BUILD FM MULTIPLEX ADAPTER

POPULAR ELECTRONICS

APRIL 1963

35 CENTS

- Ceramic Tile Speaker Enclosure
- Simple Superhet
- Code Monitor
- CB, SWL, Ham & Hi-Fi Reports

SPECIAL:
CB-Style Network in South Vietnam

Comparative Specs on Portabl

A ZIFF-DAVIS PUBLICATION

JOIN THE THOUSANDS WHO TRAINED FOR NEW CAREERS WITH NRI

"I want to thank NRI for making it all possible," says Robert L. L'Heureux of Needham, Mass., who sought our job consultant's advice in making applications and is now an Assistant Field Engineer in the DATAmatic Div. of Minneapolis-Honeywell, working on data processing systems.

"I have gone ahead financially ever since I enrolled with NRI," writes Gerald W. Kallies, now a Chief Instrument Technician of Rio Algom Nordic cerenium mines and part-time TV engineer for CKSO-TV, Elliott Lake, Ont. He enrolled with NRI on finishing high school.

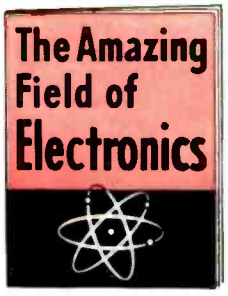
His own full-time Radio-TV shop has brought steadily rising income to Harlin C. Robertson of Oroville, Calif. In addition to employing a full-time technician, two NRI students work for him part-time. He remarks about NRI training, "I think it's tops!"

"I can recommend the NRI course to anyone who has a desire to get ahead," states Gerald L. Roberts, whose Communications training helped him become an Electronics Technician at the Coordinated Science Laboratory, U. of Illinois, working on naval research projects. He also holds a First Class FCC License with Radar Endorsement.

Cut Out And Mail NOW

FREE 64-PAGE CATALOG

NO STAMP NECESSARY
NRI PAYS POSTAGE



National Radio Institute
Washington 16, D.C. 3DD4

Please send 64-page Catalog on how to train at home for new careers in Electronics. I am interested in course checked below:

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

Name_____ Age_____

Address_____

City_____ Zone_____ State_____

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL

Where You Train Is As Important As Your Decision To Train

Electronics is a growing and expanding industry. That's why so many ambitious men are deciding to train for careers in this exciting field. They recognize the opportunities to advance and prosper. But, *where* a man trains and *how* the school of his choice teaches Electronics . . . how it encourages him to reach his goals and realize his ambitions . . . is most important to his success.

This is a fast changing world. A school offering Electronics courses must keep pace. That's why NRI—with nearly 50 years of specialized experience—now offers *nine* choices of training within the one field of Electronics. Select the course of most interest to you and receive the kind of home-study training that prepares you for a *specialized* career. NRI's large staff of specialists is always on the job keeping course material up-to-date . . . helping you earn your way while training . . . assisting you with job placement when ready. In short, whatever branch of Electronics you select, NRI is qualified through knowledge and experience to help you grow.

SPECIAL TRAINING EQUIPMENT INCLUDED

NRI "learn by practice" method is the time-proved way to learn easier, faster, better. Most NRI courses include—*at no extra cost*—special training equipment to give shop and laboratory experience in your own home. All equipment is yours to keep.

Projects you build, experiments you perform, make NRI lessons come to life. Complex subjects become interesting, easy to grasp. Your first projects are measuring voltage and current in circuits you build yourself. You use a Vacuum Tube Voltmeter which you construct. Later on, you progress into more involved experiments. If you like working with your hands, you'll enjoy learning Electronics with NRI.

THE PROVEN WAY TO BETTER PAY

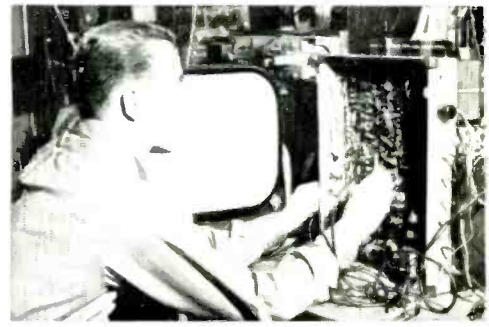
Best of all, NRI provides training right in your own home and in your spare time. No time wasted getting to school. You fit study hours to your own schedule. You go as fast or as slow as you like. Check the training of most interest to you; cut out and mail the postage-free card now. Read about Electronics opportunities, NRI courses, the NRI trial plan, convenient terms.

NRI

AMERICA'S OLDEST AND LARGEST
RADIO-TV ELECTRONICS HOME-STUDY SCHOOL

Expanding uses of Electronics in industry, business, the military, are increasing the demand for trained Electronic Technicians. Electronics needs more Technicians than engineers—from four to seven times more! Electronics is changing our world, creating interesting and important career opportunities for those who qualify. NRI training prepares you.

Communications is the key to a fast-moving world, from the mobile radio in your car to the TV set in your home and the satellite in space. Technicians are needed to help operate and service transmitting equipment used in broadcasting, aviation, marine and mobile communications. Even a service Technician needs an FCC License today to work on C-Band and other Radio equipment. NRI trains you for your choice of Communications fields.



Television and Radio are bigger than ever. Color Television, after years of experimenting, is now moving ahead fast. Hi-fi stereo, PA systems, FM all mean money-making opportunities for you as a Service Technician in your own spare-time or full-time business, or working for someone else. NRI's time-tested training not only teaches you to fix sets, but shows you how to earn spare-time money soon after enrolling. Mail postage-free card.

Pick The Career You Want In The Wonderful Field of ELECTRONICS

1 2 3 4 5 6 7 8 9

INDUSTRIAL-MILITARY ELECTRONICS

Learn Principles, Practices, Maintenance of Electronic equipment used today in business, industry, defense. Covers Electronic controls and measurement, computers, servos, telemetry, multiplexing, many other subjects.

RADIO AND TELEVISION SERVICING

Learn to service and maintain AM-FM Radios, TV sets, Stereo Hi-fi, PA systems, etc. A profitable, interesting field for part-time or full-time business of your own.

FCC LICENSE

Prepares you quickly for First Class License exams. Every communications station must have one or more FCC-licensed operators. Also valuable for Service Technicians. You train at home.

COMPLETE COMMUNICATIONS

A comprehensive training course for men seeking careers operating and maintaining transmitting equipment in Radio-TV Broadcasting or mobile, marine, aviation communications. Prepares you for FCC License.

MOBILE COMMUNICATIONS

Training in installation and maintenance of mobile equipment and associated base stations like those used by fire and police, taxi companies, etc. Prepares you for First Class FCC License exams.

MARINE COMMUNICATIONS

Shipboard transmitting equipment, direction finders, depth indicators, radar are all covered in this course. You prepare for your First Class Radiotelephone License with Radar Endorsement.

AVIATION COMMUNICATIONS

For men who want careers working with and around planes. Covers direction finders, ranges, markers, loran, shoran, radar, landing systems, transmitters. Prepares you for FCC License exams.

MATH FOR ELECTRONICS

A short course package of five carefully prepared texts that take you from basic arithmetic review through graphs and electronic formulas. Quick, complete and low in cost.

BASIC ELECTRONICS

An abbreviated, 26-lesson course covering Automation-Electronics, Radio-Television language, components and principles. Ideal for salesmen, hobbyists and others who find it valuable to be familiar with the fundamentals of this fast-growing industry.

NRI

MAIL POSTAGE-FREE CARD NOW

POPULAR ELECTRONICS

ZIFF-DAVIS PUBLISHING COMPANY

POPULAR ELECTRONICS is indexed in the Readers' Guide to Periodical Literature

This month's cover photo by Bruce Pendleton

VOLUME 18 APRIL 1963 NUMBER 4

Special Feature

Electronic Construction Projects

Audio and High Fidelity

Amateur, CB, and SWL

Electronic Features and New Developments

Departments

The Quality... Features... Engineering Excellence You Expect from Scott at Unexpected Prices!

New Scott FM Stereo Tuner Kit

From the famous Scott engineering laboratories . . . an amazing low priced FM Stereo tuner kit that performs like higher priced Scott units. All the exclusive Scott features you want and need are included: "Time-Switching" multiplex circuitry, Wide-Band design, Sonic Monitor stereo indicator, precision tuning indicator, and separate level controls for perfect channel balancing. Scott engineers used new Space-Age compactron circuitry to assure perfect performance at this remarkably low price.

$109.95

Like all Scott kits the new Model LT-111 comes with an exclusive full-color instruction book to make construction absolutely foolproof. The high conductivity copper RF front end is pre-wired and aligned at the factory. All wires are precut and stripped. Scott's amazing new Align-A-Scope lets you align each section of the tuner perfectly without special instruments.

Specifications: Usable Sensitivity 4.0 μv; Signal to Noise Ratio 55 db; Harmonic Distortion 0.8%; Drift 0.02%; Capture Ratio 6 db; Selectivity 32 db; I.M. Distortion 0.3% (CCIF); Separation (1 kc) over 30 db. Dimensions in accessory case: 15½ w x 5¼ h x 13¼ d.

Available early in April.

Prices slightly higher west of Rockies. Subject to change without notice.

New Scott 30-Watt Stereo Amplifier Kit

$99.95

Imagine! A stereo amplifier kit . . . from Scott, the quality leader . . . at less than $100! This superb 30-Watt stereo amplifier has all of the most needed Scott features: dual tone controls, tape monitor, front panel stereo headphone output, derived center channel output, all-aluminum chassis, scratch filter, stereo balancing, and loudness-volume control. Unique Scott output circuitry delivers full power down to the low frequencies where power is really needed and where most moderately priced amplifiers fail to meet their published specifications. That is why the new Model LK-30 will drive most inefficient speaker systems to full room volume.

Like Scott's new tuner kit, the LK-30 utilizes a full color instruction book, Kit-Pak container, and all the Scott-kit features the experts recommend so highly. Its performance will astound you!

Specifications: Power Rating (IHFM) 30 watts; Power Band (IHFM) 25-19,000 cps. Distortion under 0.8%. Hum and Noise —70 db. Frequency Response (normal listening levels) 20-20,000 cps ±1 db. Dimensions in accessory case 15½ w x 5¼ h x 13¼ d.

Available early in March.

Export: Morhan Exporting Corp., 458 Broadway, N.Y.C. Canada: Atlas Radio Corp., 50 Wingold Ave., Toronto.

SCOTT

H. H. Scott Inc., Dept. 520-4, 111 Powdermill Rd., Maynard, Mass. Rush me complete details on your new budget priced FM Stereo Tuner and 30-Watt Stereo Amplifier kits.

Name .....

Address .....

City ..... Zone .... State .....

Include names of interested friends, we will send them details, too.

POPULAR ELECTRONICS

World's Largest-Selling Electronics Magazine

Publisher **PHILLIP T. HEFFERNAN**

Editor **OLIVER P. FERRELL**

Managing Editor **JULIAN M. SIENKIEWICZ, WA2CQL**

Art Editor **JAMES A. ROTH**

Associate Editors **RICHARD A. FLANAGAN**
MARGARET MAGNA

Assistant Editor **DAVID N. KAPSACK**

Draftsman **ANDRE DUZANT**

Amateur Radio Editor **H. S. BRIER, W9EGQ**
CB Editor **M. P. SPINELLO, 18W4689**
Semiconductor Editor **L. E. GARNER, JR.**
Short-Wave Editor **H. BENNETT, W2PNA**
Contributing Editor **J. T. FRYE, W9EGV**
Radio Propagation Editor **STANLEY LEINWOLL**
Editorial Consultant **OLIVER READ, W4TWV**

Advertising Manager **WILLIAM G. McROY, 2W4144**
Advertising Service Manager **ARDYS C. MORAN**

ZIFF-DAVIS PUBLISHING COMPANY

Editorial and Executive Offices (ORegon 9-7200)
One Park Avenue, New York 16, New York

William B. Ziff, Chairman of the Board (1946-1953)
William Ziff, President
W. Bradford Briggs, Executive Vice President
Hershel B. Sarbin, Vice President and General Manager
M. T. Birmingham, Jr., Vice President and Treasurer
Robert P. Breeding, Circulation Director
Charles Housman, Financial Vice President
Stanley R. Greenfield, Vice President

Midwestern and Circulation Office (WAbash 2-4911)
434 South Wabash Avenue, Chicago 5, Illinois
Midwestern Advertising Manager JAMES WEAKLEY

Western Office (CRestview 4-0265)
9025 Wilshire Boulevard, Beverly Hills, California
Western Advertising Manager, WILLIAM J. RYAN, 11Q3002

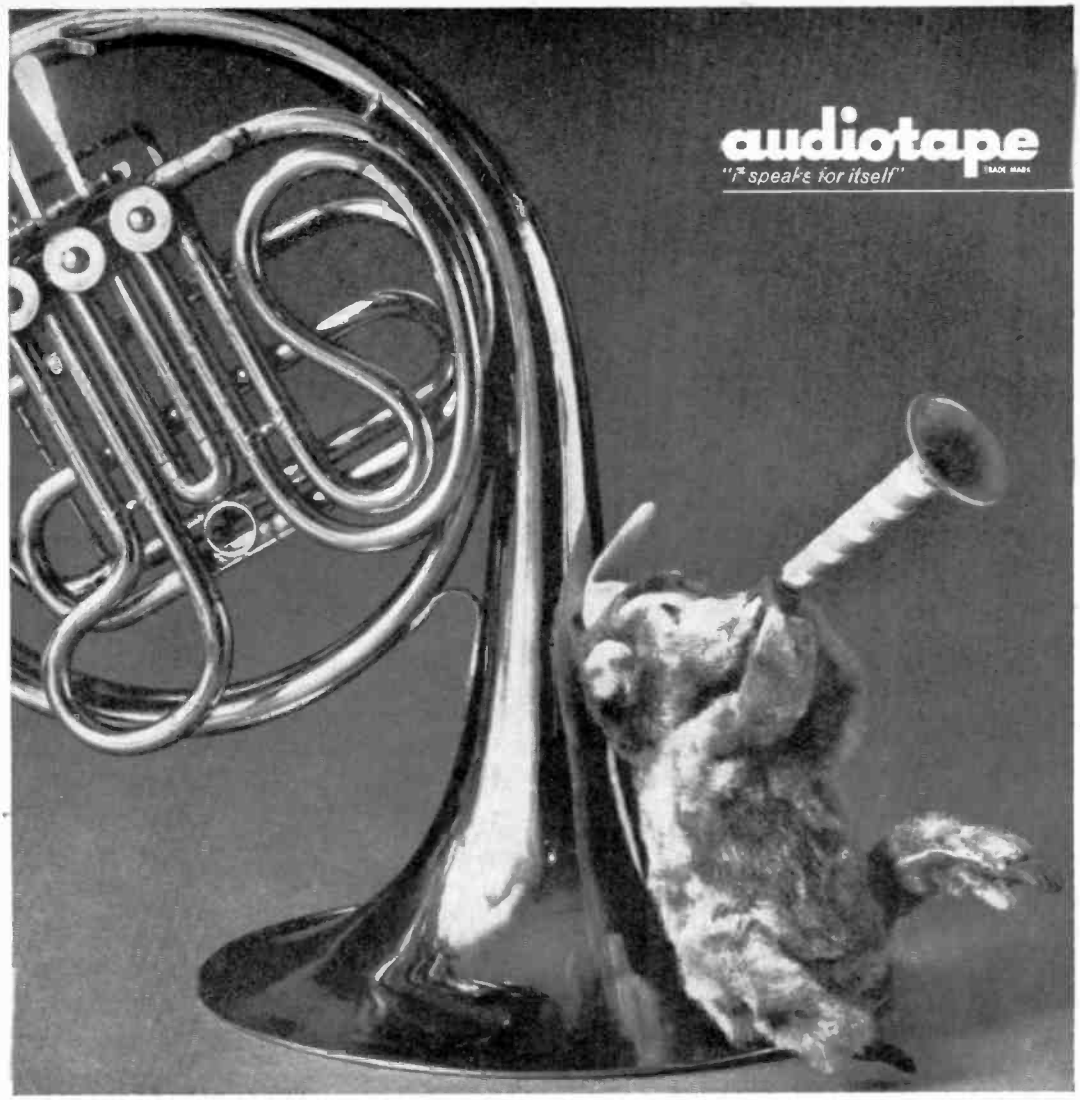
Foreign Advertising Representative
D. A. Goodall Ltd., London, England

Member
Audit Bureau of
Circulations

SUBSCRIPTION SERVICE: All subscription correspondence should be addressed to POPULAR ELECTRONICS, Circulation Department, 434 South Wabash Avenue, Chicago 5, Illinois. Please allow at least six weeks for change of address. Include your old address as well as new—enclosing if possible an address label from a recent issue.

EDITORIAL CONTRIBUTIONS must be accompanied by return postage and will be handled with reasonable care; however, publisher assumes no responsibility for return or safety of art work, photographs or manuscripts.

POPULAR ELECTRONICS is published monthly by Ziff-Davis Publishing Company at 434 South Wabash Avenue, Chicago 5, Illinois. Subscription Rates: One year United States and possessions, $4.00; Canada and Pan American Union Countries, $4.50; all other foreign countries, $5.00. Second Class postage paid at Chicago, Illinois, and at additional mailing offices. Authorized as second class mail by the Post Office Department, Ottawa, Canada, and for payment of postage in cash. April, 1963, Volume 18, Number 4.



BLOW UP A STORM

(Audiotape will capture every note)

We hope some of you haven't tried Audiotape yet. The reason is simple. Those who always use Audiotape tend to get a bit blasé. They expect to get superb reproduction every time. They accept the fact that Audiotape has remarkable clarity and range and the absolute minimum in background noise and distortion. What else is new?

That's why we hope some of you haven't discovered Audiotape. You'll really appreciate us, especially if you enjoy music. Whether you record a Dixieland combo or a hundred-man symphony, Audiotape captures all the sound. Every instrument comes through as clear as life . . . from the deepest, mellowest note of the French horn to the highest, sweetest sound of the trumpet.

So let 'em all blow up a storm. You won't miss a riff or a glissando as long as you have Audiotape. Try it today.

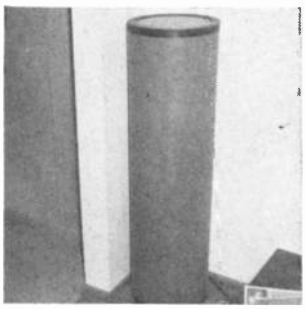
AUDIO DEVICES, INC.
444 Madison Avenue, New York 22, New York
Offices in Los Angeles • Chicago • Washington, D. C.

LETTER TRAY

Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS One Park Avenue, New York 16, N. Y.

"Drainpipe 8"—Disguised

■ A few modifications to the "Drainpipe 8" enclosure ("Clean Sound from the Drainpipe 8," June, 1962, p. 59), and I ended up with the speaker system shown in the photo. By using a 4' pipe and cutting 12" off the "bell" end, I was able to disguise it so that the unit no longer resembles a sewer pipe. Two other modifications included (1) mounting a horn tweeter on the top brace—to help the highs, and (2) instead of painting the unit, covering the entire enclosure with grille cloth. The performance is excellent, and the system draws many favorable comments from those that see and hear it.



BRAD BALZER
Anaheim, Calif.

Peter Galvin Refuted

■ Peter Galvin's letter in the January, 1963, *Letter Tray* is really way out! I have built a great many projects from P.E.'s plans and never had any bad experiences with them. For example, I built 12 models of the "Compactron VHF Receiver" (September, 1961, p. 45) for friends, and didn't have a single "blow-up." Five similar units—built by other people—were sent to me to see if I could discover why they didn't work. The main troubles with these units—and other "don't work" projects, too, I'm sure—were poor solder joints, and incorrect parts substitution and parts placement. So far as I'm concerned, I hope that P.E. continues to publish such fine projects—I'll keep right on building them.

CHARLES H. LATHE, JR.
Oakland, Calif.

■ I agree that inferior parts or deviations from the values given can result in the finished project not working. I have found the construction articles in POPULAR ELECTRONICS to be both good and concise, and in the past nine years I've had no trouble with any project I've attempted. If I happen to want to build something from an older issue, however, I always check the "Out of Tune" column before starting construction just in case there has

(*Continued on page* 8)

Letter Tray

(*Continued from page* 6)

been some kind of a change—I have found this to be a worthwhile practice.

Incidentally, I would like to state that I have *NO* P.E.'s for sale. I own every issue since October, 1954, and I won't give one away, throw one away, or sell any. They are much too handy for reference purposes.

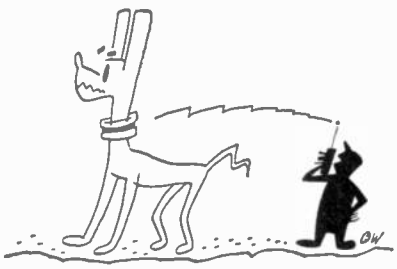
DUTCH MEYER
Chief Engineer, KMSO-TV
Missoula, Mont.

■ I am pleased to say that I have never built a project from P.E. plans that wasn't a success. Among the items I have constructed are a square-wave generator, an electrolytic "restorer," and a power supply—all of which look good and perform beautifully. Since Peter Galvin lives not far from me, I would be glad to have him come over and look at my equipment. Perhaps I can help him determine why he has so much trouble.

ROBERT A. DONALDSON
Box 2181
Paterson, N.J.

Electronic Dog Collar

■ Since I train hunting dogs, I am naturally very much interested in an electronic device that I learned about recently. It's an electronic dog collar which—upon command from a portable transmitter—shocks the dog that happens to be wearing it. The device has an effective range of about ¼ mile, but it's also rather expensive—about $200.00. I



wonder if P.E. could lend a helping hand and publish construction details on such a device—so that I can build my own?

BRUCE HANNON
Ivesdale, Ill.

We've received a number of letters similar to yours, Bruce, and we would like to make public our feeling on such devices. Since there is a possibility that a homemade electronic dog collar might cause injury to a dog—if it's improperly constructed or improperly used—we prefer not to print construction details on one at this time.

(*Continued on page* 10)

DID **YOU** EARN $6,000.00 TO $8,000.00 LAST YEAR?

THESE MEN DID—AFTER COMPLETING GRANTHAM TRAINING

Here, in a nutshell, are their success stories:

"I was a grocery clerk . . ."
(Max D. Reece, Seattle, Washington)

He says: "Before I took the course, I was a grocery clerk." He states that the Grantham course enabled him to gain employment in electronics. (His salary is now over $6,000.00 a year.)

"money saved . . ."
(David R. Karn, Spokane, Washington)

He says: "I worked for Boeing and Lockheed . . . due to Grantham training. With the money I saved from electronics employment, I am now able to attend college." He says the course was "invaluable" in deciding his career.

"test given by employer . . ."
(Douglas E. Evers, Seattle, Washington)

He says that Grantham training ". . . helped greatly in obtaining a high score on the test given by my employer." (Employed in electronics by a large airplane manufacturer. Salary: $7,000.00 a year.)

"would not have been hired . . ."
(Robert F. Henke, Carnegie, Penna.)

He says: "Without Grantham training, I would not have been hired. My job is more satisfying, interesting, and pays much more." (He is engineer at Radio Station KQV. Salary: Over $7,000.00.)

"able to move in . . ."
(E. W. Hale, Arlington, Virginia)

He says: "Was able to move into this job after having Grantham training." (Now employed by a large airline at over $7,000.00 a year. He maintains radio equipment.)

"amazed . . ."
(Douglas S. Atkins, Las Vegas, Nevada)

He says: "I was amazed . . ." at how complete the course is. He credits Grantham with preparing him for his last two promotions. (Earns $6,500.00 plus $3,500.00 in bonus and overtime.)

"wages tripled . . ."
V. Godoshian, Pontiac, Michigan)

He says: "My wages have tripled (since completing the course) . . ." What influence did the course have? "My job depended on it." (He is employed at a radio station. His salary: Over $7,000.00 a year.)

"a classmate told me . . ."
(Antone J. Mello, Grand Rapids, Mich.)

He says that a classmate told him about the opening that led to his present job. (Employed by radio-TV station. Salary: Over $8,000.00 a year. Says GSE training got him his job.)

"by far the best . . ."
(Michael J. Mitchell, Seattle, Washington)

He says: "Your course did help me . . . it is by far the best in its field." (He earns $6,800.00 plus overtime. Also, his part-time electronics company nets him an additional $1,500.00.)

What about other Grantham graduates?

Many others, like these men, have greatly improved their positions after getting their first class F.C.C. licenses through Grantham training. Frequently, these men write to us or drop in at one of our schools to let us know how much the training and the license means to them. And, if we don't hear from them before very long, we write them, to learn what they have been doing since graduating from our school.

As a matter of fact, it wasn't very long ago that we sent out a questionnaire form to a number of our graduates. We wish you could see their replies. Actually, in many cases, these men plainly stated that they could not have advanced so rapidly in their jobs, in both prestige and in salary, if they had not taken our course of training. And, as we expected, this survey proved that the turning point in a man's career often comes when he obtains his first class F.C.C. license.

We are encouraged by their successes. There is no better proof, we feel, that the Grantham course can do big things for others. It can do big things for you. Why not look into it? We invite your inquiry. Use the coupon below and we will send you our brochure by return mail.

A Word About the Course of Instruction:

When you receive our brochure, you will see that Grantham offers *both* home study instruction and resident (classroom) instruction. You will see how these training programs are conducted, the length of time necessary for completion of the course, and all other pertinent information.

The brochure will tell you, for example, that the resident course can be completed in just 12 weeks. It will tell you how you can estimate the length of time necessary for completion of the home study course. And, it will tell you that Grantham School is an accredited member of the National Home Study Council.

GRANTHAM SCHOOL OF ELECTRONICS

1505 N. Western Ave. Hollywood 27, Calif. (HO 7-7727)	408 Marion Street Seattle 4, Wash. (MA 2-7227)	3123 Gillham Road Kansas City 9, Mo. (JE 1-6320)	821-19th Street, NW Washington 6, D. C. (ST 3-3614)

(Mail coupon for complete details)

To: GRANTHAM SCHOOL OF ELECTRONICS
NATIONAL HEADQUARTERS OFFICE
1505 N. Western Ave., Hollywood 27, Calif.

Upon receipt of this coupon, the School will send complete details by return mail. There is no obligation, and no salesman will call. (Please indicate the division of the School in which you are interested.) ☐ Hollywood classes, ☐ Seattle classes, ☐ Kansas City classes, ☐ Washington classes, ☐ Home Study.

Name _____ Age _____
(PLEASE PRINT)

Address _____

City _____

State _____

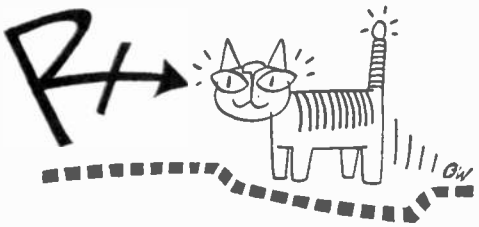
33D

Letter Tray

(*Continued from page* 8)

"Blinky" Transformed

■ After reading about "Blinky" (December, 1962, page 61), I thought it would be nice to build such an animal for my little cousin in the hospital. I changed the plans—to conform to what I thought she would like—and came up with a cat rather



than a bee. The tail as well as the eyes on the cat blink, and a small electric motor makes the cat walk. Fortunately, my cousin brightened up as soon as she saw the gadget, and she was out of the hospital shortly thereafter.

CADET M. G. SINGER
Bordentown Military Institute, N. J.

Congratulations, Cadet Singer. You put your experimenting talents to fine use in cheering up your cousin, and you also showed a lot of ingenuity in redesigning "Blinky" to represent a cat. —30—

Out of Tune

Six-Band Nuvistor Booster (*February*, 1963, *page* 77). The call-outs for resistor *R1* and potentiometer *R2* in the underchassis view should be reversed.

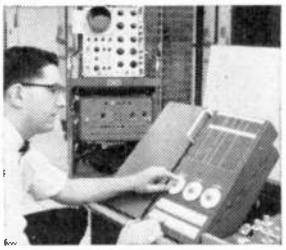
TD/RFG (*February*, 1963, *page* 47). In the following parenthetical statement, "the fundamental will be the highest frequency which will give a zero beat," insert the word *lowest* in place of *highest*.

RF Power Capsule (*February*, 1963, *page* 59). The indication obtained on a milliammeter—as referred to at the bottom of the first column—should be 400 μa. and not 400 ma. Similarly, 750 ma. (*page* 99) should be 750 μa.

Ultrasonic Sniffer (*March*, 1963, *page* 43). The coil nearest the center of the circuit board in the photo at the bottom of the page should be labeled *L2*. —30—

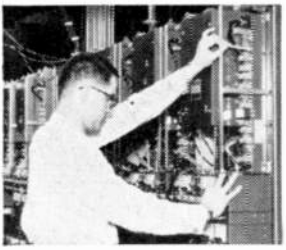
Pick the course for your career...

Electronics Technology



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

Electronic Communications



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

First Class FCC License

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

Broadcast Engineering

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

Get A Commercial FCC License ...Or Your Money Back!

A Commercial FCC License is proof of electronics skill and knowledge. Many top jobs require it . . . every employer understands its significance. In your possession, an FCC Commercial Ticket stamps you as a man who knows and understands electronics theory . . . a man who's ready for the high-paid, more challenging positions.

Cleveland Institute home study is far and away the quickest, most economical way to prepare for the FCC License examination. And that's why we can make this exclusive statement:

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

Before you turn this page, select the program that fits your career objective. Then, mark your selection on the coupon below and mail it to us today. We'll send you . . . without obligation . . . complete details on our effective Cleveland Institute home study. Act NOW . . . and insure *your* future in electronics.

Cleveland Institute of Electronics

1776 E. 17th Street, Dept. PE-3
Cleveland 14, Ohio

Accredited Member

Mail Coupon TODAY For FREE Catalog

Cleveland Institute of Electronics
1776 E. 17th St., Dept. PE-3
Cleveland 14, Ohio

How to Succeed in Electronics

Please send FREE Career Information prepared to help me get ahead in Electronics, without further obligation.

CHECK AREA OF MOST INTEREST—

- ☐ Electronics Technology
- ☐ Industrial Electronics
- ☐ Broadcast Engineering
- ☐ First Class FCC License
- ☐ Electronic Communications
- ☐ _____ other

Your present occupation _____

Name _____ Age ____
(please print)

Address _____

City _____ Zone ____ State _____

Approved for Veteran's Training under Korean GI Bill. PE-3

Hi-Fi Showcase

*A quick look at new products in the stereo/hi-fi field**

FULL-VOLUME stereo is yours any time of the day or night with the new Knight KN-845 stereo headset from *Allied Radio.* Each ear-cup is actually a precision-built, 3½" cone-type dynamic transducer, housed in a carefully designed acoustic chamber. The KN-845's 4- to 16-ohm impedance matches just about any amplifier on the market, and its 25- to 16,000-cycle response provides full-fidelity reproduction. An optional accessory, the KN-846 remote control unit accommodates two KN-845 headsets and allows independent "chairside" control of each. Prices: $19.95 for the headset; $7.95 for the control unit. . . .

Knight KN-845 stereo headset

From *Audio Originals* come two new ideas in equipment enclosures. One—the Model 101—consists of a wall-hanging enclosure measuring 8" x 37¼" x 15¾". It has a compartment for tuners and amplifiers, and a top suitable for a record changer or turntable and a tape recorder; a matching record shelf intended for "eye-height" mounting completes the unit. The second enclosure—the Model 404—is a 30" x 41" x 19½" floor-mounting cabinet. It's equipped with two large drawers—one with mounting board for changer or turntable, the other for records or even a tape recorder. In addition, an "equipment area" measuring 8" x 37¼" x 16" is available for other components. Drawer fronts are obtainable with either accenting cane cloth or matching wood veneers. The Model 101 is available in oiled walnut only and sells for $69.50; the Model 404 is supplied in either oiled walnut or fruitwood finish and is priced at $99.50.

Three new tape recorders—including two

**Write to the manufacturers listed at the end of this column for more data on products mentioned*

A CREI Program helped Edward W. Yeagle advance to project engineer at Barnes Engineering Co., Stamford, Conn.

Are you standing still in electronics while this man advances?

Find out why and do something about it if you have the ambition to want a career instead of just a job

Experience alone is no guarantee of success in electronics today. In this rapidly changing, increasingly complex field, employers demand advanced, up-to-date technical knowledge and this can't be learned on the job. Success comes to men who back up their experience with advanced education in modern electronics. CREI provides this education through industry-recognized home study programs that emphasize immediate application of knowledge acquired. The material a CREI man studies *today* will help him *tomorrow*—as well as in the years ahead.

If you are working in electronics, send for Free 58-page book. It explains how CREI Programs can help you as they have Edward W. Yeagle and thousands of other CREI men in every phase of electronics. Use coupon or write: CREI, Dept. 1204-A, 3224 Sixteenth St., N.W., Washington 10, D. C.

SEND FOR FREE 58-PAGE BOOK

CREI

Founded 1927
Accredited
Member of the
National Home
Study Council

The Capitol Radio Engineering Institute

Dept. 1204-A, 3224 Sixteenth St., N.W., Washington 10, D. C.

Please send me FREE Book describing career opportunities and CREI Programs in advanced electronics. I am employed in electronics and have a high school education.

Name_____ Age____

Address_____

City_____ Zone____ State____

Employed by_____

Type of Present Work_____

Check: ☐ Home Study ☐ Residence School ☐ G.I. Bill 44

Showcase

(*Continued from page* 12)

stereo models—by *Estey Electronics* record and play at either 7½ or 3¾ ips and accept up to 7" reels. Most inexpensive of the three, the Model 207 is a dual-track monaural recorder with a high/low input level switch to allow recording from microphone, radio, phono, tuner, or preamplifier. A safety interlock prevents accidental erasure of recordings, and one knob controls both record and play functions. The two stereo models in the line—Models 430W and 430—are identical except for finish and accessories supplied. Both provide for "sound-on-sound" recordings, both use professional VU-type record level meters, and both are equipped with a digital counter to facilitate locating selections. The Model 430W is supplied in a walnut enclosure, with two external speakers in matching wood cabinets; the Model 430 is finished in black vinyl and supplied less auxiliary speakers. Prices: $99.95 for the Model 207; $299.95 for the Model 430; $379.95 for the Model 430W. . . . From *Fisher* comes a powerhouse of an amplifier capable of driving even the lowest efficiency speakers under any condition. A 6-position input level attenuator is fully compensated for all settings and is graduated in 3-db steps. As for the output stages, push-pull power pentodes—triode-connected—drive two pairs of 8417's to full power output without even the slightest trace of strain. Oversized output transformers afford truly remarkable bass response, and separate bias and balance adjustments provide for optimum settings of operating parameters. Hum and noise are a full 90 db down from the r.m.s. power output (130 watts); harmonic distortion at rated output, 0.25%. Price of SA-1000, $329.50.

The *Ortofon* Model RMG-212 12" professional-type tone arm accepts any cartridge and is adjustable for stylus overhang. Its

Ortofon RMG-212
stereo tone arm

calibrated counter-weight, ball-bearing gimbal suspension, and base are all made of special Swedish alloys; the unique design of

(*Continued on page* 20)

LOWER THE COST OF FUN
WITH VERSATILE TARZIAN TAPE

Make a Priceless Family Heirloom—*The Easy Tarzian Way*

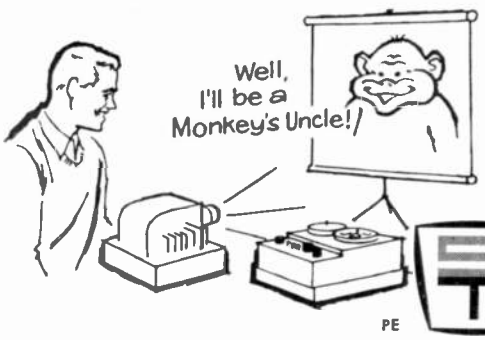
Next time the family gets together for a special occasion... and everytime a high point comes along in the lives of the children and grandchildren...be sure to record the events on long-lasting Mylar*-base Tarzian Tape. The tape will last indefinitely—and so will your pleasure—with a priceless heritage of voices and events unique to your family. Such moments can seldom be repeated, but thanks to Tarzian Tape they can always be remembered.

Double Your Pleasure With an Extra ¼ Inch

Here's good news for owners of battery operated tape recorders. If you feel restricted by the standard 3-inch reel capacity, try the new Tarzian 3¼ inch reel for ½-mil "tensilized" Mylar* tape. Tape footage and available recording time are doubled. You get 600 feet of Tarzian Tape and one full hour of recording at 3¾ i.p.s.—compared to 300 feet and 30 minutes with the old-fashioned 3-inch reel.

Video Plus Audio

Tape recorders and Tarzian Tape pep up your movie and slide shows just as Rodgers worked with Hammerstein —good separately, outstanding together. In addition to straight commentary and music, other voices and sounds can be taped from radio and TV for use as needed—applause, traffic, etc. Speaking of taping from radio and TV, if you use a microphone try wrapping it lightly in a handkerchief to cut down on unwanted outside noise. You're even better off to eliminate the microphone. Obtain a recorder accessory cord with input plug on one end, and alligator clips on the other. The clips can be attached directly to the speaker voice coil.



This Is Tarzian's New Tape Booklet

"Lower the Cost of Fun." It is free, useful, and distills a wealth of information on recorder and tape use and care—into 32 interesting pages. Send for your copy today, or ask for one from your local camera, high fidelity, or tape recorder dealer. Meanwhile, depend on Tarzian Tape to capture every sound with professional fidelity. Available in 1½ and 1-mil acetate, 1-mil and ½-mil Mylar—on 3, 3¼, 5, and 7-inch reels to meet every recording requirement. The price is competitive...the quality is unchallenged.

PE

SARKES TARZIAN, Inc.

World's Leading Manufacturers of TV and FM Tuners • Closed Circuit TV Systems • Broadcast Equipment • Air Trimmers • FM Radios • Magnetic Recording Tape • Semiconductor Devices

MAGNETIC TAPE DIVISION • BLOOMINGTON, INDIANA

Export: Ad Auriema, Inc., N.Y. • Canada: E. J. Piggott Enterprises Ltd., Toronto, Ont.

FREE

ALL NEW 1963 B-A CATALOG

HI-FI & STEREO COMPONENTS AND SYSTEMS

THE OUTSTANDING $$$ SAVING BUYING GUIDE FOR EVERYTHING IN RADIO, TV, ELECTRONICS FOR 35 YEARS

MAIL THIS CARD OR THE COUPON BELOW

SAVE UP TO 50% ON B-A SELECTED KITS

30 PAGES OF BARGAINS NOT IN ANY OTHER CATALOG

100's OF NEW ITEMS LISTED FOR FIRST TIME

TUBES PARTS, ETC. AT VERY LOWEST PRICES

Send for this big book now and see for yourself the amazing money-saving prices on the latest of everything in Electronics. From parts and tubes to complete Hi-Fi systems, you'll get the most for every dollar when you order from this Giant catalog.

B-A has hundreds of items not listed in any other catalog—and all at unbelievable low prices. You'll find page-after-page of • Tools • Kits • Tape Recorders • Phonos • LP Records • Radios • Ham Equipment • Public Address and Intercoms • TV Antennas and Tubes • Photographic Equipment and Film . . . all backed by B-A's money-back guarantee and rushed to you by the fast efficient service developed by over 35 years of mail order experience. You can buy on B-A's Easy Terms—No money down and up to 24 months to pay if you desire.

BURSTEIN-APPLEBEE CO.

Dept. 21, 1012 McGee, Kansas City 6, Mo.

☐ Rush me New 1963 B-A Catalog No. 631.

Name _____

Address _____

City _____ Zone ____ State _____

FREE

ALL NEW 1963 B-A CATALOG

THE OUTSTANDING
$$$ SAVING
BUYING GUIDE
FOR EVERYTHING
IN RADIO, TV,
ELECTRONICS
FOR 35 YEARS

MAIL THIS CARD
OR THE COUPON
BELOW

HI-FI & STEREO COMPONENTS AND SYSTEMS

30 PAGES OF BARGAINS NOT IN ANY OTHER CATALOG

SAVE UP TO 50% ON B-A SELECTED KITS

TOP VALUES IN POWER & HAND TOOLS

100's OF NEW ITEMS LISTED FOR FIRST TIME

Send for this big book now and see for yourself the amazing money-saving prices on the latest of everything in Electronics. From parts and tubes to complete Hi-Fi systems, you'll get the most for every dollar when you order from this Giant catalog.

B-A has hundreds of items not listed in any other catalog—and all at unbelievable low prices. You'll find page-after-page of • Tools • Kits • Tape Recorders • Phonos • LP Records • Radios • Ham Equipment • Public Address and Intercoms • TV Antennas and Tubes • Photographic Equipment and Film . . . all backed by B-A's money-back guarantee and rushed to you by the fast efficient service developed by over 35 years of mail order experience. You can buy on B-A's Easy Terms—No money down and up to 24 months to pay if you desire.

BURSTEIN-APPLEBEE CO.

Dept. 21, 1012 McGee, Kansas City 6, Mo.

☐ Rush me the FREE 1963 B-A Catalog.

