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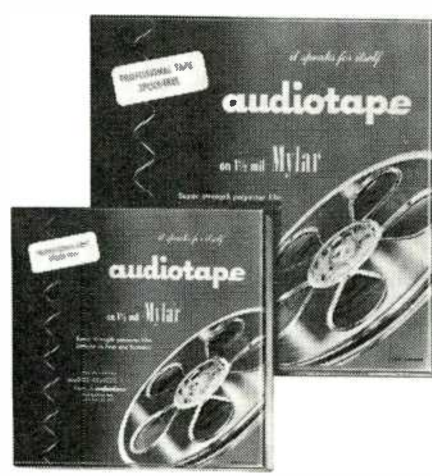

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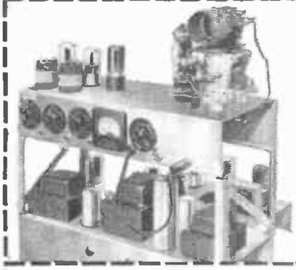

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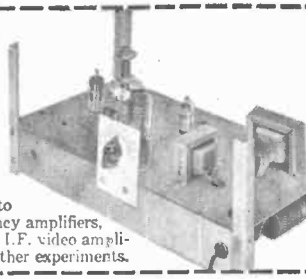

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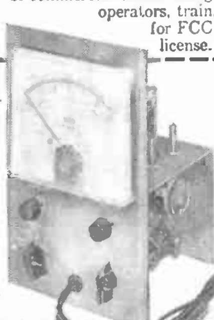

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JULY 1960

ZIFF-DAVIS PUBLISHING COMPANY

VOLUME 13 NUMBER 1

Electronic Construction Projects

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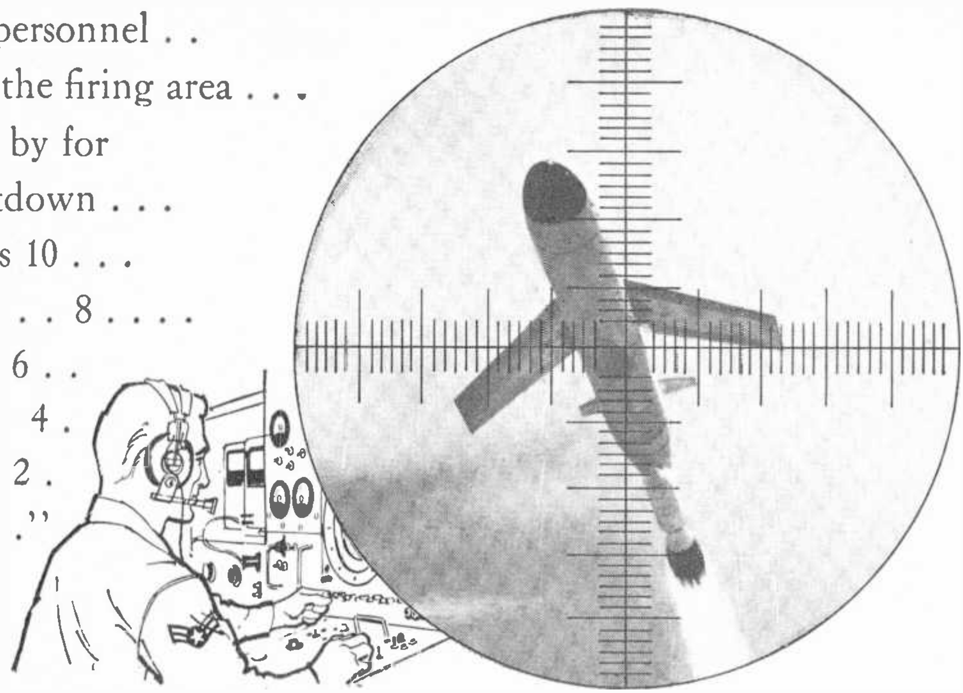

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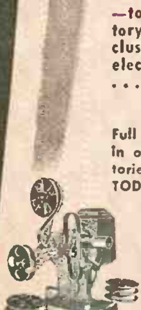

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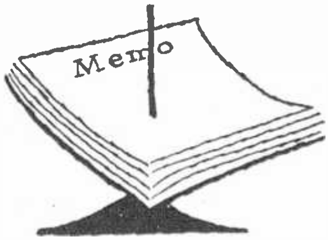

Notes from the Editor

SWL REGISTRATION. Just the other day we received a tabulated report on the Short-Wave Monitor Registration Program that was sponsored by POPULAR ELECTRONICS last year. Here are some of the statistics from the report which I think will interest you. The tabulation, incidentally, was based on 12,948 registration forms received up to January 1, 1960.

First of all, let me fill you in on the purpose of the registration program itself. There had long been a need for the "SWL" to have some individuality. Unlike hams, who are licensed by the government and assigned their own call letters, short-wave listeners had no one to turn to and were "lost in the shuffle." We decided to do something about this situation--it was high time each DX'er had his own "call sign" to use on his QSL cards rather than the anonymous "W5-SWL" type of identification. We then devised the now-famous "WPE" call signs, cleared them with the FCC, and began issuing them to DX'ers.

The most striking bit of information extracted from the tabulated report was that 41.2% of the registering short-wave monitors own more than one receiver. These receivers are not home-brew one-tube regen sets but top-notch-quality all-band receivers that would make the average ham turn green with envy. Manufacturers whose receivers were listed the most times were--in order--Hallicrafters, National, Allied Radio (Knight and Knight-Kit), and Heath. All together, these manufacturers accounted for 65% of the receivers owned by the registrants. The most frequently listed receiver was--you guessed it--the Hallicrafters S-38. Various models of the S-38 are being used by almost 10% of the registrants--quite an endorsement of this old favorite. The second most-used receiver was the Heath AR-3, a unit which has started many an SWL on the road to this rewarding hobby.

The most popular bands monitored are 20, 25, 31, and 40 meters --more than 20% of the registrants reported that they listen to these bands regularly. Over 55% of the monitors use a long-wire antenna; however, many prefer a high-gain beam antenna of some kind--with a few using antenna rotators. One last statistic points out the degree of interest that most of the registrants have in short-wave listening: almost one out of ten reported that he had already obtained over 100 QSL cards.

The overwhelming number of applicants for the certificates made the registration project worthwhile and helped us gain a great deal of valuable information about our SWL readers in addition to reaffirming our belief that DX'ing is a serious and vital electronics hobby. We hope to translate this information into better, more interesting coverage of the SWL field.

Oliver Read

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FCC Report

By ROBERT E. TALL
Washington Correspondent

Computers for FCC

THE electronic data processing bug has bitten the FCC. At the moment, chances look good that the Commission will be blipping out your Citizens Band licenses by machine in a few more years. Studies are already being made by the National Bureau of Standards to see which parts of the FCC's activities can be fitted into computer operation, but it will probably take until early 1963 for the Commission to make the necessary decisions and get the program into full swing.

Word on the computer plans was passed to the House Interstate & Foreign Commerce Communications Subcommittee when the Commission went up for its annual quizzing in connection with appropriations for the year starting July 1. Several of the Congressmen briefed on the plans expressed quick support.

FCC Executive Officer Robert W. Cox told the subcommittee that both the Bureau of Standards and the Commission feel it is "premature" to say how much money can be saved or how much faster work can be done by a computerized operation. However, both agencies are "very optimistic" about the possibilities.

The big question concerning the Citizens Band and other two-way radio fields administered by the FCC is not whether the machines can handle license processing, but whether they can do the work more economically. A decision as to whether or not to swing into a full data processing program will probably be made by the FCC this fall. If the agency goes the computer route, another complete overhauling of application and license forms is indicated.

Chairman Albert Thomas (D., Tex.) of the House Subcommittee said the work of the FCC's Safety & Special Radio Services

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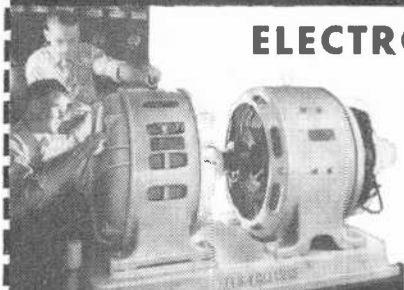

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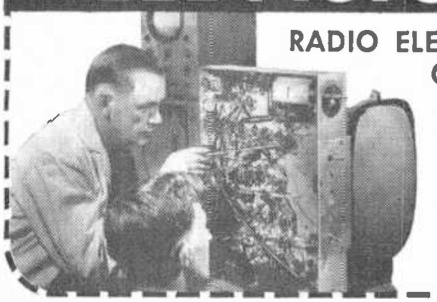

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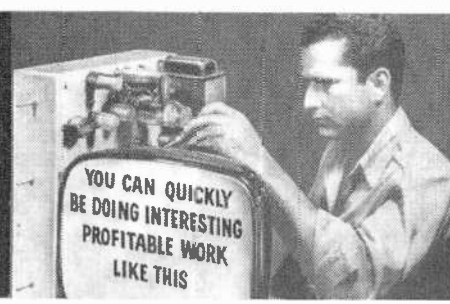

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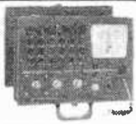

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6 Model SR-2 New Resistance Substitution Box Kit
Kit Net Price..........$8.95
Factory-wired Net Price.$11.95

7 Model RD-5 New Decade Resistor/ Divider Kit
Kit Net Price.........$23.95
Factory-wired Net Price.$29.95

8 Model ST-45 New AM-FM Stereo Tuner Kit
Kit Net Price.........$84.95
Semi-kit Net Price.....$99.95
Factory-wired Net Price $134.95

9 Model ST-35 New FM Tuner Kit
Kit Net Price.........$59.95
Semi-kit Net Price.....$69.95
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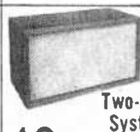

10 Model L2-U New Wide-Range Two-Way Speaker System Semi-Kit
Semi-kit, unfinished Net Price $59.95
Semi-kit, walnut finish Net Price $69.95

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PACO Test Equipment and Hi Fi Kits are produced under the auspices of *PRECISION Apparatus Company, Inc.*, world-famous manufacturer of industrial electronic test instruments and stereo high fidelity components for over a quarter of a century. Write to Dept. P for the new complete 1960 PACO Catalog, just off the press. You'll keep it for permanent reference.

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Kit Division of *PRECISION* Apparatus Co., Inc.

Bureau, which includes the Citizens Band activities, should fit into computer operation "just like it is made to order." If the program is undertaken, it very definitely should mean much quicker application processing.

Citizens Band applications were being received by the FCC at a rate of more than 10,000 a month, and the FCC told the House members that since "an estimated 50 firms are making or planning to make the relatively inexpensive Citizens Band equipment, a steady rise in receipts can be expected as sales promotion plans get under way and competition results in lowered prices." The Congressmen sitting in on the sessions did not raise many questions when they were told that the Commission expects the Citizens Radio Service to grow to an estimated 200,000 licensees this year, and that the blossoming service has required enforcement action "leading to the issuance of at least 100 citations per month" for violations.

The FCC asked for money for added enforcement personnel to handle problems involving class D licensees, which will "undoubtedly increase as the band becomes saturated." Individual CB enforcement cases continue to involve primarily off-frequency operation and failure to answer FCC violation notices.

Amateur radio, meanwhile, got a large national publicity boost when a live broadcast account of the annual meeting of President Eisenhower's Committee on Employment of the Physically Handicapped was transmitted to physically handicapped and other radio enthusiasts throughout the world.

Accounts of the May 5-6 meeting in Washington were put on the amateur airways by Miss Margaret Cauffield (W3UTR) and Gordon Walker. Miss Cauffield is a wheelchair-bound "ham" employed by the Office of Vocational Rehabilitation of the Department of Health, Education & Welfare; Mr. Walker is also confined to a wheelchair and is an electronics engineer with the Navy's Bureau of Ships.

The station they used was loaned for the venture by a Washington electronics and radio parts firm. It was operated with a power of about 145 watts, with a 55′ x 35′ antenna supplied by the Naval Research Laboratory on the roof of the Departmental Auditorium in Washington where the meeting was held. —30—

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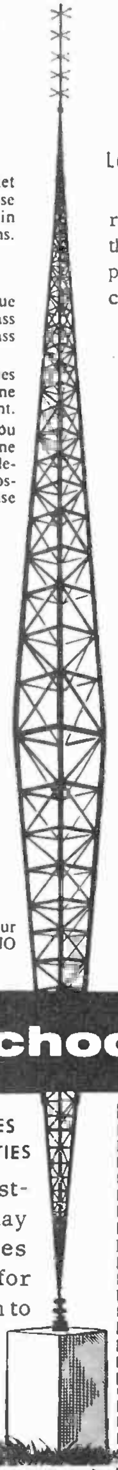
Do you WISH you were EMPLOYED in ELECTRONICS?



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The Grantham course covers the required subject matter completely. Even though it is planned primarily to lead directly to a first class FCC license, it does this by TEACHING you electronics. Some of the subjects covered in detail are: Basic Electricity for Beginners, Basic Mathematics, Ohm's and Kirchhoff's Laws, Alternating Current, Frequency and Wavelength, Inductance, Capacitance, Impedance, Resonance, Vacuum Tubes, Transistors, Basic Principles of Amplification, Classes of Amplifiers, Oscillators, Power Supplies, AM Transmitters and Receivers, FM Transmitters and Receivers, Antennas and Transmission Lines, Measuring Instruments, FCC Rules and Regulations, and extensive theory and mathematical calculations associated with all the above subjects explained simply and in detail.

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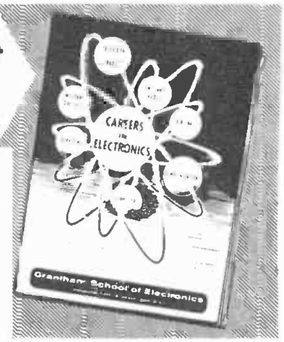

This free booklet gives details of our training and explains what an F.C.C. license can do for your future. Send for your copy today.

HERE'S PROOF...

that Grantham students prepare for F.C.C. examinations in a minimum of time. Here is a list of a few of our recent graduates, the class of license they got, and how long it took them:

	License	Weeks
Mario Bidese, 342 Alexander Avenue, Greensburg, Pa.	1st	12
Richard M. Wilhoit, 2104 Santa Paula, Las Vegas, Nev.	1st	12
Larry R. Perrine, 7 Normandy Place, Champaign, Ill.	1st	15
Emerson F. Lawson, 111 Excelsior Ave., Union, S.C.	1st	12
Marion Woolsey, 3246 Warwick, Kansas City, Mo.	1st	12
Harold W. Johnson, 5070 Hermosa Ave., Los Angeles, Calif.	1st	15
Arthur W. Hardy, 66 Dresser Ave., Great Barrington, Mass.	1st	12
Ralph Frederick Belsner, 2126 Grand, Joplin, Mo.	1st	12
N. B. Mills, II, 110 So. Race St., Statesville, N.C.	1st	12
Dean A. Darling, 403 S. Chase Ave., Columbus 4, Ohio	1st	12
Paul D. Bernard, 408 First Ave., N.E., Watertown, S.D.	1st	18
Gerald L. Chopp, 518 Aubudon Road, Kohler, Wisc.	1st	12

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Address ______
City ______ State ______

I am interested in: ☐ Home Study, ☐ Seattle classes ☐ Hollywood classes, ☐ Kansas City classes, ☐ Washington classes

03-K

Letters from our readers

Club Members Wanted

■ It seems to me that you frequently publish letters from readers who want to form clubs to promote their favorite areas of electronics. Although I am sure these readers have good intentions, I doubt that many of them know exactly what functions they wish their clubs to perform, and that even fewer have a satisfactory means of communicating with other members (unless the club is local).

Personally, I like to think of POPULAR ELECTRONICS itself as a club, with each issue serving as the club bulletin. If you consider the monthly cost of the magazine as dues, this is a pretty inexpensive club to join. No matter what the topic—if it is of general interest—there seem to be regular articles in P.E. pertaining to it. If there aren't many articles on a particular topic, chances are that few people are interested in it, and thus one would have a difficult time forming a club to promote it.

If P.E. fails to provide articles of general interest, it is up to us "members" to make our "officers" aware of it so they can correct the situation. We "members" hold the controlling interest since the "dues" are our "officers' " bread and butter.

DON F. LAMPREY
Schenectady, N. Y.

Right you are, Don. We can only add a hearty "Amen."

Extra Copies Out There?

■ For the past two years I have been trying to locate copies of the 1955 May and June issues of POPULAR ELECTRONICS. I am willing to pay any reasonable price for them, including postage.

JOSEPH A. PALMER
9 Brouillette St.
Lowell, Mass.

Batteries for Solar Cells

■ I thought you might be interested to know that I just finished building Donald L. Stoner's 40-meter solar-powered transmitter described in the August 1959 issue. Instead of solar batteries, however, I used two penlight cells for power. With all-new parts, the total cost came to $6.91.

BILL JACOBS
Boardman, Ohio

Capacitors

■ Congratulations on your fine article on capacitors which appeared in the April issue. This is the first simple, yet concise, article I have found on

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● The advertised tubes are not necessarily new, but may be electrically perfect factory seconds or used tubes—each is clearly so marked.

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5X8, 5Y3GT, 5Y4G, 6A7, 6A8, 6AB4, 6AC7, 6AF4, 6AG5, 6AG7, 6AH4GT, 6AH6, 6AK5, 6AL5, 6AL7, 6AM8, 6AN8, 6AQ5, 6AQ6, 6AQ7GT, 6AR5, 6AS5, 6AT6, 6AT8, 6AU4GT, 6AU5GT, 6AU6, 6AU8, 6AV5GT, 6AV6, 6AW8, 6AX4GT, 6AX5GT, 6B8, 6BA6, 6BC5, 6BC8, 6BD6, 6BE6, 6BF5, 6BF6, 6BG6G

6BH6, 6BJ6, 6BK5, 6BK7, 6BL7GT, 6BN8, 6BQ6GT, 6BQ7, 5BY5G, 6BZ6, 6BZ7, 6C4, 6C5, 6C6, 6CB6, 6CD6G, 6CF6, 6CG7, 6CL6, 6CM6, 6CM7, 3CN7, 6CS6, 6CU6, 6DE6, 6DQ6, 6F6, 6H6, 6[illegible]4, 6[illegible]5, 6[illegible]7, 6K6GT, 6K7, 6K8, 6L[illegible], 6N[illegible], 6Q[illegible], 6S4, 6S8GT, 6SA7, 6SC[illegible]

6SF5, 6SF7, 6SJ7, 6SK7, 6SL7GT, 6SN7GT, 6SQ7, 6SS7, 6T4, 6T8, 6U8, 6V6, 6W4GT, 6W6GT, 6X4, 6X5, 6X8, 6Y6G, 7A4/XXL, 7A5, 7A6, 7A7, 7A8, 7B4, 7B5, 7B6, 7B7, 7B8, 7C4, 7C5, 7C6, 7C7, 7E6, 7E7, 7F7, 7F8, 7H7, 7N7, 7Q7, 7X7/XXFM, 7Y4

7Z4, 12A8, 12AQ5, 12AT6, 12AT7, 12AU6, 12AU7, 12AV6, 12AV7, 12AX4GT, 12AX7, 12AZ7, 12B4, 12BA6, 12BA7, 12BE6, 12BF6, 12BH7, 12BQ6, 12BR7, 12BY7, 12CA5, 12J5, 12K7, 12L6, 12Q7, 12SA7, 12SG7, 12SJ7, 12SK7, 12SN7GT, 12SQ7, 12V6GT, 12W6GT, 12X4, 12Z3, 14A7/12B7, 14B6, 14Q7, 19, 19AU4GT

19BG6G, 19J6, 19T8, 24A, 25AV5, 25BQ6, 25DN6, 25L6GT, 25W4GT, 25Z5, 25Z6, 26, 35A5, 35B5, 35C5, 35L6GT, 35W4, 35Y4, 35Z5GT, 37, 39/44, 42, 43, 45, 50A5, 50B5, 50C5, 50L6GT, 50X6, 56, 57, 58, 71A, 75, 76, 77, 78, 80, 84/6Z4, 117Z3, 117Z6

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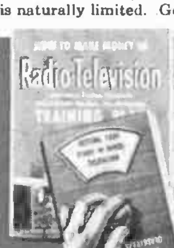

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#331B — Complete with crystal and tubes. Requires no high voltage supply. Operates on 12 V. DC. Self installed in seconds. **$24.95**
Other models for 108-162 MC avaialble.

#315A is a practical converter for emergency use. Easily installed. Tuning range approximately 12 MC in the 26-50 MC band—30 MC in the 108-174 MC band. Designed for mobile or home use. **$13.95**
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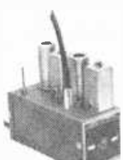

#341A CITIZENS BAND TUNEABLE CONVERTER. This universal converter covers the entire Citizens Band and is designed for use with home, car or communications sets—AC-DC or standard models. Also available: 200-400 KC Aircraft, 2-3 MC Marine, 4.5 MC-CAP. or Amateur 2-30 MC. **$24.95**

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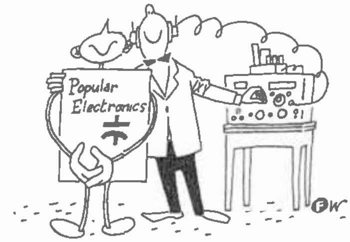
Letters

(Continued from page 12)

the subject anywhere. It was not only a refresher for old-timers, but an education in itself for any newcomer to the electronics field. In almost five



years of hamming. I had never been able to find a good, clear article on capacitors before.

BRUCE W. WALLACE, K8OIG/AFA8OIG
Rochester, Mich.

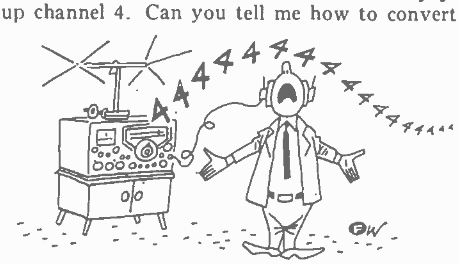
Canadian Novices

■ I would like to start a move to have Novice licenses issued in Canada. Any Canadian SWL's who are interested in becoming Novices are invited to send me their signatures so I can forward them, along with our arguments, to the Department of Transport.

DAVID A. GRANGER
73 Sunninghill Ave.
Hamilton, Ontario, Canada

Information Please

■ I recently bought a surplus receiver called a "R2/ARR 3." It works well but I can only pick up channel 4. Can you tell me how to convert it



to the FM broadcast band, or where I could get the necessary information?

JOHN BECKETT
338 Inverness Ave. East
Hamilton, Ont., Canada

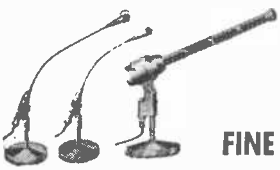
Can anyone out there give Reader Beckett a helping hand?

BC DX'ing

■ I was glad to read Mr. Leitch's letter in the April issue concerning BC'ing, for I would like to see broadcast-band listening come into its own. Although I am also a short-wave enthusiast (I've logged 35 countries, 12 verified to date), listening on the broadcast band with my Hallicrafters S-38E provides a bigger thrill—I've been doing it for about a year now, and short-wave listening was never so much fun.

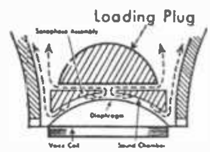
On the BC-band I have thus far logged 244 stations, covering 27 U. S. states, three Canadian

The Sounding Board



FINE DYNAMIC MICROPHONES YOU CAN DEPEND ON . . . ALWAYS

"How stable?" is the question asked most often about a microphone. Once the type of installation is determined, it is essential that frequency response and directional sensitivity characteristics remain unaffected. This is *stability*—and should remain constant. It is a clue to the wide acceptance and universal use of the Electro-Voice family of dynamic microphones—a family comprising 35 different models, each designed for a specific application. Highly developed precision tooling, extensive research, and functional design have created instruments of outstanding ruggedness and durability. All internal parts nest or interlock to prevent any movement of the reproducing mechanism even when the case is subjected to severe shock. In addition, the exclusive Acoustalloy diaphragm assures smooth response and reliability far surpassing ordinary demands. This vital moving element has no equal in withstanding high humidity, temperature extremes, corrosion and mechanical impact. Laboratory tests reveal only two ways to damage Acoustalloy: heat the microphone so hot it can't be handled, or actually puncture or tear the diaphragm. Each microphone type is field-tested prior to acceptance for manufacture and, when in production, every model is evaluated for exact frequency response, level and possible distortion, or mechanical imperfections prior to shipment. Such care in manufacturing and testing assures maximum reliability, all-important stability, and remarkable uniformity within dynamic types.



HORN-LOADED TWEETERS PROVIDE CLARITY WITHOUT DISTORTION

Electro-Voice Tweeters are noted for clarity and low distortion. But obtaining that clarity was a critical problem until E-V's development of the Avedon Sonophase Throat Design.

VHF tweeters handle the widest range of response—from 3500 to 20,000 cps. E-V tweeters function as a true piston in the lower range, but at the critical point (about 12 kc) sound must be taken from the center of the diaphragm and from the periphery at the same time. Without some way to prevent it, sound cancellation occurs because of diaphragm deformation at and above this critical frequency. This deformation causes phase shift to occur between the center and periphery of the diaphragm. Increasingly higher frequencies cause the phase shift to be more pronounced because of an ever increasing deformation of the diaphragm.

The Avedon Sonophase Throat Design accomplishes the vital restoration of phase relationship and level by incorporating a compression driver with unique loading plugs which properly phase upper frequencies while leaving lower frequencies unaffected. The loading plugs force the sound to travel a circuitous path, producing in-phase sound regardless of the frequency of the signal.

Coupled to the Avedon Sonophase Throat Design is the Hoodwin Diffraction Horn, designed to insure sound dispersion throughout the listening area. This is especially important in stereo application to prevent the "beamed" or directional nature of most high frequencies.

NEW HAM RECEIVER PASSES THE TOUGHEST TEST OF ALL

An interesting story lies behind the recent performance testing of the first RME 6900 Communications Receiver. After final inspection of the first unit, one of the RME executives (W9IOP), decided to use this new receiver in the 1960 Radio Amateur Sweepstakes. This contest, sponsored each year by the Amateur Radio Relay League, determines which amateur operator can establish the most radio contacts in a given 40 hour period.

The receiver was delivered to W9IOP only three hours before the contest began. In spite of his lack of familiarity with the receiver, W9IOP not only won the contest, but logged a record-breaking 1,369 contacts to establish a new national Sweepstakes record.

The RME 6900 Communications Receiver is the product of over 30 years of high-frequency receiver design. Engineered by radio amateurs — for radio amateurs — it incorporates every conceivable operating feature to facilitate working today's busy ham bands.

For more information write Dept. 70P

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B	TV and General Electronics (V-7)	2 yrs. High School, with Algebra, Physics or Science	Day 1½ yrs. Eve. 4½ yrs.
C	Radio & TV Servicing (V-3)	2 yrs. High School	Day 9 mos. Eve. 2¼ yrs.
D	Transistors*	V-3 or equivalent	Eve. 3 mos.
E	Electronic Drafting (V-9)*	2 yrs. High School, with Algebra, Physics or Science	Eve. 3 yrs.
F	Color TV	V-3 or equivalent	Day 3 mos. Eve. 3 mos.
G	Audio-Hi Fidelity*	V-3 or equivalent	Eve. 3 mos.
H	Video Tape*	V-3 or equivalent	Eve. 3 mos.
I	Technical Writing (V-10)	V-3 or equivalent	Eve. 3-18 mos.
J	Radio Telegraph Operating (V-5)*	2 yrs. High School, with Algebra, Physics or Science	Day 9 mos. Eve. 2¼ yrs.
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Letters

(Continued from page 14)

provinces, and nine Mexican states. In addition, I have picked up two Cuban stations but have not yet been able to enter them in my log for lack of adequate identification.

I am hoping that the hobby of logging in the broadcast band will soon begin to interest more and more fans of the airwaves. I sincerely believe that BC'ing deserves a great deal of attention, for it is most fascinating.

DONALD BURLESON
Wichita Falls, Texas

Readers interested in joining a BC DX'ing club should contact the National Radio Club, Box 63, Kensington Station, Buffalo 15, N. Y., or the DX'ers Radio Club % Jim Ernst, Mahone Bay, Nova Scotia.

Car Radio Conversion

■ Thank you for the fine article on "How to Convert a Car Radio for Home Use." by E. G. Louis in the February issue. I bought a used car radio just like the author's for $2.50. I used a Stancor PM8419 transformer for the conversion and the radio works swell—no hum or noise of any kind. I haven't put it in a cabinet yet, but it really pulls in the stations.

ELDRIDGE BRANDON
Hazel, Ky.

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■ I urgently need a copy of War Department Manual TM11-300AF for Frequency Meter BC-221 (SCR-211-AF), frequency coverage 125 kc. to 20,000 kc. I will gladly forward an International Money Order for the cost involved.

RON D. YOUNG
3 Bell Hill
Danbury, Chelmsford,
Essex, England

Young Mexican Fan

■ I thought you might like to see a picture of my son, Enrique, shortly after he went to sleep reading a copy of POPULAR ELECTRONICS. Enrique is only four years old, but he enjoys your magazine very much.

MANUEL MENDEZ
Jalapa, Mexico

Then how come it put him to sleep? —30—

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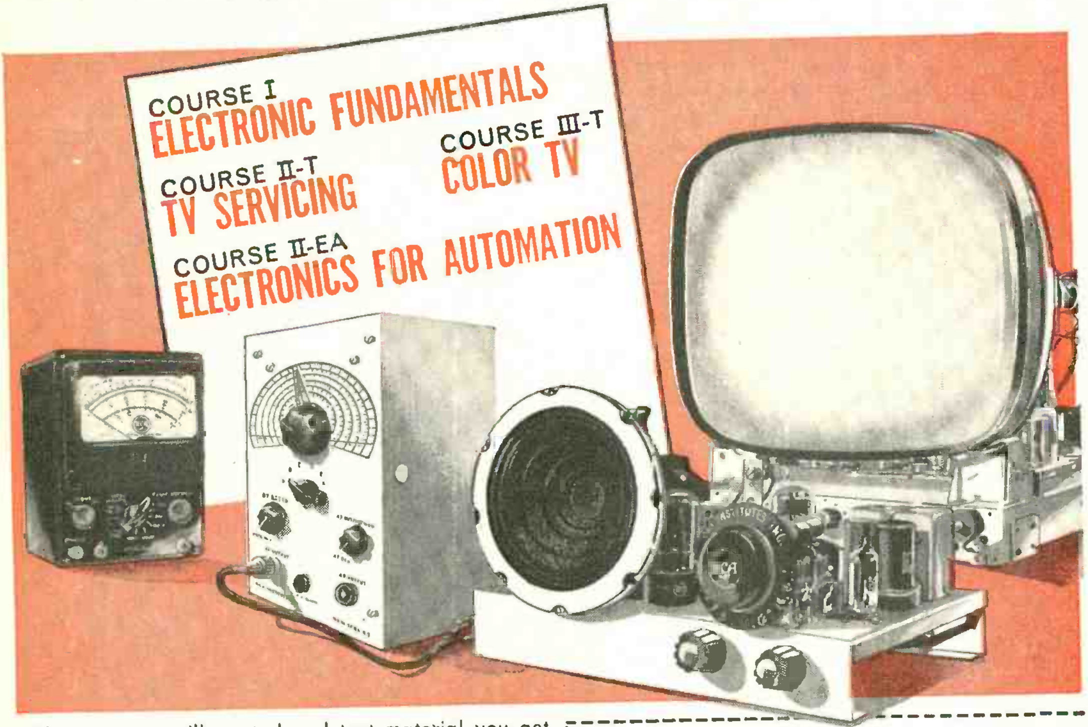

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POP'tronics Bookshelf

"APPLICATIONS OF ELECTRONICS" by Bernard Grob and Milton S. Kiver. Published by McGraw-Hill Book Company, 330 W. 42nd St., New York 36, N. Y. 628 pages. Hard cover. $7.00.

Intended as the second volume of a two-volume set, this book takes up where Mr. Grob's previous book, "Basic Electronics," left off. It can be used alone, however, by anyone who has a basic knowledge of electronics. Topics include vacuum-tube amplifiers, transistor amplifiers, receivers, test instruments, industrial electronics, military electronics, and electronic navigational aids. Recommended as a text or reference.

"101 WAYS TO USE YOUR HAM TEST EQUIPMENT" by Robert G. Middleton. Published by Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis, Ind. 168 pages. Soft cover. $2.50.

One of the best substitutes for actual bench experience is Bob Middleton's series of "101 Ways" books. This latest volume, which discusses the use of test equipment generally associated with amateur radio operation, is a worthy addition to the series. The specific equipment covered includes the grid-dip meter, the antenna impedance meter, the VOM and VTVM, the oscilloscope, reflected-power and SWR meters, plus bridges and some other miscellaneous equipment used to perform various types of measurements.

This book is well worth careful study since the diagrams and explanations of the testing procedures illustrate many aspects of electronic theory. Consequently, it is recommended not just for hams but for

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1G3GT/1B3	.70	6AH6	.47	6DB5	.59	12BQ6	.63
1R5	.51	6AL5	.43	6DE6	.43	12BY7	.65
1S5	.43	6AM8	.59	6DG6GT	.50	12CR6	.43
1T4	.51	6AN8	.64	6DQ6	.89	12CU6	.63
1U4	.51	6AQ5	.48	6DS5	.69	12CX6	.44
1U5	.43	6AS5	.52	6EA8	.66	12DB5	.59
1X2	.62	6AU4GT	.50	6H6	.47	12DE8	.59
2AF4	1.02	6AU5GT	.60	6J5	.49	12DL6	.64
2BN4	.55	6AU6	.43	6J6	.61	12DM7	.59
2CY5	.50	6AV6	.37	6K6GT	.39	12DQ6	.63
3AF4	1.02	6AW8	.50	6S4	.41	12DS7	.64
3AU6	.43	6AX4GT	.60	6SA7	.45	12EK6	.59
3BC5	.58	6BA6	.56	6SC7	.54	12EZ6	.49
3BN6	.90	6BA8	.49	6SK7	.45	12FM6	.43
3BU8	.65	6BC5	.48	6SL7GT	.60	12K5	.44
3BZ6	.45	6BC8	.59	6SN7GT	.60	12L6GT	.43
3CB6	.51	6BE6	.46	6SQ7	.38	12SA7	.45
3DT6	.51	6BF5	.48	6T8	.71	12SK7	.45
3V4	.48	6BG6G	1.18	6U8	.76	12SN7GT	.56
4AU6	.43	6BH6	.51	6V6GT	.48	12SQ7	.38
4BC8	.69	6BJ6	.51	6W4GT	.43	12V6GT	.43
4BN6	.68	6BJ8	.64	6W6GT	.53	12W6GT	.43
4BQ7	.75	6BK5	.75	6X4	.37	17AX4GT	.50
4CB6	.51	6BK7	.78	6X8	.75	17D4	.50
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4DT6	.59	6BN4	.44	8AW8	.75	19AU4	.60
5AM8	.59	6BN6	.90	8CG7	.54	19BG6G	1.48
5AN8	.64	6BQ5	.74	8CM7	.54	25BQ6GT	.82
5AQ5	.48	6BQ6GT	.83	8CX8	.90	25CD6G	1.19
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5AV8	.54	6BY5G	.75	10DE7	.49	25L6GT	.41
5BK7	.68	6BZ6	.45	11CY7	.74	25W4GT	.43
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5CL8	.64	6C4	.41	12AF6	.44	35B5	.48
5CQ8	.59	6CB6	.51	12AJ6	.43	35C5	.48
5J6	.61	6CG6G	1.63	12AT6	.37	35L6GT	.41
5U4G	.43	6CG8	.59	12AT7	.71	35W4	.33
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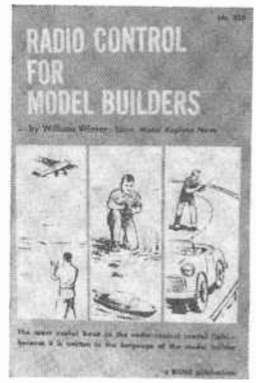
Bookshelf

(Continued from page 18)

anyone who would like to have a fuller and more detailed understanding of all phases of electronics.

"RADIO CONTROL FOR MODEL BUILDERS" by William Winter. Published by John F. Rider Publisher, Inc., 116 W. 14 St. New York 11, N. Y. 220 pages. Soft cover. $4.25.

Here is a complete guide for the radio-control fan. The author is the editor of *Model Airplane News* and he knows his subject intimately. Starting at a basic level, he gradually works his way up to more advanced topics. Following an excellent introductory chapter on how to get started in radio control, he discusses transmitters, receivers, actuators, power supplies, meters, relays, the radio-controlled boat, and advanced systems. Highly recommended as a most useful source of information about radio control.



"ABC's OF HAM RADIO" by Howard S. Pyle. Published by Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis 6, Ind. 112 pages. Soft cover. $1.50.

This simply written introduction to ham radio covers the subject from the standpoint of the complete newcomer. It discusses how to go about getting a license and how to learn code. In addition, it provides a brief course in basic electricity and electronics. Recommended to anyone interested in becoming a radio amateur, it would be a fine gift for a youngster.

"PRINCIPLES OF GUIDED MISSILES AND NUCLEAR WEAPONS," prepared by the U. S. Navy Training Publications Center. Available from Superintendent of Docu-

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Bookshelf

(*Continued from page* 20)

ments, U. S. Government Printing Office, Washington 25, D. C. 284 pages. Soft cover. $2.00.

Like many U. S. Government publications, this book is notable both for the amount of information it provides and for the clear way in which it is presented. Much of the text is devoted to explaining the principles of guided missiles, including systems for propulsion, control, and guidance. This part of the book is jam-packed with information that should interest anyone with a mechanical or electronic turn of mind.

The remainder of the work is concerned with nuclear weapons. The section on their destructive effects is absolutely spine-chilling; if anyone still believes that nuclear war is feasible, let him read this book.

"DIRECT CURRENT ELECTRICITY" by Alexander Efron. Published by John F. Rider Publisher, Inc., 116 West 14th St., New York, N. Y. Soft cover. 100 pages. $2.25.

This is a very interesting book about the fundamentals of direct current electricity in terms of the Franklinian Approach—or from the point of view that current flows from plus to minus. The illustrations effectively complement the text, adding interest and clarifying the presentation. Considerable attention is paid to electrochemistry, voltage drop, and the magnetic effects of electric current. Recommended as rewarding reading for anyone with a basic knowledge of electronics.

