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NOVEMBER 1964

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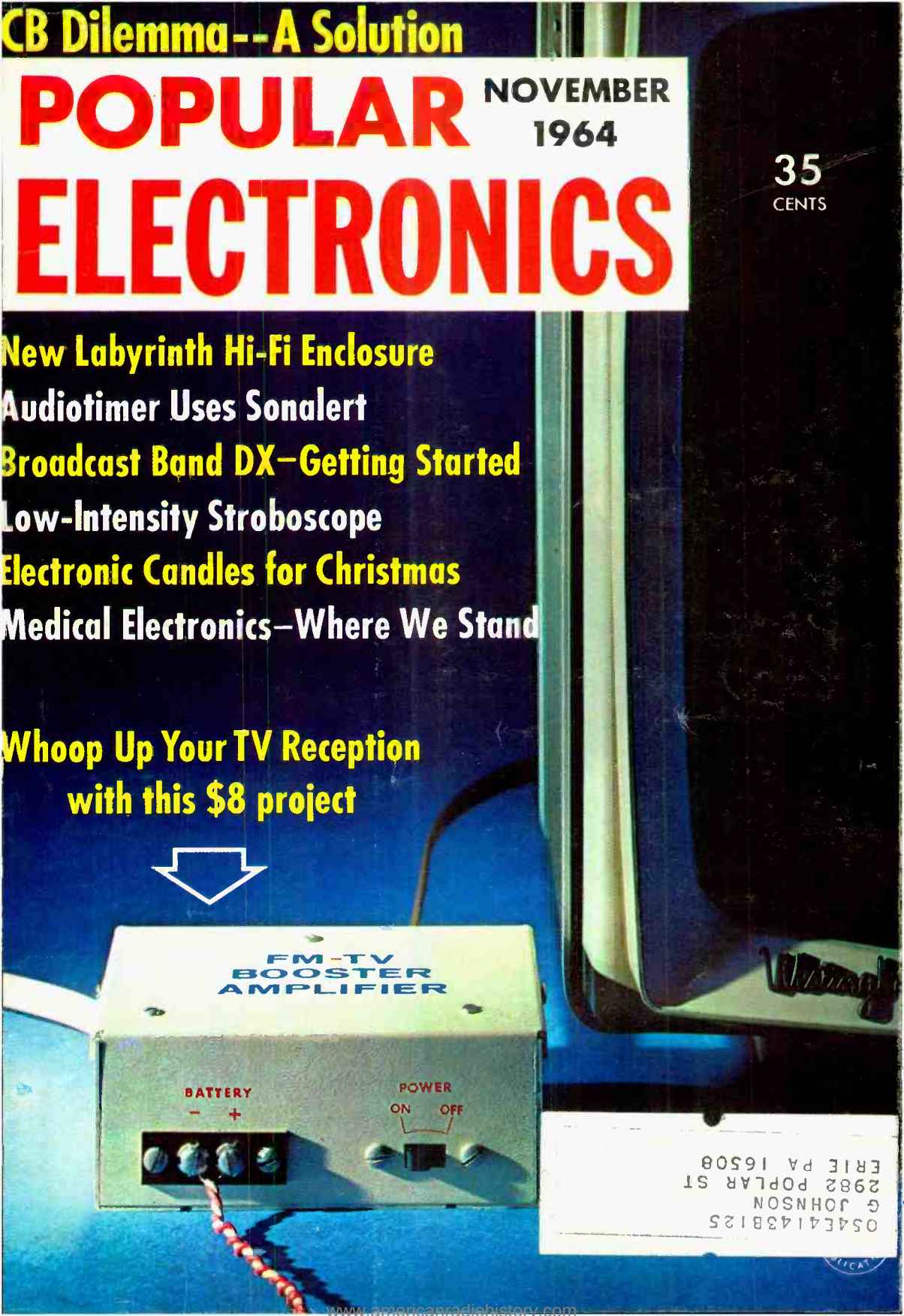

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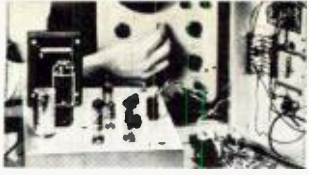

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"Many thanks to NRI for the Electronics training I received. I hold a first class FCC License and am employed as a studio and master control engineer/technician with KXJB-TV."

RONALD L. WOOD, Fargo, N.D.

"I am a Senior Engineering Aide at Litton Systems, in charge of checkout of magnetic recording devices for our computers. Without the help of NRI I would probably still be working in a factory at a lower standard of living."

DAVID F. CONRAD, Reseda, Calif.

"NRI training enabled me to land a very good job as Electronic Technician with the Post Office Dept. I also have a very profitable spare-time business fixing Radios and TV."

