's DX Club to well over 2,000. The listing here supplements the membership roster which appeared in our May '65 issue and includes those members who received Awards during the Fourth Award Period. The Fifth Award Period is open at present and applications for Awards now are being received.

William P. Altigieri, Brooklyn, N.Y.
Gordon Amey, Jr., Baltimore, Md.
Rodney G. Anastasoff, Biddeford, Me.
Darrell W. Anderson, Seattle, Wash.
James B. Anderson, Toledo, Ohio
Robert E. Anderson, K1TVF, New Britain, Conn.
Curtis H. Andrews, Jr., Rocky Mount, N.C.
Ronald Andrzejewski, Swoyersville, Pa.
Edward T. Ang, Manila, Philippines
Gary W. Arentzen, Mt. Vernon, Wash.
Austin E. Arnold, Litchfield, Conn.
Phil Ashler, Jr., Pensacola, Fla.
John R. Atwood, Longmeadow, Mass.
John P. Bagge, Springfield, Mass.
Paul W. Baker, Waynesboro, Pa.
David L. Ballew, Nashville, Tenn.
Larry J. Balzer, Conneaut, Ohio
David Barker, Chattanooga, Tenn.
Franklin J. Bayuk, Greenwood, Wis.
John R. Beattie, North Chili, N.Y.
Robert F. Beaudoin, Manchester, N.H.
Adelard J. Beaupre, Putnam, Conn.
Hubert R. Beavers, Albuquerque, N.M.
David A. Begue, Houston, Tex.
Hans O. Beihl, London, Ont.
Lawrence J. Bennett, Forest Hills, N.Y.
Joseph M. Berg, New York, N.Y.
David I. Berger, Wilmington, Del.
Thomas Berhalter, Englewood, N.J.
Edward C. Berkeley, Jr., Danvers, Mass.
Kenneth J. Bernacky, Hartford, Conn.
Walter M. Besse, Chamblee, Ga.
Martin Bigos, Los Angeles, Calif.
Robert A. Blackstone, Waukesha, Wis.
Wayne H. Blair, Altoona, Pa.
Richard W. Bluedorn, Warren, Minn.
Irvin W. Bodofsky, Salem, N.J.
James R. Bolesta, Garfield Heights, Ohio
William J. Bond, New Liskeard, Ont.
Joseph J. Boniakowski, Jersey City, N.J.
Bruce A. Boomer, Nutter Fort, W.Va.
William L. Bound, Kilgore, Tex.
Richard H. Bourcier, Pincourt, Que.
George E. Bousquet, Woonsocket, R.I.
Howard S. Brainen, WN6NRO, Encino, Calif.
John P. Brebner, Kingston, Ont.
Werner H. Breitkopf, Montreal, Que.
Edward J. Brhel, Endicott, N.Y.
Robert Britanak, Jersey City, N.J.
James A. Brodsky, Arlington, Va.
Kent W. Brown, Louisville, Ky.
Timothy C. Brown, Williamsport, Md.
Tony W. Brown, McCoy AFB, Fla.
Donald Burns, Rego Park, N.Y.
Robert H. Burtis, Aurora, Colo.
James H. Burton III, Staunton, Va.
Kenneth R. Butterfield, Plymouth, Mich.
John R. Cantrell, Lexington, Mass.
Allison W. Capson, Saint John, N.B.
Tom F. Carroll, Chicopee Falls, Mass.
Alexander D. Carson, Ft. Saskatchewan, Alta.
David W. Carter, Columbus, Ohio
Gerry A. Cavan, Brantford, Ont.
Daryl K. Cavendish, Ft. Lauderdale, Fla.
Joe J. Cervenka, Elmhurst, Ill.
David C. Chaffin, East Ridge, Tenn.
Paul S. Cherry, Philadelphia, Pa.
Gary W. Christian, St. Louis, Mo.
Robert Claytor, Lancaster, Pa.
Steve Clendenen, Castle AFB, Calif.
Gerald L. Clough, Galveston, Tex.
Curt A. Cochran, Kingston, Tenn.
Jerry A. Coffman, Warren, Mich.
Gerald A. Cohen, WN1CYT, West Hartford, Conn.
Kenneth L. Cohen, Woodbridge, N.J.
Stephen A. Colburn, McDonald, Ohio
Michael W. Colesante, Weirton, W.Va.
Frank D. Colin, Suffern, N.Y.
Robert R. Collins, Santa Ana, Calif.
John F. Condron, Pittsfield, Mass.
Bradley B. Connors, Chevy Chase, Md.
Mason Y. Cooper, Winchester, Va.
Foster J. Cooperstein, New Bedford, Mass.
William George Cornely, Marion, Ohio
Philip M. Cornyn, San Francisco, Calif.
David J. Cory, Bangor, Pa.
Lawrence I. Cotarin, Chicago, Ill.
Steve A. Courts, Milton, W.Va.
Frank T. Coveleskie, Shamokin, Pa.
Bruce P. Cox, Oxford, N.C.
Charles P. Crawford, Evansville, Ind.
Robert R. Crimmins, Yonkers, N.Y.
David Cuevas, South San Gabriel, Calif.
Robert L. Culbertson, Seneca, Pa.
Mortimer J. Cullinan, Augusta, Ga.
Frank E. Curran, Wayne, Pa.
Anthony J. Cusimano, Baltimore, Md.
Gerald R. Dalum, Minot AFB, N.Dak.
Ed Dames, Santee, Calif.
Leonard D'Andrea, Cincinnati, Ohio
Spencer E. Darrah, Media, Pa.
Donald N. Davis, W1DWA, Hinsdale, Mass.
Perry I. Davis, Jamaica, N.Y.
William M. Davis, Belmont, Calif.
Glenn R. Diemond, Ft. Wayne, Ind.
Rickey J. Delcambre, New Iberia, La.
Charles J. Dimsha, Bridgeton, N.J.
Michael J. Doherty, Willowdale, Ont.
Paul R. Donegan, Glendale, Calif.
Danny C. Douglas, McLean, Tex.
Thomas R. Doutt, Independence, Mo.
George Downes, Jr., Magnolia, Ohio
Thomas H. Downing, Independence, Kan.
Robert M. Dugger, Ft. Eustis, Va.
William H. Dundas III, Painted Post, N.Y.