Miscellaneous Literature

A complete catalog of Lafayette audio and electronic kits has recently been announced. Write to Lafayette Electronics Mfg. Corp., 104-46 Dunkirk St., Jamaica 12, N. Y. for this attractive 20-page booklet.

"Tape Recording Head Reference Guide," a 16-page booklet containing specifications and illustrations of tape recorder heads, is available for 50 cents from Robins Industries, 36-27 Prince St., Flushing, N. Y. —30—

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1C6	3BC5	5V6GT	6AU6	6BQ7	6DE6	6SH7	7B8	12AT6	12F5	26	58
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1G4	3Q4	6AB4	6AW8	6BZ6	6F6	6SQ7	7C7	12AV6	12SA7	35B5	77
1H5GT	3S4	6AC7	6AX4GT	6BZ7	6H6	6SR7	7E5	12AV7	12SJ7	35C5	78
1L4	3V4	6AF4	6AX5GT	6C4	6J4	6T4	7E6	12AX4GT	12SK7	35W4	80
1L6	4BQ7A	6AG5	6B8	6CB6	6J5	6U8	7E7	12AX7	12SN7GT	35Z5	84/6Z4
1N5GT	4BS8	6AH4GT	6BA6	6CD6G	6J6	6V6GT	7F7	12AZ7	12SQ7	36	117Z3
1R5	4BZ7	6AH6	6BC5	6CF6	6J7	6W6GT	7F8	12B4	12V6GT	38	
1S5	4CB6	6AK5	6BC8	6CG7	6K6GT	6X4	7G7	12BA6	12W6GT	39/44	
1T4	5AM8	6AL5	6BD6	6CH8	6K7	6X5GT	7H7	12BA7	12X4	41	
1U4	5AN8	6AM8	6BE6	6CL6	6N7	6X8	7N7	12BD6	14A7/12B7		
1U5	5AT8	6AN8	6BF5	6CM6	6Q7	6Y6G	7Q7	12BE6	14B6	42	
1V2	5AV8	6AQ5	6BG6G	6CM7	6S4	7A4/XXL	7S7	12BF6	14Q7	43	
1X2	5AZ4	6AQ6	6BH6	6CN7	6S7	7A5	7X6	12BH7	19	45	
2AF4	5BR8	6AQ7	6BJ6	6CQ8	6S8GT	7A6	7X7	12BQ6	19AU4GT	50A5	
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14B/CP4	11.99	16LP4	12.19	17HP4	16.99	20DP4	15.89	21AU4	18.79	21MP4	22.39	24AP4	39.49
16AD4	16.09	16RP4	11.99	17IP4	16.99	20HP4	17.80	21AVP4	18.79	21YP4	18.39	24CP4	27.79
16DP6	12.19	17AVP4	15.49	17QP4	13.89	21AP4	21.49	21AWP4	17.49	21WP4	17.49	24DP4	39.79
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All sets shipped in two cartons to avoid breakage. Sets shipped express to continental U.S.A. and Canada only. F.O.B. Harrison, New Jersey.

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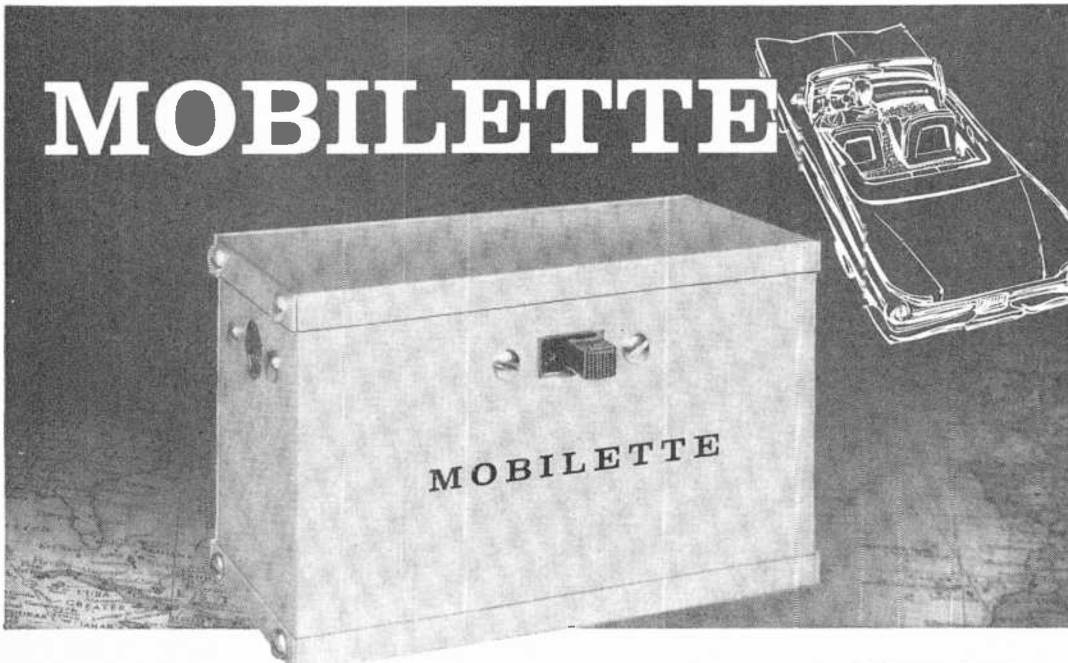
CONVERT YOUR CAR RADIO FOR SHORT WAVE RECEPTION WITH...



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Now, in a matter of minutes, your standard broadcast car radio becomes a short wave receiver . . . bringing in stations from coast-to-coast as well as the four corners of the globe.

Designed by International for AMATEURS, CITIZEN LICENSEES, SHORT WAVE LISTENERS, HOBBYIST.

Available in SEVEN frequency ranges covering the Amateur bands, 75 through 10 meters, the Citizens band, and WWV National Bureau of Standards Time Broadcasts.

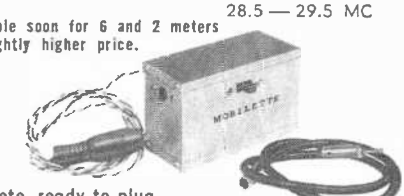
Three simple steps to install. (1) Remove antenna lead from car radio and plug into input of Mobilette. (2) Plug jumper wire from Mobilette into antenna connection of car radio. (3) Plug power connector into cigarette lighter socket. It's that easy!

Works on either 6 or 12 volts without change. Miniature size.

International Mobilettes cover these short wave bands.

Catalog No.	Frequency
630 — 105	75 meters (Amateur)
630 — 104	40 meters (Amateur)
630 — 106	10 MC (WWV Time Broadcasts)
630 — 103	20 meters (Amoteur)
630 — 102	15 meters (Amoteur)
630 — 101	11 meters (Citizens)
630 — 100	10 meters (Amoteur) 28.5 — 29.5 MC

Available soon for 6 and 2 meters at slightly higher price.



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ALL 22 FREQUENCIES IN STOCK!

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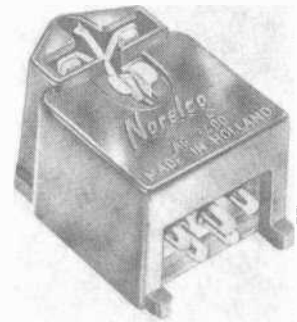
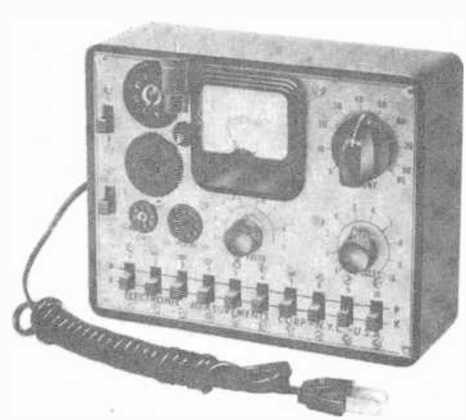


MINIATURE TUBE TESTER

Measuring only 6¾" x 5¼" x 2¼", the Model 211 tube tester checks all octal, loctal, seven- and nine-pin miniature tubes for shorts, leakages, opens, and intermittents. Emission is indicated directly on a two-color meter dial. Magic-eye tubes and voltage regulator tubes can also be tested. Shipping weight is 3 pounds. Price, $22.90 wired, $14.90 in kit form. (*Electronic Meas-*



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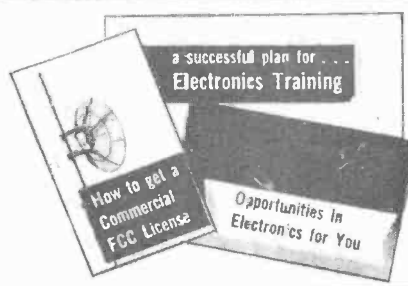

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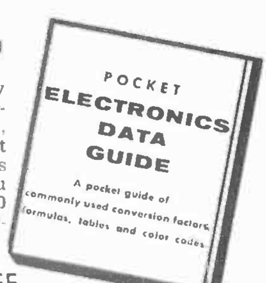

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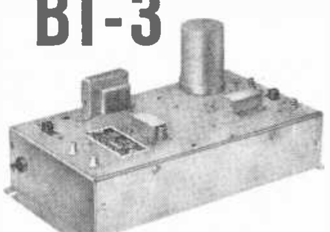

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products

(*Continued from page 24*)

urements Corp., 625 Broadway, New York 12, N. Y.)

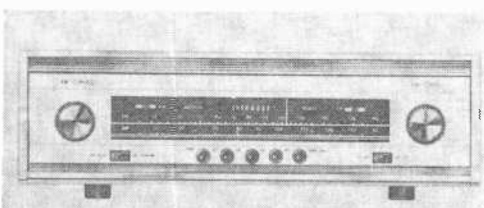
CB TRANSCEIVER KIT

The new Heath Citizens Band transceiver kit features a superhet receiver that provides for either crystal-controlled or continuously variable tuning. Other circuit refinements include a noise limiter, an adjustable squelch control, and a crystal-con-

trolled transmitter. Available in either a.c. or d.c. models, the GW-10 is supplied with a press-to-talk microphone, hardware for under-the-dash mounting in mobile installations, and FCC license application forms. Price, $62.95. (*Heath Company,* Benton Harbor, Mich.)

STEREO TUNER

Features of the Model S-2200 AM-FM-Multiplex stereo tuner announced by *Sherwood Electronic Laboratories, Inc.*, 4300 N. California Ave., Chicago 18, Ill., include



push-button operation, .95-microvolt sensitivity on FM, and an interstation noise elimination circuit. The AM section offers a choice of either 15-kc. or 5-kc. bandwidth. Price, $179.50, less case. Also available is a plug-in adapter, the Model AMX, for receiving FM multiplex stereo transmissions: price, $49.50.

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A soldering pencil holder that stays cool after 100 hours of continuous use is being

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You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, rectifiers, test equipment. You will learn and practice code, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester and the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 16 Receiver, Transmitter, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $22.95. The Signal Tracer alone is worth more than the price of the entire Kit.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment.

Many thousands of individuals of all ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble-shooting—all in a closely integrated program designed to provide an easily-learned thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are sixteen Receiver, Transmitter, Code Oscillator, Signal Tracer, and Signal Injector circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build 16 different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C.-type Questions and Answers for Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club, Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

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• SET OF TOOLS

- SOLDERING IRON
- ELECTRONICS TESTER
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- MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- PRINTED CIRCUITRY

SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

J. Stataitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend $240 for a Course, but I found your ad and sent for your Kit."

FROM OUR MAIL BAG

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits. the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Troubleshooting Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

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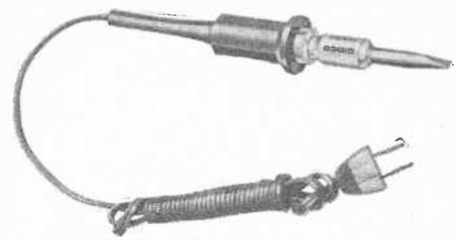
products

(*Continued from page 26*)

marketed by *Sidco,* Box 312, Venice, Calif. Constructed of nylon, the handle is air-cooled and does not require a cork grip;



interchangeable tips are held firmly in place by a device in the handle. Price, less tip, $2.50.

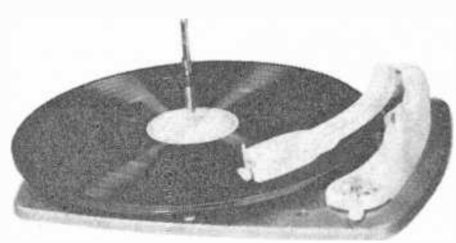
LINE-OPERATED VTVM

In addition to their battery-operated VTVM, *Century Electronics Co., Inc.,* 111 Roosevelt Ave., Mineola, N. Y., has now made available a line-operated unit, the Model VT-10. A multi-function probe can be set to operate as a d.c. probe, an a.c. probe, a "Lo-Cap" probe, or an r.f. probe.

The 6" 100-microamp meter has four multi-color scales. Price, $58.50.

RECORD CHANGER

A record changer is being marketed by *Arkay International,* 88-06 Van Wyck Expressway, Jamaica, N. Y., in both kit and



factory-assembled form. Called the "Human Brain" record changer, it will play records of all sizes, mixed in any order. Additional information can be obtained from the manufacturer. -30-

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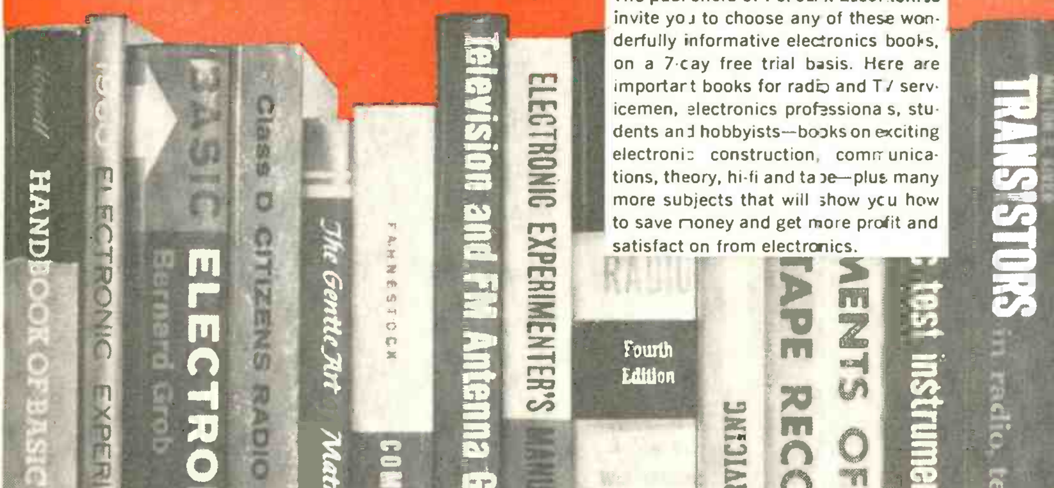

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Two antenna experts tell you their secrets of antenna choice and installation for best reception in any area. Loaded with useful tips on improving reception in fringe and difficult areas. $5.25

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2000/60. STEREO-HI-FI GUIDE, Ziff-Davis Publishing Company

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2757. RIBBONS OF SOUND, Barleben

A perfect introduction to tape recording principles and practices. Paper..$2.50; 2757C Cloth. $3.50

2760. HI-FI STEREO FOR YOUR HOME, Whitman

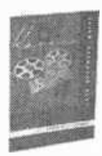
Tells what stereo is, how it works, affects home listening habits, and how to install and maintain it. $3.50

2750. ELEMENTS OF MAGNETIC TAPE RECORDING, Haynes

All aspects of this recording medium are described in easy-to-understand detail. 416 pages, $7.95

2004/60. HI-FI ANNUAL & AUDIO HANDBOOK, Ziff-Davis Publishing Company

1960 edition. Prepared by the editors of Electronics World. An excellent advanced guide to theory, construction and circuitry. $1.00



42. REVERE TAPE RECORDER GUIDE, Tydings

The first non-technical book to provide useful information on the Revere Tape Recorder. Also a basic guide to the entire field of tape. Will show you new uses and add to your enjoyment of tape recording. $1.95

2005/60. HI-FI DIRECTORY & BUYERS' GUIDE, Ziff-Davis Publishing Company

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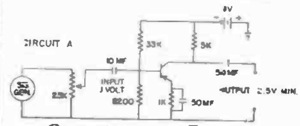

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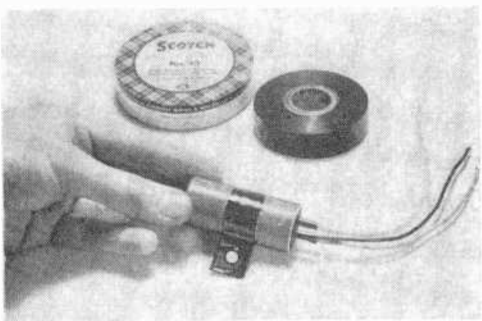
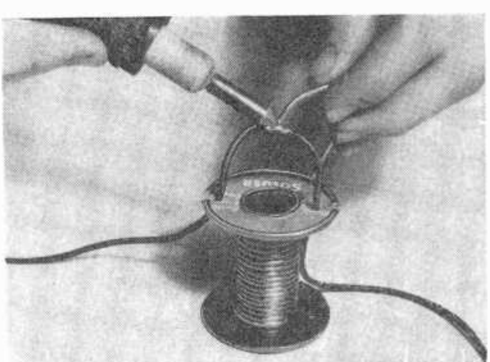


a short length of tape around the capacitor, and leave a small tab extending from the body of the unit. Punch a hole in the tab and mount the capacitor with a screw and nut.—*John A. Comstock, Wellsboro, Pa.*

SPOOL HOLDS WIRES FOR SOLDERING

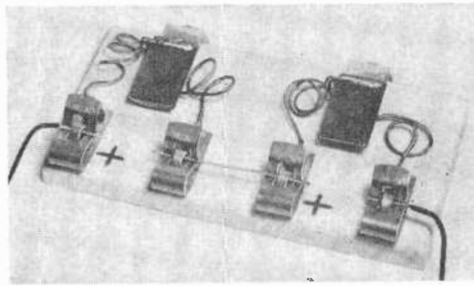
Your solder spool flange can be used to hold wires and parts while you solder them. Hacksaw a couple of "V" shaped slots on



opposite sides of one flange. File off any burrs or sharp corners on the cut edges and slip in the wires to be soldered.—*Joseph Carroll, Brooklyn, N. Y.*

PROTECTING SUN BATTERY LEADS

Sun battery leads are fragile and often break off during experiments. Since they are difficult or impossible to repair, try mounting the batteries on a small wooden base with thumb tacks, wood screws, or cellulose tape. Make the leads more compact by curling them around a stiff wire and then withdrawing the wire. Solder each lead to a medium-size (¾"-long) Fahnestock clip screwed to the wooden base. The



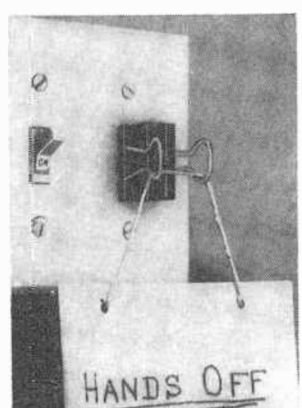
positive (red) terminals can be labeled with a ball-point pen.—*Art Trauffer, Council Bluffs, Iowa.*

MAKE YOUR OWN QSL CARDS

You can make an inexpensive and artistic QSL by drawing a sample of the desired card to size, in India ink, on a sheet of white paper or cardboard. Take this black and white "master copy" to a photo-finishing shop and have a negative made. Prints can then be ordered on heavy postcard size paper imprinted with a standard postcard form on the reverse side. (The negative can be copied at home if you have printing equipment.) Color the finished postcard prints with photo-tinting solution.—*Glenn P. Pittsley, Fayetteville, N. C.*

WALL SWITCH SAFETY LOCK

When working on electrical equipment controlled by a distant switch—basement lights and attic fans, for instance—you can use this safety "lock" to protect yourself from accidental electric shock. Take an ordinary 1¼"-wide spring-action paper clip and attach a "hands off" sign to it as shown. Clip it on the switch lever controlling the device you are about to work on. This makes it impossible for



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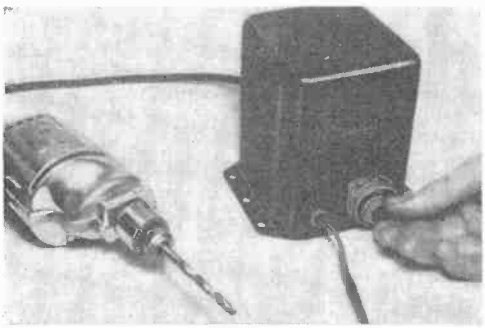
Tips

(*Continued from page* 34)

anyone to snap on the circuit accidentally without first removing the paper clip.—*George P. Pearce, Albuquerque, N. M.*

TRANSFORMER SELECTS DRILL SPEEDS

To obtain a variety of speeds from your electric drill, use an isolation transformer with adjustable output voltages. By setting



the transformer switch for an output above or below the normal line voltage, drill speed can be changed several hundred rpm, up or down. Be certain the transformer has sufficient wattage rating to handle the drill's current safely. To obtain the wattage rating of your drill, multiply its current rating by 117 volts. Don't operate your drill on higher line voltages continuously for any extended periods as this might damage the motor.—*Jerome Cunningham, Chicago, Ill.*

DON'T "VISE" THAT DRILL

Never clamp your electric drill directly in a vise in an effort to replace a horizontal drill stand. You could very easily tighten the vise enough to crack or cave-in the drill's case and cause it to rub against the motor armature. Instead, take a thin piece of scrap

aluminum, about 2" x 12", and wrap it tightly around the drill. Clamp the ends of the aluminum strip in the vise.—*Charles Lang, San Francisco, Calif.* —30—

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Highly reliable; exemplary electronic, mechanical, industrial design. Powerful 5-watt (as defined by FCC) crystal-controlled transmitter & extremely sensitive, selective superhet receiver with RF stage & noise limiter. Built-in speaker, detachable ceramic mike. Pre-set & sealed crystal oscillator circuit elements. To change channels, just change crystals — no adjustments needed. Built-in variable "pi" network matches most popular antennas. Portable whip & roof antennas available. No exams or special skill needed — any citizen 18 years or older may obtain station license by submitting FCC form, supplied free by EICO.

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Kit $29.95 Wired $49.95
includes FET, less 9V battery

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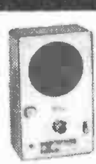
Build the Best Ham Gear



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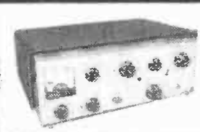
Compare — judge for yourself — at your neighborhood EICO dealer. For FREE catalog on over 70 models of easy-to-build professional test instruments, hi-fi and ham gear, fill out coupon on Page 38



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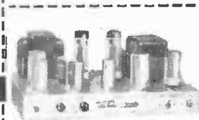
"Top quality" — ELECTRONIC KITS GUIDE. Ideal for veteran or novice. 90W CW, 65W external plate modulation. 80 through 10 meters.



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Kit $49.95 Wired $79.95
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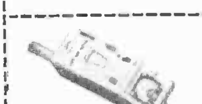

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Literature available:

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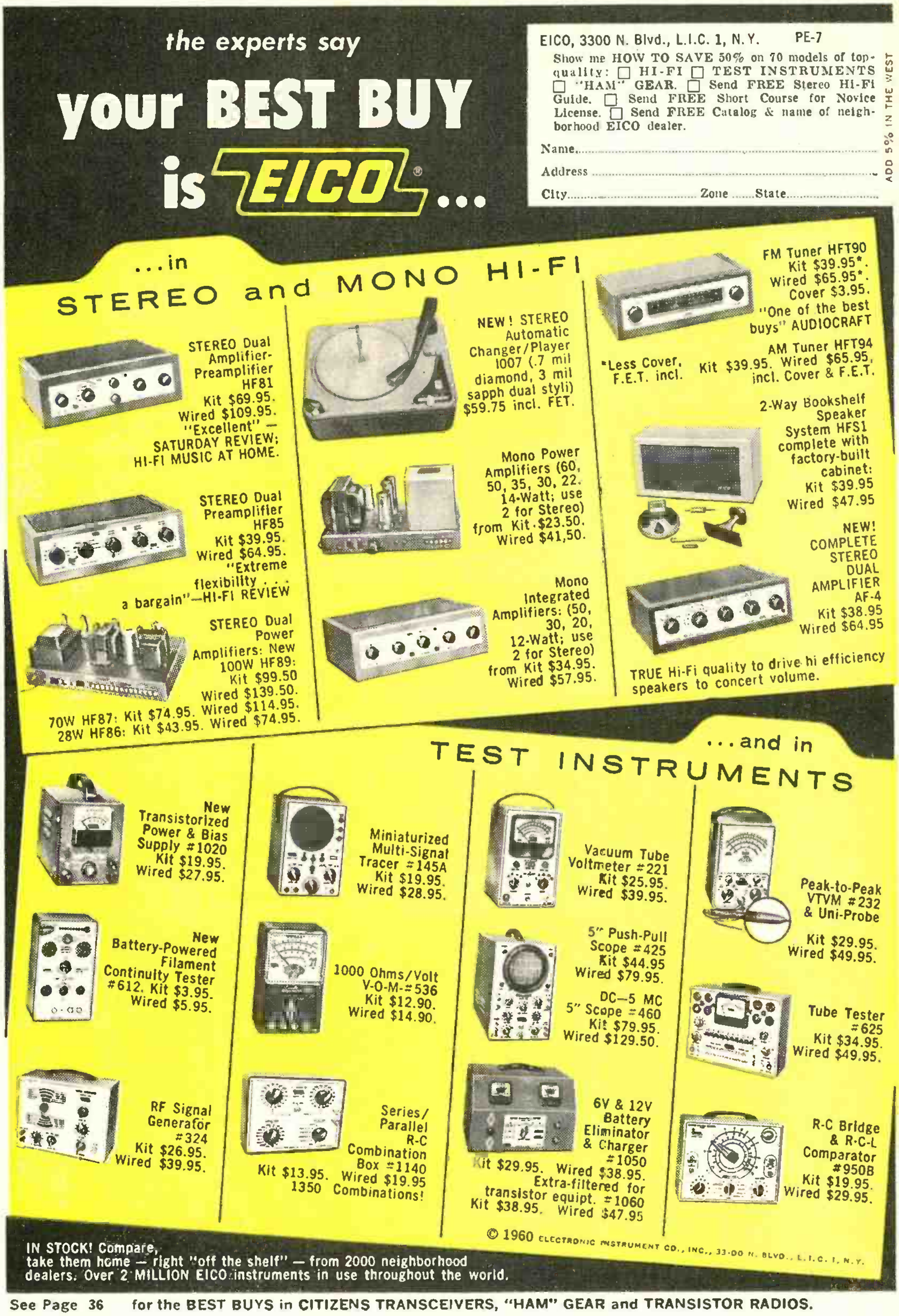
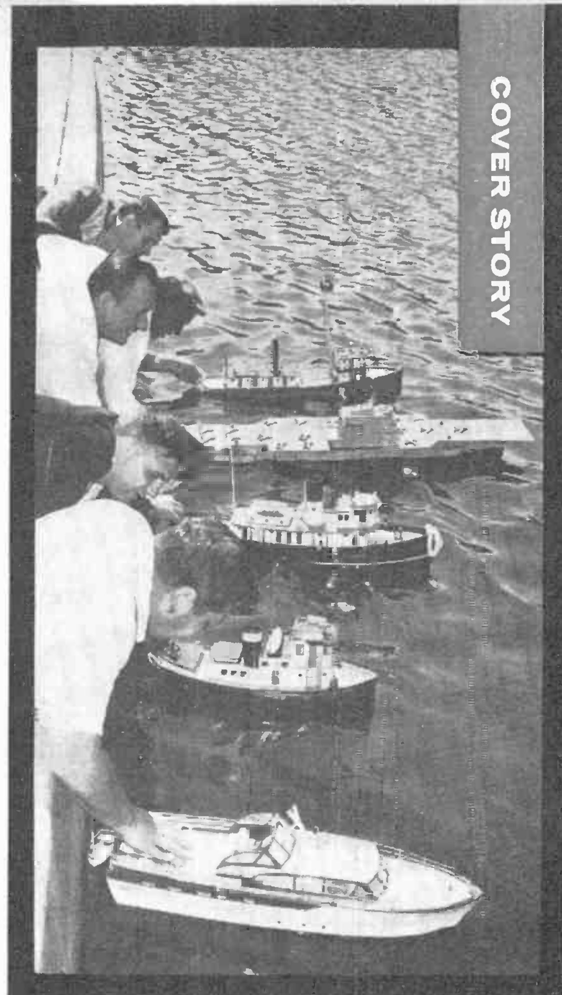


See Page 36 for the BEST BUYS in CITIZENS TRANSCEIVERS, "HAM" GEAR and TRANSISTOR RADIOS.

Operation Radio Control

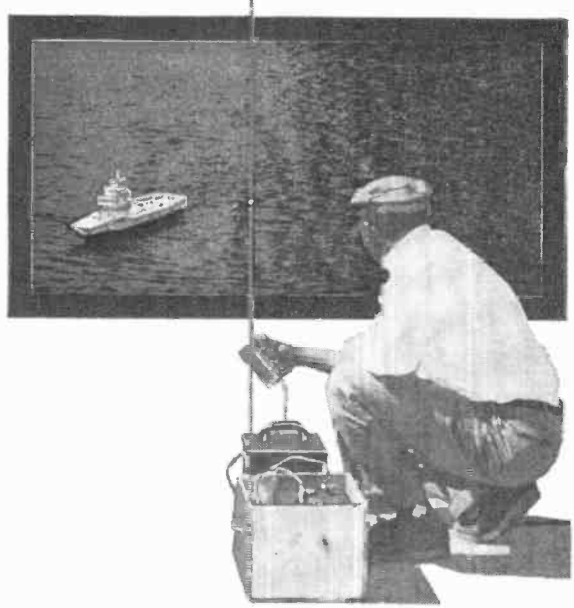
Engineers at ITT relax and have fun with radio-controlled model boats and planes



ON a lake near Nutley, New Jersey, a model aircraft carrier backs slowly out from shore, swings around, and majestically sails away. Accurately detailed down to the planes on its landing deck, the miniature craft responds to every electronic command from shore.

A few miles away, a model plane climbs into the air. It circles, goes through a series of acrobatic maneuvers, and finally comes in for a perfect landing. Again, its every action is controlled electronically from the ground.

These scenes are duplicated countless times on any sunny weekend from Maine to California. But the enthusiastic electronic hobbyists that control their models near Nutley, N. J., are unique in at least one way. During working hours, they design and develop some of Uncle Sam's most complex electronic hardware. All of these men are employed in International Telephone and Telegraph's electronic defense research laboratory. Their



Technician William Hudson puts his beautifully detailed aircraft carrier through its paces.

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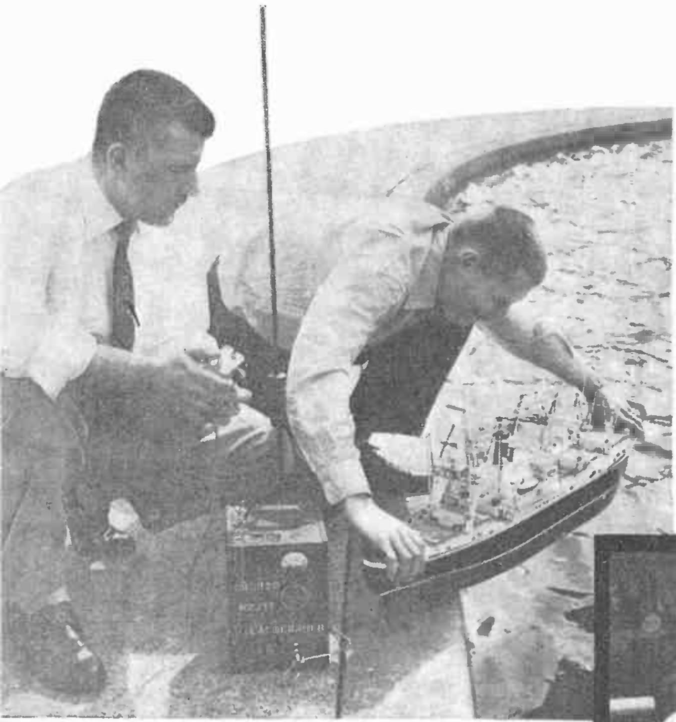

Designer Seymour Glassner has a mighty serious look on his face when he's behind his drafting board (below), but when he prepares to launch his model freighter (left), he breaks out in smiles. The freighter's hull, by the way, sports 15 alternating layers of lacquer and elbow grease. Although the ship looks almost perfect, Seymour says he will put another year's work into it. In the meantime, it's fully seaworthy, and Seymour enjoys sailing it.

jobs entail work on radar, satellite tracking and communications equipment, navigation aids, and hush-hush electronic countermeasures gear.

Since they are engineers, technicians, and designers, most of the ITT modelers have greater technical knowledge than other hobbyists. But they still run into problems with their R/C boats and planes.

One day last summer, for example, technician Dick Lachenauer wished he had never heard of radio control. It all began when he tried to be helpful. A small boy's boat had drifted out into the middle of a lake, and Dick sent his radio-controlled tug out to nudge it back in to shore. Apparently the tug nudged it a little too hard, because the boat sank! Dick ended by rolling up his trousers and going wading.

But, as with most modelers—and particularly with those who have been bitten by the radio-control bug—such minor difficulties are quickly forgotten. Not long ago we went out with the ITT radio-controllers and came back with these pictures—which prove that electronic hobbyists, be they amateur or pro, have more fun than the proverbial barrel of monkeys!

model boats...

Senior technician Richard Lachenauer —called "Cap'n Dick" by the boys—is equally at home when checking out a Loran-C navigations simulator in ITT's avionics laboratory or designing control systems for model boats.

After making some control adjustments, John DiCiccio carefully fits the superstructure back onto his sleek model cruiser. If you look closely, you'll see scale-sized passengers on the deck. This cruiser, like most model boats, is driven by an electric motor. But at least one craft in the ITT fleet is powered by a gasoline engine, and one goes still further toward realism with a miniature steam engine.

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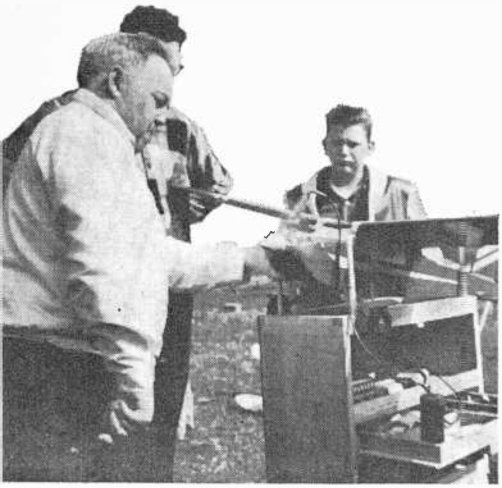
...and model planes, too!



1 Engine's revving up just right . . . the radio gear's all checked out . . . so . . .

2 . . . off she goes! Chuck does the launching himself; a friend handles the controls until Chuck can get back and take over.

KINGPIN of the ITT modelers' "airborne division" is veteran radio-control enthusiast Chuck Kenny. The possessor of college degrees in both electrical and mechanical engineering, Chuck specializes in packaging—that is, cramming more and more parts into less and less space. Like most of the other ITT modelers, Chuck designs and builds most of the 27.25-mc. control gear used in his planes. Here are some recent shots of Chuck and one of his planes in action.

3 The launch was successful ▲ and the plane is climbing steadily now. Looks like it's going to be a good flight.

4 A few minutes later, Chuck ▶ takes over the controls and puts the plane through a series of fancy aerial acrobatics.

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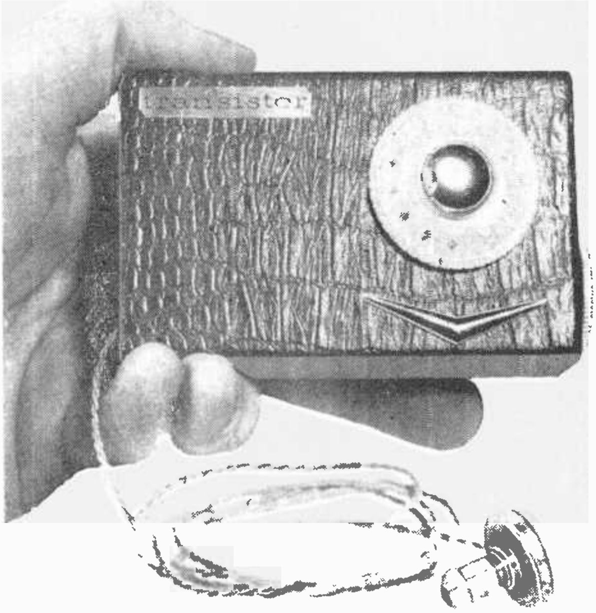

Reflex and regenerative circuits are combined in this sensitive and stable . . .

ONE TRANSISTOR POCKET RADIO

By
ALVIN MASON

DESIGNING and constructing a one-transistor pocket receiver is a challenge to any experimenter. A good many "pocket" receivers are either too large or too bulky for true "pocket" operation. Or they simply don't possess enough sensitivity and gain to pull in stations without an external antenna.

The little receiver described here gets around both of these weaknesses. It uses a combination of reflex and regenerative action to cut size and components to a minimum and increase sensitivity to striking proportions. The complete unit measures only 4" x 2½" x ¾". And it's powerful enough to pull in every local station on the dial with no external antenna at all!

Reflex Circuit. Because of the "reflex" action of the circuit, a single transistor is made to amplify the signal twice—once at radio frequencies and again, after detection, at audio frequencies (see "How It Works"). To simplify the circuit, a diode is used as a detector, leaving

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the transistor free to do nothing but amplify.

Also acting to increase the circuit's simplicity and stability is the regeneration hookup. The circuit is designed so that the amount of positive feedback or regeneration doesn't control the overall sensitivity as is usually the case with regenerative detectors. What's more, there is no regeneration control or annoying oscillation to contend with.

Since the remarkable efficiency of this little set doesn't depend on regeneration alone, only a limited amount of regeneration is used. Its stability is evidenced by the fact that, once adjusted, the set is as stable as most non-regenerative detectors.