Name _____

Address _____

City _____ Zone ___ State _____

Showcase

(*Continued from page* 14)

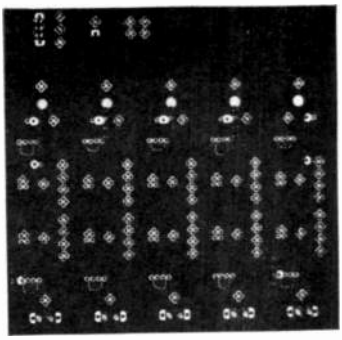
the tone arm itself brings arm resonance down to a sub-audible 8 cycles. Price, complete with shielded plug-in cables, $54.95. . . . ***Roberts Electronics*** has added something new to two of its tape recorders. Models 997 and 1057 now come equipped with an automatic, self-contained head demagnetizer. Used once a week, this device leaves heads in a completely demagnetized condition, preventing any loss of valued signal-to-noise ratio in recorded tapes. . . . A new accessory from ***Robins Industries*** is an easy-to-use stylus-pressure gauge which measures the tracking force of any stylus-and-cartridge assembly between ½ and 8 grams. Calibrated in ½-gram increments, the Model SG-2 works much like a balance, with counter-balance weights permanently in place. Price, $1.45. . . . Another device for phono fans—this one from ***Shure Bros.***—is actually six different "gauges" in "one." By simply punching and folding a card, then inserting ordinary paper clips and pennies, you can make a set of gauges to test six different record-player functions—tracking force, bearing friction, turntable level, arm "set-down" (for automatic players), stack clearance (also for automatic players), and speed (by means of a stroboscopic disc). Price, 20 cents (for postage and handling).

A new 8" hi-fi speaker by ***Sonotone*** delivers smooth response all the way from 45 to 20,000 cycles, with no perceptible dip in the vicinity of the 6000-cycle crossover frequency—thanks to a special, coaxially mounted, cone-type tweeter. Tabbed the Model WR8-BH, the unit handles 20 watts average program material, and peaks up to 40 watts. Only 4½" deep, the WR8-BH is ideal for conventional enclosures as well as the modern slim-line designs. And its screw-type terminal connections are color-coded for easy phasing in multiple speaker setups and stereo systems. List price of the WR8-BH, $13.50.

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.
Audio Originals, 474 S. Meridian St., Indianapolis 25, Ind.
Estey Electronics, Inc., General Magnetics & Electronics Div., 59 Hempstead Gardens Dr., West Hempstead, N.Y.
Fisher Radio Corp., 21-21 44th Dr., Long Island City 1, N.Y.
Ortofon Div., Elpa Marketing Industries, Inc., New Hyde Park, N.Y.
Roberts Electronics, Inc., 5920 Bowcroft St., Los Angeles 16, Calif.
Robins Industries Corp., 15-58 127th St., Flushing 56, N.Y.
Shure Bros., Inc., 222 Hartrey Ave., Evanston, Ill.
Sonotone Corp., Elmsford, N.Y.

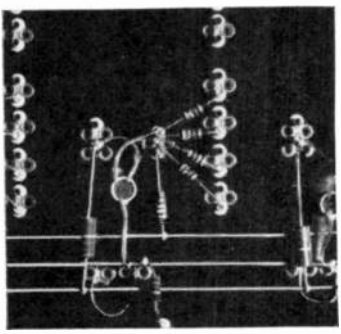
take this panel

(And 15 transistors, 93 resistors plus switches, lights and other professional components.)



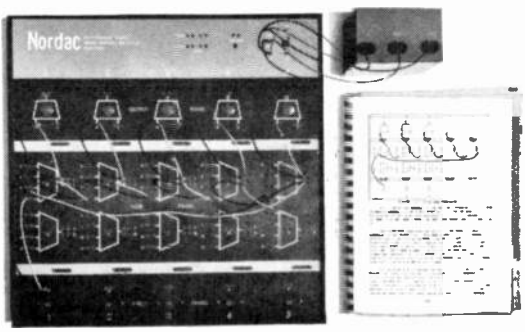
wire it

(With NOR logic circuits, like those in advanced, solid state high-speed computers.)



you've built your own computer!

(And you can program it yourself. Explore the rewarding world of computers with Nordac and its 227-page manual.)



Today computers are running everything from traffic lights to satellites. Tomorrow they will be even more important—in everybody's life, including yours. That is why Nordac was developed. Nordac is the world's first fully-transistorized digital computer kit. With it you can actually demonstrate the principles and operations of million-dollar computer systems. Nordac is your first step in a profitable and rewarding new field. You can build it with ease. It comes with step-by-step assembly instructions and wall diagrams. And Nordac is easy to understand and operate. No prior knowledge of advanced math or science is needed. Your complete kit, together with assembly manual and comprehensive instructive text, to guide you through more than 200 exciting computer experiments, costs just $64.95. How about it? How about entering the fascinating world of machines that think? The way to start? Send in the coupon.

Scientific Educational Products Corporation
Dept. 128
30 East 42nd Street, New York 17, N.Y.

☐ Please rush me complete Nordac kit and comprehensive instruction manual. Satisfaction guaranteed.

☐ Check or money order enclosed ☐ Ship C.O.D.

☐ Send me more information about Nordac and the rewarding world of computers.

Name_____

Address_____

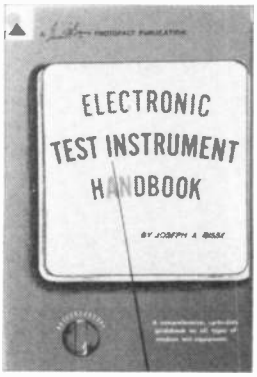
City_____ Zone____ State_____

POP'tronics Bookshelf

ELECTRONIC TEST INSTRUMENT HANDBOOK

by Joseph A. Risse

A comprehensive and up-to-date work on modern test equipment, this book belongs on every test bench.



In addition to discussing the operating principles and functions of the various types of test instruments, material is included on how, when, and where a specific piece of equipment should be used. This practical knowledge can be a valuable aid to anyone who uses electronic test equipment. The instruments covered include VOM's and VTVM's, signal generators, oscilloscopes, and noise and distortion meters, to name just a few.

Published by Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis 6, Ind. 288 pages. Soft cover. $4.95.

BASIC MATH COURSE FOR ELECTRONICS

by Henry Jacobowitz

From cover to cover, this book deals only with mathematics as applied to electronics. Formulas are not merely presented and their use left to the reader; instead, a wide variety of problems—both theoretical and practical—are analyzed. And solutions to problems are *derived*, so that the reader can better understand what's going on, and why. Illustrations and diagrams appear throughout, and the tables are grouped together in the back of the book for handy reference. Each chapter ends with a series of practical exercises.

Published by Gernsback Library, Inc., 154 W. 14th St., New York 11, N.Y. 160 pages. Hard cover, $6.45. Soft cover, $4.50.

(Continued on page 24)

CONTINENTAL '100' (EL 3585) shown on top: transistorized 7 lb., battery portable • records 2 hours on 4" reel, from any source • plays back thru self-contained speaker as well as radio, TV or record player • response: 100-6000 cps • tapes interchangeable with other 2-track 1⅞ ips machines • constant-speed operation • complete with dynamic microphone.

CONTINENTAL '200' (EL 3541) shown bottom right: 4-track stereo head output direct to external stereo preamp for portable high fidelity tape-deck applications • completely self-contained for 4-track mono record and playback • mixing facilities • lightweight, compact • dynamic microphone.

CONTINENTAL '300' (EL 3542) second from top: 4-track stereo playback (tape head output) • self-contained 4-track mono record-playback • 3 speeds • mixing facilities • dynamic microphone • self-contained phono/P.A. amplifier/speaker system • ideal for schools, churches, recreation centers, etc.

CONTINENTAL '401' (EL 3534) bottom left: Four-track stereo and mono recording and playback • 4 speeds • fully transistorized • completely self-contained, including dual recording and playback preamplifiers, dual power amplifiers, two loudspeakers (second in lid) and dual element stereo dynamic microphone • can also be used as a quality hi-fi reproducing system, stereo or mono with tuner or record player • frequency response: 60 to 16,000 cps at 7½ ips • wow and flutter less than 0.4% at 7½ ips • signal-to-noise ratio: —40 db or better.

Compare the special features...Look at the low prices ...Listen to the matchless quality... Choose the 'Continental' most suitable for your requirements... For literature and free demonstration, write: Dept. E-4

Norelco®

NORTH AMERICAN PHILIPS COMPANY, INC., High Fidelity Products Division, **230 Duffy Ave., Hicksville, L. I., N. Y.**

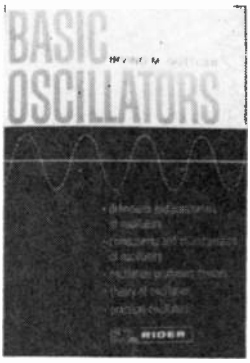
IN CANADA AND THROUGHOUT THE FREE WORLD, NORELCO CONTINENTAL IS KNOWN AS 'THE PHILIPS'.

Bookshelf

(*Continued from page 22*)

BASIC OSCILLATORS

by Irving M. Gottlieb



The encyclopedic treatment of oscillators contained between the covers of this single volume is intended for the technically minded—be they engineers, scientists, technicians, experimenters, or hobbyists. First, the basic principles and parameters involved in the subject of oscillators are defined. The text then treats the individual elements in which oscillation is induced—*LC* circuits, crystals, transmission lines, etc. Finally, after a thorough discussion of the various devices that cause oscillation, the author describes and analyzes the many oscillator circuits encountered in modern electronic practice.

Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York 11, N.Y. 208 pages. Soft cover. $4.50.

ABC'S OF COMPUTER PROGRAMMING

by Allan Lytel

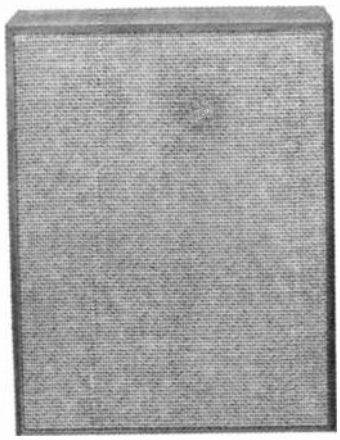
Another in Sams' popular "ABC's" series, *ABC's of Computer Programming* is intended to help the reader understand the principles and techniques of modern digital computer programming. It presents all programming fundamentals and gives specific examples of the various methods which can be used by the programmer. Punch-card machines are described, and different computer types are used as illustrative material to point out the resources a programmer has at his disposal to handle any given problem. This book is recommended for anyone considering computer programming as a field of employment, or simply looking for a source of general information on the subject.

Published by Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis 6, Ind. 128 pages. Soft cover. $1.95. —30—

Who could possibly build a genuine 3-way speaker system, with LC dividing network and 5 pounds of magnet, into a true Slim-Line enclosure—for only $59.50?

You!

(with the Fisher KS-1 StrataKit)



A 10-inch free-piston woofer with 30-cps free-air resonance . . . a 5-inch closed-back midrange driver . . . a 3-inch super-tweeter . . . a combined magnet structure weighing approximately 5 pounds...an inductive-capacitive dividing network with heavy air-core coils and crossovers at 1500 and 5000 cps . . . a magnificent 18-by-24-inch cabinet only 5¾ inches deep . . . plus lots of high-absorbency AcoustiGlas padding.

That's what goes into the *only* true Slim-Line loudspeaker system you can buy in kit form.

What comes out? The kind of sound you'd expect to hear from a $150 speaker system. How do you do it? Simply by installing the driver units, connecting the network and completing the preassembled cabinet. How does Fisher do it? With ingenious driver and crossover design and by balancing all speakers at the factory for over-all smoothness of response.

The Fisher KS-1 can be mounted on a wall, placed in a bookshelf or allowed to stand on the floor. Legs optional. Price, in unfinished sanded birch, $59.50.*

FREE! $1.00 VALUE! The Kit Builder's Manual: a new, illustrated guide to high-fidelity kit construction.

The Kit Builder's Manual

Fisher Radio Corporation
21-52 44th Drive
Long Island City 1, N.Y.

Please send me without charge The Kit Builder's Manual, complete with detailed information on all Fisher StrataKits.

Name_____

Address_____

City_____ Zone_____ State_____

10412

The Fisher

*IN UNFINISHED WALNUT, $64.50. FACTORY-ASSEMBLED, IN SANDED AND FINISHED BIRCH, $84.50; IN OILED WALNUT $89.50. PRICES SLIGHTLY HIGHER IN THE FAR WEST. EXPORT: FISHER RADIO INTERNATIONAL, INC., LONG ISLAND CITY 1, N.Y. CANADA: TRI-TEL ASSOCIATES, LTD., WILLOWDALE, ONT.

New Products

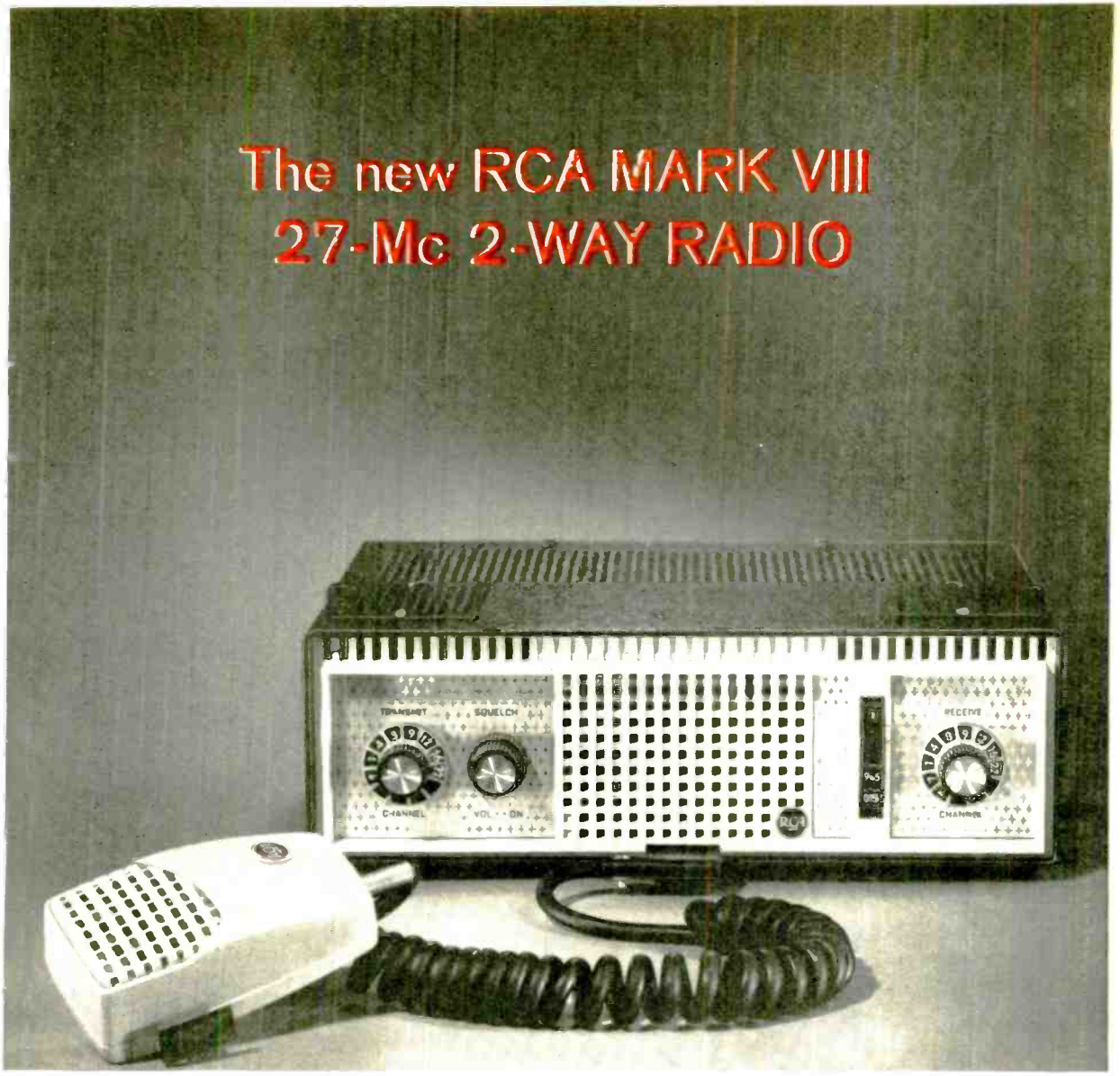
VOLTAGE ADJUSTERS

Abnormally high or low a.c. line voltages are changed to the normal 117 volts a.c. by either of two new Terado voltage adjusters. The "Planet" (Model 50-203) and the "Polaris" (Model 50-204) are for use with devices drawing up to 300 and 500 watts, respectively. Since electrical equipment works best when operating from the line voltage it was designed for, these adjusters can improve reception on TV sets, increase the fidelity of stereo and hi-fi equipment, and increase the speed of small motors—such as those on electric drills. To use either model, you simply plug your equipment into the adjuster and plug the adjuster into the a.c. outlet. Prices: "Planet," $7.80; "Polaris," $9.20. (*Terado Corp.*, 1057½ Raymond Ave., Saint Paul 8, Minn.)

HEADSET/MICROPHONE COMBINATION

Primarily designed for classroom use, the SONO/COM headset/microphone (SHM-1000) can also be used for mono and stereo hi-fi reproduction in the home. It teams Sonotone's rugged ceramic "boom" microphone (SB-3000) with its new high-performance headset (SH-2000). The microphone motor is inherently immune to extremes of temperature and humidity and is neoprene-encased for durability. Available in four colors, the SONO/COM is supplied with ear cushions

The new RCA MARK VIII
27-Mc 2-WAY RADIO



More Features · Improved Performance · AT A LOWER PRICE

Here is THE outstanding bargain today in a 2-way Citizens' Band radio: THE NEW RCA MARK VIII. Compact, dependable, simple to operate, it outperforms and offers more features than even the famous RCA Mark VII.

Look what this remarkable new unit offers you:

- 9 crystal-controlled transmit and receive channels
- Tunable receiver for reception of 23 C-B channels; dial marked in both channel numbers and frequency
- Exceptionally good voice reproduction—high intelligibility
- Maximum allowable transmitter input of 5 watts*—nominal output of 3 watts or more
- Highly selective superheterodyne receiver with one rf and two if amplifier stages
- Operates from standard 117-volt AC; separate DC power supply (optional) for mobile installations (you don't pay for unnecessary power supplies)
- Electronic switching—no relay noise or chatter
- Illuminated "working channel" feature
- Light and compact—only 3½ inches high, weighs only 8 pounds with mike; fits easily under the dashboard of even a compact car
- Improved Automatic Noise Limiter to reduce effects of ignition and similar interference

plus many more features to increase its usefulness and efficiency.

The new low Mark VIII price $149.50**
puts 2-way radio convenience within reach of everyone

GET THE FULL STORY; FILL OUT AND SEND IN THE COUPON BELOW

RCA Electron Tube Division, Commercial Engineering, Dept. D-133-R
415 South Fifth Street, Harrison, New Jersey

Please! Rush more information on the new RCA Mark VIII 2-way Citizens' Band Radio.

Name_____

Address_____

City_____ Zone_____ State_____

*Maximum plate input power to final radio-frequency amplifier stages as defined by FCC regulations

**Optional list price

The Most Trusted Name in Electronics

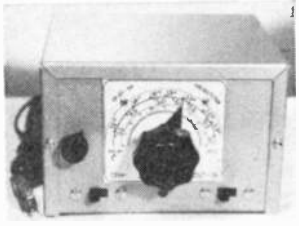
Products

(*Continued from page* 26)

for a close comfortable fit—even with glasses. The "boom" mike can be used with other headsets if desired. Price, $36.75 complete; headset only, $23.75; ceramic microphone only, $13.00. (*Sonotone Corp.*, Electronic Applications Division, Elmsford, N. Y.)

PRESELECTOR KIT

The Holstrom SK-20—a tunable, self-powered preselector—will pep up your present receiver on any frequency between 3.5 and 30 mc. A compact and attractive kit, it is said to boost the signal of general-coverage receivers by 3-6 "S" units. Coaxial input and output connectors are supplied, along with RG/58-U cable for connecting the SK-20 to your receiver. And, thanks to an "In/Out" switch, the SK-20 can remain connected to the receiver even when the preselector's not in use. The complete kit is priced at $18.99. (*Holstrom Associates*, P.O. Box 8640, Sacramento 22, Calif.)



MOBILE PA AMPLIFIER

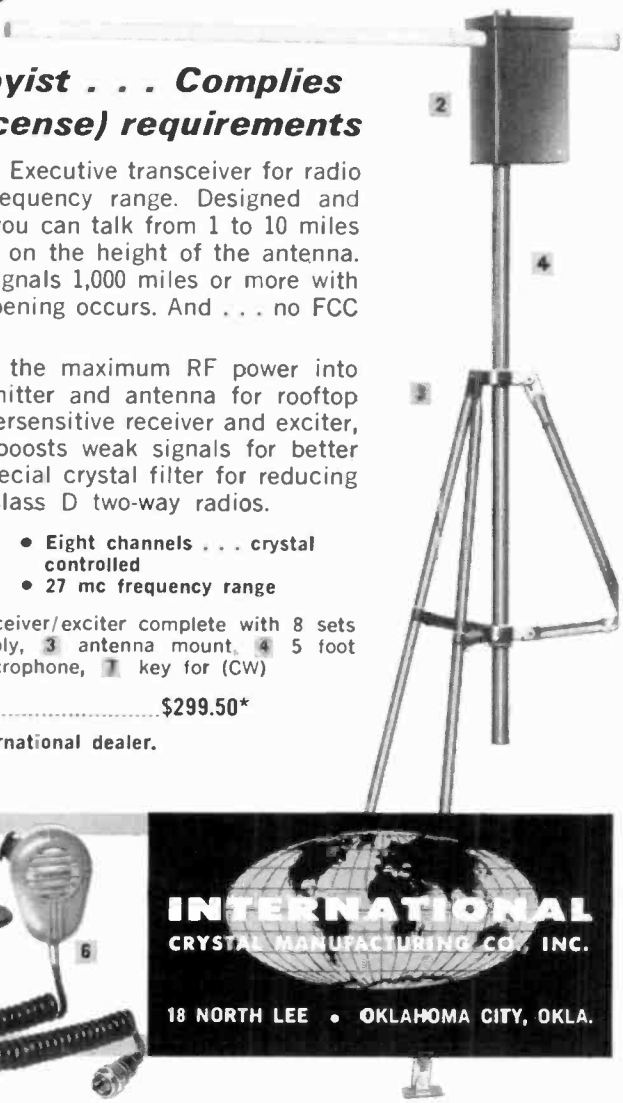
A 30-watt, all-transistor mobile p.a. amplifier, the Knight KN-3230M weighs only 11 pounds. The unit has two inputs for mike and phono, operates from 12 volts d.c., and has an idling current drain of 0.25 amp (it draws only 4.5 amp at full rated output). Frequency response is 100 - 10,000 cycles, ±3 db, with hum and noise down 67 db. A master tone control—as well as separate

mike and phono volume controls—is provided, as are outputs for 4-, 8-, and 16-ohm speakers. Available accessories include an a.c. power pack, which allows the amplifier to be operated from a 117-volt a.c. line, and

NEW!

INTERNATIONAL EXECUTIVE TRANSCEIVER

Model *1500*



Designed for the Hobbyist . . . Complies with FCC Part 15 (no license) requirements

Here is International's new Model 1500 Executive transceiver for radio communication within the 27 mc frequency range. Designed and engineered for phone and cw (code), you can talk from 1 to 10 miles with other Part 15 stations depending on the height of the antenna. You are also permitted to work skip signals 1,000 miles or more with other Part 15 stations when a band opening occurs. And . . . no FCC license is required.

This feature packed transceiver puts the maximum RF power into the antenna by combining the transmitter and antenna for rooftop mounting. A second unit houses a supersensitive receiver and exciter, while a preamplifier at the antenna boosts weak signals for better reception. Other features include a special crystal filter for reducing interference from adjacent channel Class D two-way radios.

- **100 milliwatts input / 60" antenna**
- **115 vac operation**
- **Phone and CW**
- **Eight channels . . . crystal controlled**
- **27 mc frequency range**

A complete, "ready to go", package. 1 receiver/exciter complete with 8 sets of crystals, 2 transmitter/antenna assembly, 3 antenna mount, 4 5 foot mast, 5 100 feet of control cable, 6 microphone, 7 key for (CW)

Model 1500 transceiver complete.....$299.50*

See the Model 1500 transceiver at your International dealer.
* other models from $80.00

INTERNATIONAL
CRYSTAL MANUFACTURING CO., INC.
18 NORTH LEE • OKLAHOMA CITY, OKLA.

Write today for International's 1963 catalog.

Products

(*Continued from page* 28)

a "phono-top" that will play 33⅓-, 45-, and 78-rpm records up to 12" in diameter. Price of the KN-3230M, $69.95. (*Allied Electronics Corp.*, 100 N. Western Ave., Chicago 80, Ill.)

UP-TO-DATE TUBE TESTER

Sockets for all the newer tubes, as well as previous popular types, are included on the front panel of Seco's Model 88 tube tester. The meter reads grid emission and all common leakage and short faults in one step. Filament continuity and open elements are also indicated, as well as cathode emission, in a special low-impedance circuit. Grid circuit and tube-merit test scales show all tube faults quickly and accurately on a single burnout-proof meter. The Model 88 is unconditionally guaranteed to be up-to-date—adapter kits or set-up data will be furnished without cost for any new tube types which appear within one year of purchase. Simple operation and compact size make the tester easy to handle. Price, $69.50. (*Seco Electronics, Inc.*, 1201 S. Clover Drive, Minneapolis 20, Minn.)

FLUORESCENT BALLAST KIT

Old pre-heat fluorescent fixtures can be converted to rapid-start operation with the "Convert-A-Ballast Kit." The kit provides the latest rapid-start circuit and four modern, prewired sockets—to handle two 40-watt lamps—for updating old fashioned fixtures. And it eliminates an all-too-often source of trouble: the starter. No change in lamp type is necessary when converting to this circuit—just continue to use the lamp already in the socket. The kit is factory-wired, reducing the chance of installation error. Price, $8.50. (*Jefferson Electric Co.*, Bellwood, Ill.) —30—

BUILD 20 RADIO CIRCUITS AT HOME

with the New

PROGRESSIVE RADIO "EDU-KIT"®

Reg. U.S. Pat. Off.

A Practical Home Radio Course

only **$26.95**

Training Electronics Technicians Since 1946

Now Includes

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

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ EXCELLENT BACKGROUND FOR TV
- ★ School Inquiries Invited
- ★ Sold In 79 Countries

YOU DON'T HAVE TO SPEND
HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

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

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build 20 Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $26.95. 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 use 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 twenty Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector Circuits. These are not unprofessional "breadboard" experimental 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 instruction necessary to build 20 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, selenium rectifiers, volume controls and switches, etc.

In addition, you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code instructions and the Progressive Code Oscillator, in addition to F.C.C.-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.

FREE EXTRAS

• SET OF TOOLS

- • SOLDERING IRON
- • ELECTRONICS TESTER
- • PLIERS-CUTTERS
- • ALIGNMENT TOOL
- • WRENCH SET
- • VALUABLE DISCOUNT CARD
- • CERTIFICATE OF MERIT
- • TESTER INSTRUCTION MANUAL
- • HIGH FIDELITY GUIDE • QUIZZES
- • TELEVISION BOOK • RADIO TROUBLE-SHOOTING BOOK
- • MEMBERSHIP IN RADIO-TV CLUB: CONSULTATION SERVICE • FCC AMATEUR LICENSE TRAINING
- • PRINTED CIRCUITRY

SERVICING LESSONS

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

FROM OUR MAIL BAG

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

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

Robert L. Shull, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Trouble-shooting 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.

UNCONDITIONAL MONEY-BACK GUARANTEE

ORDER DIRECT FROM AD—RECEIVE FREE BONUS RESISTOR AND CONDENSER KITS WORTH $7

- ☐ Send "Edu-Kit" postpaid. I enclose full payment of $26.95.
- ☐ Send "Edu-Kit" C.O.D. I will pay $26.95 plus postage.
- ☐ Rush me FREE descriptive literature concerning "Edu-Kit."

Name. .....

Address. .....

.....

PROGRESSIVE "EDU-KITS" INC.

1186 Broadway, Dept. 603D, Hewlett, N. Y.

The following satellites, launched by the United States, were reported to have beacon and telemetry transmissions as of February 12, 1963. The satellites are listed by their code names, according to frequency; because some transmit on more than one frequency, they appear more than once.

Transit IVA	54.000 mc.
Courier 1B	107.970 mc.
TIROS I	107.997 mc.
TIROS III	108.000 mc.
Vanguard I*	108.024 mc.
TIROS III	108.030 mc.
Telstar	136.050 mc.
Explorer XV	136.101 mc.
Relay I	136.140 mc.
Transit IVA	136.200 mc.
Explorer XVI	136.200 mc.
TIROS IV	136.230 mc.
TIROS V and TIROS VI	136.235 mc.
Ariel	136.408 mc.
Explorer XIV	136.440 mc.
Injun SR-3	136.500 mc.
Alouette	136.590 mc.
Relay I	136.620 mc.
Traac*	136.650 mc.
OSO I	136.744 mc.
Transit IVB	136.800 mc.
Anna 1B	136.815 mc.
Explorer XVI	136.858 mc.
TIROS IV	136.920 mc.
TIROS V and TIROS VI	136.922 mc.
Alouette	136.979 mc.
Transit IVA	150.000 mc.
Transit VA	150.000 mc.
Transit IIA	161.990 mc.
Transit IIA	215.990 mc.
Midas IV	228.200 mc.
Midas IV	232.400 mc.
Transit VA	400.000 mc.

*Signal may be very weak

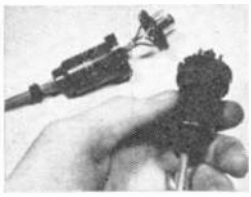
There are several more satellites in orbit which may be transmitting. However, these are so-called "secret" satellites launched by the U.S. Air Force.

If you're interested in eavesdropping on satellites, and missed our June 1962 article on the NASA-136 converter, we recommend that you look it up. Easy to construct, this sensitive converter can intercept the satellites operating in the 136-137 mc. band.

Tips and Techniques

CONVERT OLD METAL TUBES TO INEXPENSIVE PLUGS

Don't throw out those metal tubes you've removed from old pieces of electronic equipment; you can put them to use as inexpensive plugs for auxiliary power sockets. With a screwdriver, pry open the tabs that hold the body and base together. Then break the glass bond between the base and body—a tap or two against a hammer head or some other hard surface should do the trick—but be sure to wrap the tube in a cloth first, so glass fragments will not fly loose and inflict injury. Now, using a soldering iron and pliers, remove the wires connecting the tube elements to the pins, and discard the elements. If there is a grid cap, break it off and enlarge the hole to accept a rubber grommet—if not, drill a suitable hole and insert the grommet. After hooking up the cable—as shown in the photo—bend the tabs back in place to secure the body to the base. —*Robert E. Kelland*



DUAL-PURPOSE INDICATOR LAMP

Want a double-duty B+ indicator lamp that will let you know when the B+ is on and when the filter capacitors have discharged? All you need—in addition to your power supply—is an NE-2 neon lamp; a socket for it; and a 150,000-ohm, ½-watt resistor. Install the socket on the front panel, and wire it so that one side of the bulb goes to the lead connecting the bleeder resistor and the final filtering capacitor. (If there is no bleeder in the supply, hook the wire to the final capacitor and the filter choke.) The other side of the socket should be wired to the 150,000-ohm resistor, and the other end of the resistor grounded. Now, when the

(*Continued on page* 37)

NOW! at a price you can afford!

MAKE MORE MONEY in ELECTRONICS

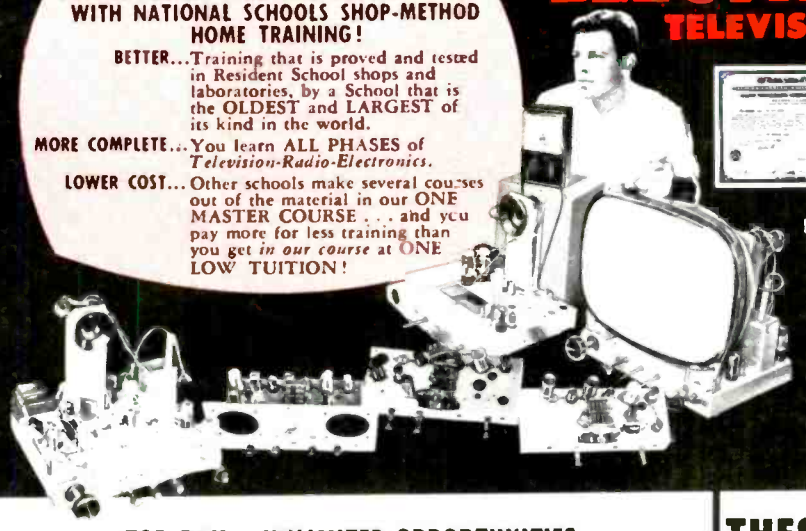
TELEVISION-RADIO

BETTER...MORE COMPLETE...LOWER COST... WITH NATIONAL SCHOOLS SHOP-METHOD HOME TRAINING!

BETTER... Training that is proved and tested in Resident School shops and laboratories, by a School that is the OLDEST and LARGEST of its kind in the world.

MORE COMPLETE... You learn ALL PHASES of *Television-Radio-Electronics.*

LOWER COST... Other schools make several courses out of the material in our ONE MASTER COURSE . . . and you pay more for less training than you get *in our course* at ONE LOW TUITION!



Prepare for your F.C.C. LICENSE

Be prepared for secure future in
- INDUSTRIAL ELECTRONICS
- COMPUTERS
- GUIDED MISSILE SYSTEMS
- ELECTRONIC CONTROLS

or go into . . .
- COLOR TV REPAIR
- HI-FI AND SOUND SYSTEMS
- BROADCASTING STUDIOS
- INSTALLATION

TOP PAY... UNLIMITED OPPORTUNITIES LIFETIME SECURITY CAN BE YOURS!

You are needed in the Television, Radio, and Electronics industry! Trained technicians are in growing demand at excellent pay—in ALL PHASES, including Servicing, Manufacturing, Broadcasting and Communications, Automation, Radar, Government Missile Projects.

NATIONAL SCHOOLS SHOP-METHOD HOME TRAINING, with newly added lessons and equipment, trains you in your spare time at home, for these unlimited opportunities, including many technical jobs leading to supervisory positions.

YOU LEARN BY BUILDING EQUIPMENT WITH KITS AND PARTS WE SEND YOU. Your National Schools course includes thorough Practical training—YOU LEARN BY DOING! We send you complete standard equipment of professional quality for building various experimental and test units. You advance step by step, perform more than 100 experiments, and you build a complete TV set from the ground up that is yours to keep! A big, new TV picture tube is included at no extra charge.

EARN AS YOU LEARN. We'll show you how. Many students pay for their course—and more, while studying.

YOU GET...

- 19 Big Kits—YOURS TO KEEP!
- Friendly Instruction and Guidance
- Job Placement Service
- Unlimited Consultation
- Diploma—Recognized by Industry
- EVERYTHING YOU NEED FOR SUCCESS!

IMPORTANT SEE OTHER SIDE

THESE TWO FREE BOOKS TELL HOW

SEND FOR FREE FULLY-ILLUSTRATED BOOK AND ACTUAL LESSON TODAY.

Your own copy of "Your Future In Electronics-Television-Radio" will be mailed to you at once. No salesman will call; there is no obligation. Cut out card along dotted lines, fill in and mail today!

NO POSTAGE NECESSARY.

GET THE BENEFIT OF OUR OVER 55 YEARS EXPERIENCE

APPROVED FOR GI TRAINING

ACCREDITED MEMBER

NATIONAL TECHNICAL SCHOOLS

World-Wide Training Since 1905

Write to Dept. R2G

4000 So. Figueroa Street

Los Angeles 37, California

CUT OUT AND MAIL THIS CARD TODAY

Yes, I want to make more money in Electronics-TV-Radio. Send me your **FREE** Fully-Illustrated Opportunity Book and Actual Lesson today.

RUSH TODAY—NO POSTAGE NECESSARY

Name _____ Age _____

Address _____

City _____ Zone _____ State _____

☐ Check here if interested only in Resident Training at Los Angeles.
Veterans: Give date of discharge _____ R2G-43

NO SALESMAN WILL CALL; NO OBLIGATION ON YOUR PART

DON'T BE HALF-TRAINED

Be a MASTER TECHNICIAN in ELECTRONICS-TV-RADIO

Only N.T.S. offers you ALL 8 PHASES in ONE MASTER COURSE

SUCCESS IS THEIRS; IT CAN BE YOURS TOO!

I cannot praise N.T.S. enough. I've just graduated and already I have started repairing radios and servicing TV's . . . At 53, I'm starting a new life and my diploma from National Technical Schools is my proudest possession.

William E. Eckenrod

As field director of Berean Mission Inc., I have complete charge of our radio work. With the expert advice and training I am receiving from you I can do my own repairs on our recorders and P.A. systems, besides keeping our radios going. My training from N.T.S. helps keep us on the air. I feel privileged to be a member of such a fine institution.

Rev. Enoch P. Sanford

Thanks to N.T.S. I have a business of my own right in my home. I have paid for all my equipment with money earned servicing TV sets. Yes, N.T.S. gave me my start in television.

Louis A. Tabat

I have a TV-Radio shop in Yorkville, Illinois, about 4 miles from my home, and it has been going real good. I started part-time but I got so much work that I am doing it full-time. Thanks to National Technical Schools.

Alvin Spera

SEE OTHER SIDE

ALL 8 PHASES IN ONE MASTER COURSE

PHASE 1 TELEVISION INCLUDING COLOR TV
90% of homes have at least one set. Color TV is becoming more popular daily. TV Stations grow in number, need technicians. Maintenance and repair offer big opportunities.

PHASE 2 RADIO—AM & FM
Radios in homes, cars, schools, all need expert upkeep. Stations expand as FM becomes popular. Now transistors boom entire field.

PHASE 3 INDUSTRIAL ELECTRONICS
Computers, Data-Processing machines, Electronic Controls, Guided Missile Systems are new fields where Electronics play a vital role.

PHASE 4 SOUND SYSTEMS
New popularity of Hi-Fi-Stereo, as well as industrial sound systems and business intercoms make this a highly specialized and important field.

PHASE 5 FCC LICENSE PREPARATION
FCC License holders have a wide range of top jobs open to them. FCC License now a requirement for most Communication jobs.

PHASE 6 RADAR AND MICROWAVES
These are the communications systems of the future, already used in tracking and cont acting satellites.

PHASE 7 AUTOMATION & COMPUTERS
Automation and Computer electronics are the new tools of industry and commerce. Skilled Technicians in these fields are in great demand at top pay.

PHASE 8 BROADCASTING & COMMUNICATIONS
In the entertainment industry, or in commerce, communications and broadcasting have great importance. Installation and maintenance of equipment requires trained technician know-how.

FIRST CLASS
Permit No. 3087
Los Angeles, Calif.

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

— POSTAGE WILL BE PAID BY —

NATIONAL TECHNICAL SCHOOLS
WORLD-WIDE TRAINING SINCE 1905
4000 So. Figueroa Street
Los Angeles 37, California

RESIDENT TRAINING AT LOS ANGELES
If you wish to take your training in our famous Resident School in Los Angeles—the oldest and largest school of its kind in the world—check special box in coupon.

Approved for GI Training

NATIONAL TECHNICAL SCHOOLS
WORLD-WIDE TRAINING SINCE 1905

Address correspondence to Dept. R2G
4000 So. Figueroa Street
Los Angeles 37, California

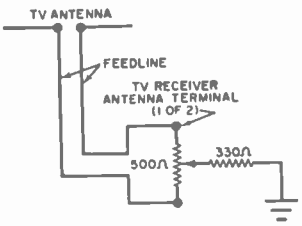
National Technical Schools also offers Complete Home Study Training Programs in Auto Mechanics & Diesel, Air Conditioning, Refrigeration-Electrical Appliances, and Home Appliances Repair. For information and FREE BOOK write the School, Dept. RDC, stating course desired.

Tips (*Continued from page* 34)

B+ is on, the neon bulb will light; and when the supply is turned off, the bulb will remain lit until the filter capacitors have discharged. —*Charles Craft, WPE3BIK*

PHASE CONTROL ELIMINATES TV GHOST

Do you have an unwanted guest whenever you watch television? Well, if he's only a ghost on your TV screen, a flick of the wrist —while holding the right knob—can cause him to vanish.



Simply install a 500-ohm, non-inductive potentiometer across the antenna terminals of your TV set (see schematic) and a 330-ohm resistor from the potentiometer center tap to ground. (Use a water pipe, or any source other than the chassis for the ground connection.) When you see a ghost, just vary the pot—in most cases, you'll kill him on the spot. You're actually loading one side of the feedline and in turn balancing out the other side—matching the feedline and antenna impedance to that of the TV set.

—*Dudley McCown*

FUSE CARTRIDGE MAKES STURDY DRILL BIT-HOLDER

Drill bit storage is always a problem. One solution is to employ fuse cartridges as storage containers.

These cartridges—used in many high-current fuse boxes—have brass ends which can be unscrewed to replace the fuse element. Just unscrew the ends of a cartridge, remove the damaged fuse element, and replace one end. Then, when you slip your bits in the other end and screw *that* cap on, you'll have a small but sturdy bit-holder that won't take up much room in your tool box.

