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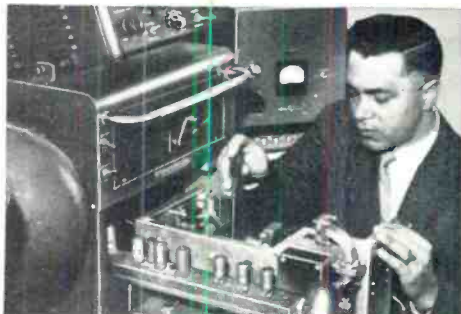
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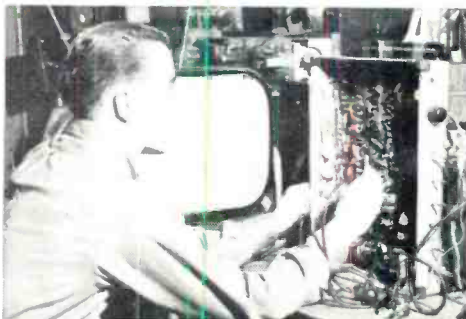
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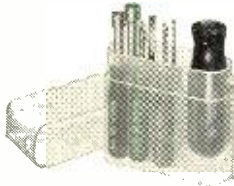
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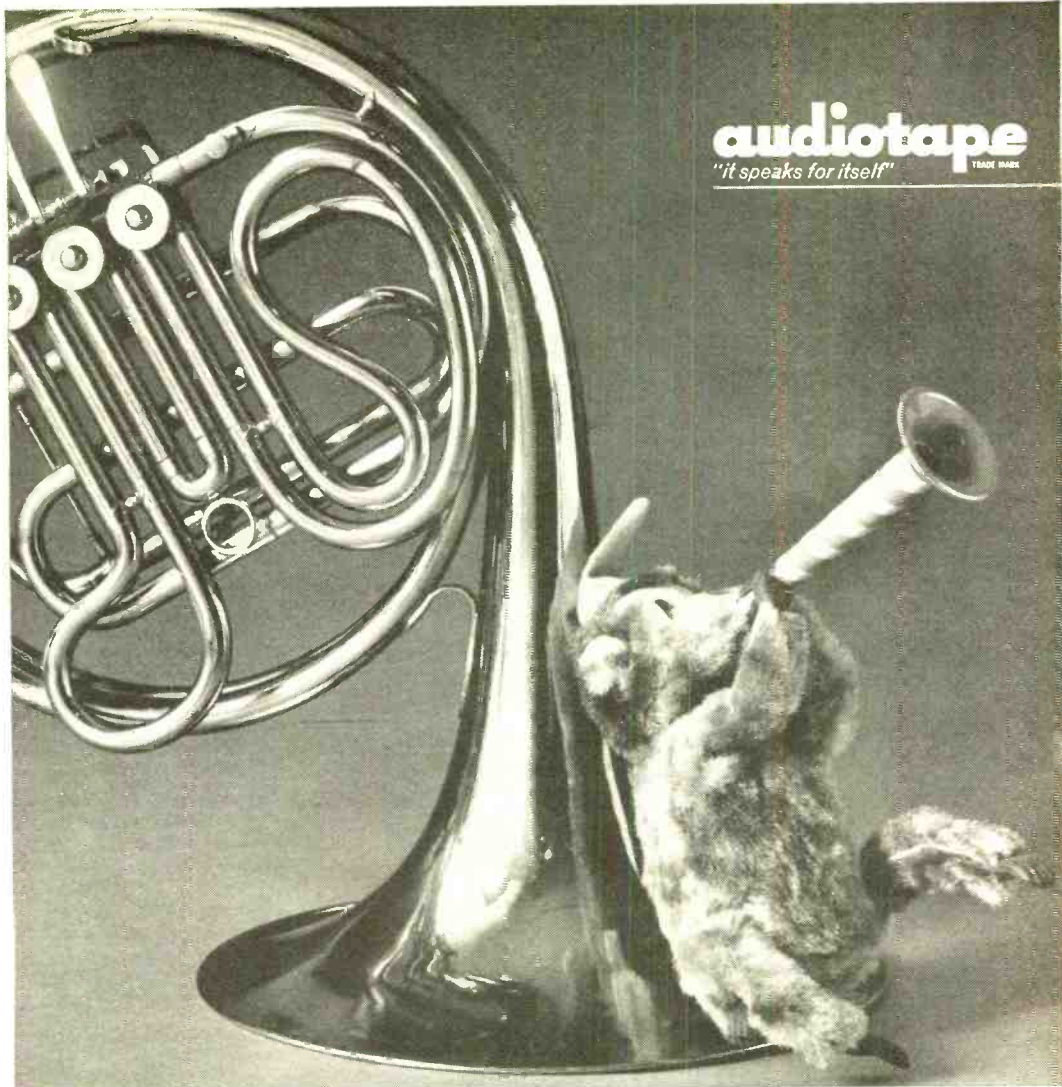


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"Drainpipe 8"—Disguised

■ 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)

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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.

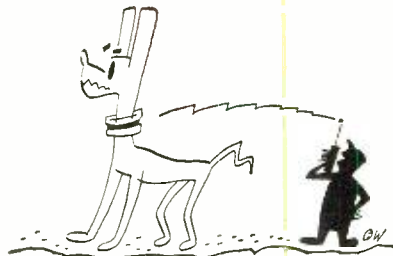
■ I am pleased to say that I have never built a project from P.E. plans that wasn't a success. Among the items I have constructed are a square-wave generator, an electrolytic "restorer," and a power supply—all of which look good and perform beautifully. Since Peter Galvin lives not far from me, I would 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 $\frac{1}{4}$ mile, but it's also rather expensive—about \$200.00. I

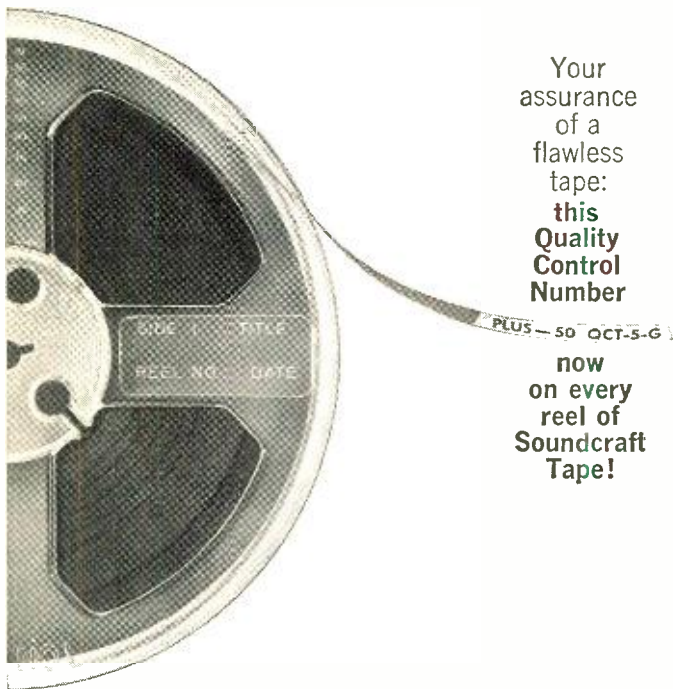


wonder if P.E. could lend a helping hand and publish construction details on such a device—so that I can build my own?

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)



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"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.)

"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.)

"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.

"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.)

"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.)

"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.)

"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.)

"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.

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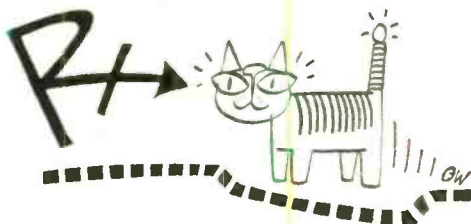
SONY CORPORATION OF AMERICA
580 Fifth Avenue, New York 36, N.Y.

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 Nuvisor 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 μ a. and not 400 ma. Similarly, 750 ma. (page 99) should be 750 μ a.

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-

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Pick the course for your career...

Electronics Technology



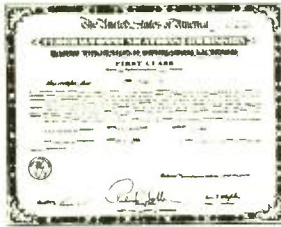
A comprehensive program covering Automation, Communications, Computers, Industrial Controls, Television, Transistors, and preparation for a 1st Class FCC License.

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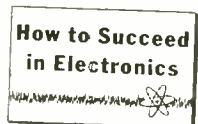
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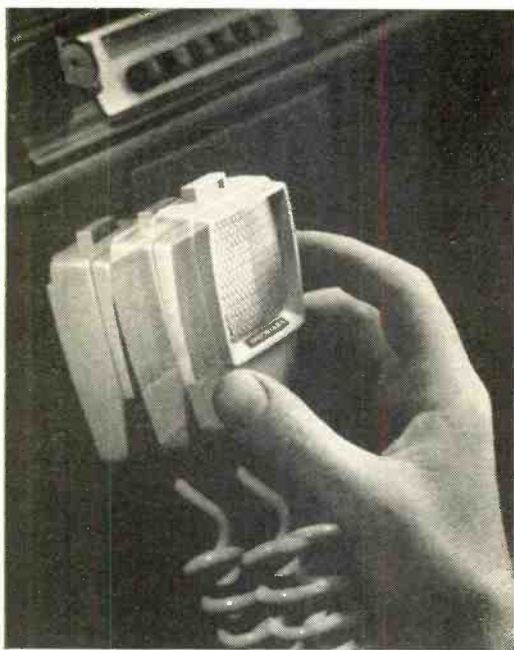
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Kerchunk! new sound of safety

Kerchunk is the sound made by the heavy duty magnet on the back of a Sonotone CB Ceramike as it mounts firmly, securely to your car's dashboard.

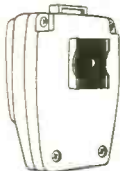
Kerchunk says: "Message to base completed easily, safely." *Kerchunk* means no more groping when you return your mike to its dashboard mounting bracket—no need to take your eyes off the road.

Responsible for this boon to those who rely on CB or mobile communication, from car or truck, is an important Sonotone development called "Magnet Mount." A heavy duty magnet on the back of Sonotone Ceramike mobile communications Models "CM-30M" and "CM-31M" lets you place the mike almost anywhere on or around the dashboard. Further, Magnet Mount eliminates the need to drill holes for dashboard mounting brackets.

Sonotone Ceramikes have far more to recommend them than just this amazing mounting device. The quality-engineered mobile communications models, "CM-30M" and "CM-31M" provide loud and clear reception. Inherently immune to extremes of temperature and humidity, they will operate even if immersed in water. Neoprene encased transducers render them shock and impact-proof.

CERAMIKE "CM-30M" — Intelligibility unsurpassed. High sensitivity from -49 db from 60 to 7000 cps. Lightweight, shatterproof plastic case. Convenient "Push-to-Talk" button. Spring-spiraled, 4-conductor shielded cable—list \$16.50 With dashboard mounting bracket instead of Magnet Mount. Model "CM-30"—list \$14.00

CERAMIKE "CM-31M" — Budget-priced communications model in shatterproof plastic case features excellent intelligibility in 60 to 7000 cps at -49 db sensitivity. 2-conductor coil cable, no switch, list \$16.00. With dashboard mounting bracket instead of "Magnet Mount." "CM-31"—list \$13.50



SEE SONOTONE CB CERAMIKES FEATURING MAGNET MOUNT

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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.



Knight KN-845 stereo headset

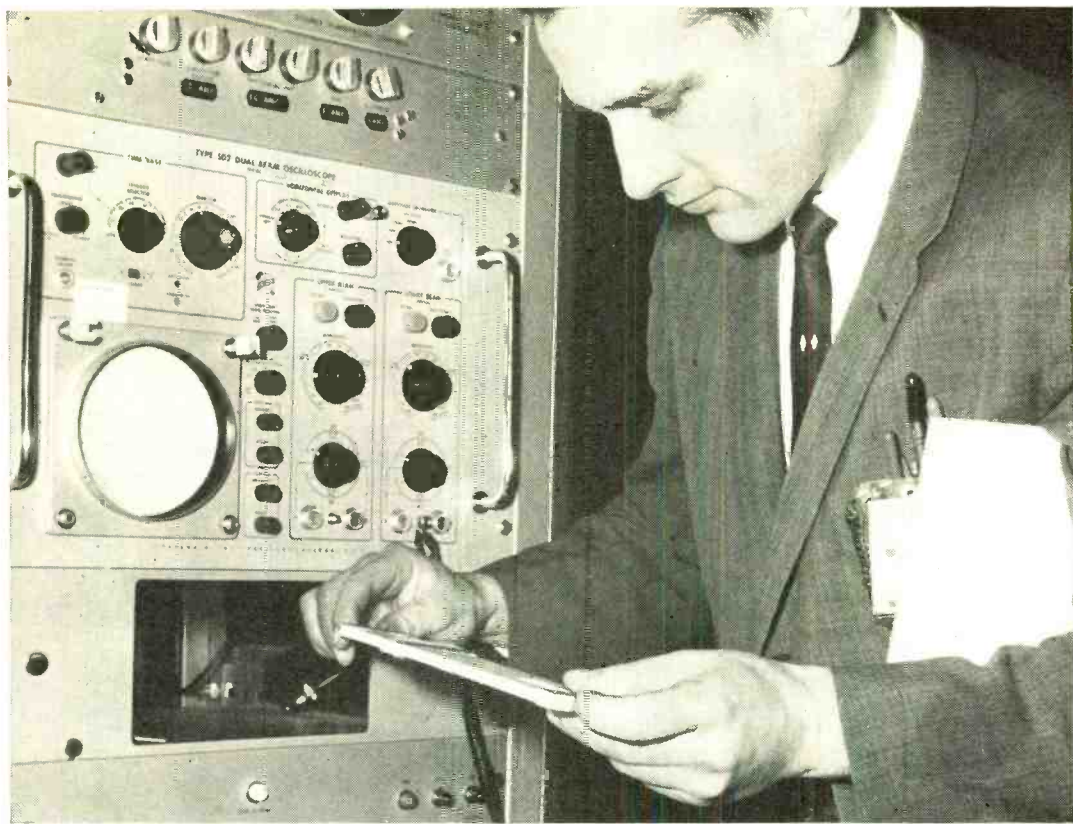
The KN-845's 4- to 16-ohm impedance matches just about any amplifier on the market, and its 25- to 16,000-cycle response provides full-fidelity reproduction. An optional accessory, the KN-846 remote control unit accommodates

two KN-845 headsets and allows independent "chairside" control of each. Prices: \$19.95 for the headset; \$7.95 for the control unit. . . . From *Audio Originals* come two new ideas in equipment enclosures. One—the Model 101—consists of a wall-hanging enclosure measuring 8" x 37½" 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*

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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)

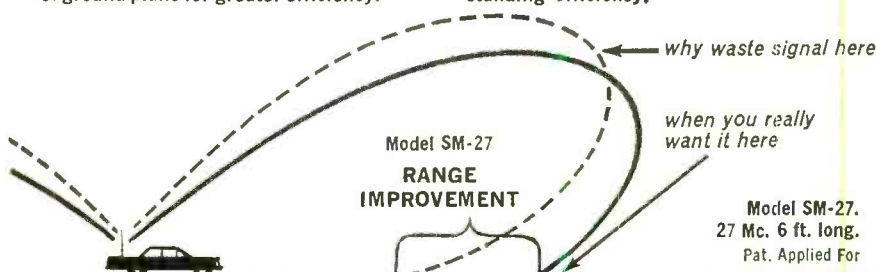
TOTALLY NEW CONCEPT GREATLY IMPROVES CB COMMUNICATIONS New MARK Monowhip SLEEVE MONOPOLE CB ANTENNAS

Lower angle of radiation gives stronger signals and greater range.