Andrew Durosky, Richmond Hill, N.Y.
Jess E. Dyer, Dearborn, Mich.
Bill Eben, Lachine, Que.
Lawrence A. Edler, Daly City, Calif.
Jack A. Elias, WN3CBO, Elkins Park, Pa.
Wayne L. Elsmore, Klamath Falls, Ore.
James J. Elson, West Chicago, Ill.
Ronald A. Epstein, Salem, N.J.
Lloyd Erlick, Toronto, Ont.
Peter J. Eslinger, Wallingford, Conn.
John C. Espir, Lake Hiawatha, N.J.
K. Robert Evenson, Vermilion, Ohio
Peter Ewenko, Schofield, Wis.
Bruce M. Ewenstein, Whitestone, N.Y.
Ray C. Fallen, WN3DEE, Coraopolis, Pa.
Steve M. Fetter, Newark, Ohio
Robert D. Fiedel, New York, N.Y.
Barry T. Firth, Lakeland, Fla.
Timothy C. Fleming, Albany, N.Y.
Derek James Ford, Auckland, New Zealand
Gary C. Foss, Coulee Dam, Wash.
Geoffrey Joel Fox, Flushing, N.Y.
Barry Francis, Victoria, Tex.
William C. Freeman, Weirton, W.Va.
Donald L. Fuchik, Victoria, Tex.
Roger S. Gaborski, WB2QFI, Rochester, N.Y.
Arnold J. Galina, Worcester, Mass.
Emile G. Gallant, St. Joseph, Mo.
Tom A. Ganser, Chicago Heights, Ill.
David L. Garvey, Grand Rapids, Mich.
John G. Genadopoulos, Pearisburg, Va.
Jan S. Gershkoff, Jericho, N.Y.
Russ Gevertz, San Francisco, Calif.
Richard H. Glassner, Long Beach, Calif.
John W. Gleason, San Bruno, Calif.
Michael A. Glenn, Chicago, Ill.
Ronald C. Goldfarb, WN2OZE, Brooklyn, N.Y.
Kenneth R. Golkin, Silver Spring, Md.
Cliff R. Goodlet, Chattanooga, Tenn.
Bob D. Gordon, Clairton, Pa.
Jim M. Gordon, Monroe, Wis.
Stanford Gordon, Greensburg, Pa.
John R. Gould, Houston, Tex.
Bertrand Goulet, Montreal, Que.
Bernard Greene, Brooklyn, N.Y.
Jeff J. Greene, Bronx, N.Y.
Roger D. Greene, Bronx, N.Y.
Allan R. Greer, New Westminster, B.C.
Walter R. Gregory, San Antonio, Tex.
Edward R. Groholski, Valdosta, Ga.
Neil V. Gustafson, Williamston, N.C.
Dennis Haarsager, Beresford, S.Dak.
George E. Hall, Saddle Brook, N.J.
John R. Hall, Hornell, N.Y.
Frank Halpin, Queens Village, N.Y.
Buddy Hamburg, Denver, Colo.
Douglas A. Hamilton, Santa Maria, Calif.
Patrick A. Hanes, Middletown, Ind.
Kenneth U. Hanning, Houston, Tex.
Jay Hans, White Plains, N.Y.
Vincent R. Harbst, Lewiston, Pa.
Richard W. Hardt, Crown Point, Ind.
Norman M. Hartford, El Monte, Calif.
Ted P. Hasentaub, Fairview Park, Ohio
John E. Hasse, Vermillion, S.Dak.
David W. Hatfield, Clearwater, Fla.
Clarence J. Hattings, W. Hartford, Conn.
Dorian E. Hausman, Wallaceburg, Ont.
Ernest H. Haynes, Lakeland, Fla.
Jerry W. Headen, Winston-Salem, N.C.
Ronald W. Hehard, Tulsa, Okla.
David E. Heil, WN8LET, Oak Hill, W.Va.
Dennis S. Heim, North Tonawanda, N.Y.
Roger W. Heinig, Fitchburg, Mass.
Steven H. Heller, New York, N.Y.
Edgar W. Hellingsworth, Jr., Albany, Ga.
Albert A. Henry, Anaheim, Calif.
Jeremiah T. Herlihy, Sandusky, Ohio
Jerry Herman, Patchogue, N.Y.
Brian L. Hickey, Wayne, Pa.
Jerry C. Hill, New York, N.Y.
Thomas R. Hocker, Arlington, Va.
Herman A. Hodges, Chicago, Ill.
Robert G. Holbrook, Lake Placid, N.Y.
Brent H. Holcomb, Clinton, S.C.
Frank W. Holton, Huntsville, Ala.
John A. Howard, Childersburg, Ala.
Richard T. Howard, Portland, Ore.
John M. Hubbell, Port Credit, Ont.
Donald E. Huber, Huntington, N.Y.
Charles Husinko, New York, N.Y.
Joseph M. Hutchens, Marquette, Mich.
Robert Isele, Gasport, N.Y.
Steven M. Jackel, New Milford, N.J.
Steve N. Jafolis, Manchester, N.H.
Michael W. Jakiela, Seaford, N.Y.
John F. Januszewski, Sayreville, N.J.
Eddie T. Jaworski, Richmond Hill, N.Y.
Calvin R. Jeffries, Toledo, Ohio
Richard F. Jemison, Des Plaines, Ill.
Linford A. Jennings, Dixon, Mo.
Jim Jindrick, Racine, Wis.
Bruce L. Johnson, Elk Grove Village, Ill.
Charles W. Johnson, Charlottesville, Va.
David P. Johnson, Denver, Colo.
Joseph P. Johnson, Racine, Wis.
G. Franklin Johnston, Michigan City, Ind.
Christy W. Jones, Alma, Ga.
Michael L. Jones, Dallas, Tex.
Philip A. Jones, Whittier, Calif.
Cornelius J. Jongkind, La Porte, Ind.
Dennis Jump, Glendale, Calif.
Allan B. Kachel, Flushing, N.Y.
George R. Kahn, Medford Station, N.Y.
Walter J. Kakereka, Jr., Moscow, Pa.
Edward Kalin, West Hartford, Conn.
Robert Kaplan, New York, N.Y.
John Karlen, Franklin, Pa.
Nicholas P. Karin, Whiting, Ind.
John W. Kazmaier, Burlington, Wis.
William E. Keicher, Pittsburgh, Pa.
Bill B. Keller, Hamden, Conn.
Jeffrey R. Kelley, Elizabethton, Tenn.
Kenneth J. Kelly, West Chester, Pa.
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## Can You Recharge Any Battery?