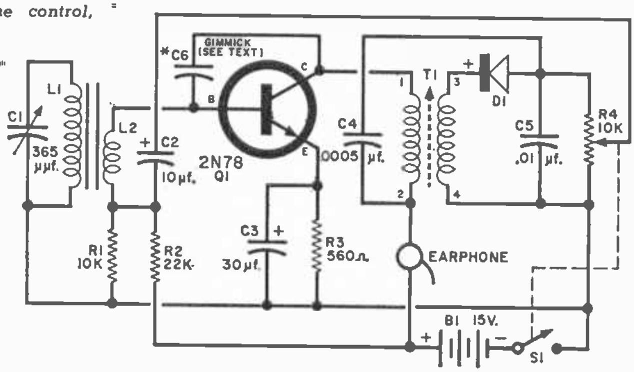
Although a Philco r.f. transformer was used as *T1* in the model, this particular transformer is available only from authorized Philco distributors and may prove hard to get. However, *T1* is in no way critical—a number of transformers were substituted for the Philco unit, and most of them worked satisfactorily.

The Argonne AR-162 (available from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y., for $2.95) seems to be a good substitution. A miniature output transformer measuring only 1" x ¾" x ¾", the AR-162 has identical center-tapped primary and secondary windings of 500 ohms with a d.c. resistance of 18 ohms. You'll have to remove the transformer's strap and laminations to fit the unit in the small plastic box specified in the parts list. But you'll find that this bit of disassembling proves no problem (see illustration on next page). The windings are light enough to be held in place with a strip of transparent tape. The center-taps are not used.

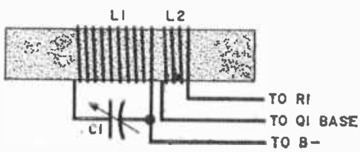
Construction. The chassis is a piece of Formica or phenolic board about 4" x 2½" x 1/16". Depending on the size of the components, the chassis should fit into a small plastic box measuring about 4" x 2½" x ¾". Homemade printed circuitry was used on the model, but standard wiring will do just as well. Most of the component leads are long enough to permit point-to-point

PARTS LIST

B1—15-volt battery (two Eveready 404E's or equivalent in parallel)
C1—365-µµf. variable capacitor (Lafayette MS-445 or equivalent)
C2—10-µf., 25-volt miniature electrolytic capacitor
C3—30-µf., 25-volt miniature electrolytic capacitor
C4—.0005-µf. ceramic capacitor
C5—.01-µf. ceramic capacitor
C6—Gimmick capacitor (see text)
D1—1N60 diode
L1—Antenna coil for C1 (Superex 2004 or equivalent)
L2—Six turns of #26 insulated wire wound on L1 (see text)
Q1—2N78 transistor
R1—10,000 ohms } *All resistors ¼ watt*
R2—22,000 ohms
R3—560 ohms
R4—10,000-ohm volume control with s.p.s.t. switch S1 (Lafayette VC-28 or equivalent)
S1—S.p.s.t. switch (on R4)
T1—Coupling transformer (Philco 32-4763-2 or equivalent—see text)
1—2000-ohm impedance earphone (Lafayette MS-368 or equivalent)
1—Transistor socket
1—4" x 2½" x ¾" plastic box
1—4" x 2½" x 1/16" phenolic board
Misc.—Tuning dial, knob for volume control, wire, solder, etc.



One transistor does the work of two in this highly efficient circuit. The signal is amplified twice—once at radio frequencies and, after detection, at audio frequencies.



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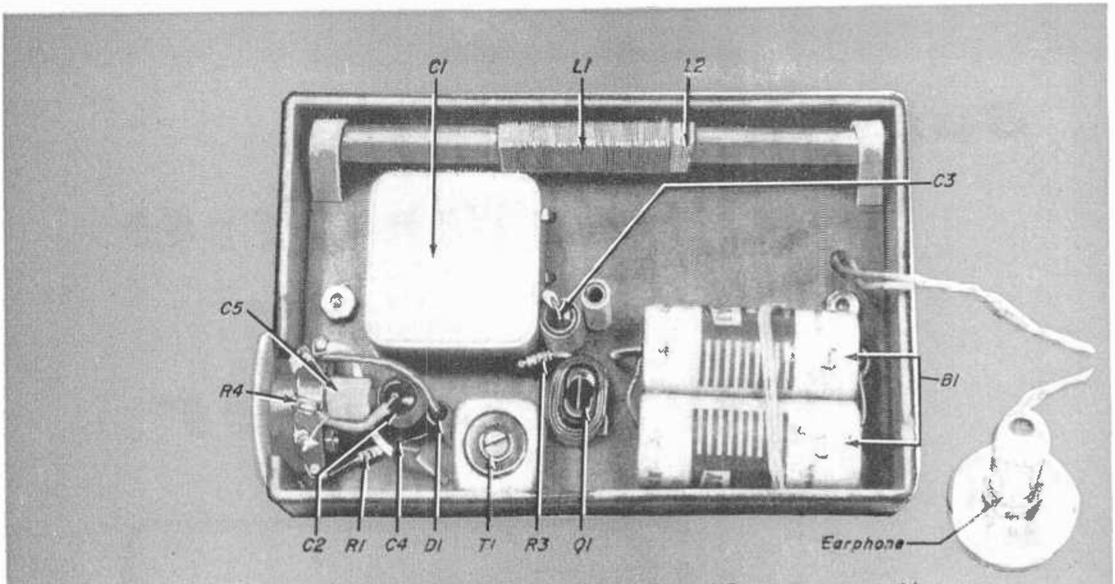


Parts are mounted on a phenolic board; R2 and C6 are on reverse side.

wiring, but a transistor socket was used to prevent possible damage to the transistor when soldering.

Coil *L2* consists of six to nine turns of No. 26 insulated hookup wire wound on the "ground" end of *L1* and spaced 1/16" from it. "Gimmick" capacitor *C6* is made up of two ½" lengths of insulated hookup wire twisted together several times to form a small capacitor.

It's a good idea to lay out all parts and drill most of the holes in the chassis before starting assembly. Since the wiring is relatively simple, you should be able to take your time and do a good job. As with any construction project, time spent in careful wiring will pay off in the long run.

Operation. After all parts have been mounted and soldered in place, double-check all connections. Now, with the switch off and battery *B1* in place, plug in the transistor. Turn on the set and rotate the volume control to full on. Select a station, preferably the strongest one on the dial. Listen for distortion. If necessary, either loosen the coupling in capacitor *C6* by untwisting the leads slightly or by snipping off the leads bit by bit until the distortion disappears.

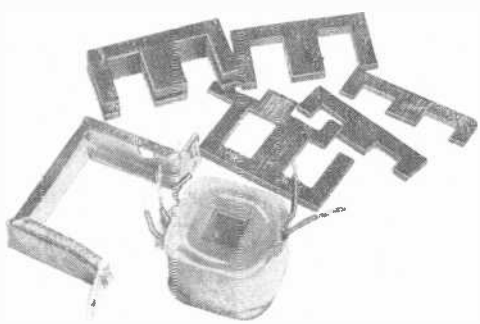
Once adjusted, the set should be nearly as stable as the superhet in your living room. And it's a safe bet that in sensitivity and portability this little unit will have few equals. —30—

HOW IT WORKS

One transistor and one diode are employed in a circuit that combines the advantages of both reflex and regenerative action. Because the signal passes through transistor *Q1* twice—once as r.f. and once as a.f.—the transistor is properly described as operating in a "reflex" circuit. Adding to the already high efficiency of this circuit is the regeneration furnished by gimmick capacitor *C6*.

In operation, the r.f. signal picked up by antenna coil *L1* is tuned by coil-capacitor combination *L1-C1* and induced into secondary coil *L2*. Fed directly into the base of transistor *Q1*, the r.f. signal is amplified and passed to transformer *T1*. A portion of the signal from *Q1*'s collector is returned to *Q1*'s base by capacitor *C6* to provide additional gain through regeneration. The signal induced in *T1*'s secondary is detected by diode *D1*, smoothed by capacitor *C5*, and returned to the base of *Q1* through volume-control *R4* and coupling capacitor *C2*.

Transistor *Q1* again amplifies the signal, this time at audio frequencies. The audio signal from *Q1*'s collector is fed through the primary of *T1* to the earphone.



Coupling transformer T1 must be a miniature unit. If Argonne Type AR-162 is used, it can be reduced in size by removing the strap and laminations.

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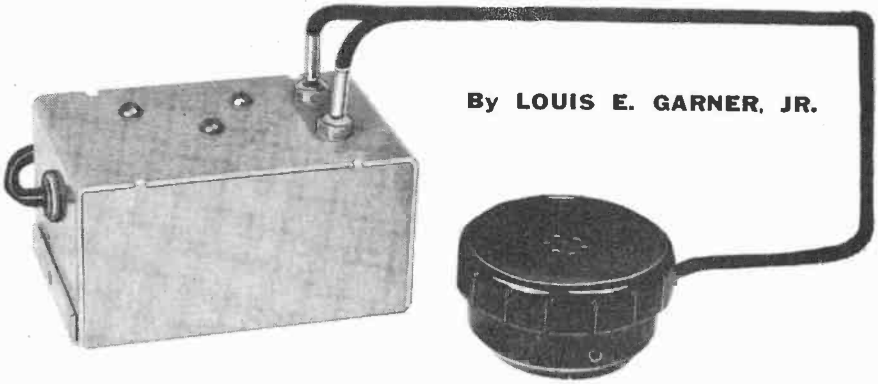
Build an

Earphone Booster Amplifier

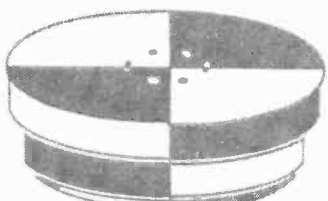


By LOUIS E. GARNER, JR.

Self-powered device steps up earphone volume

MAGNETIC earphones are a familiar item in the experimenter's world. Beginners use them with crystal sets, one- and two-tube radios, and small transistor receivers. More advanced hobbyists use them with signal tracers, short-wave sets, and dozens of other units.

This little transistorized earphone "booster-amplifier" will increase the sensitivity of any standard magnetic earphone. Inexpensive and easy-to-build, it is one of the most useful accessories the experimenter can own. Only standard



components available through both local and mail order supply houses are incorporated.

Construction. Use a clean, hot, well-tinned soldering iron and rosin-core solder for all connections. The transistor leads should be soldered as quickly as possible to avoid overheating; use your long-nose pliers as a heat sink by gripping the transistor lead between the joint to be soldered and the transistor case, and insulate all bare leads with spaghetti tubing.

Resistor *R1* should be selected to match the output impedance of the unit used with the earphone booster. Transistor portables will probably re-

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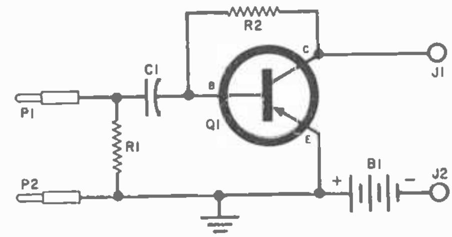
quire a 470-ohm, ½-watt resistor for *R1;* crystal radios about 47,000 ohms, ½ watt; vacuum-tube receivers about 100,000 ohms, ½ watt.

Make the battery connections last—note that the terminal strip lug connected to the positive battery terminal is grounded. Because battery life is quite long, the battery can be soldered permanently into the circuit. Avoid heating the battery excessively when soldering, since heat may damage it.

With the wiring completed, double-check all connections for possible errors, poorly soldered joints, and accidental shorts. And pay particular attention to battery polarity.

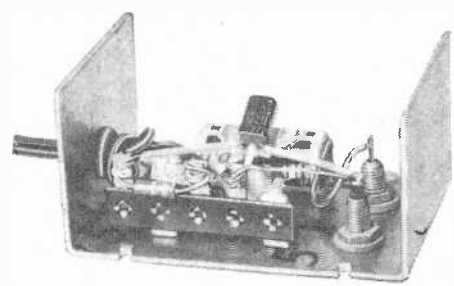
Operation. To use the completed instrument, plug standard magnetic earphones (units from 500 to 6000 ohms impedance will work with the booster) into output jacks *J1* and *J2*. Next, plug input tip plugs *P1* and *P2* into the earphone jacks of the unit whose output you want to boost —a crystal receiver, for example.

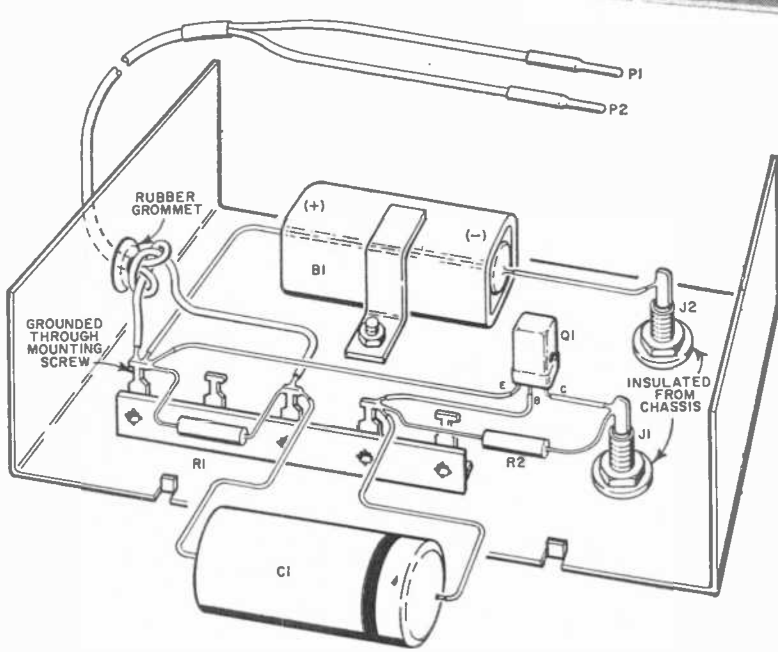
The earphone booster goes on the instant phones are plugged into it; so be sure to unplug the phone from the booster when it's not in use to conserve the battery. —30—



HOW IT WORKS

A one-stage resistance-coupled amplifier, the earphone booster uses a *p-n-p* transistor in the common-emitter arrangement. The input signal applied across *R1* is coupled through d.c. blocking capacitor *C1* to *Q1*'s base. Amplified output from *Q1* appears across the magnetic earphones serving as *Q1*'s collector load. Operating current is supplied from a single 15-volt battery, *B1;* base bias is obtained from the collector circuit through resistor *R2* which also introduces inverse feedback to improve transistor interchangeability.





PARTS LIST.

B1—15-volt battery (Burgess Y10 or equivalent)
C1—0.1-µf., 200-volt capacitor
J1, J2—Phone tip jack
P1, P2—Phone tip plug
Q1—CK722 transistor
R1—See text
R2—270,000-ohm, ½-watt resistor
1—3¼" x 2⅛" x 1⅝" aluminum box (Bud CU-3001A or equivalent)
Misc.—Hardware, 5-lug terminal strip, small bracket, grommet, etc.

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TV Explores Deep Wells

Watertight TV camera provides "inside" pictures from 1500 feet down

CLOSED-CIRCUIT TV, already at work in factories, banks, hotels, and garages, is now being used to explore the watery depths of wells. A Los Angeles company, Hallamore Electronics, in conjunction with Layne and Bowler Pump Co., has designed a special watertight TV camera that can be lowered into well shafts up to 1500 feet deep.

The TV camera is cylindrical in shape and measures about 4" in diameter and 20" in length. It carries its own lighting—three tiny 150-watt filament-type bulbs, each with a quartz envelope. Lighting intensity is variable, being controlled at the surface by a Variac.

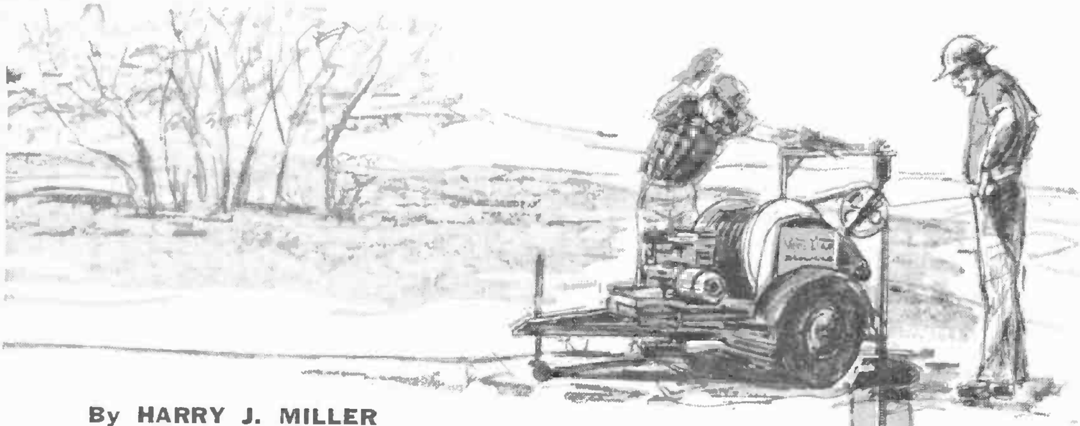
Whatever the camera sees down in the well is viewed on a 17" monitor receiver. During a well survey, photos can be taken of the monitor screen, thus providing a permanent record of the well's condition. The sweep waveforms for the camera are supplied by circuitry in the monitor and are carried down to the camera by a multiconductor cable.

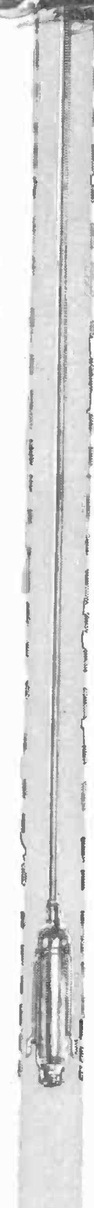
This is the custom-built TV camera that sends back pictures from the bottoms of deep wells.

The new system has already proven its worth many times. In one well, for example, the bottom part of a pump had fallen off as it was being pulled out of the shaft and had become tightly wedged. The camera quickly showed exactly how the part was stuck, providing the workmen with enough information to retrieve it.

In another instance, a well was not delivering as much water as had been anticipated. When the camera was lowered to the level at which water had first been located during the drilling operation, a flow of water could be clearly determined by watching the movement of particles floating past the camera. The problem was solved when the camera also showed that layers of white limestone were impeding a full flow of water.

Since the system has been in operation only a relatively short time, well drillers expect this new electronic underwater eye to disclose many more deep secrets. —30—





By **HARRY J. MILLER**

Gasoline-operated generator makes the TV system independent of power lines.

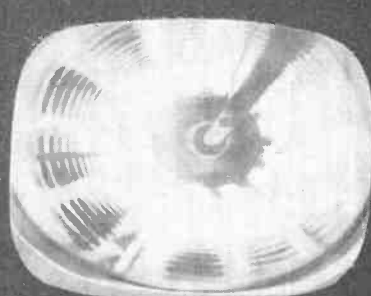


Photo taken off monitor shows the metal screening at the bottom of a 200′ well.

Here, the impeller of a pump lies at the bottom of a well and impedes water flow.

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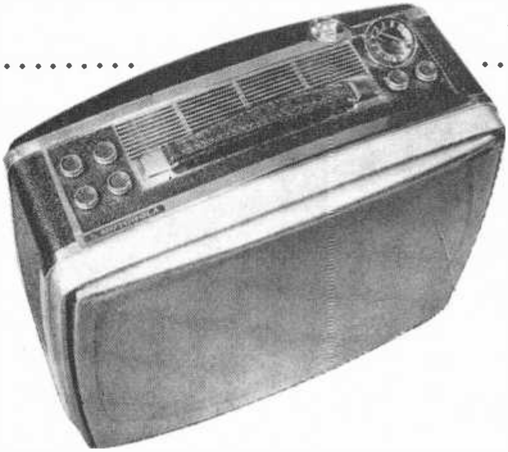
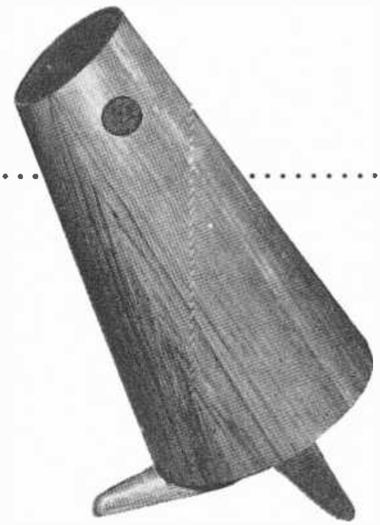
NEW DEVELOPMENTS IN PRODUCT DESIGN



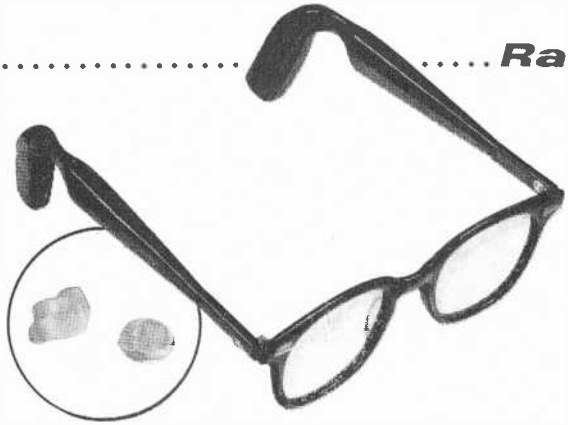
Large-Screen Portable TV

THE Motorola "Astronaut" is the first large-screen battery-operated portable TV set to be offered for sale. Completely transistorized, the forty-pound "Astronaut" features a 19" picture tube. A silver-cadmium battery which can be recharged overnight from an a.c. outlet powers the set for five or six hours of operation. Price: around $360.00, including battery.



Swedish Hi-Fi Speaker

ONE of the most unconventional loudspeaker systems ever to reach these shores, the Swedish-made Lund 1001 is a two-way speaker with a built-in bass-treble bi-amplifying system. The frequency response of the amplifiers—which operate without output transformers—is adjusted to complement the response of the speakers. The Lund 1001 will be priced for sale in this country at approximately $395.00.



Radio Hearing Aid

A NEW concept in eyeglass hearing aids, the Telex "Radiant" is a two-piece unit, with a five-transistor miniature radio transmitter built into the earpiece and a one-transistor receiver incorporated into a separate dime-sized earphone. The design of the "Radiant" eliminates all external wires and mechanical connections and reduces acoustical feedback. Price: about $330.00.

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DX'ing

EVER wonder what goes on "down below" the standard broadcast band? Most of us think of short-wave listening when we think of DX, but there are many diligent and adventurous DX'ers who find excitement in a different world of communications. They DX from 540 kc. down to 10 kc. —otherwise known as the long-wave band.

The special "gimmick" on this band is something called "ground wave." Short-wave stations have it too, but on a small scale compared to long-wave stations. Ground-wave signals travel along the surface of the earth from the transmitting antenna. The intensity tends to drop with distance, but if you blast out with enough power at low frequencies, you can cover the globe on a ground wave 24 hours a day.

Huge antennas are required for long-wave transmission. And tremendous transmitting power is needed to push the ground-wave signal around the earth. One long-wave station, operated by the U. S. Navy in Jim Creek, Wash., puts out a million watts, pumping its signal into an antenna that has its supporting wires strung between several mountain tops; its signal packs such a wallop that it can be heard by submarines 90 feet below the surface of the water, wherever they may be.

The long-wave band is only a half-megacycle wide, compared with over 26 mc. for the international short-wave bands. Half a megacycle is close quarters in any man's band. But there are many stations that must operate on these low frequencies, stations which comprise the delicacies of "down below" DX'ing.

The "rock bottom" of the radio spectrum—below 20 kc.—chatters away with c.w. stations of the U. S. Navy, the British Post Office, the Swedish Telecommunications Dept., the German Post Office, and about 101 other outfits. These stations extend upwards in frequency to 90 kc. Here they are joined by many of the world's coastal telegraph stations that contact ships on international routes. The ships themselves start showing up on 130 kc. They soon become intermixed with over 85 European and Asian broadcasting stations, beginning at 150 kc.

The next group of stations is by far the most popular with long-wave DX'ers. They are the zillions of radio navigational stations throughout the world which start popping up around 200 kc. These aeronautical and marine beacons and ranges, operated by commercial, government, and military interests, send their identifications

down below

Listen to hundreds of fascinating stations all over the world on the little-known v.l.f. band

By **TOM KNEITEL,** WPE2AB

TYPICAL LONG-WAVE STATIONS HEARD IN U.S.A.

Kc.	Call	Location	Kc.	Call	Location
14.5	CNM	Casablanca, Morocco	98.5	XPM50	Thule, Greenland
15.3	NHB	Kodiak, Alaska	98.5	TAB	Ankara, Turkey
15.3	NPN	Guam, Mariannas Is.	99.55	OEV33	D. Altenburg, Austria
15.3	NLK	Jim Creek, Wash.	99.7	DIU	Potsdam, E. Germany
15.5	NSS	Annapolis, Md.	100.0	CCS	Santiago, Chile
15.7	NPL	San Diego, Calif.	103.4	NAU	San Juan, P.R.
16.0	GBR	Rugby, England	103.4	NAU3	St. Thomas, V.I.
16.4	DMA	Bonames, W. Germany	108.0	RKA76	Moscow, U.S.S.R.
16.6	NPM	Honolulu, Hawaii	110.05	GYP	Hong Kong
17.0	NDT	Tokyo, Japan	110.15	CQX	S. Tome Is., S. Atlantic
17.2	SAQ	Varberg, Sweden	110.15	CQZ	Lobito, Angola
18.0	NBA	Balboa, Canal Zone	112.0	NHY	Pt. Lyautey, Morocco
18.0	NPG	San Francisco, Calif.	112.85	GYS	Singapore, Malaya
20.27	IDR	Rome, Italy	115.3	CFH	Halifax, N.S., Canada
33.95	LCA	Jeloey, Norway	119.15	NAM	Norfolk, Va.
39.35	JJC	Tokyo, Japan	119.15	ZSL	Capetown, U. of S. Africa
44.0	VHB	Belconnen, Australia	121.0	UBP	* U.S.S.R.
44.8	GYU2	Gibraltar	122.65	CQF	Bissau, Port. Guinea
51.7	XDA	Mexico City, Mex.	124.75	CTF	Flores, Azores Is.
53.0	NUD	Adak Is., Alaska	124.75	CTQ	Funchal, Madeira
55.5	NPO	Manila, Phil. Is.	125.0	HRC	Tela, Honduras
58.0	NPC	Keyport, Wash.	125.0	STP	Pt. Sudan, Egyptian U.A.R.
60.0	KK2XEI	Boulder, Colo.	125.0	VPC	Pt. Stanley, Falkland Is.
60.0	MSF	Rugby, England	125.0	XXA	Goa, Port. India
62.0	GIZ20	Rugby, England	125.0	YQI	Costanta, Roumania
62.1	ORL48	Ruiselede, Belgium	126.0	UDL3	* U.S.S.R.
62.45	SOA71	Radom, Poland	127.0	UCJ	Vanavara, U.S.S.R.
63.1	HAB	Szekesfehervar, Hungary	131.0	UNA	Kherson, U.S.S.R.
63.85	FYO3	Paris, France	132.0	RFSO	* U.S.S.R.
65.95	NAW	Guantanamo Bay, Cuba	132.0	ULV	Faizabad, U.S.S.R.
65.95	PEW	Kootwijk, Netherlands	135.0	PGU	Pt. Barrios, Guatemala
72.45	EAA	Aranjuez, Spain	142.0	UOX	Chamidta Mys, U.S.S.R.
75.6	OXE21	Skamlebaek, Denmark	142.86	UBJ	Baku, U.S.S.R.
78.2	GYC	Whitehall, England	142.86	UIX	Tcheliuskin, U.S.S.R.
78.55	LOF	Mar del Plata, Argentina	147.5	WCC	Chatham, Mass.
79.0	RET	Leningrad, U.S.S.R.	150.0	ZBH	S. Georgia Is., S. Atlantic
83.1	OFA83	Nummela, Finland	152.0	YNNA	Managua, Nicaragua
85.7	OAZ	Lima, Peru	153.0	VWC	Madras, India
96.05	HBB	Berne, Switzerland	182.0	TFU	Reykjavik, Iceland
97.45	GYZ	Malta	194.0	ASK	Karachi, Pakistan

*Location unknown

so slowly that, even if you don't read c.w., you can log them with one ear tied behind your back. All you have to do is jot the actual "dots" and "dashes" down on a piece of paper and later decipher them from a list of Morse code characters.

Many of the aeronautical stations send weather transmissions in voice at 15 minutes before and after each hour. There are also many airport control towers to be heard which use voice. At 405 kc., the navigational stations end and the maritime communications stations again take over.

If you can copy c.w. at any respectable speed, you might find more excitement during a few hours of listening on 500 kc. than you'd get from a week of watching TV. This is the "International Calling and Distress" channel, used by every commercial coastal telegraph station, every Coast Guard and Navy station, and every ocean-going commercial and military ship in the world. Many planes flying international routes also operate on this frequency.

In the remaining portion of the "down below" band—510 through 535 kc.—there are numerous government beacon stations, familiar to the many DX'ers who have wandered off the beaten path with regular "communications receivers."

DX'ploring receivers that tune down to the 15-kc. sub-basement are inexpensive and plentiful in the used and military surplus market. They include the U. S. Navy's RAK and RBL models and RCA's AR-8510. The soldering-gun crowd can build a sensitive 13-to-550 kc. receiver from plans in the December 1958 POPULAR ELECTRONICS. For receiving, any long-wire antenna will give dandy results in this range.

If, like many, you are interested in the beacon stations—200 to 400 kc.—you have a still wider selection of sets to choose from. If you stick with the low-priced sur-

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plus gear, you'll find the U. S. Army's low-frequency beacon receivers quite good. They include the BC 344, 348, 433, and 1206. The Navy has its own models: the ARB, ARN, RAL, RAO, and RAX. There are also available many used commercial long-wave receivers: the Bendix MN-26; Hallicrafters S-51 and S-72L; and National's HRO and NC-200.

New commercial receivers for the beacon frequencies are currently manufactured by Admiral, Heath, LT Labs, Motorola, National, Nova-Tech, Sonar, Zenith, and a host of others. In addition, European manufacturers normally include a long-wave band in the majority of "home-type" receivers they turn out.

Of particular interest to the dollar-conscious DX'er is an efficient and inexpensive low-frequency converter, the TC-1, recently developed by Boulevard Electronics (1229 W. Washington Blvd., Chicago 7, Ill.). It can be connected to the antenna of any good communications receiver or car radio. Battery-operated and transistorized, it tunes from 200 to 400 kc.

QSL's from v.l.f. stations are something to try for. Station information is plentiful, especially from the Secretary General, International Telecommunications Union, Palais Wilson, Geneva, Switzerland. Write directly to Geneva for details and prices of their many lists.

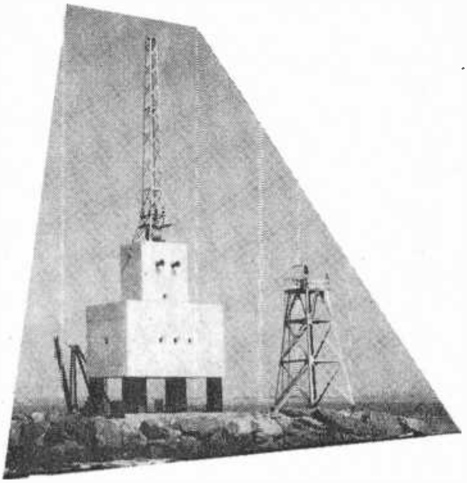
Many easily heard U. S. aero beacons and ranges are listed in the bi-weekly booklet called "Airman's Guide," sold by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Prices vary from issue to issue—usually ranging between 50 cents and $1.00.

Canadian aero beacons and ranges are given in "Air Navigational Radio Aids," available for 25 cents (in Canadian funds) from the Queen's Printer, Department of Public Printing and Stationery, Ottawa, Ont., Canada. Make checks and money

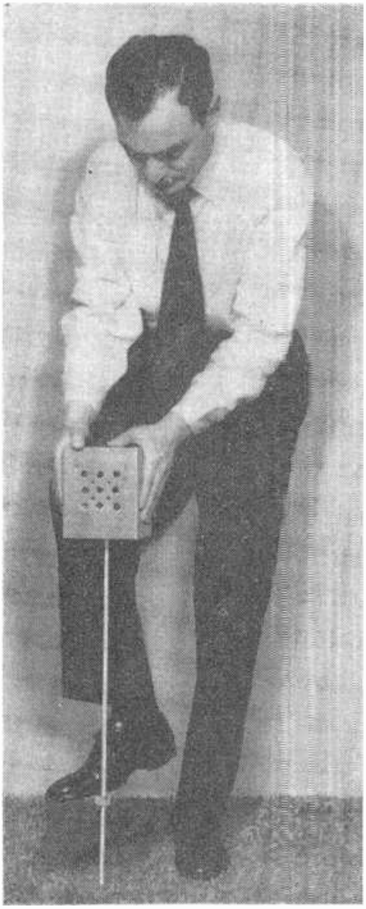
(*Continued on page* 108)

The author's listening post. His long-wave receiver, an RBL-2, is second from the bottom on the left.

U. S. Coast Guard radio operators "stand watch" on 500 kc., the International Calling and Distress Frequency, which is monitored by all marine stations and ships at sea.



This three-way navigational aid at Long Beach Harbor, Calif., transmits a low-frequency radio beacon in addition to flashing a 140,000-candlepower light and blasting on its foghorn. (U. S. Coast Guard photo)



Hook up the extension speaker assembly to your car radio as shown, then mount it near your picnic area by driving the aluminum spike into the ground.

Build a Picnic Speaker

By LUIS VICENS

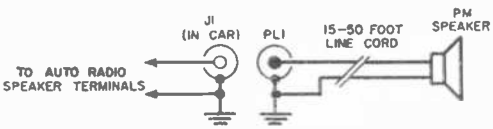
JUST "pipe" the output of your car radio into this extension loudspeaker, and you can have pleasant background music at picnics and beach parties. The complete assembly costs only a few dollars and takes an hour or so to put together.

Basically, the unit is a small PM loudspeaker (about 4") mounted in a box. You'll also need a length of connecting line, a carrying handle, and a sharpened spike for mounting the assembly in the ground near your picnic spread. The extension speaker is hooked up in parallel with the speaker on your car radio.

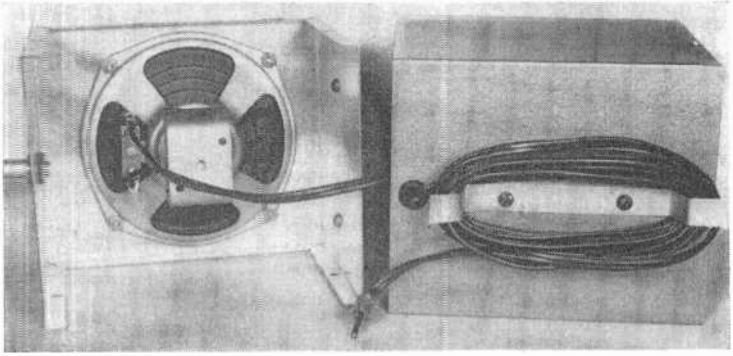
Mount the picnic speaker in an aluminum chassis box about 4" x 5" x 6" or larger (Bud CU-2107A or equivalent). Cut a baffle opening in the box and cover it with grille cloth or screen-door netting to keep careless fingers out. If you prefer to work with wood, you can use a cigar box, lacquered to make it weatherproof.

The spike is made from a 28" to 32" length of ⅜" aluminum rod. File one end to a point and thread the other end to accept a mounting nut. A small bracket can be attached part-way down the spike to provide a toe grip for driving the spike into hard-packed soil.

Connect the picnic speaker's voice-coil terminals to the car radio with about 15 to 50 feet of 117-volt rubber-insulated "zip" cord. Attach an RCA phono plug (*PL1*) to the end of the cord, and bring the car radio's voice coil terminals out to a matching RCA phono jack (*J1*) which can be mounted on a bracket under the car's dashboard. —30—



Metal cleat bolted to rear of unit holds cord in place when the picnic speaker is not in use.



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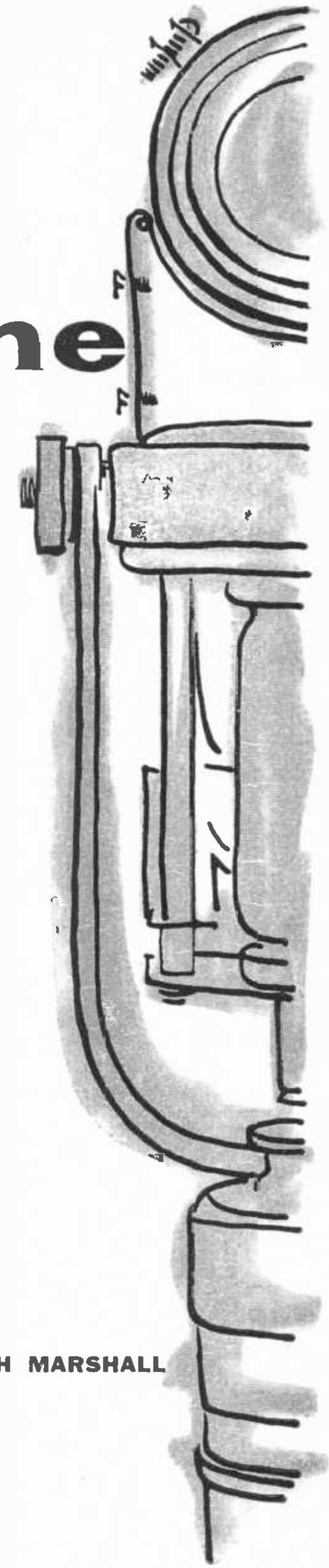
INSIDE the Hi-Fi Microphone



PART 1 of two parts

MICROPHONES are transducers—they convert mechanical energy (sound waves) into electrical energy, just as loudspeakers convert electrical energy into mechanical. As a matter of fact, these two transducers—microphones and loudspeakers—are so closely related that, given the right conditions, any dynamic speaker can be used as a microphone and vice-versa. This dual-function use is utilized in intercom systems and is one reason intercoms can be produced so cheaply.

There are many different types of microphones. Some are rough-and-tough customers that you can drop on the floor with no ill effects. Others are prima donnas that will refuse to work if you so much as sneeze at them (this is literally true in the case of the ribbon microphone). To see why the various types of microphones have the specific advantages and disadvantages that they do, let's start by discussing the dynamic mike, a versatile performer which can be found in use all the way from ham shacks to recording studios.