Excitation (feed point) occurs at mid-point of radiator—effectively removed from region of ground plane for greater efficiency.

Exceptionally wide bandwidth with low VSWR. 50 ohm match.

Permits rear bumper mounting, as well as side cowl or fender mounting, with outstanding efficiency.



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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 3¾ inch reel for ½-mil "tensitized" 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.



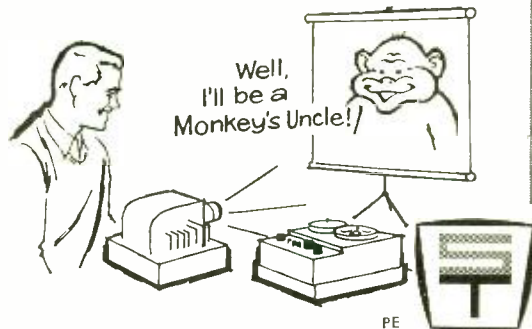
Video Plus Audio

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.

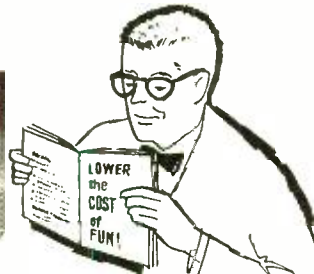
The clips can be attached directly to the speaker voice coil.



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, 3¾, 5, and 7-inch reels to meet every recording requirement.

The price is competitive...the quality is unchallenged.



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Showcase

(Continued from page 14)

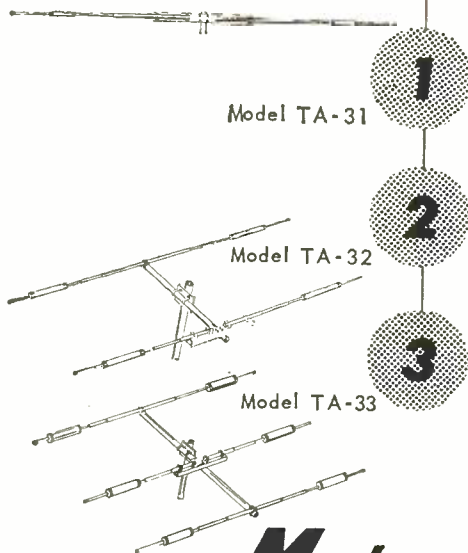
the tone arm itself brings arm resonance down to a sub-audible 8 cycles. Price, complete with shielded plug-in cables, \$54.95. . . . **Roberts Electronics** has added something new to two of its tape recorders. Models 997 and 1057 now come equipped with an automatic, self-contained head demagnetizer. 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 1/2 and 8 grams. Calibrated in 1/2-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 4 1/2" 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 D., 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.

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Begin today with the Purchase of the inexpensive Model TA-31, and in two additional steps you can have the famous TA-33 Trapmaster Beam. Fully rated for maximum legal power, the TA-31 is a radiator element from the TA-33.

Amateur Net \$25.85

Purchase the conversion kit to make the TA-31 a TA-32. This conversion kit consists of a reflector element, a seven foot boom, boom-to-mast plate and necessary hardware.

Model TA-31-32 Net, \$43.65

For your final step to outstanding performance, purchase the conversion kit to make the TA-32 a TA-33. This includes a director element, seven foot boom, boom splice and necessary hardware.

Model TA-32-33 Net, \$30.25

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World Famous Trapmaster Antennas for 10, 15 and 20 Meters

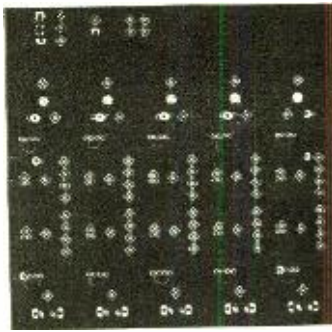
Mosley

Electronics Inc.

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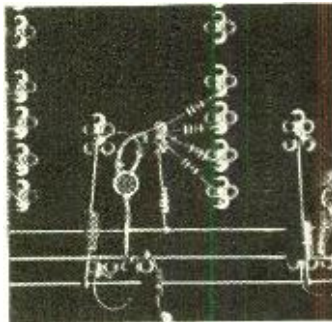
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(And 15 transistors, 93 resistors plus switches, lights and other professional components.)



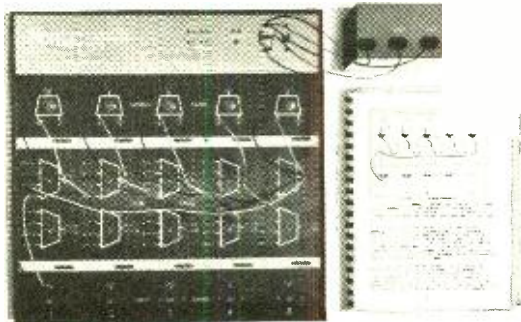
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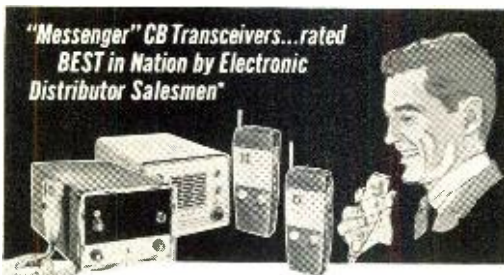
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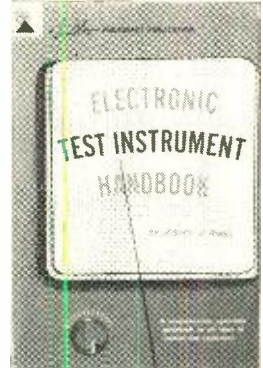


POPtronics Bookshelf

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A comprehensive and up-to-date work on modern test equipment, his 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

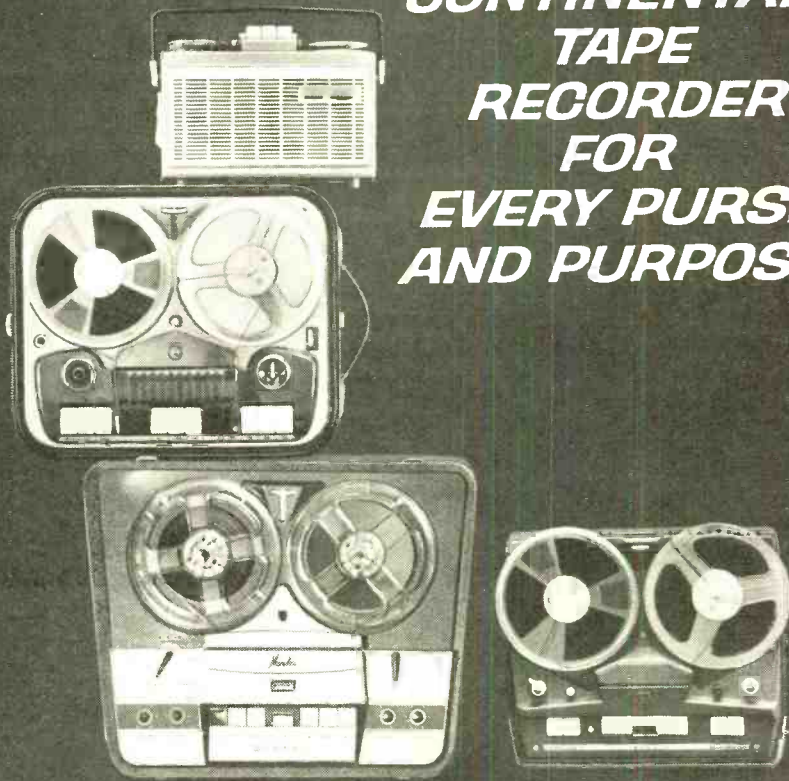
From cover to cover, this book deals only with mathematics as applied to electronics. Formulas are not merely presented and their use left to the reader; instead, a wide variety of problems—both theoretical and practical—are analyzed. And solutions to problems are derived, so that the reader can better 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)

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RECORDER
FOR
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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 1 7/8 ips machines • constant-speed operation • complete with dynamic microphone.

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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-

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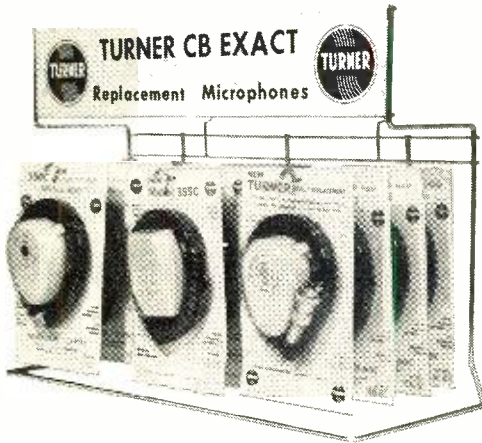
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Bookshelf

(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.,
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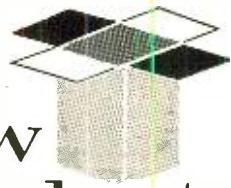
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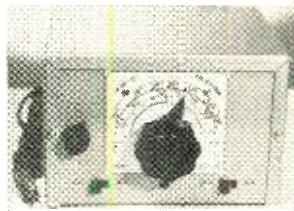
(Continued from page 26)

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.)

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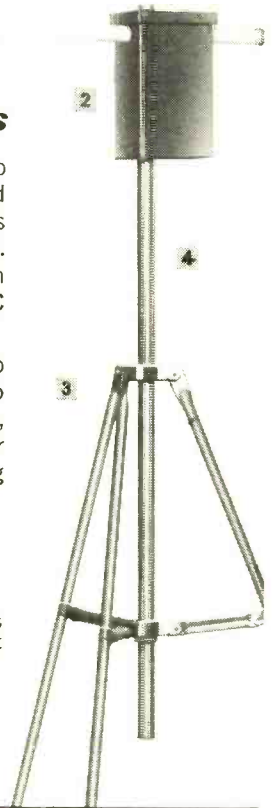
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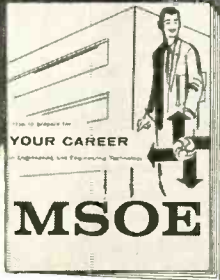
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Discharge date _____

MS-117

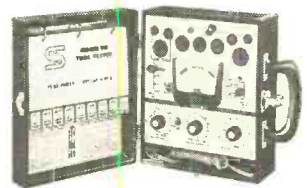
Products

(Continued from page 28)

a "phono-top" that will play 33½-, 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—



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Training Electronics Technicians Since 1946

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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, 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 intensive 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 easy-to-learn, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing (building) 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" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and 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, caps, 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.

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.

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. Statalis, 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, writes: "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 write and build. You write and like to build Radio Testing Equipment. I enjoyed every minute. I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Shuff, 1534 Monroe Ave., Huntington, W. Va., writes: "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, and to be found."

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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

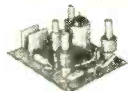
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SA-210.....**\$29.95**

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12 WATT AMP-PREAMP
Williamson type,
4 inputs; inc. Magnetic
MA-12.....**\$22.95**



STEREO AMP-PREAMP
30 WATTS; William-
son Type, 8 inputs
SA-30.....**\$39.95**

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PREAMP, 36 WATTS**
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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 IB	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 IB	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.

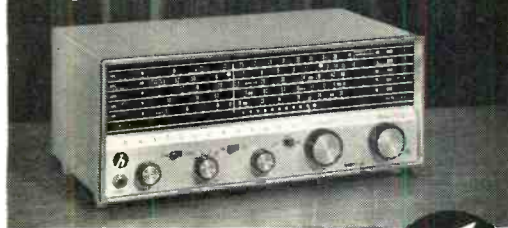
*Signal may be very weak

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.

CUBA?

History reports itself while
it is happening, in English,
from the Caribbean . . .
Moscow . . . New Delhi . . .
London . . . Laos . . . Little
America . . . and very soon,
the Moon. Be there to-
night on a hallicrafters.



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for short wave and local broadcast

For 64-pg. miniature
book, "Guide to Short
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Added features for extra versatility. An improved kit version of the famous RCA SENIOR VOLTOHMYST.

Most important new feature: a half-volt full-scale DC range for more accurate measuring of low voltages used in transistor circuits.