*Continued from page 53*

sistor radio batteries, are another story. They have no safety vents, so too high a charging current can build up internal pressure to the point where the battery goes *boom!* Sealed batteries generally have the recommended recharge current and the time necessary for full charge printed right on the case.

As a general rule it is not wise to charge several series-connected cells unless you know their exact discharge state and individually remove them from the charge circuit. If just one cell in a string of fully discharged cells were only slightly discharged, it would be overcharged before the remaining cells were fully charged. And given high charge rates, a single cell might be boiled out before you realize it.

As we said at the beginning of this article, any commonly-used battery can be recharged. However, you must keep in mind all of the ands, ifs, and buts. A little thought can save you a lot of money.—*Bert Mann*


*"And this is a little ultrasonic cleaner I built myself."*

## CB Corner

*Continued from page 67*

pened to Sabu, the Elephant Boy?" Business radio, the strictly business cousin of CB, is no newcomer, but who's heard of it?

This situation could change rapidly with the new HB-600 transceiver just introduced by Lafayette (see our photo). It provides all regular CB channels and has provision for

New HB-600 transceiver by Lafayette is CB's first combo rig, tunes regular and business channels.

two additional crystals in the near-27-mc business band. End result is a dual rig that could work fine for combined business or pleasure. Listen too casually, though, and you might hear something like "ship two hundred cases of chicken fat . . . and we'll eat it at the picnic" (uttered by different speakers, of course).

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**Wall Paper.** In any case, run-of-the-mill violations definitely are being joined by a smattering of the exotic. Take this chap in Worcester, Mass. He drew a pair without even opening his mouth. Crime 1: failure to modify his license after changing his home address. Crime 2: failure to post his station license in a conspicuous place.