—*Kent A. Mitchell, W3WTO*

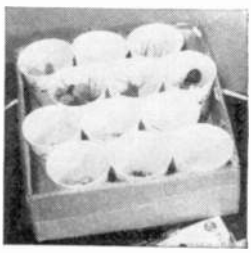
(*Continued on page* 38)

Tips

(*Continued from page 37*)

RESISTOR AND CAPACITOR FILE

Having trouble keeping track of your stock of resistors and capacitors? Here's a handy little filing system: 12 containers—paper drinking cups work fine—and a cardboard box to keep them in. Half the cups hold resistors and the other half capacitors. The first cup of resistors contains values from 10 to 99 ohms (black third band), the second cup values from 100 990 ohms (brown third band), and so on. The capacitors are arranged similarly in the other cups. When you look for a specific value, you won't have to go through too many components, and you can easily pour the contents of a cup into your hand for a better look.



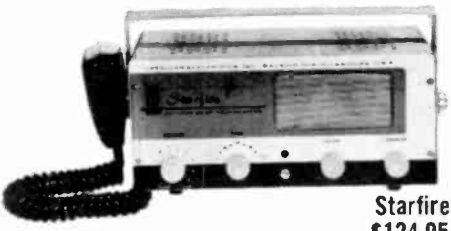
—Stanley E. Bammel

COMING NEXT MONTH

The three triodes that grace next month's cover tie in to a Lou Garner story on the vacuum tube's family tree. You'll find his fascinating account of the discovery and development of the various types of vacuum tubes of great interest. This is the first of two parts.

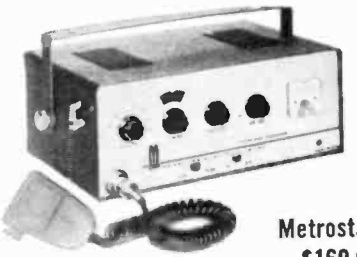
ON SALE APRIL 25

- **CRYSTAL CHECKER**
  Lives there a CB'er without several dozen extra crystals on hand? This simplified crystal checker will help CB'ers weed out the good and the bad.
- **WIRELESS EARPHONE**
  Here's a project you may have been putting off as being too complex for you to build. It's an induction loop transmitter and receiver combination built out of transistor modules.
- **OUR HEARTLESS FRIEND—THE ROBOT**
  Well-known science writer D. S. Halacy brings us up to date on robot technology. You'll be surprised to know you can buy one off-the-shelf!



Starfire
$124.95

DeVille
Available soon



Metrostar
$169.95

METROTEK
has them all!

Power-packed citizens band equipment for every purse and purpose:

From the soon to be available DeVille transceiver by Metrotek . . . the 23 channel all crystal controlled unit with distinctive performance . . . to the quality built low cost Starfire . . . the dependable performer with the crisp sound — Metrotek has a complete line of value-packed transceivers plus auxiliary equipment.

Metrotek also has available the unique Monocall . . . a selective calling device that is fast becoming the standard of quality and performance in the industry.

If you'd like more information and detailed specifications on any of the Metrotek models, just fill out the coupon below. Dealer inquiries are also invited.

Space Station
Available soon

Power Pack
12-volt $18.00
6-12 volt $22.70

Monocall Encoder $39.95
Monocall Encoder-Decoder $79.95

Metrotek's 66
Available soon

METROTEK ELECTRONICS, INC.
205 W. Cabarrus St., Raleigh, N. C.

I would like more information on _____

_____

NAME _____

ADDRESS _____

CITY _____ STATE _____

BEST BUYS IN STEREO AND MONO HI-FI

Transistorized Stereo/Mono 4-Track Tape Deck RP100
Semikit (electronics in kit form) $299.95 Wired $399.95

New Stereo FM Multiplex Tuner ST97
Kit $99.95* Wired $149.95*

FM-AM Stereo Tuner ST96
Kit $89.95* Wired $129.95*
*Incl. FET

70-Watt Integrated Stereo Amplifier ST70
Kit $99.95 Wired $149.95

40-Watt Integrated Stereo Amplifier ST40
Kit $79.95 Wired $129.95

28W Integrated Stereo Amplifier HF81
Kit $69.95 Wired $109.95

FM Tuner HFT90
Kit $39.95 Wired $65.95
Incl. FET Metal Cover $3.95

AM Tuner HFT94 Incl. FET
Kit $39.95 Wired $65.95

Stereophonic Dual Preamplifier ST84
Kit $59.95 Wired $89.95

Stereo Power Amplifiers

	Kit	Wired
70W HF87A:	$74.95	$114.95
100W HF89A:	$99.50	$139.50
28W HF86:	$43.95	$ 74.95

FM-Multiplex Autodaptor MX99
Kit $39.95 Wired $64.95
Cover Optional, $2.95
(Patents Pending)

Bookshelf Speaker System HFS1 Kit $39.95 Wired $47.95

BEST BUYS IN CITIZENS TRANSCEIVERS, HAM GEAR, RADIOS

Citizens Band Transceivers 770 Series from
Kit $79.95
Wired $109.95

U. S. Pat.

60W CW Transmitter #723
Kit $59.95 Wired $89.95

Walkie-Talkie Citizens Band Transceiver #740
Kit $54.95.
Wired $79.95.
Complete with rechargeable battery & charger.

BEST BUYS IN TEST EQUIPMENT

Metered Variable Auto-Transformer AC Bench Supplies

Model 1073
(3 amps)
Kit $35.95 Wired $47.95

Model 1078 (7½ amps)
Kit $42.95 Wired $54.95

Peak-To-Peak VTVM #232
& Uni-Probe® (U.S. Pat.)
Kit $29.95
Wired $49.95

VTVM #221
Kit $25.95 Wired $39.95

DC—5 MC 5" Scope #460
Kit $79.95
Wired $129.50

General Purpose 5" Scope #427
Kit $69.95 Wired $109.95

Tube Tester #625
Kit $34.95 Wired $49.95

RF Signal Generator #324
Kit $28.95
Wired $39.95

1000 Ohms/Volt V-O-M #536
Kit $14.95
Wired $18.95

6- & 12V Battery Eliminator & Charger #1050
Kit $29.95
Wired $38.95

Extra-filtered for transistor equipt. #1060
Kit $39.95 Wired $49.95

AC Volt-Watt Meter #261*
Kit $49.95
Wired $79.95
*Formerly called #260

Multi-Signal Tracer #145A
Kit $23.95
Wired $32.95

EICO

EXCELLENCE IN CREATIVE ELECTRONICS

Over 2 MILLION EICO instruments in use throughout the world. Compare, take them home — right "off the shelf" — from 2000 neighborhood dealers, most of whom offer budget terms.

EICO, 3300 N. Blvd., L.I.C., N.Y. PE-4
☐ Send free Catalog describing over 106 top-quality products, free **Stereo Hi-Fi Guide**, free **Short Course for Novice License**, name of nearest EICO dealer. ☐ Send new 36-page GUIDEBOOK TO HI-FI for which I enclose 25¢ for postage & handling.

Name .....
Address .....
City ..... Zone ..... State .....
Add 5% in the West

Listen to the EICO Hour, WABC-FM, N. Y. 95.5 MC, Mon.-Fri., 7:15-8 P.M.

SOUTH VIETNAM'S 40 MEGACYCLE INTERCOM

By ARTURO F. GONZALEZ JR.

SAIGON, SOUTH VIETNAM. A tiny piece of electronic equipment weighing less than 20 pounds may be the deciding factor in the brutal guerrilla war now being waged in this battle-wrecked countryside. Simple South Vietnamese villagers spread out across the rice paddies and jungles of this sub-tropical country are learning how to use this equipment. Upon how well they learn depend the future tactical movements of many of the 13,000 American military "advisors" —now leading, bleeding, and dying in the arduous and often futile war against the shadowy, Communist-guided Viet Cong insurgents.

The equipment is an ingenious radio transceiver, labeled the TR-20. It's produced by the Radio Industries Co. of Kansas City, Kansas—a Hallicrafters subsidiary which has successfully designed and manufactured some 2400 of these units for the U.S. Operations Mission (USOM) headquartered in Saigon. More than 2000 of these single-channel sets

SOUTH VIETNAM'S 40 MEGACYCLE INTERCOM

have already been installed in each of 2000 key villages in South Vietnam.

The story of the pressing need for these sets, their design and installation, is one of the unknown tales of the Vietnam war. Although overshadowed by such other epics as America's helicopter raids and Special Forces ambushes against the cunning Viet Cong, the tale is no less stirring.

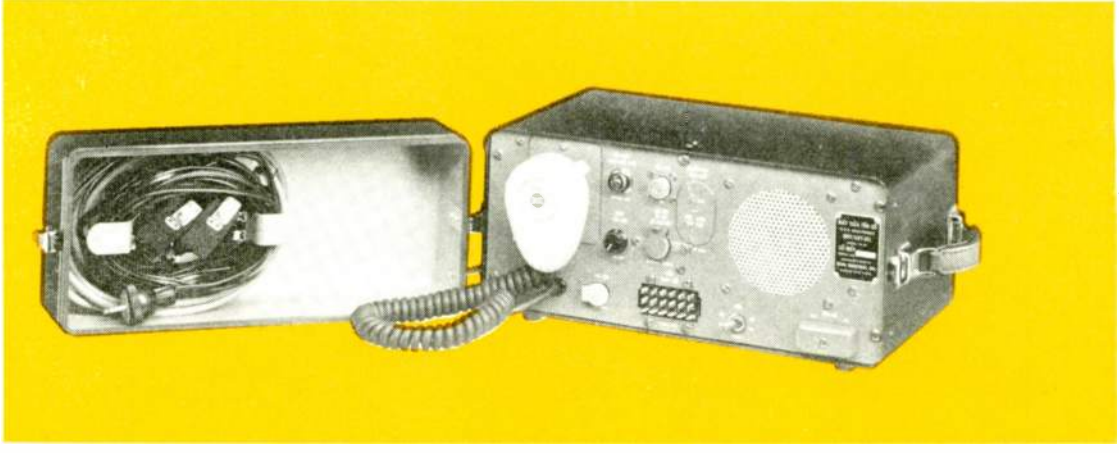
Jungle Background. The story began several years ago in the offices of the Public Safety Division of the U.S. Operations Mission in Vietnam. This outfit was on hand to help the local authorities do a better job of law enforcement throughout Vietnam in the face of steadily increasing Viet Cong murders, assaults, and other assorted intimidations. Immediately apparent was the need for greatly improved communications.

Vietnam is a country chopped up into tiny remote provinces and villages separated by rugged peaks and a jungle so thick a man needs a full day to slash 100 yards through it. Roads and railroads are few and far between—and lined with places where the Viet Cong can set up deadly machine gun and land mine ambushes. Nationwide telephone and telegraph services simply do not exist.

The USOM decided immediately that a radio network had to be set up, enabling isolated villages to call immediately for help from nearby military forces whenever the Viet Cong struck.

The transceivers had to be simple to operate, self-powered, rugged, portable, suitable for voice transmission, and with enough range to reach the receivers of Vietnamese armed forces in the vicinity. When the sealed bids for an initial order of 2400 sets were opened, the small Kansas City firm, Radio Industries, had come up with the TR-20, the best design at the most competitive price.

Village Radio. The TR-20 operates on only one crystal-controlled frequency; even the simplest Vietnamese peasant can't upset its tuning. It can operate on a 12-volt battery—and most do, since the tiny villages seldom have access to any electric power. On a preset frequency somewhere between 30 and 40 mc., it puts out 20 watts when transmitting—more than enough to cover the distance between most villages and the district headquarters where troop garrisons in Vietnam are based. Thanks to its printed circuit, it can take the heat, humidity, and general wear-and-tear of its jungle environment in stride.



Among the special "extras" on this simple-to-operate transmitter and receiver is a "Destruct Switch" which, when activated, jolts 300 volts through the set and completely burns it out. To date, roughly 20 of the 2000 sets distributed have had to be destroyed when Viet Cong troops overran local garrisons.

Armed Installation. If designing and manufacturing this specific piece of Cold War equipment is interesting information, the tale of its installation throughout the 2000 key villages of South Vietnam is a truly heroic one.

As the transceivers arrived, they had to be distributed to each of the villages. Often the installation took just a matter of an hour or two—but it meant, in many cases, an armed trek into enemy countryside lasting days and sometimes even weeks.

The typical attire of a member of these USOM installation teams usually included an armored vest (called a flak suit), a sub-machine gun, a knife, rations, a canteen, and elements of a jungle survival kit. Most of the five- and six-man teams went out escorted by at least a platoon of battle-equipped South Vietnamese troops carrying machine guns, grenades, mortars, and other equipment to beat off the frequently executed Viet Cong ambushes.

The sets were convoyed to Vietnam's remote villages on every conceivable type of vehicle. Many were helicoptered in. Some came up the Vietnamese rivers and canals in armored barges. Most were lugged in on the backs of human porters. At every break in the jungle path was the threat of an ambush—machine gun crossfire, a land mine going off, grenading from the trees and hills all around. The Viet Cong fought the transceivers with everything they had for they knew these new devices robbed them of their biggest weapons against the frightened Vietnamese villagers—the twin threats of isolation and surprise.

Grizzly Souvenirs. In the USOM offices in downtown Saigon there are physical reminders of the hard-slugging battle carried on to get these two-way radios into the villages. Behind the desk of Frank Walton, head of Public Safety, is a torn and blood-stained left boot, with an 8-inch spike rammed right up through the sole. A member of the radio installation team was wearing the boot when he stepped into a cunningly covered-over pit in a jungle path, driving down on the spike with the full weight of his body.

Another fiendish device designed to chill the blood of the radio installers is

Just what kind of transceiver is Radio Industries' amazing TR-20 "Village Radio"? Actually, it's just what the doctor ordered—ultra-compact, ultra-dependable, "capture-proof," easy to operate, and ready for use in the most adverse environments. A single-channel, crystal-controlled, 20-watt transmitter comprises "half" its circuitry; a single-channel, crystal-controlled, double-conversion superheterodyne receiver makes up the bulk. Twenty pounds of components are packed within its sturdy 12½"x11½"x6" case. Choice of power cable determines the type of power supply required—117 volts a.c., or 12 volts d.c., much like a standard CB rig. Battery drain is held to a minimum through the use of fully transistorized receiver, modulator, and power supply sections; in addition, "instant-heating" filament-type tubes in both the power amplifier and oscillator/tripler stages require no warm-up whatever. As for the range of the TR-20, it's about 20 miles, depending on terrain.

SOUTH VIETNAM'S 40 MEGACYCLE INTERCOM

Helicopters were a "natural" for delivering the TR-20 transceivers to South Vietnam's far-flung villages. Roads are few, railroads almost nonexistent in this sub-tropical land.

also on unofficial display. This is a spring-operated board which lies alongside a jungle path and then slams into an upright position when tripped. Three poisoned 10" spikes are imbedded in it so as to drive into the calf, thigh, and knee of the unwary person passing by.

On another desk is the "mantis"—a crude scattergun fashioned from a hollow metal fencepost and operated with a primitive firing pin and a small charge of explosive. Filled with rusty nails, glass, jagged stones, and metal bits, it can be fired from the jungles to cut down everything within 25 feet of its muzzle.

Typical "Combat" Leader. Many rugged Vietnamese technicians led by a handful of Americans braved crude terror devices like these to get the TR-20's in place. At least 11 paid with their lives and many more were injured. Singling out any one individual for a lion's share of the credit is impossible. But Ed Schlachter, a young Kentuckian, is typical of the men who have been getting the job done.

Ed served three years in the U.S. Army, coming out as a sergeant in Special Forces—the Army's specially trained counter-insurgency group. When he became a civilian, the Government approached him with a proposition—that he put his jungle know-how to work in South Vietnam as a civilian advisor to the USOM. The job ultimately evolved into his leading radio installation teams—armed and ready for trouble—out into the brush.

Ultra-simple operation and tropic-proof design are two of the TR-20's many special qualities. Here, inexperienced and untrained South Vietnamese find talking to the next village as easy as working in a rice paddy.

He hardly looks the 23 years he claims to be, and his small black goatee gives him the appearance of a bop musician or a Left Bank Parisian college student. But after listening to his experiences, you realize that he's seen more combat

Both USOM technicians and South Vietnamese troops helped local villagers install antennas for their nation's "40-megacycle intercom." Flag near antenna in bottom photo is South Vietnam's national banner; it consists of three narrow red stripes in a yellow field.

just delivering South Vietnam's intercoms than most troopers see in a lifetime.

Temporarily at his office desk between missions, he's not above tinkering with a secretary's broken transistor radio so that she can hear some music while typing. But when his boss comes by and drops an automatic weapon on his desk to be used on his next few missions, you are suddenly aware that Ed's radio installations are a lot different from the stateside "friendly neighborhood repairman" variety.

"I use a folding stock carbine," Ed explains, "because sometimes we make part of the trip by commercial airliner, and it's easier to pack it out of sight in a suitcase that way."

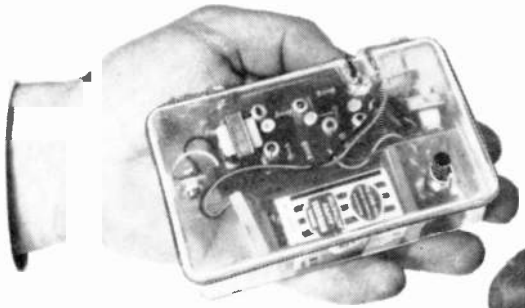
Ed estimates that he has installed transceivers in roughly 500 villages. On occasion, it has meant actually blasting through enemy lines to get into a village. His helicopter has been shot at a number of times. Eight men in one installation party were killed outright when their truck went over a Viet Cong mine.

Patrol Boat Mission. Ed most vividly remembers a recent installation mission to the watery southeastern Vietnam province of Kien Giang. He went to work wearing his usual attire for the job—old Army combat fatigues, a flak jacket, his pistol, a machine gun, and a bandoleer of grenades. In addition, there were the

(*Continued on page* 102)

AIRLINE

Special "pocket portable"



By GEORGE L. DOWNS
K2FG

FOR ABOUT six years, as a passenger on commercial airlines, I've been carrying a little hearing-aid-like device that enables me to overhear what the pilot is saying on his two-way radio. I call this gadget my "Airline Eavesdropper." Although I sit in the passenger cabin like every other passenger, I generally know where we are, how high we're flying, our estimated time of arrival, and whether the pilot is flying under Instrument (IFR) or Visual (VFR) flight regulations.

Once assured that the Eavesdropper is a "crystal set" and that it radiates no signals to interfere with the plane's equipment, airline personnel have no objection to its use. Stewardesses like to "listen in," and I have had various captains fill me in on their courses so I could "navigate" with them.

In addition to what the pilot is saying (you can't hear the other end of the conversation unless you're very near the control tower), you can hear the beep (or buzz) of radar signals as the plane comes within range. Around the airport you can hear other planes, the control tower, code signals from the low-frequency beacons, and even vehicle ignition noise. As a matter of fact, you don't even have to be airborne—you can hear some very interesting things just carrying (or wearing) an Eavesdropper on an airport observation deck.

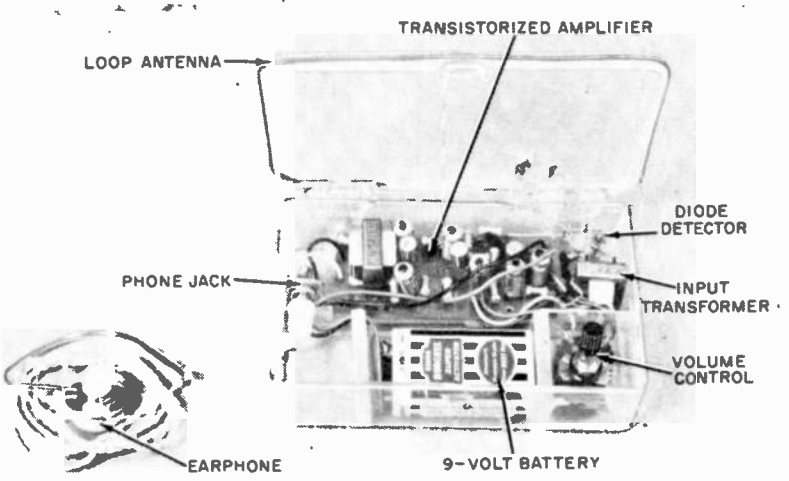
Construction of the Eavesdropper is exceedingly simple. You just group the parts in the box in some logical arrange-

PARTS LIST

B1—9-volt battery (Burgess 2MN6 or equivalent)
C1—0.002-μf. ceramic disc capacitor, working voltage not critical
D1—1N34A diode
J1—Subminiature phone jack (Lafayette MS-282 or equivalent)
P1—Subminiature phone plug (part of earphone assembly)
R1—5000-ohm subminiature potentiometer (Lafayette VC-27 or equivalent)
S1—S.p.s.t. switch (part of R1)
T1—Subminiature transistor input transformer; primary, 209,000 ohms; secondary, 1000 ohms (Lafayette TR-120 or equivalent)
1—Dynamic earphone, 6-ohm impedance (Lafayette MS-591 or equivalent)
1—1⅛" x 4⅝" x 2¾" plastic case (Lafayette MS-161 or equivalent)
1—Loop antenna—see text
1—3-transistor subminiature audio amplifier (Lafayette PK-522 or equivalent)
Misc.—Wire, solder, plastic dividers, knob, etc.

EAVESDROPPER

lets you listen in on pilots, control towers, and beacons



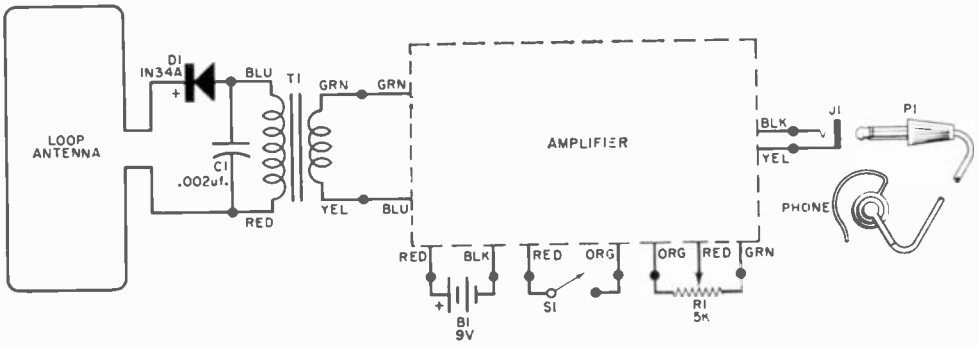
A single plastic case holds all parts—including built-in loop antenna. Phone jack, volume control, and other major components are mounted on small pieces of plastic glued to bottom of case.

ment—don't forget to leave room for the earpiece and cord, however. Then cut and cement plastic partitions in place to form supports for the various components, mount the components, and wire them up.

The Eavesdropper can be operated with the cover open or closed. With the cover closed, it can be slipped into a jacket pocket and worn as a hearing aid. Maximum pickup in most planes is with the loop flat against the plane's window. However, the loop is quite sensitive to orientation and a little experimentation will give you the best position. Sometimes, for example, you'll hear the hum of the 400-cycle supply used on planes. In this case, the loop should be oriented for minimum hum pickup.

If you fly regularly, you may want to obtain a copy of the Instrument Enroute Charts covering your most used routes. They are available for 25¢ each from the U.S. Dept. of Commerce, Coast and Geodetic Survey, Washington, D.C. —30—

Loop antenna and diode detector comprise r.f. portion of Eavesdropper circuit, while commercially assembled transistor amplifier makes up a.f. section. Unit lacks oscillators, thus cannot be source of interference.



CARLA'S

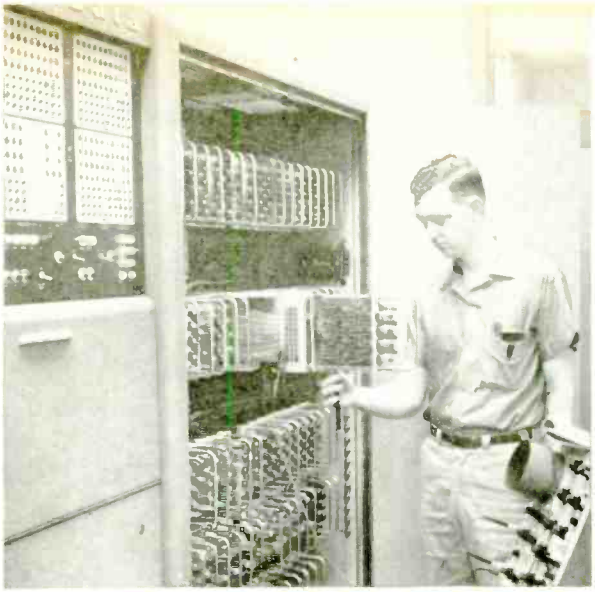
How Hurricane Carla "blew" a soaked

Sea-soaked manuals and operational guides helped Texas A & I students learn how the computer circuitry was supposed to work. Looking for shorts (below) and checking modular panel with oscilloscope (above, right) were just two of the jobs the students had to perform.

WHEN Hurricane Carla smashed into the Texas Gulf in September, 1961, she was a vicious threat to any living thing and any property in her path. Now just a memory, she was then a screaming, shrieking terror. At Freeport, on the Coast, employees of the Dow Chemical Company battened down their plant —one which uses sea water as a raw material in the manufacture of many chemical and plastic products—as best they could. Then they fled.

Carla roared in, packing winds up to 176 miles per hour. She pushed a 14-foot tide before her—a wall of water which broke over, under, and around dikes and levees. The Dow plant, one of many in her path, was flooded as water seven feet deep rushed through the industrial complex. Wind tore at the plant's roof, blasted out windows.

When Carla had spent her fury, the Dow people started repairing the plant. By the time the job was complete, Dow figured its cost in round figures at $6 millions—including a Burroughs 205 computer, which was written off as a "total loss."



Wide World photo

COMPUTER

and salty Burroughs 205 straight into a college lab

That is when a young Dow physicist, a graduate of Texas A & I, contacted members of his college faculty. "I think the company might give the Burroughs 205 to you if you want it," he said, "although you might never make it work!"

Dr. J. R. Guinn, professor and chairman of the college's Department of Electrical Engineering, told his students about it. "We have an opportunity to build up a computing department the college could never hope to afford," he said, "but it is going to take much hard and tedious work which will have to be done on a voluntary basis after hours."

A group of two dozen volunteers attacked the computer with scrub buckets and brushes—cleansing every exposed area they could find, inside and out. Even after the cleaning job that the Dow workmen had done in trying to save the 205, the students found a pint of sea water in the magnetic drum "memory" section.

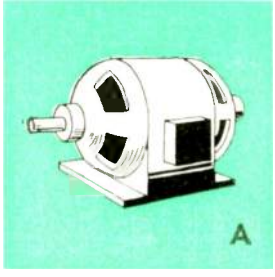
Cables that Burroughs feared were soaked beyond use were hung upon pipes to dry, and critical parts were dried in a vacuum chamber. When the drying was completed, and the computer had been reassembled, power was turned on. "Nothing worked right," Dr. Guinn declares. "That's when the job really began."

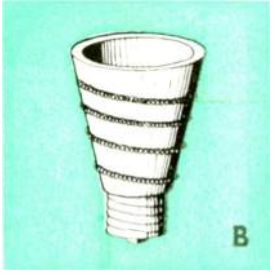
Guiding themselves by leafing through salt-water-soaked technical manuals, the students and Dr. Guinn began tracing every circuit, checking every tube, every connection. It took months and uncounted thousands of man-hours. Finally, a year to the day after Carla struck, a test program was run successfully. Not all components worked—but the students had proven there was hope. Today, says Dr. Guinn, the 205 is "100% operable."

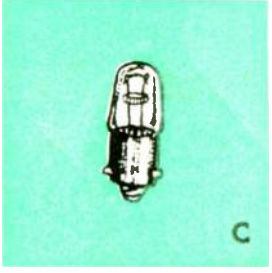
"We don't have to be content to tell our students about large computers any more," Dr. Guinn explains. "We can show them—give them experience. In that respect," he adds with a wry smile, "I doubt that any college group ever got more thorough experience than our student volunteers. They may never build a career in data processing, but one thing's certain: they know at least one computer—Carla's Computer—by heart, front to back, and top to bottom!" -30-

ENERGY CONVERSION QUIZ

By ROBERT P. BALIN

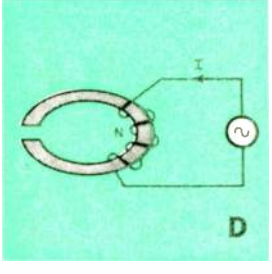


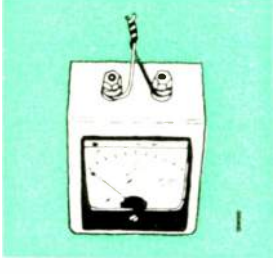


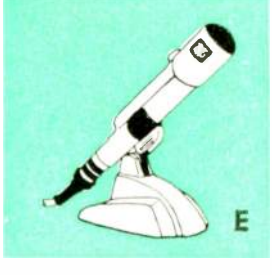


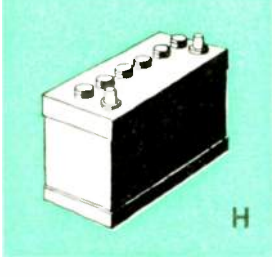
Energy can be neither created nor destroyed, but only changed from one form to another. Some electrical and electronic devices do their jobs by changing energy from one form (heat, light, chemical, magnetic, etc.) to another useful form. See if you can match the devices (A-J) shown here with the input and output forms of energy (1-10) listed below.

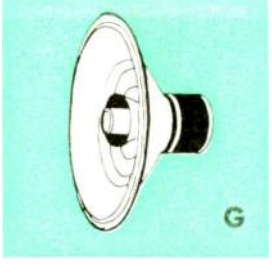
(Answers on page 100)

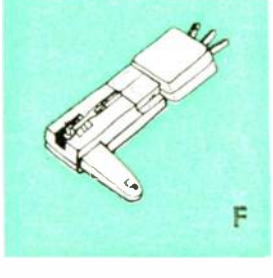




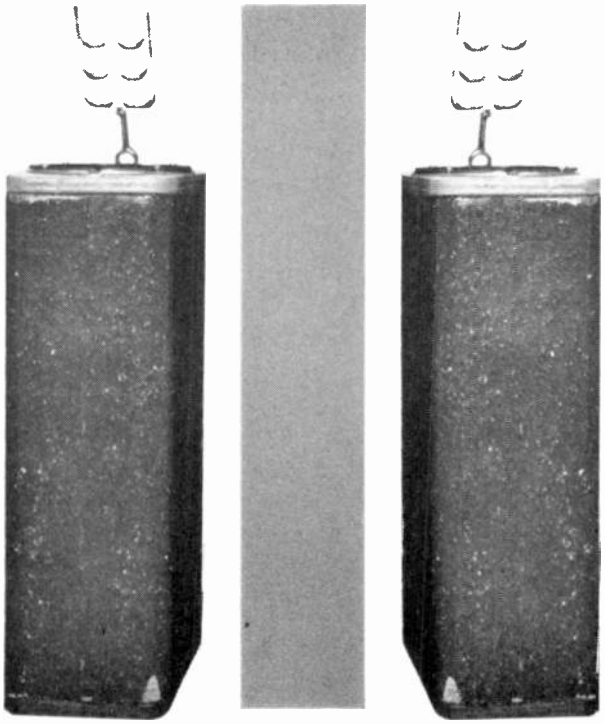








1 Chemical to Electrical	_____	**6** Electrical to Mechanical	_____
2 Electrical to Light	_____	**7** Acoustical to Electrical	_____
3 Heat to Electrical	_____	**8** Electrical to Heat	_____
4 Electrical to Acoustical	_____	**9** Mechanical to Electrical	_____
5 Light to Electrical	_____	**10** Magnetic to Electrical	_____



ANOTHER CERAMIC TILE ENCLOSURE

A ducted-port bass reflex for 8" speakers, this system is non-vibrant, inexpensive, and exceedingly compact

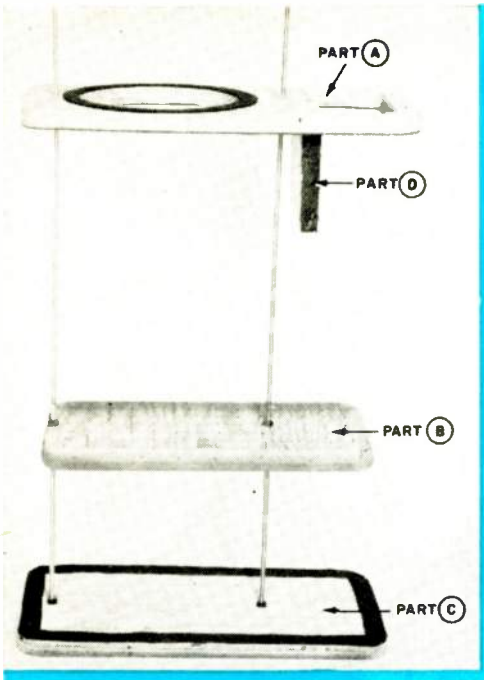
By DAVID WEEMS

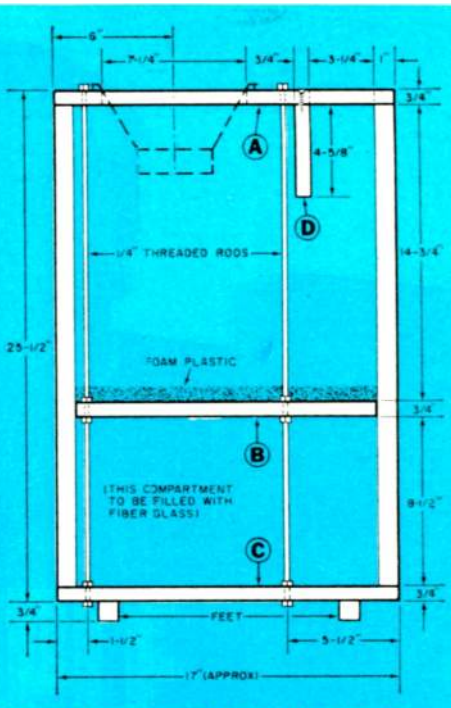
SOME speaker enclosures are small, some enormous; some are cheap, some cost dearly. But all speaker enclosures fall into one of two categories—good or bad. Actually, it makes little sense to house a good speaker in a poor enclosure, no matter whether the reason is to save money, space, or both. On the other hand, with a quality enclosure that also happens to be low in cost, the savings can be applied on a better speaker, or on other components.

In the stereo age the space problem is usually with us, so we can always hope for something compact. The system described here *is* compact, yet it sacrifices little in quality. What's more, each basic enclosure costs only about $6.00, so two enclosures for a stereo setup would run you only about $12.00. Soundwise, almost all the advantages of this enclosure stem from its tile construction.

Tile for Density? The important argument for the use of tile can be found in any complete "Density of Materials" chart. For example, the chart published in Briggs' *Sound Reproduction*[1] lists plywood, the usual material for speaker enclosures, at a density of 0.67. This is admittedly rather good, at least when compared with other forms of wood

[1]Sound Reproduction, *by G. A. Briggs, Third Edition, p. 102*





General design of enclosure is evident in photo and drawing above. Parts A and C form top and bottom, respectively, and are held securely in place against tile by two threaded bolts. Gaskets made from 1/8" foam plastic insure airtight fit between plywood parts and the ceramic tile.

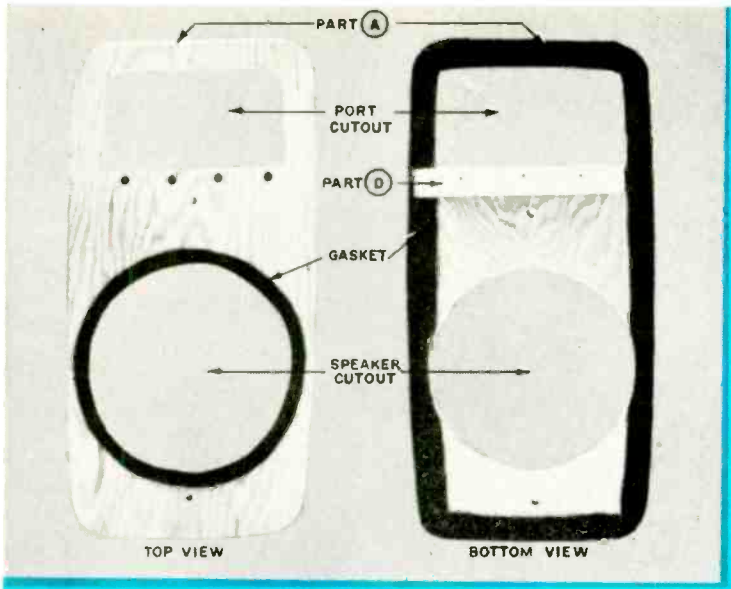
(walnut, for example, is only 0.56). But tile boasts a figure of 2.0, or just about three times that of plywood. In addition, the tile used here has a thickness of a full inch, compared to the usual $^{3}/_{4}$" for plywood.

To quote Mr. Briggs again, "All will agree on the necessity of overcoming vibration and resonance at low frequencies, and this is achieved by adequate density." When Mr. Briggs says "All," he surely means all hi-fi and stereo fans who are conscious of what true bass sounds like. People still talk about the beautiful "tone" of a wooden cabinet, forgetting that the speaker system isn't a musical instrument, but a reproducer of an endless variety of instruments and tones. Any energy used up in panel vibrations is lost so far as true bass response is concerned. Even worse, it comes back to us in the form of hangover.

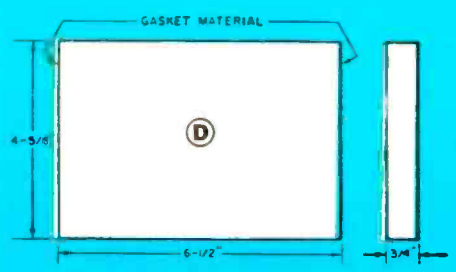
The speaker system shown here uses some plywood, but only at the ends. Furthermore, the plywood end pieces are held securely by two threaded rods, which adds considerably to their rigidity. The bulk of the enclosure is made of non-vibrating tile, sold by lumber yards as "flue tile."

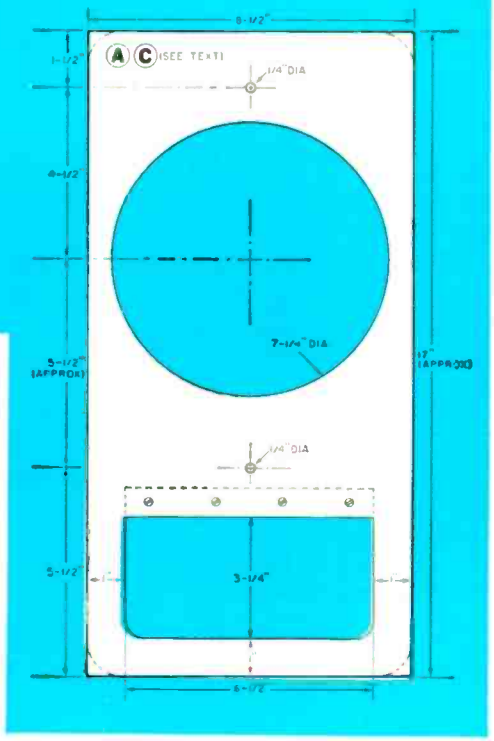
Port with Padding. The basic design of this system is simply a ducted port bass reflex, and any *good* 8" speaker can be used. The only unusual feature is the resonant chamber at the bottom which cancels out a tendency toward a peak or boom at one point in the bass range. Most compact enclosures show such a peak, and the elimination of this peak is probably more important than precise matching of port and speaker.

Best results are obtained with this chamber completely but loosely filled with fiber glass. Several materials were tested, and fiber glass was found to work best. Cotton batting was almost as good, but rug padding and foam plastic were less effective. Interestingly enough, a change of material was evident in the impedance curve of the speaker as well as in the actual sound of the system.



Top and bottom views of Part A appear at left; drawings of Parts D, A, and C have been reproduced below. Parts A and C are identical, with the exception that Part C requires no port or speaker cutouts. Gasket surrounding speaker cutout on top of Part A is for speaker flange which is on top of (rather than underneath) Part A in the finished enclosure.

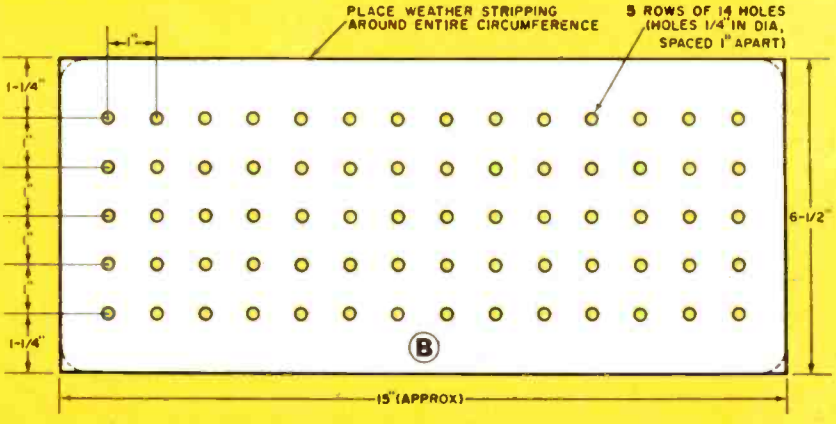


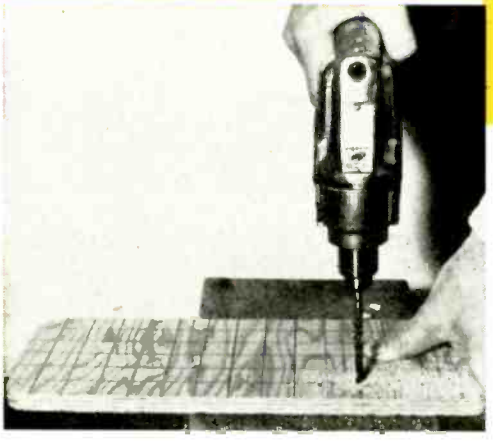


The kind of padding you use in the speaker compartment is another matter. Here personal taste is the best guide. Fiber glass will probably give you the most level response, but the sound will be "livelier" with foam plastic. However, fiber glass could damage some speakers if it is placed too close to them. If you do choose to use it, you'll be wise to cover it with cheesecloth.