NORMAN RALSTON, Cincinnati, Ohio

POPULAR ELECTRONICS

ZIFF-DAVIS PUBLISHING COMPANY

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

This month's cover Photo by Bruce Pendleton

VOLUME 21 NOVEMBER, 1964 NUMBER 5

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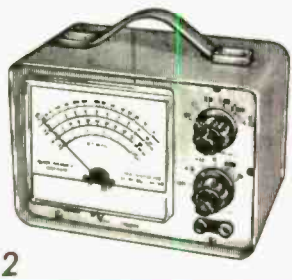

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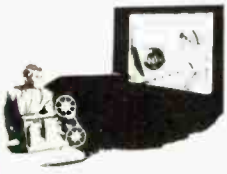

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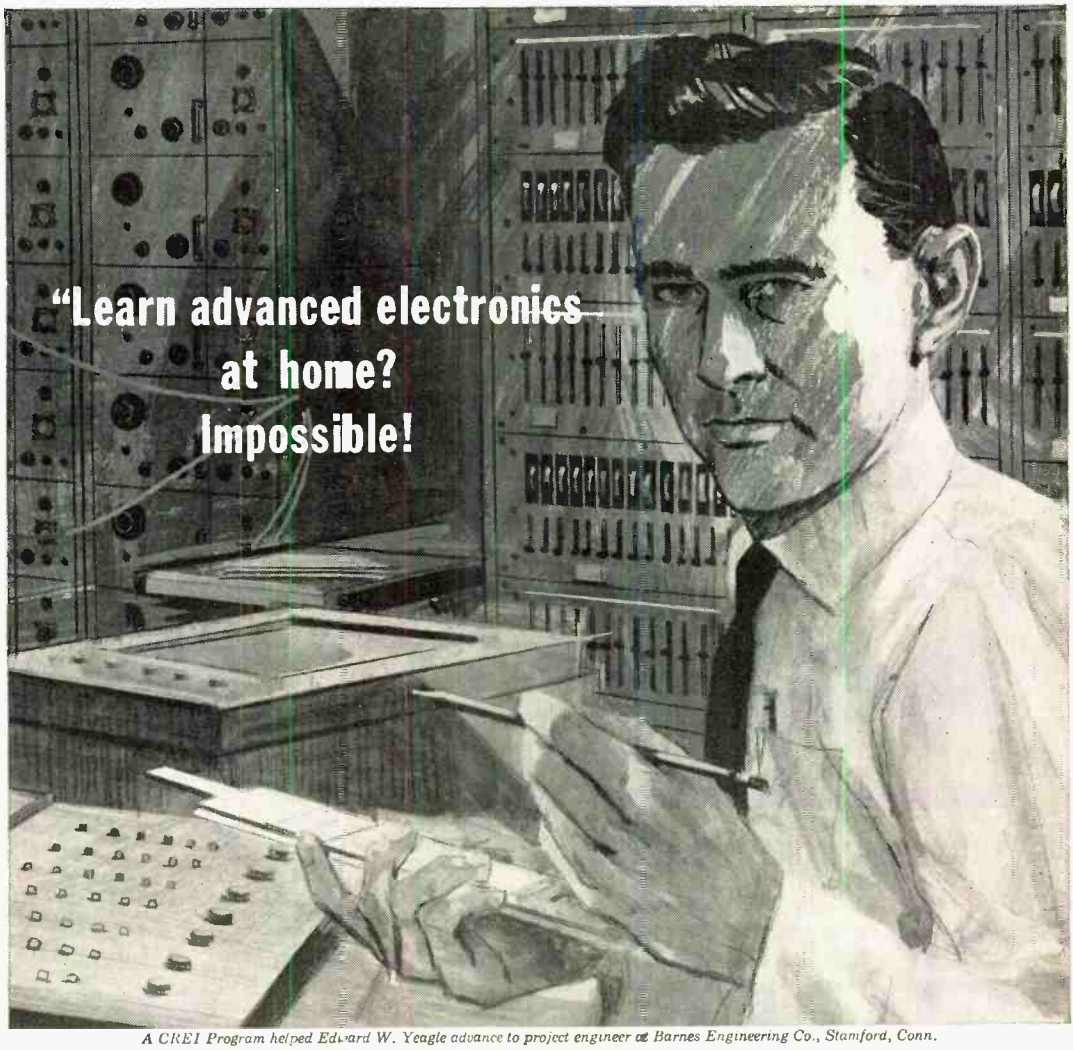

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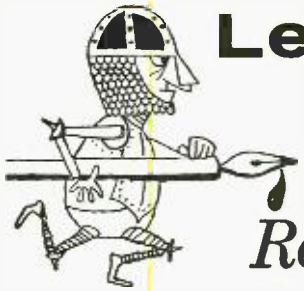

Letters *from our Readers*

Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS One Park Avenue, New York, N. Y. 10016

Lamp Costs $$$, He Claims

■ The "Hi-Lighter" (September, 1964) is a neat lamp, and highly effective for close work. I would, however, question your cost estimate. I incurred the following expenses: socket—$1; gooseneck—$1.36; transformer—$5.46; switch—52 cents; lamp bulb—26 cents; Minibox—$1.20. The total was $9.80, a far cry from the $5 mentioned in the text.

