

BIONICS—NATURE'S ELECTRONIC ARSENAL

POPULAR ELECTRONICS

OCTOBER
1962

35
CENTS

MAC 10

BUILD:

- **UHF-TV Converter**
- **2-Meter Receiver**
- **Folded Horn Enclosure**
- **Stereo Intercom**



Tape-Off-The-Air
(page 57)



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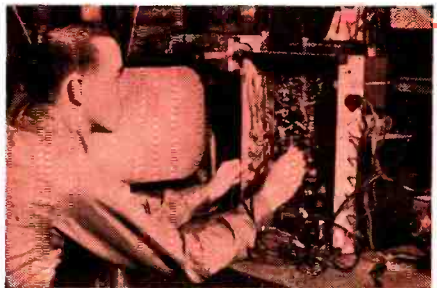
TV-Radio COMMUNICATIONS

In NRI's Communications course you get *actual experience* as NRI trains you for your choice of Communications fields. Commercial methods and techniques of Radio-TV Broadcasting; teletype; facsimile; microwave; radar; mobile and marine radio; navigation devices; multiplexing are some of the subjects covered. You work with special training equipment.



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NRI's time-tested course in Servicing not only trains you to fix radios, TV sets, hi-fi, etc., but also shows you how to earn spare-time money starting soon after enrolling. Fast growth in number of sets means money-making opportunities for you in your own spare-time or full-time business, or working for someone else. Special training equipment at no extra cost. Mail postcard.



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NRI is America's oldest, largest home-study Electronics, Radio-Television school. NRI teaches *only* by home-study. The interests and efforts of our carefully-selected staff are devoted exclusively to this method of training. For nearly 50 years NRI has maintained the confidence and respect of students, graduates, and the Electronics Industry for constantly providing the best possible home-study training, at a cost most anyone can afford. For the complete NRI story, mail the postage-free card at the left. This could be the most profitable move you ever made.

For Nearly 50 Years NRI Has Been The Leader In Training At Home For Electronics, TV-Radio



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It takes a growing industry to give qualified men the best opportunity to advance and prosper. That's why so many men are deciding on a career in Electronics. But, even more important is *where* you get your training, and *how* the school of your choice teaches Electronics . . . how it trains and encourages men to reach their goals and realize their ambitions. It takes a growing

school—with years of specialized experience behind it—to do that for you.

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NRI's Outstanding Staff Is Directed By These Men

DIRECTOR OF EDUCATION, William F. Dunn, supervises lesson preparation, training equipment development, consultation services, lesson grading. He heads a full staff of instructors and advisors.



SUPERVISOR OF TRAINING, J. B. Straughn, is particularly concerned with NRI home-training equipment and its integration into course subject matter.

CHIEF TECHNICAL EDITOR, James P. Tate, Jr., heads a staff whose concern is the careful writing, editing and illustrating of lesson texts, keeping lessons up-to-date.



DIRECTOR OF PUBLICATIONS, Oliver Read, was formerly editor and publisher of Electronics World magazine; publisher Popular Electronics and Hi-Fi Stereo Review magazines.

POPULAR ELECTRONICS



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

This month's cover photo by Bruce Pendleton

VOLUME 17

OCTOBER 1962

NUMBER 4

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Those new UHF TV channels will roll in as nice as you please on your present TV set, once you've hooked up this one-transistor converter

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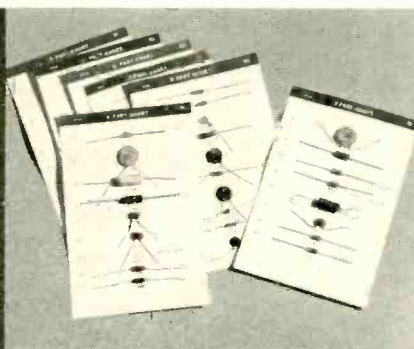
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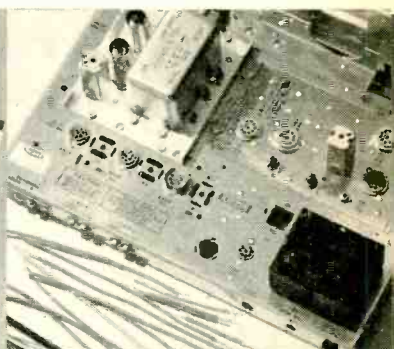
Here's why Audio Magazine says Scott® Kits are "Simplest to build..." and have "Engineering of the highest calibre"*



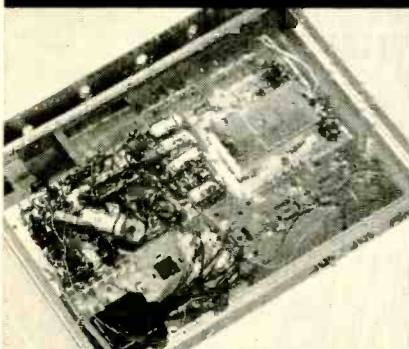
The exclusive Scott full color instruction book shows every part and every wire in natural color and in proper position. To make the instruction book even clearer each of the full color illustrations shows only a few assembly steps. There are no oversized sheets to confuse you.



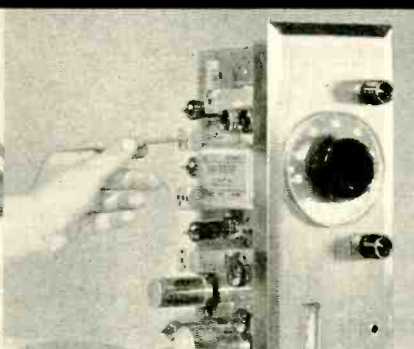
Each full color illustration is accompanied by its own Part Chart... another Scott exclusive. The actual parts described in the illustration are placed in the exact sequence in which they are used. You can't possibly make a mistake.



Much of the uninteresting mechanical assembly is completed when you open your Scott Kit-Pak. All the terminal strips and tube sockets are already permanently riveted to the chassis. To insure accuracy all wires are pre-cut and pre-stripped to proper length.



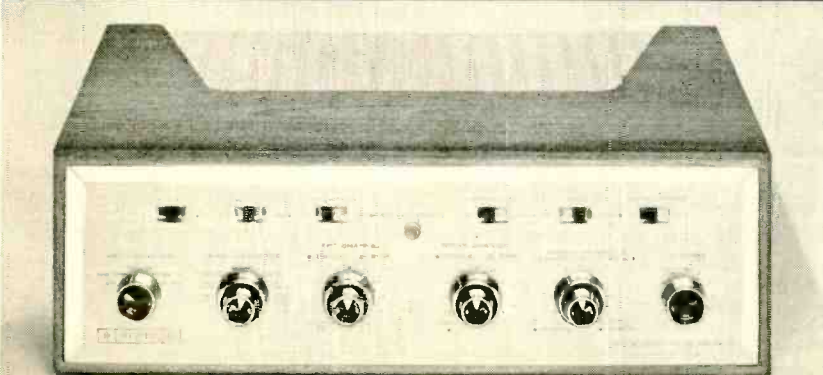
There are certain areas in every professional high fidelity component where wiring is critical and difficult. FM front ends and multiplex sections are an example. In Scott Kits these sections are wired at the factory, and thoroughly tested by Scott experts, assuring you a completed kit meeting stringent factory standards.



Tuners are aligned with the unique Scott Ez-A-Line method using the meter on the tuner itself. This assures perfect alignment without expensive signal generators. Amplifier kits require no laboratory instruments for perfect balancing.



The new Scott Warranty Performance Plan guarantees that your kit will work perfectly when completed. If you have followed all recommended procedures and your kit fails to work Scott guarantees to put your kit in working order at the factory at minimum cost.



When you finish your kit you'll be delighted by its handsome good looks. And when you turn your Scott Kit system on you'll know for yourself why the expert editors of leading high fidelity magazines like Audio say... "only the most sophisticated engineering thinking could design a kit as simple and foolproof as this..."*

*Audio - February 1961. Pages 54-56



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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 Quadra booster 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.

Which one is best for you? Try one, or both. They can be hooked up in seconds at the set terminals. Try them on all channels. With either an IT-4 or a B-33, you'll end up with the best TV reception possible.

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3GK5	.99	6CD6	1.51	8CN7	.97	12L6	.73
3Q4	.63	6CG7	.61	8CS7	.74	12SF7	.69
3S4	.75	6C88	.80	8EB8	.94	12SK7	.95
3V4	.63	6CL8	.79	8FQ7	.56	12SL7	.80
4BQ7	1.01	6CM7	.69	9CL8	.79	12SN7	.67
4CS6	.61	6CN7	.70	11CV7	.75	12SQ7	.91
4DT6	.55	6C88	.92	12A4	.60	12U7	.62
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5CL8	.76	6DG6	.62	12AL8	.95	19BG6	1.39
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5EA8	.80	6DK6	.59	12AT6	.50	19T8	.85
5EU8	.80	6DN6	1.55	12AT7	.76	21EX6	1.49
5J6	.72	6DQ6	1.10	12AU6	.51	25AX4	.70
5T8	.86	6DT5	.81	12AU7	.61	25C5	.53
5U4	.60	6DT6	.53	12AV6	.41	25CA5	.59
5U8	.84	6DT8	.94	12AV7	.82	25CD6	1.52
5V6	.56	6EA8	.79	12AX4	.67	25CU6	1.11
5X8	.82	6EB5	.73	12AX7	.63	25DN6	1.42

5Y3	.46	6EB8	.94	12AY7	1.44	25EH5	.55
6AB4	.46	6EM5	.77	12AZ7	.86	25L6	.57
6AC7	.96	6EM7	.82	12B4	.68	25W4	.68
6AF4	1.01	6EU8	.79	12B6	.50	32E75	.55
6AG5	.70	6EV5	.75	12BE6	.53	35C5	.51
6AH4	.81	6EW6	.57	12BF6	.60	35L6	.60
6AH6	1.10	6EY6	.75	12B7	.77	35W4	.42
6AK5	.95	6FG7	.69	12BK5	1.00	35Z5	.60
6AL5	.47	6FV8	.79	12BL6	.56	36AM3	.36
6AM8	.78	6GH8	.80	12BQ6	1.16	50B5	.69
6AQ5	.53	6GK5	.61	12BR7	.74	50C5	.53
6AS5	.60	6GK6	.79	12BV7	.76	50EH5	.55
6AT6	.49	6GN8	.94	12BY7	.77	50L6	.61
6AT8	.86	6H6	.58	12BZ7	.86	70L7	.97
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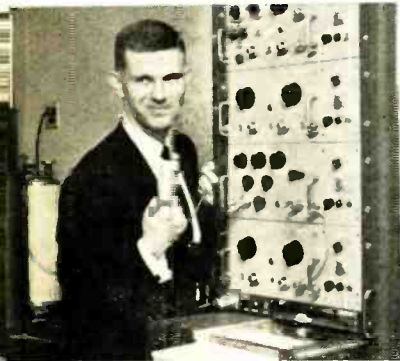


POP'tronics

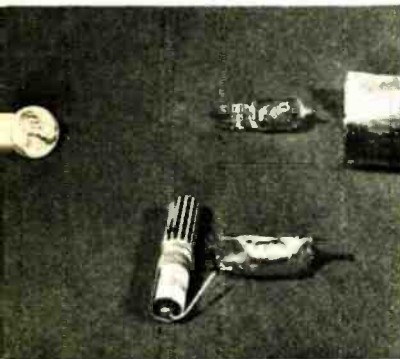
NEWS SCOPE



◀ **"WEIGHTLESS" ALUMINUM FOIL**, or so it seems to be when compared to a feather on a delicate balance, helps form the skin of Project Echo's giant A-12 balloon satellites. The gossamer material, made by Aluminum Company of America, is .00018" thick, only a fourth the thickness of Alcoa's regular household foil. The G. T. Schjeldahl Company (Northfield, Minn.) laminates the aluminum to both sides of a plastic film, and fabricates the sandwich material into mammoth 135' diameter spheres. This ultra-thin foil has replaced the vacuum-deposited aluminum film used for the plastic envelope of Echo 1. The "weightless" foil provides improved reflectivity, structural rigidity, resistance to deterioration.



◀ **BLOOD PRESSURE** measured with the usual pressure instrument requires a doctor or trained technician to perform the test while the patient remains motionless. Lt. Richard G. Gowan, USAF, (shown at left) has invented an electronic blood pressure measuring device which tests and records automatically, even if the patient moves about. Developed for his doctorate thesis in Iowa State University's bio-medical electronics program, the device uses a pulse sensor pickup that fits snugly over one of the subject's fingers instead of the upper arm. Then the machine does the rest in an unbelievable 15 seconds, completely unattended.



◀ **THE WORLD'S SMALLEST LASER "SYSTEM"** could be built by an experimenter as easily as any simple home-brew POP'tronics project. The "system" devised by scientists of American Optical Company's Research Center places an AG-1 flash bulb of the type used by photographers in intimate contact with a 1/16"-diameter clad neodymium glass laser rod .006" thick by 1 1/4" long, and the two are wrapped as a unit with aluminum foil. (Note size as compared to a penny in photo at left.) The flash bulb is triggered by a standard 1 1/2-volt size 7 (AAA) dry cell, and the resulting high-intensity light causes 5-millisecond pulses to emanate from the laser. Longer pulses—13 milliseconds—have been measured when two flash bulbs were used.



◀ **GOOSE GREASE AND LOUDSPEAKERS**—Almost everyone is familiar with the preparation spread on a swimmer about to brave the waters of the English Channel. But a young lady of 24 named Mary Margaret Revell has decided to try a round-trip non-stop swim of the Channel, and this calls for special equipment such as power hailers and loudspeakers designed to operate continuously above and below the water. University Loudspeakers, of White Plains, N.Y., is supplying the speakers that will relay information to Miss Revell from motor launches, and help keep her awake. The speakers can reproduce both speech and music with absolute intelligibility, overriding water turbulence and noises.

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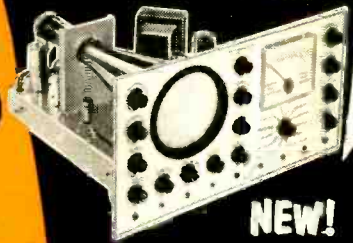
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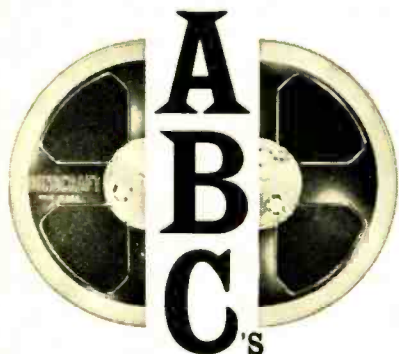
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The following satellites, launched by the United States and the Soviet Union, were reported to have beacon and telemetry transmissions as of August 13, 1962. The satellites are listed by their code names, according to frequency; because some transmit on more than one frequency, they appear more than once.

Explorer VII*	19.990 mc.
Cosmos II (Sputnik XII)	20.005 mc.
Discoverer XXXVI	20.005 mc.
Cosmos V (Sputnik XV)	20.008 mc.
Transit IVB	54.000 mc.
Cosmos II (Sputnik XII)	90.011 mc.
Cosmos VI	90.023 mc.
Courier IB	107.970 mc.
TIROS I	107.997 mc.
TIROS III	108.000 mc.
Vanguard I*	108.022 mc.
TIROS III	108.030 mc.
Telstar	136.050 mc.
Transit IVA	136.200 mc.
TIROS IV	136.230 mc.
TIROS V	136.235 mc.
Ariel	136.410 mc.
Injun SR-3	136.500 mc.
Traac	136.650 mc.
OSO I	136.744 mc.
Transit IVB	136.800 mc.
TIROS IV	136.920 mc.
TIROS V	136.922 mc.
Transit IIA	161.990 mc.
Transit IIA	215.990 mc.

*Signal may be very weak

At least ten more satellites are in orbit and 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.

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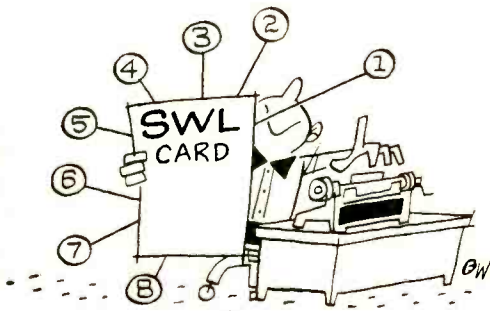
Good Advice for SWL's

■ Like many hams, I receive between three and ten SWL cards a week. The typical one goes something like this:

"I am an SWL. I heard you on 15-meter phone. You were working a K1. Please send me your QSL card."

Because I was an SWL once, I answer every such card I receive. But I doubt that many other hams take the trouble to do so. If SWL's would tell hams something they don't already know, the SWL's would probably get many more answers.

I think most hams would answer an SWL card which contained: (1) a signal report; (2) strength



compared with other signals on the band; (3) band conditions at the time; (4) stations the ham was working; (5) modulation or tone quality; (6) type of equipment the SWL was using; (7) time and date; and (8) some of the other stations being copied at the time.

WILLIAM OSBORNE, WA4CQD
 Benton, Ky.

Experimenter's Transistor Tester

■ I just built the "Experimenter's Transistor Tester" (April, 1962, issue). Deciding that I would like a louder indicating tone than the unit provided, I added a Lafayette PK-522 3-transistor amplifier. Now I can hear the tone in the next room.

JEFF REDLUS
 Bronx, N.Y.

Clever idea, Jeff. So long as it doesn't interfere with the hi-fi.

More P.E.'s For Sale

■ If Lawrence Churchill (see July, 1962, "Letter Tray") has experienced an avalanche of eager buyers for his complete collection of P.E., I'd like to announce that I, too, have saved every issue from

the very first one. Like Larry, I'm running out of space and would like to sell out. I'll ship all issues to the first disappointed, would-be buyer of the Churchill collection who sends me 25 dollars. Within the continental U.S. only, please.

HERMAN STERN
 1563 Inwood Ave.
 New York 52, N.Y.

Starved Circuit Amplifier

■ Enclosed is a picture of my "Starved Circuit Amplifier" (July 1961 issue). I kept the cost down



to about \$6.00 by using surplus parts, and the results were quite satisfying. One suggestion: an octal plug should be used at J2 rather than the octal socket shown. Then the power supply cable can be equipped with a socket instead of a plug, and the

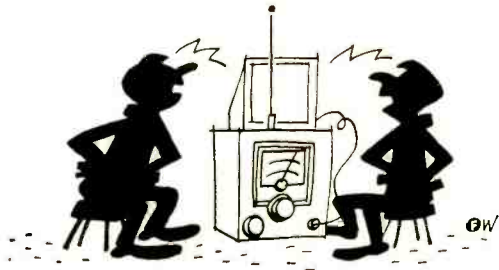
possibility of shock hazard in this project will be greatly minimized.

JACK ELIAS
 Philadelphia, Pa.

If you want to add some fidelity to that good-looking unit, don't miss our November issue.

Compactron Complement

■ My brother and I built the "Compactron VHF Receiver" (September 1961 issue) and made a few modifications to the original circuit. We've added plug-in coils to step up the tuning range to cover 80 to 100 mc., a home-brew audio amplifier to drive a loudspeaker, and a full-wave rectifier for the B+ circuit. Aside from a bit of "warm-up



drift," the receiver is very stable and selective, and we are quite pleased with its performance.

DENNIS MURRAY
 Wilmington, Del.

And rightly so. Murray brothers two. A good deal of care went into the planning of the original circuit, and the additions to suit your needs seem to have been equally well planned and carried out.

A New Breed of Hams

■ A short while ago, the 11-meter ham frequencies were taken away to be used as a public-service "Citizens Band." But when we tuned across the CB frequencies recently, we noticed that a new breed of amateurs had moved in instead. Most of these Citizens Banders, or "lids" as we call them in ham circles, appear to be misusing their licenses

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Dennis P. Miller, 416 W. Oak St., Alexandria, Va.....	1st	12
Cecil C. Hironimus, 113 Berwick Rd., Johnstown, Pa.....	1st	12
Max D. Reece, 4222 Fremont Ave. N., Seattle 3, Wash.....	1st	20
Robert Bennis, 3802 Military Rd. N.W., Washington, D. C.....	1st	12
Jon M. Martin, 7913 Sausalito Ave., Canoga Park, Calif.....	1st	24
Kline H. Mengle, 401 Granville Dr., Silver Spring, Md.....	1st	24
Gary D. Burnard, Johnson Rd., Kirkwood, RD #1, N. Y.....	1st	12
Newton E. Hastings, 318 Poplar Hill Ave., Salisbury, Md.....	1st	12
Larry L. Tracewell, 1509 43rd St., Parkersburg, W. Va.....	1st	12

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Letter Tray

(Continued from page 10)

by attempting to work world-wide DX. And they even send out QSL cards! Admittedly, there are some good CB operators, but when one sees a 4-element, 11-meter beam mounted on an 80-foot tower, one begins to wonder. Why don't these



would-be hams get the proper licenses and trim their antennas for the 10-meter ham band next door?

JOHN MAASS, K7JKZ
PETER SCHUMACHER, K7MOY
Great Falls, Montana

You'll probably both be glad to know that the FCC is now in a position to levy fines on CB'ers (or hams) who misuse their licenses (see FCC Report in last month's P.E. and Across the Ham Bands in this issue). Perhaps some of the flagrant violations we've all observed will now be cleared up. -30-

Out of Tune

Transceiver for 6 (August, 1962, page 47). Resistors R10 and R11 are specified as 330,000-ohm units. They should actually be 330 ohms each.

CB Directory (August, 1962, page 81). The University Model 61/61 HF microphone mentioned as having a ceramic element actually has a dynamic element with an impedance of 25,000 ohms.

One for the Road (July, 1962, page 46). The pictorial drawing at the top of the page fails to show that pins 3 and 4 on V1's socket are to be bent back and soldered to the socket's metal frame. The terminal holding the junction of C4, L2, and one wire from T1 is of the insulated variety and should not be grounded.

The NASA-136 (June, 1962, page 40). Under L3 in the Parts List, change "1-watt" to "3/16"-diameter." Under L10 and L11, respectively, change "1/2-watt" to "9/64"-diameter." If you are having trouble locating forms for L2, L4, L7 and L8, try Newark Electronics Corp., 223 West Madison St., Chicago 6, Ill. -30-

Always say you saw it in-POPULAR ELECTRONICS



RICHARD S. CONWAY (CREI grad 1960) is Supervisor, Electronic Test Department Wilcox Electric Co., Kansas City, Mo.



ROBERT T. BLANKS (CREI grad 1960) is Engineer, Research & Study Div., Vitro Labs., Division of Vitro Corp. of America, Silver Spring, Md.



MEARL MARTIN, Jr. (CREI grad 1956) is a Senior Engineer and Field Support Manager, Tektronix, Inc., Portland, Oregon.

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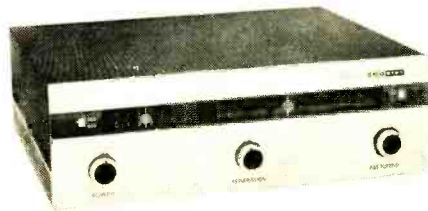
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Hi-Fi Showcase

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

GOOD FM-stereo listening demands a good FM antenna, and the new Mark Stereo 7 released by *B & K Manufacturing* is an excellent choice. For one thing, you can use it indoors or out. In addition, it's both lightweight and rugged, and comes complete with all the hardware you'll need for easy mast mounting. A seven-element, horizontally polarized unit, the Stereo 7 is priced at \$24.95. . . . And speaking of FM-stereo, *EICO* has come up with a new FM-stereo tuner that's available in both kit and factory-assembled form. Dubbed the ST 97, the tuner comes with pre-wired and pre-aligned r.f. and i.f. sections for excellent fringe-area performance. An automatic stereo in-



EICO ST 97 FM-stereo tuner

dicator and station tuning indicator travel in tandem on twin slide-rule dials, and cathode-followers provide the preferred low-impedance outputs. Prices: \$99.95 for the semi-kit; \$149.95, fully wired and tested.

From *Heath* comes a new 3-way speaker system (in kit form) that's slim enough and trim enough to fit almost anywhere. Just 5" deep, the AS-22 system can be set on the floor, placed on a table or bookshelf, or even hung on the wall. What's inside? A 10" woofer of special inverted design, a 6" mid-range speaker, and a 3 1/2" tweeter. And the price? \$49.95 in unfinished whitewood (Model AS-22U), \$54.95 in finished walnut (Model AS-22W), both prices f.o.b. Benton Harbor, Mich. . . . Another item from *Heath*—an "apartment size" equipment cabinet—is styled and finished to match speaker cabinets in the company's

(Continued on page 20)

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

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a separate microphone and speaker



SPEAKER

If you're considering the purchase of a portable Citizens Band transceiver system, there are several good reasons why you should look to SONY. Not in the least is that, while FCC regulations strictly limit maximum output, they put no limit on intelligence of design and manufacture. In the SONY CB-901 transceiver, you will find a separate microphone and speaker, rather than the all-in-one unit commonly found on other models. Naturally, since each is designed to do a specific job, rather than double in brass, you are assured of clearer transmission, and much better reception. Then again, you should consider the fact that SONY uses only components of its own manufacture, including all 9 transistors. Powered by 8 penlight cells, the CB-901 has



MICROPHONE

a range of up to 6 miles depending on terrain, telescoping whip antenna, press-to-talk button. Complete with private earphone, batteries, and leather carrying case.

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*in Electronic Fundamentals • TV Servicing • Color TV
Communications Electronics • Automation Electronics
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Voluntary Tuition Plan. All RCA Institutes Home Study courses are available under the Voluntary Tuition Plan. This plan affords you the most economical possible method of home study training. You pay for lessons only as you order them. If, for any reason, you should wish to interrupt your training, you can do so and you will not owe a cent until you resume the course. No other obligations! No installment payments required.

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courses specially designed to provide the basic math and physics required for a career in electronics.

Free Placement Service. RCA Institutes graduates are now employed in important jobs at military installations with important companies such as IBM, Bell Telephone Labs, General Electric, RCA, and in radio and TV stations all over the country. Many other graduates have opened their own businesses. A recent New York Resident School class had 93% of the graduates who used the FREE Placement Service accepted by important electronics companies . . . and had their jobs waiting for them on the day they graduated!

Coeducational Day and Evening Courses. Day and Evening Courses are available at Resident Schools in New York City and Los Angeles. You can prepare for a career in electronics while continuing your normal full-time or part-time employment. Regular classes start four times each year.



3 NEW LOCATIONS

In addition to RCA Institutes Inc. courses, Radio Corporation of America offers a limited selection of basic Resident School Courses in Electronics at three new locations . . . Chicago, Philadelphia, and Cherry Hill, N. J., (near Camden). For complete information, write the city of your preference next to your name on the attached postcard.

RCA INSTITUTES, INC. DEPT. PE-02, A SERVICE OF RADIO CORPORATION OF AMERICA, 350 WEST 4TH ST., NEW YORK 14, N. Y.
PACIFIC ELECTRIC BLDG., 610 S. MAIN ST., LOS ANGELES 14, CALIF.



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**3 Models to
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\$1200**

**Console Model
\$800**

**Spinet Model
\$650**

This is the Schober Console Model with two full 61-note keyboards, 17 pedals and 22 individual stops. It is comparable to finished organs selling from \$1800 to \$2500.

You'll love the rich, thrilling tone of a Schober Electronic Organ, and you'll love the price, too—starting as low as \$550. Whichever Schober Organ you prefer, you'll happily find it's only half the price of a comparable, ready-made organ sold in a store. In fact, many people who could well afford to buy any organ, have chosen to build a Schober Organ simply because they prefer it musically! You get a full-size organ on which you can play classical and popular music.

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Even a beginner can quickly learn to play a Schober Organ. You'll soon discover a whole new world of music, and endless hours of pleasure. Unquestionably, this organ is the king of instruments!

We are so proud of our organs we've made a 10" Hi-Fi demonstration record we'd like you to hear. The initial cost of the record is \$2 but this will be refunded when you send for your first organ building kit.

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Please send me FREE booklet and other literature on the Schober Organ.

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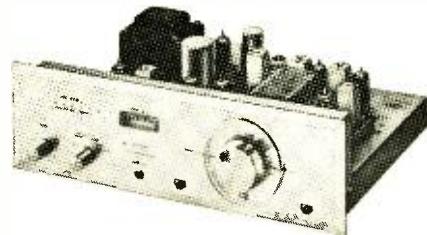
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Showcase

(Continued from page 14)

AE-30 series. Included are shelves for a tuner and an integrated amplifier, and there's also a compartment which will accept either a record changer or a tape recorder. The cabinet measures 32 3/8" x 18 3/4" x 19"; the shelves are 6 1/8" x 17 1/8" x 16 3/4", while the changer compartment is 9 1/2" x 17 1/8" x 17 1/4". Prices (f.o.b. Benton Harbor, Mich.) are \$58.50 unfinished (Model AE-12U), \$68.50 in walnut (Model AE-12W); drawers are available as optional extras. . . . Remote control of a.c. power in any type of hi-fi system is yours with the "Audio Robot" by Royce. Although it draws only 1/10 of a watt (less than an electric clock), the unit will control systems consuming up to 500 watts. Designed specifically for use with extension speakers, the "Robot" makes use of the existing 2-conductor speaker cable. The result: no additional wiring is required, and up to five remote control units can be employed to permit independent control of a.c. power from six different locations. The "Robot" with one remote control unit sells for \$32.95; additional control units for additional remote stations are priced at \$5.49 each.

H. H. Scott's new version of the 350 FM-stereo tuner incorporates many new features—including the patented "Sonic Moni-



Scott 350 FM-stereo tuner

tor." In addition to increased sensitivity, the 350B offers stereo separation in excess of 30 db. A convenient tape output jack has been added to the front panel, and separate level controls make it possible to achieve perfect channel balance. And as for the "Sonic Monitor," it guarantees top-notch stereo separation on every stereo broadcast. The 350B sells for \$219.95, east of Rockies.

B & K Mfg. Co., 1801 W. Belle Plaine, Chicago 13, Ill.
EICO Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N.Y.
Heath Co., Benton Harbor, Mich.
Royce Electronic Developments Inc., P.O. Box 321, Valley Stream, N.Y.
H. H. Scott Inc., Dept. P, 111 Powdermill Rd., Maynard, Mass.

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**NOW...A NORELCO
'CONTINENTAL'
TAPE
RECORDER
FOR
EVERY PURSE
AND PURPOSE**



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.

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

CONTINENTAL '300' (EL 3542) second from top: 4-track stereo playback (tape head output) • self-contained 4-track mono record-playback • 3 speeds • mixing facilities • dynamic microphone • self-

contained phono/P.A. amplifier/speaker system • ideal for schools, churches, recreation centers, etc.

CONTINENTAL '400' (EL 3536) bottom left: Four-track stereo and mono recording and playback • 3 speeds • completely self-contained, including dual recording and playback preamplifiers, dual power amplifiers, two loudspeakers (second in lid) and dual element stereo dynamic microphone • can also be used as a quality hi-fi reproducing system, stereo or mono, with tuner or record player • frequency response: 50 to 18,000 cps at 7 1/2 ips • wow and flutter less than .15% at 7 1/2 ips • signals-to-noise ratio: -48 db or better • cross-talk: -55 db

Compare the special features...Look at the low prices... Listen to the matchless quality... Choose the 'Continental' most suitable for your requirements... For literature and free demonstration, write: Dept E-10.

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Turner has the tested, proved and leading line of mobile mikes for Citizens Band, Business Band and all mobile communications. Here are three excellent reasons for selecting Turner.

CERAMIC MODEL 350C

More 350C microphones are used as original equipment on CB than any other. Equipped with five foot extended rubber-jacketed coiled cord, wired for relay operation. Response: 80-7000 cps. Output: -54db.

List Price \$16.80



MODEL 355C CERAMIC

Convenient, easy to operate hand-ease switch makes this the most advanced styling concept in years. Response: 80-7000 cps. Output: -50db.

List Price \$12.50

CERAMIC MODEL 254C

The matched desk companion to the fine mobile microphones above. Features on-off push-to-talk and lock switch. Cable is 7 foot, three conductor (one shielded) wired for relay operation. Response: 80-7000 cps. Output: -54db.

List Price \$23.50



THE TURNER MICROPHONE COMPANY
946 17th St. N.E., Cedar Rapids, Iowa

Tri-Tel Associates, Ltd.
IN CANADA: 81 Sheppard Avenue West
Willowdale, Ontario

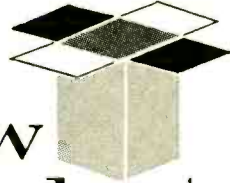
Please send me complete specifications on

- Turner Model 350C Turner Model 355C
 Turner Model 254C

Name _____

Address _____

City _____ Zone _____ State _____



New Products

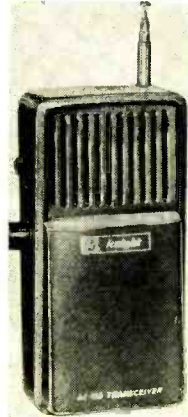
CONVERTIBLE NUTDRIVERS

Xcelite has introduced a unique set of convertible pocket-sized nutdrivers. The set (Cat. No. PS-120) contains ten color-coded tools having hex openings ranging in size from 3/32" to 3/8", plus a "torque amplifier." Any of the nutdrivers can be converted to the equivalent of a standard-sized unit by slipping an extra handle (the "torque amplifier") over its regular handle. All items are housed in a sturdy "see-through" plastic case which can be carried in a pocket or used as a bench stand. Price, about \$5.00. (Xcelite, Inc., Orchard Park, N. Y.)