Dynamic Microphones. Since dynamic microphones are similar to loudspeakers in basic theory, they present some of the same design problems. (See Fig. 1.) Somewhat like a loudspeaker, a dynamic microphone tends to have a peak in its mid range because of resonance in its suspension system. This peak, however, can be controlled by providing an empty space behind the diaphragm. The air cavity works to reduce resonant peaks in the same way a properly designed enclosure damps out a loudspeaker's resonances. Several other small air chambers behind the diaphragm—carefully proportioned to emphasize or attenuate certain frequencies—are generally included in the microphone's design.

The bass response of a dynamic microphone is sometimes extended by building a "ducted port" into the case. This is a hollow tube which permits

By
JOSEPH MARSHALL

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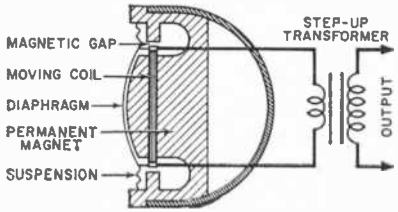
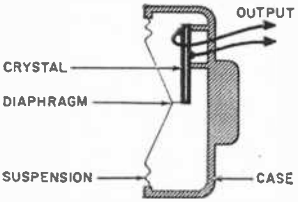


Fig. 1. Construction of a typical dynamic microphone is shown at upper left. Examples of dynamic microphones include the Shure 530 (at left) and the Electro-Voice 635 (above).

Fig. 2. Basic design of a bimorphic crystal microphone is shown below. At right is the Sonotone CM-10 ceramic microphone.



the sound to excite a resonant chamber, vibrating the back of the cone in phase with the front and thus producing a greater movement of the diaphragm at frequencies near the chamber's natural resonance. This boost can be removed by closing the duct.

The dynamic mike has several advantageous features. If it is well designed and carefully constructed, it can provide a very wide and smooth frequency response. In addition, it is quite sturdy and can take its share of hard knocks without damage.

One of the most important characteristics of a dynamic microphone is its low output impedance. This is a valuable feature since it allows long cables to be run from the mike to the amplifier without excessive hum pickup. But this low output impedance necessitates the use of a special step-up transformer at the amplifier to match it to a high-impedance input.

The polar pattern of a dynamic mike is normally omni-directional—that is, it picks up sound from any direction equally well. It is possible, however, to modify this pickup pattern, as we shall see.

Crystal and Ceramic Mikes. Some crystalline materials such as Rochelle salts and barium titanate produce electric voltages when they are bent. This phenomenon is the basis for the operation of both the crystal microphone and the crystal phono pickup.

There are two types of crystal mikes: the

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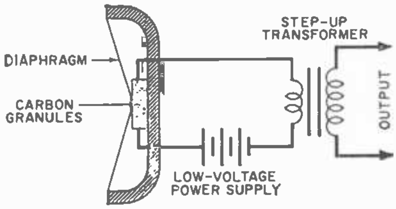

Fig. 3. Diagram of a carbon microphone with its associated power supply and transformer.

bimorphic and the sound-cell. In the bimorphic type, a crystal is connected by a lever to a diaphragm so that the movement of the diaphragm bends the crystal and generates a voltage. (See Fig. 2.) In the sound-cell type, there is no diaphragm: sound waves hit the face of a bank of crystals and bend them directly. Bimorphic crystal mikes are inexpensive and produce a response up to around 7000 cps. Sound-cell types are more expensive but they go up to 10,000 cps and beyond.

Crystal mikes are omni-directional and have relatively high output at very high impedances—from 500,000 ohms to 5 megohms. For this reason, they can be connected directly to the input of an amplifier without using a transformer. The characteristic high impedance of crystal mikes makes them highly susceptible to hum pickup, however, unless a short interconnecting cable is used.

Ceramic mikes are very similar to crystal mikes in general characteristics, price, and performance. They are much less susceptible to heat and humidity, however.

Carbon Mikes. The oldest and cheapest microphone is the carbon mike. Carbon granules are attached to a diaphragm so that the carbon is compressed "in tune" with the variations of the sound waves as the diaphragm moves. The resistance of the carbon varies at an audio rate as the carbon is compressed. When the carbon "button" is connected to a battery, its varying resistance causes the current going through it to vary also. These current variations are delivered to an amplifier through a transformer. (See Fig. 3.)

A carbon mike delivers high output voltages and consequently needs little amplification. But its frequency response is limited, and, because of the changing con-

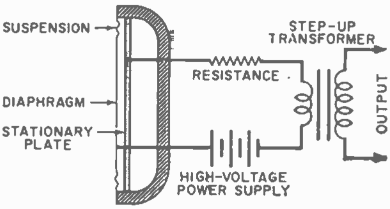

Fig. 4. Elements of a capacitor mike are shown above. At upper left are internal and external views of the Sony C37A capacitor microphone. Immediately at left is the Altec Lansing 21D "Lipstik" mike.

tact resistance of the carbon granules, it is quite noisy. Carbon microphones are used in telephones and in the simpler types of voice communications where price is an important consideration; they are not suited for high-fidelity applications.

Capacitor Mikes. The moving diaphragm of a capacitor microphone is one plate of a two-plate variable capacitor. When a fixed high voltage is applied to the two plates and a resistor is placed in series with this polarizing voltage, a movement of the diaphragm will cause the capacitance between the plates to vary, thus varying

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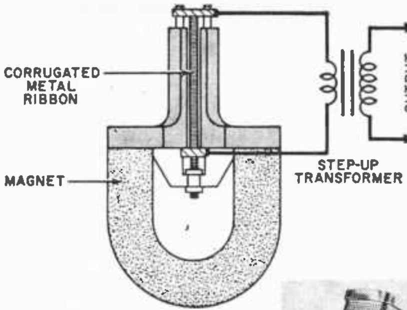

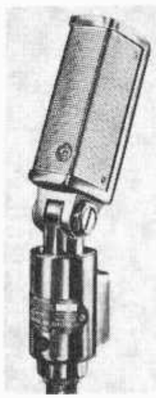

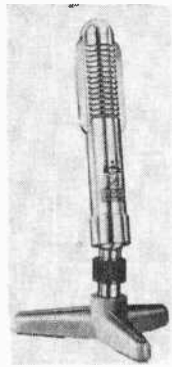

Fig. 5. Construction of a ribbon microphone is detailed above. Commercially available ribbon mikes include Shure 330 (at right) and the Dynaco B&O 50 (upper right).

the current flow through the resistor. (See Fig. 4.)

Because the current variation is very small, however, the resistor must be quite large to produce a useful voltage drop. This results in a high-impedance circuit which would be susceptible to hum and noise pickup if a long shielded cable leading to the amplifier were used. For this reason, the preamplifier is built right into the microphone; the preamp is designed to have a low output impedance so that cable length is not critical.

In the old days, the physical size of capacitor microphones made them unsuitable for most purposes. Recently, however, the techniques of miniaturization have helped the capacitor mike come back with a bang. One example, the Altec Lansing "Lipstik" microphone, is even smaller than most dynamic and crystal mikes, being only 5/8" in diameter and 6" long, complete with a built-in preamplifier, but less the power supply which is in a separate box a few feet away.

The new capacitor mikes approach the ideal in frequency response and dynamic range characteristics, covering the entire audio range with an unprecedented evenness and lack of coloration. For this reason, they are widely used today in professional recording. Since capacitor mikes are largely handcrafted, they are expensive—around $400.00 apiece.

Ribbon Mikes. A less expensive type of microphone that approaches the capacitor type in overall performance is the ribbon mike. This design consists of a narrow ribbon of corrugated Duralumin supported at its ends in a magnetic gap. As the ribbon vibrates in response to sound waves, it cuts the gap's magnetic field and generates a voltage. (See Fig. 5.) Because it has no diaphragm and complex suspension system, a ribbon mike's resonance can be kept below 20 cycles. The ribbon mike is also free from cavity resonances and pressure doubling.

Ribbon microphones have extremely low output impedances and thus have built-in transformers to match them to the line (usually 600 ohms). Frequency response in less expensive models can extend to beyond 13,000 cycles, and some broadcast and recording ribbon mikes go from 20 to 20,000 cycles.

The main disadvantage of the ribbon mike is that the ribbon itself is very fragile and will not stand up to rough treatment. To avoid damage to the ribbon, it should not be used outdoors if there is a wind. Also, a ribbon mike has a tendency to overaccentuate the bass end when picking up a voice at close range. This effect has been reduced in many models, however, by the addition of damping pads or electrical networks to roll off the low end.

The ribbon mike differs from the others we have discussed so far in that it is bidirectional. A sound that comes from the side will not move the ribbon and there is no voltage generated. Sounds from the

(*Continued on page* 107)

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By

LEO G. SANDS

Ship-Shaping Marine Radios

Good installation and operating techniques improve the seaworthiness of any marine radiotelephone

COMMON complaints about marine radiotelephones are noisy reception, inadequate range, and interference from other vessels. More often than not, however, the boat owner doesn't really understand how to get the most from his equipment. Actually, much can be done to improve the operation of boat radios.

First, consider the fact that very low power systems are involved. An AM broadcasting station's signal, for example, comes from a transmitter as powerful as 50,000 watts. But a boat radio radiates only 2 - 5 watts. Even a telephone company shore station radiates only about 100 watts. Yet there are users who expect greater range from a boat radio than from a broadcasting station!

Typical boat radios are rated at 20 to 150

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watts input. Since power rating is based on power *input* rather than *output,* a "20-watt" set doesn't actually deliver 20 watts. Its final r.f. power amplifier tube *consumes* 20 watts, a figure derived by multiplying its plate voltage by its plate current in amperes. Most transmitters are about 50% efficient, so a 20-watt transmitter will deliver about 10 watts of honest-to-goodness r.f. energy to the antenna.

To go one step further, the transmitting range is determined by the power radiated by the antenna, not the power that it consumes. When a 20-watt transmitter is fed into an antenna of 20 - 25% efficiency, the effective radiated power is on the order of 2 - 2½ watts. This is low power indeed compared to a 50,000-watt AM broadcasting station or a TV transmitter with an effective radiated power in excess of 100,000 watts.

Antenna/Ground System. No boat radio is better than its antenna system. And a good boat antenna is rarely more than 25% efficient because it simply isn't as long as it should be. For best results, the antenna should be one-half wavelength long, which, at 2 mc., would mean an antenna 230 feet in length! A quarter-wave vertical antenna about 115′ long would be an efficient radiator, but even a quarter-wave antenna is far too long for small-craft use.

Consequently, a compromise must be made. This compromise usually takes the form of a loaded antenna consisting of two rods joined in the middle by a loading coil. The loading coil "stretches" the rods so that the antenna takes on some of the electrical characteristics of a long-wire. While this is not a very efficient scheme, it is the best answer engineers have come up with to date.

Many boat owners are unaware that the actual antenna is only *half* of an antenna system. Without an effective *ground,* even a good antenna will function poorly. A metal hull is an excellent ground, but good electrical contact must be made with it. A bolt through the hull is one safe bet, with the hull scraped clean so that good electrical contact can be made with a piece of flat metal braid (½″ or larger) connected to the radio ground terminal. Both the metal braid and the antenna lead-in should be as short as possible.

To obtain a good ground on a boat with a wooden or plastic hull, a large (12′ x 12′, if possible) copper plate on the outside of the hull is best. If this isn't feasible, brass or copper strips about 3″ - 4″ wide can be fastened to the inside or outside of the hull, securely bonded together by copper braid soldered or bolted to each strip. In addition, the engine and all large metal parts should be bonded to the ground system to obtain as much ground area as possible.

Recently, special grounding devices of porous metal have been developed which are less than a square foot or so in area. These devices are sponge-like in construction, and their makers claim that water seeping through their pores helps make them effective grounds.

But regardless of the installation, the proof of the antenna "pudding" is in its performance. A radio technician can determine the antenna ground system efficiency by noting how well the transmitter loads into its antenna. And the boat owner himself can check antenna ground efficiency by noting how far he can talk.

Modulation. Most modern transmitters are designed so that modulation cannot exceed 100%. But if modulation is less than 80%, range will be impaired.

In most transmitters, a modulation limiter is included to prevent overmodulation and to maintain a higher average level of modulation. Weaker sounds picked up by the microphone are boosted and louder sounds are prevented from being amplified

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◀ **A handset** is often better than an ordinary microphone for marine use. Inexperienced users find it hard to hold a telephone-type handset improperly. Also, the handset's directional properties cut noise pickup from wind, rough weather and the boat's motor.

Microphones are sometimes a source of trouble for the uninformed boat-owner. Used correctly, they should be held two to three inches from the lips in order to deliver enough output for good modulation.

to a level that would produce overmodulation.

The percentage of modulation achieved depends to some extent upon how the microphone is used. Talking too softly into a microphone at an excessive distance usually results in insufficient modulation. And, because of the action of the modulation limiter, background noises picked up by the microphone may be too loud, making it difficult for a distant listener to separate the voice from the noise.

By talking into the microphone at a distance of 2 - 3 inches, in a normal voice, adequate modulation and good range should be attainable. Talking more loudly than required to obtain maximum modulation won't increase range and can actually cause distortion.

Input Voltage. Transmitting range is also determined in part by the input voltage applied to the transmitter. On small craft, power is usually obtained from a 12-volt storage battery, but the actual voltage across the battery terminals will vary. What's more, there is a loss in the wires leading from the battery to the equipment.

This loss is determined by the size and length of the wires as well as by any elec-

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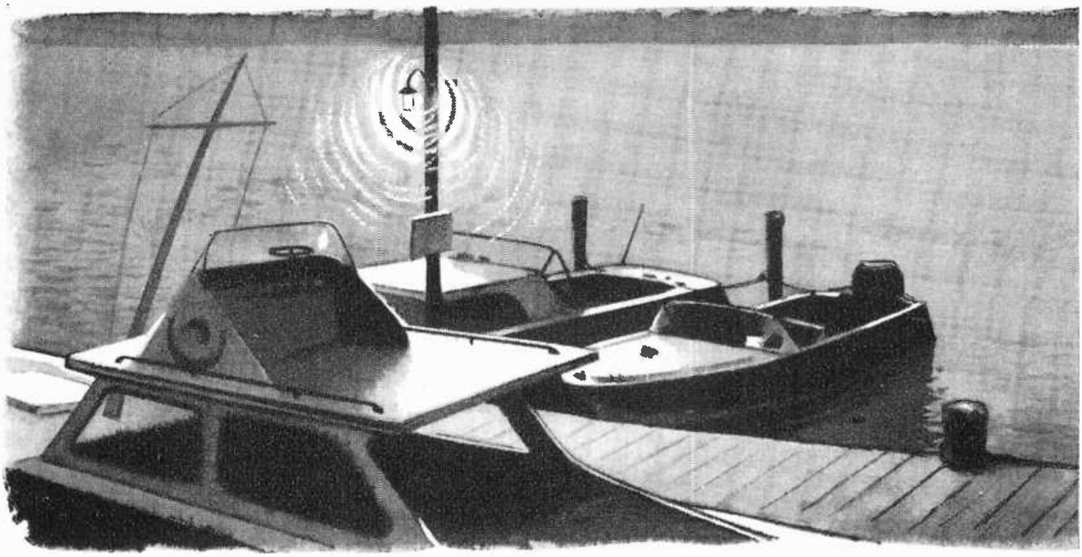

Build an Electronic

Inexpensive unit protects your boat, car,

NOW THAT the boating season is in full swing, you'll want to take steps to protect your shipboard gear from burglary and vandalism. Here's an inexpensive and simple burglar alarm that can turn on a warning light, a horn, or even a siren, if any unauthorized persons attempt to remove equipment from the craft. It can also be used to protect ham gear in your car, or guard your home while you're away on vacation. This electronic watchman will make your summer holiday more carefree and enjoyable.

The alarm uses only a few parts and will operate for months on its self-contained battery—standby current is only 50 microamperes. Due to the low operating voltage and current, there is no danger of shock. Even so, the relay in the alarm can carry up to 2 amps at 125 volts, enough to operate most bells and sirens.

Construction. The model was built into a 6" x 3⅛" x 1½" plastic box with a hinged top, as shown in the pictorial. The accompanying test unit was built into a 2⅞" x 1¼" x 1⅛" plastic box and is designed to plug into the burglar alarm. Other containers or layouts can be used, if you wish, since the circuit is not critical.

Relay *K1* plugs into a standard octal tube socket and transistor *Q1* into a transistor socket. All other parts are supported by their leads except "five-way" binding posts *BP1, BP2, BP3,* and *BP4,* which are mounted at one end of the box. Be sure to position *BP1* and *BP2* exactly ¾" apart in order to match the spacing of banana plugs *P1* and *P2* on the test unit. If desired, potentiometer *R1* and transistor *Q1* can be mounted in a separate plastic box as shown.

The relay should be waterproofed before it is installed in the alarm. To do so, remove the four screws from the relay's plastic cover. Then, using lacquer or clear nail polish, coat the area between the octal base and the metal flange, both inside and outside the relay. Replace the cover and screws, and coat the mating area between the relay cover and the metal flange. Use plenty of lacquer around each of the four screws.

Adjustment. Before adjusting the alarm, be sure that the relay and transistor are firmly seated in the sockets and that the

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Burglar Alarm

or home while you're away

By ED DUDA

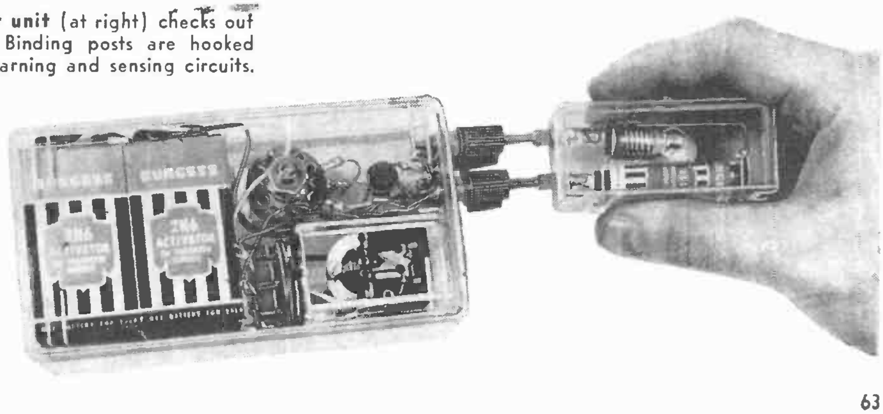
18-volt battery is properly connected. Wrong battery polarity can ruin the transistor.

Next, plug *P1* and *P2* of the test unit into binding posts *BP1* and *BP2* of the burglar alarm; lamp *PL1* on the test unit should light. Connect binding posts *BP3* and *BP4* with a length of wire and adjust potentiometer *R1* until the lamp goes out. When you remove the jumper wire, the lamp should light once more. The burglar alarm should now be ready for installation.

Be sure to keep a jumper wire across *BP3* and *BP4* when the unit is not connected to an alarm circuit. This keeps current drain on battery *B1* at a minimum.

Installation. One of the most important considerations in any burglar-alarm system is to prevent the burglar from disabling the alarm. Once a convenient hiding place has been selected for the alarm, the next step is to hook up binding posts *BP3* and

Simple test unit (at right) checks out the alarm. Binding posts are hooked up to the warning and sensing circuits.



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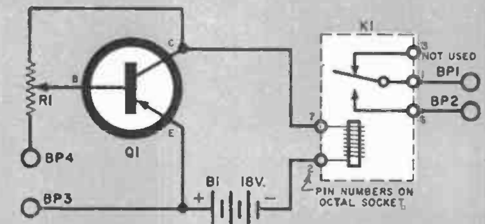
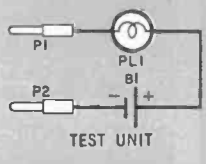
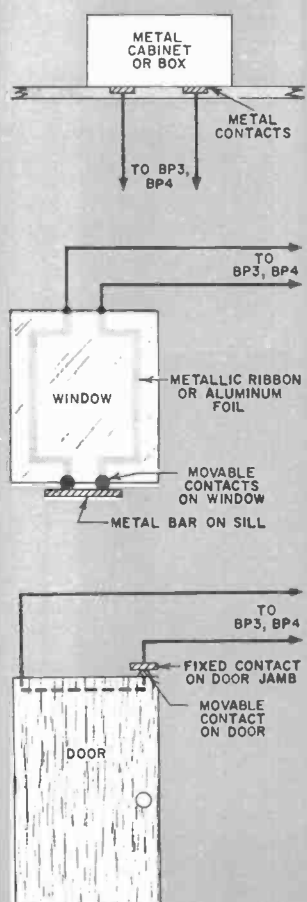




Single transistor (Q1) energizes relay K1 when circuit across BP3 and BP4 is opened. Test unit plugs into BP1 and BP2; lamp PL1 lights when K1 is energized.

PARTS LIST

B1—18-volt battery (two Burgess 2N6 9-volt batteries or equivalent in series)
B2—1.5-volt penlight cell (test unit)
BP1, BP2, BP3, BP4—Five-way binding post (Lafayette MS-566 or equivalent)
K1—S.p.d.t. relay, 4000-ohm coil; 2-amp., 125-volt contacts; 1.9-ma. operating current (Kurman 23DB42 or equivalent)
P1, P2—Banana plug
PL1—1.5-volt flashlight lamp (test unit)
Q1—2N188A transistor
R1—250,000-ohm, 2-watt potentiometer (Ohmite CLU-2541 or equivalent)
1—Octal tube socket
1—Transistor socket
Misc.—Hardware, plastic boxes, battery clips, penlight cell holder, penlight bulb socket, etc.



Sensing circuits are "switches" which trip alarm when they are opened. As current is only 50 microamps, alarm is safe to operate near children or pets.

BP4 to a "sensing" circuit at the property requiring protection. The sensing circuit is nothing more than a switch that is inadvertently operated by the burglar when he attempts to remove equipment or open a window or door. Typical sensing circuits, one for each of these three cases, are shown at left.

The final step is to connect binding posts *BP1* and *BP2* to the warning circuit, which can be any of a number of electrical signaling devices. Two typical warning circuits are shown at right. On your car or boat, you can use your horn for an alarm. To do this, connect one lead from binding post *BP1* to one horn-button terminal and another lead from *BP2* to the other horn-button terminal. In other installations, *BP1* and *BP2* can be connected to an alarm gong, flashing light, siren or even to a door bell.

If the equipment to be protected is a piece of mobile electronic gear housed in a metal cabinet, attach leads from *BP3* and *BP4* to separate metal plates underneath the cabinet. Should the cabinet be lifted off the metal plates, the circuit through the cabinet will be broken and the alarm set off.

This same technique can be used with the front or rear door of your home. A movable switch contact should be mounted on the door and a fixed contact on the door jamb; one contact is connected to *BP3* and the other to *BP4*. If anyone opens the door, the alarm will go off. Be sure to use a sensing switch that will remain open once the door has been opened; otherwise the thief could close the door after him and thus silence the alarm. —30—

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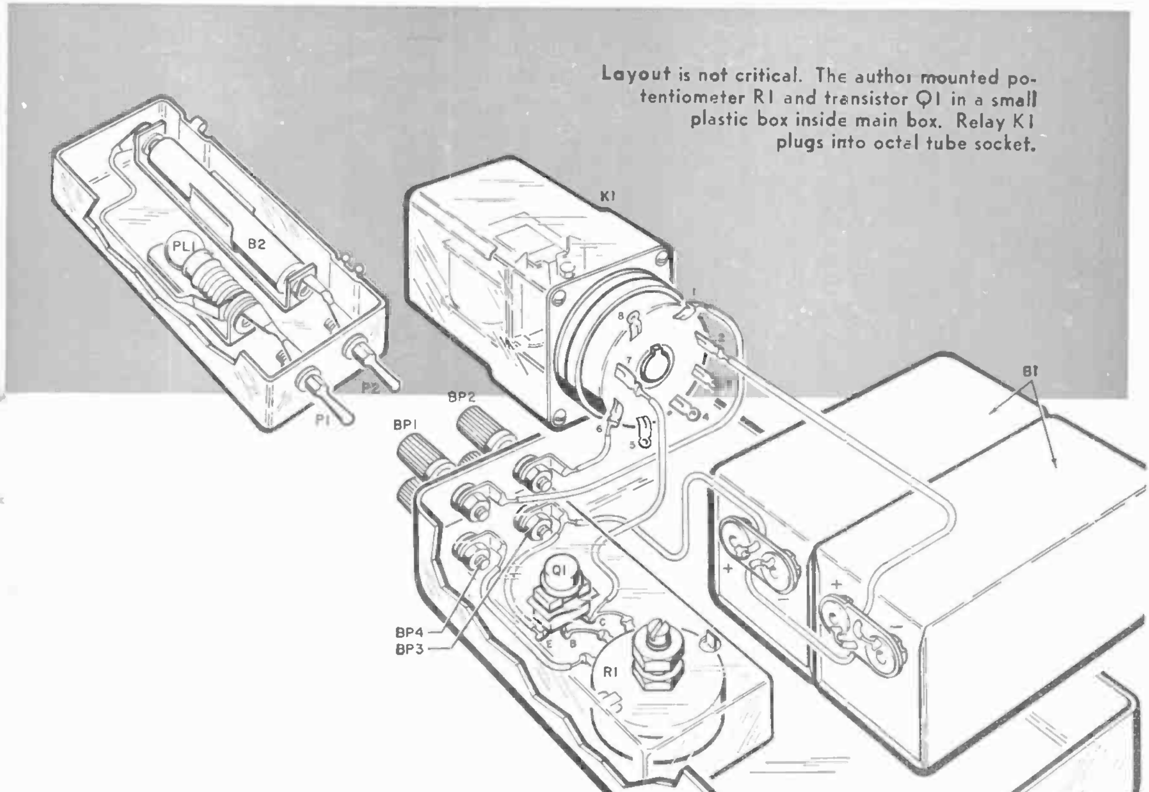
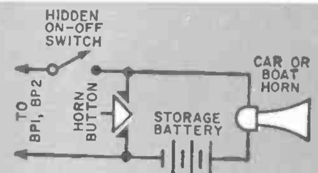
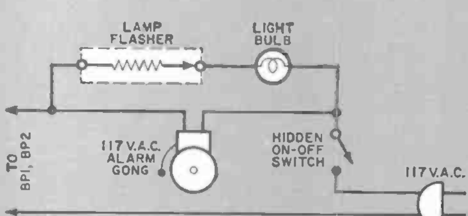


Layout is not critical. The author mounted potentiometer R1 and transistor Q1 in a small plastic box inside main box. Relay K1 plugs into octal tube socket.





Warning circuit on boat or car can use horn to sound the alarm. Installations in homes or stores can operate a 117-volt a.c. system. Open hidden switch to silence alarm after it has been tripped.

HOW IT WORKS

The burglar alarm employs a single transistor (*Q1*) with a relay (*K1*) as its collector load. In operation, *BP3* and *BP4* are connected to each other at the equipment under protection. Potentiometer *R1* acts as a voltage divider in series with battery *B1* and relay *K1*.

The arm of *R1* is set to a point where the base of *Q1* is only slightly less positive than *Q1*'s emitter. This setting of *R1* keeps *Q1* in the non-conductive state; insufficient current flows to energize relay *K1*. When the circuit across *BP3* and *BP4* is opened, the base of *Q1* goes very negative and *Q1* conducts heavily, energizing *K1*. With *K1* energized, normally open contacts 1 and 6 of *K1* close and connect binding posts *BP1* and *BP2*. This switches on the warning device and thus sounds an alarm.

When plugs *P1* and *P2* of the test unit are plugged into *BP1* and *BP2*, battery *B2* will light warning lamp *PL1* if there is a break in the circuit connecting *BP3* and *BP4*. In actual use, a bell, siren, or other warning device is substituted for the test unit.

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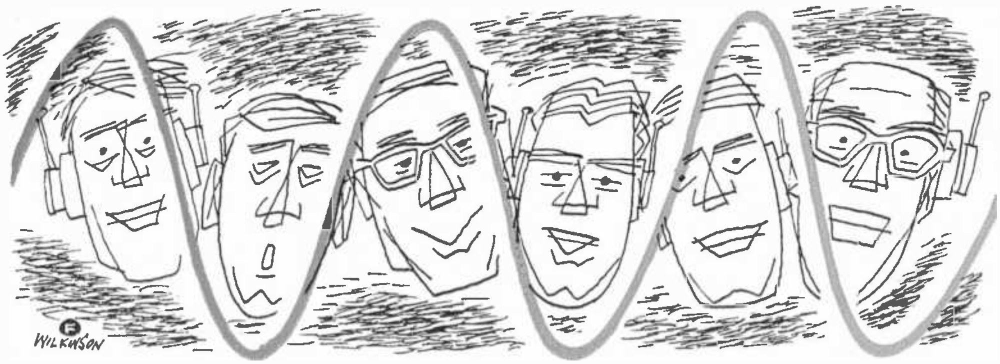
The Strange Inhabitants of



75-Meter Phone

There's no lack of unusual characters on 75-meter phone. How many of the operators described here have you come across?

By

JAMES F. VAN DETTA, WA2FQZ

ONE of the most popular meeting places for hams is the 75-meter phone band. Although the propagation characteristics of this band aren't particularly conducive to exotic DX, evening time finds the frequencies between 3800 and 4000 kc. buzzing with activity.

Most of the operators that work this band turn up night after night to talk about anything and everything under the sun. The great majority of them are fine, considerate gentlemen; a few are miserable clods. In between are all kinds imaginable. Here are some of the stranger types you'll meet on 75-meter phone.

FIRST, let's consider the lovable character who calls CQ, gets you to answer his call, transmits for half an hour, and then signs off because he has to run some urgent errand. As he signs off, he asks you to give him your handle quickly because he "can't even hang around for your final." "My final!" you weep pitifully, "I haven't even had my *initial!*"

Then there's the fellow who just won't sign off. He's more difficult to disengage than a Novice after his first DX contact. This verbose chap comes back for a "final final," then for a "short final final final," and so it goes. After a half hour or so of this kind of thing, you begin to flush with the excitement of the challenge. As time slips by, an earnest duel evolves. If you're fortunate, QRM renders the official decision: a draw.

Perhaps you've run into the guy who leaves you to "tie the ribbons on it" while he sneaks off the frequency to find another QSO. He doesn't even wait to hear your final transmission before scampering off in search of another contact. After you sign off with him and tune up about 30 kc., there

Waiting for the fellow who continually has to search for words can be a harrowing experience. His best bet might be to try a written script.

he is, already in another QSO. It gives you a nice warm feeling to know you have been talking to the frequency instead of to another human being.

Did you ever meet the fellow who doesn't seem to know the name of anything? He makes you want to break into his transmission and supply him with the appropriate word. "At last my *ah-uh-oh* my *ah-uh* trans *uh-ah* mit *ah-oh* ter is working fine now, but my *uh-ah-oh* . . ." The poor guy just seems to be noun-less.

Worse than being noun-less is the operator who is thought-less. "Yessiree. Now

Transmit-receive switching can be complex, but this guy carries things too far. If he goofs his switching sequence, your ears will be the losers.

you wanted to know about . . . (long pause) . . . Say, did you ever hear about that idea to have all . . . (pause) . . . I wonder if my SWR will . . . (long pause) . . . When I tell you . . ." This fellow seems determined never to finish a thought.

Since we all can't afford the kind of transmit-receive switching we would like, sometimes you'll find a ham who has to throw a dozen switches before he turns it back over to you. Once in a while, he will get his switch-throwing sequence mixed up and his signal will howl and screech until he completes his switching operations. As your eardrums vibrate against your chattering molars, you'll have the unforgettable experience of knowing what a sound engineer means when he talks about the "threshold of pain."

Your nerves can also be quickly worn to a frazzle by the fellow who has an electronic voice control circuit that isn't functioning properly. After he mutters each phrase, his carrier snaps off with a thump and the background noise smashes into your ears. "Well, I *ROAR-ROAR* hope you *ROAR-ROAR-ROAR* can copy me *ROAR-ROAR* over there *ROAR-ROAR-ROAR.*" This situation has to be experienced to be appreciated.

"A lot can still be said in favor of a hand-operated T-R switch," you explain to the nice man in the white coat as he adjusts your snug-fitting jacket.

THE independent fellow with his own phonetics often confuses more than he informs. If his name is Pat, for example, his phonetics might be "psychological; Aetna; tsetse." If the QRM is pretty rough, you get only the last word of phonetics. So when you come back at him with, "Well, Fifi, the QRM is pretty bad here. . . ," it hits him where it hurts most—in his phonetics!

The operator who avoids "I," "me," and "mine" like the plague is apparently unaware that "I" and its various forms are perfectly respectable. "*We* have enjoyed the

Racks of home-brew equipment fill the ham shack of the self-styled "electronic designer." You'll recognize him on the air by his 60-cycle hum.

QSO, OM. It has been a pleasure for *us* to meet up with you." You wonder if perhaps he is a pair of Siamese Twins.

Then there's the fanatic single-sidebander who scornfully refers to AM as "ancient modulation." Following his wobbly signal as it wanders around the band requires an alert pair of hands on the receiver controls. As he recites his enthusiastic praises of SSB, he also remarks that the reason you're having trouble receiving him must be faulty operational technique on your part, or maybe a design defect in your 75A4.

And who hasn't met the operator with a homebrew rig who fancies himself an elec-

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tronic designer? This character is easy to recognize because his signal features a healthy 60-cycle hum. He joyfully spends three times the cost of a commercial kit to get one-third its performance and sneers disdainfully at anyone who buys a kit. If he only knew how much his performance could be improved!

Closely allied in spirit to the "electronic designer" is the self-appointed "electronic genius." You'll find him to be a generous fellow when you are experiencing some trouble with your rig. With unmatched swiftness, he will offer a diagnosis of your difficulty.

Your problem, he will tell you with an air of condescension, is due to *one or more* of the following: (1) bad tubes, (2) bad components, (3) shorts, (4) improper transmitter tuning, (5) faulty design, (6) faulty wiring, (7) something wrong with antenna system, (8) something wrong with a.c. line.

The amateur comedian really breaks himself up with his own corn-ball jokes. His attempts at humor are usually met with cold silence at the other end.

And wonder of wonders, when you do find your trouble, it is almost invariably one or more of the causes suggested by the helpful diagnostician! Are there any others? How quickly this wizard can pinpoint troubles is an endless source of amazement.

A CHARACTER we could do without is the fellow who tunes up his transmitter without checking to see if the frequency is clear. Listening to his variable-pitched whistling, one becomes quite convinced that he must be a cross between a parrot and an intoxicated canary. However, he dispels this assumption to some extent by his "count-ups" and "count-downs." He usually counts up to about 100 and then back down to 1 . . . by 1's, as if he were training to become count-down officer at Cape Canaveral.

When he finally comes back to some of the stations that have been calling him, this guy says, "Thanks for the shout, fellows. I was just tuning up the ole rig here. Wanted to make sure it was socking out the ole soup. You know, I've been on the air umpteen years, and I never yet called a CQ. Don't believe in it. No need for all this CQ'ing."

Occasionally you run into a would-be comedian. He has a new joke every day. A sample of his refreshing humor goes like this:

"Did you hear the one about the two balun coils? There was these two balun coils and one says to the other, 'Social security'." Here he breaks into riotous laughter as he turns it over to you.

"I don't get it," you admit.

He comes back howling with hilarity, "You won't—ha ha ha—until you're 65!"

TRAFFIC NETS are a distinct plus for ham radio. You always feel your shoulders go back a little in pride as you hear the net begin to pass messages.

> *"Being discharged on April 5th.*
> *Bake a cake, Mom. Warm up the car,*
> *Dad. See you both soon. Love."*

So goes a message from a soldier who is shortly to join his parents. You slowly break into a smile of vicarious satisfaction. Then it hits you. This is the 28th of April! The message is over three weeks old! The poor ex-GI will probably receive his own message at home. Or maybe it will be received by one of his descendants.

For a first-hand course in the torments of frustration, try a QSO with the joker who has a one-track mind. Regardless of your comments or questions, he will ignore your transmissions. If he's a hi-fi buff, for example, he will come back to you with, "Yeah, OK there, OM. Well, today I got this new speaker system for the hi-fi. Complete absence of coloration with acoustical suspension, you know? Say, when you compare it with the old system I had . . ." and on he rambles.

Finally, to complete our cast of characters on 75-meter phone, there is, as you may have suspected, the unlikely individual who makes notes on some of the other inhabitants of 75-meter phone and sends in an article to POPULAR ELECTRONICS describing them. His only additional words are, "BCNU on 75!" —30—

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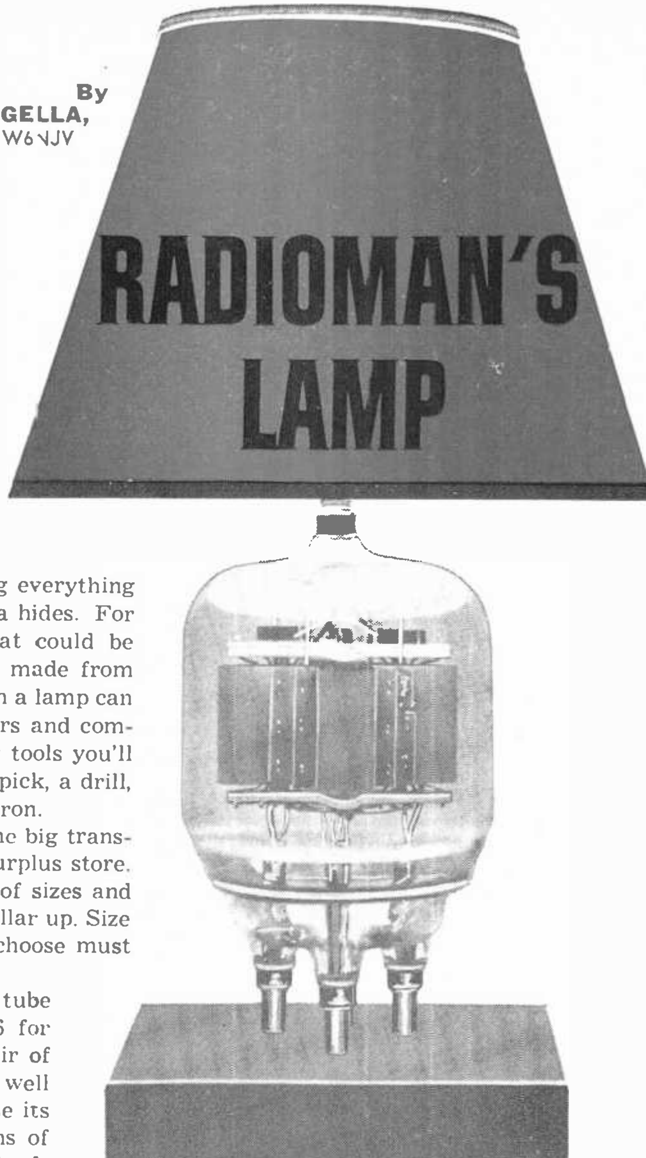
By
CHARLES CARINGELLA,
W6NJV

RADIOMAN'S LAMP



High-power transmitting tube makes attractive table lamp

LAMPS have been made using everything from abalone shells to zebra hides. For the electronics enthusiast, what could be more appropriate than a lamp made from a large transmitting tube? Such a lamp can be built for less than ten dollars and completed in one evening. The only tools you'll need for the project are an ice pick, a drill, a screwdriver, and a soldering iron.