Building the Enclosure. This is a rather easy system to construct if you take a few precautions. The plywood parts can be marked out by using each tile as a pattern. Of course, you should label each part, not only as to location, but as to which side is "up" and which is "down." This is necessary because some tiles are asymmetrical. Reverse the speaker board, for example, and it may fit like a left shoe on a right foot.

When the parts are sawed to fit and the gasket materials are glued in place, you can begin putting the enclosure together. Note that a 1/8" foam plastic gasket is used to insure a tight fit between the top and bottom boards (Parts





Partition (Part B) must be drilled as shown here before mounting; you'll also have to drill two holes for rods (see photo and drawing on page 52).

BILL OF MATERIALS

1—24" length of 8½" x 17" flue or fireplace tile for basic enclosure (this is called "18-inch tile" by some dealers)
1—18" x 24" sheet of ¾" fir plywood (for Parts A, B, and C)
1—4⅜" x 6½" sheet of ¾" wood (for Part D)
2—36" lengths of ¼" threaded steel rods
10—¼" hex nuts
4—¼" washers
1—4' length of weather stripping, foam plastic or foam rubber (for edges of Part B)
1—12" x 36" sheet of ⅛" "Art Foam" foam plastic (for gaskets on Parts A, C, and D)
1—36" length of ½" to 1" foam plastic (damping material for top of Part B and speaker compartment walls—see text)
1—8" PM hi-fi speaker
Misc.—Wood and machine screws, nuts, fiber glass, glue, grille cloth, etc.

Optional (see text)

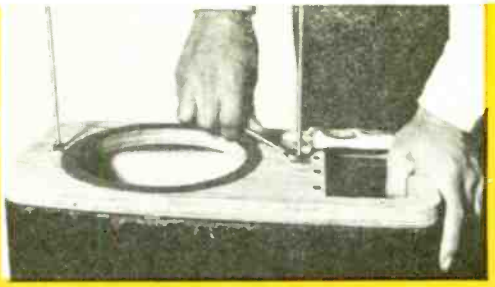
1—8½" x 17" sheet of ¼" fir plywood (for mask)
1—Plastic egg tray
1—5/16" x 4" eye bolt
1—Cable strap
Window screen wire (for mask)

A and *C*) and the tile, between the speaker and Part *A*, and between the sides of Part *D* and the tile itself. Weather stripping is best for gasketing the partition (Part *B*).

Drill the holes for the threaded rod in the top speaker board (Part *A*) as shown on p. 53. Then, using the speaker board as a pattern, drill holes for the rods in the bottom (Part *C*) and middle partition (Part *B*). One way to properly locate the holes in the partition is to place it just inside the tile and lay the top or bottom over it. The duct wall (Part *D*) can now be glued and screwed to the speaker board.

Next, locate the partition (Part *B*) 9½" from one end of the two rods by running nuts down tightly on each side and using bolt-and-nut sealant or lock washers. Now add a nut to each rod at the end, turning it on far enough to allow the bottom board (Part *C*) to go in place. Use a washer under the nut on the bottom side, and tighten both nuts securely on each rod, again using sealant.

The assembly can now be slid into the bottom of the tile, but don't forget to fill the space between the bottom and the partition (Part *B*) with fiber glass. Then line the top of the partition with foam plastic, and pad the walls around the speaker. Drop the speaker board down over the threaded rods and add a



Top (Part A) and bottom (Part C) are the two pieces of "bread" in this flue tile "sandwich." A hacksaw can be used to trim off protruding portion of the threaded rods after the nuts have been tightened securely.

Plastic egg-tray treble diffuser (in photo below) aids in dispersing the "high's" throughout listening room.

If space is really at a premium, the enclosure can be placed between two pieces of furniture, as it is here.

washer and a nut from the top. Tighten the nut as firmly as possible, but don't overdo the job—you may strip the threads if you use a long wrench and apply too much force.

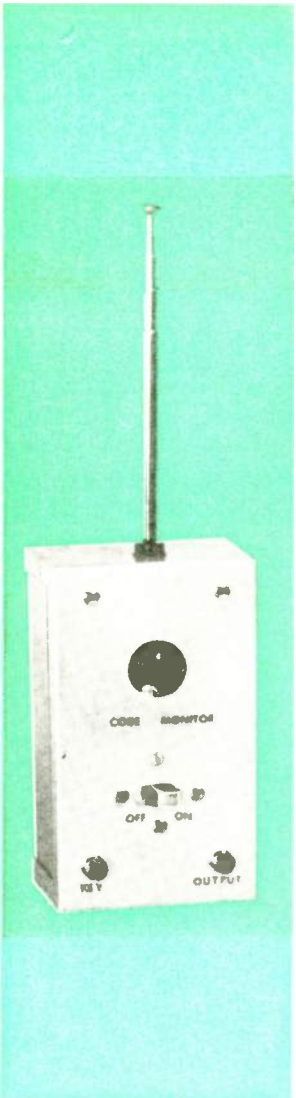
Placement Possibilities. There are many ways of using this system, depending upon the space you have available. One builder succeeded in stowing away the flue tile enclosures in room corners and placing small tweeter baffles on table tops. With the tiles more or less out of view, there was no decorating problem.

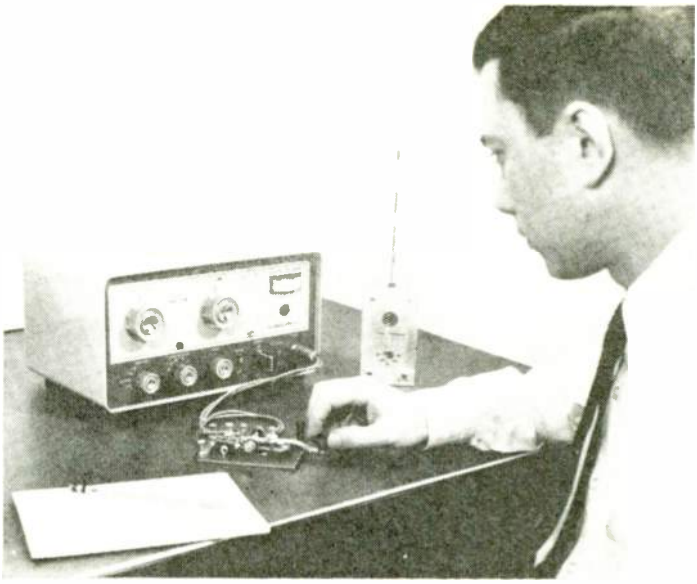
Perhaps the next best solution, with regard to saving space, is that shown at right. The enclosures lie on edge with the speakers toward the upper front. This is especially useful if you must keep the enclosure as low as possible but don't want to go to the woofer/tweeter arrangement.

The projections of the speaker and the bolts on the speaker board require setting the grille cloth out a short distance from the board. One practical way of solving this problem is with a "mask." The mask is made from ¼" plywood with cutouts for the speaker and bolts. To stiffen the grille cloth and protect the speakers, wire can be glued to the mask and the edges trimmed to fit with old scissors. Then the grille cloth can be folded over the edge of the mask and glued in place. Finally, to hide the edge of the speaker board, a coat of paint can be applied (ideally to match the color of the tile).

Some purists may object to having the high frequencies produced from a point about a foot above the floor. If you happen to like your highs "elevated," the enclosure can be stood on end with the speaker facing up and some kind of

(*Continued on page* 105)





MONITOR YOUR CODE

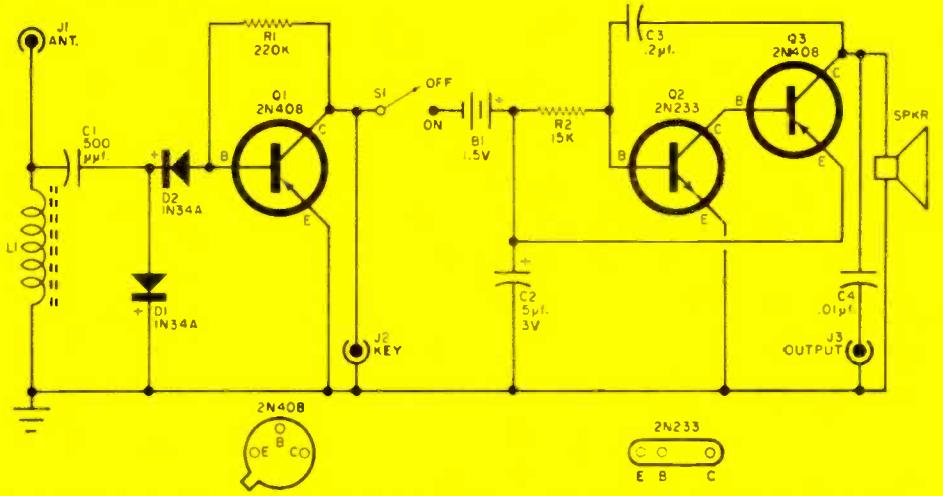
Battery-powered circuit detects c.w. signals and triggers audio tone oscillator to clue you in

By I. C. CHAPEL

THE Novice amateur who has just received his ticket often finds working c.w. a difficult chore. Reason? He probably learned code by *listening* to himself "send" with the aid of a code practice oscillator (CPO). But now that he's on the air, he finds himself sending in almost complete "silence." However, there *is* a way to listen to the "sound of your fist" as you pound the key of your transmitter. If this is your goal, then the Code Monitor is for you.

Eavesdropping on yourself isn't the only function of the Code Monitor, though. It can help you tune up your transmitter for optimum power output, and tell you whether the keying circuits are producing a clean-cut signal. In fact, the Code Monitor can be used as a relative field strength indicator with an audio output instead of the usual meter indication. And as an extra bonus, you can plug your key into the unit and use it as a CPO to bring up your code speed or break in on a "bug."

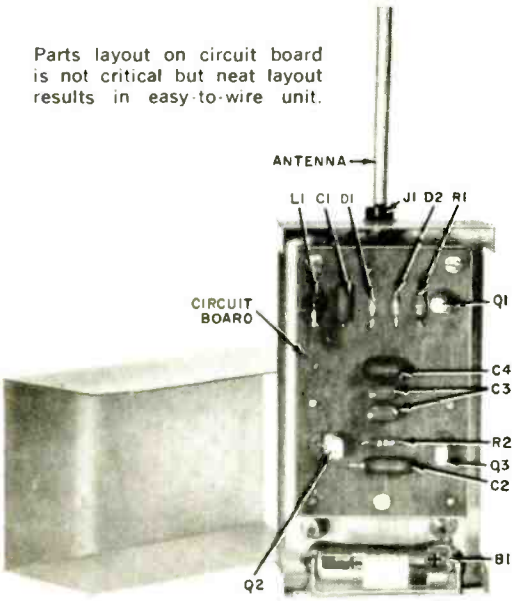
Construction. Since the circuitry for the Code Monitor isn't particularly critical, how it is put together is entirely up to you. The author elected to mount most of the components on a $2\frac{1}{2}$" x 4"



Transistor Q1 serves as an electronic switch designed to close when strong r.f. signals are picked up by the antenna. Audio tone circuit (Q2 and Q3) beeps away when Q1 "closes."

PARTS LIST

B1—1.5-volt penlight battery (Burgess Type Z or equivalent)
C1—0.0005-μf., 400-volt paper or ceramic capacitor
C2—5-μf., 3-w.v.d.c. electrolytic capacitor
C3—0.2-μf., 400-volt Mylar capacitor
C4—0.01-μf., 400-volt Mylar capacitor
D1, D2 — General - purpose germanium diode (1N34A or equivalent)
J1, J2—Phono jack for front panel mounting (Switchcraft 3501FP or equivalent)
J3—Insulated banana jack (G-C Electrocraft 33-188 or equivalent)
L1—1000-μh. iron-core r.f. choke (Miller 1300-1000 or equivalent)
Q1, Q3—2N408 transistor (RCA)
Q2—2N233 transistor (Sylvania)
R1—220,000-ohm, ½-watt resistor
R2—15,000-ohm, ½-watt resistor
S1—S.p.s.t. slide switch
SPKR—2¼" PM speaker, 8-ohm voice coil (Lafayette SK-190 or equivalent)
1—3" x 5¼" x 2⅛" aluminum chassis box, gray hammertone finish (Bud CU-3006-A or equivalent)
1—Battery holder for B1 (Keystone 139 or equivalent)
3—Transistor sockets
Misc.—10" antenna, 1½" spacers, 2½" x 4" phenolic or Formica sheet, self-tapping screws



Parts layout on circuit board is not critical but neat layout results in easy-to-wire unit.

Formica sheet, but a Bakelite or phenolic sheet would do just as well. The three transistor sockets were mounted at different quarters on the board to make for an uncluttered circuit layout (see photo). Holes were drilled to pass the leads from the diodes, capacitors, and resistors; these leads, in turn, were used as interconnecting leads or terminals, depending upon their lengths.

The three jacks, switch, battery holder, and speaker were mounted on the aluminum chassis. With the circuit board standing on its longer side next to the chassis, wires were connected from it to the parts on the chassis. After the wiring was completed, the circuit board was secured to the chassis on three 1½" hollow spacers.

A 10" antenna can be made from stiff

(*Continued on page* 111)

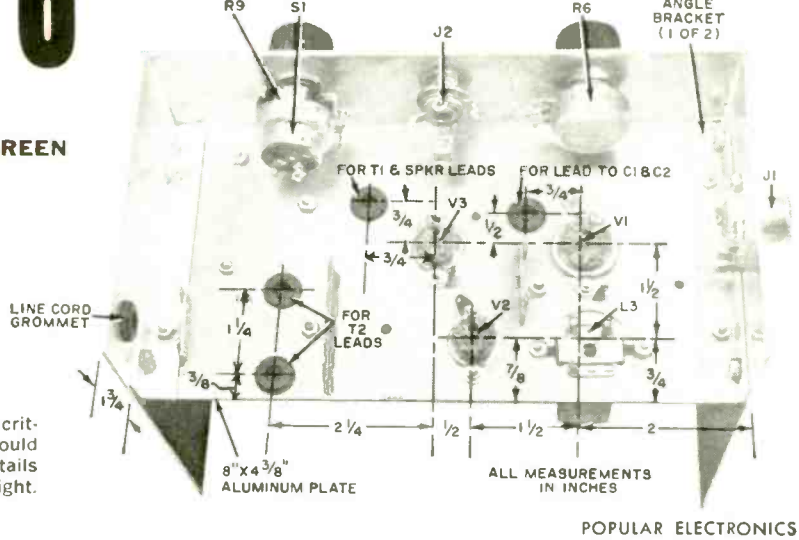
Perfect for the newcomer to 6 meters, this receiver will also make an excellent standby unit for the "old pro"

SIMPLE SUPERHET FOR 6

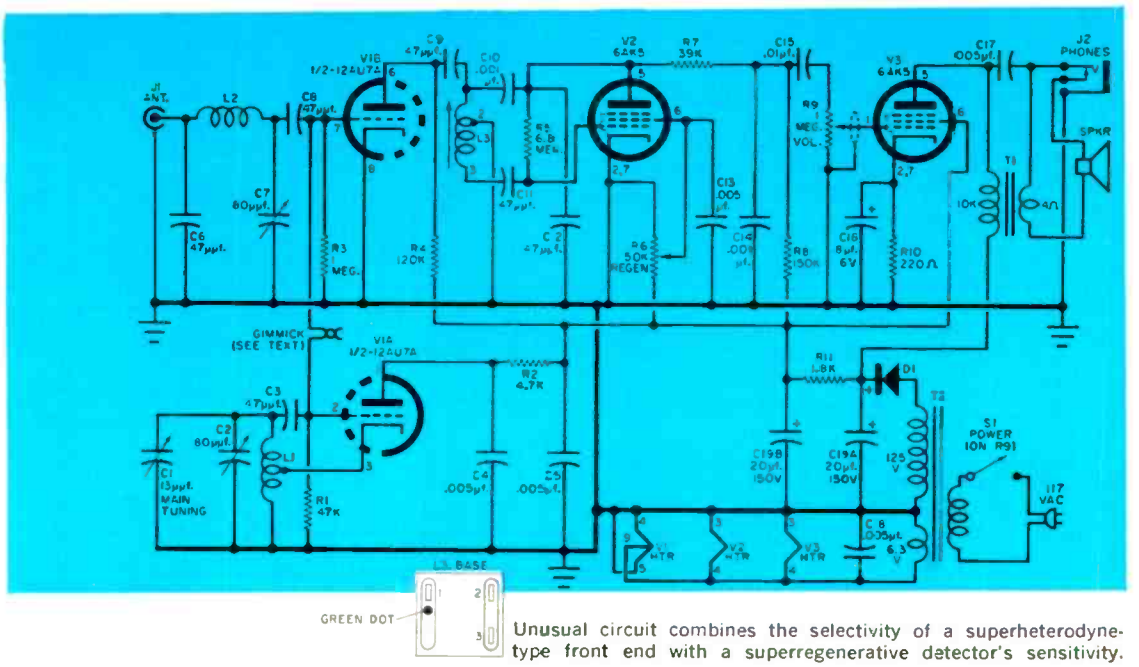
By CHARLES GREEN
W3IKH

WHETHER you're a brand-new Technician or a General or Extra Class ham of long standing, this 3-tube, 6-meter receiver deserves a place in your shack. It covers the main (50-53 mc.) portion of the band, and boasts a superhet-type front end with superregenerative detector. While the latter combination is unusual, it provides a degree of sensitivity and selectivity not often found in such simple sets.

What's more, the rig has its own built-in power supply and speaker, the whole package fitting comfortably into a



Parts layout is very critical, so the builder should follow closely the details given in the photo at right.



Unusual circuit combines the selectivity of a superheterodyne-type front end with a superregenerative detector's sensitivity.

middle-sized utility box. Construct it with the care that all VHF circuits require, and you'll have a peppy little receiver which takes up very little room on your operating bench. Excellent for use as a "second" or emergency unit, it's also a fine full-time performer for hams with limited budgets.

About the Circuit. Signals from antenna jack *J1* enter a bandpass network consisting of capacitors *C6* and *C7* and coil *L2*. This network is adjusted to resonate at 6 meters by trimmer capacitor *C7*. The 6-meter signals appearing at the output of the network are fed to the grid of mixer *V1b*.

Also fed to *V1b*'s grid (via a "gimmick" capacitor) is the output of oscillator *V1a*. The oscillator circuit, like the bandpass network, operates on 6 meters. Its frequency is controlled by coil *L1*, "bandsetting" trimmer capacitor *C2*, and main tuning capacitor *C1*.

The output of *V1b* is coupled to a superregenerative detector stage designed around tube *V2*. Detector coil *L3* is tuned to about 2 mc., thus establishing that frequency as the i.f. Potentiometer *R6*, which controls *V2*'s screen voltage, acts as a regeneration control.

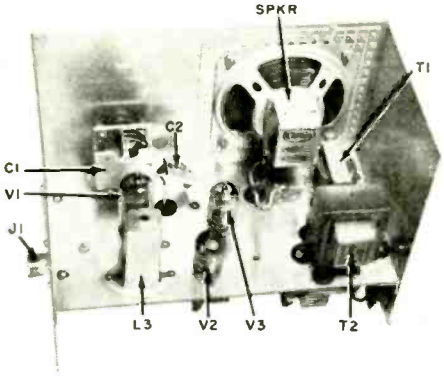
An R/C filter circuit (*R7*/*C14*) attenuates the superregenerative quench frequency before the detected signal is amplified by tube *V3*. Potentiometer *R9* is connected into *V3*'s grid circuit to serve as a volume control.

From *V3* the signal passes through output transformer *T1*, which matches *V3*'s plate circuit to the speaker. When a set of headphones is plugged into closed-circuit jack *J2*, the speaker is disconnected and the phones operate directly from the plate circuit.

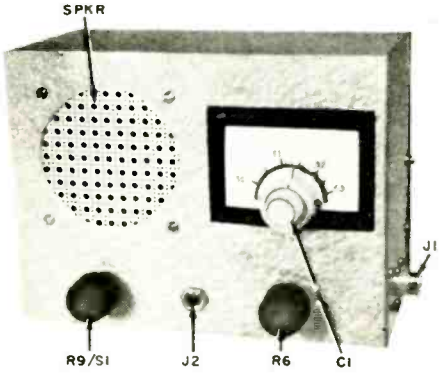
Operating voltages for the receiver are supplied by power transformer *T2*, rectifier *D1*, and a filter network consisting of dual capacitor *C19* and resistor *R11*. Switch *S1* (mounted on *R9*) turns the set on and off.

Construction. The unit is housed in an 8" x 6" x 4½" aluminum utility box. As you can see in the photographs, the box is fitted with a "chassis shelf" which is cut from a piece of aluminum. Use a pair of angle brackets to mount the shelf about 1¾" from the bottom of the box.

Try to follow the parts layout illustrated as closely as possible. As in all VHF circuits, layout is critical—and you'll stand a better chance of duplicating the author's results if you duplicate his construction. Notice that dimensions are given for locating most of the



View of receiver's top deck shows parts neatly spaced. Trimmer C2 is held in place by soldering its terminals to a ground lug and the stator terminal of C1.



Three control knobs and an operator are all that are needed to pull in those 6-meter calls after unit is assembled, aligned, and connected to an antenna.

PARTS LIST

C1—13-μμf. variable capacitor with vernier shaft (Lafayette HP-72)
C2, C7—80-μμf. mica trimmer capacitor
C3, C6, C8, C9, C11, C12—47-μμf., 600-volt ceramic tubular capacitor
C4, C5, C13, C17, C18—0.005 μf. } *600-volt*
C10, C14—0.001 μf. } *ceramic disc*
C15—0.01 μf. } *capacitors*
C16—8-μf., 6-volt miniature electrolytic capacitor
C19—Dual 20-μf., 150-volt electrolytic capacitor
D1—380-PIV, 65-ma. selenium rectifier stack (Sarkes Tarzian Type 65 or equivalent)
J1—Chassis-mounting coaxial receptacle (Amphenol 83-1R or equivalent)
J2—Closed-circuit phone jack
L1—8 turns of #16 tinned copper wire, wound 1" long and ⅜" in diameter—center-tap and provide with ½" leads
L2—12 turns of #16 tinned copper wire, wound ⅞" long and ⅜" in diameter—provide with ½" leads
L3—Oscillator coil (Meissner 14-1412)
R1—47,000 ohms } *All resistors*
R2—4700 ohms } *½-watt, 10%, unless*
R3—1 megohm } *otherwise specified*
R4—120,000 ohms
R5—6.8 megohms
R6—50,000-ohm potentiometer
R7—39,000 ohms
R8—150,000 ohms
R9—1-megohm potentiometer (with S1)
R10—220 ohms
R11—1800-ohm, 2-watt, 10% resistor
S1—S.p.s.t. switch (on R9)
SPKR—3.2-ohm, 3½" speaker (Utah SP35RY or equivalent)
T1—Output transformer; primary, 10,000 ohms; secondary, 4 ohms (Stancor A3879 or equivalent)
T2—Power transformer; primary, 117 volts; secondaries, 125 volts @ 15 ma., 6.3 volts @ 0.6 amp (Stancor PS-8415 or equivalent)
V1—12AU7A tube
V2, V3—6AK5 tube
1—8" x 6" x 4½" aluminum utility box (LMB 146 or equivalent)
1—8" x 4⅜" aluminum plate (for chassis shelf)
Misc.—Line cord and plug, tube sockets, angle brackets for mounting shelf, ⅜" spacers, grommets, terminal strips, shielded wire, knobs, speaker grille, etc.

components and openings on the shelf.

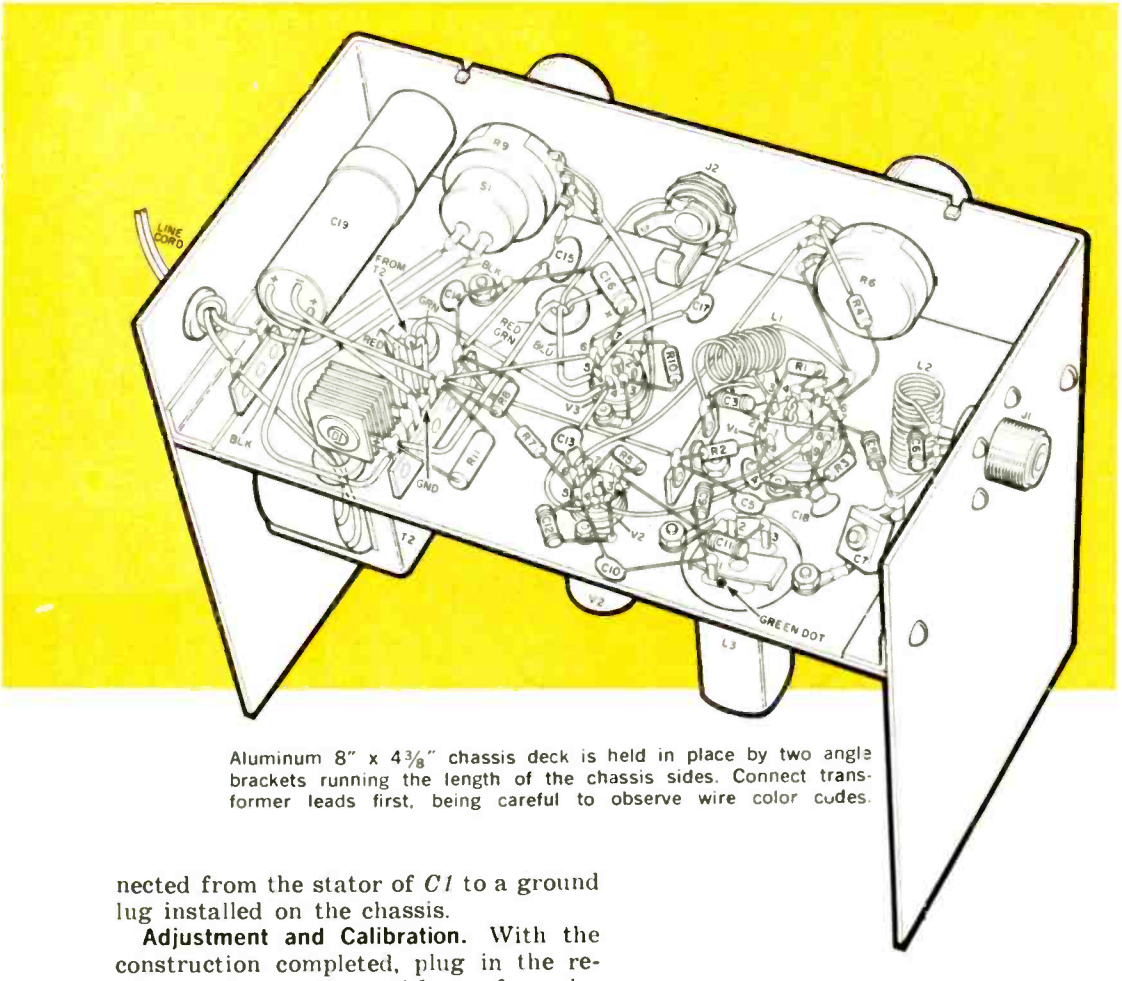
Notice, too, that output transformer *T1* has been mounted at right angles to power transformer *T2*. This minimizes the possibility of *T2* inducing hum into *T1*.

The only components placed on the box itself are potentiometers *R6* and *R9/S1*, jacks *J1* and *J2*, capacitor *C1*, and the speaker. When installing *C1*, set it back from the front panel by mounting it on ⅜" spacers. The author used a 4" square of perforated aluminum as a speaker grille; a piece of grille cloth could be employed instead—or you might simply drill a series of holes in the panel.

When carrying out the wiring, once again try to follow the author's layout as closely as possible. This is particularly important for the components associated with *V1a* and *V1b*. The major part of this circuitry is located under the chassis shelf and illustrated in the pictorial diagram.

The "gimmick" capacitor connecting the grids of *V1a* and *V1b* is made from a couple of short pieces of hookup wire. Just twist the ends of the wires together (twice), and solder the free ends into the circuit on terminals 2 and 7 on *V1*'s socket.

Capacitors *C1* and *C2* are visible only in the photo of the shelf's reverse side. As the photo shows, trimmer *C2* is con-



Aluminum 8" x 4⅜" chassis deck is held in place by two angle brackets running the length of the chassis sides. Connect transformer leads first, being careful to observe wire color codes.

nected from the stator of *C1* to a ground lug installed on the chassis.

Adjustment and Calibration. With the construction completed, plug in the receiver and turn it on. After a few minutes of warm-up time, adjust volume control *R9* to maximum and turn regeneration control *R6* until you hear a typical "superregenerative hiss" in the speaker. If all is well, leave the set on for about 10 minutes before proceeding.

After adjusting the slug in *L3* for maximum hiss (using a non-metallic screwdriver), connect a signal generator set at 50 mc. to *J1*. Starting with *C1* and *C2* at maximum capacity, reduce the capacity of *C2* until you hear the generator's signal in the speaker. Next, adjust *C7* for maximum volume.

The last step is to calibrate the receiver. For this purpose, the author taped a paper scale to the front panel and glued a pointer behind *C1*'s tuning knob. You can use the same arrangement, or any other variation your imagination suggests.

The maximum-capacity position of *C1* has already been set at 50 mc. and should be so marked. All you have to do now is use the signal generator to identify the 51-, 52-, and 53-mc. positions of *C1* and mark the dial accordingly (do not disturb the settings of *C2* or *C7*).

If a signal generator is not available, adjust *L3*'s slug as before and connect a good antenna to *J1*. Capacitor *C2* can then be set so that ham signals are picked up over most of *C1*'s tuning range. Finally, adjust *C7* for maximum volume of any station received near the maximum-capacity position of *C1*.

Once you begin to use the receiver, you'll find that its built-in speaker provides adequate volume for most signals. When DX'ing, however, keep a set of headphones handy to help you pull in the weak ones. 30

Short-Wave Broadcast Predictions

By STANLEY LEINWOLL
Radio Propagation Editor

APRIL 1963

DURING March and April, the sun is almost directly overhead in the equatorial regions—a condition which has a beneficial effect on signals traveling from one point to the "antipodal" point on the other side of the globe. For example, if you live along the Eastern seaboard, this is the time of year to tune for short-wave broadcasts from Australia and New Zealand. West Coast listeners should simultaneously be looking for DX signals from South Africa. If—depending on the time in the country you want to tune in—the path between the DX station and your receiving location is across a zone of daylight, listen in on the 15-mc. band. If the path is across darkness, listen in on the 6- or 7-mc. band. And don't forget that radio signals take the "Great Circle" route, which is simply the shortest distance between two points on the globe.

TIME (EST)

Between Eastern USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	7	6	7	11	15	15	17	17	15	9	9	7	
Eastern Europe	6	6	7	11	15	15	15	11	9	7	7	7	
South & Central America	11	11	11	11	17	17	17	17	17	17	15	11	
Near East	7	7	7	11	15	15	15	15	11	9	9	9	
North Africa	7	6	6	11	15	17	17	17	15	11	9	7	
South & Central Africa	9	9	9	15	21	21	21	21	15	11	11	7	
Australia & New Zealand	11	11	11	9	11	11	*	17	21	21	17	11	

TIME (CST)

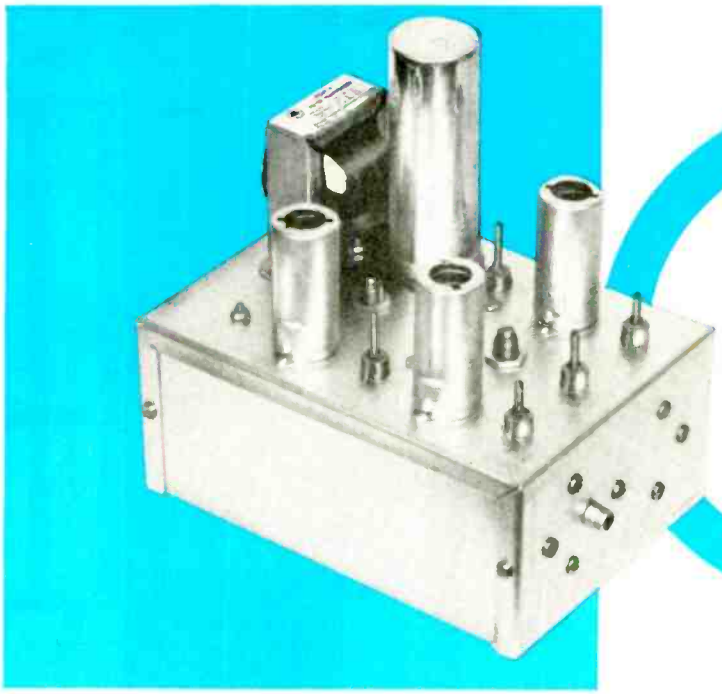
Between Central USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	7	6	7	11	15	15	17	15	9	7	7	6	
Eastern Europe	7	7	7	11	15	15	11	11	7	7	6	7	
South & Central America	11	9	9	15	17	17	17	17	15	11	11	11	
North Africa	7	7	7	11	15	17	17	15	11	9	9	7	
South & Central Africa	7	7	7	15	17	17	17	17	17	15	11	9	
Far East	9	7	7	7	9	9	9	15	17	17	15	11	
Australia & New Zealand	11	11	11	9	11	11	*	21	21	21	17	11	

TIME (PST)

Between Western USA and:	00	02	04	06	08	10	12	14	16	18	20	22	24
Western Europe	7	7	7	11	15	15	15	11	7	6	6	6	
Eastern Europe	7	7	7	11	15	15	11	9	7	7	7	9	
South & Central America	9	9	9	15	17	17	17	17	17	15	11	11	
Africa	7	7	7	11	15	17	15	11	11	9	7	7	
Far East	9	9	9	7	11	11	11	17	21	21	15	11	
South Asia	7	7	7	7	11	15	11	9	15	17	15	9	
Australia & New Zealand	11	11	9	7	11	17	21	21	21	21	17	11	

To determine the frequencies and times for best short-wave reception in the United States, select the table for the area you are located in, read down the left-hand column to the region you want to hear, then follow the line to the right until you are under the figures indicating your approximate local time. The boxed numbers will tell you the frequency band (in megacycles) to listen to during any 2-hour interval. Asterisk (*) indicates that signals will probably not be heard.

Part 1



BUILD THE MPX

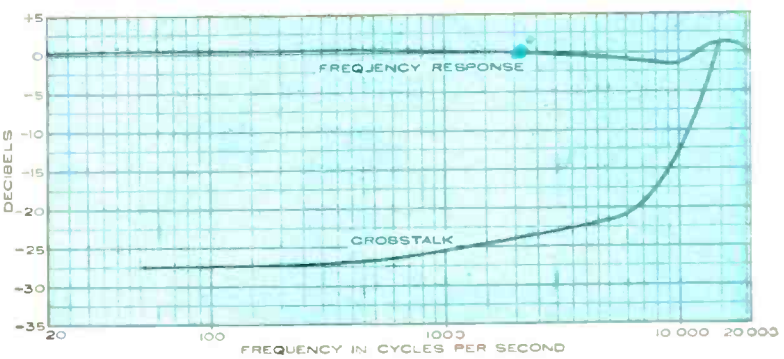
By ALTON B. OTIS, JR.

A challenge for even the experienced constructor, this self-powered multiplex adapter provides performance well worth the extra effort

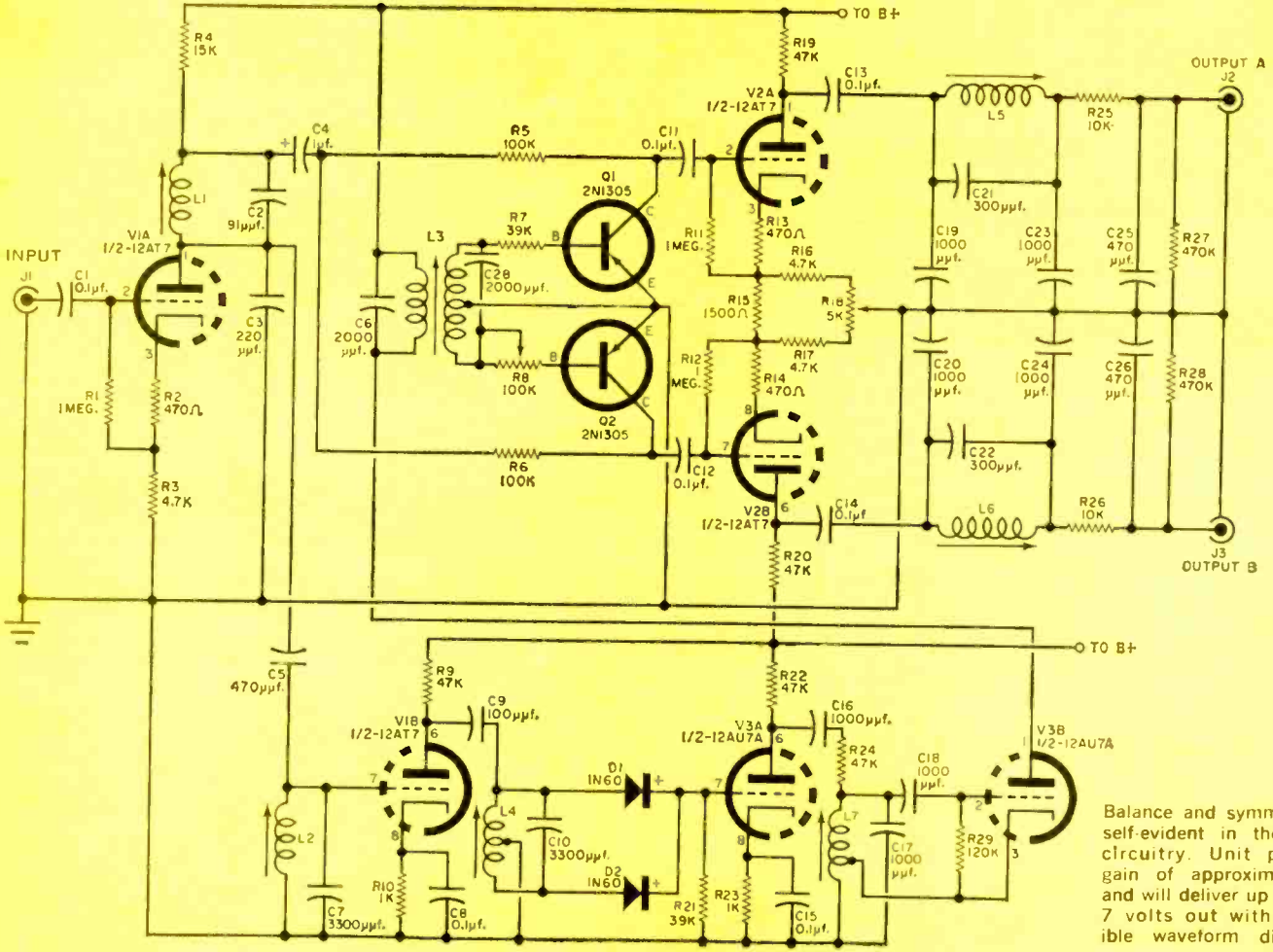
A GOOD MANY multiplex adapters have hit the nation's hi-fi showrooms since the FCC approved the Zenith/GE system for FM-stereo broadcasts 'way back in early 1961. Today, there is even a multitude of kits on the market for people who like to "build their own." For those constructors who prefer to start with an unpunched chassis, however, the MPX poses a challenge which —if met—will pay off in results that are truly superlative.

As indicated in the graph below, the Hirsch-Houck Laboratories' tests on the MPX show a frequency response within 1.5 db from 20 to 20,000 cycles—and with none of the high-frequency roll-off often found in FM-stereo adapters and tuners with 38-kc. filters. In addition, separation (crosstalk) exceeds 20 db up to 6500 cycles and is still better than 10 db at 10,000 cycles!

Matrixing vs. Switching. Basically, there are two types of detection methods



The MPX came through its Hirsch-Houck Lab Check with flying colors—sound quality, noise level, and separation were all found to be "excellent." Note that frequency response and crosstalk for the two channels have been averaged here for simplicity.

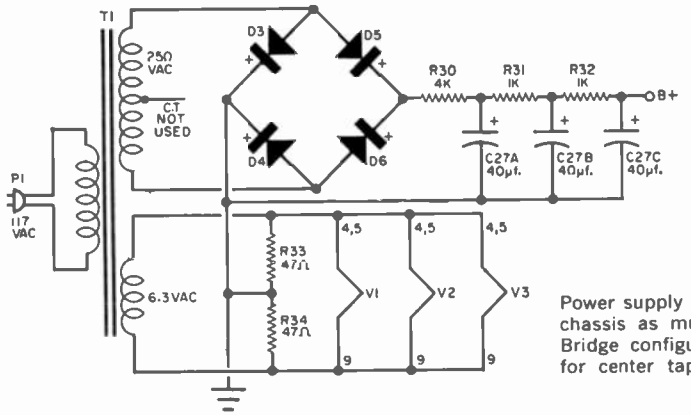


Balance and symmetry are self-evident in the MPX's circuitry. Unit provides gain of approximately 7, and will deliver up to about 7 volts out without visible waveform distortion.