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**Shot Down in Flames** . . . If you think CB is just for talking, you've overlooked the magnificent men and their flying machines. Point is that 27 mc also contains the beep-beep boys—earthbound Baron von Richtovens who radio-control model aircraft. And truth to tell, they've been doing ground loops ever since class-D operators began to flood the frequencies.

Interference to air-borne model receivers has bashed biplanes and fouled Fokkers. But did the fly-boys sob over their wreckage? Not by a long shot. Unlike other segments of CB, they plotted a careful vector toward the FCC, prepared a sensible, well-reasoned argument about their plight and sat back.

Contact! The FCC answered with a slate of now less than five new frequencies for the modelers. In the 72-76 mc band, they're spotted well away from the tight traffic pattern of CB. Looks as though it pays to straighten up and fly right.

## A Guide To SWL Receivers

*Continued from page 94*

ing of ship-to-shore or short-wave broadcasts of the BBC or Radio Moscow variety, a budget receiver is perfectly adequate. Considering that these stations usually come booming in (drowning out all others) and considering that they operate on frequencies which usually are received well by even the lowest-cost receivers, a budget receiver should not be overlooked if reception of this sort is what you have in mind. Budget receivers also are adequate for the student or electronics beginner with just a smattering of interest in SWLing.

When SWL interest is high, with particular attraction to rare, weak or distant stations, good coverage to at least 25 mc is a necessity and attention should be given to receivers in the $100 to $200 range. Budget receivers lack the sensitivity and selectivity to do the job; top-of-the-line receivers, on the other hand, furnish unneeded features.

When SWLing becomes a hobby unto itself, it's wise to start with the best, the top of the line. The excellent calibration of these receivers makes finding a station on a specific frequency a pleasure rather than a chore. Even more important, high selectivity insures they will be capable of digging a weak station out of the QRM. The advantages of high sensitivity and frequency stability speak for themselves.

Unquestionably, if you're a typical SWL you already will have selected the next receiver before the first one arrives. Making the right choice only insures you'll realize decent depreciation before you trade up. To aid your selection, our chart lists all current SWL receivers in order of price. While not intended for comparative purposes, the feature check list indicates the specs most frequently looked for by SWLs. Happy listening!

## Who Speaks For CB?

*Continued from page 69*

club might retain its favorite son in control of the home front, though he also would function as delegate to a national convention. His strength there would be in direct proportion to the size of the club he represented.

The local clubs still would function as they individually saw fit. But they periodically would send their delegate to a national convention to struggle with problems common to CB and CBers. Such a congress ideally would serve to clear the air on matters of general interest and concern to any of the three groups sharing the CB channels.

Significantly enough, this type of association of local clubs presently is in its formative stages in Canada—a country which started in CB years after the U.S. and which has far fewer operators packed onto the band. Even so, it too has yet to see creation of a single club to represent Canadian CBers on a national scale. And whether the current attempt will meet with a degree of success remains a prime question.—*Alex Karlin*

## Bootleg Music Adaptor

*Continued from page 55*

We found the frequency response of the adaptor to be 2db up at 50 cps and 9db down at 6 kc. This limited high-end response combined with the attenuated high-frequency response of the transmitted SCA signal produced a notably muffled sound. Harmonic distortion was found to be 2.7 per cent. The mute, or squelch, circuit works effectively so long as the input signal is not weak. Such a circuit is necessary to kill background noise when the 67-kc subcarrier is not transmitted between music selections. Without the squelch circuit you would hear a hissing background noise as you hear between FM stations on a receiver that does not have squelch. There are only two controls on the adaptor. One establishes the operating point of the squelch. The other control is used to compensate for aging of the 12AX7A multivibrator tube. Once set, they seldom require readjustment.

All in all, if you want hours of pleasant and familiar popular music this SCA adaptor is the way to get it—and without distracting commercials.

## Universal Light Dimmer

*Continued from page 50*

at the junction of R3 and C3 to come up to D1's firing point.

When C3 is charged to about 40 volts, D1 conducts and discharges C3. The discharging of C3 sends a pulse of current through the primary of T1.

T1 then steps up the pulse of current to about 200 volts and applies it to D2 which is in series with the line and the lamp. Since D2's switching voltage is exceeded it conducts. The lamp then lights in proportion to how much of the sine wave is utilized (shaded area, Fig. 6). Because both diodes are two-way devices, they function the same way on both the positive and negative halves of the sine wave thus permitting full-wave control from off to full on.

## Good Reading

*Continued from page 99*

of equipment characteristics and station operation. And all this makes for an excellent gift book for the nearest ham-in-the-making.

**And make note of . . .**

*THE FOUNDER'S TOUCH. By Harry Mark Petrakis. McGraw-Hill, New York. 240 pages. $4.95*

The life of Paul Galvin, founder of Motorola.