WALKIE-TALKIE KIT

A 3-transistor walkie-talkie with a half-mile range is available, in kit form, from

Allied Radio. The Knight-Kit C-100 transceiver has a superregenerative receiver, and both receiver and transmitter are crystal-controlled. No license is required to operate the unit, which will run for 75 hours on its 9-volt battery. Controls include a send-receive button, a 2-position volume switch, and a power switch. A 45" telescoping whip antenna is built into the case. Price, \$9.95 including transmit/receive crystal but less battery. (Allied Radio, 100 N. Western Ave., Chicago 80, Ill.)



Allied Radio, 100 N. Western Ave., Chicago 80, Ill.)

AUDIO COMPRESSOR KIT

In addition to improving the audio quality of any CB or ham transceiver, the "Speak-Easy" audio compressor amplifier by Communications, Inc., makes the operator's voice seem louder, thereby increasing copying range. An "out-in" switch, "modulation gain" control, and "percentage modulation" meter are provided on the unit's front panel. Models are available for 115/12 volt or 115/6 volt operation, and the units are designed for easy installation in vehicles or

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Some say that only women are privileged to change their minds, and their faces, whenever they choose. We disagree. And we have the courage of our convictions, because—from this day forward—Audiotape will be wearing a bright new face you've never seen before.

We think you'll like the new Audiotape look, not only because it's fresh, clean and attractive but because it will now be easier than ever to select the type of Audiotape you need. We've assigned a distinct, highly visible color to each of the eight types so that you can locate your favorite immediately. We've also printed a description of the contents on every package—brief, simple and in large, clear letters. (No matter which Audiotape you favor, you're getting the tape that quality made famous.)

Look for the new family of Audiotape packages. They're well worth your attention.



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- Troubleshooting With the VOM-VTVM.** Shows you exactly how to use these instruments for troubleshooting TV circuits. Details all measurement and analysis procedures. Order **TWV-1, only** \$2.50
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- Fundamentals of Modern Semiconductors.** Detailed explanation of solid-state physics, with a minimum of mathematics. Fully covers diode and transistor fundamentals, including the latest developments. Order **FSK-1, only** \$2.95
- Modern Communications Course Vol. 1. Radio Frequency Systems**—gives you a complete understanding of transmitters, including design, operating principles and practices. Order **MCN-1, only** \$4.95
- Fundamentals of Magnetic Amplifiers.** The practical book for everyone working with saturable-core devices, such as those used in missiles, computers, industrial equipment, lab instruments. **FMA-1, only** \$2.95
- Servicing Transistorized 2-Way Radio.** Complete servicing techniques for transistorized 2-way designs used by the major manufacturers. Full troubleshooting and maintenance details. Order **TRT-1, only** . . . \$2.95
- TV Servicing Guide, SGS-1** \$2.00
- How to Read Schematic Diagrams** 1.50
- ABC's of Ultrasonics. ULT-1** 1.95
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- Troubleshooting With the Oscilloscope. TOS-1** 2.50
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Products

(Continued from page 22)

base stations. Price, \$24.95 in kit form, \$34.75 factory-wired. (*Communications, Inc.*, 33 Danbury Rd., Wilton, Conn.)

INSTANT LETTERING

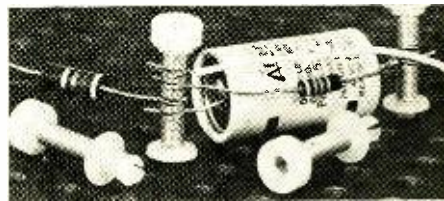
"Letraset Instant Lettering" is designed for marking all kinds of electronic panels, chassis, etc. It takes just a quick, light pressure to transfer words (or individual letters) from the Letraset carrying sheet to the surface to be marked.



Each set contains 24 3" x 5" sheets, carrying thousands of pre-set words and phrases that are useful to the electronics technician or hobbyist (each set is said to provide up to 95% of all electronics panel markings). Sheets of alphabets and numerals are also included. Price, \$4.95 per set, available with either black or white lettering. (*The Datak Corp.*, 63 - 71st St., Guttenberg, N. J.)

BREADBOARDING KITS

A simplified technique for breadboarding experimental electronic circuits features the "Koil-Klip," a versatile solderless connector. The Koil Klip consists of a helical



spring having a nylon mounting plug on one end and a combination handle and banana-plug receptacle on the other. Once mounted on a perforated circuit board, the spring can be pulled upward and as many as 10 average-sized component leads inserted between the coils. Kit K-200, consisting of 50 Koil Klips and an 11" x 17" circuit board, sells for \$10.95. A kit of 15 Koil Klips and an 8½" x 11" board (K-150) costs \$3.95. Plug-in tube and transistor socket adapters, switch holders, and potentiometer holders are also available. (*Electronic Training Aids Co.*, P. O. Box 53, Cambridge 41, Mass.)

-30-

You Have Aptitude for Electronics

... Why Not Make It Your Career?

Get the Training You Need at COYNE then Step into High Salary Position in the Branch of Electronics You Like Best!

No matter what branch of electronics you prefer, you'll have no trouble landing just the job you want—provided you get the right kind of training.

Without this training you'll not get far. With it, most of our graduates start right out with a beginner's salary of \$100 a week or more. Once you've started, you can move ahead fast to more important jobs that pay as much as \$14,000 a year.

AIRLINES NEED MEN

Who pays this kind of money to beginners? You'd be surprised at how many fine openings there are for Coyne-trained men—in small towns and big cities everywhere all year 'round. For example, the airlines are always on the lookout for men who can fill jobs as radio mechanics, aircraft electricians and electronic systems technicians, to mention only a few. From a good starting salary, a trained man can quickly boost his income to \$8,000 a year. And that is by no means the limit.



THE MISSILE INDUSTRY

Another field where employers are clamoring for trained men is the missile industry—an industry growing so fast as to be almost unbelievable. Here there is a constantly increasing need for trained men. Every day these companies are hiring electronic technicians, laboratory technicians, electronic assembly inspectors and field service engineers. A field service engineer with minimum experience can easily demand and get \$8,000 a year—plus extra compensation in the form of living expenses and incentive pay.

COMPUTERS—Data Processing
A tremendous field. Men with basic electronic training are welcomed by manufacturers to receive further training—while on salary in—the operation and maintenance of their specialized equipment. Opportunities unlimited. No ceiling on salaries.

TV and RADIO Manufacturers
Perhaps the biggest opportunities of all are to be found with the large electronic manufacturers. With these giants, job opportunities are practically without limit.



And the same thing can be said of salaries. These radio and TV manufacturers are expanding into new fields and are growing at an unheard-of rate. Any man with ability and ambition can grow with them, earn promotion after promotion. With these promotions come frequent pay raises as he continues to step from one important job to one still more important.

OR, YOUR OWN BUSINESS

Hundreds of graduates have gone to work for former graduates, servicing TVs and Radios, Air Conditioners, Refrigerators, other household appliances—then, after learning business methods have branched out and started their own shops. Others have started their own shops immediately upon graduating. Profits as independent business men, after taxes and other business expenses, are as high as \$10,000 to \$20,000 a year.

These are not dreams. They are realities. But don't try to break into Electronics "on your own." You can save years of struggle and disappointment by first getting the necessary training at the great shop-laboratories of the Coyne School in Chicago.



CHICAGO—THE NATION'S ELECTRONICS CENTER

Don't get the idea that coming to Chicago to learn with Coyne is a costly or complicated undertaking. *Nothing could be further from the truth.* With modern transportation, Chicago is "close by" no matter where you live. High living costs? Not at all. We find a place for you to live—a place where, in many cases, your room and board cost no more than you would pay at home. And don't forget that you have every opportunity to earn money while you learn. Our employment department helps you get a part time job if you need extra money.

And think of the training you will get! Coyne is the oldest, largest and most completely equipped Resident School of its kind. And it is right in the heart of America's electronics center! Best of all, you can start your training with only a small down payment. Then take care of the balance after you graduate!

FREE BOOK You've just read a bare outline of what Coyne offers to men who want to get into electronics. You'll find the complete, fascinating story in our big 48-page book "Your Opportunities in Electronics." We'll be glad to send you free. Read this Book before you make up your mind what you want to do.

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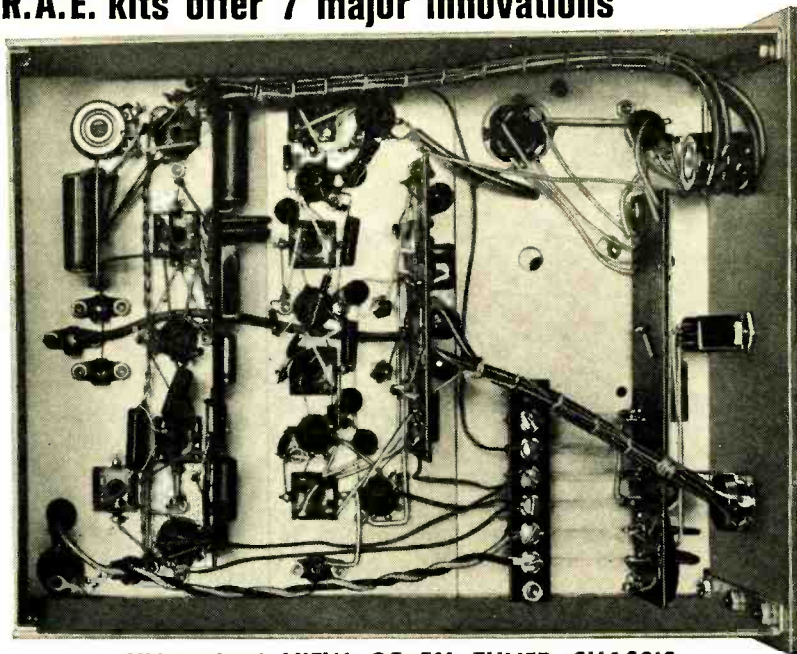
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NEW KITS DESIGNED SPECIFICALLY FOR

new R.A.E. kits offer 7 major innovations

When a group of kit building enthusiasts got together and decided to design their own kits — kits that could actually be assembled on a kitchen table — exciting things began to happen.

It started the idea of the R•A•E Society, now a national organization of kit-builders, already past 12,000 members. It also started a new concept of kit designs, embodying features of advanced military equipment and precision instruments adapted specifically to home construction — not just parts for components intended to be assembled on factory production lines.



UNDERSIDE VIEW OF FM TUNER CHASSIS

1. PARTS-BOARD MOUNTING METHOD

The usual confusion of parts and wires is eliminated. Parts are mounted by putting the leads through pre-drilled holes in Grade XXX phenolic boards, and using the leads for most of the wiring. This reduces heat transfer to parts in soldering, eliminates AF and RF coupling effects, improves reliability, and simplifies wiring.

2. MODULAR CHASSIS CONSTRUCTION

Circuit sections (RF, IF, multiplex, power supply) are carried on separate aluminum decks or modules, on which the parts boards are mounted. Each is completely assembled and wired, then mounted on the chassis. Individual modules are easy to handle. All parts and wires are readily accessible. This is a basic improvement over conventional one-piece chassis design.

3. PERFECT SOLDER CONNECTIONS

Most common cause of failures is the practice of running 5, 6, or 7 wires to a single terminal. When solder does not flow over all the wires, open circuits result. R•A•E kits are so designed that not more than 2 wires (rarely, 3 wires) are run to any one terminal or lug.

4. FINEST PARTS, 1-YEAR GUARANTEE

Only R•A•E guarantees that all parts are of current production, purchased directly from the manufacturers. (No close-out or military surplus parts in any R•A•E kit.) Only R•A•E supplies such extra-cost items as Keps nuts, grade XXX phenolic panels, Teflon tubing. Only R•A•E guarantees all parts except tubes for one year.

5. KITS DESIGNED FOR KIT-BUILDERS

Standard practice today is to furnish components designed for factory production in kit form also. Such designs, intended for high-speed production-line assembly, are ill-suited to home construction. Only R•A•E kits are designed by kit-builders for kit-builders. Moreover, they follow the most advanced design practices developed for precision commercial and military equipment. Net result is your assurance of success with the assembly and wiring, high-quality performance, trouble-free operation, and the appearance of professional workmanship.

6. ERROR-PROOF INSTRUCTIONS

R•A•E has perfected an entirely new style of instructions to guard you against errors. In addition, R•A•E provides an inspection check-list for each

KIT BUILDING

stage, so that if a mistake is made, it will be found and corrected at once. R•A•E has also worked out a new and greatly simplified style of wiring diagrams which are a pleasure to follow.

7. \$20.00 IN DIVIDEND COUPONS

The R•A•E Society, a nation-wide association of kit-builders, publishes the quarterly R•A•E Journal. Current issue contains ten articles and departments on kit designs, kit building, system planning, Society activities, and related subjects — profusely illustrated with drawings and photographs handsomely printed on fine paper. You are invited to send in the application form below. Dues of \$1.00 per year cover full membership privileges. On acceptance of your application, you will receive a membership card, your first copy of the Journal and Member's Dividend Coupons to the value of \$20.00 which you can apply to the purchase of R•A•E kits.

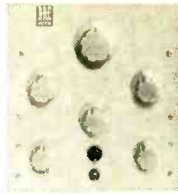
YOU CAN NOW BUILD AND ENJOY ONE OF THESE FABULOUS NEW R•A•E KITS



R•A•E 250 STEREO-MONO FM TUNER:

Sensitivity 1.2 microvolts for 30db quieting at 100% modulation; harmonic distortion

under 2%; drift under 02%; flat to 1db 20 to 20,000 cycles; stereo separation 32db; controls for tuning, stereo volume, mono volume, channel separation; EM84 tuning indicator; tubes 2-ECC85, 3-6AU6, 6BN6, 12AU7, 6AV6, 6BL6, 6x4, 2-1N874 diodes; tuning unit and transformers pre-aligned; panel 8¾ high by 9 ins.; depth 11 ins.; front panel finish, choice of standard gray or anodized soft-tone gold. Complete Kit \$129.95.



R•A•E 400 STEREO-MONO PREAMP:

Function switch for mikes, phono low, phono high, tape, FM, AM-TV; 4-position speaker

switch; balance; class 2 matched controls for volume, bass, treble; maximum output approx. 2.5 volts from each input; amplifier and tape outputs; total distortion below .4%; hum-noise -70db; cathode-follower outputs; tubes 6-12AX7; panel 8¾ high by 8 ins.; depth 11 ins.; front panel finish, choice of standard gray or anodized soft-tone gold. Complete Kit \$97.50.



R•A•E 100 ADJUSTABLE NETWORK:

Improves quality of any audio system by separating high and low frequencies before power

amplification. Separate switches limit highest frequency fed to woofer, and lowest frequency fed to tweeter at 150, 200, 350, 500, 700, 1000, 1500, 2200 or 3500 cycles. Separate level controls permit exact balancing of low and high-range outputs. Tubes 3-12AX7 providing cathode follower outputs; panel 8¾ high by 6 ins.; depth 11 ins.; front panel finish, choice of standard gray or anodized soft-tone gold. Complete Kit \$74.95.

GUARANTEED FOR ONE YEAR

All kit components and parts, except tubes, will be replaced without charge if found defective within one year from date of purchase.

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- Model 25 Stereo-Mono FM Tuner \$129.95
- Model 400 Stereo-Mono Preamp 97.50
- Electronic Crossover Network 74.95

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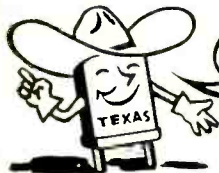
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Matched crystal sets for ALL CB units (Specify equipment make and model numbers) **\$5.90 per set**

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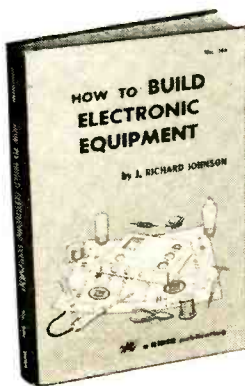


POP'tronics Bookshelf

HOW TO BUILD ELECTRONIC EQUIPMENT

by J. Richard Johnson

This volume lets the reader in on 99% of the "secrets" of planning, laying out, wiring, and testing electronic projects.



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Published by John F. Rider, Inc., 116 West 14th St., New York 11, N.Y. 288 pages. Hard cover. \$6.95.

ADDITIONAL 1962 TELEVISION SERVICING INFORMATION

by M. N. Beitman

Volume TV-20 in Supreme's series of TV service manuals provides data on 1962 models released after the publication of the *Early 1962 TV Manual*. The book covers all sets produced by major manufacturers and includes schematics, alignment facts, printed-board views, waveforms, voltage values, and factory-recommended changes.

Published by Supreme Publications, 1760 Balsam Rd., Highland Park, Ill. 192 pages. Soft cover. \$3.00.

(Continued on page 30)

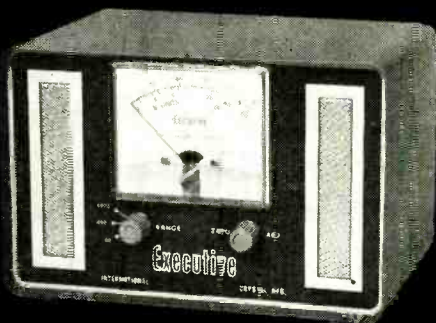
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Bookshelf

(Continued from page 28)

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HOW TO BUILD ELECTRONIC EQUIPMENT by J. Richard Johnson. Covers all the situations you'll ever face in building electronic equipment. This book will save you money because you'll avoid many common mistakes made in building equipment. It'll save you time by providing practical tips on how to layout the chassis and how to use the tools because the finished equipment will perform the way it was designed to. Hundreds of down-to-earth ideas make this book indispensable to the kit builder, the newcomer and the experienced "pro" who builds equipment from "scratch." Use it for years and years as a reference and guide book. "... a thoroughly practical handbook." — ELECTRONICS WORLD. #286, hard cover, \$6.95

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Repairing Home Audio Systems provides practical, up-to-date information on the operation, maintenance, and repair of all types of home sound equipment. The book covers the essential facts required to analyze and isolate troubles in tuners, amplifiers, turntables, record changers, tape recorders, portable phonographs, speakers, etc. Many times only the changing of a tube or the

bending of a lever is all that is needed to restore a defective unit to perfect working order, but the reader will also learn to recognize and correct troubles of a less obvious nature. Handy trouble-shooting charts, listing symptoms, possible causes, and solutions, are included as an aid to quick servicing.

Published by McGraw-Hill Book Co., 330 West 42nd St., New York 36, N. Y. 311 pages. Hard cover. \$6.95.

New Literature

Now available from Commercial Engineering, RCA Semiconductor and Materials Division, Somerville, N. J., is a 12-page "Application Guide" entitled "Transistorized Voltage Regulators." The guide, which sells for 25 cents, describes step-by-step design procedures and provides solutions to sample design problems for the three basic types of transistor regulating systems: series, shunt and series-shunt.

The "Trader's Handbook" tells, clearly and simply, the complete story of Audio Exchange's nationwide hi-fi equipment trading system. For your copy (and a copy of the free Audio Exchange "Bulletin"), send 25 cents to Audio Exchange, 153-21 Hillside Ave., Jamaica, N. Y.

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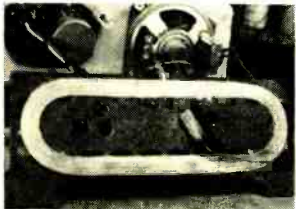
Tips and Techniques

NEW RADIO BACKS FROM LINOLEUM SCRAPS

The backs on small table-model radios always seem to get torn and loose. But it's quite easy to make a replacement from a scrap of linoleum. Using the old back as a template, trace the outline onto the linoleum.

Then cut the linoleum with a pair of heavy shears or tin snips. Finally, remove the loop antenna—or loopstick—from the old back, and fasten it to the new one.

—H. L. Davidson



COPPER PENNY IMPROVES TRANSISTOR PORTABLE'S RECEPTION

Does your portable transistor radio refuse to pull in those distant stations? Try placing a copper penny on the set's cabinet—right over the built-in antenna. If it does the trick, fasten the penny to the cabinet with Scotch tape. In the case of the Channel Master set shown here, reception was improved amazingly.



—John A. Comstock

TURN SIGNAL FOR ADJUSTMENT SCREWDRIVERS

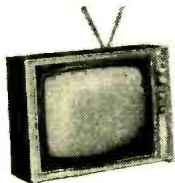
Here's a good way to keep track of the number of turns you make when adjusting screwdriver-operated controls. Just file a marker (in alignment with the blade tip) across the top of your adjustment screwdriver. Then, for better visibility, fill in the file mark with paint. To make quarter-turns

(Continued on page 38)

VACUUM TUBE VOLT METER KIT (6-INCH METER)—RMS and p. to p. scale. Input imp. 12.2 meg. Professional performance and appearance. Kit: \$31.95 Assembled: \$44.95



"CUSTOM 70" TV SET KIT—Excellent sensitivity. Transformer power supply; 3 stages of IF. Includes slimline cabinet, tube—everything. NOT a portable. Kit Price: \$135.00



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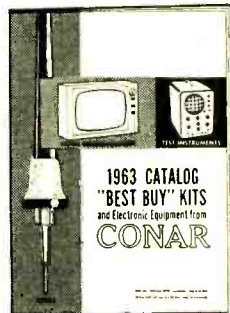


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Tips

(Continued from page 32)

more accurately, form a "plus" sign by placing a similar marker (of a different color) at right angles to the first.

—Jerome Cunningham

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Simplify zero-adjusting your ohmmeter by installing a momentary-contact, push-button switch across its jacks. Then you won't have to remove the meter's test clips from the circuit being measured in order to short them together.



If your meter is a VOM and the jacks are also used for voltage testing, be sure the switch you install is rated at a high enough voltage not to arc over. Be sure, too, that the switch's bushing is long enough to pass through the meter's front panel.

—Robert E. Kelland

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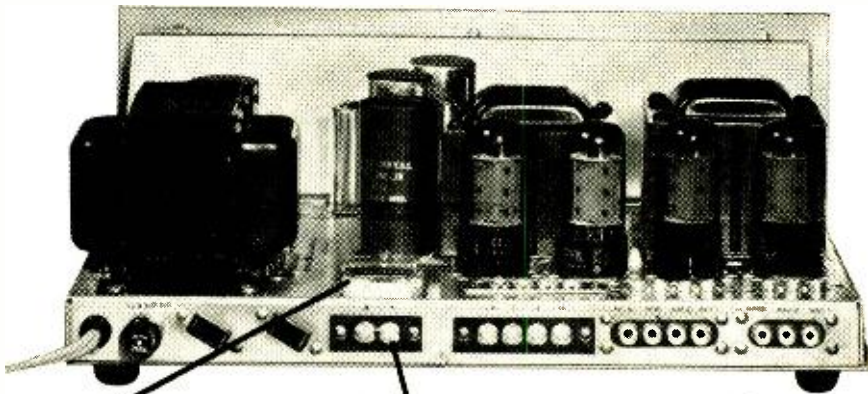
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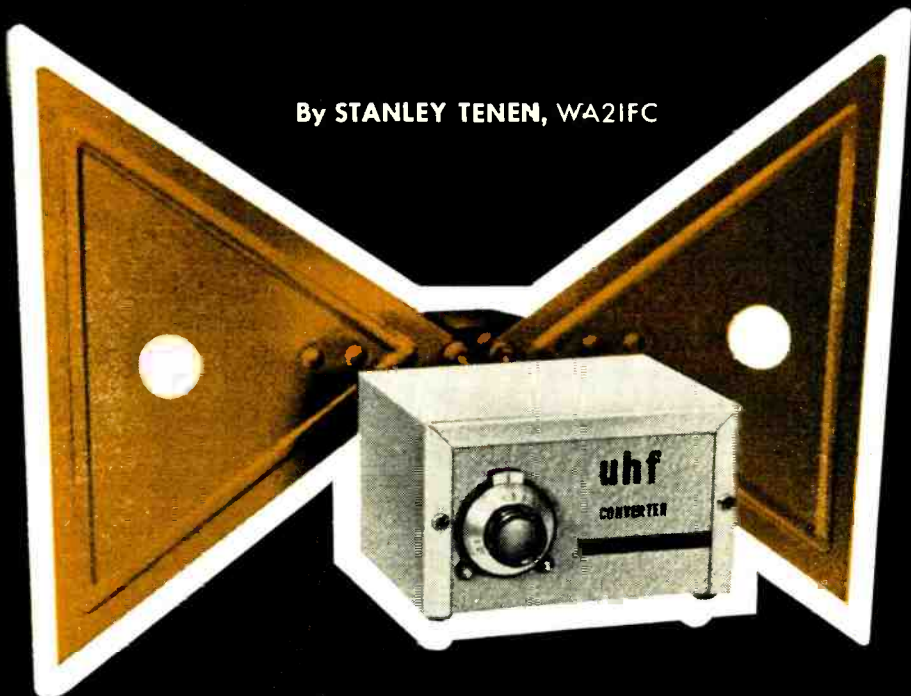
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THE 14-83

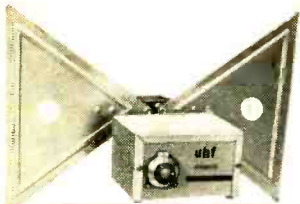
This little UHF converter is about as simple as they come. Yet it's all you'll need to pull in those 70 new TV channels, assuming you already have a standard VHF TV set.

By STANLEY TENEN, WA2IFC



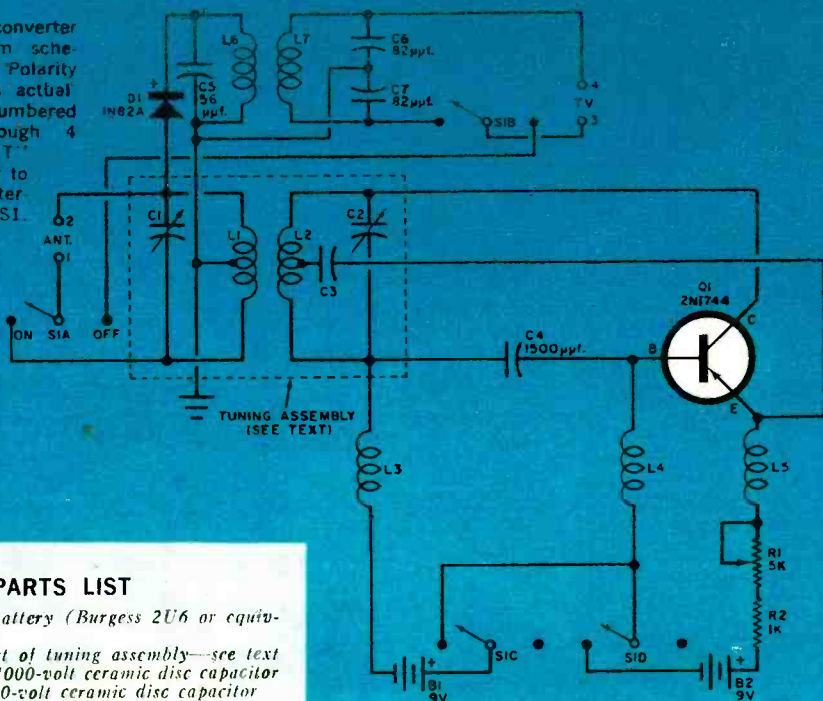
WITH UHF TELEVISION the "big news" these days, you've probably been wondering just how to go about adding those 70 UHF channels to your TV coverage. Actually, there are three ways you might do so: (1) buy a new TV set — the Congress recently passed a bill requiring new television sets to come equipped for all-channel reception; (2) purchase a UHF converter; or (3) build a converter of your own. Of these alternatives, the third is the most inexpensive, and the little one-transistor converter about to be described will fill the bill nicely.

This converter can provide good reception on all UHF channels up to 20 miles from a transmitter, and you should be able to



THE 14-83

Simplicity of converter is evident from schematic diagram. Polarity of diode D1 is actually immaterial; numbered points 1 through 4 (marked "ANT" and "TV") refer to terminals on terminal strip TS1.



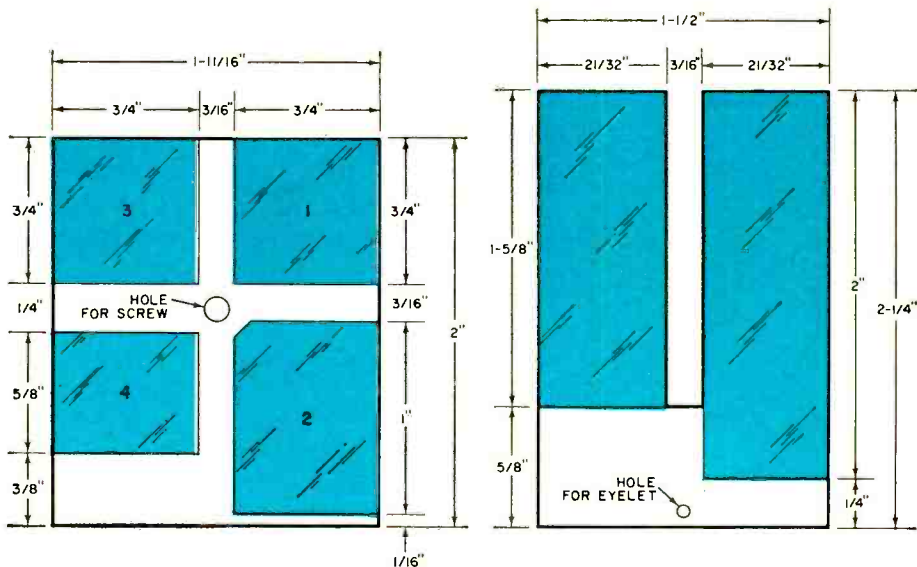
PARTS LIST

- B1, B2—9-volt battery (Burgess 2U6 or equivalent)
- C1, C2, C3—Part of tuning assembly—see text
- C4—0.0015- μ f., 1000-volt ceramic disc capacitor
- C5—56- μ f., 1000-volt ceramic disc capacitor
- C6, C7—82- μ f., 1000-volt ceramic disc capacitor
- D1—1N82A diode
- L1, L2—Part of tuning assembly—see text
- L3, L4, L5—R.f. chokes (35 turns of #24 enameled wire, close-wound, $\frac{1}{8}$ " in diameter, coated with Duco cement for rigidity)
- L6, L7—I.f. transformer: primary 3 turns, secondary 4 turns of #20 solid tinned copper wire, $\frac{1}{4}$ " in diameter, spaced the width of the wire
- Q1—2N1744 transistor (Philco)
- R1—5000-ohm miniature potentiometer, linear taper
- R2—1000-ohm, $\frac{1}{2}$ -watt, 10% resistor
- S1—4-p.d.t. miniature slide switch (Lafayette SW-91 or equivalent)
- TS1—4-lug terminal strip
- 1—5" x 4" x 3" aluminum utility box, gray hammer-tone finish (Bud CU-2105-A or equivalent)
- 1—3 $\frac{21}{32}$ " x $6\frac{3}{4}$ " perforated board (Lafayette MS-305 or equivalent)
- 1—6" x 4 $\frac{1}{2}$ " copper-clad board
- 1—6-oz. bottle of copper etchant
- 1—Polystyrene rod, 3 $\frac{1}{2}$ " long, $\frac{1}{4}$ " in diameter
- 1—2" x 3" piece of $\frac{1}{64}$ "-thick copper sheet
- 1—Vernier dial, $\frac{1}{2}$ " in diameter (Lafayette F-348 or equivalent)
- Misc.—Mica-filled transistor socket, eyelets for perforated board, grommets, battery clips, hardware, wire, solder, etc.

build it for less than \$11.00. You can even use your present VHF antenna, although performance will naturally be improved with a UHF antenna and elimination of the "ANT/TV" switch.

About the Circuit. The converter itself is straightforward and has no r.f. or i.f. amplification. Heart of the device is a Philco 2N1744 transistor, an amazing unit that costs only \$2.79 and can oscillate at frequencies up to a kilomegacycle.

This transistor (Q1) is connected as an oscillator and generates a signal 80 to 85 mc. below the frequency of the UHF station to be received. Section L2/C2 of the tuning assembly determines the frequency of oscillation and radiates



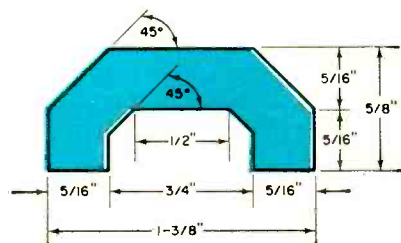
Top and bottom sections of tuning assembly (at left, above) are identical; center slide section is at right above. Plastic electrical tape can be used as resist material for etching all 3 sections (shown actual size).

the signal to $L1/C1$; capacitor $C3$ provides the necessary feedback for oscillation. Potentiometer $R1$ adjusts the emitter current for optimum output, while resistor $R2$ limits the emitter voltage to a safe value (more than 0.2 volt across the emitter/base junction for even a second can ruin the transistor).