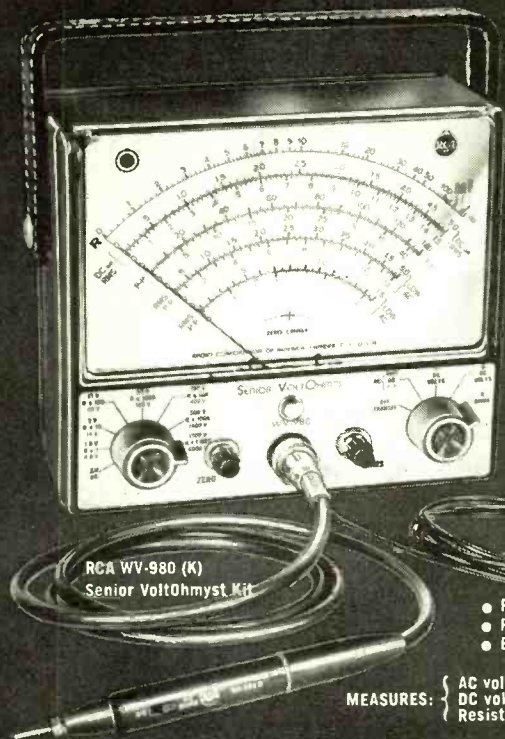
Extra plus feature: Pre-assembled, factory-tested DC/AC-OHMS probe (WG-239D) included with every kit.

Other deluxe features:

- Big 6½" meter—one of the most readable ever designed into a VTVM—electronically protected against burnout
- Color-coded scales differentiate peak-to-peak and rms readings
- ±3% accuracy, full-scale on both AC and DC measurements.
- Less than 1% tracking error
- Precision multiplier resistors accurate to ±1%
- Rugged die-cast aluminum case with leather handle
- Brushed aluminum control panel with etched markings

MEASURES: { AC voltages (0.1 to 4200 volts peak-to-peak and 0.1 to 1500 volts rms)
DC voltages (0.005 to 1500)
Resistances (0.2 ohms to 1,000 megohms)

RCA Senior VoltOhmyst WV-98C, also available factory-wired and calibrated, \$79.50*



RCA WV-98C (K)
Senior VoltOhmyst Kit

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VOLT-OHM-MILLIAMMETER KIT
Only \$29.95*

The V-O-M with the extras! • 0.25-volt and 1.0-volt DC ranges • Big easy-to-read 5¼" meter • Non-breakable sealed plastic case—no glass to crack or shatter • Jacks located below switches to keep leads out of the way • Spring clips on handle to hold leads • Attractive, scuff resistant, rugged carrying case, only \$4.95* extra.

RCA WV-38A available factory-wired and calibrated: \$43.95*



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TUBE TESTER

TESTS ALL MODERN TUBES
INCLUDING THE NEW



- ✓ NOVARS
- ✓ NUVISTORS
- ✓ 10 PINS
- ✓ 12 PIN COMPACTRONS

SPECIFICATIONS:

- Employs new improved emission circuit.
- Tests over 850 tube types.
- Tests 0Z4 and other gas filled tubes.
- Employs new 4" meter with sealed air-damping chamber resulting in accurate vibrationless readings.
- Use of 26 sockets permits testing all popular tube types.
- Dual Scale meter permits testing of low current tubes.
- 7 and 9 pin straighteners mounted on panel.
- All sections of multi-element tubes tested simultaneously.
- Ultra-sensitive leakage test circuit will indicate leakage up to 5 megohms.

Model 820 comes complete with tube charts and instructions: **\$3850**
Housed in handsome, portable, Saddle-Stitched Texon case. Only

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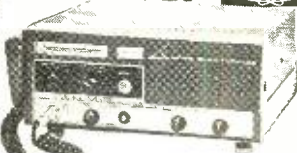
Try it for 15 days before you buy. If completely satisfied then send \$3.00 and pay balance at rate of \$5.00 per month until total price of \$38.50 (Plus postage) is paid - No Interest or Finance Charge Added! If not completely satisfied, return to us, no explanation necessary.

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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, 1/2-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)

Always say you saw it in—POPULAR ELECTRONICS

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at a price
you can afford!

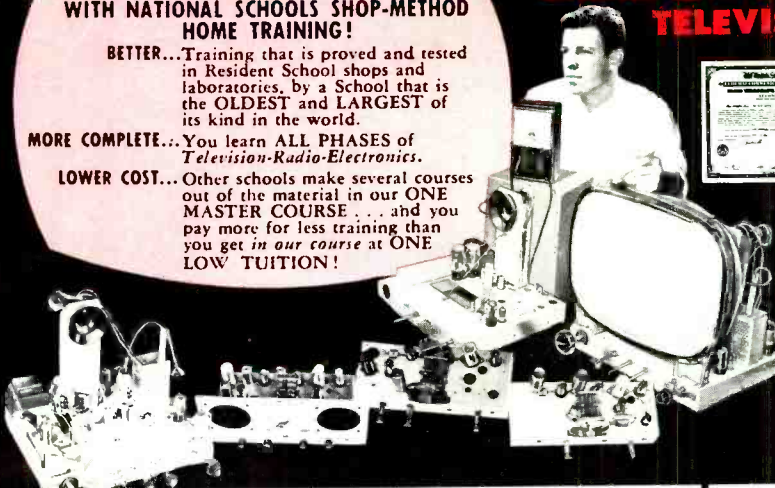
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I cannot praise N.T.S. enough. I've just graduated and already I have started repairing radios and servicing TV's ... At 53, I'm starting a new life and my diploma from National Technical Schools is my proudest possession.

William E. Eckenrad

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 Sperra

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

**PHASE 6
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These are the communications systems of the future, already used in tracking and contacting satellites.

**PHASE 7
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& COMPUTERS**
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**PHASE 8
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**PHASE 4
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Tips (Continued from page 34)

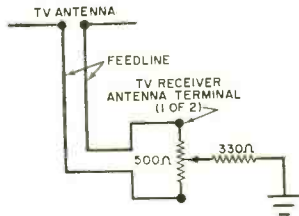
B+ is on, the neon bulb will light; and when the supply is turned off, the bulb will remain lit until the filter capacitors have discharged. —Charles Craft, WPE3BIK

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)



why does Blonder-Tongue offer two new indoor boosters?

Let's talk straight-from-the-shoulder about indoor boosters. Transistor boosters provide higher gain and are more rugged, but they have one problem—overload (windshield wiper effect, loss of sync, etc.). If you use a transistor booster in an area with one or more strong TV or FM signals—you may be buying too much booster! On the other hand, tubed boosters perform very well in these areas—and what's more, they cost less.

That's why Blonder-Tongue has two new home indoor boosters—the transistor IT-4 Quadrabooster and the frame-grid tubed B-33 Amplicoupler.

The B-33 costs less than the transistor IT-4, \$19.95 as against \$33.00. In most cases, the extra cost of the IT-4 is more than justified by its remarkable performance and long life. However, if the B-33 can do the job, we don't want you to spend more than is necessary for the finest TV reception.

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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.

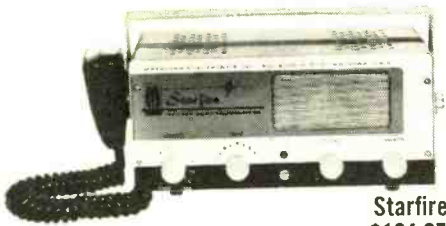
● WIRELESS EARPHONE

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.

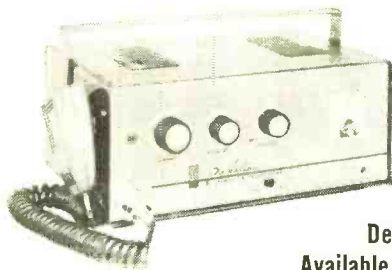
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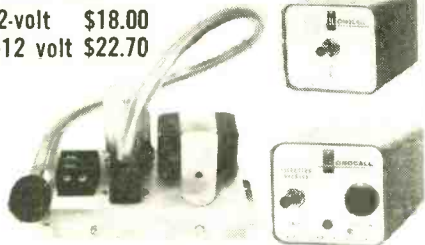


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SOUTH VIETNAM'S 40 MEGACYCLE INTERCOM

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 subtropical 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 transmitter, 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



By ARTURO F. GONZALEZ, JR.



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 sepa-

rated 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

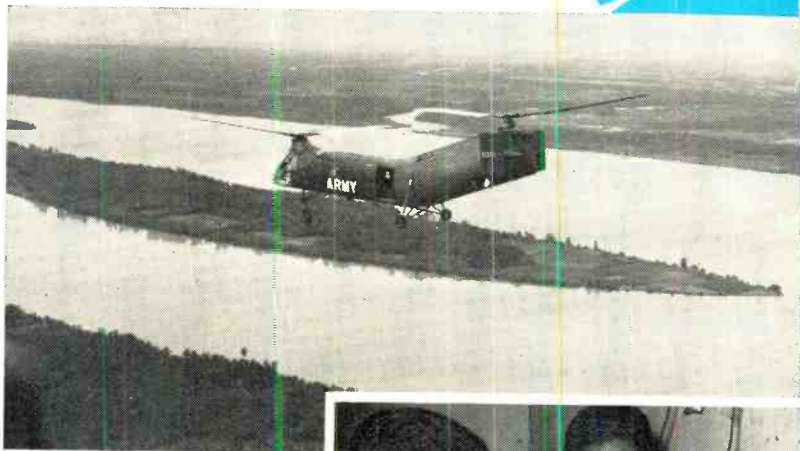


Just what kind of transceiver is Radio Industries' amazing TR-20 "Village Radio"? Actually, it's just what the doctor ordered—ultra-compact, ultra-dependable, "capture-proof," easy to operate, and ready for use in the most adverse environments. A single-channel, crystal-controlled, 20-watt transmitter 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 non-existent 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

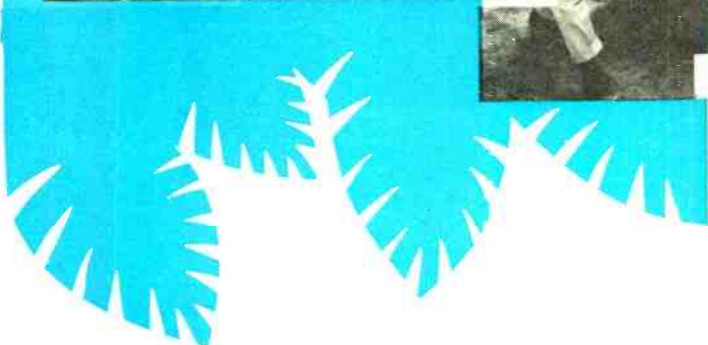


Ultra-simple operation and tropic-proof design are two of the TR-20's many special qualities. Here, inexperienced and untrained South Vietnamese find talking to the next village as easy as working in a rice paddy.

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.

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 in-

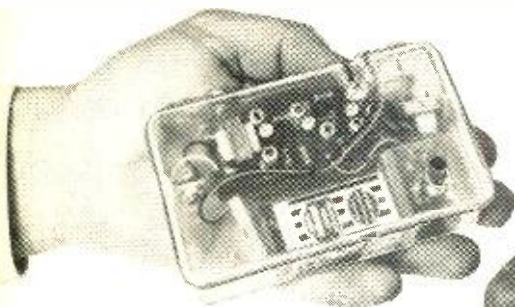
stallation party were killed outright when their truck went over a Viet Cong mine.

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.

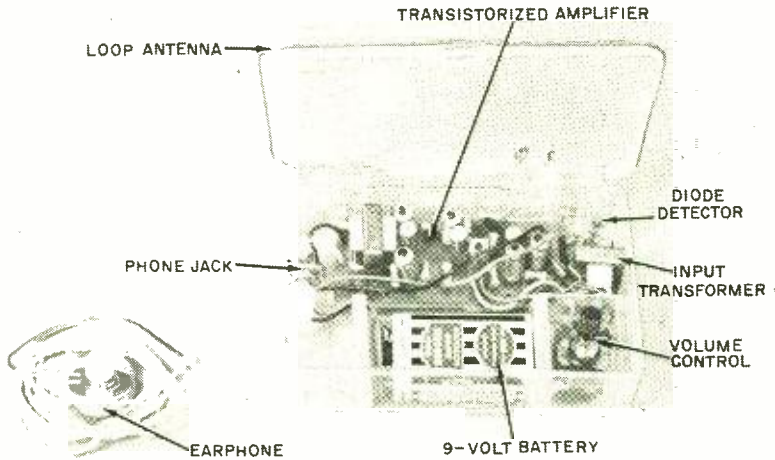
Construction of the Eavesdropper is exceedingly simple. You just group the parts in the box in some logical arrange-

PARTS LIST

- B1—9-volt battery (Burgess 2MN6 or equivalent)
- C1—0.002- μ i. 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 carphone 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, 200,000 ohms; secondary, 1000 ohms (Lafayette TR-120 or equivalent)
- 1—Dynamic carphone, 6-ohm impedance (Lafayette MS-591 or equivalent)
- 1—1 $\frac{1}{8}$ " x 4 $\frac{5}{8}$ " x 2 $\frac{3}{4}$ " 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.

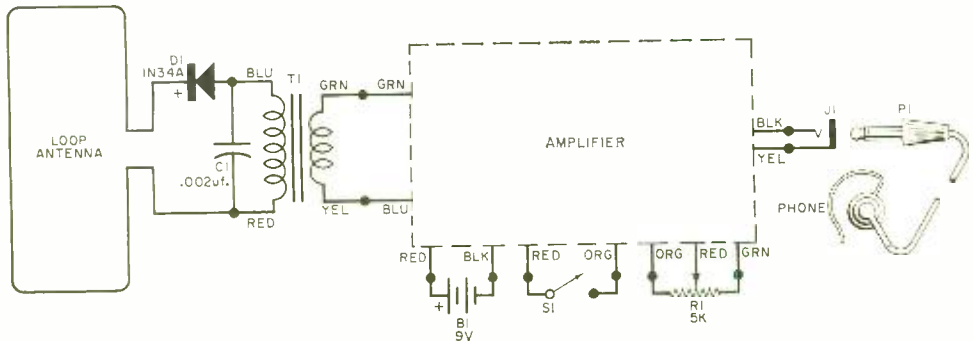
ment—don't forget to leave room for the earpiece and cord, however. Then cut and cement plastic partitions in place to form supports for the various components, mount the components, and wire them up.