PARTS LIST

C1, C8, C11, C12, C13, C14, C15—0.1-μf., 200-volt paper capacitor
C2—91-μμf., 5% mica capacitor
C3—220-μμf., 5% mica capacitor
C4—1.0-μf., 450-w.v.d.c. electrolytic capacitor
C5—470-μμf., 5% mica capacitor
C6, C28—2000-μμf., 5% mica capacitor
C7, C10—3300-μμf., 5% mica capacitor
C9—100-μμf., 10% ceramic disc capacitor
C16, C17, C18—1000-μμf., 5% mica capacitor
C19, C20, C23, C24—1000-μμf., 10% ceramic disc capacitor
C21, C22—300-μμf., 10% ceramic disc capacitor
C25, C26—470-μμf., 10% ceramic disc capacitor
C27- Triple 40/40/40 μf., 450-w.v.d.c. electrolytic capacitor
D1, D2 1N60 diode (G.E., Sylvania see text)
D3, D4, D5, D6—400-PIV, 50-ma. (or more) silicon diode (International Rectifier 2E4 or equivalent)
J1, J2, J3— RCA-type phono jack
L1, L2, L3, L4, L5, L6, L7—Hand-wound coils—see details in Part 2
Q1, Q2—2N1305 transistor (RCA, Texas Instruments)
R1, R11, R12—1 megohm; R2, R13, R14—470 ohms; R3, R16, R17—4700 ohms; All resistors ½-watt, 10%, unless otherwise noted
R4—15,000 ohms
R5, R6—100,000 ohms, 1%, matched
R7, R21—39,000 ohms
R8—100,000-ohm potentiometer, linear taper
R9, R19, R20, R22, R24—47,000 ohms
R10, R23—1000 ohms
R15—1500 ohms
R18—5000-ohm potentiometer, linear taper
R25, R26—10,000 ohms
R27, R28—470,000 ohms
R29—120,000 ohms
R30—4000-ohm, 5-watt resistor
R31, R32—1000-ohm, 2-watt resistor
R33, R34—47-ohm, 2-watt resistor
T1—Power transformer: primary, 117 volts a.c.; secondaries, 250 volts a.c. CT @ 25 ma., and 6.3 volts a.c. @ 1.0 amp (Stancor PS-8416 or equivalent)
V1, V2 12AT7 tube
V3—12AU7-A tube
1—7" x 5" x 3" aluminum chassis box (Bud CU-3008-A or equivalent)
3 -9-pin tube sockets with turret (Vector S-N-12T or equivalent)
2 -Terminal turrets for above (Vector S-12 or equivalent)
7—Coil forms (Superex C-4 or equivalent)

Misc.— Line cord and plug, tube shield bases, tube shields, 18- or 20-gauge aluminum, terminal strips, wire, solder, hardware, etc.



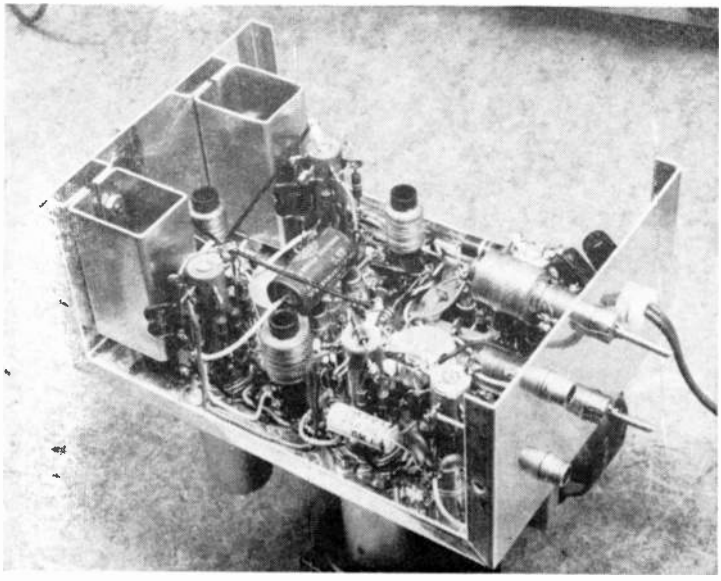
Power supply can be built on same chassis as multiplex circuit above. Bridge configuration obviates need for center tap on transformer T1.

for FM-stereo, and the simpler and more obvious one is matrixing. In a matrix-type adapter, the incoming signal is selectively filtered into three components —the L + R signal, the L — R signal, and the 19-kc. pilot carrier. The latter is used to synchronize an oscillator/doubler, or is itself simply amplified and doubled. The regenerated 38-kc. subcarrier is injected into the L — R signal and electrically added to and subtracted from the delayed L + R signal by a diode matrix system. The resultant separated L and R signals are de-emphasized (to correct for the standard 75-μsec. pre-emphasis) and sometimes amplified before output.

The practical application of this circuit requires very careful construction and alignment of the filtering networks to provide the best compromise between phase shift and separation over the entire audio range. But this approach is still essentially a compromise.

The second method—that of switching —is less obvious in theory, but provides a cleaner signal transfer due to a minimum number of phase-distorting *LC* networks in the signal path. The composite (L + R and L — R) multiplex signal, with only the SCA transmission removed, is switched on and off during alternate 38-kc. half cycles at the grids of the output amplifiers of each channel. The 38-kc. switching is synchronized with the transmitted pilot carrier.

By proper phasing of the switching



Author's model of the MPX has all parts mounted on "half" of a 7" x 5" x 3" chassis box. While definitely not a project for beginners, the MPX is capable of such top-notch performance that it's certain to appeal to the more advanced hobbyist. Full construction and alignment data will appear next month.

signal and filtering of the final output, the left and right signals can be successfully reconstructed. In practice, however, complete on/off switching at peak amplitudes can't be obtained, and separation isn't as great as theoretical predictions might suggest. To compensate for this, a differential amplifier is used as the output amplifier to decrease the effective amplification during the "on" portion in one channel, and thus further suppress the signal in the other.

Theory Into Practice. The signal from the multiplex output jack on the associated FM tuner is fed into an amplifier (tube *V1a*) with a very high input impedance to prevent loading the tuner output. The parallel *LC* combination (*L1/C2*) in the plate circuit of this stage (in conjunction with capacitors *C3* and *C5*) provides the necessary SCA rejection. Capacitor *C5* also feeds some of the signal into the 19-kc. tuned grid circuit of the 19-kc. amplifier (tube *V1b*, and the other "half" of the "first" 12AT7).

The amplified 19-kc. signal is passed to *L4* and *C10* (also tuned to 19 kc.), and diodes *D1* and *D2* act as a full-wave rectifier to produce a semi-sinusoidal 38-kc. signal. This signal, in turn, is amplified by tube *V3a* (the first "half" of a 12AU7-A) and used to synchronize a 38-kc. Hartley oscillator (tube *V3b*, the other "half" of the 12AU7-A).

The output from the oscillator is fed (via *L3*) into the bases of the switching transistors (*Q1* and *Q2*). The composite signal applied to the collectors is alternatively switched on and off in the two channels as the transistors are driven from cutoff to saturation, respectively. During cutoff, the impedance of the transistor is on the order of 1 megohm; while during saturation it drops to a few ohms. The net result is that the transistor acts as a "switch" and thus provides the switching action.

Tube *V2*—another 12AT7—is the differential amplifier. When the input to one half is greater than that to the other, the voltage across resistor *R15* increases the voltage across the cathode resistor in the channel with the lower input. As a result, the gain of that channel is reduced, and separation is increased in a manner analogous to the operation of any push-pull "driver" stage with a "common" cathode resistor.

The output from the differential amplifier is finally fed through a 38-kc. reject filter and de-emphasis network before going to the output jacks.

NEXT MONTH: Part 2 Constructing and Aligning the MPX

A buyers' guide for

COVER STORY

PORTABLE TAPE RECORDERS

. . . featuring 30 different transistorized, battery-powered, capstan-drive units

By **FRED BLECHMAN,** K6UGT

THINKING of buying a transistorized, battery-operated tape recorder? They're great for anything from plain fun to big business. There's a lot of enjoyment to be had with one at parties or even on an everyday basis—hams and SWL's can tape their "contacts" for future playbacks—students can use a tape recorder to study with (while sleeping, if you like)—businessmen can make on-the-spot memos. And, if you're a slide or home movie enthusiast, you can add sound to your presentations—even record the sound when you shoot the film!

With all these uses—and more—for tape recorders, it's no wonder there are so many domestic and imported units on the market today. And, because there are so many models, finding the proper

(*Continued on page* 70)

See Tape Recorder Comparison Chart on following two pages ▶

TAPE RECORDER

MODEL	SOURCE	PRICE	TRANSIS-TORS	TRACKS	SPEEDS	REEL DIAMETER (INCHES)	FREQUENCY RESPONSE	RECORD INTERLOCK
CIPHER III	H	$119.95	7	2	3¾;1⅞	3	200-6000	√
CITROEN 550	D	129.50	5	2	7½;3¾; 1⅞	3	250-6000	√
CITROEN 660	D	149.50	5	2	7½;3¾; 1⅞	3	200-7000	√
CONTINENTAL "100"	P	129.50	7	2	1⅞	4	100-6000	
COSMOPOLITAN 400	B	197.50	12	2	3¾;1⅞	5	150-7000	√
CRAIG TR-403	E	159.95	6	2	3¾;1⅞	3	NA	√
CRAIG TR-505	E	159.95	6	2	3¾;1⅞	5	NA	√
FANON-MASCO FTR-1	F	149.95	6	2	3¾;1⅞	3	200-6000	
FI-CORD 101	I	199.50	4	2	1⅞	2	100-4000	
FI-CORD 202	I	350.00	NA	2	7½;3¾	4	50-12,000	√
FUJIYA MTR-252	G	89.95	4	2	3¾;1⅞	3	150-5000	√
FUJIYA TBR-31	G	74.50	4	2	3¾	3	150-6000	√
GLOBAL GT-101	M	50.00	6	2	3¾	3	200-4000	√
GRUNDIG-MAJESTIC TK-1	K	139.00	7	2	3¾	3	80-10,000	√
HITACHI TRQ-370	R	99.95	7	2	3¾;1⅞	3	150-6500	√
MICROCORDER II	S	149.50	6	2	3¾;1⅞	3	250-5000	√
MIRANDA "MIRANDETTE"	A	159.95	6	2	3¾;1⅞	3	200-6000	NA
PANASONIC RQ-114	O	129.95	5	2	3¾;1⅞		200-5000	√
PHONO TRIX EXECUTIVE 88B	N	149.95	6	2	1⅞	2½	100-6000	
PHONO TRIX MARK II (4178)	N	79.95	4	2	1⅞	3	200-6000	
PHONO TRIX MARK II (4334)	N	79.95	4	2	3¾	3	200-6000	
PHONO TRIX MARK III (5178)	N	99.95	4	2	1⅞	3	200-6000	
PHONO TRIX MARK III (5334)	N	99.95	4	2	3¾	3	200-6000	
PHONO TRIX MARK IV	N	129.95	6	2	3¾	3	150-9000	
REALISTIC 14K90LX531	Q	99.95	4	4	3¾;1⅞	3	200-5500	
REALISTIC 14K90LX558	Q	69.95	4	2	3¾;1⅞	3	200-5500	
TECHNICORDER RK-126L	J	79.50	6	2	3¾;1⅞	3	200-6000	√
TRANSCORDER RK-425WX	J	174.50	4	2	1⅞	4	150-5000	
UHER 4000 REPORT	L	379.00	10	2	7½;3¾ 1⅞;15/16	5	50-22,000	NA
UNICORDER 61	C	179.95	6	2	3¾;1⅞	3¼	80-8000	√

A—Allied Impex Corp.
300 Park Ave. S.
New York 10, N.Y.

B—American Concertone, Inc.
9449 W. Jefferson Blvd.
Culver City, Calif.

C—American Geloso Electronics, Inc.
251 Park Ave. S.
New York 10, N.Y.

D—Citroen Electronics Corp.
832 N. La Brea
Los Angeles 38, Calif.

E—Craig-Panorama, Inc.
5290 W. Washington Blvd.
Los Angeles 16, Calif.

F—Fanon Electronic Industries, Inc.
439 Frelinghuysen Ave.
Newark 14, N.J.

G—Fujiya Corp., Ltd.
45 W. 21st St.
New York 10, N.Y.

H—Inter-Mark Corp.
80-00 Cooper Ave.
Brooklyn 27, N.Y.

I—Karl Heitz, Inc.
480 Lexington Ave.
New York 17, N.Y.

J—Lafayette Radio Electronics Corp.
111 Jericho Turnpike
Syosset, L.I., N.Y.

K—Majestic International Sales
743 N. LaSalle St.
Chicago 10, Ill.

L—Martel Electronics
7400 Melrose Ave.
Los Angeles 46, Calif.

M—Masuyama International Corp.
214 W. 14th St.
New York 11, N.Y.

N—Matthew Stuart & Co.
156 Fifth Ave.
New York 10, N.Y.

O—Matsushita Electric Corp. of America
41 E. 42nd St.
New York 17, N.Y.

COMPARISON CHART

BATTERY REPLACEMENT COST	RECORD LEVEL INDICATOR	ACCESSORIES INCLUDED	ACCESSORIES OPTIONAL	REMOTE CONTROL	DIMENSIONS (INCHES) H x W x D	WEIGHT (POUNDS)	FAST FORWARD	FEATURES
$0.60	√	2,6,7,8	1,4,5	√	2¾ x 7⅛ x 6¾	4		17,18,20,22,24,35
.60	√	1,6,7,8	4,5	√	2½ x 5 x 9	5		22,34
.60	√	1,6,7,8	4,5	√	2½ x 7½ x 7	5½		22,34
.90	√	2	7		7½ x 10½ x 3¾	7		20,22,24,25
.60	√	6,8,11	1,4	√	3⅜ x 11 x 7⅞	10	√	17,20,21,22,29,32,33
1.70	√	2,6,8	1,4,5	√	2¾ x 7½ x 6⅞	5		22,24,25
.90	√	6,7,8	1,4	NA	5 x 12 x 10½	10	√	11,17,19,22,31
.60	√	7,8	1,4,5,6	√	3 x 9½ x 8	6		15,17,20,24,25
.20		7	1,4,6 7,8,9		1⅝ x 6⅜ x 3¼	1.7	√	14,20,22,23,24
19.80	√	7	3,5,6, 7,8,9	√	4½ x 9 x 6½	6¾	√	18,22,24,25,27,33
1.68	√	8	5,6	√	3⅛ x 9½ x 5⅝	4.6		
.90	28	8	5,6		3 x 11 x 6½	7		
1.61	√	NA	7	√	3 x 9 x 6¾	4½		20,22,24,25
.88	√	7	1,2		4½ x 11¾ x 7	8		18,19,31
.56	√	2,6,8	5,7	√	3⅜ x 8 x 6	5	√	17,18,22,24,25
.60	√	7	2,3,5,6	√	2¼ x 8 x 8	4½	√	20,22,24,25
.60	√		1,2,4, 6,7,8		3 x 9½ x 7¾	6¾		11,17,18,20,22,24,25, 26
2.16	√	6,7,8	1,4,5	√	2⅛ x 7¼ x 7	4¾	√	17,22,24,25,31
.72	28	8,14	1,2,4, 5,6,7,9	√	1⅞ x 4¼ x 7½	2¼	√	20,24,25
.60	28		1,2,5, 7,8,9		4¼ x 9 x 5	4		20,25,27
.60	28		1,2,5, 7,8,9		4¼ x 9 x 5	4		20,25,27
.60	28	6	1,2,5, 7,8,9		4¼ x 9 x 5	5		19,20,27
.60	28	6	1,2,5, 7,8,9		4¼ x 9 x 5	5		19,20,27
.60	28	6	1,2,5, 7,8,9		4¼ x 9 x 5	5		19,20,27
1.65	√	6,7,8	1,3,4,5	√	2¾ x 9 x 6	4½	√	18,22,24,25
1.65	√	6,7,8	1,3,4,5	√	2¾ x 9 x 6	4½		18,22,24,25
.60	√	2,6,7,8	1,3,4,5	√	3 x 9½ x 8	6		17,20,22,24,25,26
1.82	28	7,13,14	1,4,5, 6,8,9		1⅞ x 3⅜ x 3½	3		22,24,25,30
.60	√	5,6,12	1,2,3, 4,8,10	√	3¼ x 10½ x 8½	6	√	18,19,20,21,22,24,25, 27,31
1.00	√	6,7,8,11	1,2,4	√	2¾ x 7 x 6	5	√	17,18,22,24,25,26

P—North American Philips Co., Inc.
230 Duffy Ave.
Hicksville, L.I., N.Y.

Q—Radio Shack Corp.
730 Commonwealth Ave.
Boston 17, Mass.

R—Sampson International Importers
2242 S. Western Ave.
Chicago 8, Ill.

S—Webcor, Inc.
5610 Bloomingdale Ave.
Chicago 39, Ill.

NA—Information not available

1—Telephone pickup
2—Patch cord for radio & TV
3—Remote start/stop control
4—Footswitch control
5—117-volt a.c. converter
6—Carrying case
7—Batteries
8—Earphone
9—Separate amplifier/speaker
10—Voice-operated start/stop
11—Built-in a.c. converter
12—Rechargeable battery
13—Uses special tape cartridge
14—Microphone used as speaker
15—Microphone controls stop, record, rewind, and playback
16—Battery charger
17—Uses a.c. recording bias
18—Separate radio input
19—Pause control for editing
20—Push-button controls
21—Batteries recharge while operating on 117 volts a.c.
22—Battery voltage monitor
23—Automatic recording level control
24—Can be controlled with cover closed
25—Reels are visible with cover closed
26—Synchronizes with 8-mm. movie film
27—Monitors while recording
28—Mark on volume control sets recording level
29—Separate drive and rewind motors
30—Manual rewind
31—Tone control
32—Built-in BCB superhet receiver
33—Digital tape counter
34—Tape position indicator
35—Illuminated tape footage indicator

PORTABLE TAPE RECORDERS

recorder to suit your individual needs could be a time-consuming chore. Read this article, though, and choosing your tape recorder will be a snap. Even if you consider a unit other than one discussed in this article, the facts contained here will give you a firm basis for evaluation.

The portable recorders listed in the Comparison Chart on pages 68 and 69 have been limited to those containing certain basic features which enable them to be used as is or in complete compatibility with standard, 117-volt, plug-in units. These features, common to all the recorders listed, are capstan drive, built-in record and playback amplifiers, and a playback and record volume control.

The first question you should ask yourself when you consider purchasing a tape recorder is: "What will I use it for?" If your answer is: "Just for kicks at parties, etc.," the determining factor is how much you want to spend—since just about any unit will be suitable. However, if you want quality reproduction, frequency response is an important factor —the wider the better. All frequency response figures in the Comparison Chart have been taken from manufacturers' literature and, incidentally, are for the fastest speed of the recorder.

Although the Comparison Chart is limited to capstan-drive (constant-speed) units, there are also rim-drive (fluctuating-speed), and variable-speed recorders available. The capstan-drive principle offers the best results and is the one employed on standard recorders.

Tapes recorded on a portable unit having a capstan drive can be played back on standard tape recorders and vice versa. On the other hand, a recording made on a rim-drive or variable-speed recorder can be played back only on a similar machine and, in many cases, only on the unit which made the recording. This is an important factor to keep in mind if you plan to correspond by tape, or use a second recorder interchangeably with your portable unit.

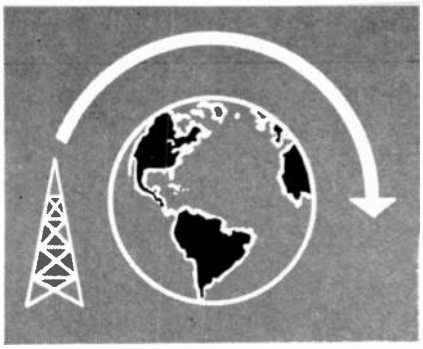
The "Transistors" column in the chart may be helpful to you in determining the ability of a recorder to give quality reproduction. A good guide—though not a hard and fast rule—is that the more transistors, the better. This can be seen by the fact that a push-pull audio output stage, which requires two transistors, offers better quality than a single-ended output stage—which needs only one transistor.

Recording speed is measured in inches per second (ips)—which means that a machine recording at 7½ ips allows 7½ inches of tape to pass the recording head each second. The majority of home recorders have 3¾ ips as one of their speeds, but 1⅞ and 15/16 ips are also com-

(*Continued on page* 102)

TAPE TYPES AND RECORDING TIMES

TAPE	TYPE and THICKNESS (mils)	PRICE	REEL SIZE (inches)	TAPE LENGTH (feet)	RECORDING TIME (minutes) 7½ ips	3¾ ips	1⅞ ips
American D-5MT	Mylar 0.5	$2.50	3	500	26	53	106
Audiotape 261	Mylar 1.0	.66	3	225	11	22	45
Burgess 200-3	Mylar 0.5	1.60	3	300	15	30	60
Irish 351	Mylar 0.5	1.35	3	300	15	30	60
Knight 95R757-J	Mylar 0.5	.72	3	300	15	30	60
Lafayette RT-21	Mylar 0.5	1.35	3¼	600	30	60	120
Realistic 44K1049	Mylar 0.5	.75	3	300	15	30	60
Sarkes Tarzian 1321-02	Mylar 1.0	1.00	3	225	11	22	45



Monthly Short-Wave Report

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

DX'ER OF THE MONTH

IF YOU THINK you can't hear much with an inexpensive receiver, our DX'er of the Month—Earl H. Kinmonth—will tell you differently. Earl's first set cost a little over $25.00, but he was able to log 45 countries—and he has verifications from 23 of them!

Holder of the Monitor Registration WPE9AGB, Earl lives at 2524 Golfview Rd., Joliet, Ill., is a high school student (with a 97.4% average), and is also editor of the Special Features section of the Midwest DX Shortwave Club paper. He started in radio by tinkering with old receivers, and has since "graduated" to the point where he is able to service radios and TV receivers for his friends and relatives.

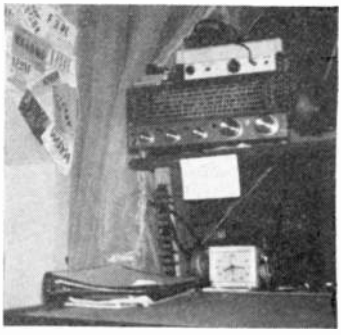
Earl recently replaced his original two-tube Knight "Span Master" receiver with a Hammarlund HQ-129X, with which he hopes to considerably increase his total of countries heard and verified. His extremely well equipped listening post includes, in addition to the HQ-129X, a Heath MR-1 "Comanche" ham-band receiver and a DX-35 transmitter, a "Voice of Music" stereo tape recorder, a Knight KF-75 FM tuner, an H. H. Scott multiplex adapter, and a Heath AA-20 stereo preamplifier. After he has received his amateur radio license—which should be very soon now, he hopes to talk to amateurs in many of the countries he has already logged. He'll be using the DX-35 and "Comanche" listed above, of course.

An advocate of classical music, Earl will usually be tuned to WFMT, one of Chicago's FM stations, while he's doing his studies. Because of his appreciation of serious music and programming, his favorite overseas stations are those of the British Broadcasting Corporation, the *Voice of Germany*, *Radio Nederland*, and the Swiss Short-Wave Service.

Earl DX'es on the 31-meter band (9 megacycles) most of the time, although

Earl H. Kinmonth, of Joliet, Ill., our DX'er of the Month, in his well-equipped listening post. Some of the units shown include his new Hammarlund HQ-129X receiver, Heath MR-1 "Comanche" amateur-band receiver, and a Motorola TV set.

George Hemingway, of Taftville, Conn., is the operator of Monitor Station WPE1DYC. George receives with a Lafayette HE-10 and a Knight "Ocean Hopper." His record: 59 countries logged; 41 verified.



The listening post of David Siddall, WPE1EBN, Hyannis, Mass., features a Hallicrafters S-118 receiver. Dave has logged 49 countries.

a recent venture into the 60-meter band promptly netted him signals from Accra, Ghana; and ELWA, Monrovia, Liberia. Other areas logged recently: Israel, Southern Rhodesia, Okinawa, and Saudi Arabia.

Our DX'er of the Month has a few more hobbies: coin collecting, piano and trumpet playing, and last—but not least—writing. You may be interested to know that back in 1960 Earl prepared an article on *Radio Canada* which, with surprisingly little editing, appeared in this column in August of that year.

The future plans of the versatile WPE9AGB include, among other things, the taping of programs and transmissions for reporting to stations. He feels that this method of reporting is of considerably greater use to a station than the standard accepted practice.

(*Continued on page* 106)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

All of the stations below specifically beam English-language newscasts to the U.S.A. The times may vary a few minutes from day to day.

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Australia	Melbourne	17,840, 15,315 9580	2030, 2130, 2230 0745
Bulgaria	Sofia	6070	1900, 2000, 2300
East Congo	Leopoldville	11,755	1630, 2100, 2230
West Congo	Brazzaville	11,725	2015
Czechoslovakia	Prague	11,990, 9795, 9550, 9345, 5930	2000, 2330
Denmark	Copenhagen	9520	2100, 2230
West Germany	Cologne	9735, 5980 9605, 6145 9735, 6110	1530 1920 0000
Hungary	Budapest	11,890, 9833, 9770 9833, 9770, 7220	1900 2230
Italy	Rome	11,905, 9575	1930, 2205
Netherlands	Hilversum	9715, 6085 6035, 5985	1625 (exc. Sun.) 2030 (exc. Sun.)
Portugal	Lisbon	6185, 6025	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840 9605 6065	0900 2215 2045
Switzerland	Berne	11,865, 9535, 6165	2030, 2330
U.S.S.R.	Moscow	9650, 9570, 7330, 7320, 7290, 7280, 7250, 7240, 7200, 7180, 7170, 7150, 7130, 6100, 6070, 5960[1]	1700, 1900, 2000, 2100, 2300, 0000, 0040

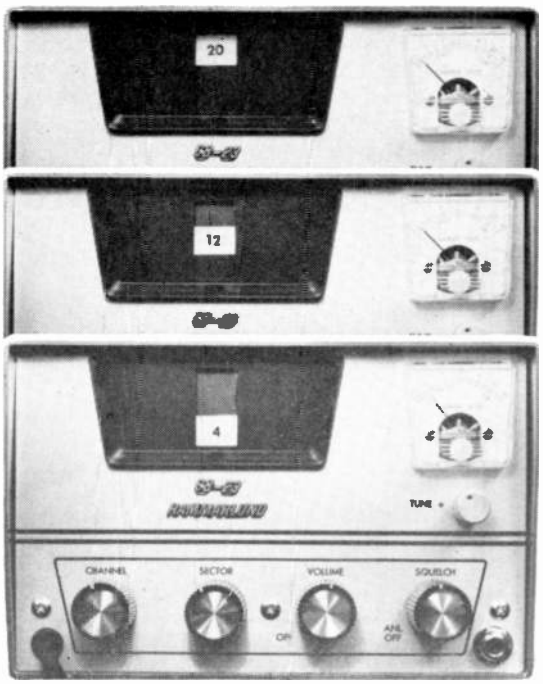
1. Not all channels are in use at any one time.

Equipment Report

Hammarlund Introduces 23-Channel CB

HERE'S a CB transceiver that deserves the accolade, "something new under the sun." It's the Model CB-23 transceiver built by the Hammarlund Manufacturing Co., 53 West 23rd St., New York 10, N.Y. Housed in this medium-sized package is a 23-channel crystal-controlled transmitting and receiving system ready to go to town on any CB channel the minute it's unwrapped, connected to an antenna, and plugged into the a.c. line. With no extra crystals to buy (and possibly misplace), the CB-23 puts the CB'er about as far up the ladder of "operating convenience" as he can expect to go.

The secret behind the CB-23's amazing performance is a crystal-controlled frequency synthesis circuit that makes 11 crystals do the work of 46. Not only is there no loss of stability with this arrangement, but the double-conversion receive section is so sharp that it has a vernier tuning adjustment on the front panel for "zeroing in" the other station on receive. In brief, this is a truly professional CB transceiver, built to last.



Triplets? Not really—it's just our way of showing how CB channels on the CB-23 are divided into three "sectors," with 7 or 8 channels per position. Note how the dial screens out the unused sector as the sector panel switch is moved through its three positions. The small knob directly under the combination S-meter and modulation percentage indicator, incidentally, is the vernier tuning adjustment for the receive section.

BOX SCORE				
	Excellent	Good	Fair	Poor
Talk Power	✓			
Selectivity	✓			
Sensitivity	✓			
Squelch	✓			
Noise Limiting	✓			
Stability	✓			
Operating Ease	✓✓			

Hi-Fi Lab Check

Heathkit AA-21
Transistorized Stereo Amplifier

Manufactured by Heath Company, Benton Harbor, Mich.

Prices: $134.95 (kit); $219.95 (assembled and tested).

ALTHOUGH we jumped the gun by putting the AA-21 on the cover of our February issue, it has proven to be a stereo amplifier worth waiting for. Possibly it's the fascination of a high-powered transistorized amplifier, but the AA-21 *does* sound cleaner, quieter, and sharper than 9 out of 10 tube-type amplifiers.

The AA-21 is a *real* project to build. We assembled our test model in 19 hours, but found that haste had brought on two cold solder joints that goofed up the first laboratory tests. Locating these joints was a tough job. It's better to take it easy and spend 20-21 hours assembling the amplifier.

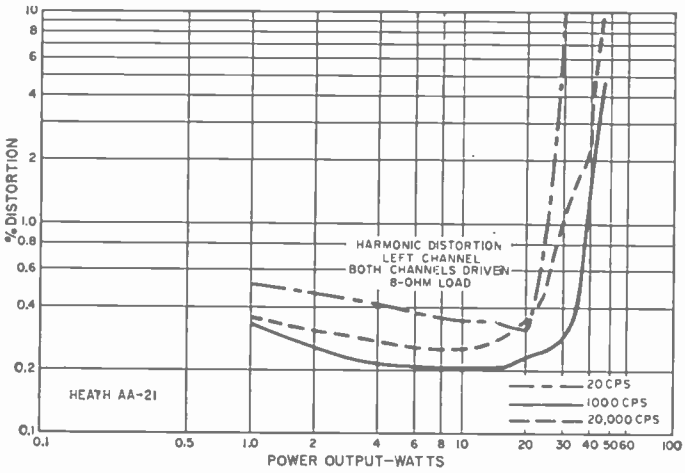
CIRCUIT REPORT: It would require several pages to adequately describe the complex circuit of the AA-21. Suffice it to say that this amplifier consists of 28 transistors, 10 diodes, 4 printed circuit boards, 6 epoxy-coated modules, all the controls to be expected from an amplifier in this price category—and no output transformers!

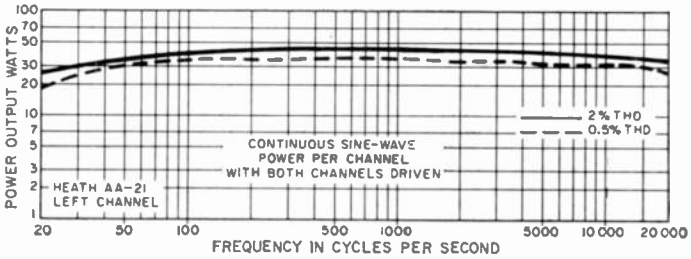
HIRSCH-HOUCK REPORT: The AA-21 lives up to or exceeds the manufacturer's specifications. This is particularly true with regard to the power output level —the curve being very smooth and nearly flat, with little difference between the 2% and 0.5% harmonic distortion values.

Phono sensitivity was 1.2 mv. for 10 watts output. Auxiliary input sensitivity

At left is a view of the drop-down front panel flap which conceals the seldom-used controls of the AA-21; the short panel to the right of the flap is the on-off switch. The photo at far right is a close-up of the huge 3000-μf. filter capacitors in the power supply; two of the printed-circuit boards and heat sinks are also visible here. Immediately at right, the finger points to one of the vacuum-encased circuit breakers that protect the power output transistors.

Harmonic distortion was measured at three different frequencies with both channels driven. Values pertain to the 8-ohm output, the best choice of output impedance on this type of amplifier.





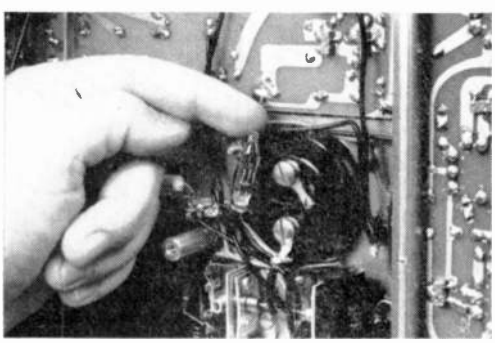
Graph at left shows actual output wattage for two different levels of harmonic distortion. Since both channels were driven, the AA-21 amplifier was putting out nearly 90 watts of audio at the 1000-cycle, 2% distortion point!

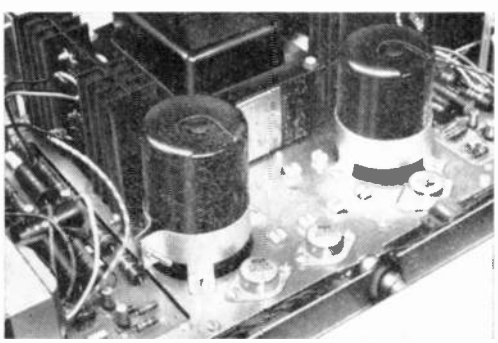
was 0.115 volt. Hum and noise were measured at —62 db and —70.5 db below 10 watts, respectively, on the two inputs.

The amplifier is extremely stable—the circuit breakers which protect the transistors in the power output stages did not open, even when the AA-21 was overdriven.

Crosstalk from phono to other inputs is negligible. There is a soft click as the power supply settles down when the amplifier is switched off. The tone control range is good, with a maximum boost of 17.5 and 14 db at 50 and 10,000 cycles, respectively. The "cut" figures are 19.5 and 18 db, in the same order.

IN CLOSING: Assembling the AA-21 is a challenge equaled by only one other hi-fi kit we know of (a tape recorder). The techniques of transistor mounting and soldering are different and some of the individual components are totally new to the kit field. But the finished amplifier is something you won't find in your next-door neighbor's stereo system. Considering how well the AA-21 performs, he's going to wish he had one!





Knight-Kit KG-12 Multiplex Adapter

Manufactured by Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.

Price: $29.95 (kit)

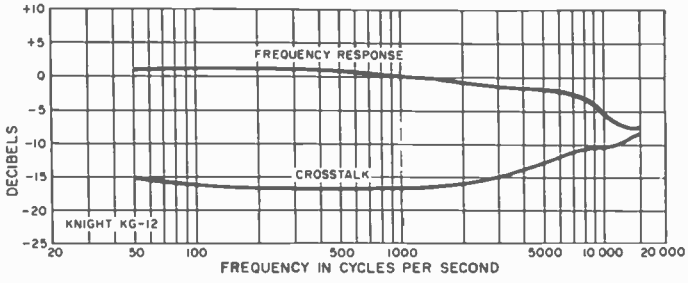
THE Model KG-12 multiplex adapter is compatible with most wide-band FM tuners, and the assembly manual explains how to hook it up to tuners not equipped with multiplex output jacks. It is self-powered and compact enough ($4\frac{3}{4}$" x 6" x $7\frac{1}{2}$") to sit alongside the tuner in most stereo installations. A front-panel selector switch enables the operator to bypass the adapter during conventional FM broadcasts.

CIRCUIT REPORT. The KG-12 incorporates four tubes and a selenium rectifier. A 12AU7 dual triode serves as a wide-band amplifier and bandpass amplifier; a 12AT7 dual triode as a 19-kc. amplifier and stereo indicator amplifier; a 6BN8 triode/dual diode as a 19-kc. oscillator/doubler and L − R and −L + R detectors; and a 12AX7 dual triode as left and right audio amplifiers. The output is fed through the required 75-μsec. de-emphasis networks to two standard phono jacks.

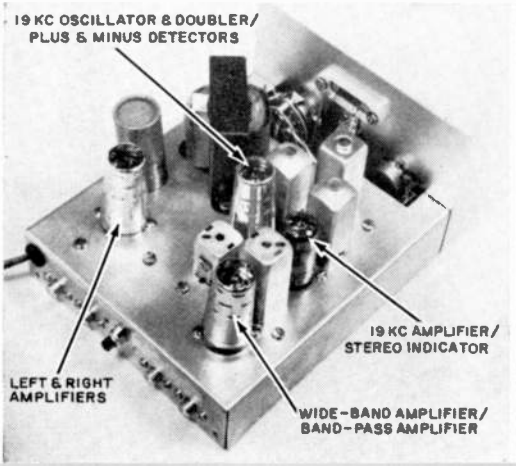
HIRSCH-HOUCK LAB CHECK. The adapter worked well, although separation was only about 15 db at middle frequencies and less at higher frequencies. The alignment procedure outlined in the manual produced an apparent improvement (to about 20-22 db), but the adjustments were very critical and separation was affected by input level, pilot carrier level, etc.

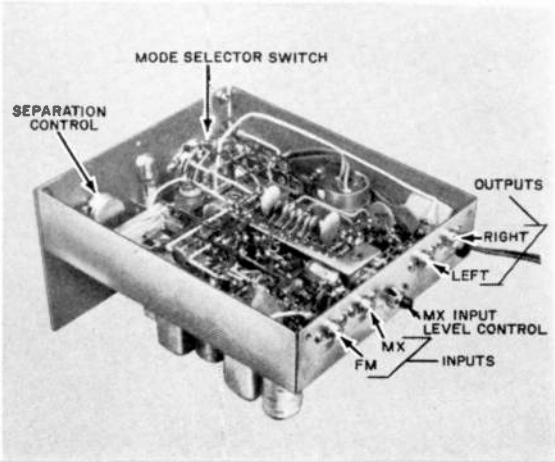
The final test data are representative of what can be obtained in practical situations, although separation was not as good as published figures. The adapter will work with signals as low as 0.2 to 0.25 volt. -30-

Frequency response and crosstalk (i.e., separation) for the KG-12 were measured with a 0.5-volt composite input signal and at an output of 1.0 volt. Maximum undistorted output was about 4.0 volts—more than enough to drive any power amplifier.



Parts placement is neat and wiring relatively uncluttered on the KG-12. Stereo indicator light (near top of front panel in left photo) lights up when station is transmitting FM-stereo broadcasts; pilot light (front-center of chassis in photo at right) lights up when you turn the KG-12 on.



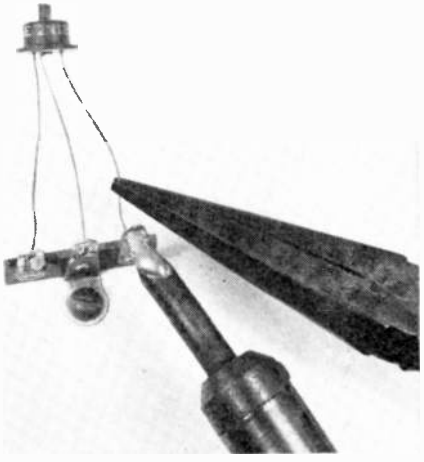


EXTRA FINGERS — — EXTRA HANDS

JUST ABOUT everyone in electronics is called on to supply photographs at some time or other—a couple of "shots" of a Science Fair project, photos to illustrate a "Tips & Techniques" contribution, or perhaps some illustrations for an engineering or technical report. Actually, basic picture-taking procedure was thoroughly covered in the article, "How To Photograph Electronic Equipment," which appeared in POPULAR ELECTRONICS, December, 1962, p. 72. But there's one problem that has plagued nearly every would-be photographer since the days of Daguerre—how to come up with enough fingers and hands to get lights, camera, tools, equipment, and umpteen other "ingredients" all together at the same time.

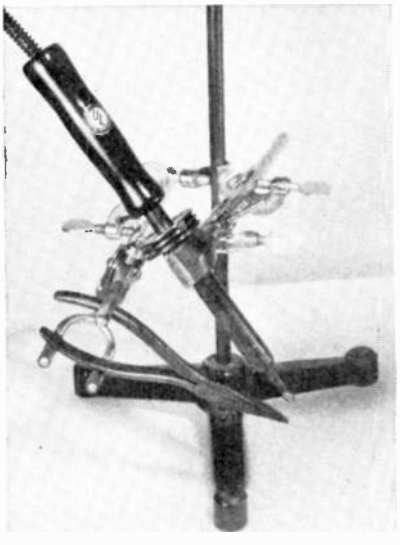
One solution to the problem is to beg, buy, or borrow a stand of the sort used in chemistry laboratories. One of these stands, along with an assortment of matching clamps, will provide you with all the fingers and hands you could ask for. And you'll find your new "limbs" steady enough for even long time exposures (in color, if you wish). In addition, you can control camera angle and picture composition so that your extra fingers and extra hands won't show in the final photo. Take a close look at how one photographer turned the trick—and start shooting!