The incoming UHF signal is applied across $L1/C1$, which is tuned to the desired UHF station. Since both the UHF signal and the oscillator signal appear on coil $L1$, diode $D1$ "mixes" them and supplies a difference frequency of 80 - 85 mc. to i.f. transformer $L6/L7$. This coil combination is broadly tuned to VHF channel 5 or 6 (80 - 85 mc.) and provides a balanced output for a standard 300-ohm line to the antenna terminals of the TV set. In its off position, switch $S1$ disconnects the antenna from $L1/C1$ and connects it directly to the TV set.

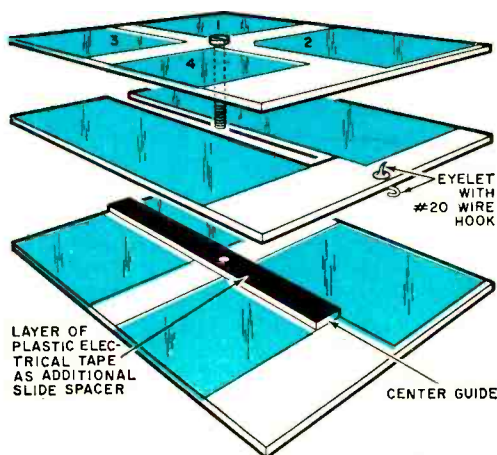
Construction. Most of the parts are mounted on a piece of perforated board cut to fit a 5" x 4" x 3" aluminum utility box. Since lead dress can be very critical at UHF frequencies, parts placement should follow that in the author's model as closely as possible.

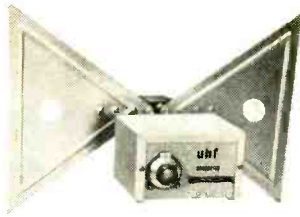
The tuning assembly should be built first. Cut and etch the copper-clad board



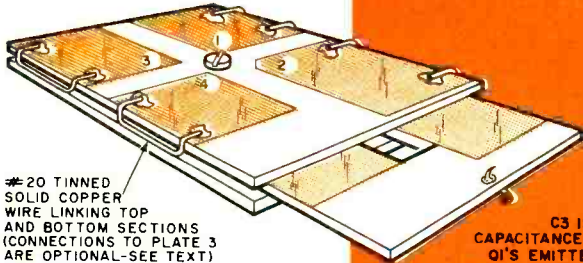
"Coils" $L1$ and $L2$ are highly critical and must be constructed exactly as shown above. Part of the tuning assembly, they are soldered to capacitors $C1$ and $C2$, as illustrated in pictorial diagram on the next page.

A very small amount of glue should hold center guide in place. Any excess glue must be filed away to allow the center section to slide smoothly.



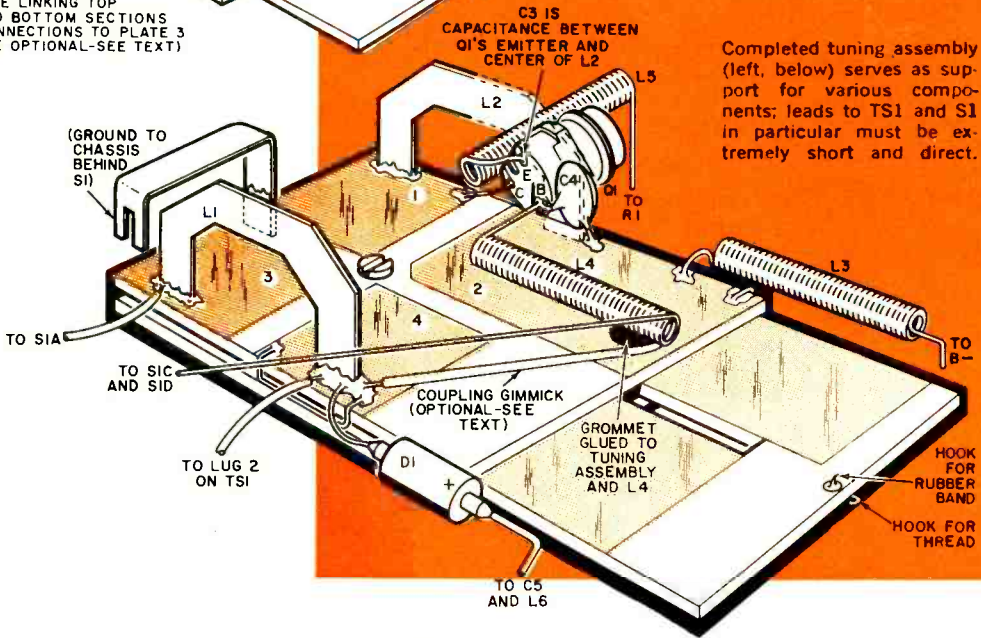


THE 14-83



#20 TINNED SOLID COPPER WIRE LINKING TOP AND BOTTOM SECTIONS (CONNECTIONS TO PLATE 3 ARE OPTIONAL-SEE TEXT)

Wire links join top and bottom sections of tuning assembly, as shown at left. Use as little solder as possible, and be certain that the wire doesn't touch the center section (note that the solder on the bottom section isn't visible here).



Completed tuning assembly (left, below) serves as support for various components; leads to TS1 and S1 in particular must be extremely short and direct.

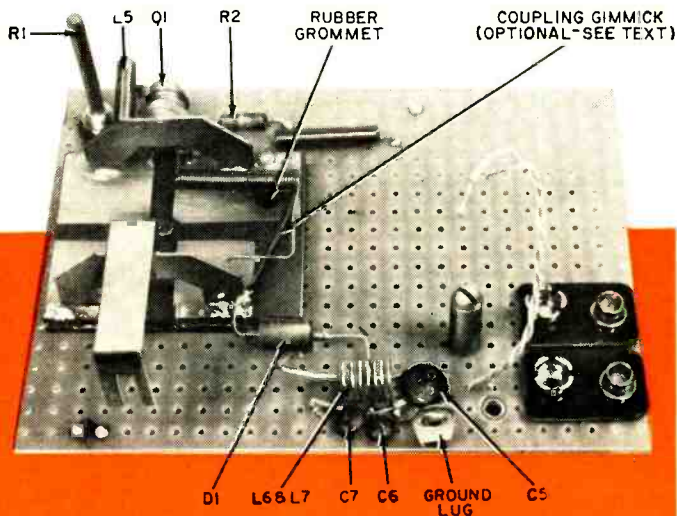
to the dimensions indicated, then drill a 1/16" hole at the end of the center or "slide" section and crimp an eyelet in it. Solder a short length of #20 solid hookup wire in the eyelet to serve as a post for the rubber-band thread drive system.

A fine coping saw should be used for cutting the center guide from the slide. This guide is glued to the lower section of the tuning assembly (all sections copper side up) and a layer of plastic electrical tape is added on top of it. Short lengths of bare solid tinned hookup wire should be carefully soldered to the lower section—two to the edge of each of the four plates, exactly as illustrated.

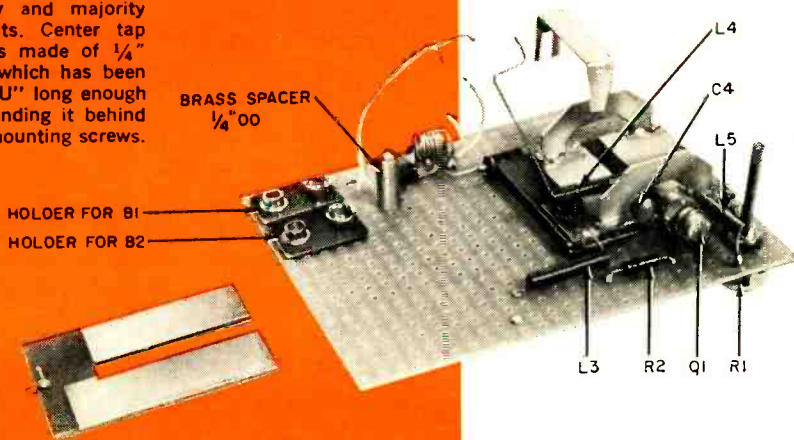
Next, a mounting hole should be drilled

through the center of the top and bottom sections and these two sections fastened together with a brass screw and nut. The leads from the lower section are now bent over and soldered to the corresponding plates on the upper section. This done, try sliding in the center section. If it doesn't slide freely, file away phenolic from the underside and edges not to reduce the size of the copper plates.

The transistor socket and "coils" L1 and L2 must be mounted exactly as shown. Mount the socket so that the emitter lead is central and up—it happens to be one plate of "capacitor" C3! The collector lead is soldered directly



Perforated board holds tuning assembly and majority of components. Center tap for coil L1 is made of 1/4" copper strip which has been bent into a "U" long enough to allow grounding it behind one of S1's mounting screws.



to plate 1 and the base is soldered to *C4* which in turn is soldered to plate 2 of the tuning assembly; capacitor *C4* should have leads no longer than 1/8" before soldering.

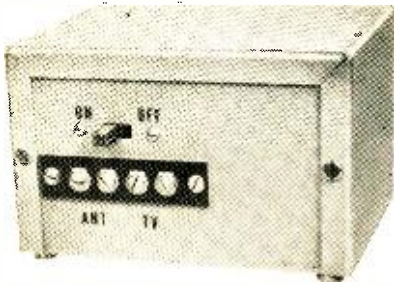
Now cut *L1* and *L2* from a piece of 1/64"-thick copper sheet. And remember: it's absolutely essential that these coils be of the dimensions indicated (see drawing on page 43—this "same size" sketch shows exactly how the coils should be shaped).

The center of *L2* should be about 1/8" to 1/4" from the emitter lead of the transistor socket—it is the other half of "capacitor" *C3*. Coil *L1* is mounted parallel to *L2* about 1/16" from the edge

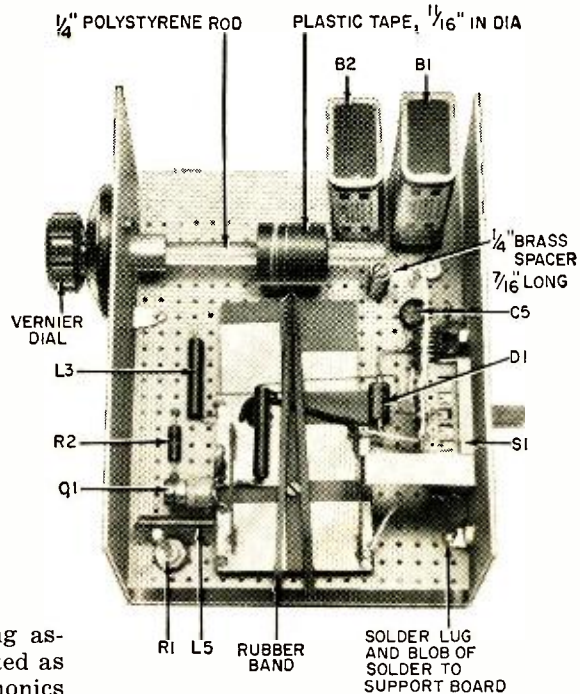
of the "antenna" half of the tuning assembly.

Now cut the perforated board to size and mount the i.f. transformer (coils *L6* and *L7*), potentiometer *R1*, resistor *R2*, the prepared tuning assembly, and the battery clips, exactly as indicated. The ends of the i.f. transformer coils are mounted in eyelets to which *C5*, *C6*, and *C7* are soldered. The battery clips and other components which are not part of the tuning assembly should also be soldered to eyelets crimped into the perforated board.

Wind the r.f. chokes (coils *L3*, *L4*, and *L5*) and mount them as shown; coil *L4* is glued to a small grommet which is



Completed "14-83," with cover removed, is at right. One end of rubber band attaches to hook on center slide section of tuning assembly; other end is looped around screw in tuning assembly. Terminal strip TS1 on rear of cabinet (above) makes for easy connection of both antenna and leads to TV set; lugs on TS1, as seen from rear of cabinet, are numbered 1 through 4 on schematic diagram. Switch S1 turns unit on and off, also switches antenna between converter and TV set.



then glued to plate 2 of the tuning assembly. All parts should be mounted as rigidly as possible to avoid microphonics—any vibrating part will frequency-modulate the oscillator and distort the signal; actual audio feedback from the TV speaker is entirely possible.

Carefully solder leads to the mixer diode (*D1*) and solder *D1* in place, taking every precaution to avoid overheating the diode. Mount *S1*, the vernier dial, and the terminal strip *TS1* in precut holes in the chassis box. Mount the perforated board in the box and screw a smooth post to it in a position to keep the phenolic rod from bending (see illustrations). Before mounting, a section of the rod is built up to 11/16" diameter with plastic electrical tape.

Wire the switch and the terminal strip with short direct leads to *L1/C1*. Solder a 1/4"-wide length of copper strip to the center of *L1*, bend it around to one of the mounting holes of *S1*, and screw the switch tight against it; this is the center tap to ground shown in the schematic. Place a small washer between *S1* and the chassis box at the other mounting hole so the switch will lie flat.

Attach one end of a suitable rubber band (about 3" long) to the tuning assembly mounting screw under the perforated board, and the other end to the wire on the center slide section. Attach a length of strong thread to this same

wire and wind the other end around the "built up" portion of the phenolic rod. Set the vernier dial to zero and secure the thread with a drop of cement.

When the dial is rotated from zero to ten, the slide assembly should move smoothly out approximately 1 1/16". When the dial is turned back to zero, the slide should retract fully. If there is binding, the slide should be filed until the motion is free (a small amount of Vaseline may be helpful here).

Operation and Adjustment. The UHF converter is very easy to use. Connect your present 300-ohm VHF antenna lead-in to the antenna terminals on the converter, and attach a short length of 300-ohm twin-lead from the output terminals of the converter to the antenna terminals of your TV set. Switch the TV set to channel 5 or 6 (whichever is unused in your area) and set the fine tuning control at its approximate midpoint.

Set the vernier dial and potentiometer *R1* about midway also, snap the two batteries in place, and turn on *S1*. "Rock" both *R1* and the vernier dial until you receive a signal. You should have no difficulty obtaining oscillation; and if you have cut *L2* to the correct size, all the

(Continued on page 99)



By
ROALD E. DYBVIK

The MELLO MONSTER

You asked for it!

**A hi-fi speaker enclosure
with a "monstrous" folded
horn compressed into a
relatively small cabinet**

HOW WOULD YOU LIKE to have a complete speaker system that sounds as though it were worth hundreds of dollars—for an actual cost of about \$25.00? You can—by building the "Mello Monster." Very little equipment or wood-working skill will be required. And, after hearing this system, you and your friends will find it hard to believe that such wonderful sound can be obtained from a single 8" speaker.

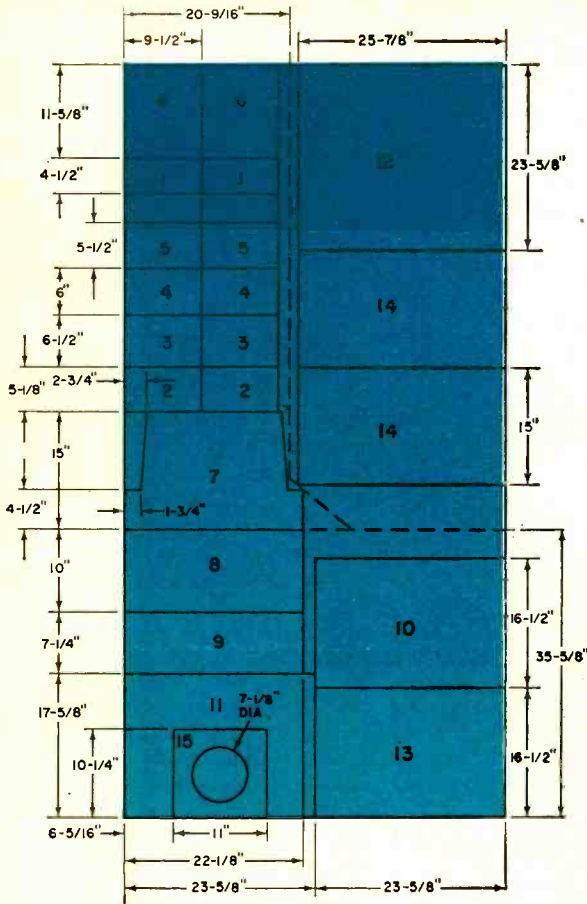
Speaker Enclosure Theory. It's pretty much common knowledge that the greatest problem in designing a speaker system is getting maximum coupling between the speaker cone and the air at all desired frequencies. By way of explanation, a speaker has the job of converting electrical energy into acoustical energy. And, just as important, its enclosure has the task of coupling the speaker to its load—the air.

The enclosure which many audio experts concede to be the best compromise for overall reproduction is the exponential horn. This type of enclosure gives the necessary bass reinforcement, and it does so "musically"—its sound or *timbre* isn't "boomy" like some bass-reflex enclosures or "mushy" like some infinite-baffle types.

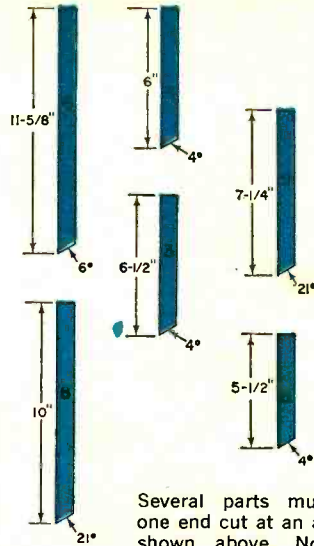
In case you don't agree with these statements, keep in mind that we enter an area that is downright intangible whenever tone qualities come up for discussion. The whole matter boils down to personal preference, since no one is in a position to say what sounds good to someone else's ear (the ear is notoriously unreliable at best, but it remains the only thing we have to hear with). Therefore, it's necessary to compare speaker enclosures on a basis of which one *sounds* best to *your* ear.

But let's get back to that word *timbre*—"the characteristic quality of sound produced by a particular instrument or voice." Singers who achieve wide public acclaim presumably have voices with a pleasing *timbre*. Speakers, too, have their individual "timbre" characteristics, and so do speaker enclosures.

The aim, then, is to bring together a speaker and an enclosure which will complement each other and produce pleasing sounds. Authorities agree that optimum tonal quality will result only when the enclosure is designed with the charac-



A 4' x 8' sheet of 3/4" plywood supplies bulk of parts. For ease in handling, the sheet can be cut into three separate sections, as indicated by the dotted line.



Several parts must have one end cut at an angle, as shown above. Note that there are two identical pieces for Parts 3, 4, 5, and 6, both of which are beveled.

BILL OF MATERIALS

- 1—4' x 8' sheet of 3/4" plywood
- 1—Square yard of grille cloth
- 1—8" hi-fi speaker

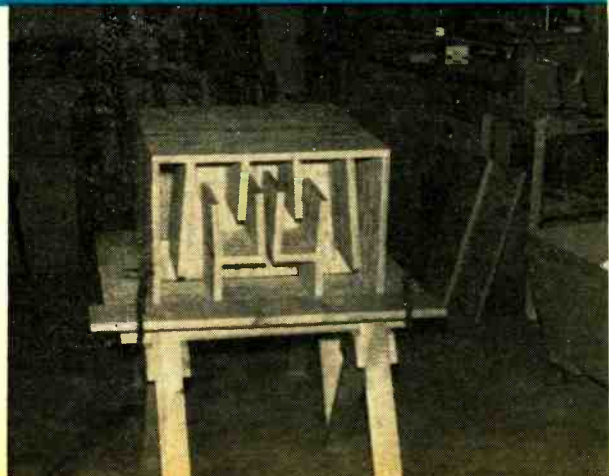
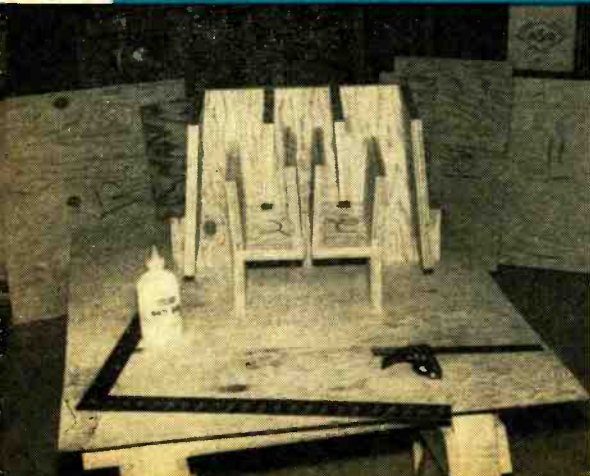
Misc.—Glue, flat-head wood screws, black screen enamel, molding, Formica sheet, etc.

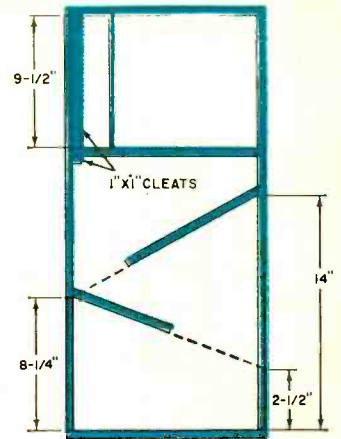
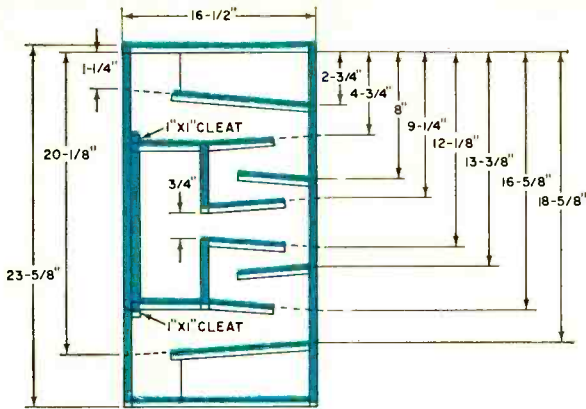
Tools You'll Probably Need

- | | |
|----------------------|---------------------|
| Hand saw | Plane |
| Keyhole or saber saw | Paint brush |
| Screwdriver | Hammer |
| Square | Scissors (or knife) |

A Upper labyrinth is most complicated section of the Mello Monster and the first to be completed. This photo shows it lying face down, with all parts securely glued in place.

B Once the sides (Part 14) have been added, the next step is to attach the back (Part 12). Like every other part in this system, the back must make an air-tight fit with all parts that touch it.

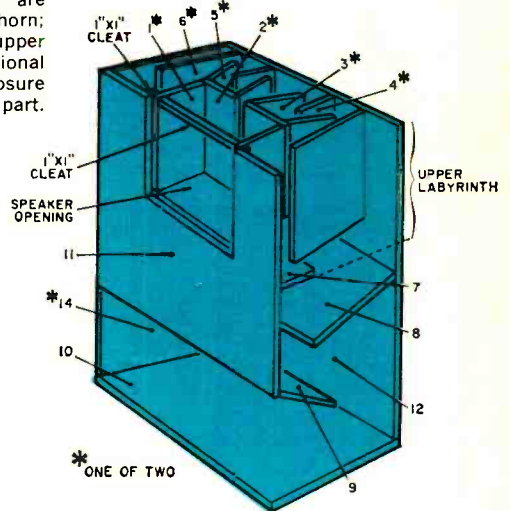




Internal construction of the Mello Monster can be gathered from the drawings on this page. Top view (above) with top of enclosure removed shows how various pieces are angled to approach the flare of an exponential horn; side view (right, above) shows relative location of upper labyrinth and baffle "plates" 8 and 9. Three-dimensional drawing (right, below) with top and one side of enclosure removed, indicates general location of every major part.

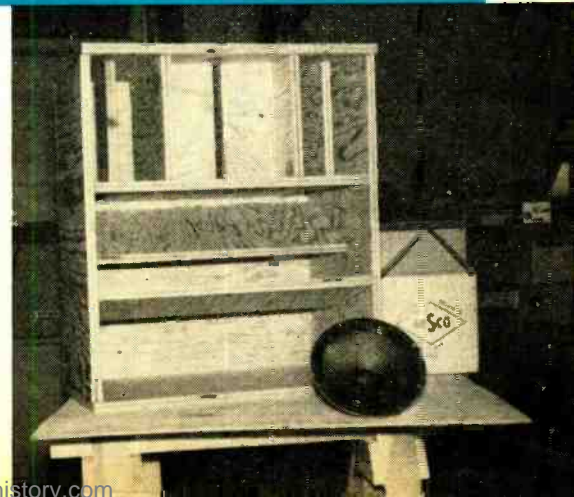
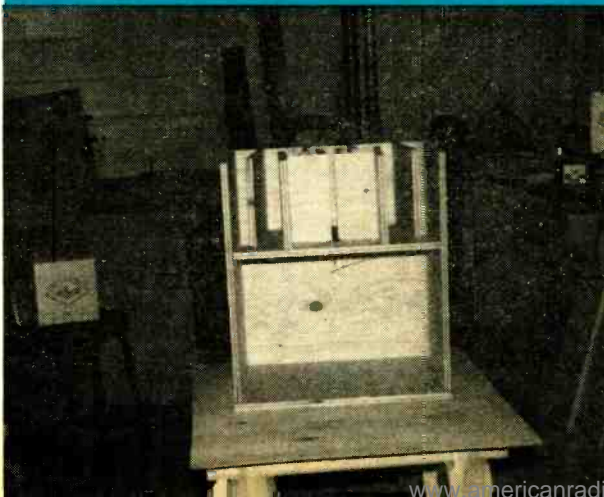
teristics of the speaker in mind. The flux density, the size of the cone, the mass of the voice coil, and so on, all influence the enclosure's design.

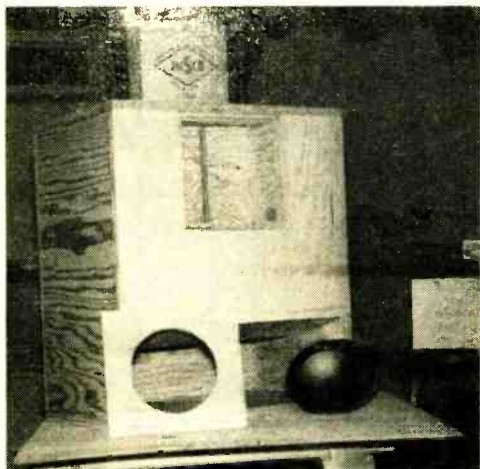
Testing the Theory. The "Mello Monster" described here uses a single 8" hi-fi speaker, and the enclosure has been carefully adjusted to complement the speaker. But we don't mean to imply that this horn is theoretically correct, since, in theory, a port approximately 7' x 9' and a horn as long as 30'



C Set the assembly upright, and you'll see that the Mello Monster is beginning to "take shape." Here, only top (Part 13), baffle "plates" (Parts 8 and 9), and front panel (Part 11) remain to be added.

D Mello Monster is now taking on the appearance of the true "folded-horn" that it is. Author used a F-8-HF speaker made by Minneapolis Speaker Co., but any 8" hi-fi speaker will do.





E With front panel in place, you're ready to install speaker leads. Standard lamp cord makes suitable conductor and can be run to two-terminal, screw-type connector mounted on back of unit.



F Entire front panel (including speaker panel itself) should be carefully coated with black screen enamel to hide various joints behind grille cloth. Take care not to touch speaker with brush.

would be required to reproduce 40 cycles. Obviously, "correct" theoretical design must be compromised to get an enclosure size practical for use in an average room.

And how does the "Mello Monster" sound? Well, this system has been acclaimed by novices who just "liked what they heard," by audiophiles with trained ears, and by professional musicians whose standards of comparison are live performances.

At a hi-fi show in the Midwest, two "Mello Monsters" were placed behind drapes, and people were asked to guess what kind of speaker system they were listening to. Nearly everybody guessed "big speaker" or "multiple speaker" systems. When shown the system in actual use, some wouldn't believe that such sound could come from a single 8" speaker! Some even examined the enclosures very carefully, trying to find the hidden speakers!

Since all who have heard this system agree that it is truly amazing, let's gather the necessary materials together and get started!*

Putting It Into Practice. You can save yourself a good deal of time and trouble by getting a local lumberyard or cabinet

shop to saw all the pieces to size. If you elect to do the sawing yourself, take your time and make sure the parts are exactly the right size. Number the parts as you saw them for ease in identification.

Note that Parts 3, 4, 5, 6, 8, and 9 have one side cut at an angle. Part 15 (the speaker panel) is sawed from Part 11, and the speaker hole is then cut from Part 15. A keyhole or saber saw will be required to saw both Part 15 and the speaker hole.

To assemble the various parts, first collect all the partitions used in the upper labyrinth (two each of Parts 1, 2, 3, 4, 5, and 6). Attach all of the labyrinth partitions to Part 7, using plenty of glue and screws (see Photo A). Add the sides of the baffle (two Part 14's) to this upper assembly, making sure that the tops of the sides and those of the various partitions are flush with one another.

Next, attach the back of the baffle (Part 12), gluing and screwing it to all surfaces that join it (see Photo B). Attach the bottom (Part 10)—see Photo C—and then the top (Part 13), again gluing and screwing all adjoining surfaces. This done, you can install the baffle "plates" (Parts 8 and 9) as shown in Photo D, then the 1" x 1" cleats around the speaker opening. Finally, attach the

(Continued on page 97)

*Full-scale drawings and step-by-step construction details for building the "Mello Monster" are available for \$2.00 a set. Mail your check or money order to Mr. Rould E. Duvvig, 275½ Xenwood Ave., St. Louis Park 16, Minn.

BIONICS

a Weird World

By KEN GILMORE

*Nature is the teacher,
man the student,
electronics the gainer
in this strange
new scientific venture*

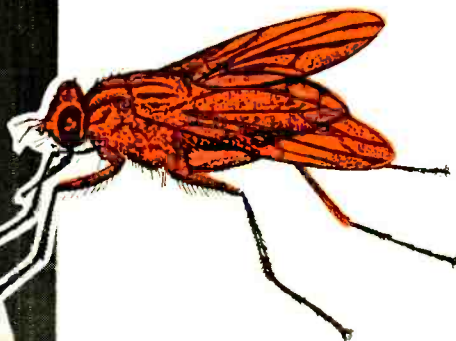
SCIENTISTS who "invented" radar just before World War II found themselves in for a surprise. Shortly after the first successful units went into operation, they realized that their invention wasn't new at all. In fact, it was millions of years old.

Bats, they discovered, had been using their own personal radar systems to steer in the dark before man was even "out of the trees." Had we known as much about bats as we do now, radar and sonar might have been developed decades earlier.

Are there other areas in which we can learn from nature? Researchers in the exciting new field of *bionics*—the science of building electronic circuits that copy living creatures—say there are hundreds, maybe thousands of such areas. Bionics scientists are taking advantage of the fact that through millions of years of trial and error, nature has developed creatures that can perform tasks of unbelievable precision and complexity.

One example: a tiny hummingbird navigates 4000 miles so accurately that he ends up in the same nest he left the season before. A second example: a mosquito can detect the faint buzzing of another a hundred yards away, in spite of howling winds, thunder, screaming sirens, and other ear-splitting





FLY was source of "new" gyroscope developed by Sperry Rand, yet insect's "flight instrument" is 50 million years old!

noises loud enough to drown out a brass band or a fire brigade!

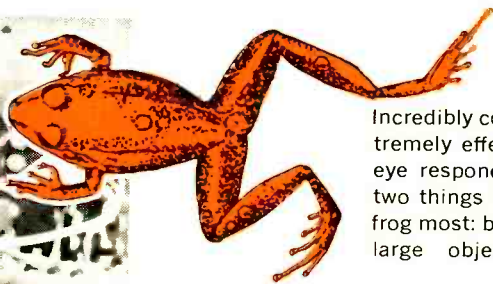
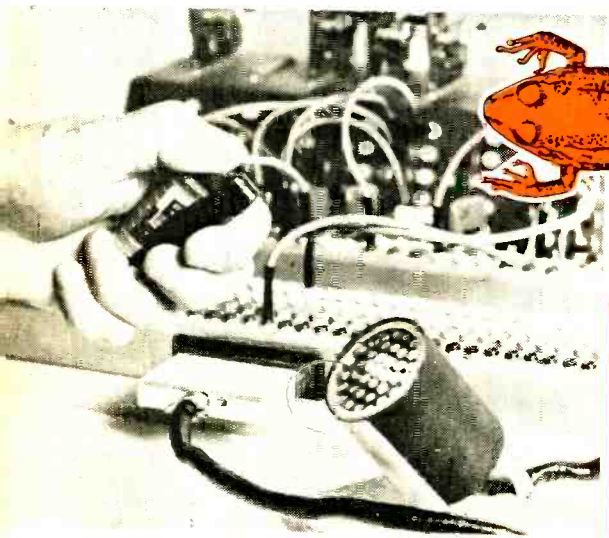
From Beetles to Flies. By studying these creatures and finding out how they perform their seemingly impossible jobs so easily and accurately, bionics scientists are getting clues on how to build better electronic gear. Here's what's already happened.