*SELECTED SEMICONDUCTOR CIRCUITS. TechPress Publications, Brownsburg, Ind. 80 pages. $1.25*

Lots of interesting transistor and diode circuits for the advanced experimenter.

*ABC's OF HAM RADIO. By Howard S. Pyle. Sams. 128 pages. $1.95*

An introduction to the amateur's amazing world.

*ADDITIONAL 1965 TELEVISION SERVICING INFORMATION. Compiled by M.N. Beitman. Supreme Publications. 192 pages. $3.*

Must-have data for the TV repairman.

## ELECTRONIC SWAP SHOP

*Continued from page 20*

corder or CB transceivers. Lanse Adams, 215 W. Queen St., Edenton, N.C.

RA-11 tape recorder with accessories. Want CB transceivers, 4-speed record changer, stereo amplifier or go-kart engine. Robert Petruska, 52 Church St., Beaver Meadows, Pa.

CRYSTALS for Globe Electronics CB-100. Have channels 9, 11 and 18 receive, want equivalent crystals, same channels, for CB-100A transceiver. David Stefun, 2606 Angie Way, Rancho Cordova, Calif. 95670.

EICO 803 Geiger counter. Make swap offer. T. A. Flournoy, Rte. 1, Mineola, Tex. 75773.

ARC-3 VHF receiver with conversion instructions. Will trade for CB transceiver. William D. Kriegs, 4209 Highland Ave., Downers Grove, Ill. 60515.

LAFAYETTE HE-29C transceivers. Want SWL, ham or CB gear. James Mitzel, 41 W. Maple St., Dallastown, Pa. 17313.

HALLICRAFTERS S-40A and Philco AM/FM receiver. Need Hallicrafters SX-62 and TV signal booster. Gene Harris, 1736 Lowell Dr., Kingsport, Tenn. 37660.

LAFAYETTE atom smasher and assorted electronic components. Interested in VFO or license-free transceiver. Bill Patrick, Box 23, Booneville, Ky.

HEATH IM-10 VTVM and HD-11 Q-multiplier. Want Heath Twoer or Sixer. J. B. Ballard, 300 N. King St., Xenia, Ohio.

SW RECEIVER, picture tubes and model engines. Need CB transceiver. Mike Campbell, 4212 Searcy Dr., Louisville, Ky. 40216.

DUKANE mono tape recorder. Want ham equipment. Paul Songer, 2925 N.E. 45th Ave., Portland, Ore. 97213.

HALLICRAFTERS HT-40, SX-140 and Knight V-44 VFO. Will swap for Heath HW-12 or HW-32 transceiver. Joe Cross, WA0BPR, 5676 N.E. 22nd St., Des Moines, Iowa. 50313.

ASSORTED COMPONENTS in 5-lb. box, Symphonic portable record player, other items. Make swap offer. P. Barta, 10235 De Martigny St., Montreal 12, Que.

NOVICE TRANSMITTER. Will trade for 2- or 6-meter transceiver or CB transceiver. Robert Casey, WN4ZIH, 5925 A St., Little Rock, Ark. 72205.

ASSORTED COMPONENTS. Will exchange for ham equipment. Mike Craig, 10642 Dorothy, Apt. 8, Garden Grove, Calif.

KNIGHT Ocean Hopper. Will trade for Heath GW-31 transceiver. John Gussman, 612 Miller Ave., Pacifica, Calif. 94044.

KNIGHT Star Roamer and Hy-Gain 14 AVS antenna. Will swap for tape recorder. Charles Dauwalder, Box 164, Newfield, N.J. 08344.

FORD car radio (1957). Will swap for oscilloscope. Jack Thompson, 14 Rose Terr., Chatham, N. J. 07928.

VOCALINE CB transceivers. Will trade for CB transceivers of equal value. William E. Quick, 2843rd USAF Disp., Olmstead AFB, Pa. 17057.

SIMPSON meters, Crown portable radio, Kodak movie camera. Will swap for communications receiver. Carlos E. Villia, 14 Wompatuck Rd., Hingham, Mass. 02043.

KUHN 353B AM/FM receiver. Want Lafayette HB-115 or other CB transceiver. Mike Esposito, 2105 Rockaway Pkwy., Brooklyn, N.Y. 11236.

OLD TUBES, cameras, typewriters, Knight communications receiver. Looking for movie camera or FM receiver. Robert Koontz, 1018 Washington St., Huntington, Pa. 16652.

GR-81 short-wave receiver. Will trade for Knight Span Master or Ocean Hopper. Doug Keenan, 712 Penn St., El Segundo, Calif.

LAFAYETTE Explor-Air SW receiver. Make swap offer. R.K. Wells, Bonnie Brae Lodge, Bernhards Bay, N.Y. 13028.