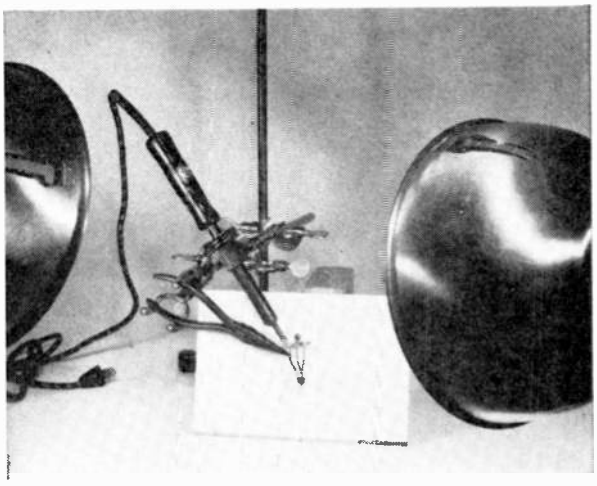
—Lou Garner



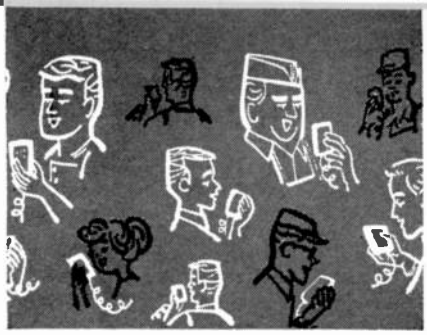
This is the kind of photo every electronics enthusiast can produce—if he brings some extra fingers and hands into the "picture." Illustrations below show how this photo was made.

Two floodlights—one on either side of the "subject"—help minimize shadows. Photo was turned to place transistor "right side up."





Clamps on a chemistry-lab stand were the fingers and hands that made the photo at top left possible. Neither stand nor clamps are visible in final "product."



On the Citizens Band

with **MATT P. SPINELLO,** 18W4689, CB Editor

TAKE your pick: Paris, Egypt, Holland, Italy, or Mexico! Or maybe you'd like to be a part of a world tour starting from Los Angeles, with stops in the Philippines, Japan, Hong Kong, and Indonesia. Then on to Istanbul, into the Holy Land, visiting much of Western Europe, and a last stop at Beirut or Tel-Aviv before heading for home. Such have been the travels of a large group of Airstream Trailer owners known as the "Wally Byam Caravanners."

CB TRAVELS WITH THE WALLY BYAM CARAVANNERS

We learned of this club's activities during a chat with Bob Fleming, GC Electronics' marketing director, while discussing new and unusual applications of CB equipment. Bob informed us that Wally Byam, the Airstream board chairman, had been organizing these trailer caravans for several years, nationally and internationally, including trips to Canada, the Kentucky Derby, the Indianapolis 500, etc. Roundups and rallies have brought as many as 500 trailers, touring from California to Florida, with close to 2000 caravanners participating in the events.

In the early months of 1960, the club members decided to try CB equipment as a means of communication during their caravanning ventures. After a successful Airstream tour during which CB transceivers were employed in the lead and last cars of the caravan, a rousing interest in CB sprouted among the membership. To date, so many members have purchased CB gear that the Caravan Headquarters in Bakersfield, Calif., contemplates printing a CB Caravan Directory of club members and their call-signs.

The advantages afforded Wally Byam's Caravanners through the use of Citizens Band equipment are obvious. Since "home" becomes anywhere they might care to travel, on tour they are as close to one another, and to assistance, as their CB microphones. The uniqueness of it all lies, perhaps, in the thought that they are truly the only *mobile* CB *base* stations in the country.

Many of us have no doubt passed these

The wagon-wheel parking design is a familiar sight at rallies and roundups attended by Wally Byam's Airstream Caravanners. These world-wide travelers have turned to CB radio to help make their journeys coast to coast across the good ol' USA safe and successful.

Wally Byam Caravan club leaders (above) prepare to install a Globe Electronics CB set. While unlicensed for CB operation in foreign lands, the Caravanners probably wondered what kind of range they could get with an antenna atop the pyramid at right.

happy caravanners on the nation's highways, and many more will be seeing them in the future. To spot one of these world travelers, any one of the following might be considered the "sign of a Wally Byam Caravanner": a symbolic beret perched atop the heads of the vehicle's passengers; an Airstream trailer rolling behind; and, in most cases, a Globe CB transceiver mounted under the dash of the car, or in the trailer.

Watch for them—and assist them if you can. These people have the distinction of being able to state that they have "the world at their doorstep!"

CB For The Birds? One of the most gratifying rewards bestowed upon an editor of this type of magazine column (or any column for that matter) is reader mail—pro or con! A representative cross-section of these United States can be found within the monthly bundle that arrives at this desk, usually with an education attached.

A notable example is a letter recently received from S. Elliott Uhler (3Q0339 & WPE2FUY) of Mt. Holly, N. J. Elliott's brief sketch of communication-years-gone-by pretty much made us sit up and listen, with hope for as interesting an electronic life span as has been experienced by Elliott, and surely many others like him.

Sixty-five years young today, Elliott held claim to a ham ticket more than fifty years ago—in 1912 and '13—with a brief "3MA" as a call-sign. As Elliott states: "In those days we only had a 30 amp. service in the house, and the lights in the house would go dim until the rotary spark gap picked up speed. This annoyance would make the 'old gent' so darn mad that he couldn't read his evening paper."

During summer vacations Elliott "hammered the brass" on freighters between New York and Jacksonville, Fla., and not too long ago served on tankers and sea-going tugs, with "ship-to-shore phones, to be sure!" He even found time to include a position as disc jockey with an eastern radio station in his electronic adventures. Presently, Elliott is with us on the Citizens Band, utilizing seven pieces of equipment, including a CB transceiver, two walkie-talkies, an FM receiver, and various short-wave gear.

In signing off his letter, Elliott pegged himself as "the old buzzard of Rancocas Woods!" If this is any indication that those who sign a pact with the spirit of electronics

for the rest of their days turn into some kind of birds, then we look forward to watching our wings grow and our beaks sharpen over the next half-century.

We can't help but get the feeling that while many of us can look back on 10, 20, or maybe even 30 years of electronic schooling and experience in the field, cases like S. Elliott Uhler's mean much more than just the *doing* of a job in a particular field; rather, it might be better stated that he *has become a part* of that field.

At any rate, while we feel like some sort of veterans in the field ourselves, actually—both time- and experience-wise—"we have a long way to grow!"

Another "First." Meet John Slowey and Clem O'Hare! John is a multi-talented television director and college student from Wales, Wisc.; Clem is a many splintered thing—a creation that stems from John's childhood. Midwest youngsters by the thousands have thrilled to John and Clem's shenanigans for nigh on to 15 years, through personal appearances, live and taped TV performances.

Being a good ventriloquist without lip or jaw movement wasn't enough for John. Clem was made on special order to do practically everything but walk. His eyelids operate independently, as do his eyes (in either direction), along with movements of both lower and upper lips, enough to make Clem one of the most human accumulations of lumber we've ever seen.

John and Clem came to our attention CB-wise when we discovered two short antennas hanging over the side of a footlocker and two hand-held CB transceivers attached to the other ends. Neatly reclining beside them was Clem, but he wasn't talking! After much prodding, John let us in on the CB secret, which, we will state here and now, just *has* to be a *first* to add to the ever-growing list of uses of Citizens Band equipment.

In the middle of a performance, John finds an excuse to leave the room, leaving Clem behind with a stern warning to behave while he's gone. Obligingly, Clem remains. But much to the audience's surprise, he might whistle an entire chorus of *Rhapsody in Blue* (upper lip raised) or may hum or sing (with lyrics) the latest rock-'n-roll rage tune. Often, Clem will direct remarks about John to the audience. All this through the magic of CB hand-held units—one in John's hands, the other compactly concealed near Clem's liver.

How John handles the remote-control apparatus for Clem's moving parts we'll keep a secret for now, since he was gracious enough to let us divulge his communication system with Clem. But we wanted to be first to reveal one of the most unusual CB applications heard of anywhere. Wooden you? Ouch!

CB/AM Duo. The Antenna Specialists Co. of Cleveland, Ohio, has just placed the sleek, professional-appearing M-103 antenna on the CB market. Carefully peaked for maximum CB performance, the M-103 is said to function equally as well for AM broadcast reception. It boasts *no* knobs to twist or buttons to push. Switching is all done with a new automatic dividing harness—you merely turn on your CB rig, or the car

(*Continued on page* 104)

John Slowey and Clem O'Hare (he's the wooden one) hash over preparations for their next performance.

Photo by Dave McCullough

Antenna Specialists Model M-103 CB/AM center-loaded antenna.

DX AWARDS

Last month POPULAR ELECTRONICS announced its first series of DX Awards for SWL's registered with the WPE Short-Wave Monitor program. If you are a WPE monitor and have logged and *verified* at least 25 different countries, you're eligible for one of these coveted DX Awards. To apply for your award, read the rules carefully and fill out the coupon below.

1 Each applicant must be a registered WPE Short-Wave Monitor, and must enter his call letters on the application form.

2 Each applicant must submit a list of stations for which he has received verifications, one for each country heard. The list should contain 25, 50, 75, 100, or 150 countries, depending on which DX Award is being applied for. And the following information must be furnished in tabular form for each verification:

(a) Country heard
(b) Call-sign or name of station heard
(c) Frequency
(d) Date station was heard
(e) Date of verification

All the above information should be copied from the station's verification. Do not list any verification you cannot supply for authentication on demand.

3 All pertinent verifications, whether QSL cards or letters, should be carefully packaged and stored by the applicant until such time as instructions are received to send in some or all of them for checking purposes. Instructions on how and to whom to send the verifications will be given at that time. Failure to comply with these instructions will disqualify the application.

4 A fee of 50 cents (in U.S. coin) must accompany the list of verifications to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible for an Award.

5 Apply for the highest DX Award for which you are eligible. If, at a later date, you become eligible for a higher Award, then apply for that Award, following these rules and regulations exactly as before.

6 Awards will be issued to all duly qualified applicants whose applications are received during the year 1963. Any applications postmarked after midnight, December 31, 1963, will be invalid.

7 Mail your verification list 50¢ fee, and application form to: Hank Bennett, Short-Wave Editor, POPULAR ELECTRONICS DX AWARDS, P. O. Box 254, Haddonfield, N. J. Include in the envelope only those items which are directly related to your entry for the Award. Do not include an application for a Short-Wave Monitor Certificate (you are not eligible for any of the Awards until you have a Short-Wave Monitor Certificate in your possession). If you want to ask other questions or supply news items, reports, etc., use another envelope.

POPULAR ELECTRONICS' DX AWARD APPLICATION FORM

(please print)

WPE Call Letters Name

Address City Zone State

Please enter my application for the following POPULAR ELECTRONICS' DX AWARD:

(check one) 25 ☐ 50 ☐ 75 ☐ 100 ☐ 150 ☐

☐ I have enclosed a list of the required number of countries, and I hereby certify that I hold a verification from at least one short-wave broadcasting station in each of the countries listed

☐ I have enclosed 50 cents to help cover the costs of processing and mailing my DX Award

Signature_____ Date_____ 1963

This form valid only through December 31, 1963

3

Mail to Hank Bennett, POPULAR ELECTRONICS DX AWARDS, P. O. Box 254, Haddonfield, N. J.

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

WITH reliable medium-power, high-frequency transistors now available in a variety of types, several firms are producing solid-state VHF communications equipment for aircraft and mobile applications. The FM transmitter shown on this page is typical of the units being offered. Produced by Electronic Communications, Inc. (1501 72nd St. N., St. Petersburg, Fla.), the Model 503A measures only 4¼" x 3¼" x 2½" overall and can be held in the palm of your hand. Despite its small size, this unit is capable of delivering 3 watts in the 215 - 260 mc. band.

Developed under the supervision of C.P. Lawton, manager of ECI's transmitter section, and designed by senior engineers Buddy W. Patton and Neville Downs, the Model 503A has a frequency stability of better than ±0.01% and a maximum FM deviation of ±125 kc. It can operate over an ambient temperature range of −20°C to +85°C and requires no special coooling techniques. Its total primary input power is only 32 watts at 28 volts d.c.

Designed with "space" in mind (it's intended for telemetry applications), ECI's Model 503A FM transmitter is a solid-stater capable of pumping 3 watts into the 215-260 mc. band.

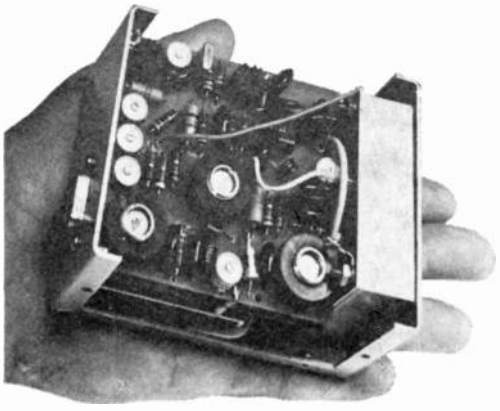


Figure 1 is a block diagram of the Model 503A. As you can see, the instrument is made up of six separate modules—*modulator, r.f. board, power amplifier, frequency tripler, bandpass filter,* and *power supply.* Except for the *r.f. board,* which is assembled on a partially encapsulated etched circuit board, all the modules are potted and encased in aluminum for protection.

The *modulator* is made up of an oscillator stage, a buffer amplifier, and an a.f.c. loop employing a discriminator, filter, and d.c. amplifier. Basic oscillator frequency is varied by applying the modulating signal across a varactor in its tuned circuit. The buffer amplifier uses the common-base configuration for better isolation; this stage serves not only to minimize the effects of changing loads on the oscillator proper, but to amplify the oscillator's 20-mc. carrier before it is applied to the discriminator and mixer stages.

The FM signal obtained from the *modulator* module is combined with a highly stable signal supplied by a Colpitts-type, crystal-controlled oscillator on the *r.f. board.* A balanced mixer is used to eliminate spurious signals, with its output coupled to a three-stage r.f. amplifier providing a power gain of 20 db and supplying approximately 0.5 watt output.

Next, the signal obtained from the *r.f. board* is applied to a two-stage *power amplifier.* Both the intermediate and final power amplifiers are identical except for their output coupling circuits. Both use the common-emitter configuration and are operated in Class C. The

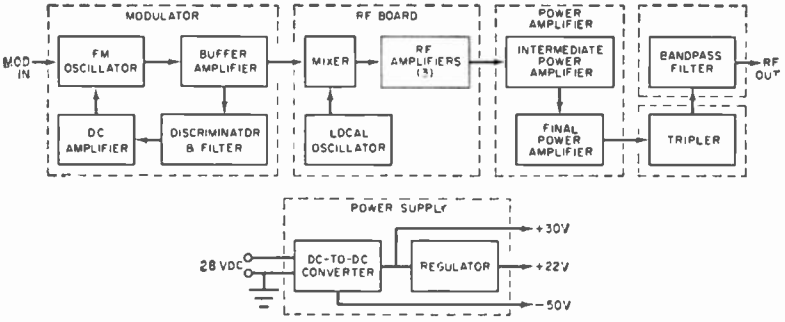


Fig. 1. Block diagram of the 503A VHF transmitter. Circuit will operate under high mechanical stress, in a hard vacuum, at high or low temperatures, and even at voltages below the nominal 28 volts input.

power amplifier module's output is approximately 7 watts in the 72- to 87-mc. frequency range.

A single, self-biased varactor is used in the *frequency tripler* stage to produce the desired signal in the 215-260 mc. band. The *frequency tripler*'s output signal is coupled to the antenna through a *bandpass filter* which serves to reduce spurious radiation to a minimum.

The transmitter's *power supply* is made up of a d.c.-to-d.c. converter and solid-state regulator. A conventional design is used, with the converter employing a pair of silicon transistors in a push-pull, transformer-coupled arrangement.

Although designed orginally for rocket-borne telemetry applications, ECI's new transmitter can be used equally well for general communications (including 'phone).

Reader's Circuit. Want to have some real fun mystifying your friends? Let's say a couple of your neighbors drop in for a short visit. The TV set is on, but nobody pays much attention to it until the announcer starts a particularly obnoxious commercial. You lift your eyes slightly, glance towards the set, and say, "Aw . . . shut up!" *And the announcer obeys!*

While your friends may think that you have an especially well trained TV set, you'll know that the secret of this amazing behavior lies in a simple sound-actuated relay hidden nearby behind a chair, couch, or drape. The "Sound-Relay" circuit, illustrated in Fig. 2, was suggested by reader Eugene Richardson (310 E. Mason Ave., Alexandria, Va.).

The Sound-Relay consists of a single-stage, transformer-coupled audio amplifier driving a two-stage, direct-coupled d.c. amplifier which, in turn, operates a relay. One *npn* and two *pnp* transistors are used.

In operation, a PM speaker serves as a dynamic microphone (*MIC*), converting sound waves into audio signals. Its output is coupled through impedance-matching transformer *T1* to transistor *Q1*'s base. Base bias current for *Q1* is supplied through resistor *R1*, bypassed by capacitor *C1*. The audio signal is amplified by *Q1* and coupled through interstage transformer *T2* and d.c. blocking capacitor *C3* to the two-stage, direct-

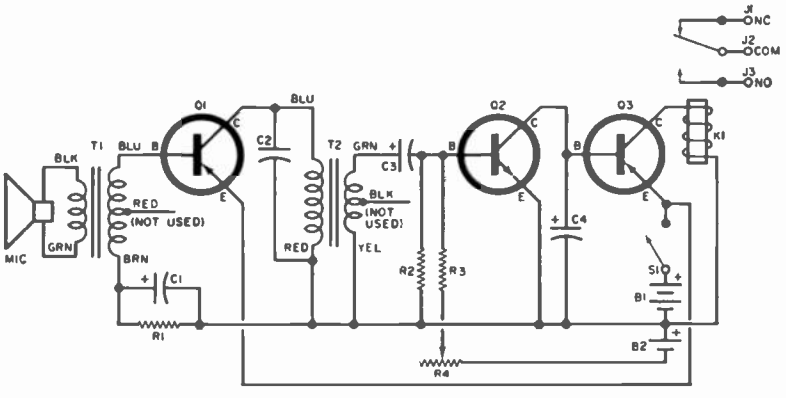
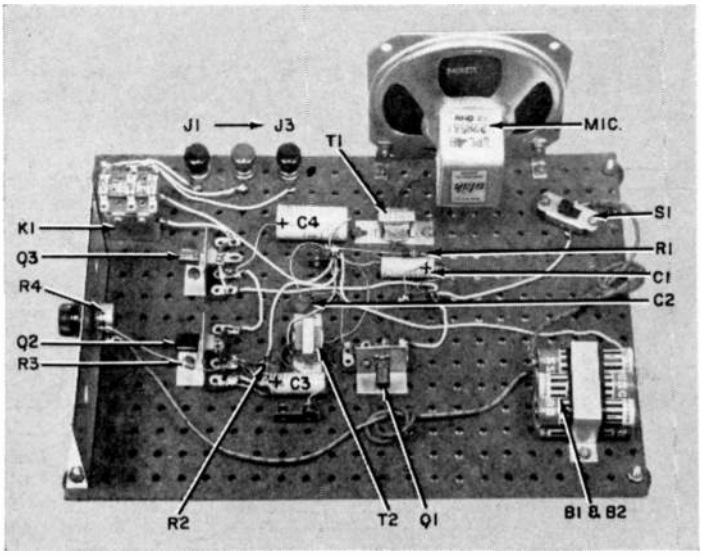


Fig. 2. Just say the "word," and this "Sound Relay" developed by reader Eugene Richardson will "kill" annoying TV commercials on the spot.



The "Sound Relay" was wired "breadboard fashion" by reader Richardson, and this photo shows the location of every major component in the event you wish to duplicate his layout. Capacitors C1, C3, and C4 are electrolytics, so be sure to observe polarity as indicated here and on the schematic diagram (Fig. 2).

coupled amplifier, *Q2/Q3*. Bypass capacitor *C2*, across *T2*'s primary, prevents high-frequency oscillation.

Capacitor *C4*, in *Q3*'s base circuit, furnishes a "time delay" in the operation of the circuit. This capacitor is initially charged through *Q3*'s base/emitter circuit when the power switch (*S1*) is first closed. As long as it is charging, there is base current flow through *Q3*, with a corresponding but larger collector current flow, which closes the relay (*K1*) and holds it closed. Once *C4* is charged, however, *Q3*'s base and collector currents drop and the relay opens.

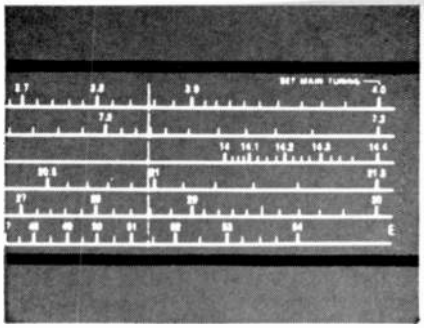
Transistor *Q2* is normally held at cutoff by the reverse (negative) base bias applied through voltage divider *R2/R3/R4*. However, the audio signal applied through *C3* cancels this bias and permits *Q2* to conduct, effectively shorting and discharging *C4*. As *C4* is discharged, *Q3*'s base and collector currents are restored, closing the relay. The relay is then held closed as long as *Q2* conducts, and for a period of time afterwards proportional to the time required to charge *C4*. The time delay period may be increased by using a larger value for *C4*, and vice-versa.

Standard, readily available components are used in the design, and a duplicate instrument can be assembled quite easily in one or two evenings. Both *Q1* and *Q3* are low-cost *pnp* transistors such as CK722's or 2N107's; *Q2* is a *npn* unit such as a 2N35, 2N170, or 2N229. Transformer *T1* is an Argonne AR-119 output transformer, wired "in reverse," while *T2* is an Argonne AR-109 driver unit. The relay is an Advance SO/1C/4000D or equivalent. Almost any 4" to 8" speaker with a 4-8 ohm voice coil can be used for the mike (*MIC*), although the larger speakers are generally more sensitive. Components *C1*, *C3*, and *C4* are 10-15 w.v.d.c. electrolytic capacitors rated at 25 μf., 25 μf., and 100 μf., respectively; while *C2* is a small disc ceramic rated at 0.001 μf. Resistors *R1*, *R2*, and *R3* are ½-watt units with values of 270,000, 4700, and 100,000 ohms, respectively; *R4* is a standard 1-megohm potentiometer, and taper isn't critical. The power supply, *B1*, is made up of five penlight cells connected in series, while bias battery *B2* is a single 1.5-volt cell. Any s.p.s.t. switch can be used for *S1*.

Eugene wired his original model "breadboard" fashion, as shown in the photo above. A similar scheme can be followed when assembling a duplicate unit, or the circuit can be wired in a Minibox, a wooden case, or even an old cigar box. Neither lead dress nor layout are critical, but good wiring practice should be followed. All signal carrying leads should be kept short and direct, and the input and output circuits should be well separated.

With the wiring completed and

(*Continued on page* 96)



Across the Ham Bands

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

FACTS AND FIGURES ON TRANSMISSION LINE LOSSES

IN OUR January column, we described how a standing-wave ratio (SWR) bridge is used to determine how well an r.f. transmission line is matched to its load. In general, the lower the SWR, the more efficient the antenna feed system will be—especially when relatively "lossy" coaxial cable is used. This month, let's dig a bit deeper and learn how line losses affect the measurement of SWR.

First, let's find out where in the antenna transmission line the SWR bridge should be connected. Actually, a properly functioning SWR bridge will indicate the true SWR *at that point*, no matter where in the line it is inserted. On the other hand, if the SWR bridge is gradually moved down the line from the load (antenna) end towards the input (transmitter) end, the measured SWR will gradually decrease, as the normal line losses absorb more and more of the power wave reflected from the mismatched load.

Naturally, if the line and load are perfectly matched, there will be no variation in SWR; under these conditions, there is no reflected wave to be absorbed. From a practical standpoint, however, the difference in SWR at different points on a transmission line in a typical amateur antenna installation can be safely ignored—except for very long transmission lines or VHF operation. Tables 1 and 2 tell the story.

Table 1. In using these Tables, remember that power losses (and gains) are usually expressed in decibels (db). In round figures, a loss of 0.25 db represents a power loss of 7%; a loss of 0.5 db represents a power loss of 12%; 1 db, 20%; 3 db, 50%; 6 db, 75%; and a loss of 10 db represents a 90% power loss.

From Table 1, we see that with a transmission line loss of 0.5 db, a 2:1 SWR at the load (antenna) end of the line will be reduced to 1.9:1 at the input (transmitter) end, and for the same line loss a 3:1 SWR will be reduced to 2.7:1. Similarly, a line loss of 1 db will decrease a 2:1 SWR to 1.75:1, and will decrease a 3:1 SWR to approximately 2.3:1.

For most amateur purposes, no correction for variations in SWR of these magnitudes is required, if for no other reason than the fact that inexpensive SWR bridges are seldom highly accurate in reading actual values of SWR. Even so, they are usually quite accurate in indicating when the line and load are accurately matched (1:1 SWR).

Table 2. When it is desirable to know the exact SWR at the antenna end of a transmission line, it still isn't necessary

Table 1. Variations in SWR at opposite ends of transmission line due to line losses.

SWR at Load End (Antenna)	SWR at Input End (Transmitter) When Transmission Line Loss Is:				
	0.5 db	1 db	2 db	3 db	5 db
2:1	1.9:1	1.75:1	1.55:1	1.4:1	1.25:1
3:1	2.7:1	2.3:1	1.95:1	1.7:1	1.4:1
4:1	3.35:1	2.8:1	2.25:1	1.85:1	1.5:1
5:1	3.95:1	3.25:1	2.5:1	2:1	1.52:1
6:1	4.5:1	3.6:1	2.6:1	2.1:1	1.6:1

Type of Coaxial Cable	Power Rating (kw.)		Impedance (ohms)	Loss in db/100 feet on Amateur Bands (80-2 meters)						
	10 mc.	15 mc.		80 m.	40 m.	20 m.	15 m.	10 m.	6 m.	2 m.
RG-8/AU RG-8/U	2.9	.78	52	.32	.47	.68	.77	1.0	1.5	2.6
RG-11/AU RG-11/U	2.9	.78	75	.40	.57	.92	1.0	1.2	1.6	2.7
RG-58/AU RG-58/CU	.7	.2	50	.93	1.4	2.0	2.3	3.0	4.2	7.8
RG-58/U	.43	.17	53.5	.73	1.0	1.4	1.9	2.4	4.2	5.9
RG-59/AU RG-59/U	.68	.25	75	.68	.96	1.4	1.5	1.9	2.5	4.2

Table 2. Loss characteristics of common coaxial cable.

to "shinny up" the line to measure it. Instead, measure the SWR at the transmitter end of the line and consult Table 2, which lists the losses of commonly used coaxial transmission lines.

For example, if, on 40 meters, your SWR bridge shows a 3.35:1 SWR at the transmitter end of a 50′ length of RG-58/U coaxial cable feeding your antenna, you can immediately determine that the SWR must be 4:1 at the load end in the following manner. From Table 2, we see that RG-58/U has a loss of 1 db per 100 feet at 40 meters; consequently, the loss in 50 feet is 0.5 db. From Table 1, a 3.35:1 SWR on the sending end of a line with 0.5 db loss corresponds to a 4:1 SWR at the load (antenna) end.

Table 2 should also quickly convince you that, although light-duty coaxial cable can be used on the lower frequency ham bands without undue loss, it is poor economy to use it on 6 and 2 meters.

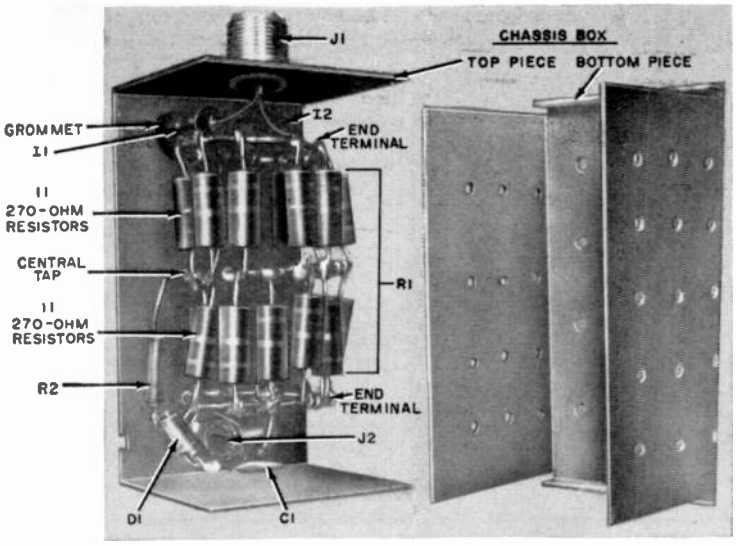
You might be tempted, for example, to use RG-58 type coaxial cable to feed an antenna in a low-power 2-meter station on the basis of its power-handling capabilities and cost. But, before placing your order, take a look at the losses in such cable on 2 meters: RG-58/U, 5.9 db per 100 feet; and 7.8 db for RG-58/AU and RG-58/CU. Translated into power losses, these figures mean that, with a 100′ feedline of RG-58/U, 25% of your transmitter power will actually reach the antenna. With RG-58/AU or RG-58/CU, only about 16% of it will get through.

With RG-8/U or RG-8/AU, however, 56% of the transmitter power will reach the antenna—twice as much as with RG-58/U, and over three times as much as with RG-58/AU or RG-58/CU. And, by selecting the new poly-foam equivalent of RG-8/U cable (manufactured by Amphenol, Belden, Mosley, etc.), you can shave these losses another 15%.

Table 3. Finally, if you want to know the amount of loss produced by various SWR's, Table 3 will tell you. Actually, SWR's of 2:1 or so don't increase losses greatly, but above 3:1, losses go up in a hurry. In addition, a large mismatch may damage the output circuit of the

Table 3. Line loss comparisons for different SWR values.

Line Loss in db When Matched (SWR 1:1)	Line Loss in db/100 feet for Various Other SWR's				
	2:1	3:1	4:1	5:1	10:1
0.25	0.25	0.37	0.52	0.65	1.15
0.5	0.62	0.77	0.97	1.15	2.0
1.0	1.2	1.5	1.82	2.2	2.5
2.0	2.3	2.8	3.3	3.5	5.5
3.0	3.39	4.0	4.3	5.0	7.0
5.0	5.45	6.2	6.7	7.3	9.3
8.0	8.5	9.25	9.8	10.5	12.9
10.0	10.52	11.3	12.0	12.5	17.0



Completed dummy load should be checked carefully for shorts before closing chassis box—especially between the chassis box bottom piece and resistor network R1.

Combined resistance of 22 resistors making up R1, and lamps I1 and I2, provides adequate impedance at the input jack, J1, to match 50-to-52 ohm transmitter outputs.

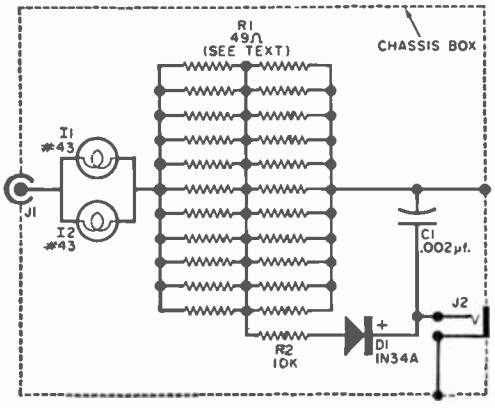
transmitter. This results from the fact that the mismatch is reflected back to the transmitter, and most modern transmitters are designed to work into 50- to 75-ohm loads in which the SWR doesn't exceed 2:1.

Where other impedances or higher values of SWR are encountered, an antenna coupler, such as the one described in our January column, should be used. Incidentally, contrary to a statement in the January issue, the SWR bridge must be inserted between the transmitter and the antenna coupler (not in the line after the coupler) to adjust it. Also, the switch used in the high-power version of the coupler is the Model 86, with two Type E wafers, available from the Radio Switch Corp., Marlboro, N.J., for approximately $10.00, postpaid.

50 - 100 WATT DUMMY LOAD

Have you ever wondered, after spending an evening sending out unanswered CQ's, whether your transmitter was still delivering its rated power output? If so, you probably touched up the transmitter's tuning "just in case," and hoped for the best. However, with the calibrated dummy load described here, you can quickly resolve all doubts by actually checking your transmitter's output —either by observing the brightness of the relative-power indicator lamps, or by plugging a 1-ma. meter into the meter jack.

The dummy load will handle 50 watts (the nominal output of a 75-watt transmitter) for extended periods and up to 100 watts long enough to take a power reading. In addition, its 51-ohm resistance matches the rated output impedance of most modern ham transmitters, and it



PARTS LIST

C1—0.002-μf., 600-volt disc capacitor
D1—1N34A diode (or equivalent)
I1, I2—2.5-volt, 0.5-amp pilot lamp (GE #43 or equivalent)
J1—Coaxial connector, UHF type (Military Type SO-239A, Amphenol 83-798, or equivalent)
J2—Phone jack, open-circuit type (Switchcraft Type 11 or equivalent)
R1—49-ohm resistor network, made from 22 270-ohm, 2-watt composition resistors—see text
R2—10,000-ohm, ½-watt resistor
1—4¼" x 2¼" x 2¼" aluminum chassis box (Bud CU-2116-A or equivalent)
Misc.—½" rubber grommets (2 required), 20" length of #14 solid copper wire, screws, etc.

Novice Station of the Month

We are pleased to send Bruce Black, WN8DXN, Cleveland, Ohio, a one-year subscription to P. E. for submitting the winning photo in our April contest. Bruce transmits with a Heathkit DX-60 feeding a 40-meter dipole, and he receives with a Gonset G-63. His first two months on 40 and 15 meters have netted him 13 states.

If you would like to try for a similar award, send us a picture of your station—preferably showing you at the controls—along with some information about yourself, your equipment, and your activities. All entries should be sent to Herb S. Brier, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana.

makes an excellent standard for checking the operation of 50- to 52-ohm SWR bridges.

Construction. Start by drilling holes in the chassis to mount jacks *J1* and *J2*, and to accommodate two ½" grommets that will seat relative-power indicator lamps *I1* and *I2*. (See photo on p. 87.)

Take three lengths of #14 solid copper wire with the insulation stripped off, and make three wire loops about ½" in diameter. Between two of the loops, connect 11 of the 270-ohm, 2-watt resistors, spacing each evenly as staves on a barrel, and solder them in place. Connect the remaining 11 resistors to the third loop and to one of the loops already supporting the first 11 resistors. Evenly space the second batch of resistors, as before, and solder them in place.

The resistor network thus assembled is *R1* (see schematic diagram and photo). It has three terminals, each one located at a wire loop, and its resistance is 49 ohms measured at the end terminals.

Pre-tin the indicator lamp bases and insert the lamps into the rubber grommets—a drop of cement will prevent their dropping out. Then mount *J1* and *J2*.

Now wire the unit as indicated in the schematic diagram. Do a neat job and keep the leads to the components short since a lot of r.f. will be pouring into the dummy load. Avoid damage to diode *D1* when soldering it in place by grasping its leads with heat sinks or pliers while soldering.

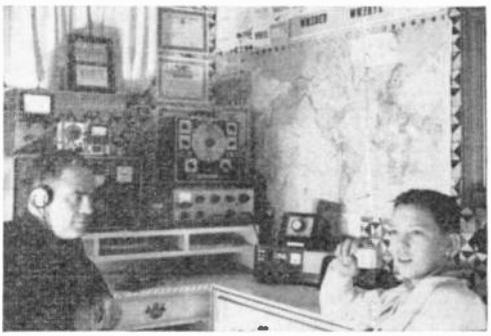
Finally, drill 15 evenly spaced ¼" holes in each of the three sides of the chassis to vent the unit. Then assemble the top and bottom pieces of the chassis box with the self-tapping screws supplied.

You can check the unit's resistance by connecting an ohmmeter between the center terminal on *J1* and the chassis. The total resistance should be about 51 ohms, due to the resistance of *R1* plus the parallel resistance of *I1* and *I2*.

Operation. Connect the dummy load to your transmitter via a short length of 50- to 53-ohm coaxial cable, and tune

(*Continued on page* 100)

This father-and-son station is the property of Jerry Berger, WN2DED, and his son, David, WN2BYK. They operate out of North Woodmere, L. I., N.Y. See the "News and Views" section on page 100 for the unusual story of how their station was born.



Slow Motion for Quick Action

a Carl and Jerry Adventure

CARL AND JERRY, home from college on spring vacation, had spent the beautiful warm afternoon wandering along the banks of Wildcat Creek with their transistorized tape recorder gathering a collection of spring sounds. Already stored on the little reel of tape were the gay "churlik! churlik!" of a robin, the excited cawing of a surprised crow, the "barrrump! barrrump!" of a bullfrog, the scolding trill of a piney squirrel, and the sounds the flooding creek made as it poured over rocks and sucked at the swollen buds on the willow branches dipping into its muddy waters.

Now the youths were sitting cross-legged on the floor of a rustic wooden covered bridge that spanned the creek and staring curiously up at the great hewed timbers constituting the framework of the structure. They did not have to worry about traffic through the bridge. A bad washout in the winding road leading to it had taken care of that for several days to come.

"They had some darned good engineers away back when this bridge was built," Carl offered. "It's at least seventy-five years old; yet those timbers look perfectly sound."

"That was partly the reason for the roof," Jerry explained. "It protected the weight-bearing timbers from the weather. The covered bridge also provided the traveler with shelter from a sudden shower."

"Yeah, and what a dan-dan-dandy place to rest the horse and pitch a little woo!" Carl added with a grin. "Hey!" he exclaimed, "am I imagining it, or did this thing shake a little?"

"Most likely it did," a voice answered from the end of the bridge. Silhouetted against the light was the lanky frame of an elderly farmer.

"I'm Clyde Butcher," he introduced himself. "I own that farm over there in the bend of the creek that has the old grist mill on it. It was my daddy's before me and his daddy's before that.

"This old bridge needs care bad," he explained, "but we can't convince the county commissioners of it. Their smart-aleck young engineer knows nothing about wooden bridges, and he just laughs when we try to tell him the bridge

By
JOHN T. FRYE
W9EGV

doesn't *sound* right and it doesn't *feel* right."

"I'm not sure I understand," Jerry said politely.

"You know that a crack in a violin will show up in the sound long before you can see it through the varnish, and a tight-rope walker can tell by the feel of the rope when something is wrong with the rigging," the old man said earnestly. "Well, just remember that I and many like me have been passing over this bridge all our lives. We know the normal sound it has when a wagon rolls across this floor, and we know it used to have a little bounce to it even when a heavy dog trotted across it. Now it doesn't sound right, and the bounce has gone out of it. The floor is sagging, too, as you can see; but that snooty engineer says it has always sagged. That's a lie. He'd like to tear the whole thing down and put in a new concrete bridge."

"That would be barbaric!" Carl exclaimed. "Only a few of these fine old bridges are left in the whole state."

"I'm glad to meet young men with a little respect for something old," Mr. Butcher said as he shook hands with the boys. "This old bridge is settling a fraction of an inch or so every day, especially during this period when the frost is going out of the ground; and unless she's given some help, she won't be here much longer."

"If you just had some evidence of this settling you could present directly to the commissioners," Jerry said thoughtfully as he stared down at the tape recorder in his lap, "maybe they'd do something."

"Maybe," the old farmer said doubtfully; "but it would have to be something simple and convincing. They know as much about engineering as a hog knows about Sunday—even less than I do."

"Could you run an a.c. line from your barn over here to the bridge to power electronic equipment we would install to record the settling of the bridge?" Jerry asked.

"Sure, but the bridge only settles a freckle every few hours. Those commissioners aren't going to sit still listening to several hours of recording."

"They won't have to. I was reading the other day that R.R. Dibble, a scientist at the Department of Scientific and Industrial Research at Wellington, New Zealand, had modified a household tape recorder to operate 500 times slower than normal and used it to record 'ice quakes' at Antarctica. The tape only moves about a half-inch a minute; so an 1800-foot reel of tape will last a month of continuous operation. When the tape is played back at normal speed, the very slow vibrations of a quake become audible sounds. What's more, twenty-four hours of recording can be reviewed in slightly less than three minutes."

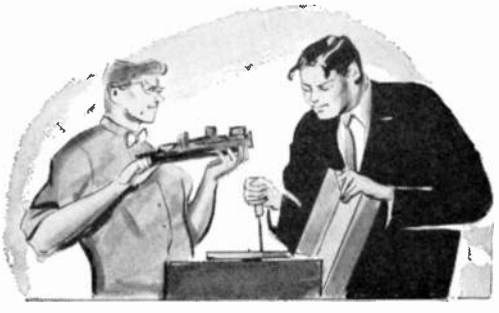
"You lost me," the old gentleman confessed; "but if you think it will work I'm game to try it. I'll string that wire first thing in the morning."

IT DIDN'T TAKE the boys long to drive to their laboratory in the basement of Jerry's house. Once there, they immediately set to work revamping an old discarded tape recorder they had been hoarding against just such an emergency.

"You slow down the recorder, and I'll make up a special bridge-settling transducer and an ultra low-frequency amplifier," Jerry suggested. "I think you can substitute that powerful little 4-rpm synchronous motor for the one in the recorder to get pretty close to that 1/500 speed reduction, and then you can turn down the capstan to hit it right on the nose. Brother Dibble probably didn't do it that way, but it's the quick-and-dirty method we'll use."