● Two scientists in Tubingen, Germany, wondered how one kind of beetle, being such a little fellow, could keep such accurate track of his position. They put

the bug in the center of a revolving cylinder so that a moving pattern of lights played over him. And they found that the way he turned depended on the direction and speed of the moving lights. The beetle's eyes—multi-faceted like a cut diamond—could accurately integrate information to judge speed and direction.

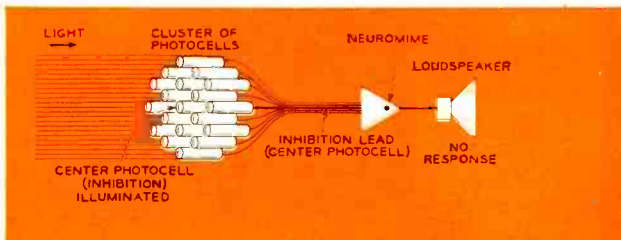
American engineers used the same principle to build an artificial two-faceted eye which can also calculate the speed of moving-light patterns. Put it in a plane, aim it toward the ground, and it becomes a highly accurate new kind of ground-speed indicator.

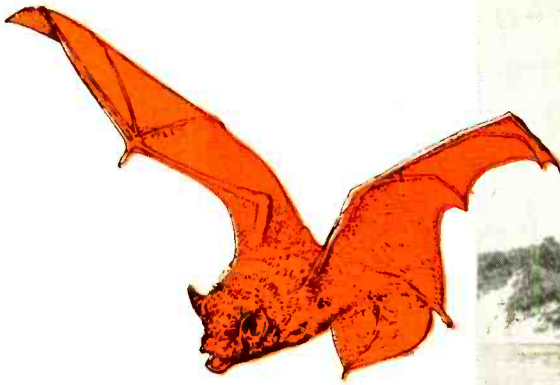
● Why will frogs try to eat anything roughly bug-sized which moves into their range of vision, yet starve to death



Frog's eye

Incredibly complex but extremely effective, a frog's eye responds only to the two things that interest a frog most: bugs (food) and large objects (danger).





BAT has used radar—one of nature's many secrets—for countless centuries, but man stumbled onto the technique only decades ago.



when knee-deep in freshly killed insects? Investigators at M.I.T. moved objects of all sizes and shapes in front of frogs, then recorded their brain waves. Their findings: a frog's eye doesn't see bugs at all. But it is a cleverly designed sensor that detects two things: moving, bug-sized objects within range of the frog's tongue, and large objects—an approaching bird, for example, which might be an attacker. The first signal makes the frog try to eat whatever comes within range; the second sends him hopping for cover. (One scientist pointed out that the frog must also be able somehow to spot objects his own size, or there wouldn't be any more frogs!)

Using the principles learned from the

frog, RCA scientists are building an electronic eye which will be able to spot moving targets and ignore all others. A new kind of radar that will record only important data, and eliminate everything else from the screen, could come out of this work.

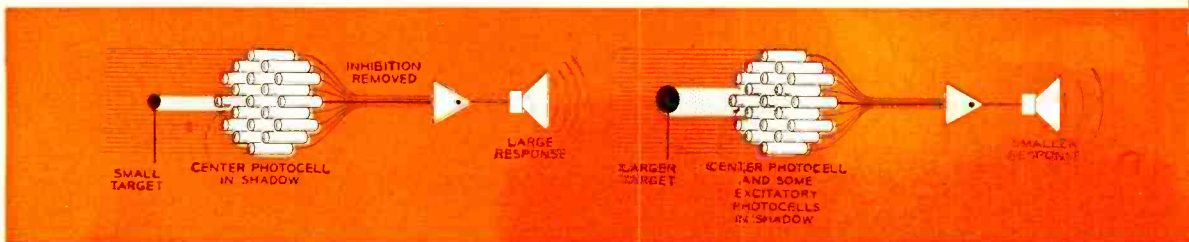
● Scientists at the Rockefeller Institute in New York found that the horseshoe crab was perfectly adapted to seeing in a murky, underwater world. The reason: his eyes automatically make objects stand out more clearly.

General Electric engineers took the basic principle and designed electronic equipment to do the same job. They came up with gear that may help make weak TV pictures from space satellites much

points the way toward new "selective-see" radar

Using a frog's eye as their model, scientists at Bell Laboratories have devised an experimental electronic "bug detector" which may well form the basis of much more important developments. Since the center photocell is connected to the "inhibitory" input, the neuron

will fire only when a small object cuts off the input to this cell alone. Possible outgrowth of the study: a new kind of "selective-see" radar, so discriminatory that it will show only the desired data, eliminate all extraneous material from its screen.





U.S. Air Force

Big hurdle for electronics scientists "copying" nature is in perfecting devices which can "think," just as nature's can. Progress in this area is far from scanty: bionic "mouse" pictured here can learn to run maze just like real mouse. Apparatus in background is bionic mouse's "brain."

sharper and therefore much easier to analyze and interpret.

● At Sperry Rand, engineers wondered how a fly managed to flit around so erratically, yet maintain perfect balance. The answer: flies have two tiny gyroscopes. Unlike our rotating gyros, though, the flies' stabilizers vibrate like a tuning fork. Sperry has built a model about the size of a flashlight for keeping missiles on course.

Jam-Proof Bats. Other scientists are working overtime to uncover scores of natural "secrets" that may give clues toward building more useful equipment. At Bell Labs, workers are trying to find out exactly how a bat's super-sensitive hearing works. We already know about his radar, but they think we may still be able to learn a trick or two from the furry flying mammals.

It's easy to see how a single bat flies into a cave, sends out his personal radar bleeps, and spots obstructions. But bats seldom fly singly. Hundreds—or even thousands—swarm into caves at once, all with their radars going full blast. With thousands of nearly identical echoes bouncing in every direction, how does a bat spot his own?

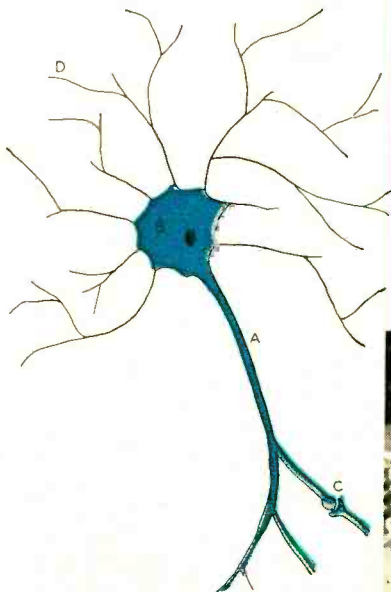
To find out, Bell Labs scientists anesthetize bats, insert tiny microelectrodes into their ear nerves, play recorded bat squeaks, and see what kind of signal the nerve puts out. If they ever find out how the bat makes himself jam-proof, they may be able to apply the same principle to radar.

Insect Guidance Systems. Electronics scientists have done wonders with micro-miniaturization, but Mother Nature makes their efforts seem clumsy. Take navigational gear, for instance. A reasonably accurate guidance system which takes bearings on the moon or stars can be built to fit into an airplane or missile. With latest miniaturization techniques, it may be only as big as a football and weigh hardly more than five pounds.

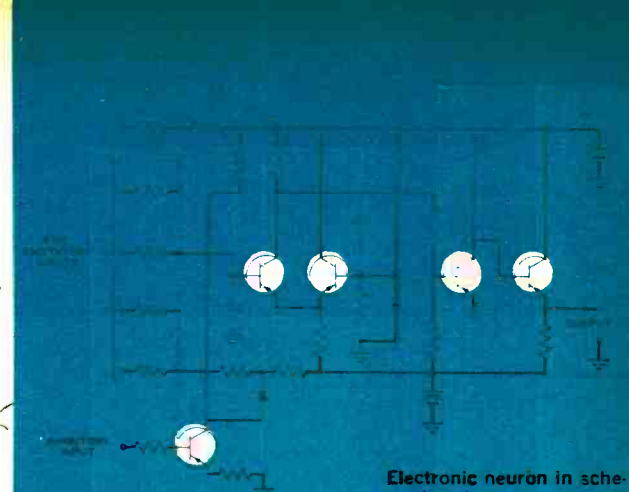
The common sand flea navigates around the beach by taking bearings on the moon, too. Yet his entire navigation system is smaller and weighs less than the period at the end of this sentence.

A gentleman silk moth, looking for his girl friend, spots her a mile away by her aroma. His sensitive smeller detects as little as one or two molecules of scent floating in the air. By comparison, our noses require thousands of molecules before we become aware of even the faintest odor. An electronic nose as sensitive as the moth's would make a dandy gas detector. It could analyze unknown compounds in the laboratory by sniffing them, identify a handkerchief's owner more quickly and accurately than a bloodhound, and detect the first hint of food spoilage long before noticeable or harmful decay could set in.

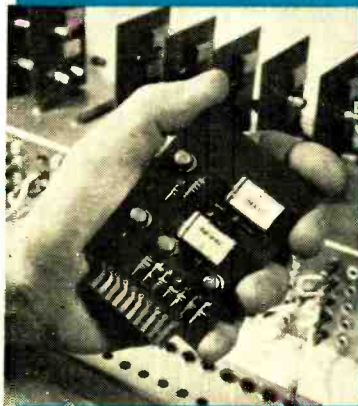
The praying mantis houses a computer of unbelievable speed and accuracy in his match-head sized cranium. The insect's eyes see a bug, and transmit data on the size, speed and trajectory of the flying snack to his brain. Instantly, the



Key "switch" in living creatures is neuron cell. When impulses come in on dendrites (D), body of cell (B) "fires." Output pulse leaves on axion (A), passes along to the next cell via synapse (C).



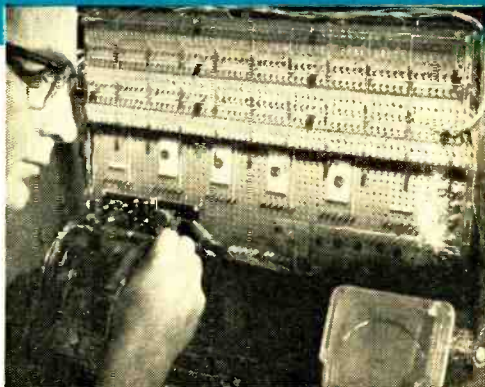
Electronic neuron in schematic above was developed by Bell Laboratories. Works much like natural neuron. When enough signals appear at its five inputs, circuit generates a single output pulse; device requires bigger signal at excitatory inputs if signal appears at inhibitory input. Mounted on printed-circuit board (left), electronic neurons are assembled into experimental networks (one appears in background). Bionic machine (below), built by Ford Motor's Aeronautic Division, uses artificial neurons, can learn to recognize letters of the alphabet.



brain goes into action, processes the information like a gun-aiming computer, and tells him where the bug will be a fraction of a second later. His head shoots out, and the flying bug becomes lunch. The whole operation takes one-twentieth of a second. Our tracking systems, weighing tons, aren't that good.

Neuron Nets. All the projects mentioned so far have to do with receptors; the devices living creatures use to see, hear and feel. But what really gets bionicists excited is the more far-reaching problem: how do they think, reason and learn? With answers to questions such as these, we'll be able to build computers that are not simply souped-up adding machines, but which can reason and learn like living things.

The secrets are locked in the basic nerve cell, the neuron. These tiny building blocks of all living brain and nerve systems, scientists now know, are basi-



cally switches. A neuron has many inputs (perhaps several thousand) and one output. Some of the inputs tend to turn it on—make it "fire" or generate an output pulse. Others tend to keep it from firing. Whether it fires or not depends on the balance of "ons" and "offs" at the inputs at any given moment.

(Continued on page 105)

SPEAKERS GO COLOR-CODED

EIA to investigate new rating system

WHEN a gold diamond beats a blue triangle, what do you have? A new poker game? No, sir; better look again. At long last, a simple system for rating the quality of loudspeakers has come upon the electronics scene. If it is adopted, it should enable you to determine at a glance just about all the important speaker performance characteristics, much like reading color bands on a resistor or the dots on a capacitor.

Methods of measuring a speaker's frequency range, acoustic power producing capacity, transient response, distortion, and other key factors have long been known. The problem is that the speaker manufacturers have not been able to agree on how to present performance data to the user. The sad situation today is that speakers remain the only major components for which no rating data is generally accepted or disseminated.

But the void may soon be filled—if a colored symbol/number system now under consideration by the Electronic Industries Association is adopted.

In the proposed system, eight colors indicate different frequency ranges (in cycles), and these are superimposed on seven symbols which pinpoint power-producing capacity (in acoustic milliwatts) as follows:

Gold	(20-20,000)	Jewel	(5000.0)
Brown	(35-16,000)	Star	(1000.0)
Violet	(45-14,000)	Diamond	(200.0)
Blue	(65-12,000)	Triangle	(50.0)
Gray	(90-10,000)	Bar	(10.0)
Orange	(120-7,000)	Circle	(2.0)
Red	(180-5,000)	Dot	(0.5)
White	(300-3,000)		

Thus, a speaker carrying a blue diamond would have a range of 65-12,000 cycles and would put out about 200 milliwatts.

Accompanying the colored symbol is a number from 1 to 10. This is the performance number. It incorporates the sum of response uniformity, transient response, distortion, sound diffusion, and efficiency or sensitivity. Each of these five characteristics is given a scoring weight of 2.0 points, so a "perfect" speaker would be rated at 10.

Realizing that numbers and response curves don't always add up to a good speaker, Lincoln Walsh, electronics consultant and author of the rating proposal, has included in his scheme a provision for "listening quality." This could affect the technical score by plus or minus one point. Listening quality—the most subjective of all speaker characteristics—would be determined by a six-man panel which would attempt to judge if the speaker sounded better or worse than was indicated by the general performance number.

Two additional features are of interest. First, if the speaker were designed for use in a multiple speaker system, it would be marked woofer, tweeter, or "middler," and would carry a colored symbol stating the high and low ratings, or the range of the complete speaker system for which it has been designed. Second, the proposed rating system could also be applied to imported speakers which, according to latest figures, account for about 40% of the American consumer and industrial speaker market.

—Edward Nanas, WA2HFF

Skeptic Squashing

or Some Thoughts About Taping Off-The-Air

By PHIL GERACI

A FEW MONTHS AGO, the Editor of this magazine told me how valuable he had found SWL tape recordings. And he had proof to back up his statement. During the morning when the capsule "Friendship 7" was in orbit, he monitored and recorded the Mercury Control Network on 15.016 mc. News broadcasts and subsequent commercial discs and tapes *did not* include many exciting moments of this epic event.

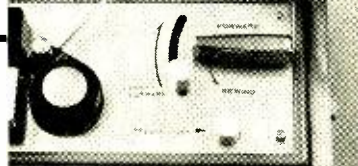
For SWL's, tape offers an ideal way

to refresh a hazy memory, or assemble an interesting demonstration. Tape lets your friends take part in your adventures on the short-wave bands by providing a "live" recounting. Playing a tape of an actual broadcast is much more effective than simply *telling* them about the stations you heard last night, last week, or even last month.

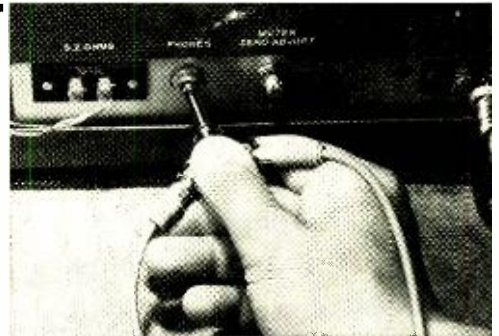
Well-selected sections of tape can be pieced together to make a "library" of your best DX catches—a sort of audible

SOME DO'S

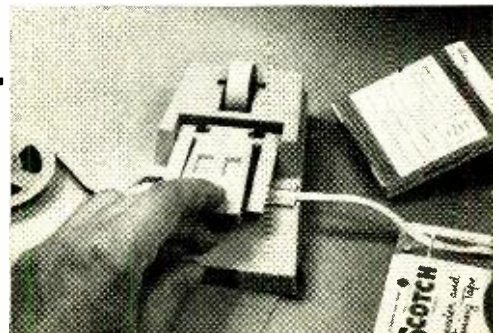
Move tape back and forth over playback head to spot beginning and end of important recorded segments. Mark with grease pencil on tape. ▼



A splicer, leader and timing tape, spare reels, and mailing cartons will all prove exceptionally valuable. ►



▲ Special connectors are available to solve difficult monitoring problems. This is a "Y-connector" for phones and recorder.



file to be stored alongside your QSL's. It will be proof positive of how well the signals were received—not just a mere boast.

Getting Started. To make a tape recording, a recorder (plus some tape) is all the extra equipment you'll need—at least at first. Later, you may want to broaden your sights and attempt live recordings and special effects. The cost of a tape recorder is a reasonably accurate guide to its potential performance, although there are some pitfalls that should be carefully avoided.

Don't seriously consider the ultra-cheap, transistorized pocket recorders. Most of these recorders aren't compatible as far as speed is concerned. In other words, while you *can* use these devices to play back your own recordings, you will find it impossible to exchange tapes with friends, or to send an important tape overseas for verification.

Since a tape recorder is a long-term investment, usable for a wide variety of things, give consideration to getting the most for your dollar. Once you have the habit of recording your DX, you may want to try connecting your recorder to your hi-fi system and even recording FM-stereo off-the-air. Or, you may want to engage in tape-correspondence with fellow SWL's. Language and musical instruction are also possibilities when you

have a good grade of tape recorder.

Be sure the recorder you buy has the following basic features: (1) at least two speeds (3¾ and 7½ ips); (2) two-track record, and two-track as well as four-track playback; (3) a recording volume level indicator—either a meter or some type of “glow” tube; (4) output connections for headphones or an external speaker; (5) several input connections (labeled “Microphone,” “Tuner,” and/or “Hi-Level”); (6) fast forward, as well as fast rewind; and (7) a reel rotation counter.

Some bonus extras that are desirable but not really necessary are: monitor-while-recording connections; a third speed (17/8 ips); and four-track record.

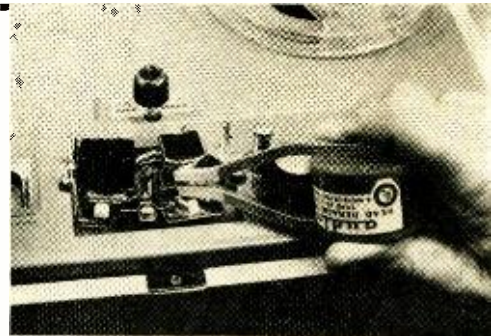
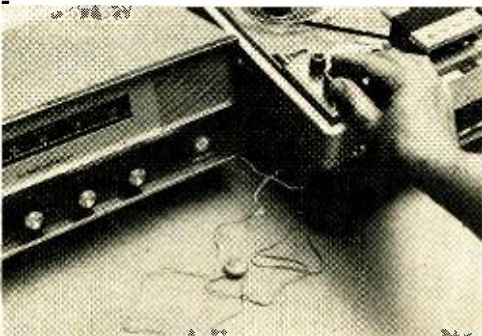
Making a Recording. Generally speaking, you can connect the tape recorder to the headphone jack on your receiver. Pull the phone plug and insert a cable (usually supplied with the recorder) between the headphone jack and the “Hi-Level” input on the recorder. Then plug the headphones into the recorder's output jack.

Adjust the output of the receiver, as well as the level control on the recorder, until you achieve a good swing of the recording level meter or flicker of the indicator lamp. The meter needle, or flicker, should reach maximum on only

(Continued on page 100)

--- SOME DONT'S ---

This is NOT the way to demagnetize tape playback heads. Hold the demagnetizer straight “up and down” so that the gap between the poles is lined up with the microscopic gap in the tape head. As a rule of thumb, heads should be demagnetized at least every three to four months.



◀ Balance the volume level by juggling both the receiver and tape recorder controls. Preset one to give you sufficient leeway to counteract sudden blasts of noise and signal. Don't set the receiver level too low and the recorder too high, as this will make the recordings excessively noisy.



On the Citizens Band

with **DICK STRIPPEL**, 2WI452, CB Editor

LATE THIS MONTH, when sports cars snarl and snort at the annual Reading, Pa., road race, the radio communications vital to the accurate timing and scoring of this event will be provided by the Qui-Co Radio League.

As those readers who are sports car enthusiasts know, a road race is *not* a hot-rod drag race! Rather, it involves following and completing a set course according to the times established by the judges. A driver who misses a check point by a few seconds could lose the race.

Therefore, the timing and scoring of the judges must be extremely accurate. Two-way radio helps provide the needed accuracy.

This particular meet, sponsored by the Eastern Pennsylvania Sports Car Club and sanctioned by the national Sports Car Club Assn. (SCCA), will be held at the Reading Municipal Airport October 20-21. All proceeds will be donated to the Reading Police Athletic League.

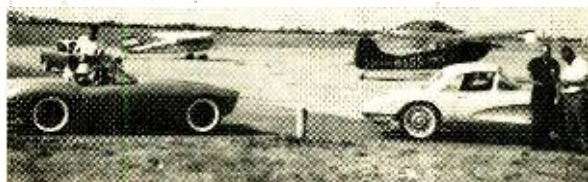
In top photo at right, Fred Kercher, KCC0853, a director of the Qui-Co Radio League, starts a trial run for the sports car road race to be held at Reading, Pa., this month. In photo at bottom, two other Qui-Co'ers, Dick Fegley, KCC0981 (far left), and Bud Conrad, KCC0175 (right) chat with two of the drivers about the role two-way radio plays in the timing and judging of the race.

The Qui-Co Radio League is, of course, furnishing its services free.

This is not the first time that the Qui-Co'ers (encompassing the Berks, Montgomery, Chester, Lancaster, and Lebanon counties in Pennsylvania) have been called upon to perform in a professional, businesslike manner. Recently, they provided back-up communications for a drill held by a local Air Force Reserve unit which lacked radio facilities. As a result of their participation, the unit's performance was rated very high by national standards.

Quite frequently, members of the club fan out over the city of Reading, according to a well-planned routine, and try to locate a preselected person or an automobile by description alone. Several months ago, this training paid off when the club was asked by local police to help locate an escaped mental patient who was capable of violence. One of the club members spotted the man and kept him under surveillance until the authorities arrived.

The president of this dynamic, growing club is Bob Hoffman, Jr., 3W3906. His





Chief of police of Reading, Pa., Charles S. Wade (at the left), and Bob Hoffman, Jr., 3W3906, president of the Qui-Co Radio League, discuss the League's participation in the city's emergency communications and law enforcement activities.

father operates a radio and TV service shop, so the younger Hoffman has been exposed to electronics since birth. When CB began, both were among the first to be licensed. Actually, Bob, Sr., was the driving force behind the formation of the club in 1960.

At that time, the CB population of the five-county area numbered exactly ten, all of whom joined. Now, two years later, the Qui-Co Radio League boasts 96 general members and 33 associate members (wives, children, and other operators of a licensee's equipment).

Running a club of this size is no penny-ante affair. This year's budget topped \$2000.00. The major source of income, of course, is dues—50 cents a month, after a \$1.00 initiation fee.

Socializing at picnics, card parties, and barbecues constitutes most get-togethers. Business meetings, however, are just that, but take on an added meaning since they usually are held at various local manufacturing plants. After the formal part of the meeting, a plant tour with company officials, followed by a refreshment session (paid for by the club), winds up the evening.

The Qui-Co Radio League's multi-page monthly bulletin, *Qui-Co News*, has a mailing list of some 500 CB'ers. It's a professional job throughout. The front page and other pages using art or photography are printed by a local lithographer, while the remainder of the bulletin is mimeographed. The president's

brand-new bride, a crackerjack secretary, does all the typing. Other clubs interested in receiving the *News* should write Bob Hoffman, Jr., at 1748 Centre Ave., Reading, Pa.

Your CB Editor was privileged to be in Qui-Co-land at the time of the club's annual summer clambake, and it was an affair we'll remember for a long while. It was held on a private estate 10 miles north of Reading. The members, their wives, plus yours truly and his wife, all had a thoroughly enjoyable time downing clams, chicken, lobster, and liquid refreshments.

We think it's possible that the club's various social activities also serve as balm for non-CB-oriented wives of members, because other club activities take up quite a bit of the members' free time. In addition to the activities already mentioned, Qui-Co has aided local authorities by providing communications for simulated disasters and even a mock evacuation of Reading.

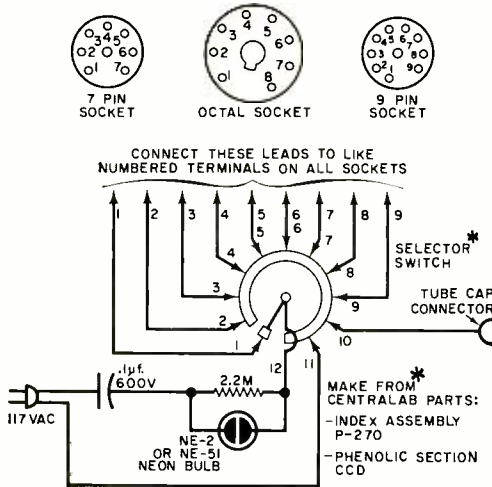
Our hats are off to the officers and directors of the Qui-Co Radio League for imaginative and purposeful leadership, and to its members for their continuing interest in this growing organization—truly one of the most active CB clubs we have ever seen.

Tech Topics. Contrary to talk heard in many circles, a short, direct ground lead from your transceiver will not help your output at all if you use a ground plane, coaxial, or similar antenna which is *properly matched* to your transceiver. Reason? Both of these antenna types, plus just about any commercial sky-hook, has its own "ground reference" for radio signals. Your only need for a ground is to keep the rig safe should a power-line filter fail. This could make the entire transceiver "hot" and cause a fatal shock if you touched it and a good ground at the same time.

As long-term licensees will agree, the vast majority of transceiver faults are due to either burned-out or "shorted" tubes. Since many transceivers designed for 6, 12, and 117 volts use a complicated series/parallel hookup for tube heaters, two or more tubes may fail to light when only one tube "goes West." A simple filament checker, obtainable from your parts distributor, or possibly at your local drug store, will spot the real culprit

easily. Alternatively, you can build a simple shorts-filament checker; the accompanying diagram shows how to hook it up.

Basically, this checker is nothing more than a group of tube sockets (use one



for each base type found in your rig), a selector switch, and a neon indicator. Wire all the same-numbered pins in parallel with the points of a 10-position rotary switch so that all pins *numbered one* will be selected by *position one* of the switch. Then connect up the capacitor, resistor, and neon bulb with the power line and switch "ring."

To use the filament checker, consult your tube manual. Set the switch to the position which corresponds to a heater pin, and if the heater is okay, the neon bulb will light. If the bulb lights in any

other position of the switch (check the manual for internal connections—one element to two pins), the tube has a "short" of up to three megohms, and should be replaced.

Club Notes. The Rebel Communications Association (P.O. Box 1467, Marietta, Ga.) celebrated its first anniversary recently. Just one year ago, a handful of CB'ers met at the base of Kennesaw Mountain and formed the first CB association in the area. Now it has grown to 54 members and is still expanding. . . . Every member of the Puget Sound Mobile-Marine CB Club holds a Red Cross first aid card. Their training paid off recently when a member gave mouth-to-mouth respiration to a child in her care who suddenly turned blue. Other members have assisted the state police on several occasions, and the club appears to be one of the few we've seen where the gals really take an interest. One is vice president, another secretary-treasurer. . . . The Southern California CB Assn. (P.O. Box 17296, San Diego 17, Calif.) has established a TVI committee which averages two or three calls per month. The committee will provide a low-pass filter for offending members at slightly above cost—the profit goes to the club's treasury.

Keep the club news coming. If you haven't already put P.E. on your news letter's mailing list, please do. In addition, if your club does something newsworthy, let us know about it *right away*. And . . . don't forget to send in pictures! Any good, clear, black-and-white shots will be fine.

-30-



The Carroll County (Ill.) Sheriff Radio Patrol is one of the few CB organizations boasting a totally deputized membership. These men provided security and information service at the Midwest National Jamboree sponsored by the Tri-County CB Radio Club at Milledgeville, Ill., in August. Bob Johnson, of Lanark, Ill. (front, center), is the leader of the group.

A Ham



"Just because I had a little tough luck with birdhouses and bookends..."

"Now, for \$64,000.00, what operating characteristics distinguish the electron-coupled type oscillator with regard to frequency stability?"



"One more 'dit-dah-dit', and I'll let ya have it!"

"I am NOT a toaster-fixer ... I'm a radio technician!"



in the Making

By **BILL HUTCHISON**

"He overheard someone refer to him as a 'lid'!"



"Someone actually answered **Wm**."



"No, I'm not after a license . . . I want to know what he's saying on that contraction!"





Equipment Report

VOCALINE Commaire PT-27

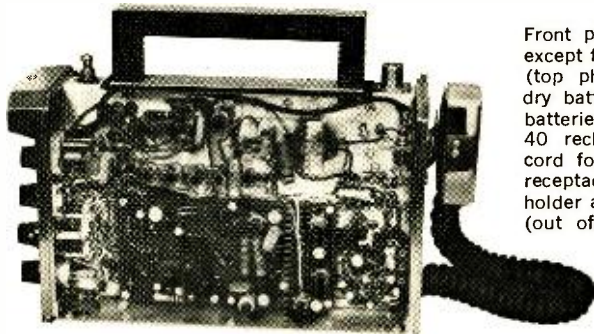


FOR far too many CB'ers, two-way communications comes to a halt at the end of the line cord for "fixed" stations and at the road's end for mobile units. Not so with the self-powered "Commaire" PT-27 introduced by Vocaline Company of America (Old Saybrook, Conn.). Priced at \$250.00 (list, less batteries), the Commaire is a truly professional 4-channel CB transceiver—with built-in AM radio—which packs 18 transistors, 8 semiconductor diodes and two tubes in a 9" x 4" x 11" case. It weighs only 11½ pounds—including the rechargeable batteries.

Considering the Commaire's complete "totability" over any terrain, the 1-watt input to the final r.f. amplifier is more than a CB'er would look for. Add to this two adjustable pi-network controls on the front panel, along with an r.f. output meter, and you can expect to squeeze most of the r.f. power into the antenna where it belongs. Of the three filaments in the PT-27, two are in the 3V4 tubes in the transmitter circuit (the other is in the front-panel dial lamp).

In the "receive" mode, the PT-27 pulls in any one of four fixed channels, tunes the entire CB dial—or your favorite AM radio station for news and weather. Noise limiting and squelch controls make CB contacts readable above channel noises. In "fixed tune," a fine tuning control lets you zero in on stations that are a few hundred cycles off frequency.

If you are the vagabond type that troops over hill and dale, or if you like to sail about in a small boat, the Commaire PT-27 may be just the CB transceiver for you to tote along. —30—



Front panel of PT-27 mounts all controls except function switch and tuning knob dial (top photo). Eveready 560 rechargeable dry batteries fit easily in unit's base; the batteries are good for 30 hours and up to 40 recharging cycles are possible. Line cord for charging connects to rear panel receptacle; rear panel also mounts mike holder and phone jack. Note 16 transistors (out of 18) visible in guts of receiver.

2-TUBE -METER

By CHARLES GREEN, W3IKH

SUPERREGEN

Ideal for the new Novice, this easily built set has its own power supply, drives speaker

THIS simple 144-148 mc. receiver is a natural for Novices who want to get in some 2-meter phone operation. Both inexpensive and sensitive, it also makes a fine "extra" set for the seasoned ham.

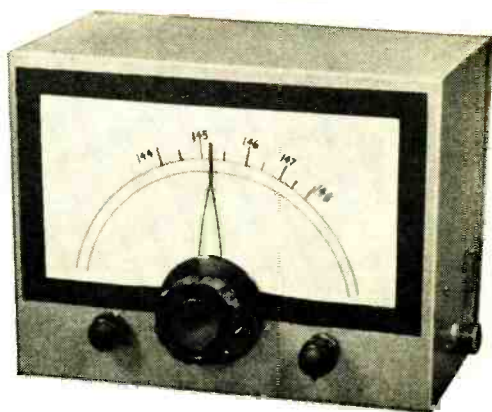
The receiver uses two tubes (one of them dual-purpose), and has a stage of r.f. amplification, a superregenerative detector, and an audio amplifier which delivers enough power to operate a speaker. Like all VHF circuits, this one requires careful construction, but even the inexperienced builder should have little trouble if he follows directions closely.

About the Circuit. Signals from antenna jack *J1* are fed to half of a 6BZ7 dual triode (*V1a*). This triode acts as an untuned r.f. amplifier and also isolates superregenerative detector *V1b* (the other half of the 6BZ7) from the loading effects of the antenna.

Coil *L1* and capacitors *C4* and *C5* select 2-meter signals from the output of *V1a*. Capacitor *C4* is the main tuning control; *C5* serves as a "band-setting" adjustment control.