LAFAYETTE HA-70 walkie-talkie. Want Heath Q-multiplier. Don Herron, 704 MacArthur, Urbana, Ill.

HEATH DX-35 transmitter, signal generator, other items. Will exchange for 6VDC/110VAC CB transceiver. Jesse Jackson, 4141 Nye Lane, Carson City, Nev.

ZENITH 3-band radio. Make swap offer. B.W. Blake, 32 W. Harding, Lombard, Ill.

GRUNOW 11G all-band receiver. Make swap offer. Gordon Estes, 301 W. College St., Georgetown, Ky. 40324.

GE 212 AM/FM receiver. Need test equipment. Rush Hood, Jr., 2404 Lane Ave., Anderson, S.C.

TAPE RECORDER, oscilloscope, other items. Will swap for back issues of Electrical Experimenter or Science & Invention. Lucy Kaprelian, 811 Philadelphia Rd., Joppa, Md. 21085.

NATIONAL NC-60 receiver. Looking for UHF equipment. Bruce Bennett, 938 Kintyre Way, Sunnyvale, Calif. 94087.

ARISTO walkie-talkies, assorted transistors. Interested in tape recorder or Hallicrafters S-119 SW receiver. Jimmy Johnson, 517 S. Person St., Raleigh, N.C.

PHONES, tubes, other parts. Will trade for Ocean Hopper. J.M. Andrews, 3303 N. Willow, Bethany, Okla. 73008.

GLOBE V-10 VFO. Want 6-meter converter. Dennis Haarsager, WAØKKR, Rte. 3, Beresford, S.D. 57004.

LAFAYETTE HE-100 walkie-talkies, Knight T-60 transmitter, Novice crystals, semi-automatic key. Will swap for 6-meter transceiver. Carl Capasso, WB2PGE, 421 Queen St., Woodbury, N.J.

OLSON/NORELCO speaker and enclosure. Will swap for Allied and Lafayette catalogs dating from 1945, FM tuner or Garrard AT-6. Ron Alsheimer, Box 37, Waterville, N.Y. 13480.

ASTATIC AT-1 TV booster and Walsco 2000 TV UHF converter. Will exchange for VHF receiver. Preston L. Meeks, 4641 Janssen, Corpus Christi, Tex. 78411.

KNIGHT 2-station intercom and Span Master, Lafayette HE-29C walkie-talkie. Want Knight Star Roamer and KG-4000A walkie-talkie. Randy Rogers, 1226 Alaska, Dallas, Tex. 75216.

TEST EQUIPMENT. Interested in Heath GC-1A, Vacationer antenna and AC grid-dip meter. Stephen Clifton, 800 West End Ave., New York, N.Y. 10025.

HEATH GR-81 short-wave receiver. Looking for CB equipment. John Irvine, Jr., 6236 Worlington, Birmingham, Mich.

ZEPHYR short-wave receiver. Will swap for tape recorder. Don Davis, 1862 Cliffhill Dr., Monterey Park, Calif. 91754.

PHILMORE PA-62D stereo amplifier and TMK TP-5 VTVM. Want VHF receiver. Bob Wilk, 6721 Charlotte, Kansas City, Mo. 64131.

MICROPHONES, assorted vacuum tubes, Magnavox walkie-talkie. Want tape recorder or oscilloscope. Leonard Rayborn, 220 W. 7th St., Hattiesboro, Mo. 39401.

INTERCOMS. Will swap for Knight RF generator or RC tester. Rick Shell, 110 S. Park Blvd., Glen Ellyn, Ill. 60137.

TV SETS. Want ham TV gear. Frank McKenny, 7731 Brookside Rd., Richmond, Va. 23229.

LAFAYETTE TE-50 tube tester, assorted old tubes. Looking for surplus oscilloscope. Howard Rock III, Box 85, Irvington, Va. 22480.

UHF RECEIVER, plug-in relays. Want tape recorder or VHF receiver. David Chandler, 6005 Apex Dr., Louisville, Ky. 40219.

WILCOX GAY tape/disc recorder. Will exchange for Hallicrafters S-120 or other communications receiver. John Palencak, 3714 Keyes, Flint, Mich. 48504.

KNIGHT T-60 transmitter. Will swap for Cadre C-75 or Knight C-22 CB transceiver. Eugene Peroni, N. Maple Ave., Basking Ridge, N.J. 07920.

PRI 106-C Geiger counter, ham equipment. Want Regency ATC-1 SW converter. Stan Putra, 1429 Lawndale, Racine, Wis. 53403.

RIC transmitter and receiver. Will trade for oscilloscope. Ken Schwartz, Box 2661, Sepulveda, Calif. 91343.

SPEAKER, assorted components, magician's equipment. Will exchange for SW receiver. James Bajor, 20748 Cyman, Warren, Mich.

BC-620 with power supply. Will trade for CB transceiver. James O'Brien, S. Main St., Haydenville, Mass. 01039.