FRED MCCARTY
Elmhurst, N.Y.

While we must admit to having the advantage of knowing "what to get where," Fred, we believe you could have cut your outlay considerably with a little judicious shopping. Even if there are no radio stores in your neighborhood, mail order houses carry suitable items for this project. One example would be a 6.3-volt, 5-ampere filament transformer, No. 13A427, available from Burstein-Applebee at $2.39; and there are others.

Electronics for Halloween

■ The "Spookin' Light" (September, 1964) set me to thinking about a Halloween gadget that might be built. Kids like to blow out jack-o'-lantern candles. My idea is to put a small tape repeater, amplifier, and speaker into a large pumpkin along with a photocell and relay rigged to start the tape if the flame is blown

out. When a little brigand set off the "pumpkin head," he would be greeted with one of the loudest, longest, most blood-curdling yells this side of death!

DAVID STROOP
Xenia, Ohio

It should be possible to work something like this up, Dave, using a small tape repeater similar to the one incorporated in the "Family Message Center" (August, 1964) and an inexpensive prefabricated transistor amplifier available from various mail order houses. You'd probably save on hand-outs, but if your young brigand happened to read P.E., you might also lose a pumpkin!

Drop OTCB, He Suggests

■ The recent revision of Part 95 of the FCC Rules and Regulations should limit the useless gab and CB "hams" on 11 meters. In keeping with this FCC pol-

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CIRCLE NO. 11 ON READER SERVICE PAGE

Letters

(*Continued from page 8*)

prevent reverberation within the microphone housing. Only dual headphones with foam rubber cushions to block out extraneous sound should be used with the tubular mike—never, for obvious reasons, a speaker or ear plug. Lastly, the operator must learn to use the mike, as it takes a little practice. It is almost like listening to a radio news broadcast in a room full of people. The ear learns to discriminate against the unwanted conversation, and "hears" only the news broadcast.

JAMES R. HOLLINGER
JOHN E. MULLIGAN
York, Pa.

Wanted: Hi-Fi Drive-In Movies

■ The speakers at drive-in theaters are usually in poor condition and have less than satisfactory acoustical properties. How about an article on how to build a

pickup which could be clipped to the theater's speaker cord? The audio section of the car radio might be used as an amplifier.

SELWYN P. MILES
Sherborn, Mass.

The Great Label Controversy

■ The reader who complained about the address labels on his copies of POPULAR ELECTRONICS ("Letters From Our Readers," July, 1964) is mistaken in assuming they can't be easily removed. The glue (for the past year and a half) seems to be a plastic base type which does not harden. All you have to do is gently lift up one corner and slowly pull the label off.

WILLIAM SOMMERWERCK
Baltimore, Md.

■ Why don't you put the labels in the right-hand corner where they would cover the price?

TERRY HOWARD
Brooklyn, N.Y.

■ The labels can be easily removed by moistening them with cigarette lighter fluid—wait for the fluid to soak the label, then pull it off.

R. B. WILCOXSON
Royal Oak, Mich.

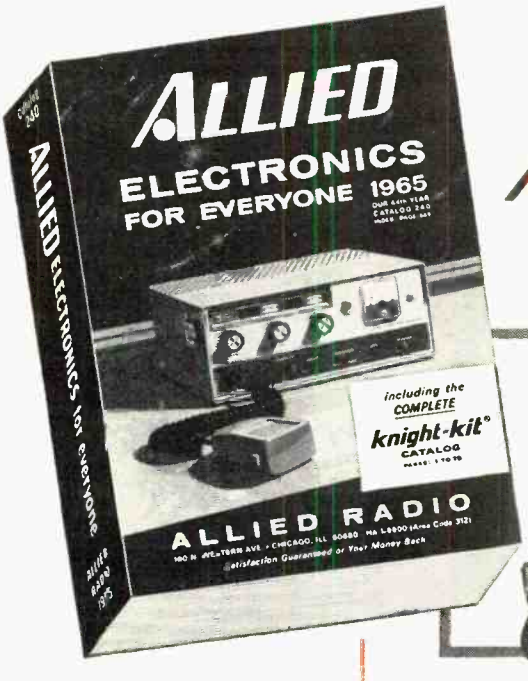
■ I'd like to compliment POPULAR ELECTRONICS for making the labels so easy to remove. The adhesive is thick and soft compared to the smooth hard surface of the cover. All you have to do is carefully slide a razor blade under the label and slice the adhesive.