Potentiometer *R5* varies the plate voltage to *V1b*, acting as a regeneration control. The signal from *V1b* is amplified by *V2* (a 6AK6) and passes, via output transformer *T1*, to speaker jack *J2*. Potentiometer *R6*, in *V2*'s grid circuit, is the volume control.

Operating voltages for the circuit are supplied by power transformer *T2*. Diode *D1* is connected as a half-wave rectifier,



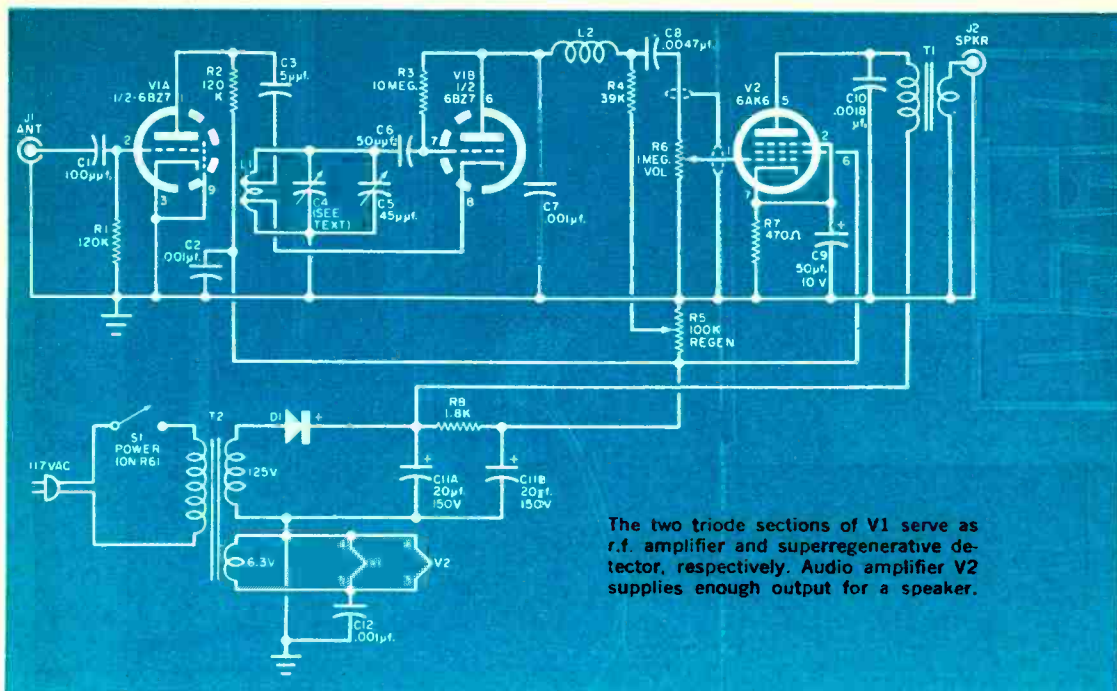
with capacitors *C11a* and *C11b* and resistor *R8* doing the filtering.

Construction. The receiver is housed in an 8" x 6" x 4½" utility box with most of the components mounted on an 8" x 4¾" "shelf" made from ¼" pegboard. Begin construction by cutting the shelf and mounting it about 2¾" above the box bottom via a set of angle brackets (see photo of interior). Place a "box ground lug" under the mounting screw for the left rear corner of the pegboard (see pictorial diagram).

Install the components on the box and pegboard in the positions shown in the photographs and pictorial. Ground lugs must be installed under both of the mounting screws for *V1*'s socket and one of the mounting screws for *J1*, *V2*'s socket, *T1*, and *T2*, respectively.

Be sure to remove *C4*'s rear rotor plate before installation. This will change the maximum capacitance from 11 μf . to the required value of about 5 μf .

When carrying out the wiring, try to duplicate the layout illustrated as closely as possible. This is particularly important for the connections associated with *V1* and the tuned circuit *L1/C4/C5*. Notice that one terminal of *C5* is con-



The two triode sections of V1 serve as r.f. amplifier and superregenerative detector, respectively. Audio amplifier V2 supplies enough output for a speaker.

nected to the stator terminal of C_4 by a lead $1\frac{1}{2}$ " long; the other is soldered directly to the rotor terminal of C_4 . Construction specifications for coil L_1 are given in Detail A.

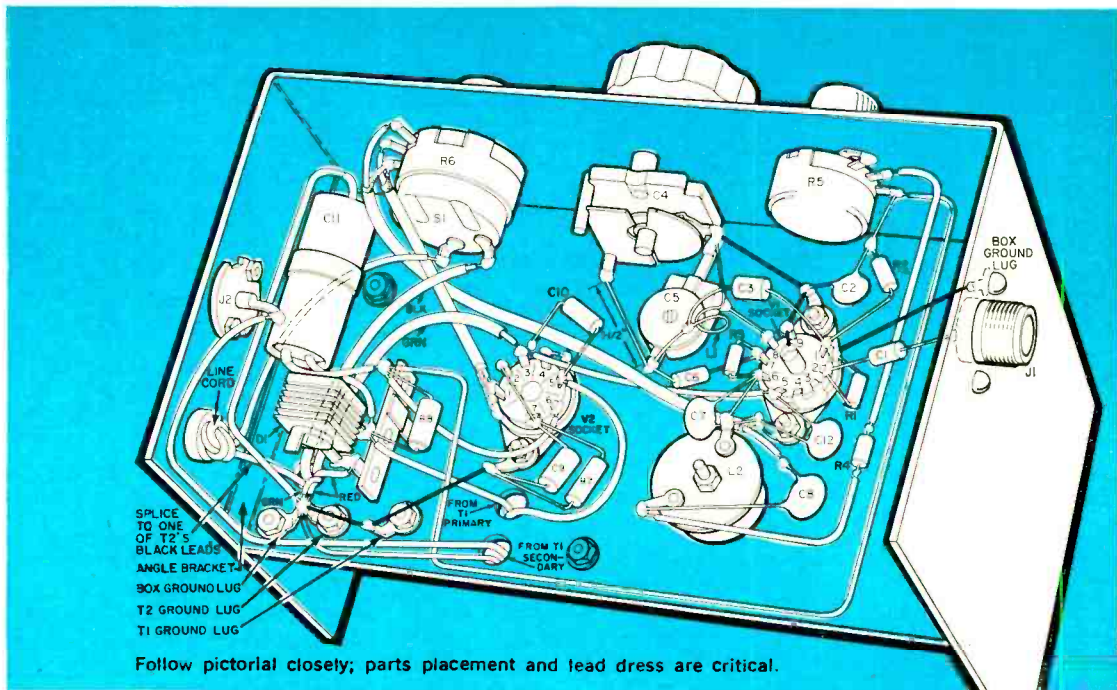
Since the circuit is built on a non-conducting surface rather than a metal chassis, the grounding arrangement is particularly important. Two ground-bus systems (the solid black wires on the pictorial diagram) are used. One runs from the "box ground lug" near J_1 to the frame of V_1 's socket, and from there to the rotor terminal of C_4 . The other starts at the "box ground lug" at the left rear corner of the pegboard, grounds the frames of T_1 and T_2 , then runs to the frame of V_2 's socket.

The author attached a long wire pointer to the rear of the control knob for C_4 . A dial scale was then laid out on white paper and taped to the box. If you prefer, you can use a commercial dial.

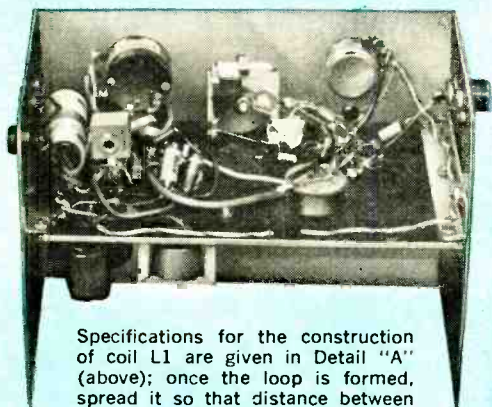
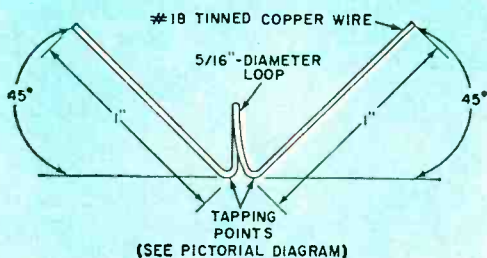
Testing and Calibration. Connect a 3-4 ohm speaker at jack J_2 and turn on the receiver. Move volume control R_6 to its "maximum" position and rotate regeneration control R_5 until you hear the typical superregenerative hiss. The posi-

PARTS LIST

- C1—100 μ f. } 1000-volt
- C2, C7, C12—0.001 μ f. } ceramic
- C3—5 μ f. } capacitors
- C4—Tuning capacitor (E.F. Johnson 167-1 with rear rotor plate removed)
- C5—45- μ f. ceramic trimmer capacitor (Centralab 822-BN or equivalent)
- C6—50- μ f., 1000-volt ceramic capacitor
- C8—0.0047- μ f., 1000-volt ceramic capacitor
- C9—50- μ f., 10-volt electrolytic capacitor
- C10—0.0018- μ f., 1000-volt ceramic capacitor
- C11—Dual 20- μ f., 150-volt electrolytic capacitor
- D1—65-ma., 380-PIV selenium rectifier (I.T.T. 1234A-H or equivalent)
- J1—Chassis-type coaxial receptacle (Amphenol 83-1R or equivalent)
- J2—RCA-type phono jack
- L1—Tuning coil—see text
- L2—100-mh. r.f. choke (J.W. Miller 960 or equivalent)
- R1, R2—120,000 ohms } $\frac{1}{2}$ -watt
- R3—10 megohms } resistors
- R4—39,000 ohms
- R5—100,000-ohm potentiometer
- R6—1-megohm potentiometer (with switch S1)
- R7—470-ohm, 1-watt resistor
- R8—1800-ohm, 2-watt resistor
- S1—S.p.s.t. switch (on R6)
- T1—Output transformer; primary, 10,000 ohms; secondary, 4 ohms (Stancor A3879 or equivalent)
- T2—Power transformer; primary, 117 volts; secondaries, 125 volts @ 15 ma., 6.3 volts @ 0.6 ampere
- V1—6BZ7 tube
- V2—6AK6 tube
- 1—8" x 6" x $4\frac{1}{2}$ " utility box (LMB 146 or equivalent)
- 1—8" x $4\frac{3}{8}$ " section of $\frac{1}{8}$ " pegboard
- Misc.—Line cord and plug, knob, tube sockets, angle brackets, #18 tinned copper wire, etc.



DETAIL A



Specifications for the construction of coil L1 are given in Detail "A" (above); once the loop is formed, spread it so that distance between "tapping points" is 1/8-inch. Photo shows interior of the completed set.

tion of $R5$ at which this occurs will give you highest sensitivity and may vary with the frequency to which the receiver is tuned.

Once you've established that the set is regenerating, proceed with the calibration. Ideally, the output of a signal generator should be fed to the receiver and $C5$ adjusted so that the 2-meter band falls within the range of $C4$'s dial. The dial can now be calibrated using the signal generator as a reference.

If no signal generator is available, try placing another 2-meter receiver next to the one you've just built; it will pick up the radiations from the superregenerative detector, thus indicating the frequency being received at any setting of $C5$ and $C4$.

In the absence of both a signal generator and extra receiver, you can locate the 2-meter band by connecting a good antenna to jack $J1$ and adjusting $C5$ until you pick up the greatest number of ham stations within the range of $C4$.

To operate the receiver, just set $R6$ for a comfortable volume and keep adjusting $R5$ to its most sensitive position as you tune across the band with $C4$.

Hi-Fi Lab Check



EICO MX99 Multiplex Autodaptor

Manufactured by EICO Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, N.Y.

Prices: \$39.95 (kit); \$64.95 (factory-wired); \$2.95 (metal cabinet cover).



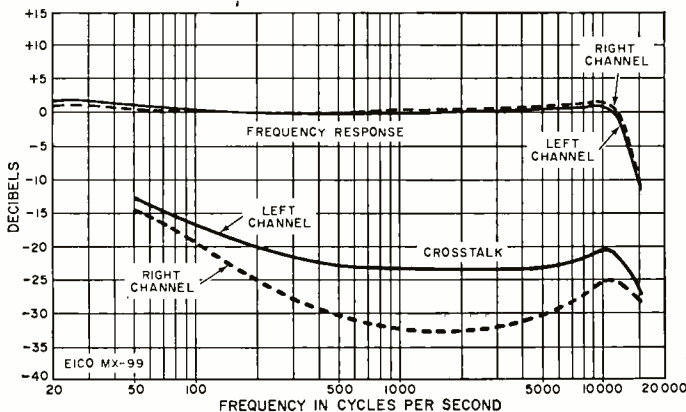
If you're one of those hi-fi fans with a superb FM tuner whose only fault is that it doesn't contain multiplexing provisions, then an adaptor is your best bet. Since practically every good FM tuner manufactured after 1959 has a "multiplex output" jack, an adaptor enables you to switch to FM multiplex re-

ception with a relatively modest investment in time and money.

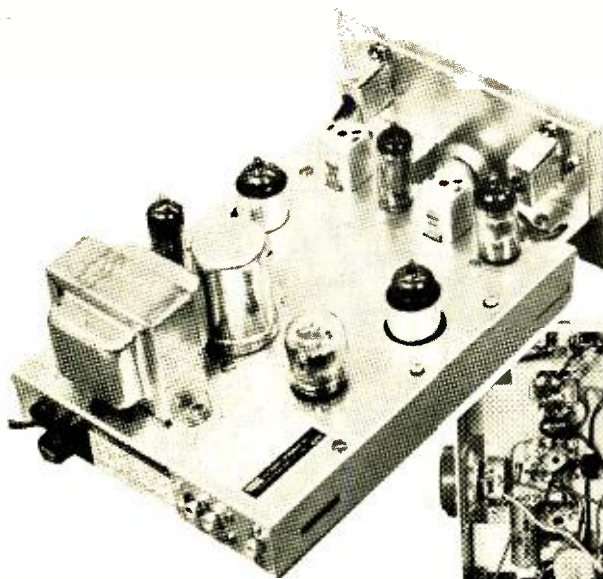
A very good example of what an adapter should be is the EICO MX99. Utilizing a printed-circuit board to hold and position the most critical circuitry, the MX99 can be completely assembled in just under nine hours. It is small (measuring $3\frac{7}{8}$ " x $6\frac{3}{8}$ " x $9\frac{1}{8}$ ") and very light in weight (7 lb.). The metal cover is optional, since many stereo fans may want to mount the adaptor in a convenient spot close to the FM tuner.

No difficulties were encountered in assembling the MX99, although it is a "you-do-everything" type of kit (except for the printed circuit). The assembler should note, however, that a nut driver is required to seat potentiometer R-31, since it cannot be reached with a pair of ordinary pliers.

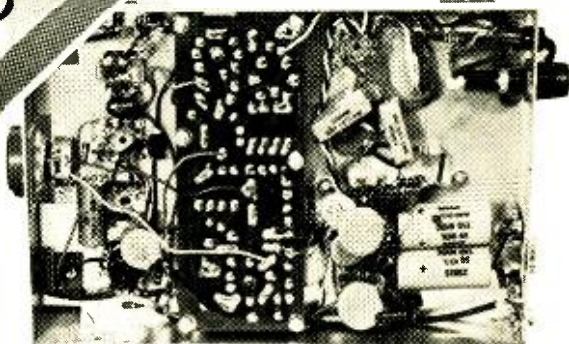
CIRCUIT REPORT: The MX99 is self-powered and equipped with a stereo indicator light that automatically comes on



The input composite signal level for the tests made was 0.6 volt, and capacitor C-25 was removed from the unit as indicated in the instruction manual. Crosstalk curves shown here reflect an optimum setting of the separation control for the right channel.



Clean layout of the MX99 is obvious from these photos; printed-circuit board is visible in underchassis view. The adapter's six tubes include three multi-element varieties involving at least 10 tube functions.



when a stereo broadcast is in progress. The MX99 delivers two-channel stereo to the preamplifier only when the stereo light is on and the *MX stereo* switch is set at "Normal." At all other times, the main channel mono program is delivered to both output channels. The unit's input is designed to match EICO's FM tuners, but it is readily adapted to other FM tuners through the removal of capacitor C-25.

Five tubes are used in the MX99, plus a 6X4 full-wave rectifier. The circuit seems to be an original EICO development that keeps phase shift at a minimum through the elimination of some filters. The design, however, suppresses the 67-kc. background music carrier, and removes all potential harmonics from the reinserted 38-kc. subcarrier and 19-kc. pilot carrier. As a result, the manufacturer states that this adapter can be used with a tape recorder without fear of introducing beat notes from the bias oscillator and 38-kc. subcarrier.

HIRSCH-HOUCK LAB CHECK: The manufacturer makes no awe-inspiring claims for the MX99 adapter, but simply states that a crosstalk separation of 30 db is "typical." This was substantiated in

laboratory checks. A slight readjustment of the *Separation* control allows approximate matching of the crosstalk curves—about midway between those plotted in the accompanying graph.

Distortion introduced by the MX99 is quite low, being less than 0.7% at 1.8 volts r.m.s. output (rated maximum). The multiplex circuits operate with pilot carrier levels of 0.035 volt or more, corresponding to a 0.35-volt composite signal. Audio response is notably flat from 20 cycles to 11,500-12,000 cycles. The sharp cutoff above 12,000 cycles is apparently deliberate and not likely to be noticed in use.

As with other adapters, the *Separation* control is difficult to adjust while listening to stereo programs. (FM stations transmitting multiplex would do well by their listeners if they would broadcast left/right "balance" tones several times each day.) To some extent, separation will vary with signal level.

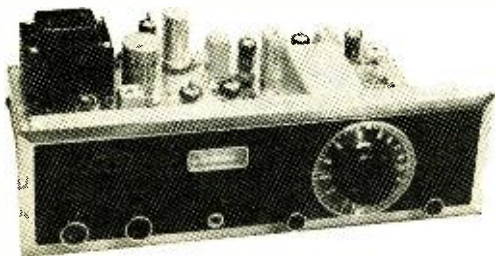
IN CLOSING: The MX99 is an outstandingly good buy at its modest price. Performance-wise, it is head and shoulders above adapters costing less, and equal to or better than numerous adapters costing up to twice as much.

(Continued on next page)

Scott LT-110 FM Tuner

Manufactured by H. H. Scott, Inc., 111 Powder Mill Rd., Maynard, Mass.

Prices: \$159.95 (kit); \$22.50 (walnut or mahogany cabinet); \$13.95 (metal cabinet with leatherette finish).



NO COMMENTARY on *Scott Kits* would be complete without first mentioning that this company pioneered new areas in the hi-fi kit market and brought forth several (then-radical) innovations. One of them continues to fascinate all purchasers of a *Scott Kit*—the full-color instruction manual. Carefully matched to each colored wire and component within the kit, this manual renders the possibility of even the most inexperienced builder making a mistake rather remote.

Scott also pioneered the *Kit-Pak*—a shipping container which serves as a temporary workbench and storage box. Thanks to the *Kit-Pak*, the builder can put the uncompleted kit away overnight without worrying that something will be missing the next day.

The LT-110 FM tuner is delivered with all tube sockets and tie points riveted in place, the power transformer and tuner front end mounted, and the multiplex demodulator section completely wired. Facing the assembler are 17 steps—including alignment and minor mechanical operations.

As proof of the above statements about ease of assembly, a test model of the LT-110 was wired at POPULAR ELECTRONICS in just under five hours. Another 40 minutes was used for careful alignment and the tuner was "on the air."

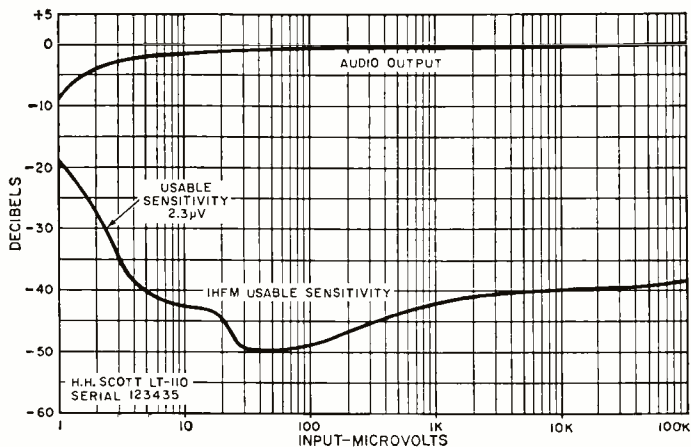
CIRCUIT REPORT: Like most Scott FM tuners, the LT-110 employs the proven-in-practice, shielded, silver-plated front end, with a 6BQ7A cascode r.f. amplifier and 6U8 mixer/oscillator. This section of the tuner is shipped prealigned and thoroughly tested. Following this section are two 6AU6 i.f. stages, a single 6AU6 limiter, and a ratio detector.

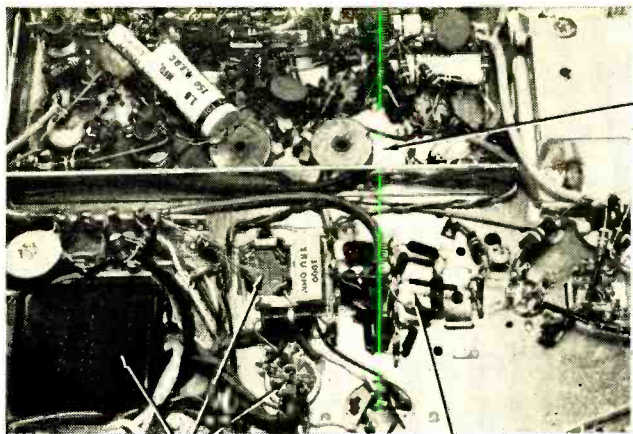
The 4-tube multiplex demodulator used in the LT-110 is factory-wired and aligned. The assembler simply solders appropriate connections to the demodulator and doesn't otherwise touch any of the circuitry.

Output jacks from the LT-110 are paralleled so that a tape recorder and amplifier can be driven simultaneously. For stereo headphone listening, a special 3-circuit output jack has been mounted on the front panel.

HIRSCH-HOUCK LAB CHECK: The LT-110 met or exceeded all the manufacturer's detailed specifications on sensitivity, dis-

Maximum output of the LT-110 FM tuner was measured at 2.1 volts. The usable sensitivity curve plots total hum, noise and distortion, as referred to 100% modulation.





PREWIRED MULTIPLEX

RECTIFIER COMPONENTS

RATIO DETECTOR

All of the "nasty" wiring in the multiplex demodulator section is done at the factory. The assembler wires the rectifier, i.f. stages, and front panel connections.

tortion, output level, a.c. hum, and capture ratio. Audio frequency response on stereo reception is within the manufacturer's rating from 20 cycles (not shown on graph) to above 12,000 cycles. At this point there is some minor falling off (about 2.5 db at 15,000 cycles) but this slight loss is considerably under that exhibited by most FM stereo tuners. In "Mono," the audio response is excellent, being within ± 1 db, from approximately 20 to 16,000 cycles.

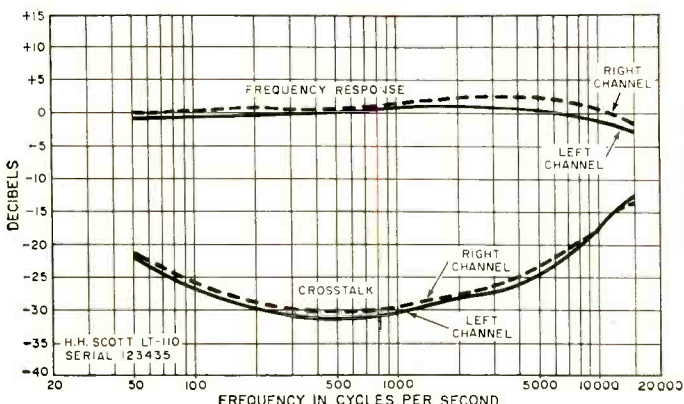
Channel-to-channel crosstalk is particularly excellent both in terms of uniformity and the fact that it holds up well above 10,000 cycles. Switching in the *Stereo Noise Filter* affects only the audio response (which it should) and not the crosstalk.

Frequency drift of the LT-110 from a

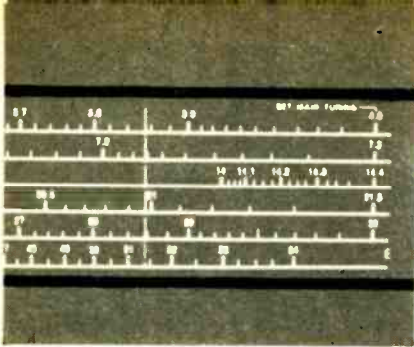
cold start is extraordinarily low—less than 5 kc. The a.c. hum level (referred to 100% modulation) is low and exceeds the manufacturer's rating by 5 db.

The *Sub-Channel Filter* is quite effective in reducing noise when you're listening to stereo in weak signal areas. Loss of audio frequency response with this filter switched *In* is negligible, but stereo separation is impaired at audio frequencies above 6000-7000 cycles.

IN CLOSING: It's difficult to imagine a kit much simpler to assemble than the LT-110. The full-color instruction book eliminates just about the last possible chance of wiring errors—in lead dress and resistor color codes. From a plain and simple operational standpoint, the LT-110 *works well and sounds good.* —30—



Frequency response continues flat from 50 down to 20 cycles. Not shown is the "Mono" curve which was flat from 20 through 16,000 cycles. All graphs used here are derived from data supplied by the Hirsch-Houck Laboratories.



Across the Ham Bands

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

THE LATEST HAM NEWS FROM WASHINGTON

HERE'S good news for anyone applying for a new, renewed, or modified ham license—if you haven't already picked up the information. Effective immediately, the FCC no longer requires that your application be notarized. In addition, if you need to have your license modified (address changed, etc.) in the last two years of its term, you can renew it for five years at the same time. Also, if you plan to leave the country for an extended period of time during the last two years of your license term, you can renew the license before you go.

Fines for Violators. At the same time the above changes were made, Congress enacted the "Small Forfeitures Act," which authorizes the FCC to levy fines up to \$100.00 against CB operators, marine-mobile operators, radio amateurs, and other "Safety and Special Services" licensees. These fines will be exacted for violations of FCC regulations that are serious enough to warrant disciplinary

action but not serious enough to warrant license revocation or suspension.

The new enforcement tool shouldn't worry the great majority of hams who have always attempted to operate in accordance with the regulations. The FCC isn't suddenly going to get tough about minor, accidental violations. It's gunning for the small percentage of people who believe that rules and regulations don't apply to them—Novices who use VFO's; operators who ignore official notices to correct transmitter defects; operators guilty of causing unnecessary interference or of using profane or indecent language on the air, etc.

Nevertheless, it's a good idea for all of us to check our operating procedures and emitted signals to avoid the possibility of getting an "FCC QSL card."

Watch Your Harmonics. Based on the number of notices issued, the biggest single headache the FCC has with hams is due to second and third harmonics

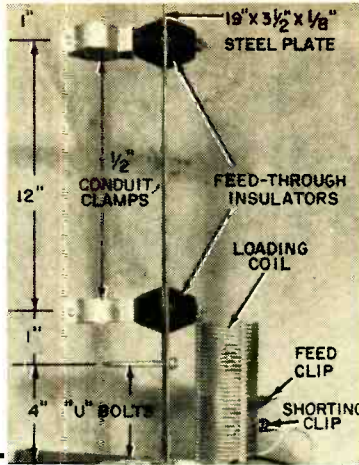
Novice Station of the Month

The winning photo in the "Novice Station of the Month" contest for October pictures the neat station of Craig Cleveland, WN4HSN, Elberton, Ga. Craig uses his Heathkit DX-60 transmitter, Hallicrafters SX-110 receiver, and 50'-high "trap" dipole on the 15-, 40-, and 80-meter Novice bands. He prefers to "rag-chew" rather than to chase DX—partly because he gets in lots of code

practice that way (he'll be going up for a "General" one of these days). Craig will receive a one-year free subscription to P.E. for his photo. If you'd like to try for a similar award, send us a picture of your station—preferably showing you at the controls, and be sure to include with your entry some information about yourself, your equipment and your activities. You may be one of the lucky winners. Entries should be sent to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana.

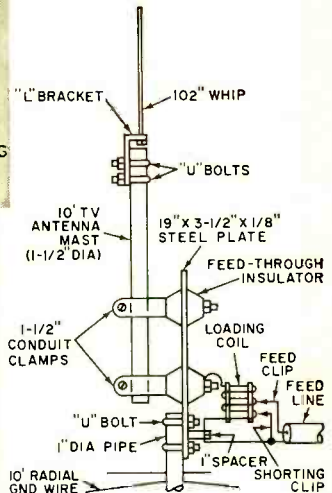


A real space saver, this vertical antenna performs well on 10 through 80 meters. Base assembly is seen in close-up at right; complete antenna appears in diagram. Watertight housing for coil is desirable, but not necessary.



BILL OF MATERIALS

- 1—102" whip antenna (*Antenna Specialists M-3B* or equivalent)
- 4—"U" bolts (*TV antenna-mast type*)
- 1—10' length of 1½"-o.d. aluminum TV mast
- 2—1½" conduit clamps (available at electrical supply houses)
- 1—19" x 3½" x ⅛" steel plate (*Par-Metal 6601 rack panel, or equivalent*)
- 2—Feedthrough insulators (*E. F. Johnson 135-52* or equivalent)
- 1—40-turn section of B&W 3905-1 "Miniductor" stock
- 2—Copper alligator clips
- Misc.—#10 brass bolt 2" long, #10 brass nut, 1" spacer, solder lugs, wire for radial ground leads, 12- or 14-gauge sheet iron for "L"-bracket, etc.



emitted by 80- and 40-meter Novice transmitters. Two frequent causes of Novice harmonic problems are sloppy transmitter tuning and trying to squeeze out more power than the rig is rated to give.

The easiest way to be sure your transmitter is not emitting strong second or third harmonics is to ask another ham within a mile or so of your location to listen for them while you transmit. To be safe, the harmonics should be at least seven "S" units weaker than your fundamental signal. If they aren't, and retuning the transmitter doesn't help, try an antenna coupler (page 60, *POPULAR ELECTRONICS*, August, 1961) or an 80- or 40-meter low-pass filter (page 92, *POPULAR ELECTRONICS*, May, 1960) between the transmitter and antenna.

"SHORTENED" VERTICAL ANTENNA

Although it's just 18½' tall, the compact vertical antenna featured this month compares well with a full-sized version. Assuming that a good ground is used, the radiated signal will be down only about 1½ "S" units on 80 meters

and about ½ "S" unit on 40 meters. There will be no loss on 20, 15, or 10 meters.

Construction. Drill mounting holes in the 19" x 3½" x ⅛" steel plate (see photograph) for the two feedthrough insulators. These are centered on the short dimension of the plate; one is positioned 1" from the top, the other 12" below the first. Then mount two "U"-bolts below the second insulator hole as shown.

Also drill a hole for a #10 brass bolt near the bottom of the plate. The bolt will support and ground the bottom of the loading coil. Cut from B&W 3905-1 "Miniductor" stock, the 40-turn coil is 2½" in diameter and wound of #12 wire (six turns per inch).

Install the feedthrough insulators in the plate and mount a 1½" conduit clamp on each insulator as illustrated. Run a 2"-long, #10 bolt through the hole made for that purpose, slip a 1"-long spacer and a couple of solder lugs over the end of the bolt, then secure the assembly with a brass nut. The loading coil is installed between one of the solder

lugs and a terminal of the bottom feed-through insulator.

Slip one end of a 10' length of 1½"-diameter TV antenna mast through the conduit clamps just installed and tighten them. Now form a 3½"-wide "L"-bracket, with one 1½" side and one 6½" side, from 12- or 14-gauge sheet iron. Mount a 102" (CB-style) whip antenna on the 1½" side and clamp the 6½" side to the free end of the 10' mast with "U"-bolts.

Installation and Adjustment. Drive a 10' (or longer), 1"-diameter pipe into the earth—leaving the last eight inches exposed. Attach six to twelve ground wires, each at least 10' long, to the pipe, extend them out radially (like spokes of a wheel), and bury each one at least six inches into the ground.

Clamp the antenna assembly to the pipe, using the "U"-bolts provided. Then ground the shield of your coaxial feed line, as well as one end of a 6" "shorting

lead," to the solder lug at the base of the loading coil. Copper alligator clips are now attached to the other end of the shorting lead and to the center conductor of the coaxial feed line.

The exact placement of the two clips on the loading coil varies with frequency and must be determined by means of a standing-wave ratio bridge inserted in the feed line at the transmitter. Pick the frequency closest to your operating frequency from the table below and set the clips to the positions indicated, then readjust them for minimum SWR.