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

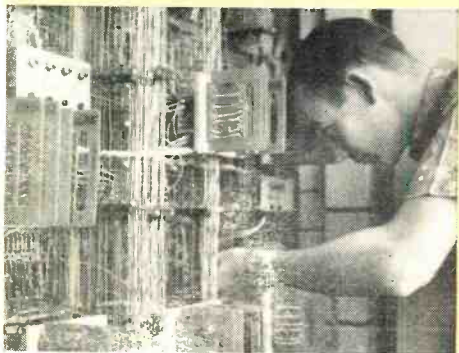


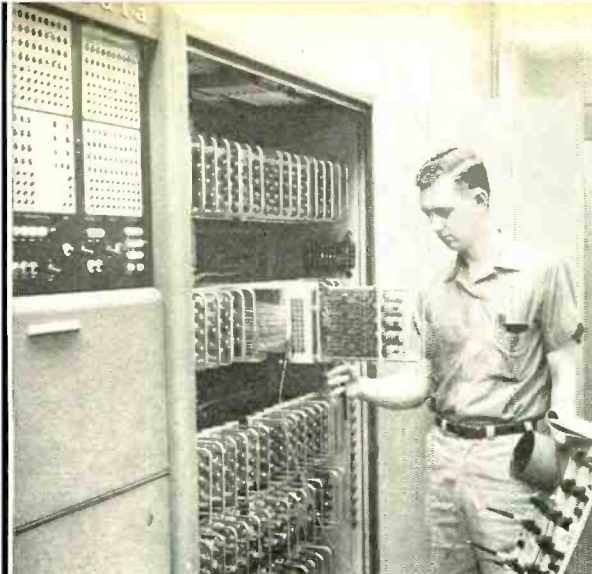
Sea-soaked manuals and operational guides helped Texas A & I students learn how the computer circuitry was supposed to work. Looking for shorts (below) and checking modular panel with oscilloscope (above, right) were just two of the jobs the students had to perform.

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

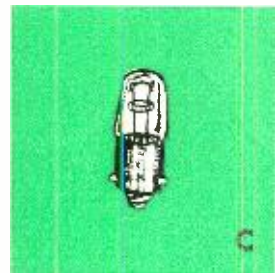
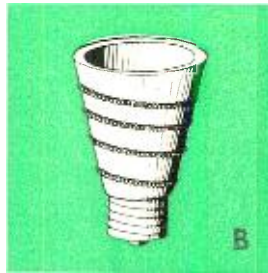
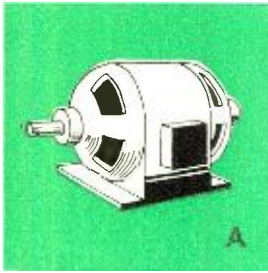
was completed, and the computer had been reassembled, power was turned on. "Nothing worked right," Dr. Guinn declares. "That's when the job really began."

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."

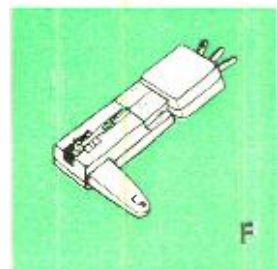
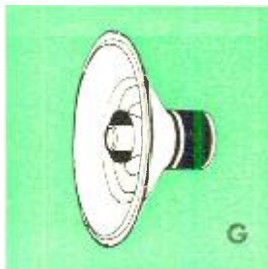
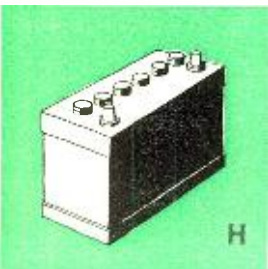
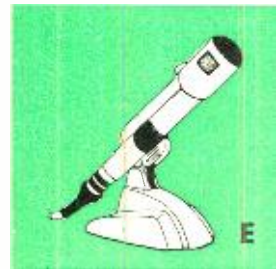
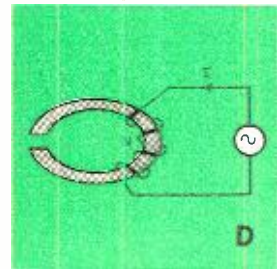
"We don't have to be content to tell our students about large computers any more," Dr. Guinn explains. "We can show them—give them experience. In that respect," he adds with a wry smile, "I doubt that any college group ever got more thorough experience than our student volunteers. They may never build 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

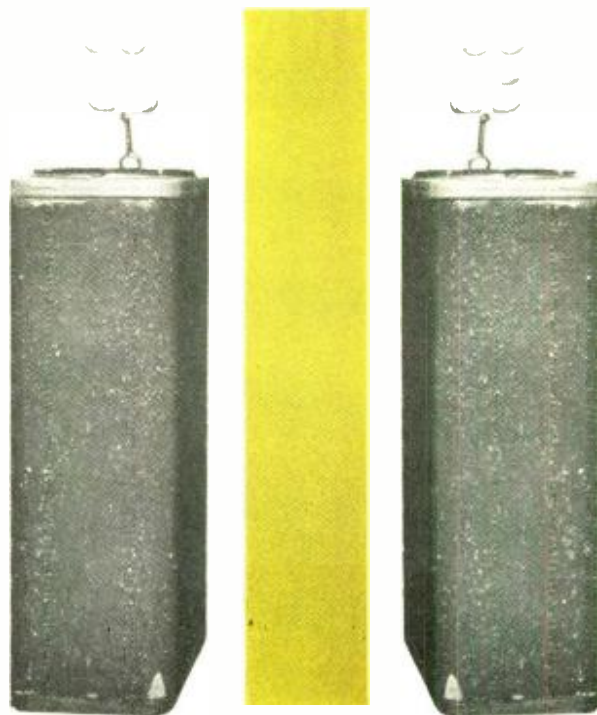


Energy can be neither created nor destroyed, but only changed from one form to another. Some electrical and electronic devices do their jobs by changing energy from one form (heat, light, chemical, magnetic, etc.) to another useful form. See if you can match the devices (A-J) shown here with the input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

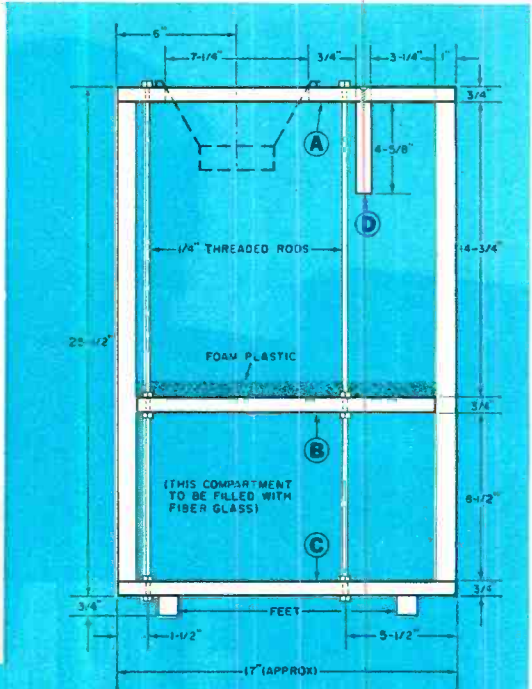
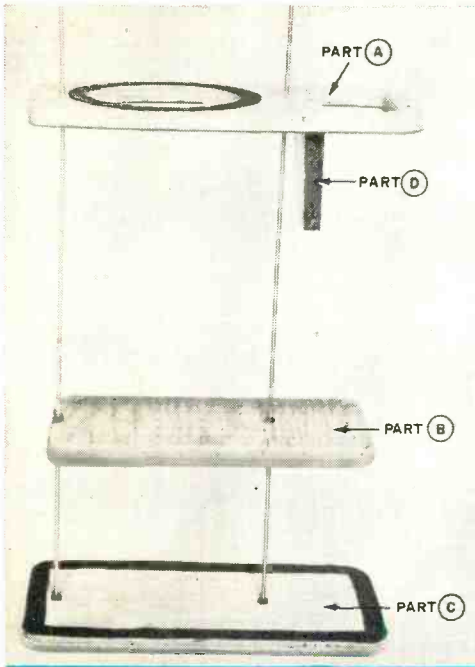
SOME speaker enclosures are small, some enormous: some are cheap, some cost dearly. But all speaker enclosures fall into one of two categories—good or bad. Actually, it makes little sense to house a good speaker in a poor enclosure, no matter whether the reason is to save money, space, or both. On the 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

¹Sound 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 $\frac{1}{8}$ " 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 $\frac{3}{4}$ " for plywood.

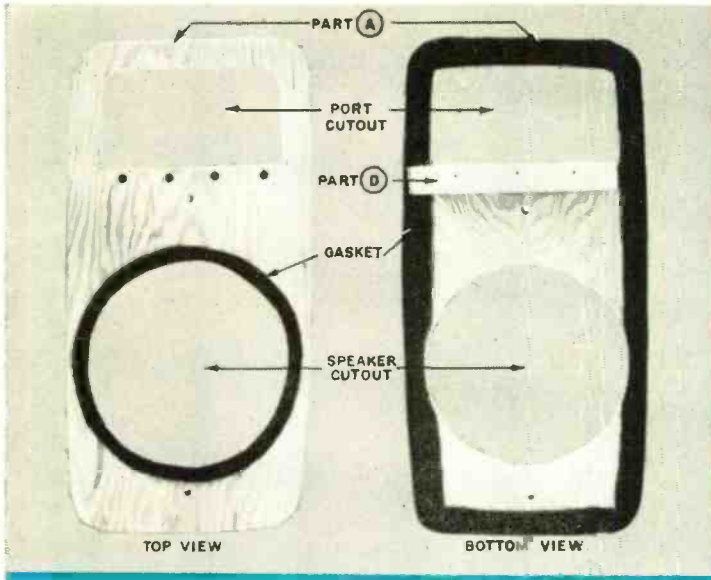
To quote Mr. Briggs again, "All will agree on the necessity of overcoming vibration and resonance at low frequencies, and this is achieved by adequate density." When Mr. Briggs says "All," he surely means all hi-fi and stereo fans who are conscious of what true bass sounds like. People still talk about 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 hang-over.

The speaker system shown here uses some plywood, but only at the ends. Furthermore, the plywood end pieces are

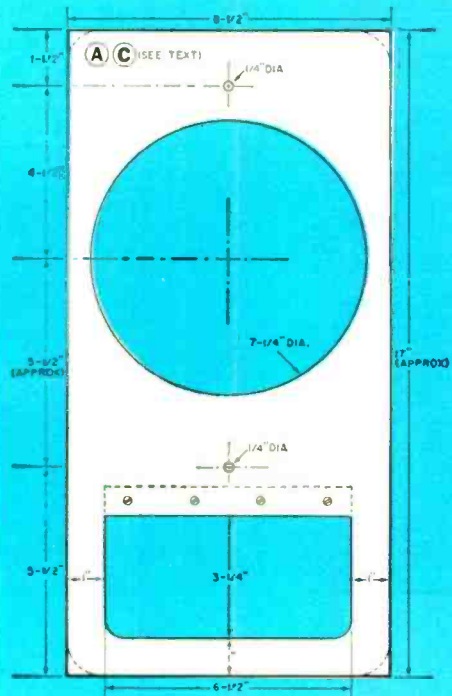
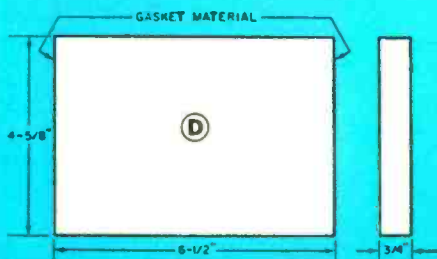
held securely by two threaded rods, which adds considerably to their rigidity. The bulk of the enclosure is made of non-vibrating tile, sold by lumber yards as "flue tile."

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.



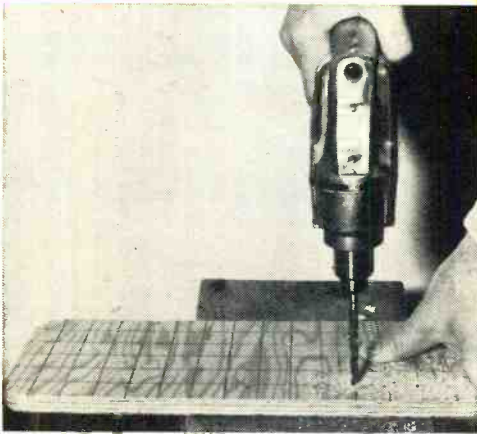
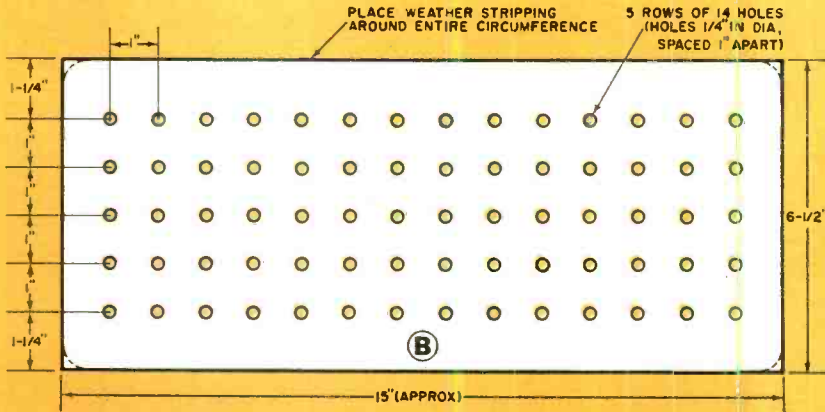
Top and bottom views of Part A appear at left; drawings of Parts D, A, and C have been reproduced below. Parts A and C are identical, with the exception that Part C requires no port or speaker cutouts. Gasket surrounding speaker cutout on top of Part A is for speaker flange which is on top of (rather 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 $\frac{1}{8}$ " 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).

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.