Your best source for one of the big transmitting tubes is an electronic surplus store. These tubes come in a variety of sizes and usually sell anywhere from a dollar up. Size isn't critical, but the one you choose must have a plate cap.

The Western Electric 701A tube used here costs about $8 ($16 for two, if you want to make a pair of matching lamps). It's especially well suited for use in a lamp because its pins are actually hollow lengths of 5/16" tubing—this makes passing leads through the pins a comparatively simple matter. Then, too, one pin is located at the top of the tube and four at the bottom, which gives the 701A the necessary top cap and base connections required for the lamp.

To start the actual construction, make a small hole in the end of one pin to release the vacuum. This can be done with any sharp instrument, such as an ice pick, since the copper pins are very soft. Play it safe by wrapping the tube in several layers of rags until it is completely covered except for the pins. The rags will absorb any accidental shocks and offer some degree of protection in the event the tube should break.

Next, drill a 1/8" hole in each of the four bottom pins and a 3/16" hole in the top pin. Be careful when drilling—and don't attempt to drill before the vacuum has been released.

Two leads of insulated No. 20 hookup

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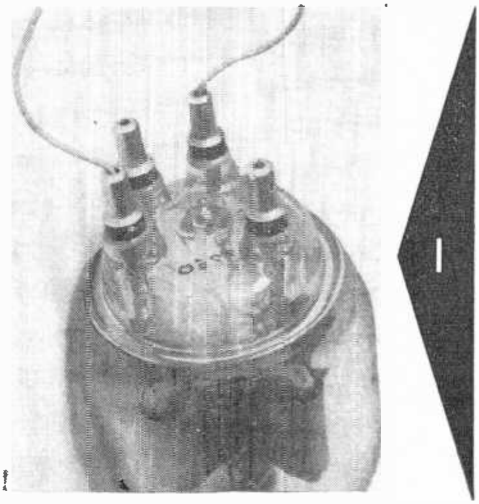

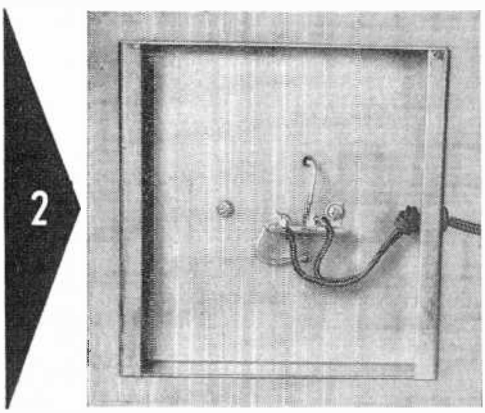

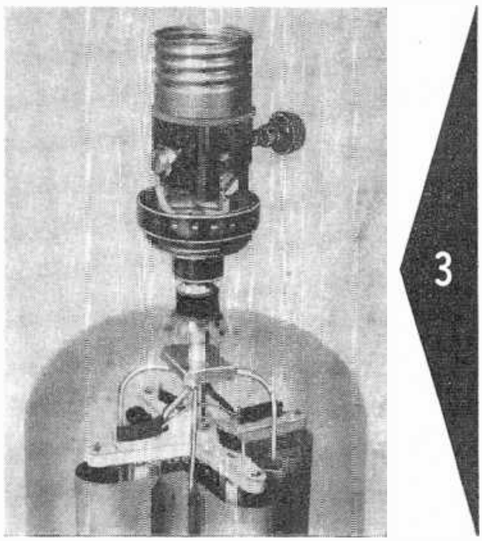

1 First step in wiring lamp is to pass two insulated leads, one at a time, through top pin, inside tube, and out bottom pins.

2 Self-tapping screws inserted in unused tube pins hold tube on chassis base. Terminal strip is tie-point for leads and line cord.

3 Socket and switch assembly attached to top pin completes lamp. QSL's or circuitry applied to shade imparts electronic "touch."

wire are required to supply power to the light bulb. Each lead is fed through the top pin, one at a time, and passed through the tube and out separate bottom pins. (The other two bottom pins are used to mount the tube to the base with a couple of self-tapping screws.) This is the critical point in the wiring—all in all, it takes a little patience and about 15 minutes to work the wires through. When this is done, fasten a standard lamp socket-switch fixture to the top pin and connect the wires to it.

Now prepare the base, which is a standard 5" x 7" x 2" aluminum chassis (Bud AC-402 or equivalent). If you wish, you can use any other size chassis or mounting base that suits your decor.

First drill four ⅛" holes through the top side of the chassis to match the location of the tube's bottom pins. Next, drill a ⅜" hole at the rear apron of the chassis to accommodate the power cord.

After all the holes are drilled, apply three or four coats of quick-drying enamel to the chassis and let it dry thoroughly. Then mount the tube to the base by inserting self-tapping screws through the appropriate holes in the chassis and into the remaining two tube pins.

Install a ⅜" rubber grommet in the power cord hole and connect the cord to the leads coming from the tube. A two-lug terminal strip can be used as a tie-point; if a terminal strip is not used, twist the leads together and carefully insulate them with electrical tape.

Add any lamp shade your heart desires, and your "transmitting tube" lamp is ready for operation. -30-

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MAGNETIC AMPLIFIERS

how they work and what they do

By KEN GILMORE

Scores of magnetic amplifiers in the world-circling Triton control its atomic reactor. Above, finishing touches are put on the General Electric "magnetic" that monitors the reactor's temperature.

THE ATOMIC SUBMARINE Triton glides swiftly and silently through the deep. As its power plant purrs steadily, scores of electronic watchdogs probe every part of the sub's powerful reactor. Suddenly the pressure in a reaction chamber begins to rise over the allowable amount. One of the electronic guardians instantly notes the rise and applies a corrective signal—before a human operator could know that anything had begun to go wrong.

The electronic watchdogs that keep the Triton's powerful nuclear plant operating without a hitch are magnetic amplifiers—

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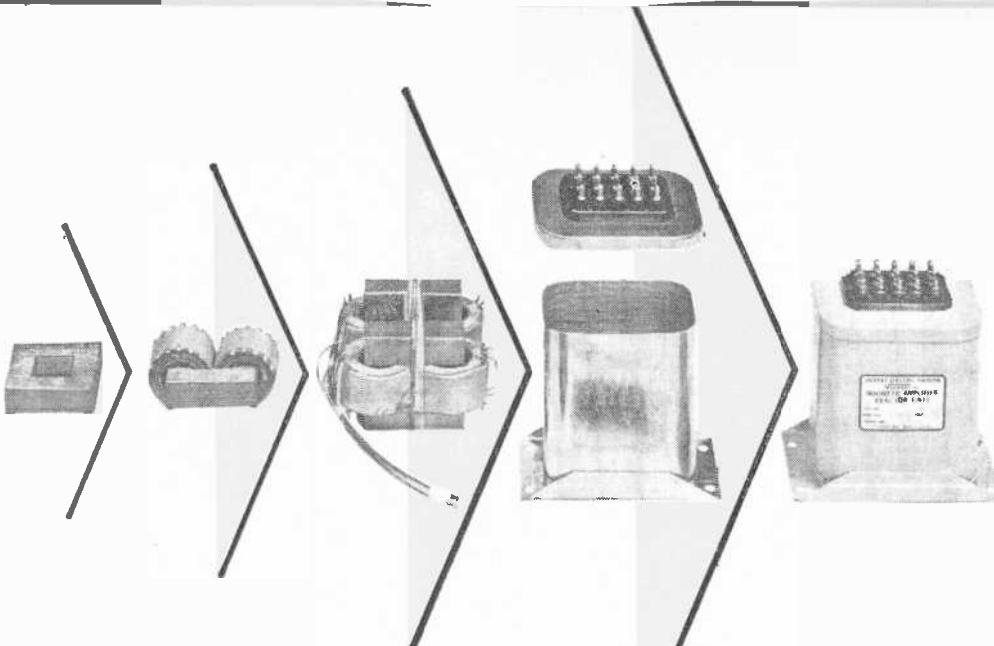

Stages in the assembly of a magnetic amplifier. Its similarity to a transformer in construction technique and general appearance is striking.

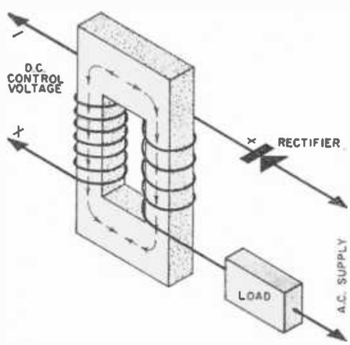

Fig. 1. Basic circuit for half-wave magnetic amplifier.

almost a hundred of them are used for this critical job. Yet these same magnetic amplifiers—the heart of the control system of one of the world's most up-to-the-minute fighting machines—are straight out of the horse-and-buggy era.

Forgotten and Rediscovered. Magnetic amplifiers came into being when the century was just one year old. It would be six years—in 1907—before a youngster named Lee DeForest would make news with his audion, the world's first vacuum-tube amplifier. And the transistor was still 47 years in the future.

For a while, it looked as though the magnetic amplifier would hold its own against that upstart, the audion. In 1916, E. F. W. Alexanderson, the electronic pioneer, employed magnetic amplifiers to modulate his early transmitters and many World War I transmitting stations used his circuits. By the early 20's, however, the flashy vacuum tube had taken over, and the "magnetic" was almost forgotten in this country.

It was not forgotten in Germany, however, as we found out when World War II started. In the years between the wars, the Germans had brought the magnetic amplifier to a high state of development. Wartime found them using magnetics for reliable, accurate, and trouble-free control of everything from gun turrets to automatic pilot systems, and they even used them in the V2 rockets.

Awakened to the possibilities inherent in this design, Allied scientists began to push the development of magnetic amplifiers. Before much progress had been made, though, the war was over. But the spark had been kindled, and a few years later Vickers Inc. (now a division of Sperry Rand) came out with the first commercially produced magnetics.

By that time, interest had been aroused all over the world. In the following decade, hundreds of other firms, including all the big names in electrical and electronic equipment, have added magnetics to their product lines. And almost no branch of industry now operates without them.

Flux Controls Current. A modern-day magnetic amplifier is, essentially, nothing

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Magnetic amplifiers like the Vickers unit above allow fingertip control of elaborate lighting systems in TV studios. *(NBC photo)*

more than an iron core with two or more coils of wire wound around it. In construction and appearance, it is similar to a transformer. But there the similarity ends.

A magnetic amplifier—or saturable reactor, as it is sometimes called—is a true amplifier. Like a vacuum tube, it uses a small signal to control a large one. But there are sharp differences. Where the vacuum tube controls a current flowing to a d.c. power supply, the magnetic amplifier controls an a.c. flow. While the vacuum tube is primarily a voltage amplifier, the magnetic is a power amplifier. And where the vacuum tube uses voltage variations to control a flow of electrons, the magnetic amplifier controls current flow through a coil by varying magnetic flux.

Magnetics come in half-wave and full-wave types, as do a.c. power supplies. First, let's look at the basic half-wave circuit shown in Fig. 1.

A d.c. current flowing through the control winding will cause a build-up of magnetic flux in the iron core. The greater the flux, the lower will be the impedance of the output winding. With a lower impedance in the circuit, more current will flow from the a.c. power supply through the output winding and the load.

When the current in the control winding reaches a certain point, the core is said to be *saturated,* which means that it has all the flux it can hold. At this point, the impedance of the output winding is very low, and the current through the load is very high. On the other hand, when there is *no* control current flowing, and consequently no flux in the core, the output impedance is extremely high, and practically no current flows through the output winding or the load. Thus, by controlling the current through the control winding, the output winding impedance, and consequently the current through the load, is made continuously variable.

A rectifier in series with the output winding keeps the constantly reversing polarity

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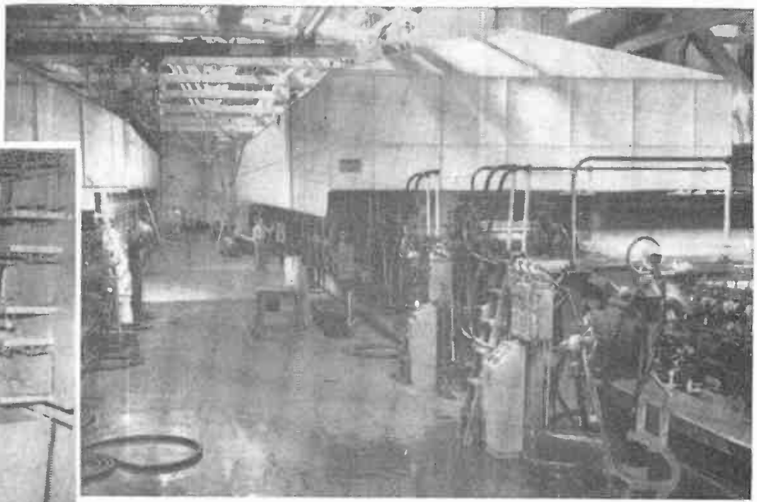
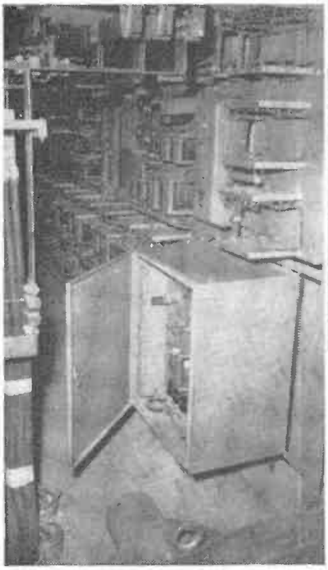
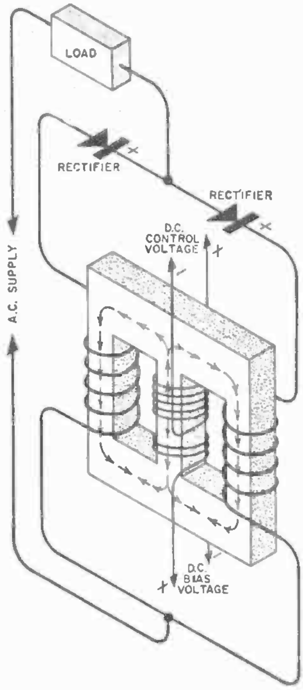




Thanks to magnetic amplifiers, this paper-making machine at West Tacoma Newsprint Corporation in Tacoma, Washington, can operate at 5000 feef per second, many times faster than previously possible. Magnetics continuously adjust the speed of the take-up rollers, slowing them down as the roll of paper gets larger. Control room is at left.

Fig. 2. Basic circuit for a full-wave magnetic amplifier.



of the a.c. supply from cancelling out the control winding flux. The direction of the current flow through the secondary is arranged so that the magnetic fluxes created by the two windings reinforce each other rather than cancel each other out.

A full-wave circuit is shown in Fig. 2. It works like the circuit in Fig. 1, except that it makes use of both half cycles of the a.c. supply current. The two halves of the output winding are wound so that the direction of the magnetic flux created by both of them in the center leg of the core is the same as the direction of the flux created by the control winding.

The bias winding can be used to control the general range of the amplifier's operation, just as the bias on a vacuum tube causes the tube to operate on a certain part of its characteristic curve. In a magnetic amplifier, when a small bias current flows, a certain amount of flux is continuously present in the core, even with no control voltage supplied. Thus, the impedance of the output winding will never reach its maximum value, nor will the current through the load reach its minimum.

Many magnetic amplifiers have an additional control winding which is used for feedback. This winding taps a certain amount of the output circuit's current and applies it back as a control current. As with a vacuum tube, the feedback can be

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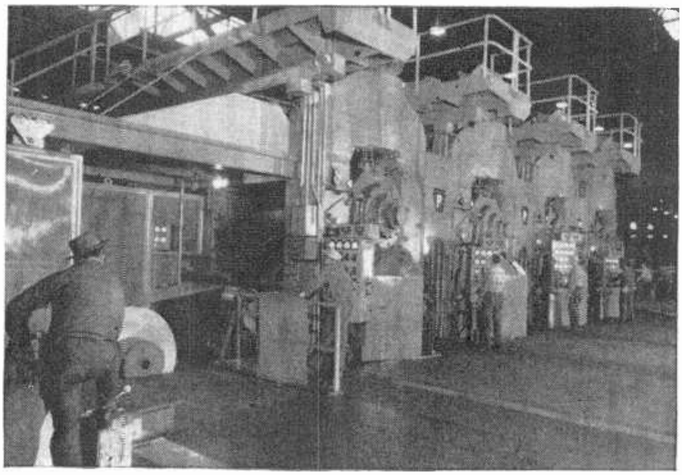
either negative or positive. In general, negative feedback improves the linearity of the amplifier while positive feedback increases its gain.

Single-stage magnetics can be built with gains of about 200,000, far beyond the capabilities of the vacuum tube. With a gain on this order, a few milliwatts of power in the control winding—an amount that could be supplied by one or two flashlight cells—may control a load of 25,000 watts in the output circuit.

Rugged and Reliable. Magnetics are extremely rugged. They can be—and frequently are—completely potted and sealed in airtight containers. They thrive on extremes of heat, dust, moisture, vibration, and other adverse conditions that would put vacuum tubes and transistors out of operation. Their efficiency is high, as with transformers and other magnetic devices. In addition, no filament current is required. So little heat is generated by magnetics that they can be packed into extremely small containers which need practically no ventilation or cooling.

Because magnetics can handle large amounts of current easily, they are a natural choice for electric furnace control. A Reynolds Aluminum Company furnace in Corpus Christi, Texas, uses such a control system. Precise furnace control by magnetics also helps to "grow" transistors in the latest types of transistor-manufacturing processes.

Magnetics have recently begun to invade the field of entertainment, too. NBC's two big color television studios—one in Burbank, California, the other in Brooklyn, N. Y.—have magnetic amplifier lighting-control systems. With this setup, the lighting man has fingertip control over each of the hundreds of lights throughout the studio. He can control them individually or in banks, as he desires, working from a small keyboard that looks something like an organ console. Unlike older types of theatre lighting devices—autotransformers and rheostats—magnetics present no fire hazard.



Steel-rolling mills use magnetic amplifiers, too. Because the steel gets longer as it is rolled, each set of rollers must turn at a slightly different speed. Magnetics keep all the rollers operating at the proper speed relationship regardless of how fast the steel is fed in. *(Pittsburgh Steel photo)*

Since magnetic amplifiers have no moving parts and no delicate components, they last for years with virtually no maintenance. For this reason, they are used in such critical applications as the control of the atomic pile in nuclear subs and in missile-guidance systems, where reliability under adverse conditions of vibration, heat, and acceleration is vital.

Reliability is also the reason magnetics were chosen to monitor and control the critical voltages and currents of the transatlantic cable. If a voltage begins to change, a magnetic compensates for the change, and, at the same time, sounds an alarm so an operator can check to find the reason for the change. If the current drawn by the underwater repeater amplifier tubes begins to rise, once again the alarm is given, and corrective action is taken automatically. By insuring that the current does not rise to dangerous levels, the magnetics pro-

(*Continued on page* 109)

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On the Citizens Band

By TOM KNEITEL, 2W1965

ANYONE who has spent five minutes listening on the 11-meter Citizens Band will agree that some "rules of the road" are badly needed to guide operators along the path to proper, courteous, and efficient operation. The POPULAR ELECTRONICS CB Courtesy Code" (below) sets forth some basic operating policies for CB'ers.

1. Do not transmit on a channel without first listening to see if it is clear. If the channel is in use, stand by until it is clear.

2. Keep calls down to a minimum ("2W4887, 2W4887, this is 2W4580" should be sufficient). If the called station doesn't reply, try again in 30 seconds. If there is still no answer, wait 10 minutes before you call again.

3. Say "over" at the end of each transmission so the operator you are contacting will know that you expect him to transmit.

4. If you hear a station being called which you know has cleared the channel, inform the calling station.

5. Always help in an emergency, even if the extent of your help is to cease transmissions and keep the channel open.

6. If a station accidentally interferes with your communications, request that the station stand by for a few moments until your communications are completed. You should then finish your contact as soon as possible.

7. Never work cross-channel unless it is the only way to send an extremely important message. If you must work cross-channel, ask the other station to give your channel a quick check to see if it is clear.

Does your station abide by the POP'tronics "CB Courtesy Code?" It should. But these pointers are only a few of the more obvious table manners that CB'ers should observe. If you have any to add, send a post card to this column with your suggestions (keep them brief). We'll incorporate them into our code if they are applicable.

A CB Log Book is being issued by "H" Enterprises, P.O. Box 867, Brooklyn 1, N. Y. Even though the FCC doesn't require logs for CB stations, you might find it useful to keep a record of communications from your station. If you are a businessman, you will probably find that keeping track of orders and dispatches is a must. The book sells for $1.98 ($1.50 to members of the Five-Watt Wizards National CB Club).

We finally found out what a Hush-Puppy is. It's an automatic squelch adapter designed for the Heath CB-1 (although it will work on many other CB and non-CB receivers, too). Taking only about four minutes to attach, it really silences the receiver until an incoming signal activates it. Write to Western Massachusetts Electronics, Great Barrington, Mass., about this adapter if you're interested.

A pocket-size field-strength meter is now available from Quaker Electronic Co. of Plymouth, Pa., for $7.95. Weighing only 1½ pounds, it shows the maximum power radiated by your transmitter. This unit comes in two models—all-band or for your specified frequency.

Canadians who want to have a Citizens Band should get in touch with Larry D. Whiting of Strathroy, Ontario. Larry is spearheading the cause and has already received a huge response to his letter on Canadian CB which appeared in our March issue.

Larry was informed recently that the Department of Transport is conducting a survey into the practicability of Canadian CB. That's a start, and we wish Larry and his group the best of luck. CB would certainly be a boon to the many people living in Canada's wide-open spaces where land-line communications don't exist. -30-

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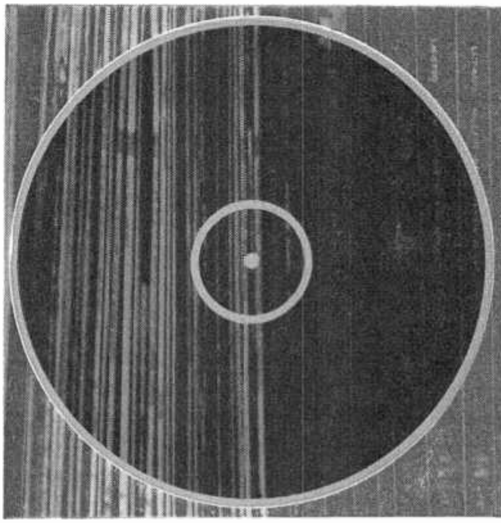
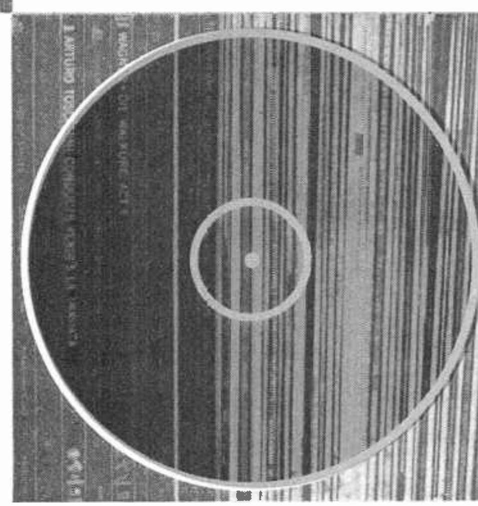


how to extend the life of your records



Here's what you should know about record wear and care

By JOHN MILDER

WHEN the time comes to show off your hi-fi rig, you frequently find that your favorite records just don't have the sparkle they once had. Annoying pops and clicks, distortion, and muffled highs supply the all-too-audible evidence of record wear. To make your system sound its best, you reach for that brand-new record fresh from your dealer's stock.

There's no denying that record wear will take the fine edge off your listening enjoyment unless you take active measures to prevent it. Fortunately, there are many ways to save your records from unnecessary punishment. With a little help from you, they can continue to sound brand-new even when they should be eligible for an old-age pension. Let's look at the inside story on record wear and see how it can be prevented.

Stylus Condition. Since the tip of your stylus is in constant contact with your records, it has a crucial influence on record wear. The first rule is: keep it clean—and not with your finger, either. A camel's hair brush is just about ideal; it will clean off the dust and dirt, but it won't damage the stylus' delicate suspension system.

There's no way to predict just how long your particular stylus will last. It depends on how much listening you do, the kind of record player you use, and the amount of pressure on the stylus. In any event, don't wait until your records begin to sound fuzzy before you have your stylus checked. By the time you can hear the effects of a worn stylus, it has already been at work damaging your records.

If you don't use a diamond tip, you should have your stylus checked at least once a month. A diamond should last a year or more, but if your record playing is a daily

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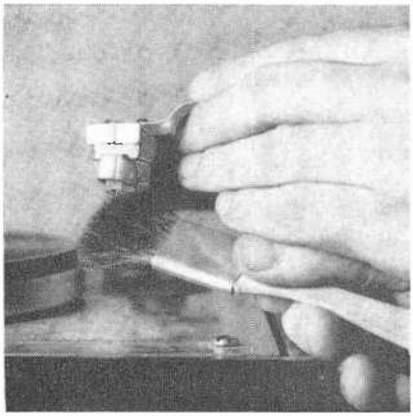

Camel's hair brushes are ideal for keeping the tip of a stylus clean. Don't use your fingers—you may damage the pickup.

Tracking pressure is easily checked with the assistance of a good pressure gauge.

habit, it's a good idea to start checking at the six-month mark and every month or so thereafter.

When it's time for stylus replacement, buy a completely new assembly. A few companies will still re-tip your old stylus bar, but the small saving involved isn't worth the disadvantage of keeping a stylus assembly which has probably lost most of its original compliance. A replacement made or approved by the manufacturer of your cartridge is the best way to make sure that your records get the treatment they deserve.

Cartridge Compliance. Probably the next most important factor in record wear is the design of the cartridge itself. The battle between a poorly designed cartridge and your record grooves will always result in your records coming out on the losing end. A good cartridge, though, can bring your records safely past the hundred-play mark.

The key to your cartridge's behavior is its compliance—the freedom of its stylus to move from side to side and up and down when following the twisting trail of a record groove. Cartridges vary in their compliances mainly because of differences in their mechanical innards. The more work the generating element inside the cartridge has to perform, the stiffer and less compliant the stylus assembly will be.

For stereo records, the cartridge's vertical compliance is particularly important. But mono records, too—despite the fact that their grooves are modulated laterally—demand a cartridge that has good vertical compliance. If the stylus has trouble moving vertically, it won't be able to cope with "pinch effect"—which requires that the stylus move up slightly when highly modulated sections of the groove reduce the effective groove diameter. A mono cartridge with poor vertical compliance will plow straight ahead through the modulation instead of moving upward. Damage to the grooves is the result. In the case of stereo records, poor vertical compliance will in time demolish the separation between the channels.

You can get a good clue to a cartridge's compliance by using test equipment no more elaborate than your own ears. A monophonic record is your best listening source, since stereo tends to divide your attention. On a mono record, a pickup with good lateral compliance will produce a smooth and wide frequency response, with a solid and well-defined bass. At normal listening volume, the loudest recorded passages (ex-

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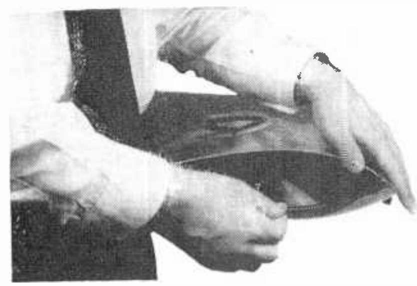
Loose dust can be cleaned off records by wiping them with a damp cloth. Don't use a dry cloth, however, because it will create static electricity, causing more dust to be attracted.



"Billow" the record jacket when sliding a record in or out of it to prevent the record surfaces from rubbing against it.

Dirt that has found its way deep into the record grooves can be removed by gently washing the records in lukewarm water.

cept at the innermost record grooves) should come through with no sense of strain and with no extraneous noise superimposed. Also, with the volume control of your amplifier all the way down, you shouldn't be able to hear much, if any, sound coming from the cartridge itself when you stand more than two or three feet away from your record player.

If your cartridge seems to flunk these tests, have it checked to see if its stylus assembly has reached the end of the road. If the stylus seems to be in good condition but it still won't fill the bill, you should think about stepping up to a better cartridge. Even if you don't have a super-duper system with all-out frequency response, both your system and your records will benefit from a better cartridge. A pickup with really good compliance will surprise you by "finding" music down in the grooves of mono records that have been damaged by less considerate cartridges.

Record-Handling Tips. Although your cartridge and its stylus have first say in the treatment of your records, you yourself are next in line. Your record-playing habits can extend—or cut short—the life of your records. Here's how to make sure that they will stay new for a long time.

Stylus pressure is of primary importance and should be checked from time to time. The important thing here is to follow the recommendations of the cartridge manufacturer. Don't make the tracking pressure either heavier or lighter than the manufacturer suggests. While it's easy to visualize record wear caused by too much stylus pressure, too little pressure can do just as much damage; it prevents good contact between the stylus and the record groove, causing the stylus to rattle around in the groove. This adds a fuzzy quality to the sound and encourages groove-skipping. Unless your cartridge and tone arm are specifically designed for ultra-low tracking pressures, don't try to get down into the one- or two-gram region.

If you use a record changer, don't pile too many records on it at once. A thick stack of records makes it tough for most

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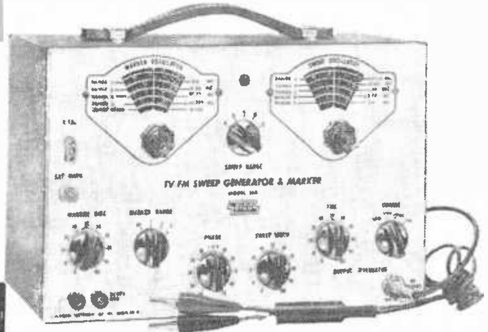
Test Instruments

the Sweep Generator



By G. H. HARRISON

How it works and how it is used

UNTIL RECENTLY, it was a rare service shop or experimenter's bench that boasted a sweep generator. But the coming of FM and TV has made this valuable test instrument an absolute necessity for the serviceman. At the same time, the ham and electronic experimenter have learned that the sweep generator can be a versatile tool in servicing and aligning a wide variety of electronic equipment.

Basically, a sweep generator is nothing more than a frequency-modulated signal generator. In other words, instead of producing a steady signal at one frequency, it *sweeps* rapidly back and forth over a selected band of frequencies, just like an FM broadcast station. Its output frequency might start at 50 mc., for example, rise swiftly to 55 mc., dip back to 45, go up again to 55, and so on. The generator would repeat this frequency sweep from 45 to 55 mc. and back 60 times each second. Such a unit would have a *sweep rate* of 60 cycles, a *sweep width* or *bandwidth* of 10 mc. (55 − 45 = 10), a *center frequency* of 50 mc.

What is the purpose of a sweep generator? Simply this—with a sweep generator and oscilloscope, you can actually *see* an overall response curve of an electronic circuit, rather than simply measuring voltages, currents, and other variables, and then figuring out what is happening.

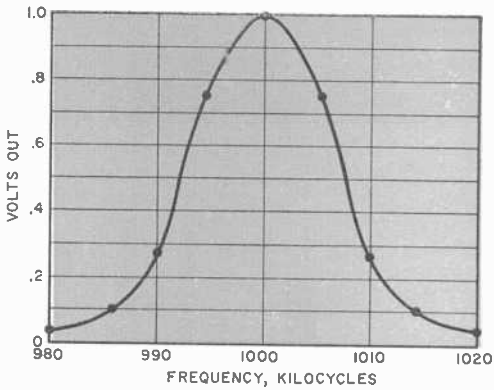


Fig. 1. A standard signal generator can be used to plot the bandwidth of an AM receiver, but the procedure is time-consuming. A sweep generator shows this complete curve instantly.

General Applications. To get a better idea of how a sweep generator works, let's examine the way it can be used in checking the bandwidth of an AM receiver. This job *could* be done with a regular AM signal generator and voltmeter by taking a series of output measurements at different frequencies. With the receiver tuned to 1000

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kc., for example, you could take output readings while tuning the signal generator to frequencies from 980 to 1020 kc. in 5-kc. steps and plotting the output curve on graph paper. The result would probably look something like Fig. 1. But a sweep generator can be set to sweep through the same band of frequencies. Then, with an oscilloscope hooked to the receiver's output, the frequency response curve will appear instantaneously on the scope tube.

While such a procedure is merely helpful when checking AM radios, it is essential for TV and FM. This is because the wide bandpass characteristics of TV and FM circuits necessitate the use of a sweep generator. Figure 2 shows two typical curves. For the associated circuits involved to operate properly, the *shape* as well as the amplitude of these curves must be accurate. The only practical way to align such circuits is to actually see the waveforms on an oscilloscope and note how the shapes change as the alignment controls are adjusted.

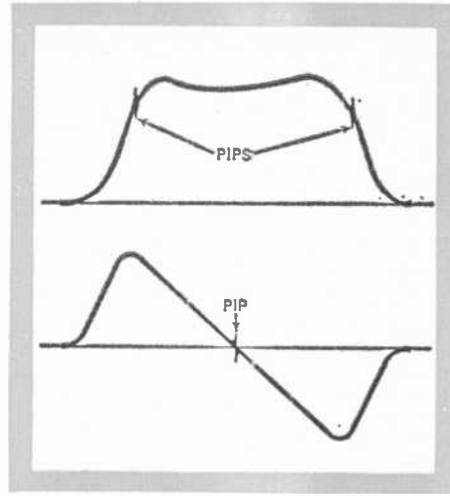

Fig. 2. Sweep generators are essential for the proper alignment of FM and TV circuits, since the curve shape is important. Pips are injected to aid in alignment.

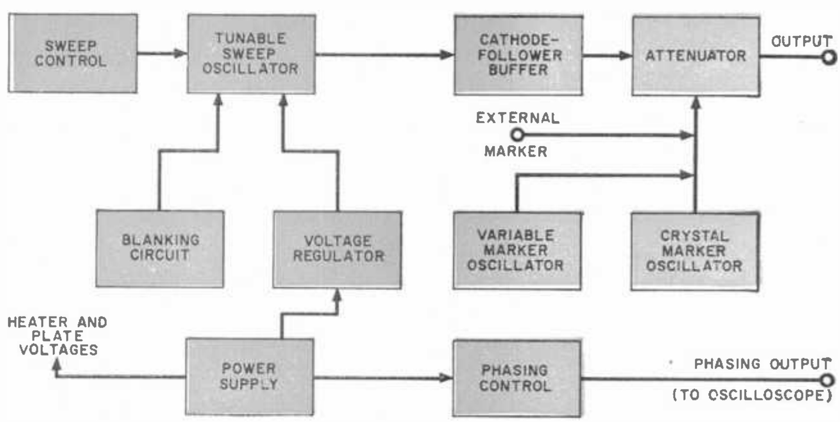

Fig. 3. Heart of a typical sweep generator is the tunable sweep oscillator. It varies its output frequency continuously back and forth around a center frequency.

Sweep "Oscillators." The block diagram of a typical sweep generator is shown in Fig. 3. Note that a "tunable sweep oscillator" has replaced the simple r.f. oscillator found in the AM signal generator. Actually, however, there isn't a great difference between the two. If you were to take an ordinary AM signal generator and turn the tuning knob back and forth, the output frequency would vary continuously as you turned the knob—you would be *sweeping* the generator through a band of frequencies. A small motor attached to the knob could be used to drive the tuning knob back and forth automatically. With the motor running, the frequency of the generator's output signal would continuously sweep through a band of frequencies.

Early sweep generators were made in exactly this way. A small, specially designed motor-driven capacitor (Fig. 4) was connected across the main oscillator's resonant tank circuit. Today's sweep generator accomplishes the same thing but generally uses more modern sweep circuits.

There are several all-electronic sweep methods in current use. The Heath TS-4A sweep generator, for example, employs the

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"Increductor," a transformer-like device in which the inductance of one coil is controlled by the amount of current flowing in the other. Figure 5 shows a simplified diagram of the Heath circuit.

The a.c. current flowing through the primary winding of the Increductor creates a magnetic field in the common core. The higher the current, the less the permeability of the core, and, consequently, the lower the inductance of the secondary coil (which forms part of the oscillator tank circuit). Thus, the oscillator frequency sweeps back and forth with the 60-cycle current applied to the primary of the Increductor; the greater the current, the wider the frequency swing.

The small rectifier in the Increductor primary circuit keeps just enough d.c. current flowing so that the tank inductance is maintained about halfway between its maximum and minimum values with no a.c. current applied. When the sweep circuit is turned on, the oscillator's frequency swings about equally above and below the center frequency, rather than in just one direction as would be the case if the rectifier weren't used.

Another popular method of sweep modulation is the reactance tube, shown in Fig. 6. Briefly, the oscillator "sees" the reactance-tube circuit connected across its tank circuit as a capacitor. As the reactance-tube control voltage varies, the circuit capacitance appearing across the tank circuit also varies, and so does the oscillator frequency.

Tunable Swept Oscillators. There are two common methods of controlling the output frequency of the sweep generator. Some units have a tunable swept oscillator —that is, the frequency-modulated oscillator can be tuned through the entire range of the instrument with the main tuning control.