Frequency (ke.)	Feed Clip (turns from bottom of coil)	Shorting Clip (turns from bottom of coil)
3725	8½	3½
7175	30½	22½
14175	37½	29½
21150	36½	32½
28700	32½	28½

(Continued on page 110)

CROSSWORD PUZZLE

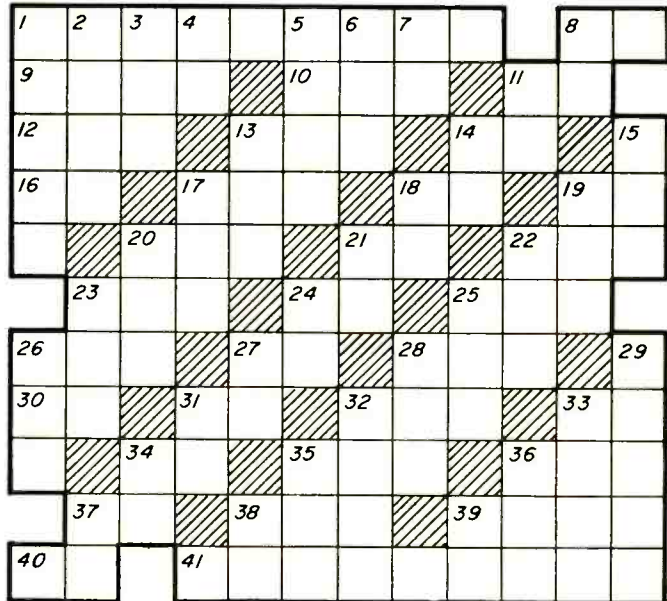
By James J. Porten

ACROSS

- 1 Type of drawing.
- 8 Switch; abbrev.
- 9 To listen.
- 10 Base of common logarithms.
- 11 Chinese measure.
- 12 City in Southern Germany.
- 13 Station's _____.
- 14 Similar to db.
- 16 Baseball league; abbrev.
- 17 To steal; archaic.
- 18 Old-timer; abbrev.
- 19 Tube characteristic.
- 20 Two (color code).
- 21 Selenium rectifier; abbrev.
- 22 Unit of resistance.
- 23 Signal; abbrev.
- 24 1/2πfC.
- 25 A communication.
- 26 Million; prefix.
- 27 Common ratio.
- 28 Good till canceled; abbrev.
- 30 Subconscious.
- 31 Neon; symbol.
- 32 Unit of reactive power.
- 33 End of transmission.
- 34 Chinese coin.
- 35 Signal of distress.
- 36 Winding; abbrev.
- 37 Amplitude modulation; abbrev.
- 38 Ten decibels.
- 39 Spool.
- 40 Direct current; abbrev.
- 41 Expressed in a picture.

DOWN

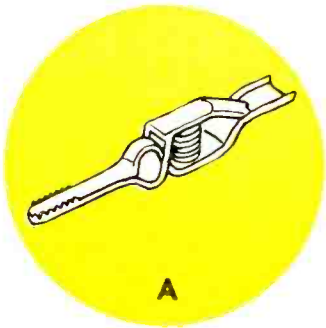
- 1 Parallel.
- 2 Receptacle containing electrodes and electrolyte.
- 3 Amateur radio operator.
- 4 Erbium; symbol.
- 5 Particle of matter.
- 6 Two-year-old sheep.
- 7 Input; abbrev.



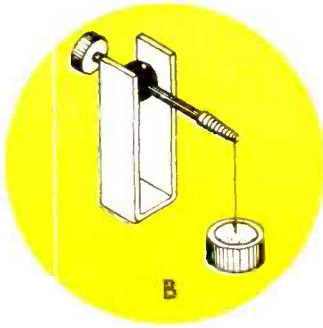
- 8 Silicon; symbol.
- 11 Lutecium; symbol.
- 13 A poor operator.
- 14 Vacuum tube; abbrev.
- 15 Total.
- 17 Negative; abbrev.
- 18 Either.
- 19 Unit of conductance.
- 20 Apparatus or gear.
- 21 Scandium; symbol.
- 22 Oscillator; abbrev.
- 23 Said; slang.
- 24 Greek letter.
- 25 The exact time is _____.

- 26 Wire measure.
 - 27 Photoelectric; abbrev.
 - 28 Solid, liquid, or _____.
 - 29 Boring instrument.
 - 31 Greek letter.
 - 32 Difference of potential.
 - 33 Region.
 - 34 Phase modulation; abbrev.
 - 35 Winding; abbrev.
 - 36 Prince Edward Island; abbrev.
 - 37 Alternating current; abbrev.
 - 38 Two; comb. form.
 - 39 Railroad; abbrev.
- (Answers on page 108)

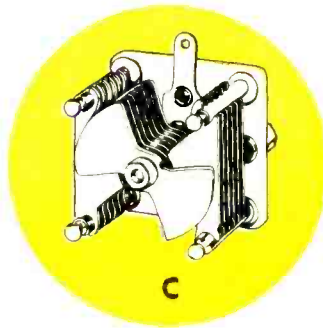
ELECTRONIC QUIZOO



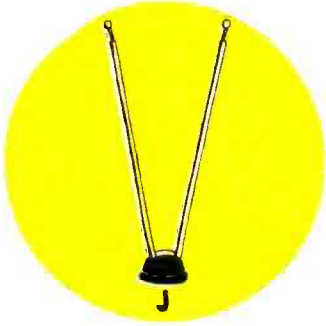
A



B



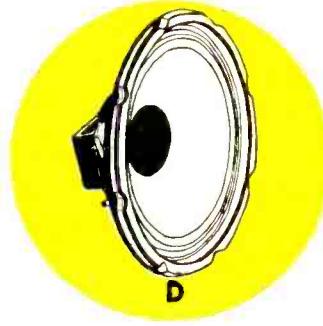
C



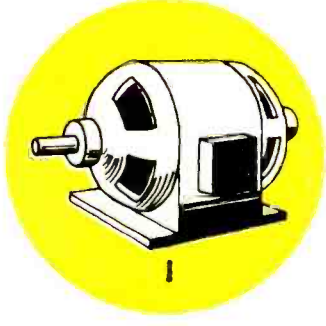
D

By ROBERT P. BALIN

When an electronic part can be likened to some member of the animal kingdom, we often name it after the animal or insect it resembles. See if you can match the drawings (A-J) in our electronic zoo with the ten names listed at bottom of page.

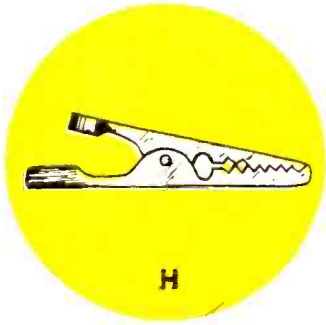


E

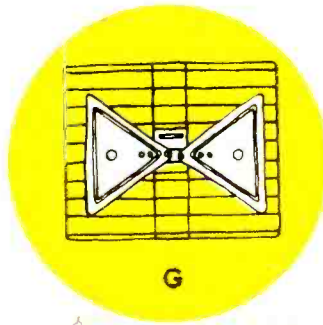


F

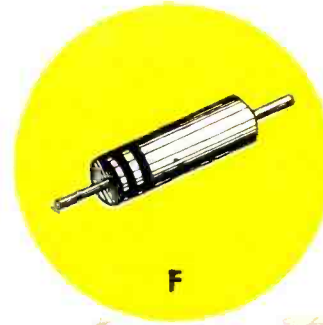
(Answers on page 116)



G



H



I

- | | | | | |
|----------------------|----------------------|-------------------|----------------|--------------------|
| 1 Alligator <u>H</u> | 2 Butterfly <u>B</u> | 3 Rabbit <u>C</u> | 4 Bat <u>D</u> | 5 Horse <u>F</u> |
| 6 Crocodile <u>A</u> | 7 Bug <u>J</u> | 8 Cat <u>E</u> | 9 Pig <u>G</u> | 10 Spider <u>H</u> |

WITH STEREO well established and the novelty, in many cases, worn off, a growing number of curious souls are wondering if and how their systems can be "modified" to perform other functions. Some brave ones have ventured forth, Miniboxes and toggle switches in hand, to train their "twin ogres" to whistle "Dixie" in harmony. If you are similarly inclined, have fun—and read on!

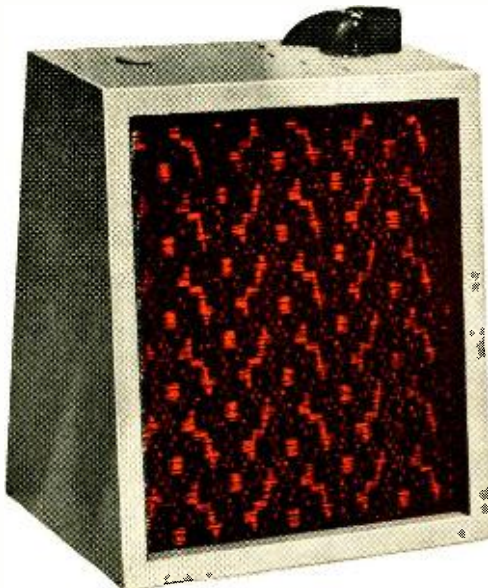
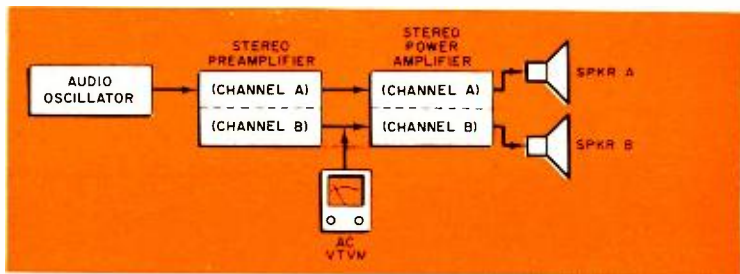
Almost any good, flexible stereo system can be adapted to certain practical monaural uses. It's possible, for example, by constructing the simple gadget described here, the "Stereo-Com," to enjoy two-way communications with another part of the house; to announce and distribute a stereo or mono program to another room; to monitor a remote nursery or sick-room while listening to a mono program source in the living room (or wherever the system is located); and, of course, still to enjoy the original purpose—"local" stereo.

Two in One? But before going any further into the details of what *can* be done, let's turn to the other side of the ledger and examine a possibility that was "blasted" after careful testing. Since program tastes are often in conflict, the idea came to mind: "Why not play TV sound or an FM program in the living room over one channel, and pipe a stack of LP's into the den or basement playroom over the other channel?" This is all well and good—if you don't mind mixing "The Defenders" and Debussy!

It can be argued that where channels are housed on separate chassis, the problem of cross-talk isn't that serious. However, the trend in stereo design is overwhelmingly toward the integrated single chassis. The result, in most cases, is that the above idea just won't work.

To prove this point, we hooked up an audio oscillator, an a.c. vacuum-tube voltmeter, a stereo preamplifier, and a stereo power amplifier; the drawing here

Fig. 1. Test setup employed by author to measure cross-talk in a stereo preamplifier. Although the amount of separation proved okay for stereo listening, it was not adequate for separate mono signals.



BUILD the *Simple switching device* *also equips your stereo*

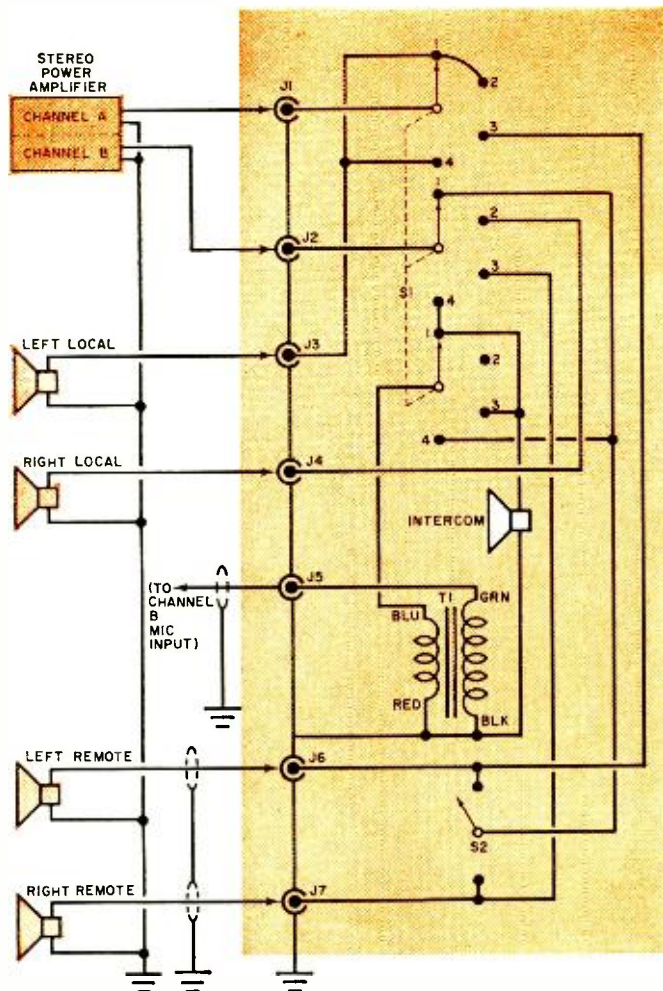
outlines the basic test layout (Fig. 1).

A 1000-cycle tone from the audio oscillator was fed into Channel A of the preamp, with the mode switch on stereo normal (for most complete isolation), the level controls wide open, and all tone controls in the flat position. The outputs of both preamp channels were measured with the a.c. VTVM, and the readings

PARTS LIST

- J1 - J7—Phono jack; single-hole mounting, RCA type (Lafayette MS-568 or equivalent)
 S1—3-pole, 4-position, single-gang, non-shorting, rotary switch (Mallory 3234J or equivalent)
 S2—S.p.d.t. toggle switch
 T1—Input transformer, voice coil or microphone to grid, 1:80 turns ratio (Thordarson 20,104 or equivalent)
 1—4" or 5" speaker (for "Intercom"), same impedance as other speakers in system—see text
 1—Wooden baffle (for "Intercom" speaker)
 Misc.—Remote speakers, shielded cable, wire, solder, hardware, knobs, etc.

Fig. 2. The "Stereo-Com" provides for local or remote stereo (or mono) and an intercom function. Schematic of unit itself appears in color; balance of diagram shows connections to amplifier and stereo speakers.



"STEREO-COM" REO

*selects local or remote stereo,
system for use as an intercom*

By MILTON OGUR

were recorded and translated into decibels of separation.

The fact that there was any tangible reading at all at the preamp Channel B output indicated cross-talk or spill-over, since nothing was being fed into this channel; the measured figure was -33 db. Although this might be considered adequate separation for stereo pro-

gram material, it is certainly too small for totally dissimilar signals.

More Than Two. As we said before, however, there is a lot that can be done to give a stereo setup greater flexibility and application. The device recommended here—the "Stereo-Com"—consists of a 4" or 5" speaker mounted in a wooden baffle, which also serves to house the

other components—transformer *T1*; a rotary switch (*S1*); a toggle switch (*S2*); and phono jacks *J1-J7*. The chart below tabulates the functions accomplished by each position of switch *S1*.

All that need be disturbed in your present stereo system are the connections between the speaker outputs and the speakers themselves. These leads can be brought out to plugs to fit the jacks mounted on the back of the local intercom baffle and connected as indicated in the schematic diagram, Fig. 2.

For remote stations, two speakers of the same impedance rating as the existing local monitors are recommended, to avoid mismatching and consequent distortion; size and quality are pretty much up to your own taste and discretion. However, since one or both will also double as a return microphone in the intercom function, it's well to bear in mind that some fine models can be found in small packages. Separate shielded cables between these remote speakers and the "Stereo-Com" will help keep hum down.

The primary (low-impedance) winding of *T1* terminates either the local "mike" or the lines to the remote "microphones," and the microphone input circuit of the Channel B preamp bridges the secondary winding. If two remote stations in different rooms are preferred to one (at the cost of remote stereo), a s.p.d.t. switch

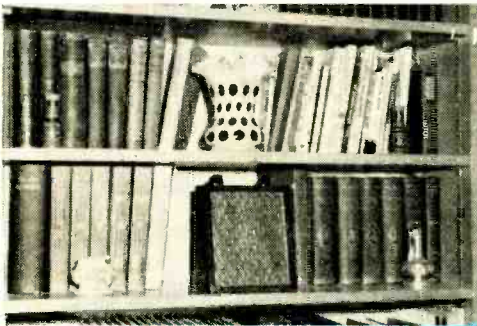
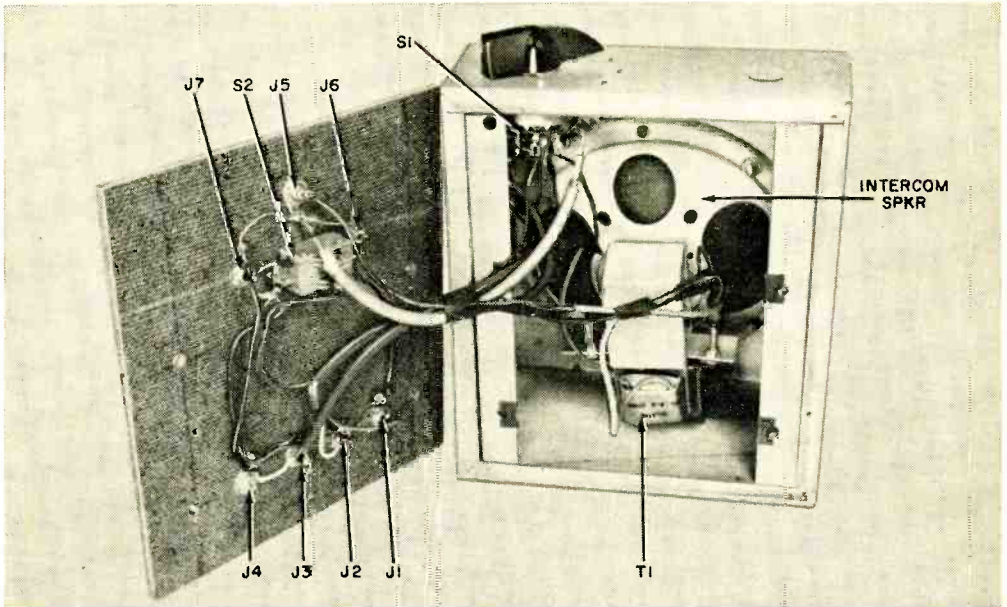
(*S2*) makes this possible, enabling you to select the station to be monitored or called. However, since *S2* is disabled in position 3 of *S1*, the stereo normal mode will serve to call the right remote speaker. If the left remote speaker is desired, you use the stereo reverse mode.

A word here about position 4 (the return position for the intercom as well as the "baby-sitting" position). Since it is desirable to keep the shielded lead from *J5* permanently connected to one channel, the right channel was selected arbitrarily. In more modest systems lacking a low-level microphone input, an "auxiliary" position on the right channel may suffice for low gain monitoring, even if not for clear two-way exchange. Nursery monitoring being what it is, the disadvantage of cross-talk can be overlooked, and the matching auxiliary input in the other channel can be used simultaneously for TV sound, tape playback, etc.

Putting "Stereo-Com" Together. Mount transformer *T1* either on the speaker or inside the bottom of the baffle, as preferred. Switch *S1*, with color-coded leads pre-wired and cabled, is mounted inside the top of the baffle with the shaft extending through a $\frac{3}{8}$ " hole countersunk from the top to accept the lock-nut.

The toggle switch (*S2*) and phono jacks (*J1-J7*) are mounted on a back

FUNCTION CHART			
Position of <i>S1</i>	Function	Action	Mode
1	Local or Remote Mono + Announce Program or Call Remote	Channel A → Left Local Speaker Channel B → Left or Right Remote Speaker Intercom "Speaker" → Channel B Microphone Input	Mono
2	Local Stereo or Mono	Channel A → Left Local Speaker Channel B → Right Local Speaker	Stereo or Mono
3	Remote Stereo or Mono + Announce Program or Call Remote + Stereo P.A. (with Auxiliary Microphone for Channel A)	Channel A → Left Remote Speaker Channel B → Right Remote Speaker Intercom "Speaker" → Channel B Microphone Input	Stereo or Mono
4	Call Local from Remote + Local Mono	Channel A → Left Local Speaker Channel B → Intercom "Speaker" Left or Right Remote Speaker → Channel B Microphone Input	Stereo or Mono



The "Stereo-Com" consists of a speaker, transformer, two switches, plus a few jacks, and should fit in a standard speaker baffle. Photo at left pictures another version of the device, with switch S2 mounted on top opposite switch S1 rather than on back panel.

Block Diagram

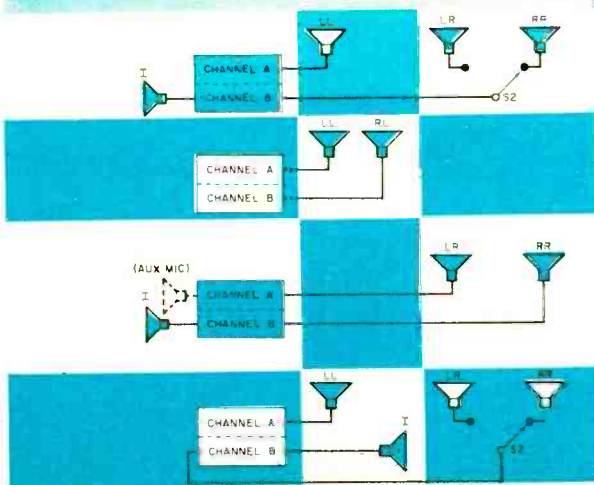


plate made from $\frac{3}{16}$ " Masonite, which in turn is anchored by self-tapping screws to two strips of angle iron screwed to the inside walls of the baffle and drilled to accept Tinnerman nuts. This method of securing the back to the baffle was devised to avoid the use of wood screws which might split the plywood. Switch S2 was oriented so that the handle pointed to the jack terminating the remote line being selected.

Care should be exercised in laying out the back plate so that the toggle switch and the various jacks will clear the other components. Label the jacks carefully on both sides of the back plate to avoid errors in wiring and, later on, in plugging in the cables. Switch S1's positions can be identified with decals, if desired.

Be sure to install and connect lines to all the speakers before testing the system. Otherwise, the amplifiers won't be terminated, and you may damage the output tubes and/or output transformers. If you wish, L-pads of the nominal impedance value can be connected to each remote speaker, and proper levels determined for all functions and noted for permanent reference.



Transistor Topics

By **LOU GARNER**, Semiconductor Editor

OF all electronic instruments, the familiar crystal receiver perhaps comes closest to being an "ideal" unit in the sense that it doesn't require an external power source. A simple "radio-powered" receiver (one which converts broadcast energy into d.c. and uses this as a source of power) is in the same category. But both units suffer from a similar disadvantage—they can be used effectively only in moderate to strong signal areas.

Where portable equipment is concerned, the need for an external power source can be a serious drawback. Chemical batteries have a definite shelf life and must be replaced at regular intervals, even if used very little. Sun batteries require at least a moderate amount of daylight for operation; mechanical generators require a secondary source of energy—someone has to turn the hand crank, or there has to be some kind of an engine.

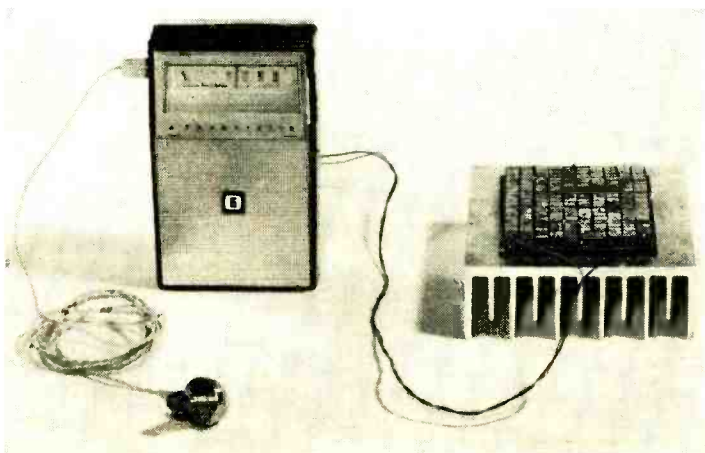
With these thoughts in mind, then, the use of human body heat as a source of power for operating such units as pocket radios and hearing aids can be

seen as a really significant development. And the Sanyo Electric Co. of Osaka, Japan, has come up with just such a technique.

The process is a relatively simple one and involves the direct conversion of body heat into electrical energy by means of semiconductor thermoelectric elements; an experimental lab setup is shown below. In operation, body heat is converted into low-voltage d.c. by the thermoelectric battery. This voltage, in turn, is changed to the higher voltages needed by a pocket-sized transistor receiver by an intermediate d.c.-to-d.c. converter.

The thermoelectric battery which serves as the "heart" of the system is made up of a number of special *pn* semiconductor junctions. When subjected to a temperature difference (that between the body and the room, for example), the electrons and "holes" in the *n*-type and *p*-type semiconductors undergo thermal diffusion and develop a small d.c. voltage at the electrodes. The process is a continuous one as long as the temperature

Ordinary body heat provides all the energy needed to power a transistor portable in this experimental laboratory setup. The secret? A new "body-heat" battery developed by the Sanyo Electric Co. of Osaka, Japan.



differential exists. Further, since there is no chemical change in the semiconductor elements themselves, "battery" life is virtually unlimited.

Inasmuch as the "battery" delivers a relatively low voltage (130 mv.), it requires a separate d.c.-to-d.c. converter, as already mentioned. However, it is theoretically possible to assemble higher voltage units by the use of series/parallel elements. This would eliminate the need for an external converter and permit powering the transistorized equipment directly from the "battery."

Although the technique is still in the laboratory stage, future possibilities are almost unlimited. Chances are, of course, that the initial applications will encompass receivers, amplifiers, and transmitters used by explorers, military men,

change in circuit loading—a body approaching the antenna plate, for example—causes the circuit to drop out of oscillation, changing emitter current and operating relay *K1*. Capacitor *C4*, across the relay coil, is included to insure smooth performance and prevent relay "chattering." The relay contacts themselves serve as a simple switch to control an external circuit, such as a lamp, a bell, or some similar device.

All components are standard and readily available through regular suppliers. Transistor *Q1* is a Type CK722; *C1* and *C3* are 0.1- μ f. tubular paper capacitors (working voltage not critical); *C2* is an

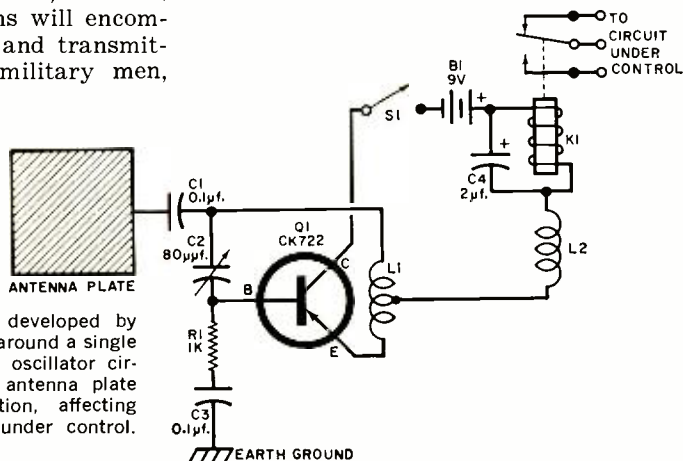


Fig. 1. Capacity-operated relay developed by reader Richard Bourgeois is built around a single transistor in a modified Hartley oscillator circuit. A person approaching the antenna plate will disrupt the unit's oscillation, affecting both relay *K1* and the circuit under control.

astronauts, and others needing equipment with unlimited battery life. Eventually, manufacturers will no doubt offer receivers, hearing aids, and similar consumer products powered by "body heat" batteries.

Reader's Circuit. This month's featured circuit, a capacity-operated relay, was submitted by reader Richard Bourgeois (P.O. Box 2746, Lafayette, La.). He developed his circuit, given in Fig. 1, by adapting and modifying a commercial tube-operated design.

Referring to the schematic diagram, a *pnp* transistor, *Q1*, is used in the common-collector configuration as a modified Hartley oscillator. A tapped coil, *L1*, provides the feedback necessary to start and sustain oscillation, with base feedback controlled by trimmer capacitor *C2*.

In operation, *C2* is adjusted until the circuit barely oscillates. Afterwards, a

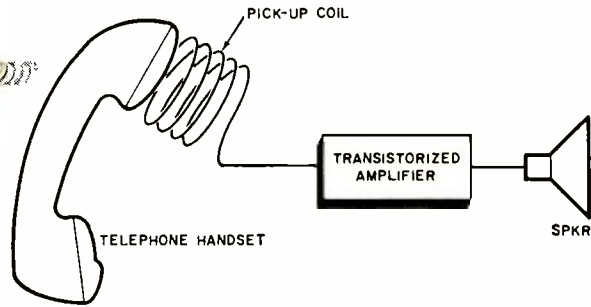
80- μ f. trimmer capacitor; and *C4* is a 2- μ f., 50-w.v.d.c. electrolytic. Resistor *R1* is a 1000-ohm, $\frac{1}{2}$ -watt unit; a Miller Type 2020 oscillator coil is used for *L1*, and a 0.5-mh. r.f. choke for *L2*. Relay *K1* is a Sigma Series 26F with an 8000-ohm coil. The antenna plate consists of a one-foot-square piece of cardboard wrapped with household aluminum foil. *S1* is a s.p.s.t. toggle or slide switch, and *B1* is a 9-volt transistor battery (such as a Burgess Type 2N6).

Richard assembled his original model, except for the relay, on a small Bakelite board, housing the unit in a 3 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " plastic case and mounting the relay on top of the case. Since neither layout nor lead dress should be especially critical, other construction methods can be employed if you wish.

According to Richard, best performance is obtained when the following adjustment procedure is used: (1) place



Fig. 2. Block diagram of typical telephone amplifier. As in GD-71 Heathkit (photo above), basic elements include inductive pickup coil, transistorized amplifier, and speaker.



the assembled unit near a standard AM receiver tuned to approximately 900 kc.; (2) with the unit turned on, adjust $C2$ slowly until a strong signal is picked up by the receiver, retuning the radio as necessary; (3) readjust $C2$ until the unit is barely oscillating; (4) connect the antenna plate; and (5) readjust $C2$ until the relay operates when the antenna is touched lightly (a test lamp and a battery can be connected in series with the relay contacts during this adjustment to indicate when the relay opens and closes).

By the way, we've received a number of inquiries in the past few weeks asking just how "Reader's Circuits" are submitted and selected. These circuits are voluntary contributions on the part of readers who would like to pass on their experiences to other hobbyists. For the most part, the circuits are submitted in the form of a brief letter, together with a clear diagram and detailed parts list; the letter contains a description of the circuit, construction hints, and application data. Each month, we select and feature the circuit (or circuits) which we feel will be of maximum interest to other experimenters.

Telephone Amplifiers. The transistorized telephone amplifier is rapidly becoming an extremely popular electronic accessory because of its value to stenographers, housewives, professional men, order clerks, salesmen, and others. In use, the typical unit picks up the signal from the handset's receiver and amplifies it to speaker volume, thus permitting the user to carry on a telephone conversation with both hands free.

Most commercial instruments employ

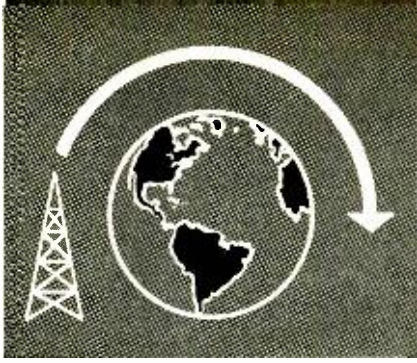
a circuit similar to the one shown in block diagram form in Fig. 2, and include an inductive pickup coil, a two- or three-stage amplifier, and a small speaker. As a general rule, no special provision is made for electronically amplifying the user's voice, but a few instruments do include an acoustic reflector to concentrate sound at the handset's microphone.

One of the most popular of the kit-type telephone amplifiers, the Heath Model GD-71 (made by the Heath Co., Benton Harbor, Mich.), is shown on this page. Assembled in a special plastic cabinet which serves as a rest for the handset, the GD-71 includes an acoustic reflector for the telephone's microphone. A two-stage amplifier is used, featuring a Class-B push-pull output stage delivering a maximum of 150 mw. to a 3" speaker. Power is supplied by a self-contained 9-volt battery, which provides up to 100 hours operating time under average conditions. An interesting design feature is a Microswitch which turns the unit "on" and "off" automatically when the handset is placed in position and removed.

Commercial telephone amplifiers sell for from about \$15.00 to \$40.00 retail, depending on brand and operating features. The Heath GD-71 kit, for example, nets for \$19.95, plus postage from the factory; local dealer prices are slightly higher.

Product News. A new teaching tool to demonstrate transistor and superheterodyne receiver circuitry has been introduced by EICO Electronic Instrument Co. (3300 Northern Blvd., Long Island City 1, N. Y.). The Model RA-6D is the

(Continued on page 101)



Monthly Short-Wave Report

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

DX-ALLIANSEN

IT HAS BEEN unofficially estimated that there are more than 100,000 short-wave listeners in the United States. While many of the SWL enthusiasts are associated with a club or group of some sort, a large percentage of them are free-lance monitors; they don't belong to any organized club nor are they registered in the WPE Monitor Program. By comparison, Sweden has a total of 40,000 to 50,000 short-wave listeners who are organized into at least 43 clubs throughout that country. Like American clubs, the primary function of many of the Swedish clubs is to spread news of programs, wavelengths and frequencies, and to report on signal strengths.