KNIGHT Star Roamer receiver. Will swap for walkie-talkie. Max B. Christensen, Box 532, Soda Springs, Idaho.

OLD TUBES, assorted components, 1939 Radio Troubleshooters Handbook. Will swap for SW receiver. Charles Stevenson, 14400 E. 14th St., Apt. 26, San Leandro, Calif.

ANTIQUE RECEIVERS. Will swap for test equipment or tri-band beam. Roland P. Boucher, Box 103, Chester, Mass.

[Continued on page 117]

## The Ham Shack

*Continued from page 79*

dissolved into perfectly good speech.

Let this be a reminder that the fone bands are open to both USB and LSB, at the option of the operator. And switching from one to the other. on the same carrier frequency, often can solve a serious QRM problem.

---

**Magical Mike** . . . Like most hams, we dread unexpected visitors who aim to be thrilled by the marvels of short-wave radio. You know what usually happens . . . nothing. The bands simply black out. So we had the excuses all ready when a neighbor dropped in with an eager-faced youth clutching a copy of EI in a notably clean hand. It was Saturday afternoon and 20 meters was a mass of heterodynes.

Weakly, we let out a few indifferent CQs, just to show how the VOX worked. A walloping signal on frequency rocked us all back on our seats. It was SM5RM, to report that we were loud and clear in Stockholm, Sweden!

Miraculously, an ionospheric funnel must have opened between us and Europe. During the next half hour we worked a string of other stations in Germany, France, Switzerland and Italy. The visitors sat in dazed silence, their eyes literally popping. When thev left, they were slightly incoherent.

## Flat TV

*Continued from page 32*

● Production. Should be easily mass-produced—an *el* screen can be fabricated with etching techniques, in much the same manner that printed-circuit boards are made.

When will you see flat TVs on the market? Before Chernow's work came to light, standard prediction was ten years from now. But with these new developments, the prophets will have to trade in their crystal balls—and for the new flat kind. Best guess has flat TV a scant five years away. By that time you should be doing a double-take before those pictures of Whistler's Mother. Even Whistler himself never would have expected to see the old gal moving and talking!

*—Len Buckwalter, K1ODH*

## The Listener

*Continued from page 46*

(Hungary). The latter, closely paralleling many of R. Portugal's activities, is concentrating on forming local chapters and already has set one up in Texas. It remains to be seen whether Prague and Budapest will follow Lisbon's lead completely and try to use the DXer's desire for a QSL to force him into a club.

EI disparages this forced marriage of pure politics and the DX hobby by *ultra*-propaganda-oriented SWBC stations. If you can get a QSL without joining, more power to you. If you can't, we say, forget it!

---

**Utility DX** . . . Until recently one of the best SW DX grab bags was Cable & Wireless Ltd., a London-based firm which provides telephone and telegraph services in a number of rare countries—Jamaica, Trinidad and Bermuda, for example—which have no SWBC stations at all. What made C&W all the better were its verification policies, since most of its regional offices would confirm reception of test transmissions.

Now all reports from DXers suddenly are being forwarded to the head office which, in turn, sends out a form letter quoting ITU secrecy regulations and concluding, "We cannot give you the information for which you ask." Of course, the DXer didn't ask for information, just a QSL.

Nevertheless, that's the policy and we're stuck with it. Only answer is to switch over to aeronautical stations for countries in this category (see the July '65 LISTENER for a discussion on how aeronautics tie in with the Caribbean's Cay Sal).

## Hi-Fi Today

*Continued from page 70*

chining the guide to a mirror finish for minimum friction against the moving tape, Uher has elected to make a rough, ridged affair that tends to remove any loose oxide or other grit on a tape before it reaches the heads. Idea is to make head maintenance easier while sparing the heads at least a bit of the usual wear.

# ELECTRONIC SWAP SHOP

*Continued from page 115*

EICO 720 transmitter and 722 VFO. Will trade for 2-meter transceiver and antenna. Steven M. Stern, WB2ICH, 406 S. First Ave., Highland Park, N.J. 08904.

SONY 464-D stereo tape deck. Will trade for Roberts 1055 recorder or Sony Micro-TV with battery pack. Neil Laursen, 137 Broadway, Dunedin, Fla.

MONITORADIO VHF receiver and Ameco VHF 2-channel converter. Want Lafayette HA-300, HA-150, HE-75 or Part-95 CB walkie-talkie. Robert H. Kluckholm, 9420 Montego Bay Dr., Miami, Fla. 33157.

ASSORTED TUBES, other components. Interested in CB transceivers, walkie-talkies, CW receivers. Keith Seamans, Jr., Box 33, E. Pembroke, N.Y. 14056.

GENERAL ELECTRIC TV sets. Will swap for tube tester or CB equipment. Larry C. Martin, Rte. 2, Pittsburgh, Tex. 75686.