"Aye, aye, sir!" Carl said mockingly, starting to remove the tape recorder motor; "but how are you going to make a bridge-settling transducer?"

"We could use a sensitive accelerometer if we had one—which we don't," Jerry mused, "and no ordinary mike will work because we're not trying to detect



FREE FOR '63

1963
CATALOG NO. 630

LAFAYETTE RADIO ELECTRONICS

388
GIANT-SIZED Pages
The Largest Catalog in Our 42-Year History

It's New — It's Big — It's Better Than Ever
It's From the "World's Hi-Fi & Electronics Shopping Center"

The exciting, all-new 1963 Lafayette Catalog features thousands of items for the audiophile, experimenter, technician, hobbyist, serviceman . . . Citizens Band, Tape Recorders, Stereo Hi-Fi, Ham and Amateur Equipment, and much more.

No Money Down on Lafayette's Budget Plan

ONLY LAFAYETTE OFFERS THESE OUTSTANDING EXTRAS:

√ SATISFACTION GUARANTEED OR MONEY REFUNDED √ LOWEST PRICES √ EXCLUSIVE LAFAYETTE KITS √ LARGEST STOCK SELECTION √ BUY THE EASY-WAY WITH EASY-PAY . . .

LAFAYETTE 24-WATT STEREO AMPLIFIER

LA-224WX **49.95**

- 12-Watts per channel
- Frequency Response 20-25,000 cps
- Complete Stereo Controls

LAFAYETTE HE-20C C.B. TRANSCEIVER

HE-20C
109.50

- Officially Approved For Use in Canada
- 8 Crystal Controlled Receive and Transmit Positions

LAFAYETTE 10-TRANSISTOR C.B. "WALKIE-TALKIE"

33.95 each, 2-for-62.90
HE-29B

- 50% More Powerful—Extra RF Stage
- Receives and Transmits up to 2 Miles

DELUXE LAFAYETTE 4-BAND SW BROADCAST RECEIVER

HE-40 **49.95**

- Covers 4-Bands 550KC-30MC
- Electrical Band Spread
- Built-in "S" Meter

LAFAYETTE 4-TRACK STEREO TAPE DECK

RK-140
99.50 less case

- Built-in Transistorized Stereo Record/Play Preamps
- Records Sound-on-Sound

MAIL ORDER AND SALES CENTER
111 Jericho Turnpike, Syosset, L. I., N. Y.

OTHER LOCATIONS

Jamaica, N. Y. — Newark, N. J.
New York, N. Y. — Plainfield, N. J.
Bronx, N. Y. — Paramus, N. J.
Scarsdale, N. Y. — Boston, Mass.
Natick, Mass.

LAFAYETTE RADIO ELECTRONICS, Dept. ID-3
P.O. Box 10, Syosset, L. I., N. Y.

☐ $_____ enclosed for Stock No. _____, shipping charges collect.

☐ Send me the free 1963 388-Page Lafayette Catalog

Name_____

Address_____

City_____ Zone_____ State_____

audible frequency vibrations. We need something that will translate a single slight vertical movement into an audible sound. . . What do you think of this? We'll mount a crystal phono cartridge on its side. A length of springy piano wire will be inserted in the needle chuck, and a small weight will be put on the end of the wire. The length of the wire and the amount of the weight will be such that when it's disturbed it will vibrate back and forth at a slow rate, say a couple of cycles per second. The flexing of the crystal caused by this motion will produce a low-frequency alternating voltage that can be amplified and recorded on the slow-moving tape."

"Can't see anything wrong with it," Carl admitted, "but why don't we use the amplifier in the recorder?"

"Shame on you for asking instead of thinking!" Jerry chided. "That amplifier probably starts to fall off pretty rapidly at 100 cycles per second. We need one that will do a good job on 100 cycles per *minute*. I intend to throw together a little direct-coupled transistorized amplifier, using both *pnp* and *npn* transistors, that will amplify right down to d.c. If we use a cheap, high output crystal cartridge, we won't need too much amplification. We'll probably have to change that recording head to a low-impedance transistor type, but fortunately I've got a spare."

Before they went to bed that night, the whole project was completed, even to testing. The slightest movement set the weighted wire to bobbing, and this put a signal on the creeping tape that came out as a quickly damped "beep" when the tape was played back on their conventional recorder.

When the boys took their equipment housed in a sturdy weather-proof box to the bridge the next morning, they found that Mr. Butcher was as good as his word. The a.c. line was ready and waiting for them at the end of the bridge. Under the curious gaze of the farmer, they fastened the box securely to the upper timbers of the bridge near the center of the span. The recorder was plugged into the a.c. line, and ropes carrying "Keep Off" signs were stretched across both ends of the structure.

"We'll let the recorder run for forty-eight hours and then see what we've got," the boys told the farmer. "That's about all the time we'll have before heading back to school."

IT HAPPENED that on the morning the recorder was to be picked up Carl had to drive over to a neighboring town for his father. It was almost one o'clock when he came dashing into the basement laboratory and found Jerry anxiously awaiting him.

"Boy, I'm glad to see you!" Jerry exclaimed. "Mr. Butcher chickened out on presenting our recording to the commissioners. Says he would ball things up because he knows nothing about electronics. We have a one-thirty appointment with them at the court house."

The three commissioners and the county engineer received the youths with poorly concealed smiles of amusement when the boys explained that they wanted to present evidence that the old covered bridge was settling. However, the men showed mild interest as Jerry set up the transducer on a heavy table in front of them and connected it to the slow-speed recorder.

Next, Jerry slid a single postcard under one leg of the table. Then a short endless loop of tape was placed in the recorder, the wire was allowed to come to rest, and then the card was pulled from beneath the leg. The one-hundredth of an inch of vertical movement at one corner of the table set the wire to bobbing. When it finally came to rest again, Jerry transferred the loop of tape to the normal recorder and let the commissioners hear the beep of sound produced by the slight vertical movement of the table.

Finally, he put the tape that had been recorded in the bridge over a 48-hour

period on the conventional recorder. During the six minutes it ran, beep after beep was heard, indicating that the bridge was settling a trifle every few hours. Just at the end of the recording, there was some Donald Duck quacking which sounded like nothing that had gone before.

"What's that?" one of the commissioners wanted to know.

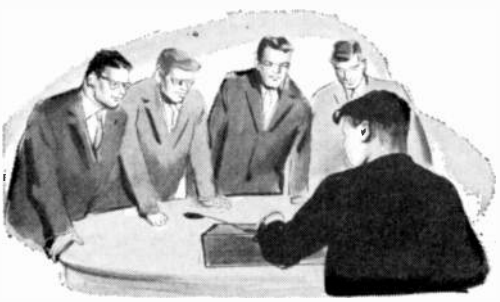
"Oh, it's just some voice recording that got in on the end of the tape," Jerry explained hurriedly. "You wouldn't want to hear it."

"How do you know we wouldn't?" the commissioner said suspiciously. "Can you make it understandable?"

"I probably could by playing the tape at a slower speed," Jerry admitted with obvious, very obvious, reluctance.

"Well, do it then," the commissioner snapped.

Jerry switched the recorder from 7½ ips to 1⅞ ips, and the voices on the tape came out clearly and distinctly. Carl recognized one voice as Mr. Butcher's,



and the other apparently belonged to a neighbor he had encountered in the bridge.

"Well, guess the commissioners are going to let the old bridge fall down," the first voice said.

"Seems like it," the other agreed. "Too bad some people care nothing about tradition and history. People drive hundreds of miles to take pictures of this bridge. And it means still more to folks around here. Why, half the men in the county learned to swim beneath it."

"I'm one, and you're another. What's more, I proposed to my wife inside that bridge. Seems a pity three short-sighted, bull-headed men can destroy something that means so much to folks who elected them."

"Maybe that's an idea. The election will be rolling around before we know it. Let's forget party lines, as far as commissioners go, and turn these jokers out and put in men who promise to do something about the bridge. Suppose we start right now talking it up among our neighbors and friends."

"That's a fine idea! I'll start the ball rolling at our grange meeting next Friday. Well, got to be going now. Be seeing you."

Jerry switched off the tape recorder and began collecting his equipment. Out of the corner of his eye he could see the three commissioners in a whispered colloquy.

"Hm-m-m-m!" the one who had been so insistent on hearing the voices said eventually; "boys, your scientific demonstration has been most convincing. It has convinced us that the bridge needs attention immediately. We are hereby instructing our engineer to go to the bridge at once and make a careful study to see what is needed to restore it to its original strength and condition, being careful not to impair its historical significance. As soon as we have his report, work will begin."

WHILE the boys were loading their equipment back into the car, Jerry could feel Carl's eyes looking at him suspiciously. Finally Carl exclaimed:

"There's some hanky-panky going on here. You know audio frequencies would never record on that tape at that slow speed. Furthermore, that transducer is no mike. Finally, even if the voices did record at one-half inch per minute, you couldn't play them back at 1⅞ inches per second and make sense. Come on; give!"

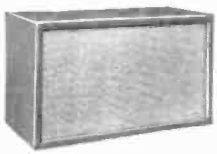
"I didn't *say* the voice recording was picked up by the transducer; the commish just jumped to that conclusion," Jerry said with a grin. "Actually I had Mr. Butcher and a crony record that conversation on our regular recorder when I picked up the other equipment. They did darned well without a script. I just had a hunch the commissioners might not be thoroughly convinced by scientific proof; so I decided to include a little something they would be sure to understand."

"And you sure did! Come on; let's go tell the good news to Mr. Butcher!" –30–

Heathkit® *multiple choice test- match your hobby to a HEATHKIT*

stereo hi-fi

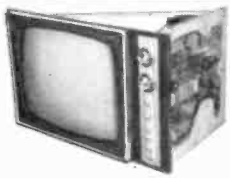
Whether you are an audiophile who demands perfection or just like good music, you'll appreciate the vast selection of Heathkit stereo/hi-fi components—from source to sound—of top quality, great versatility, and big do-it-yourself savings!



ACOUSTIC SUSPENSION SPEAKER Kit version of the AR Inc. AR-2A with genuine AR-2A speakers; 10" woofer, two 5" mid-range, 1⅜" super tweeter. AS-2A, from $89.95

home entertainment

More fun, better living for your family with Heathkit intercoms, table radios, portables, garage door openers, electronic organs, TV sets educational kits, tape recorders, automotive accessories, all at 50% savings!



23" CUSTOM TV SET High fidelity picture and high fidelity sound to build into a wall, custom cabinet or Heathkit matching cabinet. GR-22, from $169.95

boating

For the complete mariner, a host of marine electronic equipment for better, safer boating. Choose factory built or money-saving do-it-yourself depth sounders, direction finders, radiotelephones, tachometers, or converters by Heathkit.

25-WATT RADIOTELEPHONE for outboards! 4-channels; all-transistor receiver, 3-tube transmitter. Complete package for owner installing, with antenna and accessories, ready for 12v. battery. MWW-13-S, $189.95

citizen's band

For your personal two-way radio communications, Heathkit offers the world's largest selection of **C-B** equipment. Choose base stations, mobile stations, walkie-talkies, selective-calling sets, antennas, crystals, microphones, in all price ranges.

1-WATT WALKIE-TALKIE Range: five miles or more! Deluxe features. Best buy! Price includes $20 rechargeable 5000 hour nickel-cadmium battery. GW-52, $74.95 ea., $139.95 pair

amateur radio

Amateur radio operators around the world prefer Heathkit equipment for quality with economy. Biggest selection—transmitters, receivers, (mobile and fixed base), transceivers, plus a complete accessory line for all operation modes and all budgets.

6-METER SSB TRANSMITTER Upper or lower sideband, AM, CW; 50-54mc in 1mc segments; 10 watts PEP; built-in VFO, VOX; easy assembly. HX-30, $189.95

test and lab

Hobbyists, service technicians, and industrial users rely on Heathkit test equipment for accuracy, versatility, and economy. Choose from a complete line of meters, signal generators, oscilloscopes, tube testers, and accessories.

6" SERVICE BENCH VTVM Gimbal mount under bench, shelf, wall; 200 ua meter tilts to any angle; 7 AC/DC/Ohms ranges; universal probe. IM-13, $32.95

Prices & specifications subject to change without notice; dealer & export prices slightly higher.

FREE 1963 HEATHKIT CATALOG 100 pages, over 250 easy-to-build kits to fit your hobby, to give you better equipment at 50% savings. Send for your free copy today.

HEATHKIT
a subsidiary of Daystrom

HEATH COMPANY
BENTON HARBOR 10, MICHIGAN

Please Send My Free Heathkit Catalog

Name_____

Address_____

City_____ Zone_____ State_____

Transistor Topics

(*Continued from page* 84)

checked for errors, the transistors and battery can be installed. For preliminary tests, adjust *R4* to about mid-range and close *S1*. The relay (*K1*) should close for a short period, finally dropping out. Now, speak a few words in a moderately loud voice. The relay should close again, *holding in for a short period after you've finished speaking* (due to the built-in time delay). If the relay fails to drop out after a reasonable period, try readjusting *R4*, using various settings until an optimum adjustment is obtained.

To set up the Sound-Relay, simply connect *K1*'s contacts as a simple switch to control the desired equipment—a bell and battery, buzzer, lamp bulb, motor, solenoid, or any similar electrical device. To duplicate the "obedient TV" action described earlier, connect a short length of two-conductor line cord in parallel with the voice coil terminals on the TV set's speaker. Run this line to the Sound-Relay and connect it to *K1's* "common" (*COM*) and "normally open" (*NO*) terminals. With this connection, the speaker on the TV set is partially shorted when the relay closes, almost "killing" the sound. A "dead short" across the voice coil terminals is virtually impossible to achieve, however, due to the resistance of the line cord leads and the relay contacts. Consequently, you may still hear a little sound from the receiver.

Correct placement is very important to obtain best performance. The Sound-Relay should be located far enough from the TV set so that it isn't operated by the receiver's sound, yet close enough to the "operator's" position to obtain positive operation when a somewhat louder than normal speaking voice is used.

Product News. The Heath Co. (Benton Harbor, Mich.) has introduced an educational kit designed to teach basic transistor concepts and practical circuit applications. Based on the "learn-by-doing" technique, the user performs experiments designed to illustrate and

TRY THIS STEREO TEST RECORD!!

Special to our readers for only...$3.98

Featuring Tests Never Before Available To The Hobbyist

UNIQUE FEATURES OF HiFi/STEREO REVIEW'S MODEL 211 STEREO TEST RECORD

- Warble tones to minimize the distorting effects of room acoustics when making frequency-response checks.
- White-noise signals to allow the stereo channels to be matched in level and in tonal characteristics.
- Four specially designed tests to check distortion in stereo cartridges.
- Open-air recording of moving snare drums to minimize reverberation when checking stereo spread.

Why We Make the Model 211 Available Now

Although there are many stereo test records on the market today, most critical checks on existing test records have to be made with expensive test equipment.

Realizing this, HiFi STEREO REVIEW decided to produce a record that allows you to check your stereo rig, accurately and completely, just by listening! A record that would be precise enough for technicians to use in the laboratory—and versatile enough for you to use in your home.

The result: the HiFi/STEREO REVIEW Model 211 Stereo Test Record!

Stereo Checks That Can Be Made With the Model 211

- ✓ **Frequency response — a direct check of eighteen sections of the frequency spectrum, from 20 to 20,000 cps.**
- ✓ **Pickup tracking — the most sensitive tests ever available to the amateur for checking cartridge, stylus, and tone arm.**
- ✓ **Hum and rumble — foolproof tests that help you evaluate the actual audible levels of rumble and hum in your system.**
- ✓ **Flutter—a test to check whether your turntable's flutter is low, moderate, or high.**
- ✓ **Channel balance — two white-noise signals that allow you to match your system's stereo channels for level and tonal characteristics.**
- ✓ **Separation—an ingenious means of checking the stereo separation at seven different parts of the musical spectrum—from mid-bass to high treble.**

ALSO: ✓ **Stereo Spread**
Speaker Phasing
Channel Identification

PLUS SUPER FIDELITY MUSIC!

The non-test side of this record consists of music recorded directly on the master disc, without going through the usual tape process. It's a superb demonstration of flawless recording technique. A demonstration that will amaze and entertain you and your friends.

All Tests Can Be Made By Ear

HiFi/STEREO REVIEW's Model 211 Stereo Test Record will give you immediate answers to all of the questions you have about your stereo system. It's the most complete test record of its kind—contains the widest range of check-points ever included on one test disc! And you need no expensive test equipment. All checks can be made by ear!

***Note to professionals:** The Model 211 can be used as a highly efficient design and measurement tool. Recorded levels, frequencies, etc. have been controlled to very close tolerances — affording accurate numerical evaluation when used with test instruments.*

DON'T MISS OUT—ORDER NOW AND SAVE $1

The Model 211 Stereo Test Record is a full 12" disc, made from the finest virgin vinyl. For a limited time only, it is being sold by POPULAR ELECTRONICS for $3.98. Starting July 1, 1963, we will sell this record for $4.98. Order now and save $1. Make sure you don't miss out on this special offer. Fill in and mail the coupon, together with your check ($3.98 per record) today!

FILL IN AND MAIL TODAY!

Stereo Test Record
Popular Electronics—Dept. S D
One Park Ave., New York 16, N.Y.

Please send me _____ test records at $3.98 each. My check (or money order for $ _____ is enclosed. I understand that you will pay the postage and that each record is fully guaranteed.

Name _____
(Please Print)

Address _____

City _____ Zone _____ State _____

SORRY—No charge or C.O.D. orders!
(Special price offer expires on June 30, 1963) PE 463

Educational kit just introduced by Heath: the EK-3.

support the material covered in the textbook furnished with the kit. Some of the circuits assembled include a two-transistor receiver, a wireless broadcaster, an audio amplifier, and an audio test oscillator. The circuits are wired on a special experimental chassis which is easy to work with and which simplifies measurement of each circuit parameter. Also included are the necesssary components and materials required to perform the final experiment—assembly of a practical two-transistor intercom for the home. Identified as the EK-3 "Basic Transistors" kit, the new Heath item sells for $16.95 (plus postage).

In most small signal transistors, the collector is internally connected to the metal case. This can cause problems when the transistor is connected to a heat sink or used in certain types of high-frequency circuits. To overcome these problems, Fairchild Semiconductor (545 Whisman Rd., Mountain View, Calif.) has introduced a new line of planar transistors in which the collector is electrically isolated from the case. Three different types are available.

A "transistorized receptionist" (Model PR) is being produced by Electric Eye Enterprises (15540 W. Dixie Hy., North Miami Beach, Fla.). A three-piece set consisting of a combination light projector and receiver in a metal case, a mirror, and a chime, the new unit operates on any standard 117-volt a.c. line. In use, a beam of light is projected across any entrance to the mirror, which reflects the light back to the receiver. When the light beam is broken by a visitor, the chime is sounded. The Model PR nets for $40.50.

Back next month with more news, as usual. —*Lou*

Across the Ham Bands

(*Continued from page* 88)

the transmitter in the normal manner. At 50 watts, the relative-power indicator lamps will glow normally; at 5 watts, they will glow dimly. A 1-ma. meter plugged into meter jack *J2* should read 0.6 ma. at 50 watts (approximately), 0.42 ma. at 25 watts, 0.27 ma. at 10 watts, and 0.19 ma. at 5 watts.

News and Views

Don Shimasaki, KN3VTZ, 5805 Conway Rd., Bethesda, Md., really keeps the ionosphere stirred up. During his first five days on the air, he worked 49 stations in 14 states—and he prefers long rag-chews to short hello-and-goodbye DX contacts! Don uses a Heathkit DX-60 running the Novice 75-watt limit to feed a Hy-Gain dipole antenna 30' high; he receives on a Hallicrafters SX-140. All of his work to date has been on 80 meters, but a Heathkit "Twoer" is being put together right now. . . . **Bill Morrison, KN1ZJA,** 16 Poplar St., Thompsonville, Conn., is a triple-threat man—he operates on 80, 40, and 15 meters. A Heathkit DX-20 transmitter and a Heathkit GR-91 receiver have helped Bill exchange greetings with 13 states and Canada, although he's still waiting for QSL cards from two of the states. . . . **Bill McKenny, WN4KUE,** and his dad, WN4KUG, 445 E. 40th St., Hialeah, Fla., studied for their Novice licenses in a class conducted by Chuck, W4LVV, and other local hams. They use a Globe Chief De Luxe transmitter and a National NC-109 receiver, both coupled to an antenna fed with "open wire" feeders. Bill's best DX is New Jersey; his dad isn't talking.

Warning! If you don't want to get involved in the interesting hobby of ham radio, don't read POPULAR ELECTRONICS. **Jerry Berger, WN2DED,** and his son **Dave, WN2BYK,** 916 Park Court, N. Woodmere, L.I., N.Y., are hams today because Dave applied to P.E. for his WPE2HJD s.w. monitor call. After that he got his Novice license, and Jerry followed suit. (Jerry, by the way, is man-

Energy Conversion Quiz Answers

(*Quiz on page* 50)

1 - H	Battery	7 - E	Microphone
2 - C	Lamp	8 - B	Heating element
3 - I	Thermocouple	9 - F	Phonograph cartridge
4 - G	Loudspeaker		
5 - J	Phototube	10 - D	Tape recorder head
6 - A	Motor		

ager of the Special Products Division of J.F.D. Electronics Corp., a member of the Institute of Radio Engineers, and a member of the Radio Old Timer's Club, but it took his son to prove to him how much fun there was in ham radio.) Both father and son are now studying for their General Class tickets and gradually building up their dream station—Dave takes care of his share of the expense with the earnings from his paper route. So far, they have an EICO 720 transmitter, a Hammarlund HQ-145X receiver, a Hy-Gain 5BDT doublet antenna, a Lafayette H-45 converted to a 2-meter transceiver, and a 5-element, 2-meter beam. Their joint record is 39 states, Puerto Rico, France, and Canada. If you get the idea from the above that Jerry and Dave are proud of each other and their joint hobby, you're so right!

Richard Roome, WNØBKY, 5040 Garfield Ave., Minneapolis 19, Minn., will probably have finished the deal he had cooking with the FCC to trade in his old Novice ticket for a new General Class model by the time you read this. The old model gave him good mileage—20 states—although Dick isn't a DX chaser. He makes 40 meters his home band, but he slips off to 80 and 15 at times. He's been using a Hammarlund HQ-100 receiver and a Knight-Kit T-60 transmitter. . . . **Mike Mellinger, WA6USU,** 1226 E. Comstock, Glendora, Calif., worked five states on 40 meters, running 75 watts to a "surplus" TCS-6 transmitter which fed a Hornet V-75 vertical antenna; a Hallicrafters S-38D did the receiving. Mike now has his General Class ticket, a "surplus" RAO-2 15-tube receiver, plus 13 states and Canada. Incidentally, he'd like to hear from anybody who knows anything about the RAO-2. . . . **John R. Conrad, Jr., W5KRQ,** 1145 W. Jackson St., Tupelo, Miss., proved that a good antenna will pay off on 6 meters (as well as on other bands) by working 32 states, Canada, and Puerto Rico in three and a half weeks. He uses the "transmit" function of his Heathkit "Sixer" running three watts input to transmit, and receives via a converter ahead of a Hallicrafters SX-42. His secret weapon is two 4-element beams stacked 50' above the ground. Of course, John's activity on 6 meters took place last year, but it's getting around to the "skip" season on the 6-meter band again; so keep your ear open for W5KRQ, if you need Mississippi. . . . **Tom Shirk, WNØDFH,** Box 1032, 1500 19th St., Great Bend, Kansas, has worked 24 states —21 confirmed—mostly on 40 meters. He does the greater part of his operating on weekends, with a Knight-Kit T-60 transmitter, a dipole antenna 50' high, and a Hallicrafters S-38 receiver. Tom also sports the s.w. monitor call of WPEØCSW.

Let's hear *your* "News and Views." And your pictures and suggestions for construction projects are always welcome. Send them to Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana. 73,

Herb, W9EGQ

South Vietnam's Intercom

(*Continued from page* 45)

four transceivers and installation equipment which his party was carrying.

They were all on a 45′ patrol boat, most of them crouched behind sandbags on the deck to protect themselves from the ever-present Viet Cong sniper fire pinging in from both banks. Suddenly, the boat swerved sickeningly and rolled over.

"I went right down into the water," Ed recalls, "losing my weapons in the process. Luckily, I had on an Air Force type flak suit with a quick release, and I got out of it okay before its weight dragged me under. But then, somehow, the current swept me under and back up inside the capsized boat. When I finally came up for air I was inside a cabin, the water rising up past my chest and a closed porthole over my head.

"A Vietnamese Civil Guard had been swept in there with me, and, luckily, he still had his machine gun. We couldn't break the porthole—the glass was too thick—so we shot it out. It was too small for us to climb through, so I just stood there and waved my hand through it for about 15 minutes. There were guns firing on the banks, and we didn't know if the people who would see my hand and come get us would be Viet Cong's or 'friendlies'—but I just kept waving. Suddenly there was some splashing and a swimmer popped up in the compartment with us—a Vietnamese, I'm happy to say. He led us out.

"One American and two Vietnamese in my party were drowned in the accident. Even though we stripped and dove several hours for their bodies, we never found them. To this day I don't know if our boat was capsized by a swift current change, overloading, an ambush, or by disloyal crewmen who deliberately sabotaged the mission. I do know that the four radios we had were salvaged, dried out, and ultimately installed as planned."

Plans for the Future. There can be little doubt that the Vietnam "village radio" plan must be written down as an overall success. Villages equipped with transceivers have, on many recent occasions, called in helicopter troop drops or aerial rocket, bomb, and strafing runs to drive off attacking Viet Cong. Plans are already well under way to install a shorter range transceiver—the TR-5—in Vietnam's estimated 3000 strategic hamlets.

All of which means that Ed Schlachter and the handful of American technicians who work with him will be out on the trails again soon.

At stake is the safety of hundreds of thousands of simple peasants. While these natives live in medieval poverty, their link with armed protection is a tiny, 20-lb. piece of electronic equipment—a transceiver far too complex for them to understand, yet simple enough for them to operate when danger from the jungle strikes. -30-

Portable Tape Recorders

(*Continued from page* 70)

monly used. (Some recorders also have a 15-ips speed.)

However, in addition to the speed, the number of tracks that a unit records at one time is important, since this factor —along with speed—governs tape interchangeability. For example, assuming that the machines in question are capstan-drive units and have a speed of 3¾ ips, a dual-track recording played back on a full-track recorder will be unintelligible—because both "track one" (forward) and "track two" (reverse) are being played simultaneously. On the other hand, a full-track recording can be played back on a dual-track unit and it will sound okay.

The reel diameter listed (in inches) is the diameter of the reel supplied with the recorder. In some cases this will be the absolute maximum diameter the machine will take; in others, reels of slightly greater diameter can be accommodated. Generally, the amount of tape on a 3″ reel will be from 150 to 300 feet, depending upon the thickness of the tape. The thinner the tape, the more tape to the reel and the longer the recording time.

There are three standard thicknesses

of Mylar (the most popular) tape—1½, 1, and ½ mil. Although the ½-mil Mylar tape is not ideal for recordings which are to be kept and played for many years (it has a tendency to stretch somewhat and it suffers from higher print-through than thicker tapes), it is great for small portable units, which in most cases are limited to a 3″ reel. The chart on page 70 will enable you to compare various tapes, their thicknesses, and their recording times.

A record interlock, which is often called an erase preventative, is a handy feature to have. It is usually a button or slide "switch" that blocks the movement of the record button or switch, so that it can't be accidentally placed in the record position. When the record circuit is activated, an erase current or a permanent magnet is applied to the tape just before it reaches the record or record/playback head—cleaning the tape of previously recorded material. If the record switch is accidentally activated while a good recording is on the machine, the recording will be erased and lost forever.

The audio level of the recordings can be checked by a number of methods. Some machines use a visual indicator—such as a vu meter—to give a numerical value for a specific level of sound. Others employ a bulb which blinks at peak input levels. Still others have only a premarked point on the volume control, which offers a reasonable amount of volume for most inputs.

A fast forward speed is a convenient feature on a tape recorder. It enables you to wind tape in the forward direction at a greater speed than when recording or listening. For editing or advancing tape to a section some distance from the start of the reel, the fast forward speed is a welcomed time-saver.

The footnotes below the Comparison Chart list the manufacturers and importers of the recorders covered, along with certain features which are not common to all the units.

For further information concerning any of these recorders, just drop a line to the manufacturer or importer listed under "Source" on the Comparison Chart. The prices given are the suggested list prices, by the way, so they may vary with store and locality. —30—

On the Citizens Band

(*Continued from page* 80)

radio, and the antenna is automatically and simultaneously switched over.

Center-loaded, the M-103 is designed for cowl mounting and will fit in the standard hole normally provided for the average car radio. Compactly enough, the antenna is only 46″ high in the operating position and telescopes to 31″. The automatic dividing harness fits under the dashboard out of sight, is available as a separate accessory (M-104), and can be used with any ungrounded CB antenna requiring no more than 5′ of cable. The "topper" is that the new CB/AM duo may be connected with only three simple connections. All of these features, plus the heavily chromed clean lines of this inconspicuous newcomer to CB, should capture many a CB eye—including the XYL's!

Club News. The Celestial Citizens Banders, Inc., Pekin, Ill., held their first annual banquet on February 23rd. Roberty Byrd (KHB3131) passed the word that the club's banquet committee saw to it that a fine smorgasbord, entertainment, door prizes, and much fun was enjoyed by more then 100 CB'ers. . . . The Blue Mountain 10-20's of Pendleton, Ore., organized in November of '62 have announced the installation of officers, acceptance of their constitution and bylaws, and the start of proceedings to incorporate. Club reporter Fred Murtishaw (KFF0529) also informed us of how valuable a service CB has become for many ranchers in the area unable to obtain telephone service. . . . The Kadets of America, Unit 30-11, is in the process of organizing a community CB club to be dubbed the Emergency Storm Communicators. Membership is open to any CB'er living in Bellerose, Glen Oaks, Floral Park, or New Hyde Park, N. Y. The group plans to set up 24-hour communications service, and to be on call for any and all emergencies. Anyone interested in becoming a part of this effort should contact Vincent Caggiano (KBG-6673) at 83-34 265 St., Floral Park, N. Y., or phone FI 7-9282.

Following through on our request that all CB clubs send us their addresses, list of officers, number of members, and other pertinent information regarding club make-up and activities, the Western Area Citizens Band Club of Butler, Pa., mailed in a healthy bundle of information the other day. The WACBC claims to be the largest CB club in a tri-state area (122 members) and appears to be operating much like most of the larger groups in the country, jam-packed newspaper and all! Mobile units of the organization can be easily spotted by their large red reflector decal which identifies them as Channel 9 monitors. Active in civil defense, the WACBC also assists with traffic control and keeps its emergency squad on call with its own ambulance. Club members did such an excellent job during the week-long Butler Farm Show last year, covering everything from lost child recovery to relaying messages throughout the country, that they've been asked to help again this year at the same event. And of their largest projects this year will be their CB Jamboree, to be held July 13th and 14th. If you're interested in obtaining further information about WACBC, contact Jess Boring, 522 New Castle Street, Butler, Pa.

-30-

Ceramic Tile Enclosure

(*Continued from page* 55)

treble diffuser added. One method that works well is an inverted plastic funnel (as used in the "Drainpipe 8" enclosure —see POPULAR ELECTRONICS, June 1962, p. 59).

Egg Tray Diffuser. Another type of diffuser, shown on p. 55, has the advantage of being adjustable, and the multiple convex surfaces insure wide diffusion. It is made from half of a plastic refrigerator egg tray (sold in dime stores for about 29 cents), an eye bolt, and a strap that electricians use for fastening down electrical cables.

The egg tray is cut in half and a hole drilled in the remaining end to match the size of the eye bolt. A nut is then placed on each side of the plastic tray end to clamp it in place; again, sealant is called for.

The small strap will have to be drilled out on one side to allow it to fit the ¼" threaded rod as shown. If you're planning to use this diffuser, the strap should be installed at the time the speaker board is tightened, substituting it for the washer. After the diffuser is mounted, a screw should be put on the other end of the strap.

If you use this diffuser, you may want to "dress up" the system. Decorator burlap or even grille cloth can be glued directly to the outside of the tile. Alternatively, a light frame could carry the grille cloth up around the diffuser and hide it, or a frame could be built around the entire system which could then be encased in grille cloth.

The Word Is "Crisp." Not everyone will like this speaker system. One listener, for example, said he preferred his own, because it was more "mellow." But it's wise to be suspicious of that word. "Mellow" usually suggests hangover, and this in turn means transient distortion. A poorly braced cabinet can produce it in great quantities.

"Crisp" is the word for the kind of bass produced by this little enclosure. If you like your bass crisp and you aren't flush with either space or money, this system is for you! —30—

Short-Wave Report

(*Continued from page 72*)

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 254, Haddonfield, N.J., in time to reach your Short-Wave Editor by the eighth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Albania—Tirana is noted from 1620 with records and native language anmts; ID at 1630 followed by the schedule; to 1638 with Eng. news; ID and a talk to 1647; music to 1655/closing. Another Eng. period is aired at 1500-1530. Both of these xmsns are on 7092 kc. Italian is noted at 2030 and French at 2100.

Algeria—*R. Algers*, 9685 kc., verifies by letter from M. A. Laghouati, Monsieur le Directeur Technique, *Radiodiffusion Television Algerienne*, 21 Boulevard Bru, Alger, Algeria. Return postage is not required. This one has been noted recently around 0230.

Argentina—Buenos Aires is evidently using 6090 kc. for their N.A. xmsn (". . to the Eastern Zone . .") at 0100, although their printed schedule shows the xmsn in this time period as being beamed to the West Coast—and only on 9690 kc.

Bolivia—*R. la Voz del Minero,* Siglo XX, Potosi, formerly on 5750 kc., is now back on the air on 5851 kc., where it is heard with dance music from 2218—with an ID and their full address given every 15 minutes; all Spanish. They request reports. Don't confuse this station with *R. Nacional de Bolivia* on 5862 kc.

Bulgaria—Sofia has Eng. to the United Kingdom at 1430-1500 on 6070 kc., and at 1630-1700 on 6070 and 9560 kc. (the latter is a change from 9700 kc.). Supplementing the N.A. schedule given last month, there is a "Mailbag" on all three xmsns on Thursdays and during the first xmsn on Sundays, plus a DX Show on Fridays.

Burma—*The Voice of Burma* has been noted on 5040 kc. around 0740 with Burmese music.

Colombia—*R. Sutatenza*, Sutatenza, was noted operating on 5095 kc. (HJGE) and 5075 kc. (HJGC) at 1755-1950 with fair signals. The ID, given in Spanish, is quite easy to understand.

An unidentified Colombian station is being heard on 6100 kc. to 0040 s/off with some Eng. (with a broad Scottish accent). Does anyone know who this is?

HJFB, *R. Manizales*, Manizales, 6105 kc., has been reported, and HJMC, *R. Vision*, Medellin, 6105 kc., is also listed but may be inactive—*Ed.*

East Congo—Leopoldville, 4879 kc., and Stanleyville, 6085 kc., have been logged and

reported repeatedly. However, a letter from Mr. S. Gombo, Chief of the International Service, states that the Congolese regional stations do NOT verify; so, if you need this country, a report should be sent for the International Service on 11,755 kc.

West Congo—*R. Congo,* Brazzaville, 4843 kc., is heard with a program preview just prior to 1700 s/off and at 0025-0100 in French with what may be the domestic service. *R. Brazzaville,* Brazzaville, 15,190 kc., has Eng. to Africa daily at 1400-1500, with a French/Eng. language lesson at 1445.

Cuba—Some changes have been made since last month. Broadcasts are now going to North, Central, and South America on 6135 and 5975 kc. at 2200-0100 in Eng. and French; to Europe on 11,800 kc. (a change from 15,270 kc.) at 1400-1645; to North Africa on 9625 kc. (which may switch with 11,800 kc.) to 1630/closing in Arabic; also on 17,850 kc. (a change from 17,822 kc.) in Spanish around 0900 with talks.

Dominican Republic—HIZ, Santo Domingo, 6118 kc. (listed as HI1Z, 6112 kc.) is being heard well around 2230.

Ecuador—A station reported at points between 4525 and 4550 kc. may be *R. Quito, La Voz de la Capital,* Quito. It is being heard from 2140 to 2232.

Another report lists HCJB, Quito, as operating on the unannounced frequency of 3945 kc., but this is believed by some to be HCDY4, Esmeraldas. An extremely weak signal has been heard around 2245, with Spanish music.

Ethiopia—Addis Ababa was heard on 15,240 kc. with Eng. press review, at 1315; L.A. and Eastern music at 1319; an ID and request for reports at 1328; a flute IS at 1330, then French.

Fiji Islands—Suva has been logged on 4785 kc. (listed as 4756 kc.) at 0130 with songs and a good signal to at least 0345.

India—*All India Radio,* Delhi, has been noted in the 60-meter band on 4960 kc. at 0725 with IS, and at 0730 with Eng. news; not heard daily.

Iran—A difficult station to log is *R. Tabriz,* Tabriz. Try for it on 6175 kc. around the starting time of 2055; much Near East music, few ID's and QRM.

Lebanon—Beirut, 11,890 kc., is noted broadcasting to N.A. at 1630-1730 in Eng., Arabic, and Spanish. The Eng. portion on Sundays is called "Sunday Magazine."

Liberia—The *VOA* in Monrovia is heard on 15,285 kc. to 1100 with "Forum," then news, both in English; and on 3975 kc. at 0200 with Eng. news, at 0205 with pop music, at 0225 with news, and at 0230 with a special Eng. program to West Africa.

Mexico—We've received a lot of mail concerning "XETRA" (see our January, 1963,

SHORT-WAVE ABBREVIATIONS

anmt—Announcement
Eng.—English
ID—Identification
IS—Interval signal
kc.—Kilocycle
L.A.—Latin America
N.A.—North America
QRM—Station interference
R.—Radio
s/off—Sign-off
s/on—Sign-on
VOA—Voice of America
xmsn—Transmission
xmtr—Transmitter

column) with many reports indicating confusion as to the actual location of the station xmtr. A letter just in from Don Allen of "XETRA" lists the location as Tijuana, Mexico. Operating on 690 kc. with 50-kw. power, it is billed as "The World's First All-News Radio Station," operating 24 hours a day. The studios are in the Lee Tower, Los Angeles, and primary coverage of the station is from Santa Barbara and southeastward. Reports indicate, however, that it has been heard as far east as Michigan.

New Zealand—*R. New Zealand,* Wellington, is good from 0130 on 9540 and 11,780 kc. in English. An unlisted outlet on 15,110 kc. has been tuned at 2220 with auto races, relay races, and cricket games, in dual to 15,280 kc.

North Vietnam—*La Radio du Viet-nam* broadcasts in French on 9755 kc. from 0830 to 0855 with Oriental news and music. The ID given at 0840 is *Ici Hanoi, Radiodiffusion du Viet-nam.*

The Voice of Vietnam, Hanoi, is noted on 11,840 kc. at 1115-1130 with Eng., but the signal is very weak. Reports go to No. 58, Quan-Su Street, Hanoi.

Northern Rhodesia—Lusaka, 4911 kc., is usually heard best on Sundays around 2300-2330, since the interfering Venezuelan station is off the air at that time. It was noted with news, weather, and dance music.

Oman—DX'ers wanting this country should try for *Ibri Radio*, Ibri, an aeradio station operating on 5710.5 kc. on a very irregular schedule. This one may prove to be extremely difficult to get!

Pakistan—Karachi is audible on 11,672 kc., with Eng. news at 0830-0850, beamed to the Middle East. A 60-meter outlet has been noted on 4930 kc. from 2045 s/on with IS and Eng. ID, then an Asiatic language newscast; religious readings at 2100; fading by 2130.

Peru—*R. Victoria,* Lima, 4820 kc., is again being heard, dual to 6012 kc., from 2343 with L.A. music and an all-Spanish request program. S/off is at 0002.

OAX6I, *R. Universidad*, Arequipa, 6235 kc., verified after three years of trying on the part of the reporter. Their schedule now reads: 1100-1300 and 1700-2230. The power is 1000 watts. Reports go to Mr. Enrique Cornejo, Secretary.

OAX10, *R. Chiclayo*, Apartado 229, Chiclayo, has moved from 3380 to 5680 kc. and has many commercials and Peruvian music. All-Spanish, it is noted from before 2115.

A report has come in showing reception of *R. Cuzco*. 6215 kc., at 2145, with a gong, ID, a few commercials, fine music, and talks in Spanish. This may be the listed OAX7C, *R. Tahuantinsuyo,* Cuzco.

Reunion—*R. Reunion*, Saint Denis, 4820 kc., verified after 14 months—by airmail. The verification stated that this 1500-watt outlet is no longer in use, having been replaced by an 8000-watt outlet on 3380 kc.

Senegal—*R. Dakar* is heard daily with English from 1405 to 1410 on 11,895.5 kc., and from 0130 to 0300 with French anmts and old (1930 era) U.S. records on 4887 kc. (listed as 4893kc.)

South Africa—Paradys has been monitored as follows: on 7275 kc. daily except Saturdays at 2200-2300 with the National Service—com-

mercials, music, a newscast at 2245, in Eng. and Dutch; on 9523 kc. at 0900 Saturdays with a good signal; on 11,900 kc. with the African Service from 1530 after closing on 15,085 kc.; and on 15,085 kc. at 1345-1410 in Eng. with a newscast at 1400.