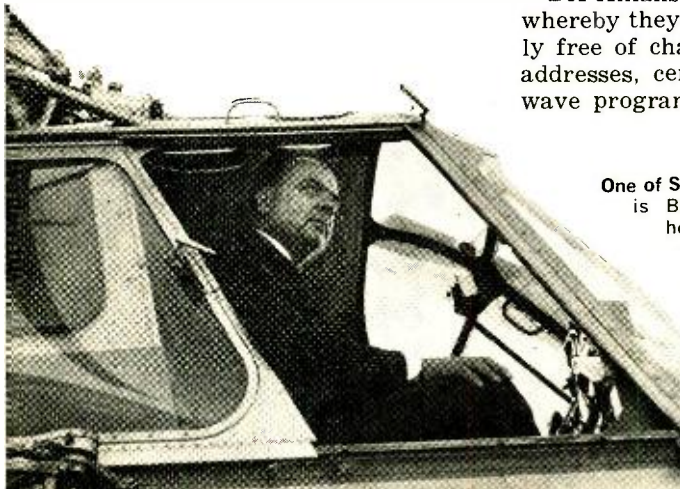
Some years ago, Mr. Arne Skoog, the well-known DX Editor of *Radio Sweden*, founded the "DX-Alliansen," a provisional organization that was set up for the prime purpose of furthering close harmony and cooperation within and between the many DX clubs in Sweden. The organization was later expanded to

include other clubs in the Scandinavian area. And recently, clubs in other countries have also been invited to join this radio union.

More positive action was eventually taken. A Board of Management was formed, with headquarters in Stockholm, and it was agreed that representatives of the many clubs would meet annually to act upon any business which might come before them and to discuss common questions that might affect the operation of the clubs or of the organization. DX-Alliansen lists as its primary function "... to spread information about the hobby of short-wave listening and to be a link between the radio enthusiast and various radio organizations."

The publication of DX-Alliansen is entitled *Allians-News*. Printed in Swedish, it contains decisions made by the Board of Management, news items from the various clubs, articles and discussions on subjects of interest to the clubs, and numerous other features.

DX-Alliansen has a service available whereby they will send to clubs completely free of charge a world club list with addresses, certificates for special short-wave programs, ground rules for clubs,



One of Sweden's many thousands of DX'ers is Birger Lagesjo, SM1PE2H, shown here in an S55 "Sikorsky" helicopter at the airport in his hometown of Gothenburg. An engineer by profession, Birger does his DX'ing with a Philips BX998A receiver and has about 175 countries verified.

contest rules, and instructions on the proper way to report. They also offer assistance to clubs in the process of being formed. And, for a small fee, they will supply a list of DX Lands (a country list), a DX Musical Guide (presumably a listing of interval signals—Ed.), a DX Mark (performance award), and various other items.

The Swedish organization is very much interested in cooperating with DX clubs the world over. Those who were unable to take part in the International DX Meeting held this year by DX-Alliansen in cooperation with two associated clubs, Malmo Shortwave Club and DX Club Lundensis, are invited to send letters and questions about DX-Alliansen and the Swedish DX clubs to: The Secretary, DX-Alliansen, Saanadal, Lidingo 2, Sweden.

American and Canadian clubs in particular are invited to write to DX-Alliansen, and your Short-Wave Editor feels

that this would be an excellent opportunity for many of our newer and smaller clubs to be placed on the world-wide list. In addition, considering the large supply of DX aids available, contact with the union should help promote better planned and organized clubs.

In view of the fact that nowhere in North America is there an equivalent union of clubs, it would seem like a good idea to join with DX-Alliansen in their endeavors. Such an organization can only further the good will and cooperation that should be readily evident within and between clubs. As a matter of fact, it might be a wise move for American clubs to form a similar union.

Our congratulations go to Mr. Skoog on the results of his time and effort in founding the present organization, and to the current DX-Alliansen president, Mr. Claes E. Englund.

(Continued on page 112)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

All of the stations that are listed here specifically beam English-language newscasts to the U.S.A. at the times indicated. The times may vary a few minutes from day to day.

COUNTRY	STATION	FREQUENCY (kc.)	TIMES (EST)
Australia	Melbourne	11,710	0745, 1016
Belgium	Brussels	9705	1900
Bulgaria	Sofia	9700	1900, 2000, 2300
Canada	Montreal	15,190, 11,760	1800
Czechoslovakia	Prague	7345, 9550, 9795, 11,990, 15, 285	2000, 2330 ¹
Denmark	Copenhagen	9520	2100, 2230
East Congo	Brazzaville	11,725	2015
		9730	0015
England	London	17,860	1100, 1200
		15,375	1800, 1900
		15,300	0930, 1100, 1200
		11,780	2100, 2200
Hungary	Budapest	11,890, 9833, 9770	1900
		9833, 9770, 7220	2230
Italy	Rome	11,905, 9575	1930, 2205
Netherlands	Hilversum	11,730, 9715, 6020	1630 (ex. Sun.)
		6035, 5985	2030 (ex. Sun.)
Portugal	Lisbon	6185 ² , 6025	2100, 2300
Spain	Madrid	9363, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840	0900
		11,805	2045, 2215
Switzerland	Berne	11,865, 9535, 6165	2030, 2315
USSR	Moscow	12,010, 11,960	1700-0100
		11,820, 11,730	(on the hour)
		9740, 9680, 9550 ³	
West Congo	Leopoldville	11,755	2100, 2230
West Germany	Cologne	9605, 6100	1740
		9640, 9575, 6100	2100, 0000
		9735, 6145	0025

1. At 2330, 11,745 replaces 15,285 kc.

2. Late reports indicate that 9740 may have replaced 6185.

3. All frequencies subject to change without notice.

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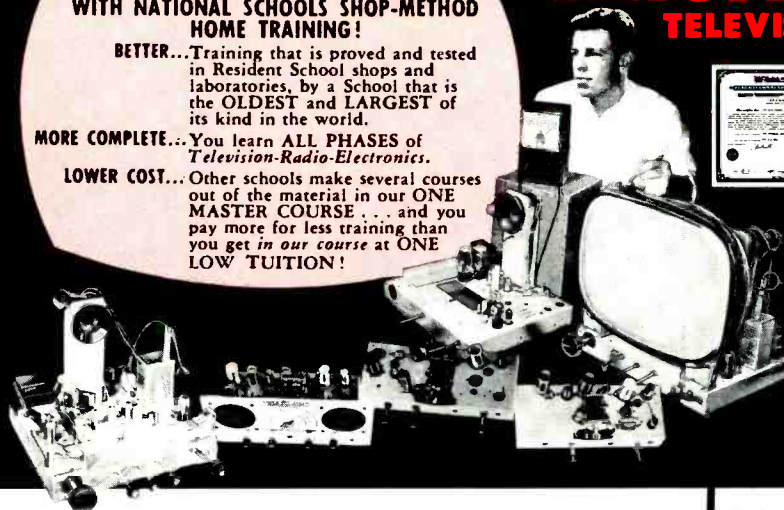
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I cannot praise N.T.S. enough. I've just graduated and already I have started repairing radios and servicing TV's ... At 53, I'm starting a new life and my diploma from National Technical Schools is my proudest possession.

William E. Eckenrod

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

Rev. Enoch P. Sanford



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

Louis A. Tabat

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

Alvin Spera



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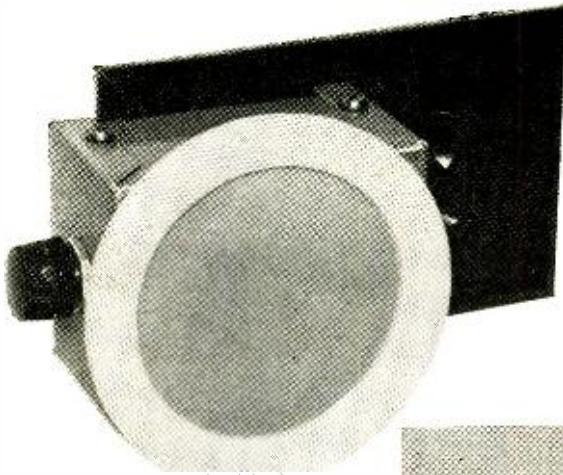
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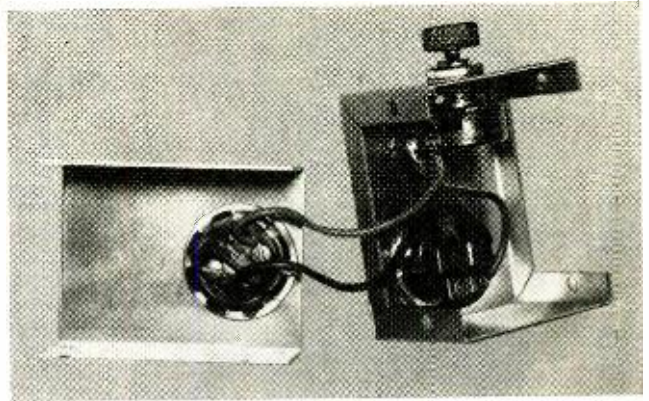
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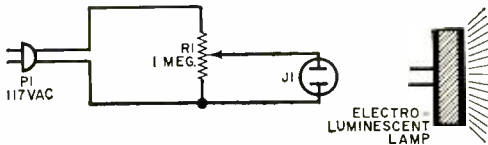
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NITE LIGHT DIMMING



The wiper contact in the potentiometer must be insulated from the metal box; do not substitute any other unit for the IRC Type Q11-137, 1-megohm potentiometer.



go to bed. Later on, as the last night owl retires, the dimmer can be turned down low for undisturbed sleep. And if you awaken at night, a simple twist of the knob will bring the light up to full brilliance.

—James E. Pugh, Jr.

THE low operating cost and weak level of illumination make the electro-luminescent lamp an ideal night light. Because of its minute power drain, you can easily control the brightness with a 1-megohm linear taper potentiometer (IRC Type Q11-137).

Mount the potentiometer in one end of a small metal box similar to the Premier Type PMC-1000 (about 3" x 2" x 1½"). On opposing sides, mount an a.c. socket (Amphenol 61-F) and male plug (Amphenol 61-M). Wire them up according to the diagram at left, plug in a Sylvania "Panelescent" night light, and you're in business.

With the control set full on, there will be enough light to bathe the room in a soft green glow when the early birds



The DIFFERENCE DETECTOR

a Carl and Jerry Adventure

By
JOHN T. FRYE
W9EGV



JERRY was hunched over a bench in the lab and workshop of WCCR, the master control station of the Parvoo University campus wired wireless system. Since he and Carl had helped Jimmy Young, the station manager, run down a "wild-cat" broadcast station the previous semester, the two boys had been privileged to work and experiment in the shop. Jerry grinned to himself as he heard heavy feet pound the stairs outside; and a minute later his chum, Carl, came puffing through the door.

"Hey! What are you trying to do . . . shake me?" Carl demanded.

"No, I left a note on the tack board in our room telling you where I was going; but, as usual, you obviously never thought to look at it. Come on over here. I've something to show you."

"It doesn't look like much," a still unmollified Carl sniffed, glancing down at a couple of skinny little glass capsules on the bench. Each was about $\frac{3}{4}$ " long and $\frac{5}{32}$ " in diameter. A stiff piece of shiny wire protruded some $\frac{3}{8}$ " from either end of the capsule.

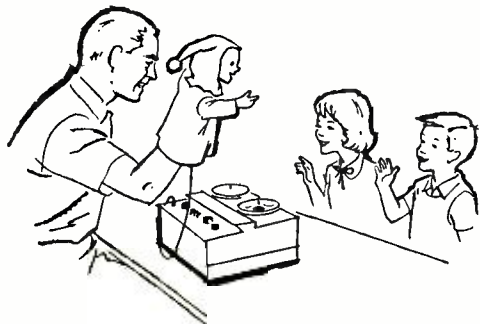
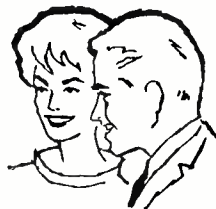
"I intend to make you eat those words," Jerry warned. "These are 'bi-reed magnetic switches,' first developed by Bell Telephone Laboratories and now manufactured by several different companies. If you will look closely, you will see that each nickel-iron wire is flattened out into a blade just after it passes through the end-seal into the capsule, and that these blades extend past each other for a short distance and are separated by a few thousandths of an inch. What you *can't* see is that the opposing surfaces of the overlapping portions of the blades are coated with diffused precious metal—probably gold—to form contacts, and that the inside of the glass envelope is filled with a mixture of nitrogen and hydrogen."

"Very fascinating, I'm sure," Carl remarked as he made an elaborate pretense of smothering a yawn.

Instead of answering, Jerry connected a flashlight bulb, a battery, and one of the bi-reed switches in series. Next he held a little rod of black metal about an

(Continued on page 92)

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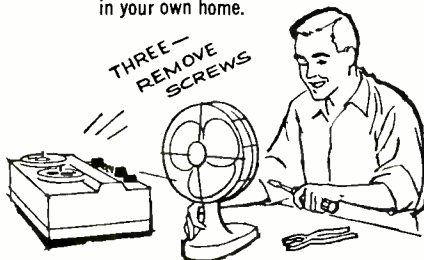
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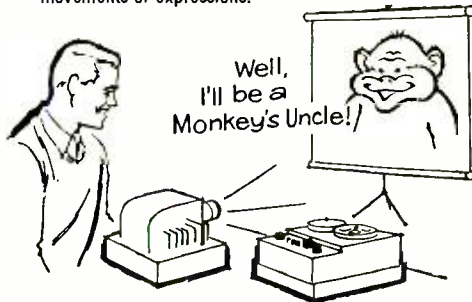
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*DuPont trademark for polyester film

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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.

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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.

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

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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.

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You will receive all parts and instructions necessary to build 20 different radio and electronic circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, coils, hardware, tubing, punched metal chassis, Instruction Manuals, Hook-up wire, solder, selenium rectifiers, volume controls and switches, etc.

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

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

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

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At no increase in price, the "Edu-Kit" now induces Printed Circuitry. You build a Printed Circuit Signal Injector, a unique serving 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.

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By popular demand, the Progressive Radio "Edu-Kit" is now available in Spanish as well as English.

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inch long and a quarter of an inch in diameter parallel to the glass capsule and about an inch away from it. The bulb lighted. He pulled the metal rod back a half inch, and the bulb went out.

"What's that little black stick?" Carl demanded, becoming interested in spite of himself.

"It's a small alnico magnet. When I hold it close to the switch, the two blades are magnetized by induction with opposite polarity and attract each other into contact, lighting the bulb. When I remove the magnet, the spring of the blades pulls them apart and restores them to their original position."

Jerry held the magnet about a half-inch from the glass-enclosed switch so that the bulb was lit; then he carefully slid a small plate of soft iron between the switch and the magnet. The lamp went dark. He removed the plate and the light came back.

"That soft iron plate 'shields' or 'short-circuits' the magnetic field, however you want to think about it," Jerry explained, "and allows the switch to open. I'm told that one auto manufacturer is using, or intends to use, devices like these as limit switches on his electrically operated windows. Current to a directional winding of an operating motor passes through a bi-reed switch held closed by a nearby magnet. When the window reaches the end of its travel, a small soft-iron vane attached to the window frame slides between the magnet and the switch, causing the latter to open and cut off power to the 'up' or 'down' winding of the motor, as the case may be. Neat, huh?"

"Very neat," Carl agreed. "You could use the same system in reverse as a burglar alarm on a house window by letting the vane slide out of the way and close the switch, sounding an alarm, when the window was raised. I hereby retract my slighting remarks about your little jewels."

"Oh, there's more," Jerry insisted as he reached over and picked up a little hollow solenoid $\frac{7}{8}$ " long and $\frac{3}{8}$ " in diameter. The magnetic switch was disconnected, slid into the hole in the center of the coil, and restored to its battery-and-bulb circuit. Leads from the coil winding were connected through a milliammeter to a variable-voltage d.c. power

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because you can prove yourself physically, mentally and emotionally fit to do a man's work. You can have the satisfaction of helping to keep America so strong the war the whole world dreads need never happen . . .

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because you can decide your own future. You can get a good education, you can get training in your choice of many different fields. The opportunities for advancement, the chance to become a leader as a commissioned or non-commissioned officer, the retirement prospects . . . all are better than most men think.

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supply. As Jerry slowly turned the knob to increase current through the coil, the flashlight bulb snapped on when the current reached 4 ma. When it was reduced to 2.5 ma., the lamp went out.

"As you've already guessed," Jerry said, "magnetism for closing the contacts is now being furnished by the small current flowing through the thousands of turns of that 2000-ohm coil. Our bi-reed switch has thus been converted to a sensitive, high-resistance relay that can, for instance, be used in the plate circuit of a tube. Not all switches I've tried are as sensitive as this one, but none take more than a few milliamperes of coil current to close them."

"But that's only a single-pole relay," Carl pointed out.

"Yes, but it's a simple matter to elongate the opening in the coil so that several bi-reed switches can be slid in side by side to form a multi-contact relay," Jerry answered. "And you can work another slick dodge to achieve a normally closed set of contacts. You simply slide a little magnet in alongside a switch to keep the contacts closed. Then the direction of current through the coil is arranged so its magnetic field bucks and cancels that of the permanent magnet, thus allowing the contacts to open when the coil is energized."

"Somebody did a lot of thinking about and playing with those switches," Carl offered.

"You're right; and no wonder: they're small and light; their firm contact pressure makes them ideal for use in dry circuits; their hermetically sealed contacts can be used in explosive atmospheres without danger; and the small contact spacing makes them very fast,

with less than a millisecond actuation time."

"How about power-handling ability?"

"I've no specifications on these tiny switches, but I doubt they're designed to handle much power. I'd say a tenth of an ampere or so would be all you'd want to apply to the contacts. Bi-reed switches are made in various sizes, though, and a slightly larger model is advertised as being able to handle 15 watts into a resistive load, with currents up to 1 ampere and voltages up to 250 volts."

AT THIS MOMENT Jimmy Young stuck his head into the door of the shop. "Say, you two. I'm supposed to go over to the Women's X Hall tomorrow night and check out the operation of the new slave station we've just installed there. Would you foxes like to accompany me to this chicken roost?"

"Yes!" Carl and Jerry said in chorus.

"I'll be handling the transistorized field strength meter; one of you can make like he's monitoring with a little receiver; but I don't know what the other's excuse for tagging along can be," Jimmy reflected. "He ought to be carrying something."

"Don't worry," Carl said hastily. "I'll have something to carry. Just wait and see."

And when they met in front of the girls' residence hall the next evening, Carl *was* carrying something. It was a little cube of mahogany, about 2" on an edge, with a red-tinted flashlight bulb sticking out the top. Burned into the other five faces were crude reproductions of the symbols for Male, Female, Birth, Death, and Infinity, copied straight from the beginning of the Ben Casey TV pro-





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you're "on-the-air" with this powerful transistor CB 2-way radio
New Cadre '510' 5-watt, 5-channel Transceiver

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Release the switch—you're still on-the-air. (Don't let the silence fool you! Adjustable squelch shuts out extraneous signals for noise-free standby reception.) The sensitive receiver circuit — a dual-conversion superheterodyne — captures weakest signals, and reproduces them with crisp, clear intelligibility. No adjacent channel interference. Highest selectivity with tuned ceramic filters. Electrical interference virtually eliminated with the '510's' effective automatic noise limiter.

MOST RELIABLE — 100% SOLID-STATE DESIGN

Whether pressing or releasing the mike switch, you're

controlling the most reliable, maintenance-free Citizens Band transceiver. It's completely transistorized — 18 transistors, 8 diodes. Keep it "ON" safely all day—no heat problems, no tubes to burn out and replace, lowest current drain prolongs vehicle battery life. Solid-state components absorb road punishment without damage.

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The smallest, full-power Citizens Band transceiver is easiest to install. Its 3½" height never steals leg room in a vehicle; fits smartly under the dash of the smallest foreign compact. And it can be used anywhere — vehicle, base station, field, marine craft. A dual-power supply — 12VDC/110-220VAC — is built right into the Cadre '510'. Add a portable pack accessory (model 500-1) with rechargeable batteries and you have the lightest, portable 5-watt radio (9½ Lbs. with batteries) for pleasure, or business.

Cadre '510' complete with dynamic microphone, set of matched Channel 11 crystals, universal mounting bracket, AC & DC cords . . . \$199.95.

gram. Jimmy eyed this suspiciously, but before he had a chance to quiz Carl about it they were ushered into the house, preceded by a warning cry of "Man in the house!" and a great scurrying up and down stairs.

Jimmy set about checking the signal strength. His indicator was actually a small meter connected in the collector circuit of one of the agc-controlled i.f. stages of a transistorized receiver. As he went from room to room, the meter deflection gave an indication of the relative strength of the wired wireless signal. Jerry had an earphone in his ear and listened for any interference to the program with another little receiver. Carl brought up the rear with the mysterious little mahogany cube balanced on the palm of his outstretched hand. The little red bulb was dark, but Carl kept his eyes glued to it as though expecting something dramatic to happen any moment.

Nothing did happen, though, until they moved into the lounge where several girls were sitting around chatting and watching TV. As Carl's blue eyes swept the scene, they settled on one rather plain-looking girl off in a corner by herself looking wistfully through her horn-rimmed glasses at the others. Quietly Carl edged around the room until he was standing beside the girl; then he gave a startled exclamation as the little red bulb flashed brightly. "Here's one!" he called excitedly to Jerry.

Conversation halted abruptly in the room as everyone stared at Carl and the glowing red bulb. It continued to burn brightly until he took three or four steps backward, and then suddenly it went out. A step forward toward the

startled-looking girl in the glasses brought it back on.

"Wha—what is that?" she quavered.

"It's a difference detector," Carl answered promptly.

"My friend and I stumbled on this physio-electronic phenomenon a short time back," Jerry explained glibly. "While we don't understand it completely ourselves, we know the device reacts strongly to the difference of the sexes—if you'll pardon the expression. When in the hands of a strong masculine type, such as my friend Carl, the little red bulb glows brightly in the presence of a strongly feminine type. What it reacts to is a combination of attractiveness, charm, sex appeal, what our parents called 'It'—in short, all the qualities that make a girl a girl. Maybe I can show you what I mean. Carl, back away until the light just goes out."

Carl did, and Jerry reached over and gently removed the girl's glasses, revealing a pair of lovely violet-colored eyes. Instantly the red light flashed on.

"See how the simple act of removing the glasses enhanced the feminine charm of this girl and increased the intensity of her difference field?" Jerry asked.

"I—I've been thinking of getting contact lenses," the girl said shyly.

By this time all the girls in the room were clustered around Carl. One took the little block of wood from his hand, and instantly the light went out. The block was passed from hand to hand, turned every which way, shaken violently, and even pounded savagely with a spiked high heel; but the light refused to come on until the difference detector was returned to Carl's hand and he moved to the side of the girl who was



still holding her glasses in her hand.

"I hate to break up this charming little seance," Jimmy said sarcastically, "but I promised the house mother we'd clear out of here by ten and it's already seven minutes past; so if you girls will kindly tear yourselves away from my *assistants*, we'll be going."

The last thing the boys saw as they went out the door was all the girls clustered around the one Carl had spotlighted with the difference detector.

ALL RIGHT, you strong masculine type, how did you do it?" Jimmy demanded. "It's really quite simple," Carl answered with a chuckle as he juggled the little block of wood back and forth in his hands. "The bulb is connected through a bi-reed switch to a little flashlight battery. The switch is mounted in a shallow groove right in the bottom of the block and is concealed by a thin layer of veneer glued over it. Tucked through the inside of my signet ring is this powerful little magnet, no larger than a pencil lead and painted flesh color.

"When the bi-reed switch was aligned with the magnet and close to it," he continued, "the lamp lighted. I could make the lamp go on or off by moving the block very slightly in my hand. Those symbols were burned on the outside just to hoke it up and fit in with the story Jerry and I concocted."

"Well, you certainly gave one girl a large evening, and you also shook up some of the hoity-toity campus queens back there in the lounge," Jimmy reflected; "but the next time I have an invite to a women's residence hall, remind me to leave you two scene-stealers behind, will you?"

The Mello Monster

(Continued from page 50)

front panel (Part 11) to the enclosure (see Photo E).

Drill a small hole in the center of the back just above Part 7, and insert two wires for the speaker leads. Next, lay the speaker over the hole in Part 15, and mark the four mounting holes. After

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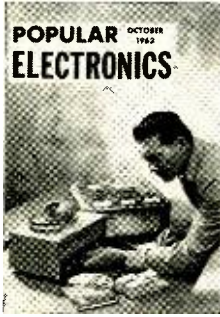
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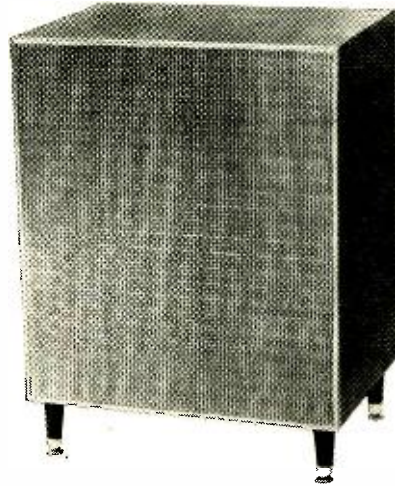
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Completed Mello Monster makes attractive addition to any listening room. The enclosure can be finished in a number of ways, depending on personal preferences in woods, fabrics, and colors.

you've drilled these holes, you can attach the speaker to the panel, and solder the lead wires to the speaker. Next, mount the speaker panel in the cabinet opening, using four #8 x 1½" flat-head wood screws. Don't glue this panel, since you may find it necessary to service the speaker some day.

Finalizing the Project. This is the time to stop work, hook up the system, and listen to the fruits of your labors. Chances are you'll want to congratulate yourself for having started the project, and then proceed to apply the finishing touches.

There are many ways to finish the enclosure. One of the easiest is to apply Formica sheet to the top, sides, bottom, and back, using "contact-bond" cement to hold it in place. For the front, a coat of black screen enamel is desirable (see Photo F); this prevents the cabinet openings from showing through the grille cloth.

Fabricate a frame from some molding (you'll find a large variety at almost any lumber yard) to fit the cabinet front; then finish the frame to match the covering you've applied to the cabinet. Staple the grille cloth to the frame, attach the assembly to the enclosure front, and you can sit back and listen with pride!

-30-

Always say you saw it in—POPULAR ELECTRONICS

The 14-83

(Continued from page 46)

UHF stations should be within tuning range.

If output is low, try spacing or squeezing coils *L6* and *L7* for better resonance at the VHF channel you are using. Next, try adding a coupling gimmick by soldering one end of an insulated 1½" length of solid #20 hookup wire to plate 4 of the tuning assembly's "antenna" section and bend the insulated wire across the tuning assembly to the vicinity of plate 2. Retune the converter if necessary.

One other adjustment is possible—snipping the wires connecting the upper and lower sections of plate 3. This may bring *L1/C1* closer into resonance with the UHF stations being tuned. (The antenna section has a very low *Q* and should be tuned closely enough in either case.) If there is little improvement, resolder the leads.

A snowy picture can usually be improved considerably by changing your lead-in and/or your antenna. Tubular 300-ohm twin-lead is especially good at UHF frequencies, although standard flat twin-lead is usable if it is in A-1 condition. In any case, be sure that the lead-in wire is supported by stand-offs at any point where it might come close to metal.

A VHF antenna of conical configuration will provide good performance on UHF stations in urban and nearby suburban areas if it is in good condition. In poor-signal areas or in cases where you are over 20 miles from the transmitter, a UHF antenna will be a necessity. In this event, external antenna switching is best and the wire from plate 3 of the tuning assembly should be removed from *S1* and soldered directly to the antenna terminal.

To date, the author has built four units and all have performed satisfactorily. You'll find construction of the UHF converter a lot less complicated than this description might seem to indicate if you'll remember that the most important things to watch at UHF frequencies are neatness, cleanliness, and very careful layout.

-30-

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1L4	5AW4	6CB6	12AV6	35L6GT
1L6	5BK7	6CD6G	12AV7	35W4
1N5GT	5E5	7A4	12AX4GT	35Y4
1Q5GT	5U1G	7A4	12AX7	35Z5GT
	5U8	7A5		37
2A3		7A6	19B6G6	39/44
2AF4		7A7	19J6	42
3BC5	6A7	7A8	19T8	43
3BN6	6A8	7B4	2A	45
3BZ6	6AB4	7B5	25A V5	39A5
3CB6	6AC7	7B6	25DQ6	78
3CF9	6AF4	7B7	25DN6	80
3CS6	6B8	7B8	25L6GT	84/6Z4
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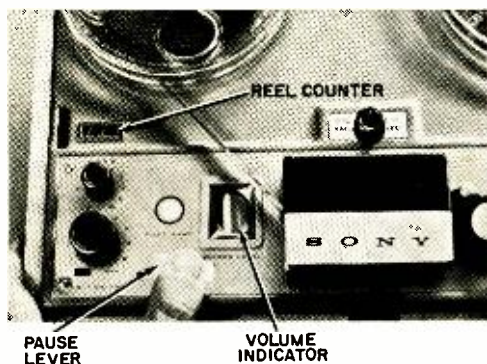
(Continued from page 58)

the very loudest bursts of noise or signal from the receiver. Be sure not to over-modulate the recorder as this will distort the recording. And don't be deceived by the clarity of the sound from the headphones or speaker attached to the recorder—unless it is a playback-after-record monitoring arrangement.

For practically all short-wave broadcasts, record at the slowest possible speed and use 1-mil, or even ½-mil, Mylar long-playing tape. You can either let the recorder run continuously (if you think this will be a "hot night" for DX), or leave it connected to the receiver so that the recorder can be flicked on at any time. If the recorder runs continuously, be prepared to write down the reel counter reading so that you will be able to find the most interesting portions of your tape for editing.

Most DX'ers let the tape run continuously; and if they have heard nothing worthwhile, they record right over the earlier recording. Of course, this permanently destroys the first recording—so be cautious first and you won't be sorry later.

If you don't want to bother to check the reel counter when you hear something you want to save on tape, have some small scraps of paper handy. Stick one of these into the winding tape to lo-



Here are some handy controls that SWL's will find useful in taping off-the-air. The "pause" lever is an instantaneous stop to temporarily delay the tape action while you write or tune the receiver.

cate a particular excerpt you will want to edit.

Don't make the mistake of trying to "save" tape by recording a half-track in one direction and the remaining half-track in the other. When it comes to editing, you'll soon realize how thoroughly impractical this false economy can become.

Tape Editing. The supplies needed for editing are few. You can do a fair job with only a razor blade, a splicing block, and splicing tape. However, a splicer is easier to use and holds the tape so that your splices will be neat and virtually noiseless in playback. A grease pencil will come in handy, as will a pair of scissors. And you'll need blank (empty) reels and boxes.

The editing process goes like this: first you play the tape to be edited and locate the parts to be preserved. Depending on the length of the "good" part of your tape, you can either cut out the useless sections and wind them on a second reel or you can cut out the portion to be joined to a library tape of DX'ing exploits. Temporarily join the pieces together with small bits of splicing tape.

Put the reel of rejects aside to be properly spliced and re-used. Rewind the "good" tape sections back onto the feed reel, so your editing can start at the beginning. Also, decide at this point if you want to dub in narration on an extra piece of tape to serve as an introduction.

Now play the tape and locate the first temporary splice. Stop the tape, then move the reels back and forth with the tape still over the heads, listening for the "grrrowlll" that indicates the end of the recording. Mark the tape right over the playback head with your grease pencil. Now skip ahead and locate the beginning of the next recording the same way.

You can splice the desirable tape sections together, if you like, by inserting a short length of leader and timing tape between sections. This special tape has no oxide coating. A 7½" length of leader will give a two-second pause (at 3¾ ips) and is also useful in finding a spot recording during a fast forward wind.

After editing, your tapes should be labeled, stored in boxes (also labeled), and filed. Store them away from heat

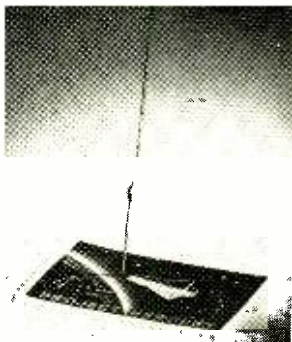
and excessive humidity. Do not store them near motors, magnets, power tools, air conditioners, speakers, or other equipment with strong magnetic fields.