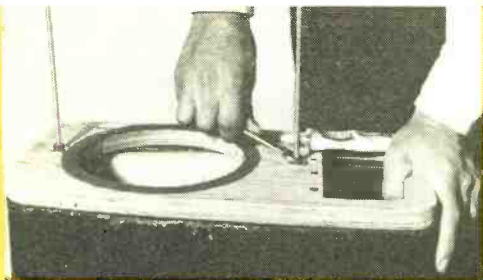
The assembly can now be slid into the bottom of the tile, but don't forget to fill the space between the bottom and the partition (Part B) with fiber glass. Then line the top of the partition with foam plastic, and pad the walls around the speaker. Drop the speaker board down over the threaded rods and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

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—4½" 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 (dampening 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—⅝" x 4" eye bolt
- 1—Cable strap
- Window screen wire (for mask)



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.



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 $\frac{1}{4}$ " 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



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

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*

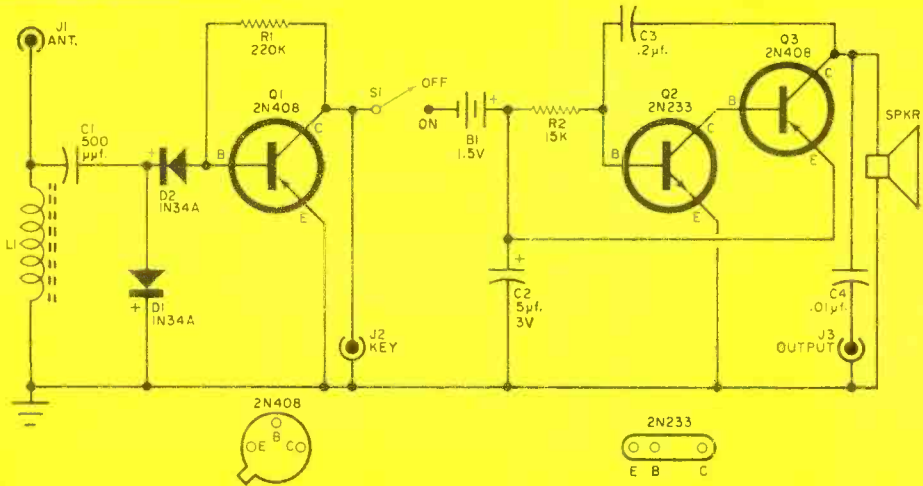
By I. C. CHAPEL

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 2½" x 4"



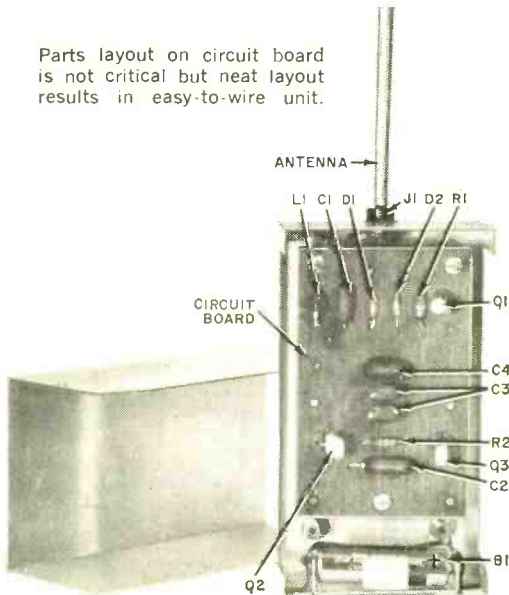
Transistor Q1 serves as an electronic switch designed to close when strong r.f. signals are picked up by the antenna. Audio tone circuit (Q2 and Q3) beeps away when Q1 "closes."

PARTS LIST

B1—1.5-volt penlight battery (Burgess Type Z or equivalent)
 C1—0.0005- μ f., 400-volt paper or ceramic capacitor
 C2—5- μ f., 3-v.d.c. electrolytic capacitor
 C3—0.2- μ f., 400-volt Mylar capacitor
 C4—0.01- μ f., 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- μ h. iron-core r.f. choke (Millen J300-1000 or equivalent)

Q1, Q3—2N408 transistor (RCA)
 Q2—2N233 transistor (Sylvania)
 R1—220,000-ohm, $\frac{1}{2}$ -watt resistor
 R2—15,000-ohm, $\frac{1}{2}$ -watt resistor
 S1—S.p.s.t. slide switch
 SPKR—2 $\frac{1}{2}$ " PAI speaker, 8-ohm voice coil (Lafayette SK-190 or equivalent)
 1—3" x 5 $\frac{1}{4}$ " x 2 $\frac{1}{8}$ " aluminum chassis box, gray hammer-tone finish (Bud CU-3006-A or equivalent)
 1—Battery holder for B1 (Keystone 139 or equivalent)
 3—Transistor sockets
 Misc.—10" antenna, 1 $\frac{1}{2}$ " spacers, 2 $\frac{1}{2}$ " x 4" phenolic or Formica sheet, self-tapping screws

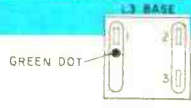
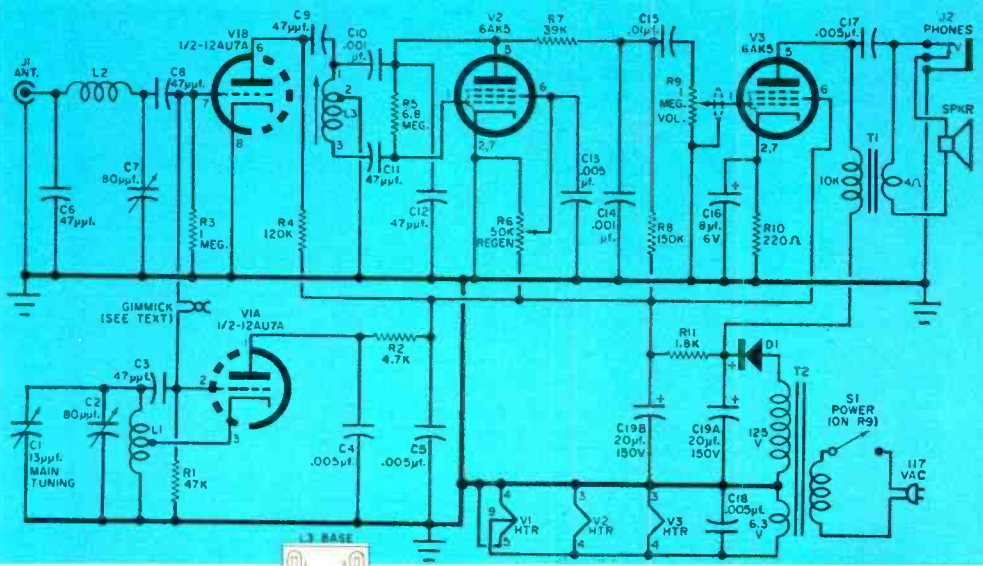
Parts layout on circuit board is not critical but neat layout results in easy-to-wire unit.



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 1 $\frac{1}{2}$ " hollow spacers.

A 10" antenna can be made from stiff
 (Continued on page 111)



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 1¼" 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

Short-Wave Broadcast Predictions

By **STANLEY LEINWOLL**
Radio Propagation Editor

APRIL 1963

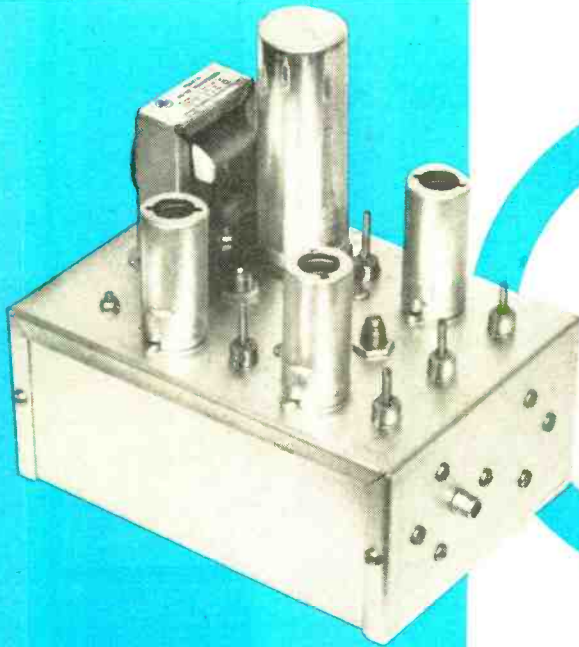
DURING March and April, the sun is almost directly overhead in the equatorial regions—a condition which has a beneficial effect on signals traveling from one point to the “antipodal” point on the other side of the globe. For example, if you live along the Eastern seaboard, this is the time of year to 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.



BUILD THE MPX

By ALTON B. OTIS, JR.

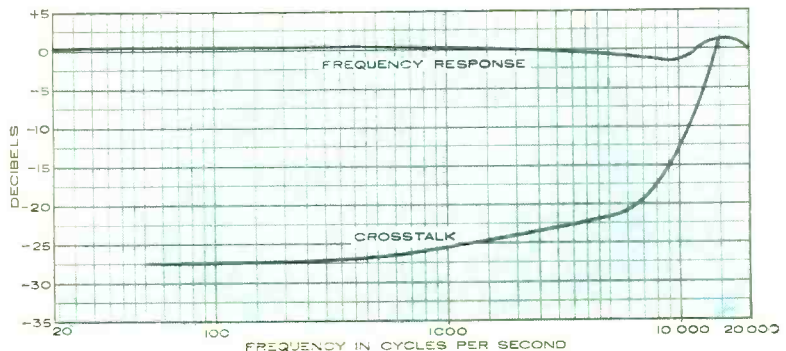
A challenge for even the experienced constructor, this self-powered multiplex adapter provides performance well worth the extra effort

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

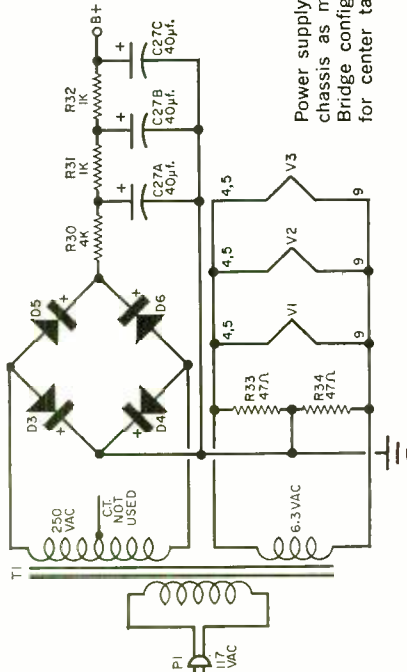
The MPX came through its Hirsch-Houck Lab Check with flying colors—sound quality, noise level, and separation were all found to be "excellent." Note that frequency response and crosstalk for the two channels have been averaged here for simplicity.



PARTS LIST

- C1, C8, C11, C12, C13, C14, C15—0.1- μ f., 200-volt paper capacitor
- C2—91- μ f., 5% mica capacitor
- C3—220- μ f., 5% mica capacitor
- C4—1.0- μ f., 450-v.d.c. electrolytic capacitor
- C5—47.0- μ f., 5% mica capacitor
- C6, C28—2000- μ f., 5% mica capacitor
- C7, C10—3300- μ f., 5% mica capacitor
- C9—100- μ f., 10% ceramic disc capacitor
- C16, C17, C18—1000- μ f., 5% mica capacitor
- C19, C20, C23, C24—1000- μ f., 10% ceramic disc capacitor
- C21, C22—300- μ f., 10% ceramic disc capacitor
- C25, C26—470- μ f., 10% ceramic disc capacitor
- C27—Triple 30/30/30- μ f., 450-v.d.c. electrolytic capacitor
- D1, D2—1N70 diode (C.G.S., 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 phone 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 } All resistors
- R2, R13, R14—470 ohms } $\frac{1}{2}$ -watt, 10% unless
- R3, R16, R17—4700 ohms } 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—3000-ohm potentiometer, linear taper
- R25, R26—40,000 ohms
- R27, R28—470,000 ohms
- R29—120,000 ohms
- R30—1000-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.; secondary, 250 volts a.c. CT for 25 ma., and 6.3 volts a.c. for 1.0 amp (Stancor PS-8416 or equivalent)
- V1, V2—12AT7 tube
- V3—12AU6-A tube
- 1—7" x 5" x 3" aluminum chassis box (Bud CE-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 (Supertex 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.