This circuit has the important advantage of simplicity, but it has one drawback, too. There is some variation in the sweep width as the center frequency is changed. To overcome this, some generators operate on a somewhat different principle, using the basic circuit shown in Fig. 7. The swept oscillator operates at a constant 100 mc.; the tunable oscillator has two bands—100-200 mc. and 200-300 mc. The outputs of the two oscillators are heterodyned to give any sum or difference frequency between 0 and 400 mc. (In practice, the output would probably be used only up to 300 mc., as shown in the diagram.) Since the frequency of the swept oscillator is fixed, the sweep width is absolutely constant over the entire range of the instrument.

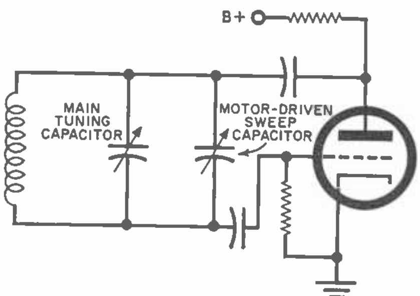

Fig. 4. Motors once turned capacitors to provide sweep, but most sweep generators today have electronic sweep circuits.

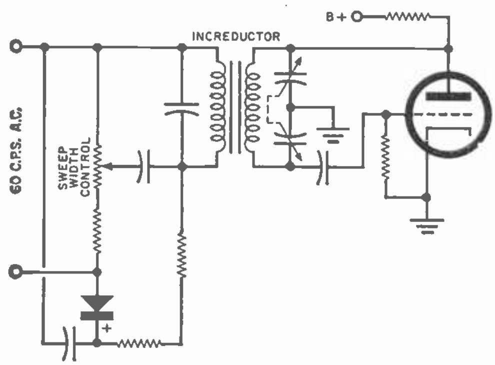

Fig. 5. Heath TS-4A sweep generator uses an Increductor to provide electronic sweep from Colpitts oscillator circuit.

Other Controls. Most sweep generators also contain one or more *marker oscillators* (see Fig. 3). These oscillators generate small markers or "pips" which can be seen on the output waveform (see Fig. 2). Since the frequency of the marker pip is known from the marker dial setting, an operator can adjust the waveform until the pips appear on exactly the proper part of the curve. He then knows that the waveform is accurately aligned. Many generators have two marker oscillators: one crystal-controlled, the other tunable. The

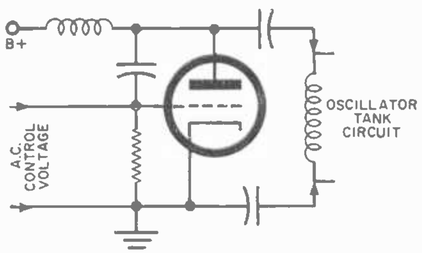

Fig. 6. Reactance tube varies oscillator frequency electrically by altering capacitance in the oscillator tank circuit.

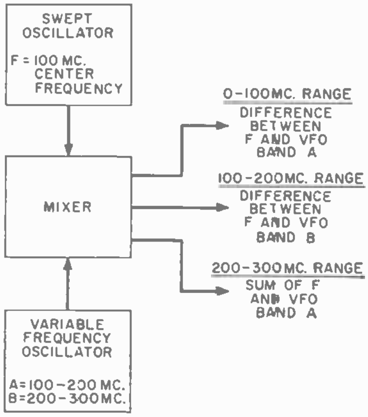

Fig. 7. A fixed center frequency for the swept oscillator increases stability; oscillator outputs are heterodyned.

crystal oscillator is used both to produce a fixed-frequency pip and to calibrate all of the other ranges of the instrument.

Sweep generators also usually have an input which will accommodate an external marker oscillator. An ordinary signal generator can be used as an external marker. With this arrangement, it is possible for an operator to have three separate, individually controllable pips on the sweep—two from the generator's own oscillators, and one from an external oscillator. (A skillful operator can have even more pips by mixing the outputs of the various oscillators to produce a series of harmonics at proper frequencies.) Simpler generators may not have an internal tunable marker oscillator at all; instead, they may merely incorporate an input jack for an external marker.

Sweep generators usually provide a *blanking circuit*. This circuit makes the output waveform appearing on the oscilloscope face easier to read by blanking out the generator's return sweep. For example, if the generator were set to sweep from 45 to 55 mc. and back again, the blanking circuit would let the rising sweep from 45 to 55 mc. go through but would "blank out" the return sweep from 55 back down to 45 mc. Although TV or FM receivers can be aligned without this feature, the scope face in most cases is a little easier to read and interpret with the sweep showing in one direction only.

There is one more control on most sweep generators—the *phasing control* which is used to synchronize the generator's sweep with the oscilloscope's trace. As the generator sweeps from 45 to 55 mc., for example, the scope trace will travel from left to right across the face of the scope in exact synchronism, if the phasing control is properly adjusted.

Aligning Receivers. The actual procedure for aligning a television receiver is quite complex, and varies considerably from one set to another depending on the circuits used by the manufacturer. Therefore, even experienced servicemen usually find it necessary to have the manufacturer's alignment instructions on hand before undertaking this job. Although the alignment of an FM receiver is considerably simpler, it helps to have the manufacturer's instructions here, too.

Television and FM circuits operate at higher frequencies than AM circuits and are therefore much more critical. Consequently, these 10 general rules will help you get best results when using a sweep generator with these receivers:

1. Follow the manufacturer's instructions exactly. Use only recommended tools, and set the controls exactly as indicated.

2. Grounding is important. Connect the sweep generator ground lead as close to the hot input as possible. If grasping the leads causes any change in waveform, try to get better grounding. Use heavy straps (hookup wire is usually not suitable) to connect the chassis of the various pieces of equipment together. A metal-surfaced work bench is ideal for this purpose.

(*Continued on page* 113)

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Transistor Topics

By LOU GARNER

BOATING, with its allied sports of fishing, water skiing, and skin diving, is among the nation's fastest-growing hobbies. And paralleling this increasing interest in boating is a strong demand for economical, reliable, and easy-to-use marine electronic equipment. As we might expect, the transistor's chief attributes—high efficiency, light weight, small size, low power requirements, and good reliability—make it ideal for use in most types of marine electronic gear.

One of the most interesting electronic devices available to boating enthusiasts is the echo-type depth sounder. Heath's Model DS-1A, available as a comparatively low-cost, easy-to-assemble kit, is typical of commercial depth sounders. Its basic principle of operation is illustrated in Fig. 1; the block diagram (Fig. 2) shows the important circuit functions.

In operation, the DS-1A projects a "beam" of sharp, accurately spaced, high-frequency (185-kc.) ultrasonic pulses through the water from a barium titanate ceramic transducer mounted on the boat's hull. These pulse-like signals are reflected or "bounced back" from the bottom as well as from submerged objects, fish, or other obstacles beneath the boat—in much the same way that an echo is reflected from the side of a building or from a distant canyon wall.

Water depths are measured by determining the time required for a single pulse to be bounced back to the boat. This time lapse is equal to *twice* the time required for the pulse to reach the reflecting surface. If the velocity of ultrasonic energy in water is assumed constant, then the lapsed time is directly proportional to the distance to the bottom (or to the submerged object).

The signal's velocity in water is approximately 4800 feet per second. Reducing this to unit length, it requires .000208 second for the signal to travel one foot. Suppose, now, that we send out a pulse and receive an echo exactly .0208 second later. Since this represents *twice* the time required for the signal to reach the target (half going to target, half returning as echo), we divide in half, giving .0104 second. Dividing .000208 into .0104, we find that the target, be it the bottom or a submerged object, is exactly 50 feet away from our signal source.

The heart of the DS-1A is a governor-controlled, battery-powered motor driving a rotor which carries a small magnet and a neon indicator lamp (see Fig. 2). The motor speed is held accurately at 1440 rpm, so that the time required for a single revolution (.0416 second) exactly equals the time required for a pulse to travel 100 feet

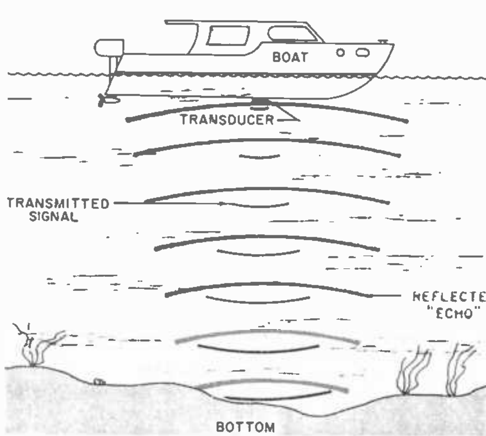

Fig. 1. Depth sounders determine the distance to underwater objects by sending out a pulse and then measuring how long it takes for the echo to return.

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through water and to return as an echo.

As the rotor spins, the magnet is aligned once in every revolution with a small pick-up coil. Passing the coil, the magnet generates a sharp electrical pulse. This pulse, in turn, triggers a 185-kc. transistorized oscillator, turning it "on" for a few cycles of operation. The high-frequency energy developed is fed simultaneously to the ceramic transducer and to a five-stage transistorized amplifier.

The electrical energy coupled to the transducer is converted into sound energy and projected as an ultrasonic pulse through the water. The reflected pulse or "echo," returning when the oscillator is inactive, is detected by the transducer and coupled to the five-stage amplifier. Of course, the reflected pulse is much weaker than the original signal, due to loss of energy and dispersion in the water.

Both the original pulse and the echo signal are amplified and clipped to similar levels. The two signals are then used to drive the neon indicator attached to the motor's rotor arm. Each pulse causes the neon lamp to flash. The original pulse flashes the lamp when the magnet is lined up with the pickup coil; this represents "zero" depth. The echo pulse flashes the lamp at some point during its rotation, with the angle of rotation directly proportional to the distance to the object causing the echo. Thus, the dial scale behind which the neon lamp rotates can be calibrated in feet.

Since any object under the water can cause an echo, multiple flashes may occur. These flashes vary somewhat in intensity, depending on the strength of the reflected signal and hence, to some extent, on the size of the object. With experience, the depth sounder operator can tell the nature of submerged objects (fish, sunken wreck, or what have you) and the type of bottom over which the boat is traveling.

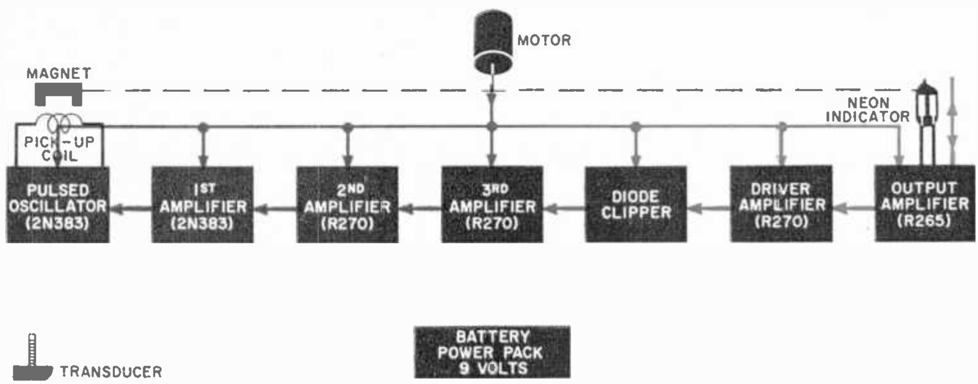
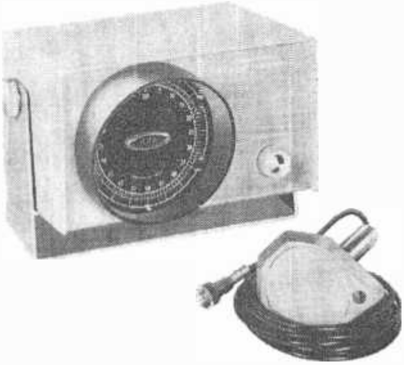


Fig. 2. Heath's DS-1A depth sounder is an all-transistorized device for small boat owners. The R270 and R265 transistors are produced by Texas Instruments.



Readers' Circuits. Robert Palladino, 34 Aspen Rd., West Orange, N. J., sent in the simple receiver circuit shown in Fig. 3, and the audio level meter circuit in Fig. 4 comes from Robert Bari, 207 N. Washington Ave., Bergenfield, N. J.

Referring first to Fig. 3, this two-transistor broadcast-band receiver is a relatively high-gain, low-cost set requiring a minimum of components. Coil *L1* is standard Superex ferrite loopstick, *C1* a 365-$\mu\mu$f. variable capacitor. Almost any diode can be used for *D1;* types 1N34, 1N69, and CK705 are suitable. Transistor *Q1* is a 2N35 (*n-p-n*) unit, *Q2* a CK722 (*p-n-p*) unit; other transistors with similar characteristics could be used equally well.

Aside from a pair of moderate impedance

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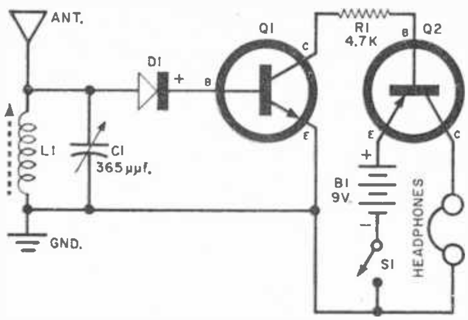

Fig. 3. Two-transistor broadcast-band receiver designed by Robert Palladino. Diode D1 is the detector; audio amplification is furnished by the transistors.

(1000- to 4000-ohm) magnetic earphones, a s.p.s.t. on-off switch, and a battery power pack, resistor *R1* is the only other electrical part required. The power pack, *B1,* can be a single transistor battery (such as an RCA Type VS309A) or it can be made up by connecting six penlight or flashlight cells in series.

In operation, r.f. signals picked up by the antenna-ground system are selected by

relative sound levels and can serve as an applause meter for amateur theatricals. This unit is also useful as a noise level meter or as a balance meter for adjusting stereo installations.

A miniature PM loudspeaker (Argonne No. AR-95) serves as a microphone. Signals picked up by the speaker are coupled to a common-emitter amplifier stage though impedance-matching transformer *T1* (Argonne Type AR-96). Capacitor *C1* is a d.c. blocking capacitor which prevents *Q1*'s base bias from passing through *T1*'s secondary winding; bias current is furnished through *R1.*

The amplified audio signal supplied by *Q1* is coupled through interstage transformer *T2* (Lafayette Type TR-98) to *Q2*, a type 2N170 *n-p-n* transistor in the common-emitter arrangement. Base bias for *Q2* is furnished through a voltage divider made up of *R2* and *T2*'s secondary winding. Resistor *R3* serves as *Q2*'s collector load.

From the second stage, the signal appearing across *R3* is coupled through capacitor *C2* to resistor *R4*. The audio signal is then rectified by diode *D1* which develops

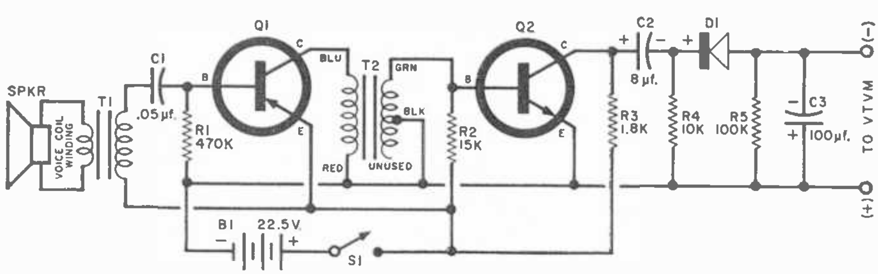

Fig. 4. The transistorized audio level meter submitted by reader Robert Bari measures sound levels. Miniature speaker serves as an inexpensive microphone.

tuned circuit *L1-C1* and detected by diode *D1.* From here, the detected audio signal is amplified by a two-stage amplifier (*Q1-Q2*) using *n-p-n* and *p-n-p* in a complementary arrangement. A common-emitter circuit is employed, with *R1* serving to limit *Q2*'s base current.

Bob indicates that best results are obtained with an external antenna, although strong local stations can be received with *L1*'s pickup alone.

The transistorized audio level meter (Fig. 4) is designed to operate with a d.c. VTVM on the 0-3 or 0-15 volt scales. It measures

a d.c. voltage across output load resistor *R5*. Capacitor *C3* serves as an output filter. Operating power is furnished by 22½-volt battery *B1* (Burgess Type U15), controlled by s.p.s.t. toggle or slide switch *S1.*

As long as standard construction practice is followed, the audio level meter's layout and lead dress shouldn't be too critical. Care must be taken to observe electrolytic, diode, and battery polarities, of course. To minimize the possibility of external hum or noise pickup, the assembled circuit should be mounted in a small metal cabinet.

Sun-Powered Car. From the International Rectifier Corporation in sunny California (1521 E. Grand Ave., El Segundo) comes news of a sun-powered automobile.

(*Continued on page* 112)

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Communicating Through The Earth

You can go on the air through the ground with this ultra-simple system

By J. C. FISCHESSER

IT ALL STARTED on a very hot day last summer. I was sprawled in a chair in my basement workshop—the coolest spot I could find—and was in the middle of a beautiful dream about the day I would get my ham ticket when the phone rang. It was Frank, and he sounded as if he had just won the Irish sweepstakes.

"Joe," he blurted, "I'm on the air in the ground."

"Frank," I said, "I know it's hot, but you can live with it. Just calm down and start over."

"It's the truth. I *am* on the air in the ground," he repeated. "Go out in your back yard and drive a ground rod at the back of your lot. Run an insulated wire from the rod into your basement, and then hook a set of headphones in series between the wire and a cold water pipe."

A few questions convinced me that Frank had not flipped his lid, but he still wouldn't tell me the whole story, so I dug out an old copper ground rod and followed his instructions. When I hooked some phones between the wire from the ground rod and the cold water pipe, I heard a 60-cycle hum, a whine or two of some higher frequency, and a few clicks and pops. This was mildly interesting, but it got old fast, and I was just about to doff the phones when I heard something

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else. Code signals, bearing the unmistakable stamp of Frank's shaky fist, were coming out of the phones! Sure enough, he was on the air in the ground.

I made it over to Frank's house—a distance of four blocks—in record time. He and I both have a common interest in electronics and a common struggle to master the code for our ham tests, but he always seems to be ahead of me when it comes to dreaming up some new experiment. This time he really had me guessing.

I found him in his workshop. He had a telegraph key, a code practice oscillator, and an audio amplifier sitting on the bench. But there was nothing new in this. I had seen those gadgets hundreds of times.

"Okay, Marconi," I said. "Explain."

"Did you hear me?" he asked.

"Yeah, I heard you. How did you do it?"

"Simplest thing in the world, Joe. I plugged the code practice oscillator into the amplifier and connected the amplifier to a couple of grounds; and, presto—I had a transmitter."

"You mean to tell me I heard the grounded output of that amplifier? How much power does that thing put out, anyway?"

"Only ten watts," Frank beamed. "I tried it out first only a couple of blocks away, and it was so loud I felt sure you would be able to hear it at your house."

"Say," I exclaimed, "you know what this means?"

"I sure do," he grinned. "It means you and I are going to breathe some new life into that old, dull code practice. We're going to have our own communication circuit through the earth."

And so we did. In fact, we found two more fellows in the neighborhood who wanted to learn the code, and we soon had a four-station net going. In the course of setting up the net, we learned a few things that might help others who want to try the same system.

The Ground System. First of all, we found that the two grounds should be as far apart as possible. Most fellows won't be able to locate the ground rod more than a hundred feet away from the point where the water pipe enters the earth, but that's good enough, and even shorter distances will work okay.

Also, the grounds should be as good as possible. You won't need to improve the water pipe ground—it's pretty good already—but the other ground should have as much metal as deep into the soil as is practical. Several ground rods bonded together are better than one, and a piece or two of scrap sheet metal buried along with the rods won't do any harm. Don't make the mistake of using the water pipes of two different houses as the two grounds. The water pipe grounds are shorted together by the neutral circuit of the power lines.

An ohmmeter can be used to check the quality of the ground system. Our best system measured 20 ohms between the two grounds, and the poorest measured 200 ohms. In measuring the resistance, always switch the meter leads and take the average of the two readings. The readings will probably differ because there will usually be a small direct current between the two grounds, which will add to or buck the meter current, depending upon the polarity of the meter connections. There is also an a.c. voltage between grounds which is usually large enough to show up on the low-voltage scale of a multimeter.

Matching Impedances. Once the ground system is installed and the resistance determined, the amplifier must be matched to that resistance. Most amplifiers have a variety of output impedances, and this makes it easy if your ground resistance falls close to one of the impedances. For example, the 16-ohm output on Frank's 10-watter worked very nicely into the 20-ohm ground at his station.

If you end up with some odd value that your amplifier won't feed, you'll have to use a matching transformer between the amplifier and the grounds. This doesn't need to be a drain on your wallet, though, since any transformer in the junk box with the proper turns ratio and power rating will work fine.

For example, one of the fellows in our net used a modulator as his audio amplifier. It was a 30-watt job that gave him a nice signal, but the lowest impedance he could match was 500 ohms. Since his ground resistance was approximately 20 ohms, he needed a transformer with an impedance step-down ratio of 25. Knowing that the turns ratio is equal to the square root of the impedance ratio, he looked around the junk box for a transformer with a turns ratio of 5 to 1. He found just what he needed in an old power transformer with a 600-volt secondary. By hooking the modulator's 500-ohm output to the high-voltage

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secondary winding of the power transformer and the 117-volt primary winding to the two grounds, he got a good match from the modulator to the load.

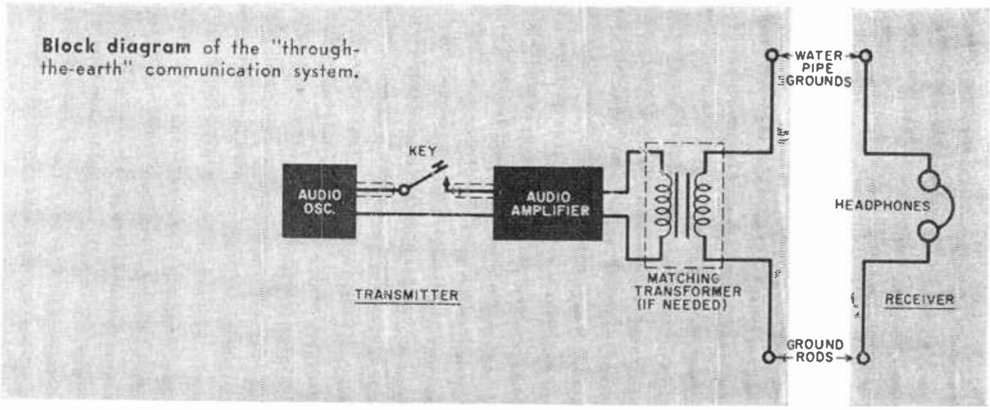
When improvising matching transformers, it is useful to check the actual power developed across the load to be sure the match is right. We did this by measuring the a.c. voltage across the two grounds while the key was closed. In the case of the modulator, we measured 25 volts across the 20-ohm grounds. Ohm's law (power equals voltage squared divided by resistance) indicated that the amplifier was developing full power (31 watts) across the load.

Installation Tips. There is very little that can be said about the receiver setup since it is so simple. Any set of headphones will do. The same grounds that are used for transmitting will serve for receiving, provided that a send-receive d.p.d.t. switch is employed. However, we found it better to use two separate ground systems. This method assures that the amplifier will always be loaded, eliminating the risk of ruining an output transformer by operating into an open circuit.

Also, a separate ground system for receiving permits monitoring your own sending and the use of break-in, which is a lot of fun in net rag-chews. The receiving grounds need not be as elaborate as those for the transmitter. We use single rods located some distance from the transmitting "antenna" so that our own signals are not deafening in the headphones.

We experimented with receiving amplifiers, but they don't help since the noise in the earth is amplified along with the signal. Filters to discriminate against the 60-cycle noise are not fully effective, either, as there are still higher-frequency noise components which ride through with the signal. We did *not* try supersonic signal frequencies with appropriate filters and amplifiers at the receiving end, however; this might be an interesting field for experiment.

Incidentally, hooking a mike instead of an audio oscillator to the amplifier gave us an easy way to use voice to compare notes on code practice. Phone signals were fair but naturally not as strong as c.w., and only stations close to each other could use this mode of operation.



Block diagram of the "through-the-earth" communication system.

Operational Range. We learned that the idea of communicating through the earth was not a new one. In fact, the French used a similar scheme with spark coils rather than audio amplifiers during World War I, and hams used the method to a limited extent when they were forced to leave the air during World War II. Nevertheless, the principle has not been used widely enough to be familiar to a large number of experimenters. Perhaps this is due to the limited communication range of the system.

The question of how much range can be covered with an earth communication system is hard to answer because there are so many variables. Based upon our experience with moderate power and simple ground systems, I would say that a mile radius is the outside limit with only headphones as a receiver. We copied a weak signal at this distance with 50 watts of transmitter power in soil which was predominantly clay. On the other hand, with improvement in the signal-to-noise ratio through the use of supersonic frequencies, amplifiers, and filters, it might be possible to extend the range to several miles. —30—

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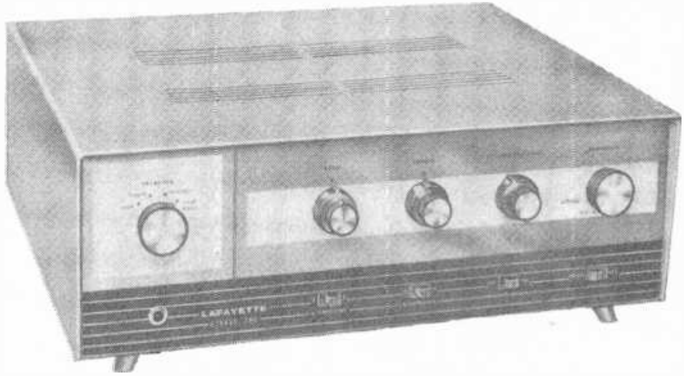
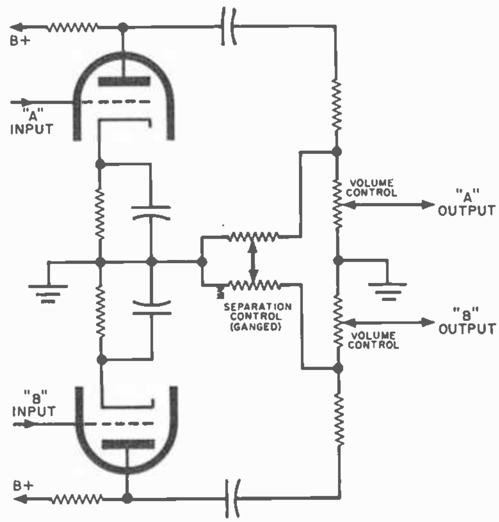
STEREO Amplifier-Preamplifier



Lafayette KT-250A delivers 25 watts per channel, provides equalized inputs for phono, tape, or tuner

IF you haven't yet "gone stereo"—or if you're looking for a "best buy" to replace your present stereo amplifier—the Lafayette KT-250A kit is a good bet. An integrated stereo amplifier-preamplifier, it has equalized inputs for magnetic or crystal phono and tape head, as well as inputs for a tuner and an "auxiliary" source. Its output matches 4-, 8-, and 16-ohm speakers, and there's a third-channel output which furnishes a monophonic blend of both stereo channels. If you really want to raise the roof, you can feed this third output to an auxiliary monophonic amplifier.

With a pair of fixed-biased EL86's in the output of each channel, the KT-250A provides 25 watts stereophonically or 50 watts monophonically. Simple switching allows four different modes of operation—reproduction of either channel through both amplifiers, normal stereo, reverse channel, and reverse phase.



Ganged "separation control" varies the amount of cross-coupling between "A" and "B" amplifiers to reduce exaggerated stereo effects.

Each channel has its own bass and treble controls. Corresponding controls for the two channels are concentrically mounted, and the volume controls can be clutched to serve as a master gain control for both channels. A touch of a switch and the volume controls become loudness controls for low-level listening.

The measured frequency response of the unit was within 1.5 db from 20 to 20,000 cps and IM distortion was 1.3% at 20 watts output per channel. Hum and noise was down 72 db on the tuner input and 48 db on phono. Sensitivity for full output was .5 volt on tuner and 3 millivolts on phono. The KT-250A is available from Lafayette Radio, 165-08 Liberty Ave., Jamaica 33, N. Y., for \$74.50; a fully wired model (LA-250A) is available for \$99.50. —30—

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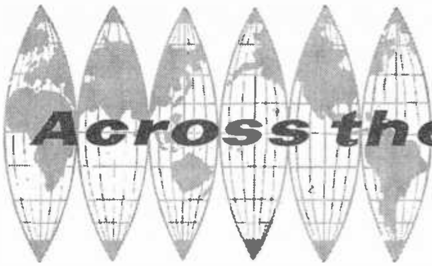
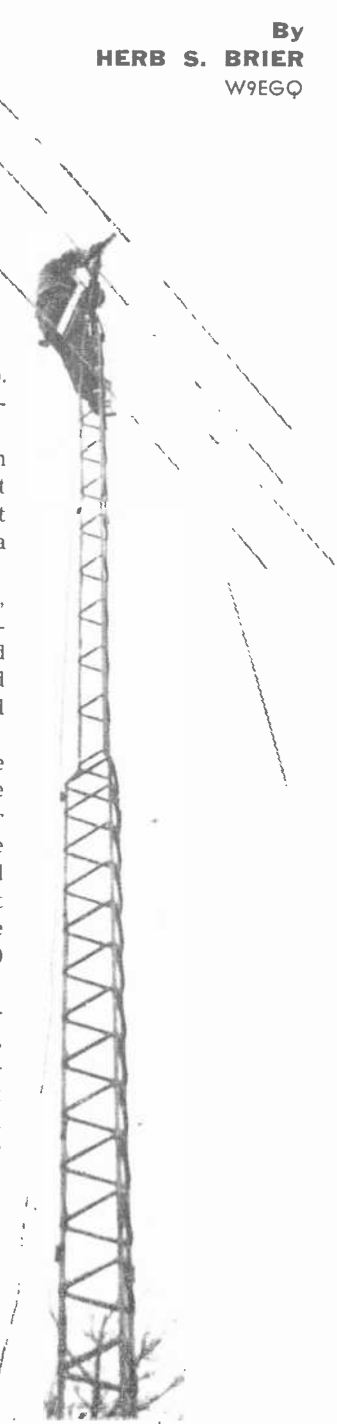


Across the Ham Bands

By
HERB S. BRIER
W9EGQ



PUTTING UP ANTENNAS

MOST hams quickly learn the importance of a good antenna system in getting more than mediocre results from a ham station. But some don't learn until too late that putting up an antenna improperly can be the most dangerous thing they ever do. The following items which appeared in midwestern newspapers in recent weeks tell the story.

"*South Bend, Ind.* Two teen-age brothers, one of whom had just received his new ham license, were killed last night when the antenna they were erecting fell against a 12,000-volt power line. A witness said, 'It was like a dozen Roman candles going off all at once.' "

"*Chicago.* Two 16-year-old boys, pals since grade school, were electrocuted last night while stringing a ham antenna between two trees. They tied a wrench to one end of the wire and threw it over a power line. One boy held on one end of it, and the other boy grabbed the other end of the wire to pull it."

High-Voltage Power Lines. Do not discount the chances of getting tangled up with 12,000 volts because you think there are no high-voltage power lines in your neighborhood. You may be right, but don't bet your life on it. There are a lot more high voltages floating around the utility lines along our streets and alleys than most people suspect. The average utility pole has at least three power lines with about 4000 volts between them and 2300 volts between each one and ground.

What's more, to satisfy the constantly increasing demand for electrical power to operate air conditioners, electric stoves, and the like, power companies are replacing these 4000-volt distribution systems with 12,000-volt lines (7200 volts to ground). In addition, there are often high-voltage lines on the poles for street lights and other special services.

With such high voltages around the utility lines, there is just no safe way to erect an antenna over or near them. Even if you did manage to put an antenna up without getting killed, the antenna would land in a maze of high

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voltage if it ever fell, and this voltage would be brought right into your ham station via the antenna feed system.

A Safe Installation. For absolute safety, no antenna should ever be erected over a power line. However, if we followed this rule, few of us would have any antennas at all, since there aren't many backyards without at least one set of power lines carrying 115 or 230 volts to our homes. Fortunately, you can still put up a safe antenna system, in spite of power lines, by exercising elementary precautions—and by making sure not to string an antenna over a line carrying more than 230 volts.

It's best to have a plan of operation before you start climbing. Your antenna should be measured and preassembled with its insulators and feed line attached. Then you won't have to measure it and put it together while hanging precariously on the top of a pole with the antenna wire draped over a couple of power lines.

Wear heavy work gloves, preferably of rubber. Their insulating qualities may save your life if you should accidentally touch a live wire. Never depend on the insulation on outside power lines; after years of being exposed to varying weather conditions, it just can't be trusted.

If the power lines across your yard make your antenna problem difficult to solve, don't hesitate to discuss the problem with a representative of the power company. You will probably be pleasantly surprised at the help and cooperation you receive.

Keeping the Antenna Up. Just as important as getting your antenna up is keeping it up. This is not too difficult. Use at least No. 14 copper-clad steel or No. 12 copper wire (enameled) for the antenna proper in conjunction with antenna insulators strong enough to stand the strain. Usually you have to contend with a lot more than merely the combined weights of the antenna and feed lines, especially when they are covered with ice or snow and the wind is blowing.

Twist all connections tightly and solder them carefully. When the antenna is supported by a tree, place a strong coil spring between the antenna insulator and the tree

Ham of the Month

Tom Moss, W4HYW, is a c.w. and radioteletype operator for the Third Army at Fort McPherson near Atlanta, Ga. As a ham, he has held practically all A.R.R.L. offices and is now Vice-Director of the Southeastern Division. He is also active in R.A.C.E.S., having served as Deputy Director of the Atlanta C. D.

W4HYW covers all ham bands from 1.8 to 148 mc. He uses separate amplifiers capable of a maximum power input of 750 watts on each band, driven by a variety of low-power transmitters. He also runs a separate 500-watt phone transmitter; the modulator on this rig doubles as a modulator for the v.h.f. finals. The equipment in his shack is rounded out with an SSB exciter, an electronic keyer, and RTTY and test gear. Tom's antennas include a Mosley 20/15/10 meter tri-bander, an "all-band" doublet and a vertical for the lower frequencies, plus separate rotaries for the v.h.f. bands.

Since 1951, Tom's major ham activity has been as manager of the K4/W4 QSL Bureau. Each month he handles a barrage of DX cards. He manages to keep them flowing to their destinations as long as the "4's" keep him supplied with stamped and addressed envelopes. However, he constantly has a backlog of several thousand unclaimed DX cards on file.

Tom is something of a DX man himself and an award chaser as well. Top man in the world-wide "Award Hunter's Club," he has over 107 recognized amateur awards to his credit.

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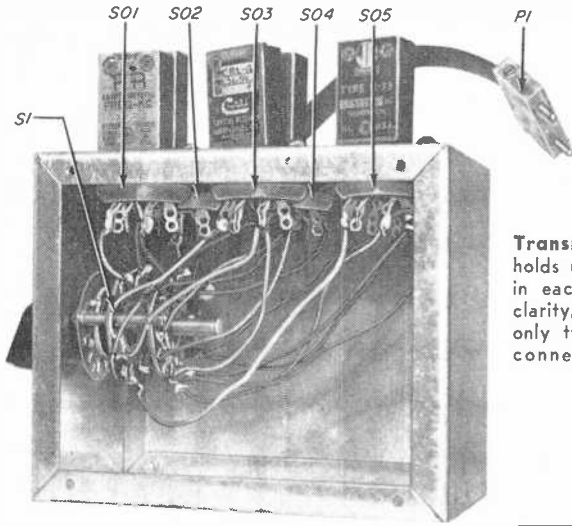
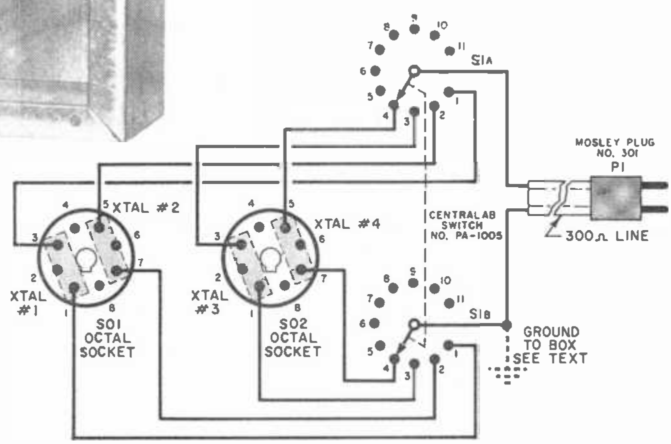


Transmitter crystal selector (left) holds up to ten crystals, two fitting in each of five octal sockets. For clarity, the schematic below shows only two of the sockets and their connections to switch S1a/S1b.



to absorb excessive strain on the antenna as the tree sways. And use heavy weatherproof rope or strong rustproof wire for your antenna halyards.

CRYSTAL SELECTOR

A crystal-controlled transmitter can be frustrating when you want to be able to change frequency quickly to get "on top" of that "rare one" calling CQ. With the plug-in adapter shown here, you can select any one of ten crystals by just turning a knob. In effect, this gives you a sort of crystal-controlled VFO.

The unit is built on a standard 3" x 4" x 5" aluminum box (Bud AU-1028 or equivalent). Standard octal tube sockets (*SO1-SO5*) are used as crystal sockets; each one accepts two crystals. Note that octal sockets *SO3*, *SO4*, and *SO5* and their connections to switch terminals 5 through 10 have been left off the schematic diagram for clarity.

Two circuits are possible, depending on the type of transmitter you have. Switch *S1a/S1b* is a double-pole, 11-position switch (Centralab PA-1005 or equivalent) which can be used for both circuits. If neither side of the crystal socket in your transmitter is grounded (as is the case with the Johnson "Adventurer" or the Knight T-50, for example), use the circuit as shown without the ground.

If one side of your transmitter's crystal socket is grounded (as in the Globe Chief 90A or the Heathkit DX-20), then ground the rotor of *S1b*. Alternately, you can use a single-pole, 11-position switch (Centralab PA-1001 or equivalent) instead of the double-pole unit. If you decide on the single-pole switch, ground one lead from the 300-ohm line and pins 1 and 7 on each octal socket; but keep in mind that this limits the adapter for use only with transmitters having one side of the crystal socket grounded.

Connect a short length (about 12") of 300-ohm line to the rotors of *S1a* and *S1b*, or to the rotor of *S1a* and ground, depending on the circuit used. This line is terminated in crystal socket plug *P1* (Mosley 301 or equivalent). Mark the ground pin on *P1* and the ground pin on the transmitter's crystal socket if your particular transmitter requires it.