STEREO AMPLIFIER, auto radio with 117 VAC power supply. Will exchange for Lafayette HB-222 CB transceiver. Gregory Van de Berghe, 77-84 271 St., New Hyde Park, N.Y. 11043.

CB CRYSTALS, disc and wire recorder, other components. Make swap offer. Olson, Apt. 1, 1510 S. Dunsmuir, Los Angeles 19, Calif.

GENERAL ELECTRIC transistor receiver. Make swap offer. Philip Bresky, 3245 St., Rte. 44, New Milford, Ohio 44263.

ZENITH Transoceanic receiver. Want communications receiver. Jan Goodsell, 9734 E. Rosencrans, Bellflower, Calif. 90706.

HALLICRAFTERS S-53A communications receiver. Will swap for Heath Twoer or other 2-meter ham gear. Mike Bane, WN4WXG, 4483 Quince Rd., Memphis, Tenn. 38117.

TAPE RECORDER, 8-mm movie camera and projector. Will trade for tube tester and signal tracer. Col. Everett F. Olin, 113A Gansevoort Rd., S. Glenns Falls, N.Y.

PACO V-70 VTVM, EICO 145A signal tracer, Knight transistor tester, Lafayette tube tester and pocket VOM, used tubes. Interested in oscilloscope, CRT rejuvenator and tester or VTVM. Paul Sullivan, 32 Juniper St., Brookline, Mass. 02146.

PEERLESS tape recorder, neon sign transformer. Want Ameco 6-meter converter or walkie-talkie. Raymond J. Frost, WB2RBQ, 224 E. High St., Painted Post, N.Y.

TRANSETTE walkie-talkies. Want Novice ham equipment. Randy Vitale, 8632 Riverside, Hollywood, Ill. 60513.

ARL-198 surplus TV camera. Need stereo-FM tuner and amplifier. Gary Bourgois, 221 Beech St., Kingsford, Mich. 49802.

RCA 10K-1 communications receiver. Want FM tuner or tape recorder. Ken Rubin, 1246 E. 22 St., Brooklyn, N.Y. 11210.

HALLICRAFTERS S-119 receiver, Heath Q-multiplier. Will exchange for preselector, mechanical filter or SWL equipment. Steve Rollin, 7546 Brockton Rd., Philadelphia, Pa. 19151.

CB transceiver. Make swap offer. James Kohl, 3801 Liberty Ave., Shadyside, Ohio 43947.

LAFAYETTE HA-60 CB walkie-talkie and Aurora racing set. Will trade for SWL receiver or test equipment. John Kuc, 193 Hampshire St., Indian Orchard, Mass. 01051.

KNIGHT Star Roamer, 80-power telescope. Will swap for ham-band receiver. Steve Scott, Box 1046, Rte. 1, Palm Harbor, Fla.

LAFAYETTE wireless broadcaster. Will trade for S-meter, VOM or burned-out tubes. Greg DeHoogh, 1523 Dick Dr., Aberdeen, S.D. 57401.

KNIGHT SW receiver. Make swap offer. Tom Jonez, 8308 W. 44th St., Tacoma, Wash. 98466.

HALLICRAFTERS S-120. Need Hallicrafters S-38 or S-38B. Gerry L. Dexter, 904 Jefferson, Apt. 8, West Bend, Wis. 53095.

ART-13 transmitter. Interested in CB equipment. Ricky Burk, Box 694, Cleveland, Miss.

KNIGHT LC-1 CPO. Will swap for anything of equal value. Henry F. O'Meara, 21 Glendale Rd., Brockport, N.Y. 14420.

LINEAR AMPLIFIER (200-watt), 80/40-meter Novice transmitter. Want 6-meter or CB transceiver. Franc Johnson, 3486 Belvedere N.W., Salem, Ore.

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TAPE RECORDERS Hi-Fi Components. Sleep Learning Equipment, tapes. Unusual values. Free Catalog. Dressner, 1523 Jericho Tpke., New Hyde Park-4, N. Y.

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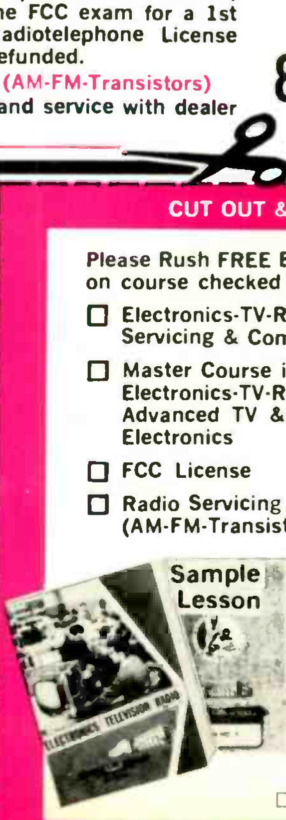

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