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. sub-carrier 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- μ sec. 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

TAPE RECORDER

MODEL	SOURCE	PRICE	TRANSISTORS	TRACKS	SPEEDS	REEL DIAMETER (INCHES)	FREQUENCY RESPONSE	RECORD INTERLOCK
CIPHER III	H	5119.95	7	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	200-6000	✓
CITROEN 550	D	129.50	5	2	7 $\frac{1}{2}$; 3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	250-6000	✓
CITROEN 660	D	149.50	5	2	7 $\frac{1}{2}$; 3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	200-7000	✓
CONTINENTAL '100'	P	129.50	7	2	1 $\frac{7}{8}$	4	100-6000	
COSMOPOLITAN 400	B	197.50	12	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	5	150-7000	✓
CRAIG TR-403	E	159.95	6	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	NA	✓
CRAIG TR-505	E	159.95	6	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	5	NA	✓
FANON-MASCO FTR-1	F	149.95	6	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	200-6000	
FI-CORD 101	I	199.50	4	2	1 $\frac{7}{8}$	2	100-4000	
FI-CORD 202	I	350.00	NA	2	7 $\frac{1}{2}$; 3 $\frac{3}{4}$	4	50-12,000	✓
FUJIYA MTR-252	G	89.95	4	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	150-5000	✓
FUJIYA TBR-31	G	74.50	4	2	3 $\frac{3}{4}$	3	150-6000	✓
GLOBAL GT-101	M	50.00	6	2	3 $\frac{3}{4}$	3	200-4000	✓
GRUNDIG-MAJESTIC TK-1	K	139.00	7	2	3 $\frac{3}{4}$	3	80-10,000	✓
HITACHI TRQ-370	R	99.95	7	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	150-6500	✓
MICROCORDER II	S	149.50	6	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	250-5000	✓
MIRANDA "MIRANDETTE"	A	159.95	6	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	200-6000	NA
PANASONIC RQ-114	O	129.95	5	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$		200-5000	✓
PHONO TRIX EXECUTIVE 88B	N	149.95	6	2	1 $\frac{7}{8}$	2 $\frac{1}{2}$	100-6000	
PHONO TRIX MARK II (4178)	N	79.95	4	2	1 $\frac{7}{8}$	3	200-6000	
PHONO TRIX MARK II (4334)	N	79.95	4	2	3 $\frac{3}{4}$	3	200-6000	
PHONO TRIX MARK III (5178)	N	99.95	4	2	1 $\frac{7}{8}$	3	200-6000	
PHONO TRIX MARK III (5334)	N	99.95	4	2	3 $\frac{3}{4}$	3	200-6000	
PHONO TRIX MARK IV	N	129.95	6	2	3 $\frac{3}{4}$	3	150-9000	
REALISTIC 14K90LX531	Q	99.95	4	4	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	200-5500	
REALISTIC 14K90LX558	Q	69.95	4	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	200-5500	
TECHNICORDER RK-126L	J	79.50	6	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3	200-6000	✓
TRANSCORDER RK-425WX	J	174.50	4	2	1 $\frac{7}{8}$	4	150-5000	
UHER 4000 REPORT	L	379.00	10	2	7 $\frac{1}{2}$; 3 $\frac{3}{4}$; 1 $\frac{7}{8}$; 1 $\frac{5}{16}$	5	50-22,000	NA
UNICORDER 61	C	179.95	6	2	3 $\frac{3}{4}$; 1 $\frac{7}{8}$	3 $\frac{1}{4}$	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 REPLACE- MENT COST	RECORD LEVEL INDICATOR	ACCESSORIES		REMOTE CONTROL	DIMENSIONS (INCHES)			WEIGHT (POUNDS)	FAST FORWARD	FEATURES
		INCLUDED	OPTIONAL		H	W	D			
\$0.60	✓	2,6,7,8	1,4,5	✓	2 ³ / ₄	7 ¹ / ₈	6 ³ / ₄	4		17,18,20,22,24,35
.60	✓	1,6,7,8	4,5	✓	2 ¹ / ₂	5	9	5		22,34
.60	✓	1,6,7,8	4,5	✓	2 ¹ / ₂	7 ¹ / ₂	7	5 ¹ / ₂		22,34
.90	✓	2	7		7 ¹ / ₂	10 ¹ / ₂	3 ³ / ₄	7		20,22,24,25
.60	✓	6,8,11	1,4	✓	3 ³ / ₈	11	7 ⁷ / ₈	10	✓	17,20,21,22,29,32,33
1.70	✓	2,6,8	1,4,5	✓	2 ³ / ₄	7 ¹ / ₂	6 ³ / ₈	5		22,24,25
.90	✓	6,7,8	1,4	NA	5	12	10 ¹ / ₂	10	✓	11,17,19,22,31
.60	✓	7,8	1,4,5,6	✓	3	9 ¹ / ₂	8	6		15,17,20,24,25
.20		7	1,4,6 7,8,9		1 ⁵ / ₈	6 ³ / ₈	3 ¹ / ₄	1.7	✓	14,20,22,23,24
19.80	✓	7	3,5,6, 7,8,9	✓	4 ¹ / ₂	9	6 ¹ / ₂	6 ³ / ₄	✓	18,22,24,25,27,33
1.68	✓	8	5,6	✓	3 ¹ / ₈	9 ¹ / ₂	5 ⁵ / ₈	4.6		
.90	28	8	5,6		3	11	6 ¹ / ₂	7		
1.61	✓	NA	7	✓	3	9	6 ³ / ₄	4 ¹ / ₂		20,22,24,25
.88	✓	7	1,2		4 ¹ / ₂	11 ³ / ₄	7	8		18,19,31
.56	✓	2,6,8	5,7	✓	3 ³ / ₈	8	6	5	✓	17,18,22,24,25
.60	✓	7	2,3,5,6	✓	2 ¹ / ₄	8	8	4 ¹ / ₂	✓	20,22,24,25
.60	✓		1,2,4, 6,7,8		3	9 ¹ / ₂	7 ³ / ₄	6 ³ / ₄		11,17,18,20,22,24,25, 26
2.16	✓	6,7,8	1,4,5	✓	2 ¹ / ₈	7 ¹ / ₄	7	4 ³ / ₄	✓	17,22,24,25,31
.72	28	8,14	1,2,4, 5,6,7,9	✓	1 ⁷ / ₈	4 ¹ / ₄	7 ¹ / ₂	2 ¹ / ₄	✓	20,24,25
.60	28		1,2,5, 7,8,9		4 ¹ / ₄	9	5	4		20,25,27
.60	28		1,2,5, 7,8,9		4 ¹ / ₄	9	5	4		20,25,27
.60	28	6	1,2,5, 7,8,9		4 ¹ / ₄	9	5	5		19,20,27
.60	28	6	1,2,5, 7,8,9		4 ¹ / ₄	9	5	5		19,20,27
.60	28	6	1,2,5, 7,8,9		4 ¹ / ₄	9	5	5		19,20,27
1.65	✓	6,7,8	1,3,4,5	✓	2 ³ / ₄	9	6	4 ¹ / ₂	✓	18,22,24,25
1.65	✓	6,7,8	1,3,4,5	✓	2 ³ / ₄	9	6	4 ¹ / ₂		18,22,24,25
.60	✓	2,6,7,8	1,3,4,5	✓	3	9 ¹ / ₂	8	6		17,20,22,24,25,26
1.82	28	7,13,14	1,4,5, 6,8,9		1 ⁷ / ₈	3 ³ / ₈	8 ¹ / ₂	3		22,24,25,30
.60	✓	5,6,12	1,2,3, 4,8,10	✓	3 ¹ / ₄	10 ¹ / ₂	8 ¹ / ₂	6	✓	18,19,20,21,22,24,25, 27,31
1.00	✓	6,7,8,11	1,2,4	✓	2 ¹ / ₄	7	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 (fluctu-

ating-speed), and variable-speed recorders available. The capstan-drive principle offers the best results and is the one employed on standard recorders.

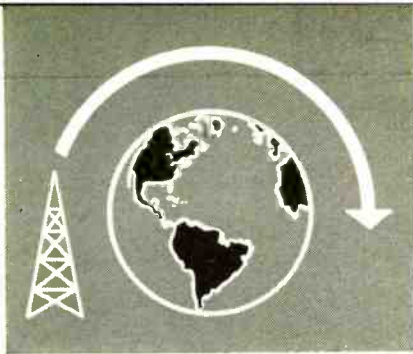
Tapes recorded on a portable unit having a capstan drive can be played back on standard tape recorders and vice versa. On the other hand, a recording made on a rim-drive or variable-speed recorder can be played back only on a similar machine and, in many cases, only on the unit which made the recording. 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 $7\frac{1}{2}$ ips allows $7\frac{1}{2}$ inches of tape to pass the recording head each second. The majority of home recorders have $3\frac{3}{4}$ ips as one of their speeds, but $1\frac{1}{8}$ and $1\frac{3}{16}$ ips are also common. (Continued on page 102)

TAPE TYPES AND RECORDING TIMES

TAPE	TYPE and THICKNESS (mils)	PRICE	REEL SIZE (inches)	TAPE LENGTH (feet)	RECORDING TIME (minutes)		
					$7\frac{1}{2}$ ips	$3\frac{3}{4}$ ips	$1\frac{1}{8}$ 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	$3\frac{1}{4}$	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	2030, 2130, 2230
		9580	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,	2000, 2330
		5930	
Denmark	Copenhagen	9520	2100, 2230
West Germany	Cologne	9735, 5980	1530
		9605, 6145	1920
		9735, 6110	0000
		11,890, 9833, 9770	1900
Hungary	Budapest	9833, 9770, 7220	2230
		11,905, 9575	1930, 2205
Italy	Rome	9715, 6085	1625 (exc. Sun.)
Netherlands	Hilversum	6035, 5985	2030 (exc. Sun.)
		6185, 6025	2105, 2305
Portugal	Lisbon	9360, 6130	2215, 2315, 0015
Spain	Madrid	17,840	0900
		9605	2215
		6065	2045
Switzerland	Berne	11,865, 9535, 6165	2030, 2330
		9650, 9570, 7330, 7320,	1700, 1900, 2000,
U.S.S.R.	Moscow	7290, 7280, 7250, 7240,	2100, 2300, 0000,
		7200, 7180, 7170, 7150,	0040
		7130, 6100, 6070, 5960 ¹	

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

Equipment Report

Hammarlund Introduces 23-Channel CB

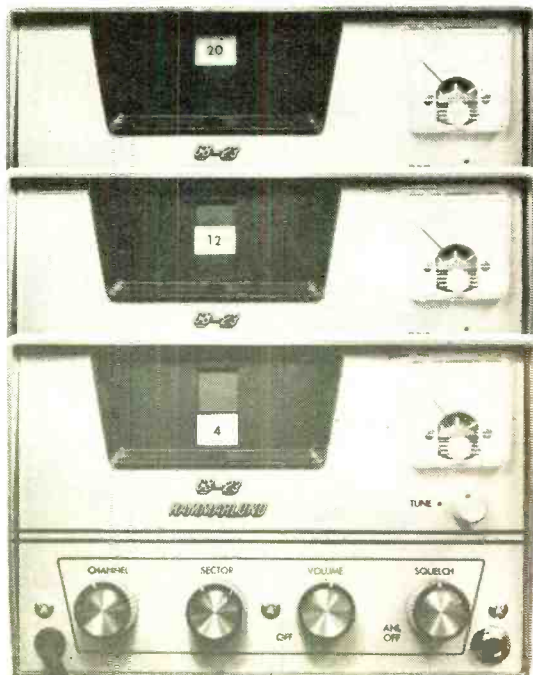


HERE'S a CB transceiver that deserves the accolade, "something new under the sun." It's the Model CB-23 transceiver built by the Hammarlund Manufacturing Co., 53 West 23rd St., New York 10, N.Y. Housed in this medium-sized package is a 23-channel crystal-controlled transmitting and receiving system ready 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.

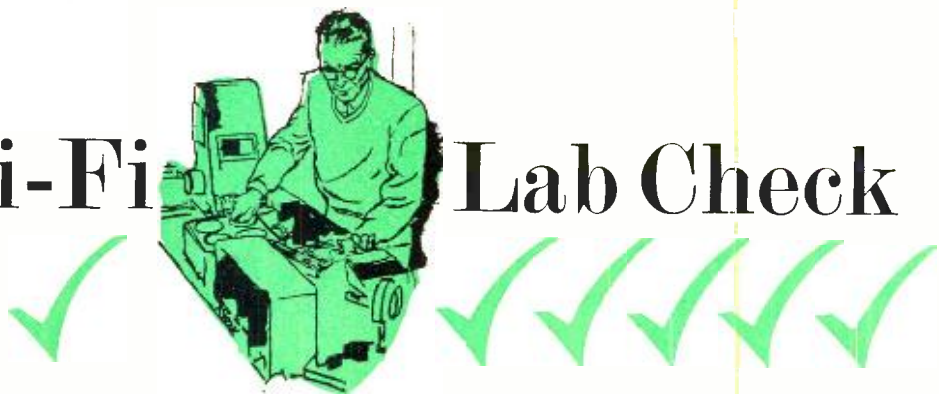
The secret behind the CB-23's amazing performance is a crystal-controlled frequency synthesis circuit that makes 11 crystals do the work of 46. Not only is there no loss of stability with this arrangement, but the double-conversion receive section is so sharp that it has a vernier tuning adjustment on 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

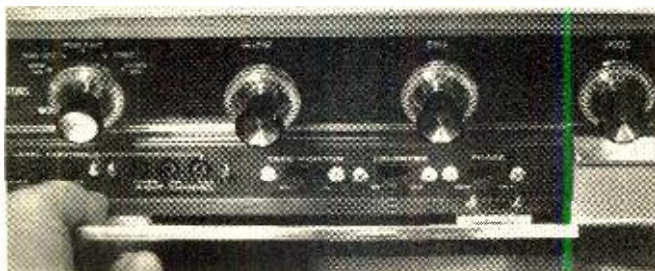


boards, 6 epoxy-coated modules, all the controls to be expected from an amplifier in this price category—and no output transformers!

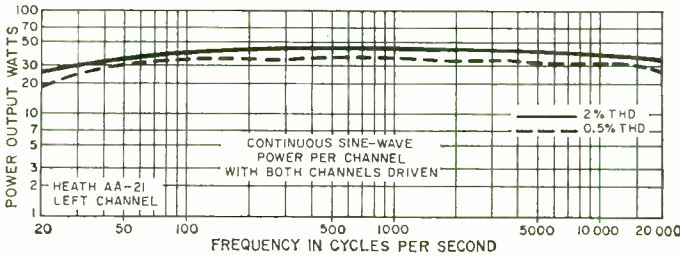
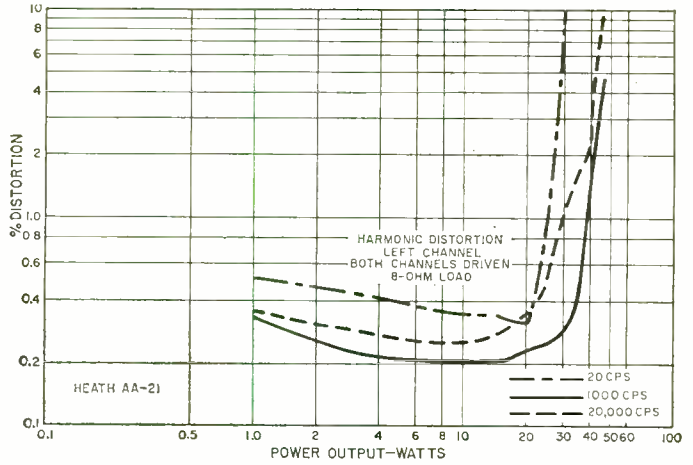
HIRSCH-HOUCK REPORT: The AA-21 lives up to or exceeds the manufacturer's specifications. This is particularly true with regard to the power output level—the curve being very smooth and nearly flat, with little difference between the 2% and 0.5% harmonic distortion values.

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- μ f. 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!