To operate the unit, plug *P1* into the transmitter crystal socket, plug crystals into the octal sockets, and use switch *S1* to select the desired crystal.

(*Continued on page* 115)

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By
JOHN T. FRYE
W9EGV

Carl and Jerry

Tussle With A Tachometer

"HERE ARE TWO electronic tachometers we can build for our car," Jerry said as he spread a magazine and a little yellow booklet on the bench in front of his pal, Carl. "This one uses an 884 thyratron powered by a vibrator power supply. As you can see, it's a detailed construction article, and the gadget uses a relatively inexpensive 1-ma. meter as an indicator.

"The other one, in this booklet published by Sylvania, has two 2N233 transistors connected in a one-shot multivibrator circuit. Power is taken directly from either a six- or twelve-volt car battery. However, about all we have to go on here is the diagram and a very limited description. And this tachometer uses a fairly expensive and delicate 50-μa. meter."

"Do both work on the same principle?"

"Actually, yes. Whenever a selected spark plug fires, the thyratron is triggered into firing or the multivibrator circuit into flip-flopping. Each 'firing' or 'flip-flop' sends a pulse of current through the meter which has a large capacitor connected across it. This meter-capacitor combination responds to the average current produced by the pulses. Since these pulses are equal in amplitude and are uniformly spaced, the average current indicated by the meter goes up in linear fashion with the frequency of the pulses. That means the meter can be calibrated to show the rpm of the motor."

"I say we build the transistor job," Carl decided, as he finished looking over the two articles. "We have the transistors and the meter, and we should know enough about electronics not to need step-by-step instructions."

"Okay, but before we start, suppose you tell me once more why we need a tachometer. Remember we resolved that anything we put on the car had to be functional."

"A tachometer *is* functional," Carl insisted. "Knowing exactly how fast the motor is turning over is important in many cases. For instance, take 'boxwork,' as we hoity-toity motorists call gear-shifting. There is one proper engine speed for each shift, and working with a tachometer permits you to find and use those speeds. Also, we can log the oil pressure for a particular engine speed and use that as a reference later to see if we're losing pressure. We can note at what engine speed our generator begins to charge the battery and use this as a check on the generator's operation. With a little math that takes into account the rear-axle ratio and the rear-wheel circumference, we can convert rpm into mph and check on the accuracy of our speedometer."

"Enough!" Jerry interrupted. "I'm convinced. All that bothers me now is how we're going to calibrate the tachometer."

"Well, just remember that a particular cylinder of a four-cycle engine fires only once every two revolutions," Carl pointed out. "When the engine is turning over at

4000 rpm, our tachometer will be receiving 2000 pulses per minute—"

"I've got it!" Jerry suddenly interrupted. "Let's get busy and build the thing. Then I'll show you an easy way to calibrate it."

IT DIDN'T TAKE the boys long to collect the parts they needed. But Carl and Jerry prided themselves on making their electronic equipment as compact and well-arranged as possible, so they spent considerable time on layout. Since they realized that the tachometer would be subjected to intense vibration in the car, they anchored all parts for the multivibrator circuit solidly on a small perforated board of insulated material, and then fastened this board securely inside a small metal cabinet. Two 10,000-volt capacitors, a neon bulb, and a fixed and variable resistor for attenuating and limiting the high-voltage pulses from the spark plug were similarly mounted in another metal box. Phono jacks on the boxes allowed them to be connected together by a short piece of RG-58/U coaxial cable. Another length of cable connected the multivibrator unit to the meter, which was shock-mounted on a bracket designed to clamp on the steering column.

"Well," Carl said as he surveyed the completed tachometer, "I guess we're ready to mount it in the car and calibrate it."

"We calibrate it first and *then* mount it in the car," Jerry corrected him. "Trot out the sine- and square-wave generator and connect it to the input of the multivibrator circuit while I set up the 'scope."

Carl did as instructed, then watched as Jerry ran leads from the output of the audio generator to the vertical input terminals of the oscilloscope and connected the 60-cycle test voltage terminal on the 'scope to the ungrounded horizontal input terminal.

"Here's my idea—double-check me and see if I'm wrong," Jerry said. "Our 0-50 μa. meter will indicate 0-5000 rpm. That means 48 μa. must correspond to 4800 rpm. This reading should be produced when the multivibrator is receiving 2400 pulses per minute, or 40 pulses per second.

"Our square-wave generator should put out a pulse that will trigger the multivibrator in the same fashion that the attenuated pulse from a spark plug does," he continued. "All we have to do is adjust the calibrating resistor of the tachometer so that the meter reads 48 μa. when the multivibrator is being fed a square-wave signal of 40 cps. We can double-check the linearity with square waves of 30 and 20 cps. They should produce readings of 3600 and 2400 rpm respectively."

"Sounds okay to me," Carl agreed, "but how are you going to be sure you have exactly 40 cycles from the generator? The dial calibration is reasonably accurate, but you can't depend on it down to the cycle."

"That's where the 'scope comes in. We'll

compare the 40-, 30-, and 20-cycle output of the generator with the 60-cycle line frequency with Lissajous figures. Watch."

Jerry turned on the 'scope and switched on the audio generator, set for sine-wave output. As he approached the 40-cycle mark on the dial, the rapidly revolving pattern of interlaced curving lines slowed down and finally stopped.

"See," Jerry said; "a line along the left side of the pattern would touch three of the loops while a line across the top would touch two. That means the ratio of the signal generator frequency to the line frequency is 2:3 or 40:60."

When the generator was putting out exactly 30 cycles, two loops of the pattern touched the imaginary vertical line and only one touched the horizontal line. At 20 cycles, only one loop still touched the horizontal line, but three loops touched the vertical line.

Jerry went back to the 40-cycle frequency and switched the generator over to square-wave output. As he did so, the distorted pattern began to wiggle, showing that the change in output had caused the generator frequency to shift slightly. A touch of the generator tuning knob stopped the pattern again. Jerry reduced the generator output until the meter indication began to fall off and move erratically; then he increased the

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output until the reading was stationary.

"Okay, now set the calibrate control for a 48-μa. reading," he instructed Carl. When this was done and the generator set exactly for a 30-cycle output, the meter read 36 μa. When the frequency was reduced to 20 cycles, the reading dropped to 24 μa.

"Right on the money!" Jerry gloated as he grinned across at his pal. "The thing is certainly linear over the top half of the scale at any rate. Disconnect that six-volt lantern battery, and let's install the gadget in the car."

THE MULTIVIBRATOR UNIT was bolted to the metal body of the car up under the dash, the attenuator unit was mounted on the front of the fire-wall in the engine compartment, and the connecting coax cable was run through a small hole in the partition. Connections were made to the rear spark plug and to the cold side of the ignition switch so that the tachometer would be switched on with the ignition. When everything was connected, the boys started the motor. Then they adjusted the variable resistor in the attenuator unit until the

meter gave a steady and unvarying indication at a constant engine speed, and moved up and down smoothly as the motor was speeded up and slowed down.

"Well, it seems to be all right, but I still would like to be sure the indication is accurate at slow speeds," Jerry fretted. "We both know bottom-of-the-scale meter readings are often less dependable than those shown in the top half of the scale."

"Maybe so, but since our square-wave generator won't go below 20 cycles, it looks as though 2400 rpm is the lowest engine speed we *know* is accurate," Carl observed.

"Wait a doggoned minute!" Jerry suddenly exclaimed, clapping an open palm to his forehead. "When the engine is running 400 rpm, the tachometer is receiving 200 shots a minute from a single spark plug. And since all six plugs fire once every two revolutions, the coil is putting out 6 x 200 or 1200 shots a minute, right?"

"Right."

"And when the tachometer is receiving 1200 pulses per minute, it reads 2400 rpm. Can you see where I'm heading?"

"Yeah, I sure can. All we have to do is connect the pickup of the tachometer to the hot lead from the ignition coil and adjust the idle until we get an indication of 2400 rpm. Then we reconnect the pickup to a single spark plug, and if the meter action is linear we should get a reading of 400 rpm."

"And 400 rpm is very close to the slowest speed we'll need to read. So if the meter indicates correctly there, we can depend on it over the whole scale."

The lead from the coil to the distributor was arranged so that a temporary connection could be made to it. Then Jerry adjusted the idle screw until 2400 rpm was indicated on the meter. Next, he used a pair of plastic photography tongs to transfer the input connection of the tachometer from the high-tension terminal of the coil to a spark plug.

"What does it read?" he called to Carl.

"It might be just a freckle low," Carl said slowly as he peered closely at the meter, "but it's so close to 4 μa. that you can't tell the difference."

"Good!" Jerry said with satisfaction.

"WE CERTAINLY went to a lot of trouble to make sure this thing was telling us the truth," Carl observed, turning off the ignition.

"When it comes to test equipment of any kind, either you have confidence in it or it's no good," Jerry remarked. "The time a technician takes to make sure his instruments are accurate is never wasted. Working with a meter whose readings you're not sure of is like using a rubber ruler to build a house. But now I've got the connection back on the spark plug, so what say we taxi around a bit with our tachometer?"

"Be my guest!" Carl said, and he opened the car door for his friend. —30—

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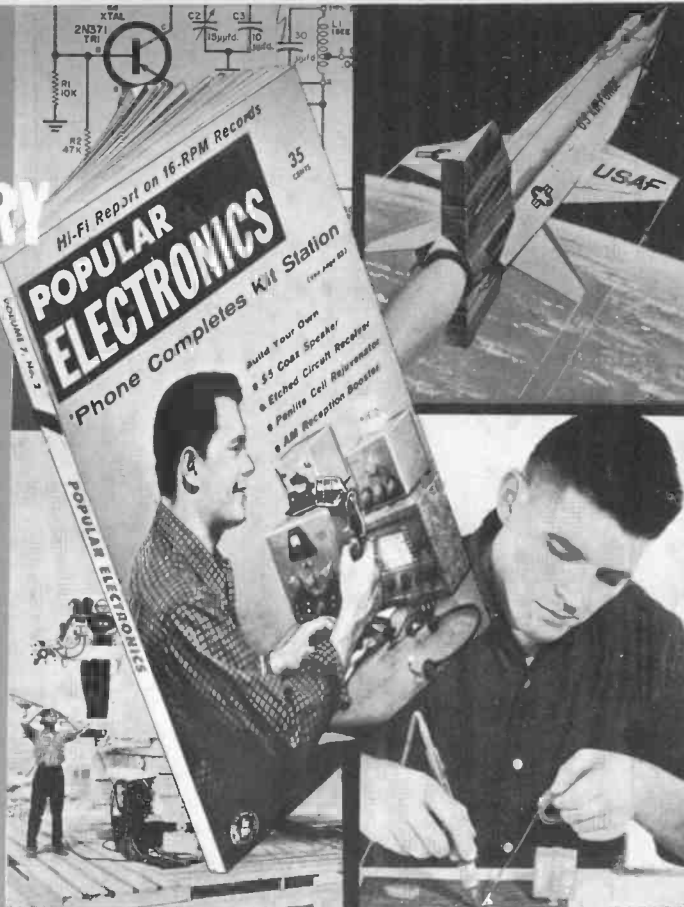

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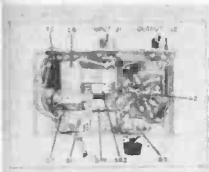

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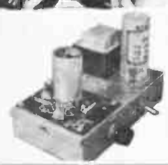

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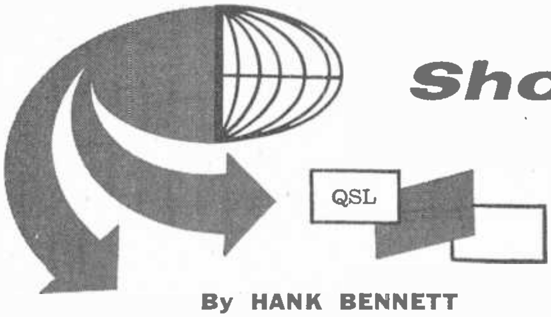

Short-Wave Report

By **HANK BENNETT**
W2PNA/WPE2FT

MINISTER, high-school teacher, free-lance newspaper and magazine writer—our featured DX'er this month is all of these things—and an amateur radio operator, licensed broadcast engineer, and short-wave monitor as well.

Primarily a Presbyterian minister, Drayton Cooper, Edisto Island, S. C., doubles as a high-school teacher specializing in higher mathematics. He also worked in broadcast radio for several years, winding up at WSB, Atlanta, as associate news editor.

Drayton developed an interest in radio at the tender age of six (he's now 27 and married). He did some SWL'ing for a while, then got his ham license (in 1955) and became known on the airways as K4KSY. He is currently one of our outstanding SWL monitors in the southern states.

Edisto Island is an ideal location for DX'ing; a semi-tropical island off the extreme lower South Carolina coast between Savannah, Georgia, and Charleston, S. C., it is right in the middle of "Hurricane Alley." Drayton frequently provides the only means of communication between the island and the mainland, especially when the local police net is unable to get through on their channel. During hurricane "Gracie" last fall, for example, K4KSY stayed on the air for 44 continuous hours. Watch for him on the 75-meter phone band during the hurricane season.

Included in Drayton's listening post is a Scott RCH receiver (Navy surplus; 12 tubes), an RME DB-20 preselector, a six-meter Gonset converter, and, for transmitting, a Globe Scout 680-A. His "antenna farm" contains 70' and 140' dipoles and a 225' long-wire. Incidentally, Drayton's RCH receiver, which dates from World War II days, provides continuous coverage from 50 kc. to 24 mc.

Since Drayton returned to short-wave listening, he has collected a total of 35 veries, covering 20 of 45 countries heard. (Previously he had a total of 100 countries with 98 verified). He considers his best veri

Drayton Cooper, K4SKY, has a minimum of equipment in his SWL corner but he makes good use of it. Radio enthusiast from the age of six, Drayton is a full-time minister and part-time writer.

to be one from HI7T, Santiago, Dom. Rep., on 90 meters. Preferring to DX the lower bands because they "present more of a challenge," his favorite listening for all-around good programing includes stations in Denmark, Switzerland, Australia, and Germany. He would like to hear from other DX-minded ministers.

(*Continued on page* 117)

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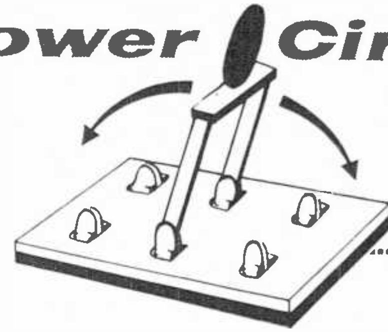
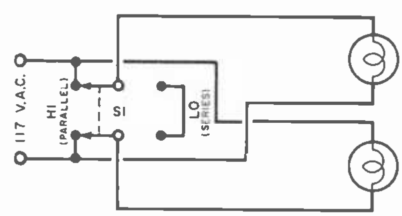
D.P.D.T. Switches in Power Circuits



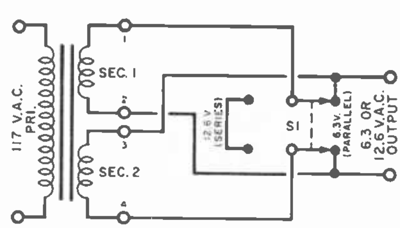
By KENNETH RICHARDSON

The common double-pole double-throw (d.p.d.t.) switch has a number of novel applications unknown to the average experimenter. By properly connecting one or more of these switches, you can achieve control over lamp brightness, transformer voltage output, and electromagnet strength.

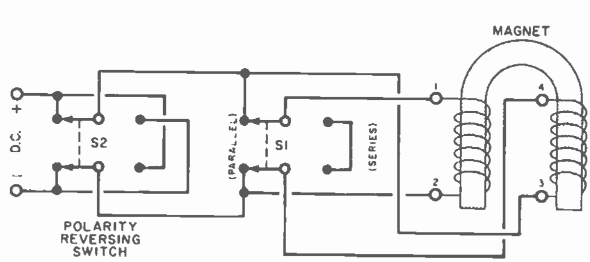
Photoflood lamps have a comparatively short life span when used on normal line voltage, but connecting two of these lamps in series will greatly lengthen their life. A quick changeover from parallel (normal) to series connection can be accomplished through use of a 10-amp switch. The series connection furnishes sufficient light to perform preliminary focusing adjustments; switching to the parallel connection delivers full illumination for exposure of the film.



A filament transformer with two 6.3-volt secondary windings can be used in an experimenter's power supply to provide either 6.3 volts or 12.6 volts at the flip of a d.p.d.t. switch. Maximum current output for the 6.3-volt output is the sum of the maximum currents of both 6.3-volt windings; the 12.6-volt output current is limited by the lower current rating of either winding. If voltage output is zero, the secondary windings are bucking each other, and the connections to one of the 6.3-volt windings should be reversed.



A d.c. electromagnet with two identical coils can be varied in strength and polarity by using two d.p.d.t. switches. Switch S1 selects either parallel or series connections for the coils. More current flows in the parallel setup, creating a more powerful magnet. Switch S2 reverses current flow, switching the magnetic poles. Reverse the connections to one coil if the magnet is weak.



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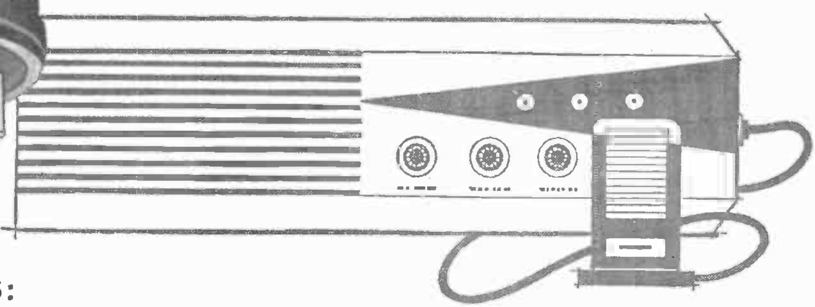

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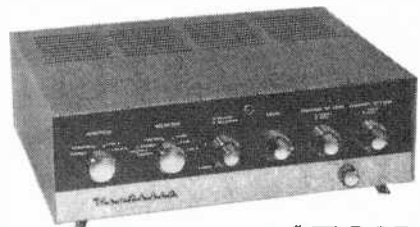

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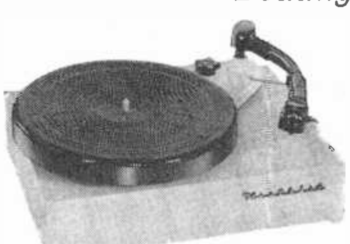

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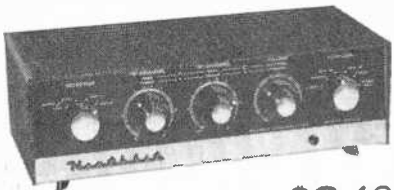

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Although these two new Heathkit models are designed as companion pieces, either one can be used with your present stereo system. The preamplifier (AA-20) features 4 inputs in each stereo channel and gives you a choice of 6 functions. It will accommodate a magnetic phonograph (RIAA equalized), a crystal or ceramic phonograph, and two auxiliary sources (AM-FM tuners, TV, tape recorders, etc.) and is completely self-powered. The six-position function selector switch gives you instant selection of "Amplifier A" or "Amplifier B" for single channel monophonic; "Monophonic A" or "Monophonic B" for dual channel monophonic using both amplifiers and either preamplifier; "Stereo" and "Stereo Reverse". 8 lbs.

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HI-FI RATED 14/14 WATT BASIC STEREO AMPLIFIER KIT

Two 14-watt high fidelity amplifiers, one for each stereo channel, are packaged in the single, compact, handsomely styled amplifier (AA-30). Suitable for use with any stereo preamplifier or with a pair of monophonic preamplifiers, it features individual amplifier gain controls and speaker phase reversal switch. Output terminals accommodate 4, 8 and 16 ohm speakers. 21 lbs.

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HI-FI RATED 14/14 WATT STEREO AMPLIFIER KIT

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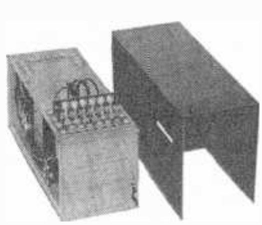

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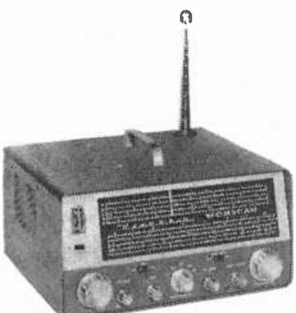

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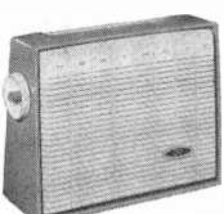

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Ship-Shaping Marine Radio

(*Continued from page* 61)

trical resistances at the connections. A total resistance of only 0.1 ohm in the joints and wires combined can cause a 1-volt drop in a 10-ampere circuit. And, in a 12-volt system, even a 1-volt drop can cause a significant loss in transmitter power output and in receiver sensitivity. The wires should be as short and heavy as possible, and connections should be tight.

Ignition. Receiving range is determined mainly by the level of man-made noise in the vicinity of the receiver. In an automobile, it's easy to control ignition noise because the engine is enclosed in a metallic compartment which acts as a shield. On a boat, it is far more of a problem because the engine and its high-voltage wiring are usually exposed.

A commercial suppressor inserted at the spark-plug end of each high-voltage line between the distributor and the spark plugs should do much toward reducing noise. In the case of a single-cylinder engine, a suppressor inserted in the lead between the ignition coil and the spark plugs is required. Sometimes it's necessary to use shielded cable (with the shield grounded to the engine head or block) between the spark plugs and the distributor or ignition coil.

A special ignition-noise-suppression capacitor, consisting simply of a capacitor inside a metal can, can be installed between the input to the ignition coil and the nearest grounded point. Since even the lighting circuits pick up and re-radiate ignition impulses, it may be necessary to install similar capacitors at switches, lamp sockets, and other points along the vessel's wiring system to bypass ignition impulses to ground. Noise caused by the sparking of generator brushes can be eliminated by connecting a capacitor across the armature of the generator.

If noise persists after all of these precautionary measures have been tried, a portable transistor radio held close to the wiring will usually pin-point sources of interference.

Other Interference Cures. Poor contacts between metal surfaces will sometimes cause metallic objects to act as a rectifier or detector, allowing noise and even radio signals to mix and form a maze of interference. Vibrating wires also contribute noise and sometimes interfere with the transmitted as well as the received signals. Bonding all metallic objects together is usually the answer, although a poor bond can aggravate the problem.

To obtain maximum range and minimum noise, every channel of your receiver should be tuned as close as possible to the correct frequency. When you're having trouble on a particular channel, the cure is to replace that channel's crystal with one specifically designed for the make and model receiver you are using. You may have trouble if the crystal was designed for another type of set, even if the frequency stamped on it is correct. If all channels are consistently noisy, the trouble could be caused by defective components in the receiver's i.f. or audio amplifiers.

Many marine radiotelephones are equipped with squelch control. The receiving range will be cut drastically if the squelch is improperly adjusted. With some settings, only very strong signals will be heard; with others, very weak signals will be heard, but the noise that accompanies them will be excessive. By varying squelch settings, you can learn to regulate the effective sensitivity and signal-to-noise ratio of your receiver to meet your requirements. Too often, a receiver is blamed when it is the squelch setting itself that is at fault. Some noise is unavoidable in receivers equipped with automatic volume control. Strong stations will have little background noise; but since sensitivity is automatically increased on weak signals, the noise level is boosted as well.

Proper Maintenance. The performance of a marine radiotelephone depends upon the kind of maintenance it is given. Both the transmitter and receiver should be checked thoroughly every few months. Tubes and vibrators should be tested and replaced when indicated. All transmit and receive frequencies should be measured with a frequency meter. Receiver sensitivity should be measured, and if found to be below par, the receiver should be realigned.

No license is required to repair or tune a transmitter as long as it's connected to a non-radiating dummy antenna. When connected to a "live" antenna, however, a transmitter can be tuned only by someone possessing a valid first- or second-class radiotelephone operator license. In all cases, it is the transmitter's licensee (station license holder) who is responsible to the FCC for its proper operation and use. —30—

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1U4	.69	5AT8	.89	6AS5	.69	6BN6	.84	6S4	.59	6V6	.69	12AV7	.93	12X4	.49
1U5	.59	5BK7A	.99	6AT6	.53	6BQ6	1.29	6SA7	.89	6W4	.74	12AX4	.75	25BQ6	1.29
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1X2A	.99	5T8	.98	6AU4	.96	6BZ6	.63	6SJ7	.79	6X4	.48	12AY7	.99	35W4	.49
3AL5	.54	5U4	.69	6AU6	.69	6BZ7	1.19	6SK7	.84	6X5	.59	12AZ7	.74	35Z5	.55
3AU6	.64	5U8	.94	6AU8	.99	6C4	.49					12B4	.74	50C5	.59
3BC5	.69	5X8	.93	6AV6	.49	6CB6	.66					12BA6	.69	50L6	.89
3BE6	.63	5Y3	.52	6AW8	.99	6CD6	1.69					12BE6	.59		
3BN6	.86	6AB4	.59	6AX4	.79	6CE5	.66					12BH7	.85		
3BY6	.69	6AC7	.99	6BA6	.57	6CF6	.72					12BK5	.99		
3BZ6	.65	6AF4	1.06	6BA8	1.04	6CG7	.69					12BQ6	1.29		
3CB6	.63	6AG5	.79	6BC5	.65	6CL6	1.04					12BY7	.85		
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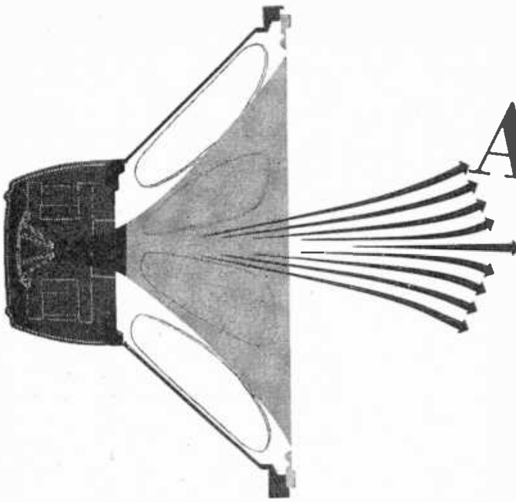

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Inside the Hi-Fi Microphone

(*Continued from page* 58)

front or back produce an output that depends on how accurately the sound source is centered either at the back or the front. The result is an overall pickup pattern having the shape of a figure eight.

Under some circumstances, the bi-directional pickup pattern has great advantages. Unwanted sounds can be minimized simply by facing the mike in a different direction. The balance between sections of an orchestra can thus be varied quite easily.

Single-Direction Mikes. Designers worked for a long time to develop uni-directional mikes and they eventually succeeded using some highly ingenious methods. One of the curious facts of geometry is that the sum of a circle and a figure eight is a figure called a cardioid—a heart-shaped pattern. Combining an omni-directional mike with a bi-directional mike results in a cardioid pattern which is a reasonable approximation to the uni-directional pattern desired. This can be done by building two microphones into the same case and then combining their outputs. (See Fig. 6.) A potentiometer which mixes the outputs of the two mikes in different proportions allows the pickup pattern to be varied.

Another type of dual-element cardioid microphone is made up of two ribbon transducers. One ribbon is open on both sides and has the typical figure-eight pattern. The back of the other ribbon, however, is totally enclosed in an acoustic labyrinth, and has an omni-directional pattern. When the outputs are combined, a cardioid pattern results.

In the RCA 77 dual-ribbon microphone, the directional pattern can be changed by adjusting the opening which leads from the back of the second ribbon to an acoustical labyrinth. When the aperture is all the way open, the back of the ribbon is also effectively open, causing the second ribbon

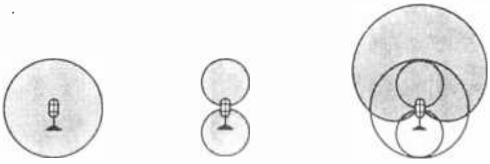
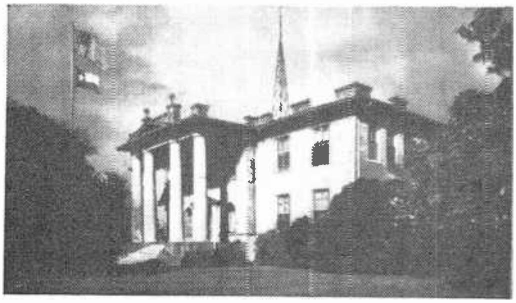


Fig. 6. The most common microphone pickup patterns are omni-directional (A), bi-directional (B), and uni-directional, or cardioid (C). When (A) and (B) are added algebraically, they produce (C).



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to have a figure-eight pattern. When the aperture is closed, the pattern of the second ribbon is omni-directional. This pattern combines with the figure-eight of the first mike to make the cardioid pattern. Other pickup patterns can be obtained by adjusting the opening.

The omni-directional pickup pattern of a dynamic mike can be converted into a cardioid shape by controlling out-of-phase pickup and by adjusting various acoustical impedances in the microphone case. There are two general ways of doing this. The first is to put one or more resonators at the back of the case which vibrate out of phase with the diaphragm, thus tending to prevent the diaphragm from responding to sounds from the side and back. The other technique is to provide several small openings at the back air chamber to permit the acoustical impedances to be varied and thus change the pickup pattern. Some manufacturers prefer to manipulate the characteristics of an omni-directional mike when they design a cardioid microphone rather than build two microphones into one case and then combine their outputs. —30—

DX'ing Down Below

(Continued from page 53)

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Hundreds of other long-wave stations are included in "Radio Navigational Aids, H.O. 205," which can be had for $5.00 from the U. S. Navy Hydrographic Office, Washington 25, D. C.

If you'd like a "sneak preview" of DX'ing on the 200- to 400-kc. aero beacon band, you can listen to a fascinating new LP record that was made aboard an aircraft in flight. It's called "On Course, On the Glide Path," and is produced by Aero-Progress, Inc., 10493 Santa Monica Blvd., Los Angeles 25, Calif. It's complete with an illustrated brochure, and should make an ideal reference guide for any DX'er. It sells for $5.98 plus 25¢ postage.

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Magnetic Amplifiers

(*Continued from page* 75)

long the lives of the submerged tubes. This is important because lifting the cable to replace a damaged tube costs thousands of dollars.

Long-Life Switching. Basic magnetic amplifier circuits can be modified to give special effects. For example, a magnetic to which excessive positive feedback has been applied becomes "bistable." This means that it is stable in only two states of operation: maximum output or minimum output. There is no in-between. The amplifier is adjusted so that the core is normally in a non-saturated state. But even the tiniest input signal—perhaps only a few microamperes—will throw it into complete saturation. Thus it becomes the equivalent of an extremely sensitive switch, or relay.

But a magnetic amplifier is a switch without moving parts or contacts, and it is virtually indestructible. The bistable magnetic is beginning to find widespread use as a replacement for relays where long, reliable service is of great importance.

Several automotive companies—the Ford Motor Co., for example—are now using magnetics to control the flow of parts in the engine assembly line. First, proximity switches containing magnetic amplifiers sense the presence or absence of necessary parts on an automated line. Other magnetics, cued by the proximity switch, supply the parts as needed. Since there are no moving components and no contacts, these magnetics show no signs of wear after millions upon millions of operations—long after normal relay contacts would have worn out. Another series of magnetics controls the speed of the engine assembly conveyor, to determine the proper production rate.

The uses for magnetic amplifiers are almost limitless. They serve as memory units in computers and as speed regulators in steel, paper, and textile mills; they control gun turrets and radar antennas on navy ships; they regulate the voltage output of huge turbine generators; they control automatic elevators, mine hoists, power shovels, cranes, and printing presses. In short, wherever the considerations of precise, reliable, trouble-free control are important—from jet aircraft to atomic submarines—you'll find magnetic amplifiers working silently and efficiently. —30—

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Extend Life of Records

(*Continued from page* 79)

changer arms to track at a uniform stylus pressure and playing angle, and there's also a greater chance for your records to do themselves damage by grinding dust and grit into each other's grooves.

Regardless of whether you play your records on a turntable or a changer, bring the unit to a complete stop before you put records on it. Don't grind those delicate record grooves against the moving surface of the table. Also try to get into the habit of slipping the records you've played back into their jackets before you settle down for more listening.

The Dust Problem. No matter how careful you are in handling your records, you still have to cope with the problem of keeping them free of dust. Records start to collect dust almost from the moment they leave the stamper at the factory, mainly because they bristle with static electricity which attracts airborne dust with tremendous speed and efficiency. Recently some of the record manufacturers have started to add a static-eliminating agent to the record "mix," but the great majority of records reach your living room with a good static charge on their surfaces.

The time to attack the problem of static electricity is before you play the record for the first time. If you wait until it has been played a few times, the dust attracted by its static charge will already be partially ground into the grooves.

Simply brushing the record off with a rag won't get rid of the dust attracted by static electricity. On the contrary, it will probably build up the static charge even more. A damp, soft cloth will usually do a satisfactory job, but for best results you need one of the products specifically designed for static elimination.

Anti-static products include treated cloths, sprays, and even mildly radioactive capsules which clip on to your tone arm and de-staticize the surface of the record as it plays. Both cloths and sprays do the job pretty well, but their effects are not permanent. Sprays have their disadvantages, too; an overenthusiastic user can apply such a healthy layer of spray that it will gum up the record grooves and the stylus as well.

Probably the easiest anti-static products to use are the radioactive types, either at-

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tached to the tone arm or imbedded in a special record brush. With these gadgets, your records can be conveniently de-staticized at each playing, and you can count on a year or two of use before having to replace the radioactive element.

Incidentally, you should always "billow" the record jacket when you're sliding a record in or out of it to prevent the surfaces of the record from rubbing against the inside of the jacket—and thus increasing the amount of static electricity build-up. Also, the glassine-type inner covers are very efficient static electricity generators and should be deposited in a nearby waste basket.

Once you've licked the static problem, you'll find it much easier to keep your records free of dust, and those pops and clicks from your loudspeaker will be few and far between. For even better listening, though, you should give your records a bath every year or two. This will get rid of the abrasive grit that's managed to find its way deep down into the grooves.

All you have to do is give your records a very gentle scrubbing with a soft sponge in some lukewarm water that contains a little sudsless detergent. A quick rinse under the faucet and a wipe with a clear sponge—plus a few seconds exposure to the air—and your records will be clean as a whistle. Try this treatment on one of your older records to see just how easy and effective it is. The only precaution here concerns the record label itself. On a few brands, the ink will run when it is wet. Although this is the exception, it's wise to check and see if the ink is color-fast before you dunk it into the wash water.

Record Storage. Storing your records is quite simple and involves only a few rules of common sense. Keep the records away from radiators and sunny windows to avoid warping, and store them on end on a shelf or in a cabinet. Don't stack them horizontally because the ones on the bottom will suffer from too much pressure and those on top are likely to warp. Plastic sleeves for your records will help seal out dust, particularly when your record jackets start to crack open with age.

If you follow the techniques for record care outlined above, your records should provide like-new performance for a long time. And the slight effort you spend to keep your records in tip-top shape will pay dividends in listening pleasure. —30—

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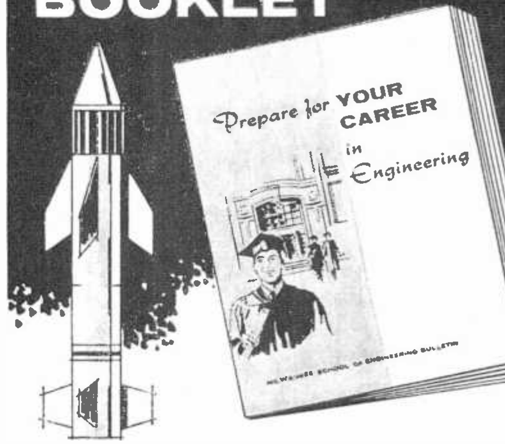

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Transistor Topics

(*Continued from page* 86)

Company engineers made up the car by combining the old and the new—a 1912 *Baker Electric* teamed with a roof-mounted panel of 10,000 silicon solar cells connected in a series-parallel arrangement to charge the storage batteries of the car's 72-volt electrical system. The panel, covering 26 square feet, can charge the batteries in 10 hours. Powered by a 3-hp. electric motor, the car is capable of speeds up to 20 mph.

But don't rush out to buy your own sun-powered car—this unit is one of a kind, and the power panels are not yet in mass production.

Product News. Sylvania's new Type D-4121 silicon diode has the highest switching rate of any commercially manufactured unit—it's capable of performing up to 500,000,000 logic functions in a fraction of a second when used in computer circuits. It has a switching speed of 0.3 μsec.—three-tenths of one thousandth-millionth of a second. And man, that's fast!

The tunnel diode continues to make news. Here in the U. S., RCA is producing these units in pilot plant quantities. And from Tokyo comes news that the world-famous Sony plant has started producing them.

The International Rectifier Corporation (El Segundo, Calif.) has introduced a new series of low-cost Zener diodes. Featuring a new sealing technique, these units are made in standard RETMA voltage steps from 5.6 to 27 volts. Rated at 10 watts, they sell for under $6.00 each.

Thermoelectric cooling units designed to maintain constant operating temperatures for transistors have been put on the commercial market. Manufactured by Westinghouse Electric Corporation (Youngwood, Pa.), they use the Peltier effect (see *Transistor Topics,* May, 1960).

From the General Electric Company (Syracuse, N. Y.) comes news of a series of high-speed germanium *n-p-n* switching transistors, Types 2N1288 and 2N1289. Under development for over two years, these units operate up to 60 mc. With maximum ratings of 20 volts, they have *betas* up to 150. Selling price, in large quantities, is under five dollars per unit.

That about covers the semiconductor story for now. I'll be back next month with more news and circuits.

Lou

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Test Instruments

(Continued from page 83)

3. Use an isolation transformer if the receiver under test is of the transformerless type.

4. Use only the output lead furnished with the sweep generator. Extending the lead with extra wire can change the waveform drastically.

5. Keep the leads as clear as possible of stages other than those under test.

6. Use the lowest sweep generator output that gives a usable waveform. A generator output even slightly too high can distort the curve.

7. Marker pips should also be kept as small as possible to avoid waveform distortion.

8. Generally, a better i.f. alignment will result if the local oscillator is disabled while i.f. is being aligned.

9. Be sure that both receiver and test equipment are warmed up for at least 30 minutes before you begin.

10. Exact bias, as called for in the manufacturer's alignment instructions, is important. If dry cells are specified for bias voltage, make certain you use fresh ones.