In a Nutshell. The above is a primer on SWL tape recordings. Much can be quickly and easily gained by practical experience. Why not try tape recording tonight? -30-

Transistor Topics
(Continued from page 82)

first large-scale transistor radio demonstrator in kit form—it's designed to be built in class by the teacher, or by students as a class project. Packaged as a kit with the complete schematic diagram silk-screened on a durable Masonite board measuring 27 $\frac{3}{4}$ " x 40 $\frac{3}{4}$ " x 3 $\frac{1}{2}$ ", the RA-6D is equipped with components which snap in and out with spring-type clips. Thus, parts can be easily taken out and replaced to teach trouble-shooting techniques as well as basic electronics theory. The RA-6D sells for \$79.95.

The International Rectifier Corp. (233 Kansas St., El Segundo, Calif.) is now offering a subminiature, silicon, light-



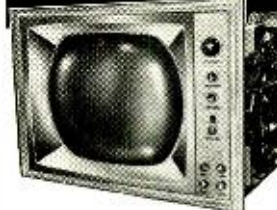
Light-activated pnpn switch by International Rectifier is mighty tiny, even when compared with a four-cent postage stamp.

actuated, pnpn switch which can be triggered by 100 to 500 footcandles of light to directly activate relays, solenoids, controlled rectifiers, and similar devices. Several types are available, with voltage ratings from 10 to 400 volts and capable of controlling currents of from 5 to 250 ma. Prices range from \$5.00 to \$25.00 each; technical specifications are given

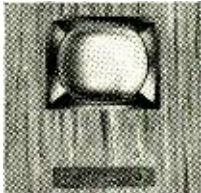
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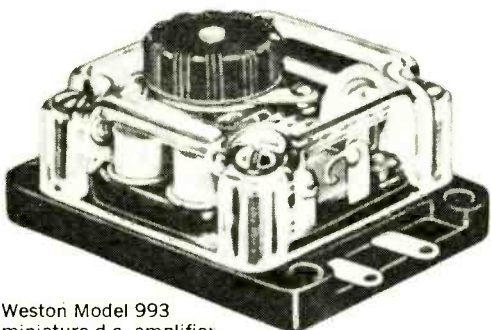
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in Bulletin SR-281, available on request from the factory.

Daystrom's Weston Instruments Division (614 Frelinghuysen Ave., Newark 14, N.J.) has developed a miniature d.c.



Weston Model 993 miniature d.c. amplifier.

amplifier designed for use with photovoltaic cells. Assembled in a small plastic case and using two transistors, the Model 993 has an input resistance of 7000 ohms and will accept signals of 0-5 μ a. With a maximum gain of 10, it delivers an output signal of 0-50 μ a. and has a frequency response of 0-10 cycles.

The amplifier is powered by a self-contained mercury cell and can be connected directly between a photovoltaic cell and a standard microammeter.

A West German firm, R & E Hopt KG —Fabrik für Radio- und Fernsehtechnik (Rottweil a.N., Germany), has introduced the world's smallest FM-tuner front end. Identified as the FMT 100 "Micro-Tuner," the unit covers 87.3 to 108 mc., has an output frequency of 10.7 mc. and an overall gain of 25 db. Fully transistorized, the FMT 100 requires 8 volts at 4 ma. for operation.

McMartin Industries (1612 California St., Omaha, Nebr.) has come out with an 8-watt, fully transistorized p.a. amplifier. Using eight transistors, the Model LT-80 offers output impedances of 4, 8, 16, 150, and 600 ohms, and has a frequency response of from 50 to 10,000 cycles at full output. It draws only 18 watts when powered from a standard 117-volt a.c. line.

That sums up the semiconductor story for now. I'll be back next month with more news, as usual.

—Lou

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1R5 .43	5AQ5 .42	6AV5 .80	6CF6 .51	6SL7 .64	12BY7 .54
1S4 .49	5A5A .53	6AV6 .33	6CG7 .43	6SN7 .46	12BT7 .60
1S5 .41	5AT8 .64	6AW8 .63	6C08 .62	6S07 .58	12CA5 .50
1T4 .46	5AV9 .67	6AX4 .46	6CH8 .76	6T8 .68	12CU5 /
1U4 .57	5B07 .66	6AX5 .59	6CL8 .63	6V8 .75	6E48 .46
1U5 .40	5B07 .78	6AX7 .78	6CM6 .51	6V3 .92	12CX6 .43
1V2 .45	5B08 .63	6AZ8 .90	6CM6 .51	6V6 .66	12D4 .55
1X2 .66	5C08 .61	6BA6 .40	6CM7 .53	6W6 .42	12L6 .46
2BM4 .52	5CL8 .61	6BB8 .70	6C08 .62	6X4 .31	12D06 .83
2CY5 .56	5C08 .67	6BC5 .48	6C08 .62	6X4 .31	12ZAT .74
2CW4 .56	5C08 .67	6BC5 .48	6C08 .62	6X4 .31	12ZAT .74
2FM5 .51	5J6 .54	6BD6 .46	6C57 .55	7AU7 .49	12SN7 .47
3A3 .63	5Y8 .65	6BE6 .44	6C08 .62	8AW8 .74	12X7 .54
3AL5 .34	5U4 .48	6BD6 1.33	6C08 .62	8C07 .50	12W6 .42
3AU6 .41	5Y8 .65	6BE6 .44	6C08 .62	8C07 .50	12W6 .42
3AV6 .33	5V3 .72	6BH8 .70	6C08 .62	8C07 .50	12W6 .42
3BC6 .43	5X8 .62	6BK5 .74	6C08 .62	8C07 .50	12W6 .42
3BE6 .42	5Y3 .37	6BJ6 .50	6C08 .62	8C07 .50	12W6 .42
3BN4 .51	6AR4 .37	6BK7 .68	6C08 .62	8C07 .50	12W6 .42
3BN6 .61	6A7 .67	6BK7 .68	6C08 .62	8C07 .50	12W6 .42
3BU8 .62	6AF3 .58	6BN4 .46	6C08 .62	8C07 .50	12W6 .42
3BY6 .41	6AF4 .58	6BN4 .46	6C08 .62	8C07 .50	12W6 .42
3BZ6 .44	6A05 .48	6BN6 .61	6C08 .62	8C07 .50	12W6 .42
3C5E .42	6A06 .48	6BQ5 .52	6C08 .62	8C07 .50	12W6 .42
3C6E .48	6AH6 .67	6BQ5 /	6C08 .62	8C07 .50	12W6 .42
3C7E .42	6A85 .85	6BQ5 /	6C08 .62	8C07 .50	12W6 .42
3CY5 .56	6AL5 .58	6C08 .62	6C08 .62	8C07 .50	12W6 .42
3DM6 .48	6AM8 .55	6B07 .80	6C08 .62	8C07 .50	12W6 .42
3D7E .40	6AN8 .74	6BR8 .72	6C08 .62	8C07 .50	12W6 .42
354 .49	6A05 .37	6BU8 .56	6C08 .62	8C07 .50	12W6 .42
3V4 .46	6A07 .60	6B7 .80	6C08 .62	8C07 .50	12W6 .42
4A4U6 .43	6AR5 .44	6BV5 .52	6C08 .62	8C07 .50	12W6 .42
4B5E .48	6A05 .37	6B7 .80	6C08 .62	8C07 .50	12W6 .42
4B07 .61	6A05 .37	6B7 .80	6C08 .62	8C07 .50	12W6 .42
4B5E .48	6A05 .37	6B7 .80	6C08 .62	8C07 .50	12W6 .42
4BZ6 .46	6A78 .63	6BZ6 .44	6C08 .62	8C07 .50	12W6 .42
4C6E .43	6A05 .37	6C4 .34	6C08 .62	8C07 .50	12W6 .42

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Bionics—a Weird World

(Continued from page 55)

Some two to three billion neuron pulses are shooting through your nerve/brain system every second. Your eyes alone may generate as many as two billion and send them streaming along the incredibly complex interconnected nerve pathways to your brain. Still only dimly understood is what the brain does with all these pulses—how it tells from a lot of little spikes of electricity what your eyes are seeing.

But with an increasing understanding of the operation of neuron nets, scientists are beginning to be able to duplicate some nerve cell functions in an elementary way. An artificial neuron designed by L. D. Harmon of Bell Labs has five inputs which can be stimulated to fire the neurons, and one which inhibits firing. Bell scientists used this artificial neuron to build a simple "bug detector" similar to the frog's.

Bionic "Mouse." As mentioned earlier, RCA is working on a far more complicated moving-target indicator containing hundreds of neurons which operates on the same principle. But perhaps the most important piece of neural-bionic hardware to come out of the laboratories so far is a "bionic mouse" built by the Melpar Corporation. The "mouse" is housed in a small red plastic case about the size of a matchbox, mounted on wheels. A thin umbilical cord of control wires, suspended from a freely moving arm above, allows complete freedom of move-

ment and connects the mouse with its "brain" mounted in a relay rack.

Although the mouse looks like a toy, U. S. Air Force scientists working with it aren't playing. They are convinced that the mouse is the first step toward a completely new kind of thinking machine, as different from today's conventional computers as a superhet from a crystal set.

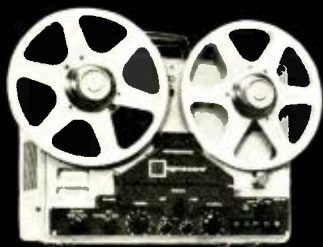
Not long ago, in a laboratory at the Wright Air Development Center in Dayton, Ohio, the author saw this "mouse" put through its paces. A technician placed it in a maze and flipped a switch. The mouse ran down alleys, turned corners, came to dead ends and backtracked, and tried other routes. Forty-five minutes later, after exploring scores of wrong turns and dead ends, it reached the end of the maze. The operator picked it up, and set it back at the beginning.

The second time round the mouse made fewer mistakes, and covered the course in about half the time. On the third attempt it ran through in eight minutes. Six tries later, it whizzed through the course in 45 seconds flat without a single error. The mouse had learned the maze, just as a live mouse would!

Bionic devices display true—though limited—intelligence in the animal sense. The bionic mouse has only 10 neurons in contrast to our 10 billion, but like an animal it can adapt to changing conditions and learn from experience. Change the maze, and it's confused—at first. But then it settles down and learns the new pattern.

A bionic "brain," in other words, can operate from generalized instructions. In the case of the "mouse," the only

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command was "learn to run the maze." Scientists call the mouse a self-organizing system which, on the basis of generalized instructions, figures out how to do the job. Human beings are self-organizing, too. A computer, on the other hand, has to be "programmed"—instructed in detail on every step. It must be told when to turn, when to store correct steps in its memory, and so on.

Pattern Recognizers. Bionic brains will eventually take over hundreds of jobs which are now too complex for computers. They will, for example, work perfectly as pattern recognizers. Airborne Instruments Laboratory already has a bionic pattern recognizer which peeks through a microscope and tells cancerous cells from healthy ones by their size, shape, and general appearance. A Lincoln Lab version looks over electroencephalograms and spots abnormal brain waves.

Bionic pattern recognizers may someday approach the capabilities of the best pattern recognizers to date: human beings. Even a baby not yet able to coordinate well enough to put one block on

top of another can instantly differentiate between his mother and any other human being. Yet the most advanced computer can't approach this kind of precision.

Future bionic pattern recognizers, though, will distinguish faces or objects of any kind. Such a device could be put in a missile, shown a map with an "X" at one point and told to fly over enemy territory until the ground pattern matched the map, and then zero in.

Handwriting is a pattern, too. An "a" made by one person is very different from an "a" made by another, yet human beings recognize "a's" easily and read handwriting. A computer can't do it nearly as accurately as a person can, but there's no reason a bionic brain won't be able to—and do it much faster than people.

Speech is little more than a pattern of sound waves—also recognizable by a bionic brain. Dr. Frank Putzrath of RCA is building an electronic ear which will use a network of artificial neurons to tell one word from another in much the same way human beings do. With a bionic listener, a business man could dic-

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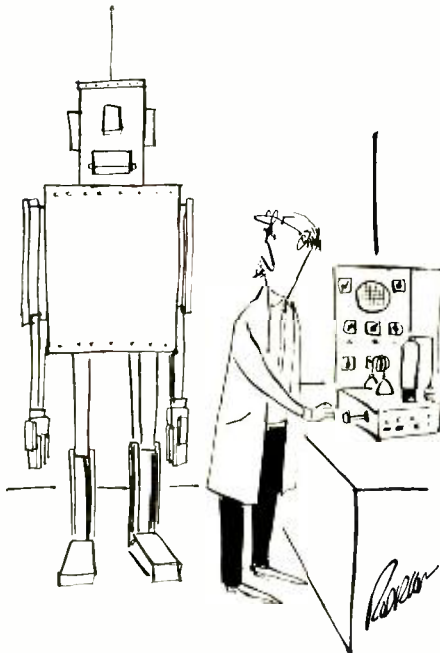
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tate letters to his typewriter. Similarly, a battle commander could direct automatic tanks, missiles, and guns—just by talking to them.

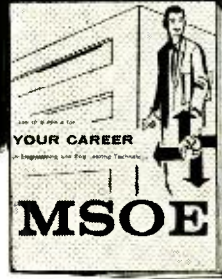
Educating Bionic Brains. Such brains would share many characteristics with human brains, among them, the necessity to learn. Today's computers are ready for operation as soon as the last soldered joint cools. A bionic brain, though, said Captain Leslie Knapp, one of the Air Force's top bionic scientists, might have to sit on the shelf for a year or more to become educated. During that time, 24 hours a day, and at electronic speed, it would soak up libraries of information about scores of different subjects. Then, when given instructions to translate a paper from one language to another, for example, it would know how.

The usefulness of such bionic machines can hardly be overestimated. A bionic robot, for instance, could be sent to explore the moon. No computer small enough to fly in a space ship could possibly be programmed to know how to deal with every possible condition it might encounter. A relatively small bionic brain, though, able to adapt to conditions as it found them, would be a



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Bionic machines may help keep man from being overwhelmed by the fantastic amount of information he has to receive, analyze, and digest in this age of science. TIROS weather satellites, for example, have helped weathermen sharpen their weather eyes, but they've brought problems, too. The flying weather station spews forth thousands of pictures every day—so many that it becomes almost impossible just to look at and interpret each one. As more weather stations go into operation, the situation could become unmanageable.

With a bionic brain aboard, a TIROS satellite could look over each picture to see if it contained important information. Then only pictures with special patterns—those showing incipient hurricanes, for example—would be transmitted to the ground. Similarly, a Midas "spy-in-the-sky" satellite could be directed to be on the lookout for troop movements and ICBM launchings.

We can expect bionic brains to run factories and offices, control traffic, keep track of national production, forecast weather, and do thousands of other jobs in our society. As the industrial revolution produced machines to relieve men of physical drudgery, the coming bionics revolution should bring forth devices to relieve him of mental drudgery. -30-

Solution to Crossword Puzzle

(Puzzle appears on page 74)

S	C	H	E	M	A	T	I	C		S	W	
H	E	A	R		T	E	N		L	I		
U	L	M		L	O	G		V	U		S	
N	L		N	I	M		O	T		M	U	
T		R	E	D		S	R		O	H	M	
	S	I	G		X	C		Q	S	O		
M	E	G		P	I		G	T	C		D	
I	D		N	E		V	A	R		A	R	
L		P	U		S	O	S		P	R	I	
	A	M		B	E	L		R	E	E	L	
D	C			P	I	C	T	O	R	I	A	L

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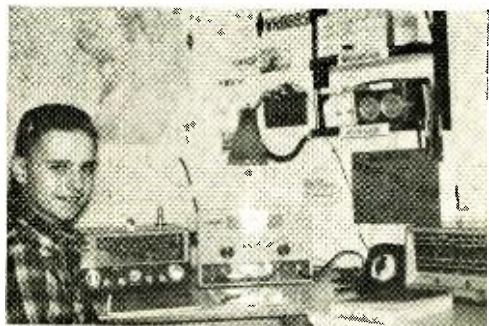
Across the Ham Bands

(Continued from page 74)

News and Views

Stan Dicks, WN4CXW, 4140 Tyng Way, Charlotte 7, N.C., got a 579 report from K8VGM on the first call, using the 15-meter ground-plane antenna he constructed from the instructions in our April, 1962, column. Stan transmits on a Heathkit DX-40 and receives on a Hallicrafters SX-98. A dipole antenna does the radiating on 80 and 40 meters. Seventeen of the 20 states he has worked, plus Canada, have QSL'ed so far. Drop a note to Stan if you'd like a sked, naming band and time. . . . **Bud Applin, WV2YUA**, RD #3, Dansville, N.Y., has worked the Philippines, Sweden, a couple of Canadians, and 30 states with his Johnson Adventurer transmitter in the half year he's been on the air. A Hammarlund HQ-129X receiver and a 40-meter dipole complete the low-frequency section of the station, and a Heathkit "Twoer" gets him around on 2 meters—where he'll be a full-fledged member of the Livingston County Civil Defense net as soon as his General ticket arrives. A wife and four children hold down the amount of time Bud can spend on the air, but he'll try to sked you if you need a New York contact. . . . **James D. Kronman, WV6UYV**, 14612 Hamlin St., Van Nuys, Calif., has his call letters entered in 254 logs in the 37 states he has worked. Most of the contacts were made on 40 meters with a Johnson Adventurer transmitter, but Jim also works 15 meters when the opportunity presents itself. An old National HRO-7, helped along by both a Heathkit Q-Multiplier and a BC-453 "surplus" receiver for extra selectivity, handles the receiving chores. Two 40-meter dipoles, a vertical, and a random-length antenna grow on the WV6UYV antenna farm.

Want to work Hawaii? **John Woods, WH6ELX**, 106 Kainalu, Kailua, Hawaii, would like to work you; John is on 7170 kc. at



Peter Diehl, **WN0BBS**, Marsland, Nebr., operates on 80 meters with a Heathkit HX-11 transmitter and "Mohican" receiver. When not on the air, he spends much of his time studying for a Conditional license.

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night and on 21,168 kc. during the day. With 43 states and 20 countries worked, it's obvious that John's Knight T-50 transmitter—feeding a Hy-Gain 3-element, 15-meter beam or an 80/40-meter dipole—gets out. Equally obviously, his Hallicrafters SX-110 receiver drags signals in well. . . . **Steve Shaw, KN1TNN**, 138 Common St., Braintree 84, Mass., is a triple-threat man. When not hamming as KN1TNN, he is SWL'ing as WPE1DQZ, or operating WEJH (his school's closed-circuit TV station). Steve's Heathkit DX-20 transmitter, feeding a 40-meter dipole, and his surplus BC-455 receiver have exchanged reports and greetings with 10 states. . . . **Paul Luczak, WN9EHF**, 608 Finley Rd., Lombard, Ill., says commercial equipment and kits are fine, but you can't beat the feeling of satisfaction gained from making contacts on your own "home-brew" equipment. In 11 days on the air, Paul's home-brew 40-watt and 8-tube receiver have made 33 contacts in 11 states; work him and he'll send you one of his QSL cards (also home-brew).

Charles Lambert, WA4EPH, 314 Jamestown Road, Williamsburg, Va., worked 30 states on 40 and 15 meters as a Novice using a Heathkit DX-20 to feed 40- and 15-meter dipoles. He receives on a Heathkit HR-10. Chuck will give you a hand if you need help in getting your ham license, and he'll sked hams who need a Virginia contact. . . . **John Williams, KN3SYB**, 207 Oakdale Road, Salisbury, Md., feeds 80- and 40-meter "inverted-

MISSOURI SLOW-SPEED NET

Meeting Monday through Friday at 1600 CST and Saturday mornings at 0800 CST on 3715 kc., the primary purpose of the Missouri Slow-Speed Net (MSN) is to teach new hams the proper method of handling recorded messages. All hams are welcome to report in the MSN; after three months of regular participation, each ham receives a Section Net Certificate from the Missouri ARRL Section Communications Manager. Also, the net sends a monthly bulletin to its members. Ruth Vollrath, KØONK, 432 North Lyon St., Marshall, Mo., is the net manager.

V" antennas with a Globe Scout De luxe transmitter and receives on a Hammarlund HQ-110. John is also in the process of building a 15-meter beam. Being a member of Explorer Post 149, BSA, is really paying off for him: an ex-Navy Communications Officer is teaching the members code and radio theory on meeting nights. . . . If you would like to play—or learn to play—chess by radio, write **Robert A. Wachtel, K3NKH**, 6009 Berkshire Drive, Bethesda, Maryland.

Keep those pictures, news items, and suggestions for construction projects coming. All mail for *Across the Ham Bands* should be addressed to: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana, 73.

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Short-Wave Report

(Continued from page 84)

Current Station Reports

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used.

Albania—Tirana, 7087 kc., has French at 1700 and Eng. from 1730 to 1756 s/off and from 1930 to 2000 s/off; Eng. news at 1730. A recent letter from them, however, gives the Eng. schedule as 1730-2300.

Angola—*R. Clube de Benguela*, Benguela, is noted on 9502 kc. from 0043 opening to past 0215. News in Portuguese is given at 0131-0140; otherwise program is mostly dance music.

Argentina—The latest schedule from *Radiodifusion Argentina Al Exterior*, Buenos Aires, reads as follows: to Europe at 1400-1500 in Spanish, at 1500-1600 in German, at 1600-1700 in Italian, at 1700-1800 in French, and at 1800-1900 in Eng. on 11,730 kc.; to N.A. at 1900-2000 in Portuguese, at 2000-2200 and 2300-0100 in Spanish, and at 2200-2300 and 0100-0200 in Eng. on 9690 kc.

Australia—Here is the schedule for *R. Australia's* domestic relays: VLI, Sydney, at 1500-0830 (to 0900 on Saturdays) on 6090 kc.; VLH, Melbourne, at 1500-1815 on 11,880 kc., at 1830-0315 on 15,230 kc., and at 0330-0830 (to 0900 on Saturdays) on 9680 kc.; VLR, Melbourne, at 1500-1730 and 0330-0800 on

6150 kc., and at 1745-0330 on 9680 kc.; VLQ and VLM, Brisbane, at 1500-0830 (to 0900 on Saturdays) on 4920 and 9660 kc.; VLW, Perth, at 1700-1900 and 0530-1030 (to 1100 on Saturdays) on 6140 kc. and at 1915-0515 on 9610 kc.; and VLX, Perth, at 1700-1900 and 0530-1030 (to 1100 on Saturdays) on 9610 kc., and at 1915-0515 on 15,425 kc. The complete Eng. schedule for *R. Australia's* Overseas Service reads: to Indonesia, S.E., S., and S.W. Asia at 1714-0800 on 25,735 kc., at 1714-0430 on 21,540 kc., at 1915-0400 on 17,870 kc., at 1714-1915 and 0300-0800 on 15,220 kc., at 0955-1230 on 11,760 kc., at 0800-1000 on 11,740 kc., at 0459-1230 on 9570 kc., and at 0800-1230 on 7220 kc.; to E. Asia and N.W. Pacific Islands at 1559-1915 on 15,240 kc., at 0244-0500 and 0600-0700 on 11,810 kc., and at 0600-0900 on 9580 kc.; to N.A. at 0714-0815 (East Coast) and at 1013-1115 (West Coast) on 11,710 kc.; to Africa at 2329-0045 on 17,820 kc.; to British Isles and Europe at 0100-0230 on 11,710 and 9570 kc.; to Mid-Pacific Islands at 1500-1700 on 15,315 kc., at 2129-0230 on 15,240 kc., and at 0244-0700 on 7190 kc.; to S. Pacific Isles at 1500-1700 on 11,840 kc., and at 0100-0415 on 11,710 and 9570 kc.

Bolivia—*La Cruz del Sur*, La Paz, now operates regularly on 4985 and 11,765 kc., but the exact schedule is not known. Reports go to Cajon 8. *R. Pio XII*, Siglo XX, has moved to 5980 kc. and is heard well in Brazil at 1822-1955, all Spanish. A newscast is given at 1825, local news at 1833. Power is 750 watts.

British Honduras—The British Honduras Broadcasting Service, Belize, 3300 kc., has been noted lately giving the ID as *Radio Belize*.

Burma—After a wait of six months, the *Voice of Burma* finally verified their 0745-0915 xmsn on 6035 kc.

Canary Islands—*La Voz de la Isla de la Palma*, Santa Cruz de la Palma, has now moved to 7341 kc. (it was formerly on 7345 and 7388 kc.), and has been noted from 1707 mostly with pop tunes, all Spanish.

China—China Press Agency, Peking, has been tuned on 10,483 kc. at 0620 with news in native language; weak.

According to the "Shortwave Reception Guide" published by the Philips Technical Library in Holland, Time Station XSG operates on 6414.5 kc. (dual to 8502 kc.) daily at

SHORT-WAVE ABBREVIATIONS

Eng.—English
ID—Identification
IS—Interval signal
kc.—Kilocycles
kw.—Kilowatts
N.A.—North America

OSL—Verification
R.—Radio
s/off—Sign-off
s/on—Sign-on
xmsn—Transmission
xmtr—Transmitter



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Many SWL and QSL cards arrive incompletely addressed, however, or addressed only to a WPE call-sign. Cards are now being held for the call-signs listed at the right.

If your call-sign appears in this list, and you have not already filed your name, address, and WPE call-sign with the Bureau, send an SASE to: LeRoy Waite, WPE2AK, Manager, SWL/QSL Bureau, 39 Hannum St., Ballston Spa, N. Y. Upon receipt of the SASE, your card/cards will be forwarded to you.

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WPE1DFS	WPE3BDV	WPE8BAU
WPE1TV	WPE3CCM	WPE8BCY
WPE2AAK	WPE3CTH	WPE8BGP
WPE2AWP	WPE3CXH	WPE8BOI
WPE2BJV	WPE3MC	WPE8BUO
WPE2BNW	WPE3UY	WPE8BXY
WPE2CBP	WPE4ATZ	WPE8CBC
WPE2CFP	WPE4CIA	WPE8CBG
WPE2CRL	WPE4CVN	WPE8CDO
WPE2CSD	WPE4EDP	WPE8CMQ
WPE2CSE	WPE4KV	WPE8EKH
WPE2CT	WPE4RX	WPE8IED
WPE2CTA		WPE8LG
WPE2DDZ	WPE5ACB	WPE9ATR
WPE2DEY	WPE5AWK	WPE9BHZ
WPE2DJP	WPE5AWV	WPE9BNX
WPE2DNL	WPE5BFB	WPE9BOJ
WPE2DTL	WPE5RJ	WPE9CLI
WPE2EAA		WPE9CQV
WPE2EC	WPE6AFB	WPE9NA
WPE2FEN	WPE6BJW	WPE9NY
WPE2FFD	WPE6BUK	
WPE2FJQ	WPE6CBQ	WPE0ABC
WPE2GJD	WPE6OT	WPE0ACM
WPE2FTF	WPE6UD	WPE0AQJ
WPE2HGI		WPE0BXQ
WPE2KK	WPE7AEU	
WPE3ABH	WPE7AKB	VE2PE3T
WPE3AGB	WPE7AQB	
WPE3AGC	WPE7AQZ	VO1PE1J

2155-0355, sending Morse time checks. The location was not given.

Columbia—Two stations noted recently are: HJCQ, *R. Nacional*, Bogota, 4955 kc., at 1900-1945, with an Eng. lesson for Spanish listeners at 1945-2000; and HJGF, Bucaramanga, 4845 kc. The latter is said to have Eng. at 2230-2300 but your reporter believes it to be 2330-0000. They s/off at 0000 with "Columbia, the Gem of the Ocean."

Dominican Republic—*R. Caribe* is noted well on HI3U, 9485 kc., at 1600-1630 with news and at 1830-1900 with music, and on HI5U, 3322 kc., with music at 2100-2130.

England—The N.A. Service of the British Broadcasting Corp. is now radiated at 0930-1200 on 15,300 kc. (a change from 15,420 kc.)

and 17,860 kc., the latter only at 1100-1200.

Ethiopia—From *Sweden Calling DX'ers* comes word that the first 100-kw. xmtr has arrived here, with test xmsns probably already in progress. Full-scale operation from ETLF, P. O. Box 654, Addis Ababa, is expected to start in February, 1963.

France—A late schedule from Paris lists Eng. at 0800-0845, French at 0845-0945, and Vietnamese at 0945-1000 to the Far East on 21,620, 17,775, and 15,245 kc., and French at 1800-1830 on 9680 and 9560 kc. Other Eng. xmsns reported are at 1545-1600 with news on 6145 kc. and at 0130 on 7160 kc. with Eng. lessons to French-speaking people.

Ghana—The newest schedule from Accra, updating that given last month, lists Eng.

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as follows: on 6070 kc. to W. Africa at 0945-1030, 1200-1245, 1500-1545, and 1630-1715; on 9545 kc. to W. Africa at 1630-1715; on 11,800 kc. to Sudan and Ethiopia at 1330-1415 and to Europe at 1550-1635; on 15,190 kc. to Sudan and Ethiopia at 0900-0945; on 15,287 kc. to S. Africa at 1500-1545; on 17,910 kc. to E. Africa at 0945-1030; and on 21,545 kc. to S., S.W., and S.E. Africa at 0945-1030. Reception reports are welcomed and should be sent to the Propagation Engineer, Ghana Broadcasting System, P. O. Box 1633, Accra, Ghana.

Greenland—According to Switzerland's DX Program, *Gronlands Radiofon*, Godthaab,

is supposed to begin a short-wave service in the near future on 6090 kc. No other details were given.

Lebanon—Beirut is on 15,235 kc. with its eight-note IS at 1558, clock strike at 1600, then a clear ID as *Huna Beyrouth*. After a brief newscast, Arabic music is heard at 1605. S/off is at 1649 with an anthem. There may also be an Arabic transmission at 1500-1550.

Liberia—ELWA, Monrovia, now operates on 9590 kc. at 2100-2230 in Eng. with religious news, music, a "Question Box," and some native music. This is dual to 11,825 kc.

Mali—*Radiodiffusion Nationale*, Bamako, is scheduled Monday through Friday at 0100-0300, 0700-0900, and 1300-1800, Saturdays at 0100-0300, 0700-1230, and 1300-1800, Sundays at 0300-1230 and 1230-1800 on 4835, 7145, and 9745 kc. in French, Bambara, Sonraie, Saracole, Maure, Ouolof, and Peull, but no English. Your best chance to log them is on 7145 kc. at 0100-0300. There may be an English lesson around 0130.

Mozambique—*Louwenco Marques* has moved from 15,300 kc. to 15,292 kc. and has been tuned from 1050 with Portuguese music. Chimes and an ID are given at 1100; dance music follows.

Netherlands—A rough broadcast to log, especially in Western U.S., is the 1625-1720 xmsn to Europe in English. Much easier to hear are the xmsns on dual channels 9715 and 11,730 kc., both operating at the same time to Europe and North America.

Paraguay—According to a QSL letter sent by Cesar Miguel Saccarello, Director-Proprietario, *R. Guarani* operates on 15,200 kc. (ZPA7) at 0700-1100 and 1400-1900. They also sent a yellow, red, and blue pennant. Re-

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POPULAR ELECTRONICS

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Vega Baja, Puerto Rico, is still being processed by the Commission.

Venezuela—Two stations which have been heard recently are YVKB, *R. Difusora Venezuela*, Caracas, and YVQN, *Ondas Portenas*, Puerto La Cruz. The former, on 4890 kc., is reported as being heard from 2200 to 2300 with music and discussions. The latter, on 4790 kc., has been heard from 2230 to 2320 with classical music, at 2320-2325 with news, s/off at 2330.

Clandestine—From a recent news magazine comes word that the often heard *R. Espana Independiente* is located in Prague, Czechoslovakia. The station reportedly features anti-Franco propaganda.

R. Libertad, La Voz de Anti-Communistas De America, gives a return address of P. O. Box 1624, Miami 1, Florida. Frequent monitoring reveals that they announce as operating on 4005, 5065, 6240, 7308, 7404, and 15,050 kc., as well as on a medium-wave channel, 1550 kc.

Unidentified—A station believed to be *FLN Radio*, Algeria, is noted with ID at 0000 in Arabic, followed by an anthem from "Aida" by Verdi, and a Moslem chanting of the Koran. Here is a verbatim translation of the opening announcement. "This is our morning broadcast every day from 7 o'clock until quarter to nine and it is on the following two waves: 25.32 and 31.38 meters. Evening broadcast is from 8 until ??? on three waves: 19.67, 19.88, and 25.96 meters. Be generous and be our friend and encourage others to hear our voice. This is the *Voice of the Liberals*." No transmitter location or address was given. -50-

Electronic Quizoo Answers

(Quiz on page 75)

- 1 — H An ALLIGATOR clip has teeth that mesh without overlapping.
- 2 — C A BUTTERFLY capacitor has wing-shaped rotor plates.
- 3 — J The RABBIT-ear antenna is used with VHF television receivers.
- 4 — G The BAT-wing antenna is used with UHF television receivers.
- 5 — I HORSEpower ratings are given to electric motors.
- 6 — A CROCODILE clips have overlapping jaws.
- 7 — E BUG refers to a telegraph key used by hams that makes "dots" automatically.
- 8 — B A CATwhisker is a crystal detector probe.
- 9 — F PIGtails are the wire leads on resistors and capacitors.
- 10 — D SPIDER is the name for the support (large black dot) that centers and holds the loudspeaker cone in place.

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