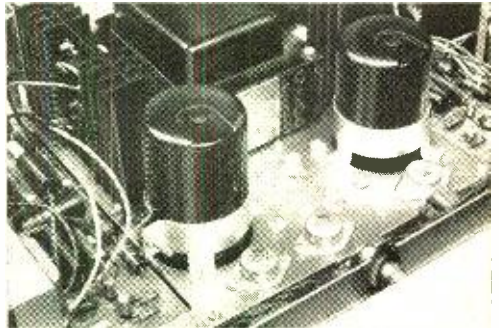
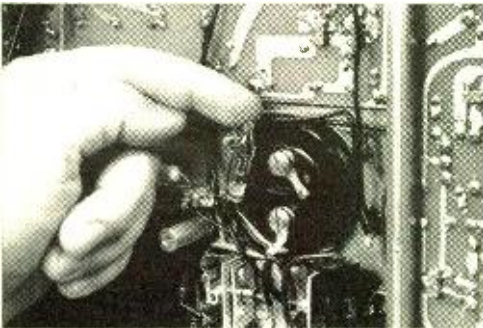
was 0.115 volt. Hum and noise were measured at -62 db and -70.5 db below 10 watts, respectively, on the two inputs.

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 over-driven.

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 (4¾" x 6" x 7½") 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.

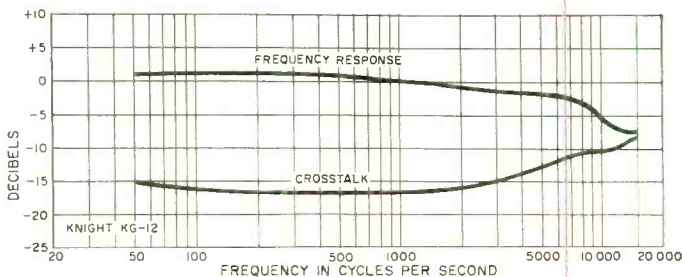


HIRSCH-HOUCK LAB CHECK. The adapter worked well, although separation was only about 15 db at middle frequencies and less at higher frequencies. The alignment procedure outlined in the manual produced an apparent improvement (to about 20-22 db), but the adjustments were very critical and separation was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

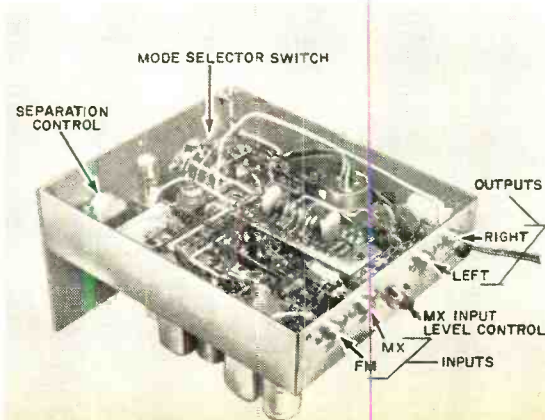
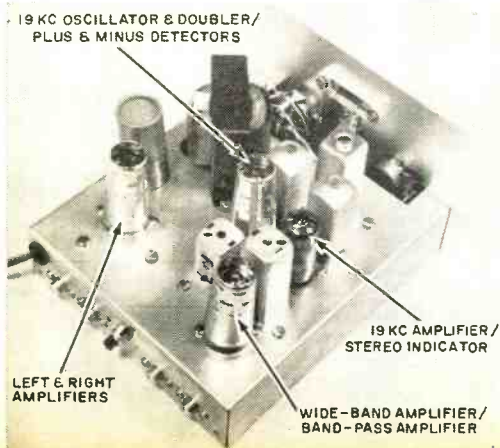
The final test data are representative of what can be obtained in practical situations, although separation was not as good as published figures. The adapter will work with signals as low as 0.2 to 0.25 volt.

-50-

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-stered broadcasts; pilot light (front-center of chassis in photo at right) lights up when you turn the KG-12 on.



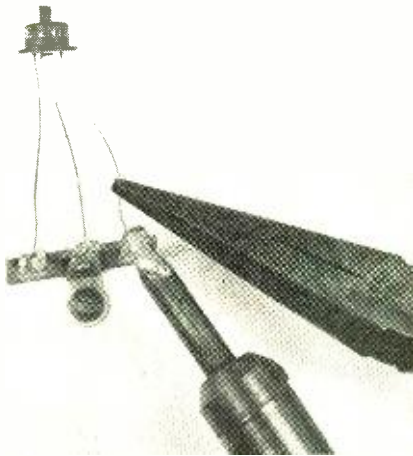
EXTRA FINGERS -- EXTRA HANDS

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.

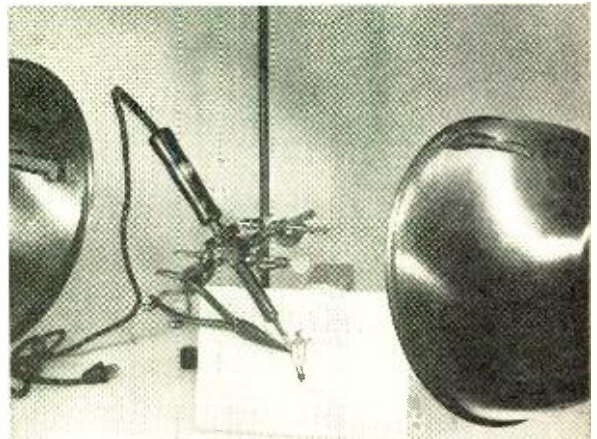
One solution to the problem is to beg, buy, or borrow a stand of the sort used in chemistry laboratories. One of these stands, along with an assortment of matching clamps, will provide you with all the fingers and hands you could ask for. And you'll find your new “limbs” steady enough for even long time 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

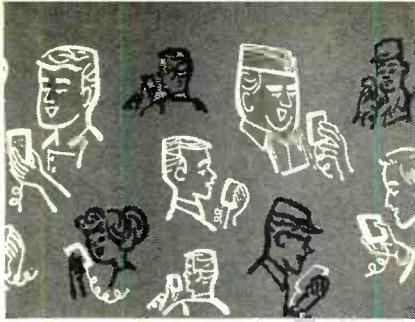


This is the kind of photo every electronics enthusiast can produce—if he brings some extra fingers and hands into the “picture.” Illustrations below show how this photo was made.

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

CB TRAVELS WITH THE WALLY BYAM CARAVANNERS

have been the travels of a large group of Airstream Trailer owners known as 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 & WPE2FUJ) 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.

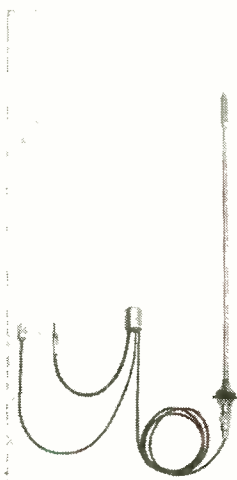
In the middle of a performance, John finds an excuse to leave the room, leaving Clem behind with a stern warning to behave while he's gone. Obligingly, Clem remains. But much to the audience's surprise, he might whistle an entire chorus of *Rhapsody in Blue* (upper lip raised) or may hum or sing (with 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

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.

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)



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

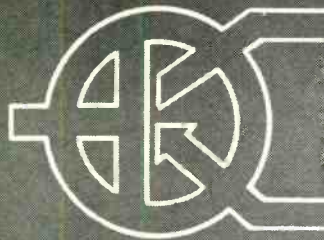
I have enclosed 50 cents to help cover the costs of processing and mailing my DX Award

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.



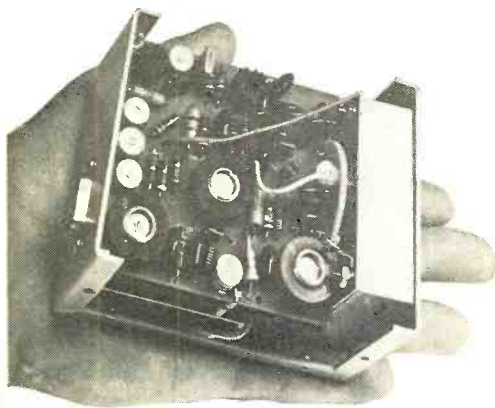
Transistor Topics

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 $4\frac{1}{4}'' \times 3\frac{1}{4}'' \times 2\frac{1}{2}''$ 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 $\pm 0.01\%$ and a maximum FM deviation of ± 125 kc. It can operate over an ambient tempera-

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.



ture range of -20°C to $+85^{\circ}\text{C}$ and requires no special cooling techniques. Its total primary input power is only 32 watts at 28 volts d.c.

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

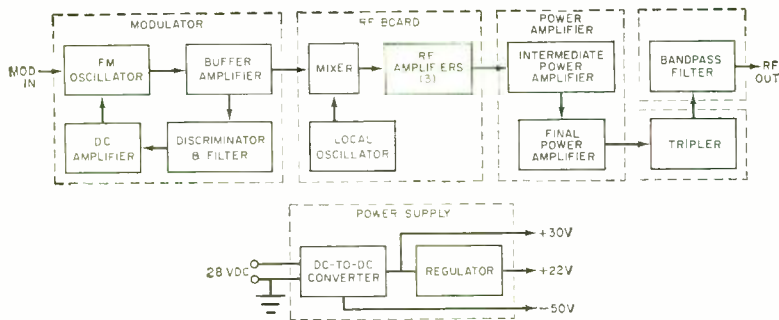


Fig. 1. Block diagram of the 503A VHF transmitter. Circuit will operate under high mechanical stress, in a hard vacuum, at high or low temperatures, and even at voltages below the nominal 28 volts input.

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 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 originally 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-

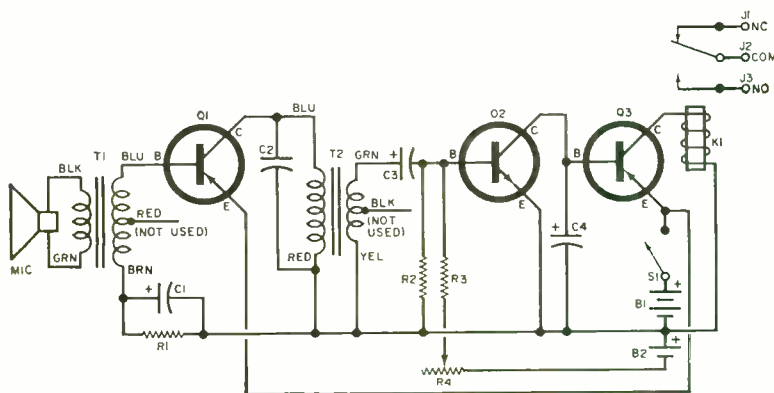
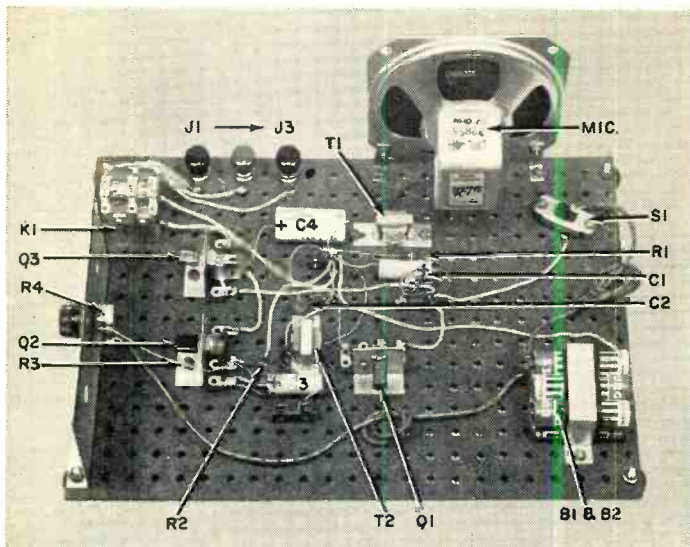


Fig. 2. Just say the "word," and this "Sound Relay" developed by reader Eugene Richardson will "kill" annoying TV commercials on the spot.



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 C_1 , C_3 , and C_4 are electrolytics, so be sure to observe polarity as indicated here and on the schematic diagram (Fig. 2).

coupled amplifier, Q_2/Q_3 . Bypass capacitor C_2 , across T_2 's primary, prevents high-frequency oscillation.

Capacitor C_4 , in Q_3 's base circuit, furnishes a "time delay" in the operation of the circuit. This capacitor is initially charged through Q_3 's base/emitter circuit when the power switch (S_1) is first closed. As long as it is charging, there is base current flow through Q_3 , with a corresponding but larger collector current flow, which closes the relay (K_1) and holds it closed. Once C_4 is charged, however, Q_3 's base and collector currents drop and the relay opens.

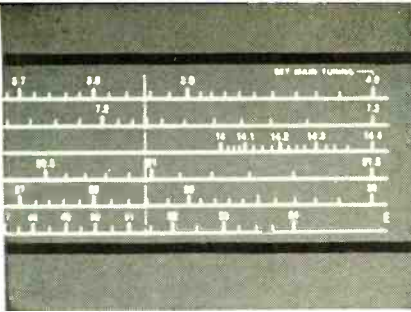
Transistor Q_2 is normally held at cutoff by the reverse (negative) base bias applied through voltage divider $R_2/R_3/R_4$. However, the audio signal applied through C_3 cancels this bias and permits Q_2 to conduct, effectively shorting and discharging C_4 . As C_4 is discharged, Q_3 's base and collector currents are restored, closing the relay. The relay is then held closed as long as Q_2 conducts, and for a period of time afterwards proportional to the time required to charge C_4 . The time delay period may be increased by using a larger value for C_4 , 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 Q_1 and Q_3 are low-cost *pnp* transistors such as CK722's or 2N107's; Q_2 is a *npn* unit

such as a 2N35, 2N170, or 2N229. Transformer T_1 is an Argonne AR-119 output transformer, wired "in reverse," while T_2 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 C_1 , C_3 , and C_4 are 10-15 w.v.d.c. electrolytic capacitors rated at 25 $\mu\text{f.}$, 25 $\mu\text{f.}$, and 100 $\mu\text{f.}$, respectively; while C_2 is a small disc ceramic rated at 0.001 $\mu\text{f.}$ Resistors R_1 , R_2 , and R_3 are $\frac{1}{2}$ -watt units with values of 270,000, 4700, and 100,000 ohms, respectively; R_4 is a standard 1-megohm potentiometer, and taper isn't critical. The power supply, B_1 , is made up of five penlight cells connected in series, while bias battery B_2 is a single 1.5-volt cell. Any s.p.s.t. switch can be used for S_1 .