Various Models. Sweep generators offer many different features, and naturally come in a wide range of prices. Some instruments have variable internal marker oscillators, for example; others do not. If you already have an AM signal generator that can be used as a marker oscillator, you may not need a sweep generator with an internal tunable marker.

Some generators have a wider sweep bandwidth than others. There are even a few generators designed for servicing FM receivers only, but most cover the FM and TV bands with room to spare on either end—some are even tunable down through the broadcast band.

Excellent sweep generators can be built from kits. They run from around $35 for the simpler models to about $75 for the more complex units. Wired models cost from almost $100 to several hundred dollars. There are also combination signal and sweep generators which can perform all the functions of both; these, naturally, are a little more expensive. Other special units can be bought with especially high- or especially low-frequency ranges, high output, or other unique features. —30—

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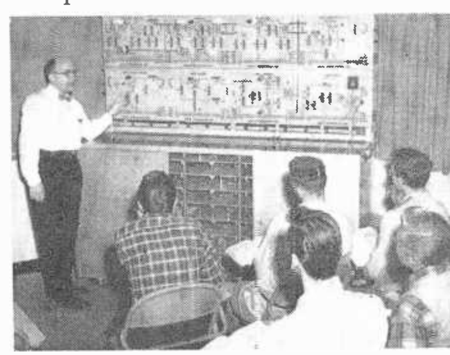

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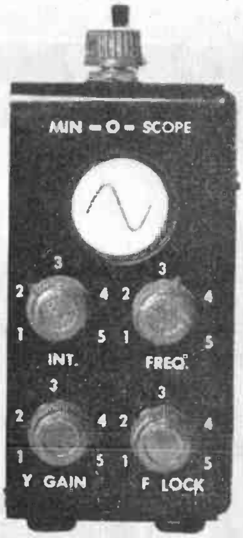

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Across the Ham Bands

(*Continued from page* 93)

News and Views

Jack Hurray, K3GRE, 1601 Indiana Ave., Monaca, Pa., runs 25 watts to a Heathkit AT-1 transmitter. He added the VFO described in "*Across The Ham Bands,*" June, 1959, to escape the QRM of the 40-meter Novice band. Now he does most of his operating between 7000 and 7150 kc., c.w., although he modulates the AT-1 about 50% with his tape-recorder amplifier and occasionally gets on 20 meters to chat with a few locals. Jack worked only 11 states as a Novice, but his total is soaring now. He receives with a Hallicrafters SX-17, and his antenna is a 40-meter dipole. . . . . In the April *"Letters from Our Readers,"* **Jim, W5UJN,** objects to using a hi-fi amplifier as a ham modulator (described in our January column) on the grounds that its frequency response would cause the signal to take up too much room in the ham bands. But a series capacitor-potentiometer high-frequency attenuator at the output of the amplifier should make it perfectly suitable for ham use. Trial and error while on the air will give you the right values for the attenuator components.

Incidentally, reader Frederic J. Mohr in Bayville, N. J., has called our attention to a typographical error in the May *Across the Ham Bands*. The parts list for the 80-meter harmonic filter on page 93 gives 0.0003-$\mu\mu$f. values for C1 and C3. These capacitors should be 0.0003-microfarad units.

Howie Lawrence, KN1MFA, 8 Fermoy Heights Ave., Dorchester, Mass., has worked 130 stations in 23 states, Canada, and Puerto Rico in two months on the air. He started on 80 meters, worked his way to 40, and then to 15, where he worked 12 new states in two days. A Heathkit DX-20 heats his 40-meter dipole, and Howie receives on a Hallicrafters S-38E. . . . . **Rich, KNØYCP,** of St. Louis. Mo., works 40 meters most of the time with his Heathkit DX-40 and Knight R-100 receiver. He asked some questions about two meters and a vertical antenna but did not include his address. If he will furnish it, we will be glad to answer

Alan Richards, WA2EGA, operates in Flushing, N. Y.

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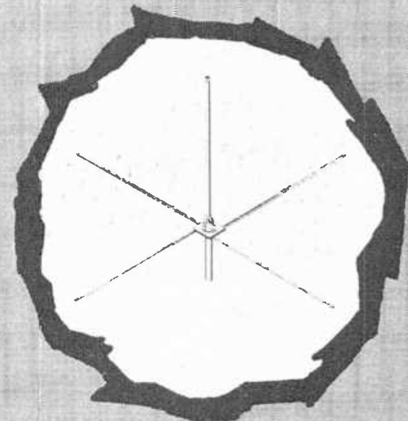

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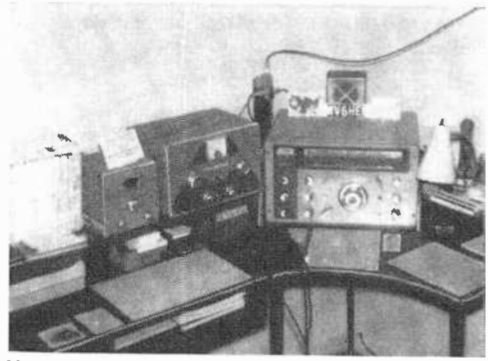
his letter. . . . . **Fred G. Leisen, WV6HEI,** 2674 Friedell Dr., San Diego 10, Calif., in 10 months as a Novice worked 34 states, three Canadians, and Ivor, VK3XB, using a DX-40 transmitter and a National NC-300 receiver. His General license is now on the way.

Dudley H. Cahn, K8QEX, 3408 Mulhern Ave., Kalamazoo, Mich., really ran up a record as a Novice with his Heathkit DX-40, Hammarlund HQ-129X receiver, home-built 15-meter beam, 40-meter dipole, and 80-meter long-

SIX-METER RULE CHANGE

The FCC has moved the 100-kc. segment of the six-meter band which is reserved for A1 (c.w. telegraphy) emission only. The authorized segment is now 50.0—50.1 mc., rather than 50.9—51.0 mc. The ruling permitting A1 emission only on 147.9—148.0 mc. in the two-meter band remains unchanged.

wire. "Worked All Continents," "Worked All States," and a 20-wpm code certificate decorate his shack wall. He has 44 countries worked with 24 confirmed. Now that he is a General, Dudley finds the competition a bit rougher. But he logged UJ8GG on the low end of 40 meters the other day. . . . . **Doug Price, WV2IRW,** 59 Mill Spring Road, Manhassett, N. Y., feeds his DX-20 into a vertical on 40 meters and into a 2-element beam on



Ham shack of Fred Leisen, WV6HEI, in San Diego.

15, with the vertical and a folded dipole serving as alternate 15-meter antennas. Doug receives with a National NC-109. He has worked 24 states and considers California on 40 meters his best DX. After just spending an extra $2.00 for postage on duplicate QSL cards, Doug's pet peeve is the non-QSL gang.

G. W. Grove, W1WHL, better known as "The Old Connecticut Squire," informs us that the Fifth Annual Graveyard Net Picnic will be held on July 9 and 10 at Jamestown, Virginia. Highlights of the event will be "Eyeball" QSO's, QSL and mobile judging contests, drawings by the dozens, equipment auctions and swaps, a beauty contest for the ladies, and games for the children. Facilities are available for camping, fishing, swimming, and boating. For more information and literature on the event, write to Norm Reynolds, K4GKN, 36 N. Lawson Rd., Poquoson, Va.

Steve Richmond, K1JAW, 115 Franklin, Reading, Mass., started as a Novice in 1958 at the age of 14. He has made the "Brass Pounder's League" for his message-handling, has a 30-wpm code certificate and a pretty fair 40-meter DX record. With his Heathkit DX-20, Knight, VFO, and 40-meter dipole, Steve has worked Russia, Poland, Sweden, Germany, Czechoslovakia, and 47 states. He will be glad to help the would-be hams in his immediate area get their tickets. . . . . **Thomas**

ELUSIVE HARMONIC

In the May issue of POPULAR ELECTRONICS, two errors crept into the article entitled "The Case of the Elusive Harmonic." One was permitting Bob, a Novice ham, to use a VFO. Well, Bob is now back on crystals and working hard for that General ticket. The other occurred in the schematic on page 71; the 2.5-mhy. r.f. choke connected across the antenna terminals should be wired from the right-hand junction of L2-R5 to the 150-ma. meter's top terminal. In the original schematic, the only DX Bob could get was from his power supply. Many thanks to our readers who pointed out these mistakes.

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M. Gooding, K4LHB/WPE4YW, P. O. Box 91, Oakton, Va., has been running five watts to a 6AQ5 on 7175 kc., and working such areas as Florida, California, and Indiana. Tom's regular transmitter is a Globe Scout-65 driving an 813, and his receiver is a Hallicrafters SX-28. He would like to compare notes with other experimenters who have low-power transmitters. . . . . **Howard W. Epley, KN7KPM,** Route 2, Box 263, Winlock, Wash., asks: "What's this about a 'Where are the sevens club?'" He will sked anyone on 15 meters for his first "7" or Washington contact. In two months on the air, Howard has worked 46 states, Canada, Wales, Sweden, Southern Rhodesia, Japan, and Puerto Rico. His tools are a Johnson Adventurer transmitter, a Hallicrafters SX-100 receiver, and a home-built two-element beam.

Carl O. Baptiste, HH2BC, Jacmel, Haiti, W. I., reports that his friend, **Jean Sorel,** P. O. Box 555, Port-au-Prince, Haiti, W. I., would like to correspond with sightless amateurs. Mr. Sorel, who is a successful lawyer, linguist, and teacher, would like to become a ham himself and then help other blind people join our hobby. . . . . **Jeff Speiser, K1LDD,** 254 W. 234 St., New York 63, N. Y., a student at M.I.T., is interested in contacting anyone with information on the CRP-46ADA radar receiver. He also wants to locate persons in the New York or Boston areas interested in the 3- and 10-cm. ham bands—radio astronomy, moon bounce, etc.

How about *your* letter, pictures, and comments for next month? 73,

Herb, W9EGQ

Short-Wave Report

(*Continued from page* 97)

The following is a resume of the current reports. All times shown are Eastern Standard and the 24-hour system is used. At time of compilation all schedules given are correct. Stations often change frequency and/or schedule with little or no advance notice. Please send all reports to P. O. Box 254, Haddonfield, N. J., in time to reach your Short-Wave Editor by the eighth of each month.

Albania—ZAA, Tirana, has been carrying an English segment at 1730-1758 on 7157 kc. French precedes this at 1700. *(WPE1AAC, WPE3NF)*

Antigua—*Radio Antigua,* British West Indies, has been found on 3255 kc. from 1758 with tuning signal and s/on at 1800 in English. A recorded music period with some request numbers followed to 1845 when the signal faded. Does anyone know the power? *(WPEØAE)*

Argentina—LRA, *Radio Nacional,* Buenos Aires, is beamed to Central Europe on 15,345 kc. at 1400 in Spanish, 1500 in German, 1600 in Italian, 1700 in French, 1800 in English, and 1900 in Portuguese, to Eastern N.A. on 9690 kc. at 2100 in Spanish and 2200 in English, and to Western N.A. on 9690 kc. at 2302 in Spanish and 0002 in English. All xmsns are one hour

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long. (*WPE1AMW, WPE1BD, WPE3EX, WPE9AHC*)

Australia—Here is the latest schedule from *R. Australia* (all English except where noted). To S. and S.E. Asia: 1714-0900 on 25,735 kc.; 1714-0415 on 21,540 kc. (Indonesian at 0100-0230); 2130-0230 on 21,600 kc. (Saturdays only —sports service): 1714-0230 on 17,840 kc. (Indonesian at 1714-1815, French at 1815-1915, Indonesian at 0100-0230); 1714-1915 on 15,210 kc.; 1714-1930 on 15,320 kc. (Indonesian at 1714-1815, French to 1915); 0100-0445 on 15,160 kc.; 0429-1230 on 11,740 kc. (Indonesian at 0429-0600, Chinese to 0800, Thai at 0830-0930); 0829-1000 on 11,760 kc.; 0459-1230 on 9580 kc.; 0429-1230 on 7220 kc. (Indonesian at 0429-0600, Chinese to 0800, Thai at 0830-0930). In the East Asia and N. Pacific Islands Service: 1559-1800 on 15,240 kc., 0244-0700 on 11,760 kc., and 0459-0900 on 9630 kc. To Mid-Pacific Islands: 1500-1700 on 15,315 kc., 1930-2030 on 17,710 kc. (French), 1930-2030 on 15,160 kc. (French), and 0100-0445 on 11,810 kc. (Saturdays at 0244-0445). To S. Pacific Islands: 1500-1700 on 11,840 kc., 1815-1915 on 21,680 kc. (French), and 0100-0415 on 11,710 kc. To N.A.: 0714-0815 on 11,710 kc. (East Coast) and 1014-1115 on 11,810 kc. (West Coast). To United Kingdom and Europe: 0100-0230 on 11,710 kc. To Africa: 2329-0045 on 21,680 kc. The DX program is aired Saturdays at 1700, Sundays at 0030, 0215, 0800, and 1100. (*WPE4BC, WPEØAE*)

Bahamas—If you have never logged these islands, look for ZNS, Nassau, in the broadcast band at 1540 kc. DX'ers along the East Coast should have little trouble finding this one during evening hours. (*WPE4JP*)

Bolivia—A new station is *R. Guavira,* Santa Cruz, 9200 kc. It was noted at 1858-1930 with Spanish anmts, good music, and frequent ID's. (*WPEØAE*)

CP27, 9444 kc., La Paz, has two English programs: "At Close of Day" at 2105 on Thursdays and a religious program daily except Tuesday and Sunday at 2100. This station, now powered at 400 watts, is expected to increase to 10 kw., according to Harold Hill, Director. (*FB*)

Brazil—ZYN31, *R. Soc. da Bahia,* Salvador, 1525 kc., is noted at 1500-2300, replacing 11,875 kc. There is severe QRM from Lisbon (beamed to Brazil) until 2100. (*WPE4FI, WPE9KM*)

The best time to log the experimental college station on 17,725 kc. is around 1800 on Saturdays or Sundays. Otherwise, this station is on an irregular schedule. (*WPE9KM*)

PRN9, *La Voz da Policia Federal,* Rio de Janeiro, is to have an English DX program put on by the Brazilian DX Club. Dates and times have not been given as yet but the frequency should be 9295 kc. Pennants will be awarded for correct reports. (*WPE1BY*)

Canary Islands—Two stations currently being heard are *R. Atlantico,* Las Palmas, 9490 kc., with English on Saturdays at 1800-1900, and EA8AB, Tenerife, 7295 kc., at 1724-1820 with talks in Spanish and some jazz music. Contrary to schedule given in *World Radio Handbook,* the broadcasting definitely runs past 1800. (*WPE3NF, WPE8BGF*)

Cook Islands—ZK1ZA, Rarotonga, 4965 kc., is on the air Wednesdays only as 2327-0030 with native music. The IS is island drum beats. (*WPE6EZ*)

Curacao—Here is another country that few have logged. Look for *R. Curom*, Willemstad, 9654 kc., at 2000-2230. This is all-Dutch but you may be able to log it by carefully listening for the ID. (*WPE4FI*)

Dominican Republic—A new station is *R. Deportiva Tangica*, 6250 kc. Previously heard on 6200 kc., it has been noted at 1730-2100 and later. (*WPE3NF, WPE9KM*)

El Salvador—A letter from YSEB, San Salvador, states that its affiliate, YSDR, Santa Ana, has a new outlet on 4800 kc. with slogan of *R. Tropical*. Reports go to Apartado Postal 1006, San Salvador. (*WPE3HP*)

Finland—*Oy Yleisradio Ab*, Helsinki, operates to Europe at 0400-0600 on 6120 kc. and at 1100-1330 on 6120, 15,190, and 17,800 kc.; to N.A. Sept. 23 to March 20 at 0630-0900 (DX program Saturdays at 0630-0700), March 21 to Sept. 22 at 1530-1800 (DX program Fridays at 1530-1600) on 15,190 and 17,800 kc. The DX program alternates weekly with "Musical Mailbag." (*WPE9ADY, WPEØSS*)

Formosa—*The Voice of Free China* has Eng. daily at 2030-2045 and 0505-0550 on BED7, 7320 kc., BED6, 11,815 kc., BED57, 15,345 kc., BED58, 17,755 kc. (*WPE1BD, ET*)

France—Paris is strong on 7280 kc. at 0100-0145, beamed to the Pacific Islands and dual to 9560, 17,765, and 21,580 kc. (*WPE6EZ*)

Germany—Cologne operates to Eastern N.A. at 1900-2200 and to Western N.A. at 2200-0100 on 11,795 and 9640 kc.; to Eastern N.A. at 1715-1845 on 15,375 and 11,795 kc. and to Western N.A. at 0000-0130 on 9735 and 11,945 kc. German lessons are given at 1815 on 11,795 and 15,375 kc., and at 0100 on 9735 and 11,945 kc. Test programs have recently been heard to West Africa at 1300-1400 on 15,275 and 17,875 kc. (Eng. news at 1330); to So. America at 1620-1630 on 15,275 kc.; and to Central America at 1920-2000 on 9605 kc. The latter two xmsns are in German and Spanish. (*WPE2AXS, WPE2BFB, WPE2BMO,*

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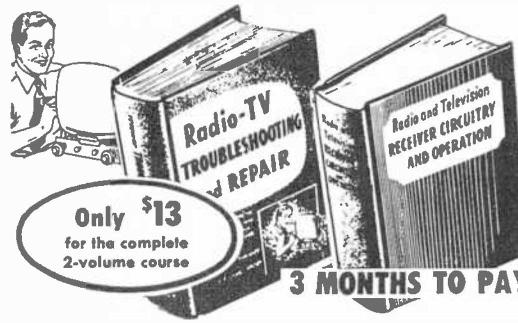

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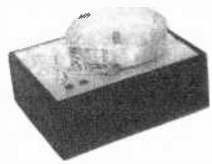

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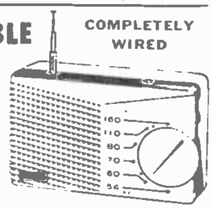

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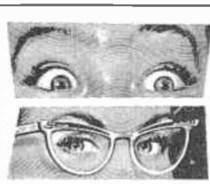

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Greece—Athens is good on 11,718 kc. with s/on at 1800. It can also be heard on 11,718 and 15,345 kc. with English news at 1230. *(WPE8BGF, WPE9KM)*

Honduras—A new outlet may be *La Voz de Suyapa*, 4940 kc. Good from 2100, it should not be confused with the Suyapa outlet on 6125 kc. *(WPE9KM)*

Iceland—A letter from TFJ gives the schedule as 1600-1700 daily and 0815-0915 on Sundays on 12,175 kc. Reports, accompanied by an IRC, should be sent to Iceland State B/C Service, Reykjavik, Iceland. *(WPE1AAC, WPE1HY)*

India—*All India Radio*, Delhi, has replaced 15,105 kc. with 15,180 kc. in the 1445-1545 xmsn to the Middle East. The 15,280-kc. channel is noted well at 0730 with IS, Eng. ID, and opening with news. *(WPE1CE, WPE3NF, WPE8HF)*

Israel—4XB31, *Voice of Jerusalem*, 9009 kc., has extended the Eng. xmsn to 1515-1600, an increase of 15 minutes. *(WPEØEH, VE2PE1H)*

Japan—The latest schedule from *R. Japan* reads as follows: to S. Asia at 1000-1130 on 11,965 and 15,325 kc. in Hindi, Urdu, Japanese and English; to Middle East at 1145-1345 on 11,705, 15,325 and 9675 kc. in Arabic, French, English and Japanese; Europe II at 1400-1600 on 11,705, 15,325 and 9675 kc. in Russian, German, French, Italian, Swedish, English, and Japanese; to N.A. at 1930-2030 on 17,855 and 15,325 kc. in English and Japanese; Latin America I at 2200-2300 on 17,855 and 15,325 kc. in Spanish and Japanese; N.A. and Hawaii at 0000-0200 on 11,705, 15,325 and 17,825 kc. in English and Japanese; Europe I at 0230-0330 on 17,855 and 21,620 kc. in English and Japanese; Latin America II at 0400-0530 on 11,705 and 9525 kc. in Portuguese, Japanese and Spanish; Australia and New Zealand at 0430-0530 on 11,800 and 15,235 kc. in English and Japanese; East Asia at 0500-0730 on 11,940 kc. in Japanese; Asian Continent at 0545-0745 on 11,705 and 9525 kc. in Chinese, Japanese, Russian and English; Philippine Islands and Indonesia at 0630-0800 on 17,855 and 15,325 kc. in Indonesian and English; Korea at 0800-0900 on 9525 kc. in Korean and Japanese; S.E. Asia at 0800-1100 on 11,705 and 9675 kc. in Chinese, Fukinese, Cantonese, Thai, French, English, and Japanese. General Asian Service at 1900-1930, 2100-2130, 2300-2330, 0100-0200, 0300-0330, 0400-0430, 0500-0530, 0600-0630, 0700-0730, and 0800-0900 on 15,135 kc. in English and Japanese. *(WPE1BD, WPE4BFY, UN, Radio Japan News)*

Jordan—A station believed to be in Amman

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	kw.—Kilowatts
B/C—Broadcasting	N.A.—North America
Eng.—English	QRM—Station interference
ID—Identification	R.—Radio
IRC—International Reply Coupon	s/off—Sign-off
IS—Interval signal	s/on—Sign-on
kc.—Kilocycles	xmsn—Transmission

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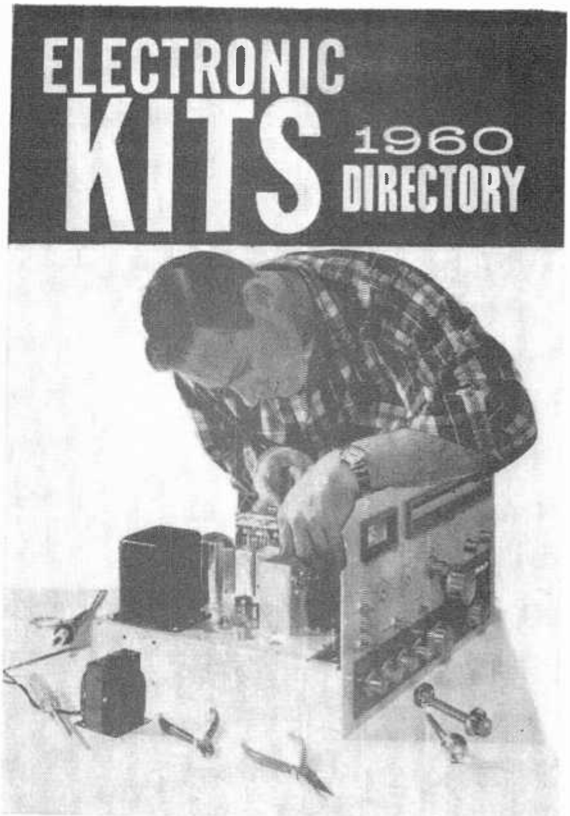

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has been noted testing on 11,812 kc. at 0000-0100 in Arabic. Further checks are being made. (*WPE3NF*)

Middle Congo Republic—Brazzaville carries English at 0015 on 21,500, 15,440, 11,725, 9730, and 5970 kc., at 0300 on 15,440 and 21,500 kc., at 0600 on 15,440 kc., at 0700 on 15,420 kc., at 0930 on 17,720 and 21,500 kc., at 1200 on 11,725, 5970, and 21,500 kc., at 1310 on 11,725 and 5970 kc., at 1430 on 9540 kc., at 2015 and 2145 on 11,725 kc. The 21,500-kc. channel is used on Sundays only. (*WPE2CPP, WPE3AJC, WPE6BAR, WPE8VS, WPEØAJP, VE4PE1U, DE, JK, HL*)

Morocco—Rabat is heard on 7115 kc. at 1600-2200, all-Arabic, and on 7226 kc. at 1740-1800 with French news at 1750 and Spanish

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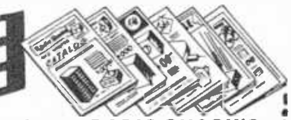

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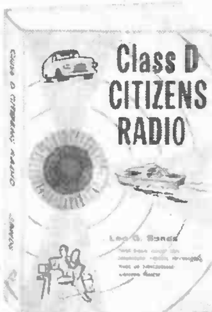

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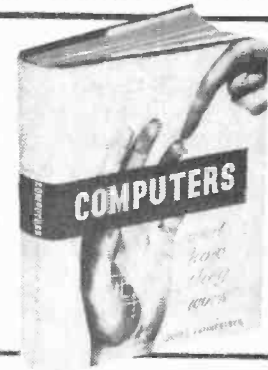
by James Fahnestock



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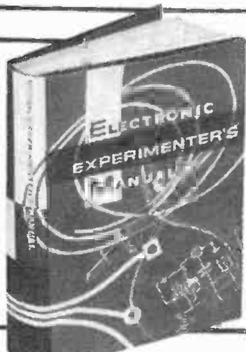

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news starting at 1800. *(WPE1BD, WPE3NF)*

Netherlands—Hilversum is now on 11,755 kc., replacing 11,915 kc., to N.A. at 2030-2120 (Sundays at 2100-2230). *(WPE1ARL, WPE1CE, WPE1DS, WPE2BRH, WPE2YK, WPE3AJC, WPE3NF, WPE4FI, WPE5RB, WPE9KM)*

Norway—*Norsk Rikskringkasting,* Oslo, operates to N.A., North Atlantic, and Caribbean areas at 2000-2120 ("Norway This Week" on Sundays at 2105-2125) and to the North Atlantic, West N.A., Pacific areas, and E. Africa at 2300-0020 ("Norway This Week" on Mondays at 0005-0025) on LLM, 15,175 kc., LLK, 11,850 kc., LLG, 9610 kc., and LKJ, 6130 kc. *(WPE3BCE, WPEØTA)*

Peru—Try for *R. Continental,* 9350 kc., at 2155-2215; dual to *R. America* on 9455 kc. only for Spanish news at 2200-2205. Another station noted well at times is *R. Loreto* on 9530 kc. from 2330 to 0000 s/off. *(WPE6EZ, JL)*

Philippines—Far East B/C Service, Manila, has English at 2300-2330 on 9730, 11,855, 15,300, 17,805, and 21,515 kc., at 0915-1045 on 9730, 15,300, and 17,805 kc., at 0800-0830 and 1000-1130 on 11,920 and 21,515 kc. English news is given at 1645, 1830, 2300, 0430, 0700, 0800, 1000, and 1045. Call letters: 9730 kc., DZH7; 11,855 kc., DZH8; 11,920 kc., DZF2; 15,300 kc., DZH9; 17,805 kc., DZI6; 21,515 kc., DZI8. *(WPE3DS, WPE5RB, WPE6TY, WPE9ARA)*

Senegal—*R. Senegal,* Dakar, 4893 kc., has English news from its own station sources, not a Brazzaville relay. Try for it at 1730 on Saturdays. *(WPE3NF)*

Sudan—*R. Omdurman,* Khartoum, has a new schedule that reads: Arabic at 2315-0030 (except Fridays), 2315-0600 (Fridays), and 0930-1600 daily. To Southern Sudan at 0900-0930 daily, 0300-0400 (Sundays). English at 0730-0800 daily. Frequencies are 5039 kc. (20 kw.), 9600 kc. (7.5 kw.), and 11,855 kc. (20 kw.). *(WPE1BY)*

Turkey—*R. Ankara,* has Eng. news and music to N.A. daily at 1815-1900 on 9515 kc. A "Mailbag" is given Sundays at 1825-1840. Other xmsns noted from Ankara include: 0830-0915 on 17,820 kc.; 1330-1415 on 7285 and 9745 kc.; and 1600-1645 on 15,160 kc. *(WPE2CNI, WPE3AYB, WPE4BFY, WPE8HS, WPE8RE, WPE9AGB, VE1PE2L, CK, JK)* —30—

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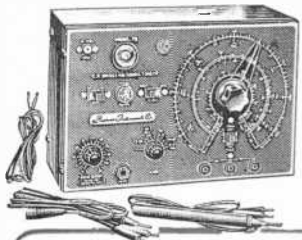

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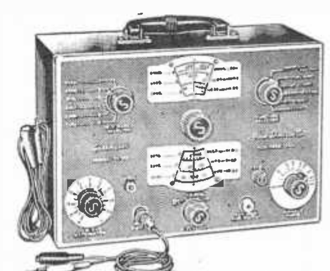
With the use of the R.F. and A.F Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc.

✔ TV ANTENNA TESTER SECTION
Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? Locates a break in any TV antenna and measures the location of the break in feet from the set terminals.

Complete with R.F. and A.F. probes and test leads **$26.95 Net**

Model 76 ALL PURPOSE BRIDGE
Total Price............$26.95
Terms: $6.95 after 10 day trial, then $5.00 per month for 4 months if satisfactory. Otherwise return, no explanation necessary.



Superior's New Model TV-50A **GENOMETER**

7 Signal Generators in One!

√ *R.F. Signal Generator for A.M.*
√ *R.F. Signal Generator for F.M.*
√ *Audio Frequency Generator*
√ *Bar Generator*
√ *Cross Hatch Generator*
√ *Color Dot Pattern Generator*
√ *Marker Generator*

This versatile All-Inclusive GENERATOR Provides ALL the Outputs for Servicing:

A.M. Radio • F.M. Radio • Amplifiers • Black and White TV • Color TV

Model TV-50A GENOMETER...
Total Price...........$47.50
Terms: $11.50 after 10 day trial, then $6.00 monthly for 6 months if satisfactory. Otherwise return, no explanation necessary.

R. F. SIGNAL GENERATOR: The Model TV-50A Genometer provides complete coverage for A.M. and F.M. alignment. Generates Radio Frequencies from 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: In addition to a fixed 400 cycle sine-wave audio, the Model TV-50A Genometer provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

BAR GENERATOR: The Model TV-50A projects an actual Bar Pattern on any TV Receiver Screen. Patterns will consist of 4 to 16 horizontal bars or 7 to 20 vertical bars.

CROSS HATCH GENERATOR: The Model TV-50A Genometer will project a cross-hatch pattern on any TV picture tube. The pattern will consist of non-shifting, horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

DOT PATTERN GENERATOR (FOR COLOR TV) Although you will be able to use most of your regular standard equipment for servicing Color TV, the one addition which is a "must" is a Dot Pattern Generator. The Dot Pattern projected on any color TV Receiver tube by the Model TV-50A will enable you to adjust for proper color convergence.

MARKER GENERATOR: The Model TV-50A includes all the most frequently needed marker points. The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency).

The Model TV-50A comes absolutely complete with shielded leads and operating instructions. Only **$47.50**

USE APPROVAL FORM ON NEXT PAGE ▶

We invite you to try before you buy any of the models described on this and the following pages. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

MOSS ELECTRONIC, INC. **Dept. D-765 3849 Tenth Avenue, New York 34, N. Y.**

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TRY FOR 10 DAYS

before you buy! **then** if satisfactory pay in easy, interest free, monthly payments. See coupon below.

Model 82A—Tube Tester
Total Price $36.50
Terms: $6.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

Superior's New Model 82A

A truly do-it-yourself type TUBE TESTER

TEST ANY TUBE IN 10 SECONDS FLAT!

1. Turn the filament selector switch to position specified.
2. Insert it into a numbered socket as designated on our chart (over 600 types included).
3. Press down the quality button —

THAT'S ALL! *Read emission quality direct on bad-good meter scale.*

FEATURES:

• Tests over 600 tube types. • Tests OZ4 and other gas-filled tubes. • Employs new 4" meter with sealed air-damping chamber resulting in accurate vibrationless readings. • Use of 22 sockets permits testing all popular tube types and prevents possible obsolescence. • Dual Scale meter permits testing of low current tubes. • 7 and 9 pin straighteners mounted on panel. • All sections of multi-element tubes tested simultaneously. • Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.

Production of this Model was delayed a full year pending careful study by Superior's engineering staff of this new method of testing tubes. Don't let the low price mislead you! We claim Model 82A will outperform similar looking units which sell for much more—and as proof, we offer to ship it on our examine before you buy policy.

Model 82A comes housed in handsome, portable, Saddle-Stitched Texon case. Only.... **$36.50 Net**

Model 83—C.R.T. Tube Tester
Total Price $38.50
Terms: $8.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

SUPERIOR'S NEW MODEL 83

C.R.T. TESTER

Tests and Rejuvenates ALL PICTURE TUBES

ALL BLACK AND WHITE TUBES
From 50 degree to 110 degree types —from 8" to 30" types.

ALL COLOR TUBES
Test ALL picture tubes—in the carton—out of the carton—in the set!

● Model 83 is not simply a rehashed black and white C.R.T. Tester with a color adapter added. Model 83 employs a new improved circuit designed specifically to test the older type black and white tubes, the newer type black and white tubes and all color picture tubes. ● Model 83 provides separate filament operating voltages for the older 6.3 types and the newer 8.4 types. ● Model 83 employs a 4" air-damped meter with quality and calibrated scales. ● Model 83 properly tests the red, green and blue sections of color tubes individually—for each section of a color tube contains its own filament, plate, grid and cathode ● Model 83 will detect tubes which are apparently good but require rejuvenation. Such tubes will provide a picture seemingly good but lacking in proper definition, contrast and focus. To test for such malfunction, you simply press the rej. switch of Model 83. If the tube is weakening, the meter reading will indicate the condition. ● Rejuvenation of picture tubes is not simply a matter of applying a high voltage to the filament. Such voltages improperly applied can strip the cathode of the oxide coating essential for proper emission. The Model 83 applies a selective low voltage uniformly to assure increased life with no danger of cathode damage.

Housed in handsome portable Saddle Stitched Texon case—complete with sockets for all black and white tubes and all color tubes. Only **$38.50**

We invite you to try before you buy any of the models described on this page, the preceding page and the following pages. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

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Please send me the units checked on approval. If completely satisfied I will pay on the terms specified with no interest or finance charges added. Otherwise, I will return after a 10 day trial positively cancelling all further obligation.

☐ Model 76 ....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.

☐ Model 83 ....Total Price $38.50 $8.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ Model TV-50A ..Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.

☐ Model 70....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.

☐ Model 82A....Total Price $36.50 $6.50 within 10 days. Balance $6.00 monthly for 5 months.

☐ Model 80 ....Total Price $42.50 $12.50 within 10 days. Balance $6.00 monthly for 5 months.

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All prices net, F.O.B., N. Y. C.

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Superior's New Model 70 UTILITY TESTER®

FOR REPAIRING ALL ELECTRICAL APPLIANCES and AUTOMOBILE CIRCUITS

Model 70—UTILITY TESTER
Total Price...$15.85—
Terms: $3.85 after 10 day trial, then $4.00 monthly for 3 months, if satisfactory. Otherwise return, no explanation necessary.

As an electrical trouble shooter the Model 70:

- Will test Toasters, Irons, Broilers, Heating Pads, Clocks, Fans, Vacuum Cleaners, Refrigerators, Lamps, Fluorescents Switches, Thermostats, etc.
- Measures A.C. and D.C. Voltages, A.C. and D.C. Current, Resistances, Leakages, etc.
- Will measure current consumption while the appliance under test is in operation.
- Incorporates a sensitive direct-reading resistance range which will measure all resistances commonly used in electrical appliances, motors, etc.
- Leakage detecting circuit will indicate continuity from zero ohms to 5 megohms (5,000,000 ohms).

As an Automotive Tester the Model 70 will test:

• Both 6 Volt and 12 Volt Storage Batteries • Generators • Starters • Distributors • Ignition Coils • Regulators • Relays • Circuit Breakers • Cigarette Lighters • Stop Lights • Condensers • Directional Signal Systems • All Lamps and Bulbs • Fuses • Heating Systems • Horns • Also will locate poor grounds, breaks in wiring, poor connections, etc.

INCLUDED FREE *This 64-page book—practically a condensed course in electricity. Learn by doing.*

Just read the following partial list of contents: What is electricity? • Simplified version of Ohms Law • What is wattage? • Simplified wattage charts • How to measure voltage, current, resistance and leakage • How to test all electrical appliances and motors using a simplified trouble-shooting technique.
• How to trace trouble in the electrical circuits and parts in automobiles and trucks.

Model 70 comes complete with 64 page book and test leads

Only $15^{85}

Model 80 ALLMETER
Total Price $42.50
Terms: $12.50 after 10 day trial, then $6.00 monthly for 5 months if satisfactory. Otherwise return, no explanation necessary.

NOTE: The line cord is used only for capacity measurements. Resistance ranges operate on self-contained batteries.

SUPERIOR'S NEW MODEL 80

20,000 OHMS PER VOLT ALLMETER

THE *ONLY* 20,000 OHMS PER VOLT V.O.M. SELLING FOR LESS THAN $50 WHICH PROVIDES *ALL* THE FOLLOWING FEATURES:

- 6 INCH FULL-VIEW METER provides large easy-to-read calibrations. No squinting or guessing when you use Model 80.
- MIRRORED SCALE permits fine accurate measurements where fractional readings are important.
- CAPACITY RANGES permit you to accurately measure all condensers from .00025 MFD to 30 MFD in addition to the standard volt, current, resistance and decibel ranges.
- HANDSOME SADDLE-STITCHED CARRYING CASE included with Model 80 Allmeter at no extra charge enables you to use this fine instrument on outside calls as well as on the bench in your shop.

SPECIFICATIONS:

7 D.C. VOLTAGE RANGES
(At a sensitivity of 20,000 Ohms per Volt)
0 to 15/75/150/300/750/1500/7500 Volts.
6 A.C. VOLTAGE RANGES:
(At a sensitivity of 5,000 Ohms per Volt)
0 to 15/75/150/300/750/1500 Volts.
3 RESISTANCE RANGES:
0 to 2,000/200,000 Ohms. 0-20 Megohms.
2 CAPACITY RANGES:
.00025 Mfd. to .3 Mfd., .05 Mfd. to 30 Mfd.
5 D.C. CURRENT RANGES
0-75 Microamperes. 0 to 7.5/75/750 Milliamperes. 0 to 15 Amperes.
3 DECIBEL RANGES: — 6 db to + 18 db. + 14 db to + 38 db + 34 db to + 58 db

Model 80 Allmeter comes complete with operating instructions, test leads and portable carrying case. Only .... **$42^{50}**

TRY FOR 10 DAYS *BEFORE* you buy! *THEN* if satisfactory

pay in easy, interest free, monthly payments. See coupon inside.

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