South Korea—Seoul, 6035 kc., has an Eng. newscast at 0330.

Spanish Guinea—*R. Ecuatorial*, Bata, has moved from 7850 to 4925 kc., where it is noted around 1600.

Switzerland—The newest schedule from Berne reads: to N.A. at 2030-2215 and 2330-0015 on 11,865, 9535, and 6165 kc.—there is a DX show on Saturdays; to United Kingdom, Ireland, and Scandinavia at 1345-1530 on 9665 and 6055 kc.; to Australia, New Zealand, and the Far East at 0400-0545 on 17,795, 15,315, and 11,865 kc.; to S. E. Asia and Japan at 0745-0930 on 17,795, 15,315, and 9665 kc.; to India and Pakistan at 0945-1130 on 17,795, 15,305, and 11,865 kc.; to the Middle East at 1145-1330 on 11,865 and 9665 kc.; and to Africa at 0200-0345 on 17,795, 15,305, and 11.715 kc.

Syria—Damascus has replaced 6165 kc. with 6140 kc. and is scheduled at 2300-0930. The Home Service is broadcast on 7398 and 15,165 kc.

Tahiti—*Radiodiffusion Francaise*, Papeete, broadcasts Saturdays and Sundays from 2330 in Polynesian on 11,825 and 6135 kc., and from 0000 in French. The French ID of *Ici Tahiti* is given at 0000.

Tanganyika—*R. Tanganyika*, Dar-es-Salaam, operates on 5050 kc. at 1415-1445, with Eng. talks, music, and short newscasts in Afrikaans at 1420 and 1435. They ID frequently.

Togo—Lome has Eng. daily at 1600-1615 on 5047 kc. French is aired from 1615.

Uganda—Kampala reportedly has moved to 4975 kc., with s/off time now set at 2000.

Upper Volta—*R. Haute-Volta*, Ouagadougou, can be heard on 4815 kc. with fair signals in French at 0130-0200.

U.S.A.—WVUS, Washington, D.C., a new station, has been heard at 1216-1426 with ID's on the hour; it has mostly Spanish programming, with newscasts at 1216, 1301, and around 1355. Some programs were from the VOA, although the station reportedly is not a VOA outlet. The frequency is 17,760 kc., and a dual outlet is operating on 15,440 kc.

The new Greenville (N.C.) VOA outlets have been noted as follows: on 5995 kc. at 2330 in Czech and at 2345 in Yugoslavian; on 6040 kc. at 1800-1830 with non-stop music and at 1930-2000 in Spanish; on 9740 and 9760 kc. at 1620 with music; on 11,710 kc. at 1700 with Eng. news; on 11,750 kc. at 2015-2200 with VOA programs; on 11,910 and 25,900 kc. at 1222 with music; and on 25,900 kc. at 1036-1129 with music. ID's are generally given every 30 minutes.

Vatican City—*Vatican Radio* is operating on a new frequency of 7250 kc., dual to 9645 kc., at 1950-2010 to N.A. with talks in English. It is also heard at 1130 on 11,905 kc. (also a new channel) on Mondays, Wednesdays, and Fridays. The 1315-1329 Eng. xmsn to N.A. on 9645 kc. is heard well; this opens with the bells of St. Peter's Cathedral.

Yemen—A station believed to be in this country has been logged on 5953 kc. at 2302

s/on with a long musical number. Some European sources list a xmsn at 1530-1600.

Medium Waves

R. Tricolor, believed to be in Bello, Colombia, is noted on 670 kc. at 0130-0200 on Mondays while WMAQ, Chicago, is silent. Frequent ID's and time checks are given in Spanish.

A station on 960 kc. giving the location as St. Georges, Bermuda, was logged on a Monday between 0230 and 0300. Southeastern area DX'ers, please check.

ZNS, Nassau, Bahamas, has been noted often on 1540 kc. in English. The early evening signal is good but later is overcome by WPTR, Albany.

R. Jamaica, Kingston, 720 kc., has often been noted by your Short-Wave Editor behind WGN, Chicago, evenings. —30—

SHORT-WAVE CONTRIBUTORS

Ernest Zecchini, *WPE1CIH*, Lawrence, Mass.
Larry Bourdon, *WPE1CNU*, Springfield, Mass.
David Knowlton, *WPE1DAR*, Manchester N. H.
Edward Manfredi, *WPE1DNA*, Providence, R. I.
(Knight Span-Master)
George Hemingway, *WPE1DYC*, Taftville, Conn.
(Lafayette HE-10)
Laurie Cohen, *WPE1DZT*, Kennebunk, Maine
(Hallicrafters SX-100)
S. C. Healy, *WPE1EAL*, Seekonk, Mass.
Paul Brenner, *WPE1EMD*, Chestnut Hill, Mass.
(RCA T-64)
Gene Molter, *WPE1IW*, Needham, Mass.
(Hammarlund HQ-145)
Bob Kapsch, *WPE2AHC*, Roselle Park, N. J.
(Hallicrafters SX-99)
Paul O'Mara, *WPE2CCO*, Yonkers, N. Y.
(Hallicrafters S-38E)
Lawrence Elkin, *WPE2CGM*, Bronx, N. Y.
Paul Kreisinger, *WPE2EKG*, Clifton, N. J.
(Knight Span-Master)
Henry Marbach, *WPE2FHU*, White Plains, N. Y.
Dave Bock, *WPE2GXV*, Newfield, N. Y.
(Hallicrafters S-38E)
Daniel Grumet, *WPE2IMF*, Toms River, N. J.
(Hallicrafters S-107)
Sandra Bailey, *WPE2INJ*, Elmira, N. Y.
(Hallicrafters S-38E)
Charles Flynn, *WPE2IWE*, Huntington Station, N. Y.
(TR-237)
Thomas Zalewski, *WPE2IXB*, Jersey City, N. J.
Michael Flomp, *WPE2IXH*, Valley Stream, N. Y.
Ben Stanilka, *WPE2IYW*, Ticonderoga, N. Y.
(Hallicrafters SX-110)
Barry Fulmer, *WPE2JAO*, Springfield, N. J.
(Hallicrafters S-120)
Ralph Morrissey, *WPE2JFZ*, Bronx, N. Y.
(Hallicrafters S-19R)
Craig Anderton, *WPE2JHM*, Ridgewood, N. J.
(Knight Span-Master)
William Dickerman, *WPE3BEB*, Williamsport, Pa.
Brian McCoola, *WPE3DQC*, Camp Hill, Pa.
(Knight Span-Master)
Chuck Pearce, *WPE3DSC*, King of Prussia, Pa.
William McCrady, III, *WPE3DUK*, Pittsburgh, Pa.
(Knight Space-Spanner)
Richard Few, *WPE3DVQ*, Rockville, Md.
George Cox, *WPE3NF*, New Castle, Del.
Grady Ferguson, *WPE4BC*, Charlotte, N. C.
(Hallicrafters SX-100)
W. G. Strait, *WPE4CT*, Lancaster, S. C.
Sheldon Daitch, *WPE4EDU*, Louisville, Ga.
Alfred Stankus, *WPE4EZP*, Miami, Fla.
(Lafayette HE-41)
Jeff Jones, *WPE4FOK*, Denbigh, Va.
(Hallicrafters S-120)
Bill Harrison, *WPE4FSJ*, Nashville, Tenn.
(National NC-60)
Roy Moore, *WPE4FWH*, Hazard, Ky.
(Knight Ocean-Hopper)
Kenneth Alyta, Jr., *WPE4FXB*, Charlotte, N. C.
(Knight Span-Master)
Jack Keene, *WPE5BMP*, Houston, Texas
(Hallicrafters S-40)
Delbert Hirst, *WPE5CFU*, Snyder, Texas
(Heath GR-91)
Bill Lund, *WPE6CJ*, Manhattan Beach, Calif.
Bob Morris, *WPE6CSP*, Rialto, Calif.
Geoffrey Ashford, *WPE6CWE*, San Carlos, Calif.
(National NC-183)
Tom Storli, *WPE6DHQ*, Los Angeles, Calif.
Wilbert Gex, *WPE6DIN*, Oakland, Calif.
D. W. Day, *WPE6DQW*, Bakersfield, Calif.
W. E. Lipis, *WPE6DRU*, El Cajon, Calif.
Loren Lindo, *WPE6DUA*, Los Angeles, Calif.
Craig Caston, *WPE6DYY*, Granada Hills, Calif.
(Knight Star-Roamer)
Bill Spring, *WPE6EBV*, Reseda, Calif.
Dennis Kimball, *WPE6ECZ*, Santa Monica, Calif.
(Lincoln TR-970)
Bill Laney, *WPE6EDT*, Covina, Calif.
(Knight Star-Roamer)
J. Art Russell, *WPE6EZ*, San Diego, Calif.
S. Z. Choudhry, *WPE6GE*, Yuba City, Calif.
Emmett Murphy, *WPE7BEF*, Butte, Montana
Tim Shaw, *WPE8BUV*, Bay Village, Ohio
David Cochrun, *WPE8DNO*, Sylvania, Ohio
Mike Ferguson, *WPE8EET*, St. Joseph, Mich.
Pat Montgomery, *WPE8EEW*, Cincinnati, Ohio
(Lafayette HE-10)
Robert Eddy, *WPE8EQW*, Newport, Ohio
(Hallicrafters S-38E)
D. N. Williamson, *WPE8EVI*, Dayton, Ohio
(Gonset GR-212)
Robert Zulinski, *WPE8FAV*, Berkley, Mich.
John Forslin, *WPE8FKB*, Wayne, Mich.
(Knight R-100)
John Miller, *WPE8FOC*, Parkersburg, W. Va.
(Crosley 82CQ)
Dick England, *WPE8FV*, Columbus, Ohio
Mike Kander, *WPE8MS*, Dayton, Ohio
Heinz Bausback, *WPE9BIVJ*, Mundelein, Ill.
(National NC-190)
Bill Strawn, *WPE9CBP*, Freeport, Ill.
(Hammarlund HQ-180A)
J. P. Arendt, *WPE9DN*, Aurora, Ill.
Phil Cutler, *WPE9FFL*, Barrington, Ill.
(Hallicrafters S-108)
Rich Appelhans, *WPE9EOV*, Chicago, Ill.
D. L. Newquist, *WPE9FDZ*, Rochelle, Ill.
(Hallicrafters S-120)
John Beaver, Sr., *WPEØAE*, Pueblo, Colo.
(National NC-109)
Bill Holscher, *WPEØATE*, Webster Groves, Mo.
(Hallicrafters SX-100)
Owen Williamson, *WPEØBSL*, Minneapolis, Minn.
(Knight R-55)
Bud Whitlock, *WPEØCQS*, Augusta, Kansas
(Hallicrafters S-120)
J. W. Harre, *WPEØCSJ*, Marshall, Mo.
(Heath AR-3)
Jack Perolo, *PY2PE1C*, Sao Paulo, Brazil
(National NC-190)
John Yokoff, *TA3PE1J*, Diyarbakir, Turkey
(R-390)
Gregg Calkin, *VE1PE3L*, St. John, N. B.
Stephen Syson, *VE3PE1HA*, Milton, Ont.
(Trio 6R45)
T. J. Gascoigne, *VE3PE1OQ*, Oshawa, Ont.
Bob Wood, *VE3PE1SM*, Tilbury, Ont.
(RCA Q-33)
Richard Laviolette, *VE7PE2M*, Richmond, B. C.
(Hammarlund HQ-180C)
Don Allen, *Radio XETRA*, Los Angeles, Calif.
Reid Briggs, Los Angeles, Calif.
Tom Colthurst, San Diego, Calif.
(Hammarlund HQ-160)
Francis Curran, Tacoma, Wash.
Daniel Dravet, Montreal, Que.
(Lafayette HE-30)
J. W. Hart, Imperial Beach, Calif.
Dennis Hoogenboom, Grand Rapids, Mich.
(Hallicrafters S-107)
Gerard A. Lawlor, Dublin, Ireland
Roger Neumann, W. Springfield, Mass.
Russell Oechslin, Carle Place, N. Y.
(Belmont 8A59)
H. E. Plew, Jr., Santa Monica, Calif.
(RBG)
Mike Sparling, Salem, Oregon
Julius Wachtel, Los Angeles, Calif.

Monitor Your Code

(*Continued from page* 57)

wire or rod and a banana jack. Or you may be able to pick up or fabricate a collapsible antenna as shown in the photos. Install the transistors in their respective sockets, and then snap in the penlight cell, being careful to observe the correct polarity.

How It Works. The Code Monitor consists of two transistor circuits connected in series—the trigger circuit and the audio tone circuit. The trigger circuit is made up of transistor *Q1*, voltage doubler diodes *D1* and *D2*, and iron core r.f. coil *L1*. A signal picked up by the antenna is dropped across *L1*, rectified and doubled by the diodes, and applied to *Q1*, causing the transistor to conduct heavily. When *Q1* conducts, it connects battery *B1* to ground, thereby providing power to the tone circuit. Closing the circuit across *Key* jack *J2* has the same effect as a conducting *Q1*.

The tone circuit is basically an audio frequency amplifier consisting of *Q2* and *Q3*, with a feedback path provided by *C3* which causes the amplifier to oscillate at an audio frequency. *Output* jack *J3* permits the connection of an a.c. voltmeter, if desired, when the Code Monitor is employed as a relative field strength indicator.

Testing and Operation. Turn the unit on and connect a telegraph key across *Key* jack *J2*. When the key is closed, a clean, crisp tone will come from the speaker. (If you prefer to use a headset rather than the speaker, connect it to *Output* jack *J3*.)

Now plug an antenna into jack *J1*, on top of the unit, and key your transmitter on either the 80- or 40-meter band. A tone should be heard. If the tone is too loud, move the unit away from the transmitter and transmission line; and if the tone is too weak or inaudible, move it closer. In extreme cases of low level r.f. fields, it may be necessary to connect the Code Monitor's case to a window screen or some other longer antenna.

ELECTRONICS MARKET PLACE

RATE 60¢ per word. Minimum 10 words prepaid. June issue closes April 5th. Send order and remittance to Martin Lincoln, POPULAR ELECTRONICS, 1 Park Ave., New York 16, N. Y.

FOR SALE

TV Tuners—Rebuilt or Exchanged $9.95 complete—all types—fast, guaranteed service. Send tuner with all parts to: L.A. Tuner Exchange, 4611 West Jefferson Blvd., Los Angeles 16, California.

GOVERNMENT Surplus Receivers, Transmitters, Snooperscopes, Parabolic Reflectors, Picture Catalog 10¢. Meshna, Malden 48, Mass.

DIAGRAMS for repairing Radios $1.00, Television $2.00. Give make, model. Diagram Service, Box 672-PE, Hartford 1, Conn.

WPE-CB-QSL cards—Brownie-W3CJI—3110A Lehigh, Allentown, Pa. Catalogue with samples 25¢.

CB WPE QSL Cards, Samples Free. Radio Press, Box 24, Pittstown, New Jersey.

"SPECIAL! WPE-SWL-CB-QSL cards, 3 colors, $2.50 per 100—Free Samples, Garth, Jutland, New Jersey."

WEBSTER Electric Inter-coms! Amateur, Marine Electronics! All bargains! Calienco, 187 Miraloma, California.

TELEPHONE Voice Switch (LS-500). Actuates automatically and unattended any tape or wire recorder. Pictorial installation instructions included. $23.75. Post Paid US. WJS Electronics, 1525 No. Hudson, Hollywood 28, Calif.

CONVERT any television to sensitive, big-screen oscilloscope. Only minor changes required. No electronic experience necessary. Illustrated plans, $2.00. Relco Industries, Box 10563, Houston 18, Texas.

SUPERSENSITIVE directional microphone picks up faint sounds at 300 feet. Detects sound through ordinary walls. Easily built for $7.00. No electronic Experience necessary. Plans, $2.00. Dee Company, Box 7263-F, Houston 8, Texas.

INVESTIGATORS! Do your own sound work. Send $1.00 for brochure of latest electronic equipment. WJS Electronics, 1525 No. Hudson, Hollywood 28, Calif.

TELEPHONE Extension In Your Car. Answer your home telephone by radion from your car. Complete diagrams and instructions $2.00. C. Carrier Co., 5880 Hollywood Blvd., Hollywood 28, Calif.

EAVESDROP with a pack of cigarettes. Miniature transistorized FM radio transmitter. Complete diagrams and instructions $2.00. C. Carrier Co., 5880 Hollywood Blvd., Hollywood 28, Calif.

BE a spy. Correspondence course on wire tapping, bugging, telescopic sound pickup, recording techniques, microphotography, and invisible photography. Lessons in surveillance, tailing, and use of equipment. Complete course $22.50. C. Carrier Co., 5880 Hollywood Blvd., Hollywood 28, Calif.

KITS, parts, tools. Free catalog. Accurate Electronics, 1111 Ave. Z, Brooklyn 35, N. Y.

SAVE dollars on radio, TV-tubes, parts at less than manufacturer's cost. 100% guaranteed! No rebrands, pulls. Request Bargain Bulletin. United Radio, 1000-E, Newark, N. J.

EMBOSSED Business Cards, 1,000 $4.00. Card Service, Box 2131, Tulsa, Oklahoma.

JUNK your distributor and voltage regulator. Improve automobile mileage and performance. Construction details for transistorized distributor and voltage regulator $4.75. No moving parts. DB Enterprises, 8959 Wonderland Ave., Hollywood 46, Calif.

TV Camera. Build for less than $50. Construction details $4.75. DB Enterprises, 8959 Wonderland Ave., Hollywood 46, Calif.

POLICE Radar Detector and legal jammer. Stop before those radar speed traps. Easy to build for less than $10; used with your car radio. Complete construction details $3.75. C. Carrier Co., 5880 Hollywood Blvd., Hollywood 28, Calif.

COLOR TV. Convert your black and white TV to color. Completely Electronic. No mechanical gadgets. Costs about $35. Complete construction details $4.75. DB Enterprises, 8959 Wonderland Ave., Hollywood 46, Calif.

COMPLETE Alarm Kit for Five Room House, or any five rooms. Price $65.00 per kit. Terms $25.00 down. Balance $6.50 per month for 8 months. Sold only by Low's Electric Alarm System, Box 118, Main Street, Epping, N. H.

TRANSISTORIZED Products Importers catalog, $1.00, Intercontinental, CPO, 1717, Tokyo, Japan.

INVESTIGATORS, free brochure, latest subminiature electronic listening devices. Ace Electronics, 11500—K NW 7th Ave., Miami 50, Fla.

INVESTIGATORS, free brochure, latest subminiature electronic listening devices. Ace Electronics, 11500-L NW 7th Ave., Miami 50, Fla.

TAPEWRITERS. New M4 Dymo Instant Label Maker $9.95. Extra Vinyl Tape 75¢ Roll. Shoson Industries, Box 434A, Harper, Kansas.

BOOK 200 Electric Stunts $1.00. Cuttziff, 875 Arastradero, Palo Alto, Calif.

TV TUNERS rebuilt $9.95—Ninety day guarantee. Western Tuner Rebuilders, 4130 El Cajon Blvd., San Diego 5, California.

CANADIANS—GIANT Surplus Bargain Packed Catalogs. Electronics, Hi-Fi, Shortwave, Amateur, Citizens Radio. Rush $1.00 (Refunded). ETCO, Dept. Z., 464 McGill, Montreal, CANADA.

TV FUSES Do-It-Yourself Kit with 350 reusable parts. Wires for 2000 fuses. Fuse assembling on-the-spot mean saving for servicemen. One Kit $7.95—Two $15.00—Three $20.00. It costs as one service call. Last for one year. Distributors Wanted. Medyn Co., P.O. Box 5228, Portland 16, Oregon.

CBER'S HAMS: Compact AAA-1 Clipper-Filter kit triples talk-power, fits any CB transceiver, improves selectivity; $10.99. Double reception with SK-3 Preselector for GW-10, GW-11; SK-4 Preselector fits GW-12 internally! Kit, $8.99; wired, $11.99. SK-20 Preselector, tunable 3.5-30 megacycles, kit, $18.98. Prices postpaid! (Free kit, antenna list.) Holstrom Associates, P.O. Box 8640-E, Sacramento 22, California.

CUT Holes Fast With Greenlee Chassis Punches—Make accurate, finished holes in one and one-half minutes or less in metal, hard rubber, and plastics. No tedious sawing or filing—a few turns of a wrench does the job. All standard sizes . . . round, square, key, or "D" shapes for sockets, switches, meters, etc. Available at your electronics parts dealer. Write for free literature. Greenlee Tool Co., 2028C Columbia Avenue, Rockford, Illinois.

MILITARY Discount—Name brands free recording tape and stereo handbook. Include rank and serial number. Electronics International, Inc., Box 3066, Charlottesville, Virginia.

WIRING Kits—Over 150 Feet of Different Colored Wire; Including High Priced Teflon Insulated Wire and Silver Plated Shielding. Only $1.95 Postpaid! W. S. Roberts, Box 2297, Phila. 3, Penna.

QSL Cards low prices—free samples. Debbeler Printing, 1309-X North 38th Street, Milwaukee 8, Wisconsin.

BARGAINS! Used ham transmitters, receivers, components. Interesting list 10¢. Brand's, Sycamore, Ill.

600 Watt G.E. experimenters transformer, Pri. 115V. Sec. tapped 8-12-16-20-24-28-36-40-52-60-68-80-96 and 120 volts. Shipped. Postpaid. $6.50. Send 5¢ stamp for bargain list. Reliable Electronics, 745 So. Kostner Ave., Chicago 24, Ill.

PRINTED circuit boards—Hams, experimenters baby Hi-Fi board PP 6AQ5's $3.95. Free catalog. P/M Electronics, Box 6288, Seattle 88, Wash.

SCHEMATICS for TV, radio, $1.00. Dees Electronics, 5945 Beverly Lane, RR #2, Middletown, Ohio.

BARGAIN prices on slightly used test equipment. Send for free list and prices. Century Electronics, 352 Maple Ave., Westbury, New York.

TELEPHONES—antique, french, modern—any model, color. Ready for extension. Picture catalog $1.00. Box 227, El Paso 42, Texas.

HI-VOLT probe for TV work. Tells in seconds whether enough Hi-volt is present. No wires to disconnect. $1.00. Latour, Box 232, Sandy, Utah.

STOP shouting! Build a home intercom. Plans and transistors, $4.00. Snyder Engineering, 3726 11th N.E., Seattle 5, Wash.

100 new insulated carbon resistors $1.00 Postpaid. Bigelow Electronics, Bluffton, Ohio.

CB QSL CARDS. New, cute designs. Three day service, low as $1.50 per 100. Free samples. R. Hellwig, Box 425, Lake Wales, Florida.

TRANSISTOR receiver-heath "Mohican", AC power supply. Make offer. William Augat, Grafton, Wisconsin.

TRANSISTORIZED treasure finder kits, assembled models from $19.95. Free catalog. Rellco, Box 10563, Houston 18, Texas.

14 Weather instrument plans $2.00. SACO, Box 2513B, South Bend, Ind.

WIRELESS broadcaster, miniature, transistorized. Plans $1.00. Baker, R.R. 1, Greencastle, Indiana.

CITIZENSBAND Walkie-Talkie Kit includes Hi-Power Transistors—Plans. $4.99. Imperial Enterprises, Inglewood, California.

CHANNEL 11 (13.5425MC) transmitting crystals. $1.59. Imperial Enterprises, Inglewood, California.

EXPERIMENTERS, hobbyists, technicians . . . buy & sell transistors, capacitors, transformers, etc. Big profit. Free wholesale catalog. Send self-addressed stamped envelope. D-E Devices, Box 214, Jericho, N.Y.

"RADIO workbench tips" handbook—50¢. Experimenter's catalog. Laboratories, 1131-L Valota, Redwood City, California.

INTERESTED in new electronic musical instruments? Send for free copy of "MoogMusic" to R. A. Moog Co., Dept. G, Box 263, Ithaca, New York.

CB transmitters $6.00. Other bargains, send 10¢ for list. Vanguard, 190-48 99th Ave., Hollis 23, N.Y.

TRANSISTORIZED converters—complete schematics and coil data for three engineered and tested converters. $3.00. 4110 Princeton, Garland, Texas.

TRANS-NITION electronic ignition parts kit. Negative ground $25.00. Coil, Manual special $8.50. Manual $2.00. Anderson Engineering, Wrentham, Massachusetts.

WANTED

CASH Paid! Unused tubes, electronic equipment. Barry, 512 Broadway, N.Y.C. 12.

QUICKSILVER, Platinum, Silver, Gold. Ores Analyzed. Free Circular. Mercury Terminal, Norwood, Mass.

OLD radios wanted for cash. The kind using headphones or horn. Worcester, R.D. 1, Frankfort, N.Y.

HIGH-FIDELITY

"LOW, Low quotes: all components and recorders. HiFi, Roslyn 9, Penna."

PRICES? The Best! Factory-Sealed Hi-Fi Components? Yes! Send for free catalog. Audion, 25P Oxford Road, Massapequa, N. Y.

DISGUSTED with "Hi" Hi-Fi Prices? Unusual discounts on your High Fidelity Requirements. Write Key Electronics, 120 Liberty St., New York 6, N. Y. DI-6-4191

RECORDERS, Components. Free wholesale catalogue. Carston, 125-P East 88, N. Y. C. 28.

WRITE for our low quotation on components, recorders. Hi-Fidelity Supply, 2817-YC Third, N.Y.C. 55

MELLO Monster Folded Horn. From designer now a 12" enclosure. Also popular 8". Plans $2.00 each. Ronald E. Dybvig, 2754 Xenwood Ave., St. Louis Park 16, Minnesota.

TAPE AND RECORDERS

TAPE Recorders, Hi-Fi, components, Sleep Learning Equipment, tapes. Unusual Values Free Catalog. Dressner, 1523PE, Jericho Turnpike, New Hyde Park, N. Y.

4/TR Stereo Tapes—bought, sold, rented, traded! Bargain closeouts! Catalog/Columbia, 9561 Foxbury, Rivera, California.

SELF-Hypnosis may help you many ways. New Tape or LP-record teaches you quickly, easily! Free literature. McKinley Company, Box 3038, San Bernardino, California.

SAVE 30% Stereo music on tape. Free bargain catalog/blank tape/recorders/Norelco speakers. Saxitone, 1776 Columbia Road, Washington, D. C.

RENT Stereo Tapes—over 2,500 different—all major labels—free catalog. Stereo—Parti, 811-G Centinela Ave., Inglewood 3, California.

TUBES

"FREE Catalog—name brand tubes 65% discount, phono needles 80% or more discount, phono cartridges, picture tubes 75¢ inch, parts, parts kits, silicon and selenium rectifiers, transmitting tubes, 7" T.V. test tube $6.99, improved batteries, tube testers, etc. Want to swap or sell tube inventory? Send us your offering. Arcturus Electronics Corp., Dept. Z.D. 502—22nd St., Union City, N. J.

TUBE Headquarters of The World! Free Catalog (tubes, electronic equipment) write! Barry, 512 Broadway, N.Y.C. 12.

BEFORE You Buy Receiving Tubes, Test Equipment, Hifi Components, Kits, Parts, etc. . . . send for your Giant Free Zalytron Current Catalog, featuring Standard Brand Tubes: RCA, GE, etc.—all Brand new Premium Quality Individually Boxed, One Year Guarantee—all at Biggest Discounts in America! We serve professional servicemen, hobbyists, experimenters, engineers, technicians. Why Pay More? Zalytron Tube Corp., 461 Jericho Turnpike, Mineola, N. Y.

REPAIRS AND SERVICING

KITS wired and tested. Guaranteed; reasonable. Write: Economy Electronics, Route 1, Box 530, Candler, N. C.

METERS—multimeters, panel instruments repaired and calibrated. Free estimates. R & S Repair Service, 175 Fifth Avenue, New York 10.

TV Tuners rebuilt and aligned per manufacturers specification. Only $9.50. Any make UHF or VHF. We ship COD. Ninety day written guarantee. Ship complete with tubes or write for free mailing kit and dealer brochure. JW Electronics, Box 51C, Bloomington, Indiana.

GOVERNMENT SURPLUS

JEEPS $278, Airplanes $159, Boats $7.88, Generators $2.68, Typewriters $8.79 are typical government surplus prices. Buy 10,001 items wholesale, direct. Full details, 627 locations and procedure only $1.00. Surplus, Box 177-C33, Abbottstown, Penna.

GOVERNMENT Sells Surplus: Electronics; Oscilloscopes; Transceivers; Test Equipment; Radar; Sonar; Walkie-Talkies; Boats; Jeeps; Aircrafts; Misc.—Send for "U.S. Depot Directory & Procedures"—$1.00—Brody, Box 425(PE), Nanuet, New York.

GOVERNMENT Surplus direct from Government. Jeeps $264.00, Radios $2.53. Typical prices. Guns, Typewriters, Cameras, Tools, thousands more. Amazing low prices. How, where to purchase, Merchandise available, etc., Only $1.00 to: Surplus, P.O. Box 50512, Dept. R, New Orleans 50, Louisiana.

BOATS, airplanes, power tools, diving equipment, sporting goods. Everything imaginable. You buy direct. "Locations and Procedures" plus "Buying for Profits". $1.00. Satisfaction guaranteed. Southwestern Surplus, Box 6091-F4, Dallas 22, Texas.

JEEPS—$223.83, transmitters—$6.18, typewriters—$4.15, receivers—$5.65, oscilloscopes, multimeters, speakers, walkie-talkies. Typical government surplus prices. Exciting details free. N.Y. Enterprises, Box 402-B3, Jamaica 30, New York.

WALKIE-talkies, jeeps, guns, radios—government surplus. Locations & procedures—$1.00. Satisfaction guaranteed. Surplus, Box 227, El Paso 42, Texas.

PLASTICS

NEW Liquid Casting Plastic, clear, colors. Embed real flowers, butterflies, photos, coins. Send 25¢ for two handbooks, "How to Cast Liquid Plastics" and "How to Make Extra Money at Home". Castolite, Dept. K-108, Woodstock, Illinois.

LEATHERCRAFT

FREE "Do-It-Yourself" Leathercraft Catalog. Tandy Leather Company, Box 791-B44, Fort Worth, Texas.

STAMPS AND COINS

FREE! Get This New Valuable North American Collection, all-different postage stamps of Greenland (North Pole), St. Pierre, Newfoundland, Canada—Eskimos, Indians, scarce 1867 Confederation. 1862 British Columbia & Vancouver Is. Cent., Nova Scotia, Northern Territories, United Nations, U.S. Stamps—19th Century, first Plane, Steam Boat, Pony Express, etc. Also, complete Colonial & Civil War Issues, many others. Plus full color flag stamps of 87 foreign countries. Extra! Bargain Catalog; "How to Recognize Rare Stamps"; other exciting stamp offers for free inspection. Send 10¢ For Mailing. Kenmore, Milford EF-462, New Hamp.

NEW Approval Service—200 world-wide stamps only 25¢ to serious collectors with request for approvals. Special selections for beginners. Martin Stamp Co., 2662 West 2nd Street, Brooklyn 23, N. Y.

SMASHING Collection Free—Includes Triangles, Early United States, Rockets, Sports, British Colonies, High Value Pictorials, etc. Complete Collection plus big illustrated Magazines, all free. Send 10¢ for postage. Gray Stamp Co., Dept. Z2, Toronto, Canada.

TOPS! Fascinating coin collection from Cameroons, Formosa, Vatican, etc., and foreign banknote. Catalog Price Over $1.50! Only 10¢ with exciting coin approvals! Littleton Coin Company, Littleton T-12, New Hampshire.

WORLD'S lowest price list—U.S. Mint and used—priced per one. Get yours now—Free. Wm. Rice, 10230-P Martinique Dr., Miami 57, Fla.

INSTRUCTION

LEARN While Asleep, hypnotize with your recorder, phonograph. Astonishing details, sensational catalog free! Sleep-Learning Association, Box 24-ZD, Olympia, Washington.

FCC License in 6 Weeks, First Class Radio telephone. Results Guaranteed. Elkins Radio School, 2603B Inwood, Dallas, Texas.

"DRAFTING, Reading Blueprints, Schematics. Send $2.00 first lesson, complete home course $25.00. Prior Inc., 23-09 169 Street, Whitstone 57, New York.

FREE! Instruction manual with purchase of 10 scale slide rule—$4.00. Illustrative, self-teaching course $2.00. Save! Combination only $4.95 postpaid. No COD. Alsynco, Dept. PE-3, 171 South Main, Natick, Mass.

INVENTIONS WANTED

INVENTIONS wanted. Patented; unpatented. Global Marketing Service, 2420-P 77th, Oakland 5, Calif.

PHOTOGRAPHY-FILM, EQUIPMENT, SERVICES

MEDICAL Film—Adults Only—"Childbirth"—1 reel 8mm. $7.50—16mm $14.95. International, Greenvale, L. I., New York.

SCIENCE Bargains—Request Free Giant Catalog "CJ" —144 pages—Astronomical Telescopes, Microscopes, Lenses, Binoculars, Kits, Parts. War surplus bargains. Edmund Scientific Co., Barrington, New Jersey.

EDUCATIONAL OPPORTUNITIES

ENGINEERING Education for the Space Age. Northrop Institute of Technology is a privately endowed, nonprofit college of engineering offering a complete Bachelor of Science Degree Program and Two-Year accredited technical institute curricula. Students from 50 states, many foreign countries. Outstandingly successful graduates employed in aeronautics, electronics, and space technology. Write today for catalog—no obligation. Northrop Institute of Technology, 1179 West Arbor Vitae Street, Inglewood 1, California.

DETECTIVE Profession. Home Study. Lapel pin, Certificate, Future. Box 41197-AG, Los Angeles 41, Calif.

COLLEGE Home Study courses from leading universities. Full credit towards Bachelor's or Master's degree. 5000-course directory $2.00. College Research, North Highlands 3, Calif.

MEN 17 to 40 you can become a professional radio announcer. Send $2.00 cash, check, or money order to: P.O. Box 2011, Parkersburg, W. Va.

EMPLOYMENT INFORMATION

SELL Champion, A-C, Autolite sparkplugs. Remanufactured, electroplated, guaranteed 10,000 miles. 100% profit. Free details. Cisco, Box 35061-D, Houston 35, Texas.

$4.50 to $25.00 an hour—all trades and professions. 33,000 top jobs coast to coast in 140 page Job Shoppers Manual and Directory—Only $2.00 Cash-Check-MO. Electro-Press, Box 315, Pasadena, California.

BUSINESS OPPORTUNITIES

BUY Direct from factories. Appliances, cameras, watches! Free details! Cam Co., 436 PE Bloomfield Ave., Verona, N. J.

VENDING Machines—No Selling. Operate a route of coin machines and earn amazing profits. 32-page catalog free. Parkway Machine Corporation, 715PE Ensor Street, Baltimore 2, Md.

ELECTROPLATING equipment and supplies. All types for home work shops. Free Catalog. HBS Equipment Division, 3445 Union Pacific, Los Angeles 23, Calif.

I MADE $40,000.00 Year by Mailorder! Helped others make money! Start with $10.00—Free Proof. Torrey, Box 3566-N, Oklahoma City 6, Oklahoma.

ASSEMBLE artificial lures at home for stores. Materials supplied free. Profitable! Write: Lures, Fort Walton Beach 1, Florida.

FREE Franchise Profit Letter tells how unique NFR service is helping thousands seeking profitable businesses. Write today. National Franchise Reports, PE-528, 333 North Michigan, Chicago 1.

MAKE $25-$50 week clipping newspaper items for publishers. Some clippings worth $5.00 each. Particulars free. National, 81 Knickerbocker Station, New York City.

BIG Money—Operate own fix-it shop. Service household appliances, motors, mowers, saws, skates, etc. Free book. Christy Trades School, A-514, 3214 W. Lawrence, Chicago 25.

$100 Weekly possible. Compile Mailing lists and address envelopes for advertisers. Home—spare time. Particulars free. National Service, 81 Knickerbocker Station, New York City.

POPULAR ELECTRONICS

April 1963

Advertisers Index

RCA Training Can Be The Smartest Investment You Ever Made!

If you're considering a future in electronics, investigate the courses offered by RCA Institutes Home Study School. In the rapidly expanding world of electronics, good basic training in Electronic Theory and Practice is most important. And you can be sure of the very finest when you enroll at RCA Institutes.

Founded in 1909, RCA Institutes is one of the largest technical schools in the United States devoted exclusively to electronics. The very name "RCA" means dependability, integrity and scientific advance.

The courses offered by RCA Institutes are many and varied. A complete program of integrated courses for beginners and advanced students is available. They include: Electronic Fundamentals, Transistors, Television Servicing, Color Television, Electronics for Automation. Each one is especially tailored to your needs, designed to prepare you for a profitable future in the ever-expanding world of electronics. And once you become an RCA Institutes graduate, you are assured of top recognition by leading companies everywhere.

Investigate the superb facilities for technical instruction at the RCA Institutes today. It can be the smartest move you ever made.

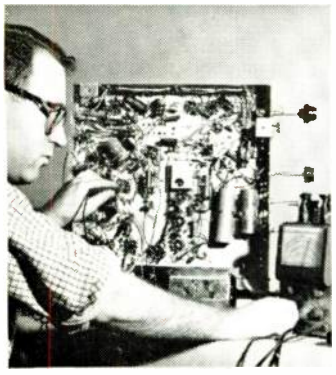
PRINTED IN U.S.A.

HOME STUDY COURSES

in Electronic Fundamentals · TV Servicing · Color TV
Communications Electronics · FCC License Preparation
Mobile Communications · Automation Electronics
Computer Programming · Transistors · Electronic Drafting

Voluntary Tuition Plan. All RCA Institutes Home Study courses are available under the Voluntary Tuition Plan. This plan affords you the most economical possible method of home study training. You pay for lessons only as you order them. If, for any reason, you should wish to interrupt your training, you can do so and you will not owe a cent until you resume the course. No other obligations! No installment payments required.

RCA Personal Instruction. With RCA Home Study training you set your own pace in keeping with your own ability, finances, and time. RCA Institutes allows you ample time to complete the course. Your lesson assignments are individually graded by technically trained personnel, and helpful comments are added where required. You get theory, experiment, and service practice beginning with the very first lesson. All lessons are profusely illustrated. You get a complete training package throughout the entire course.



You Get Prime Quality Equipment. All kits furnished with the course are complete in every respect, and the equipment is top grade. You keep all the equipment furnished to you for actual use on the job . . . and you never have to take apart one piece to build another.

RESIDENT SCHOOLS

in Los Angeles and New York City— You can study electronics in the city of your choice.

No Previous Technical Training Required For Admission. You Are Eligible Even If You Haven't Completed High School. RCA Institutes Resident Schools in Los Angeles and New York City offer training that will prepare you to work in rewarding positions on research and production projects in fields such as automation, transistors, communications, technical writing, television, computers, and other industrial and advanced electronics applications. If you did not complete high school, RCA will prepare you for such training with courses specially designed to provide the basic math and physics required for a career in electronics.

Free Placement Service. RCA Institutes graduates are now employed in important jobs at military installations with important companies such as IBM, Bell Telephone Labs, General Electric, RCA, and in radio and TV stations all over the country. Many other graduates have opened their own businesses. A recent New York Resident School class had 93% of the graduates who used the FREE Placement Service accepted by important electronics companies . . . and had their jobs waiting for them on the day they graduated!

Coeducational Day and Evening Courses. Day and Evening Courses are available at Resident Schools in New York City and Los Angeles. You can prepare for a career in electronics while continuing your normal full-time or part-time employment. Regular classes start four times each year.

SEND POSTCARD FOR FREE ILLUSTRATED BOOK TODAY! SPECIFY HOME STUDY OR NEW YORK OR LOS ANGELES RESIDENT SCHOOL

3 NEW LOCATIONS

In addition to RCA Institutes Inc. courses, Radio Corporation of America offers a limited selection of basic Resident School Courses in Electronics at three new locations . . . Chicago, Philadelphia, and Cherry Hill, N. J., (near Camden). For complete information, write the city of your preference next to your name on the attached postcard.

RCA INSTITUTES, INC. DEPT. PE-43 A SERVICE OF RADIO CORPORATION OF AMERICA, 350 WEST 4TH ST., NEW YORK 14, N. Y.
PACIFIC ELECTRIC BLDG., 610 S. MAIN ST., LOS ANGELES 14, CALIF.

The Most Trusted Name in Electronics

FIND OUT HOW TO

BUILD A SUCCESSFUL CAREER IN ELECTRONICS NOW!

RCA offers Home Training . . . and Classroom Training in New York City and Los Angeles

SEND FOR FREE BOOK

FILL OUT, DETACH, AND MAIL TODAY

RCA INSTITUTES, INC., Dept. PE-43
Schools of Television and Electronic Technology
A Service of Radio Corporation of America
350 West Fourth Street, New York 14, N. Y.
610 South Main Street, Los Angeles 14, Calif.

Please rush me the FREE illustrated book checked below. I understand that I am under no obligation and that no salesman will call.

Home Study School ☐ Classroom Training New York ☐
Classroom Training Los Angeles ☐
Other: (specify)_____

Name_____ Age____

Address_____

City_____ Zone____ State_____

CANADIANS: Take advantage of these same RCA Institutes Home Study Courses at no additional cost. No postage, no customs, no delay. Fill out this card and send in envelope to: RCA Victor Limited, 5581 Royalmount Ave., Montreal 9, Que.