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 capa-

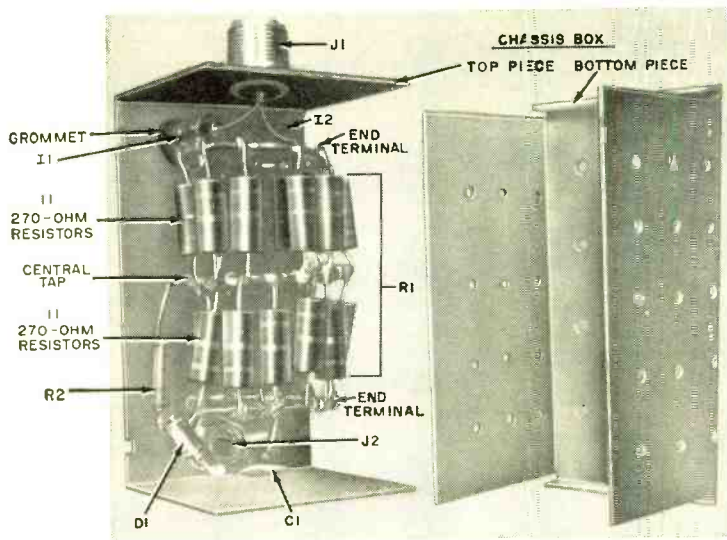
bilities and cost. But, before placing your order, take a look at the losses in such cable on 2 meters: RG-58/U, 5.9 db per 100 feet; and 7.8 db for RG-58/AU and RG-58/CU. Translated into power losses, these figures mean that, with a 100' feedline of RG-58/U, 25% of your transmitter power will actually 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.

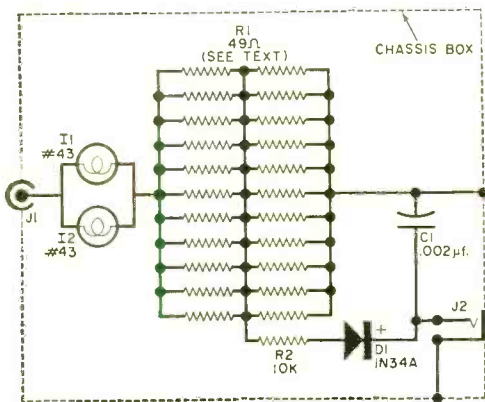
transmitter. This results from the fact that the mismatch is reflected back to the transmitter, and most modern transmitters are designed to work into 50- to 75-ohm loads in which the SWR doesn't exceed 2:1.

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



PARTS LIST

- C1—0.002- μ f., 500-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, $\frac{1}{2}$ -watt resistor
- 1—4 $\frac{1}{4}$ " x 2 $\frac{3}{4}$ " x 2 $\frac{3}{4}$ " aluminum chassis box (Bud CU-2116-A or equivalent)
- Misc.— $\frac{1}{2}$ " rubber grommets (2 required), 20" length of #14 solid copper wire, screws, etc.

(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

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 Gonsset 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 $\frac{1}{2}$ " 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 $\frac{1}{2}$ " 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 $\frac{1}{4}$ " 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, 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 "barrump! barrump!" 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."

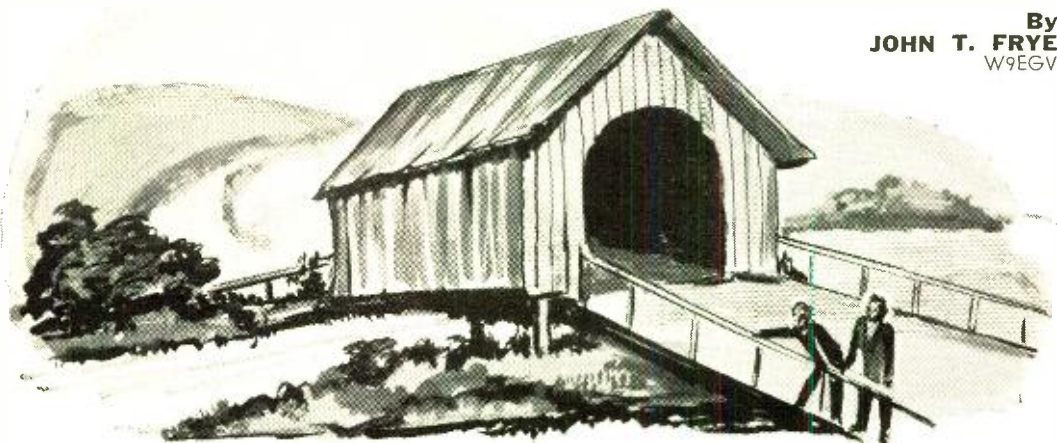
"That was partly the reason for the roof," Jerry explained. "It protected the weight-bearing timbers from the weather. The covered bridge also provided the traveler with shelter from a sudden shower."

"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 $\frac{1}{500}$ 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





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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."

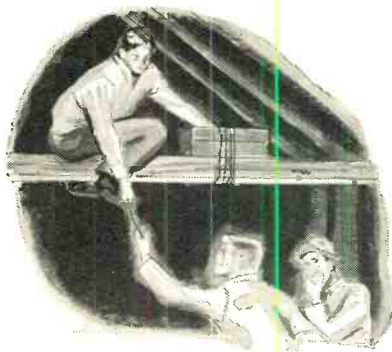
"Can't see anything wrong with it," Carl admitted, "but why don't we use the amplifier in the recorder?"

"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 *nnp* 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

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—	1R5	.77	—	6BC8	1.04	—	6SN7	.65	—	12DS7	1.84
—	1S5	.75	—	6BE6	.55	—	65Q7GT	.94	—	12DT5	.76
—	1T4	.72	—	6BF5	.90	—	6T4	.99	—	12DT7	.79
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—	3AU6	.54	—	6BJ7	.79	—	6W6	.71	—	12EG6	.62
—	3AV6	.42	—	6BK7	.85	—	6X4	.41	—	12EK6	.62
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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.

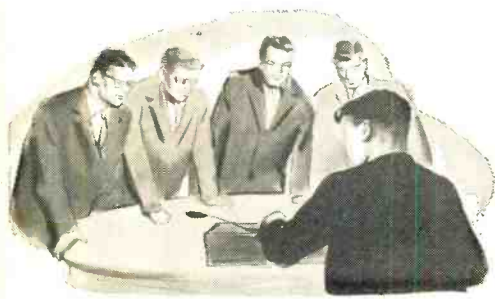
"Oh, it's just some voice recording that got in on the end of the tape," Jerry explained hurriedly. "You wouldn't want to hear it."

"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 $7\frac{1}{2}$ ips to $1\frac{7}{8}$ 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 $1\frac{7}{8}$ 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-

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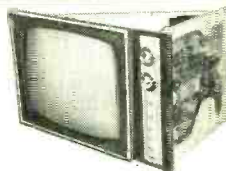
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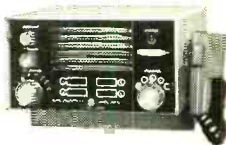
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Transistor Topics
 (Continued from page 84)

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

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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

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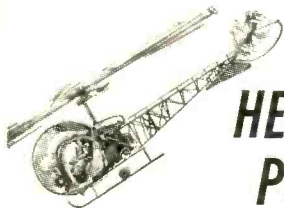
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Across the Ham Bands

(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 | 3 - B | Heating element |
| 3 - I | Thermocouple | 9 - F | Phonograph cartridge |
| 4 - G | Loudspeaker | | |
| 5 - J | Phototube | 10 - D | Tape recorder head |
| 6 - A | Motor | | |

Always say you saw it in—POPULAR ELECTRONICS

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,

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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 oc-

casions, 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 pre-marked 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.

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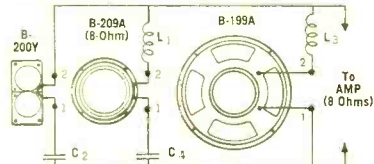


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On the Citizens Band

(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 than 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 Belle-rose, 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. -50-



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CONAR

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 $\frac{1}{4}$ " 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.

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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,

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SHORT-WAVE ABBREVIATIONS

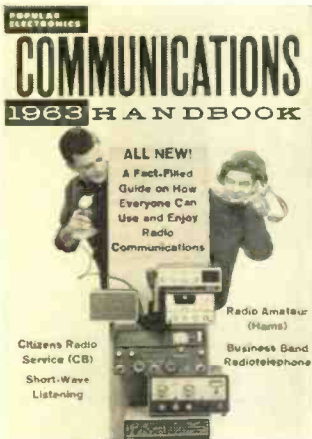
anmt—Announcement
Eng.—English
ID—Identification
IS—Interval signal
kc.—Kilocycle
L.A.—Latin America
N.A.—North America

QRM—Station interference
R.—Radio
s/off—Sign-off
s/on—Sign-on
VOA—Voice of America
xmsn—Transmission
xmtr—Transmitter



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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.

OAX61, *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 annts 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

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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-

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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.

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1F5	6AN8/A	6BA
1N5GT	6AN8/A	6K6GT
1R5	6AQ5/A	6K7
1T4	6AS5	6L6
1U4	6AT6	GA/B/C
1U5	6AT8/A	6S4
1X2	6AL7	6S7
2AF1	4GT/A	6SK7
2RN1	6AU6GT	6SL7GT
3A5	6AU6/A	6SN7
3BC5	6AV5GA	GTA/B
3BN6	6AV6	6SQ7
3BU8	6AW8/A	6T4
3BZ6	6AX4	6T8/A
3CR6	GTA/B	6U5/6G5
3C96	6AX5GT	6U8/A
3DK6	6BA6	6V6GT
3DT6	6BC6	6W4GT/A
3Q5GT	6BC8	6W6GT
3S4	6BE6	6X4
3V4	6BG6G/A	6X6GT
4BQ7A	6BH6	6XS/A
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4CR6	6BK7A/B	7A7
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5BK7A	GTA/B	7N7
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5C8	6BU8	8AW8/A
5CL8A	6BY6	8C8T
5CZ5	6BZ7	8C9T
5L6	6C4	8CX8
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5U6	6CC8	10BD7
5V4G	6CG6G/A	12A8GT
5X8	6C7	12A85
5Y3GT	6C8	12AT6
6A8GT	6C8U8	12AT7
6AB4	6DE1	12AV7
6AC5	6DQ6	12A27
6AF	/A/B	12AV5
6AT6	6DT6	12AV4
6B8	6E8	GTA/B
	6ER8	12B4
		12BB6
		12B17/A
		12B15
		12B06
		12BY7/A
		12CAB
		12CL5
		12C5
		12D6
		12D1/A
		12D15
		12DQ6
		12F8
		12D78
		12K7GT
		12L6GT
		12S47
		12SN7GT
		12SQ7
		12V6GT/A
		12W6GT
		12X4
		12D17
		12D17
		14A7
		14B6
		14Q7
		17AN4GT
		17C5
		18A14
		18T7
		18G7A
		18BQ6
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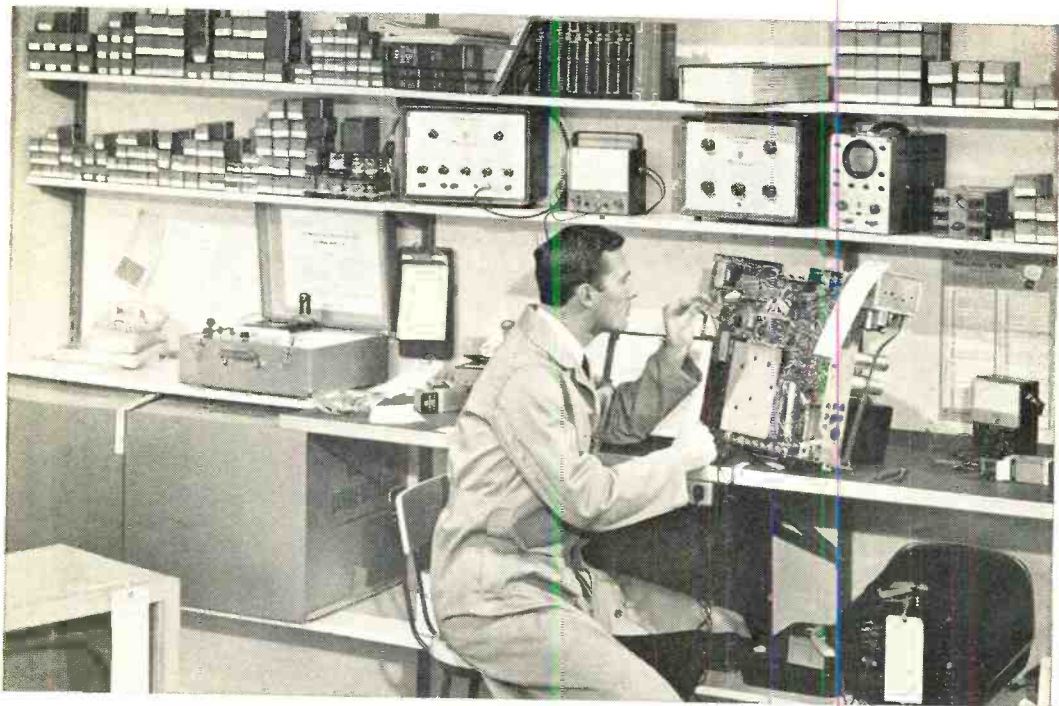
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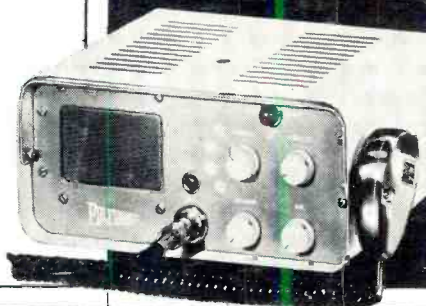
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