ROGER LENT
Candler, N.C.

■ Just run your thumb along the three horizontal strips of gum under the label.

DON MCLEAN
Palo Alto, Calif.

(*Continued on page 12*)



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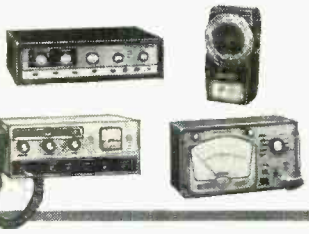

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CIRCLE NO. 1 ON READER SERVICE PAGE

Letters

(*Continued from page 10*)

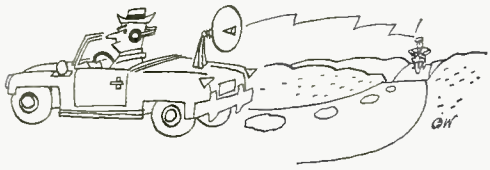
■ How about using a type of glue like *Reader's Digest* does?

CHARLES W. BRICE
Chester, S. C.

The above letters represent a small sample of those we have received on the Great Label Controversy, and will, we hope, satisfy all those with queries or comments. Your editors were blissfully unaware of this problem (or lack of same), having gone along for many years receiving their copies of P.E. WITHOUT labels.

Radar Aids for Poor Drivers?

■ "New Ultrasonic Radar for the Blind" (January, 1964) suggests interesting possibilities for people who aren't blind but drive cars. With ultrasonic transducers mounted on the rear of the vehicle, the driver could



be constantly aware of whether or not there was a car behind him, what it was doing, and how far away it was.

BART BILLARD
Washington, D.C.

Interesting idea, Bart, but "ground clutter" might be a problem (i.e., reflections from the pavement), and we can think of things less tiresome to listen to than ultrasonic reflections from that truck down the road.

That Wandering Broadcast Band

■ As a BCB DX'er, one thing puzzles me: What is the real frequency spectrum of the standard broadcast band? The markings on BCB radios vary: they include 550-1500 kc., 550-1600 kc., 540-1600 kc., and 550-1800 kc. Which figures are correct?

FRED MANN
Marrers, La.

None of them, Fred. The standard broadcast band range is from 535 to 1605 kc., although assignments are made only between 540 and 1600 kc. to allow for a 5-kc. guard band at each end.

Budget-Priced Tesla Coil

■ In an effort to reduce cost, I made the following substitutions in building "Big TC" (July, 1964). In place of a neon sign transformer, I used an oil burner ignition transformer rated at 10 kv./30 ma. Instead of acrylic tubing, I used 4"-diameter plastic sewer pipe, available from Sears Roebuck in 10' lengths at under $4, for the secondary coil form. Wooden dowels replace the ceramic standoff insulators in the primary circuit. The total cost was less than $15.00.

WILLIAM R. BROWN
Bridgeport, Conn.

Your idea of using plastic sewer pipe as the coil form for the Tesla Coil secondary sounds very good indeed, Bill. It's economical and should have excellent insulating properties. —30—

GOOD-BYE thread-up problems!

HELLO new mailing ease!

FREE long-roll bonus!

A self-threading reel with purchase of 7" roll of double or triple length tape!

No more tape fumbles, even with boxing gloves on! Just lay tape inside this reel, start recorder—and watch the reel thread-up automatically. Takes any tape thickness or leader tape. Releases freely on rewind. Get one free in the special pack shown. Just purchase a regular 7" reel of either double or triple length SCOTCH® Brand Recording Tape (up to 6 hours recording time at 3¾ ips). See your dealer for this long-roll bonus.

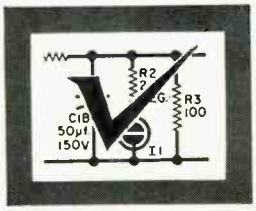
FREE short-roll bonus!

New heavy-duty plastic mailer with each "Living Letter" tape!

New high-strength, dust-free case for "Living Letters" makes handling, storage, mailing of taped corresponcence the easiest, most secure ever. Conforms to new postal regulations. Address label included. Built-in post holds reel securely. *New reel, too!* Fits all reel-to-reel recorders. Only 3" reel available that holds full 600' of triple length tape (an hour recording at 3¾ ips). 150' and 300' lengths also offered. Look for new "mailbox" display.

Magnetic Products Division 3M COMPANY

Operation Assist



THROUGH THIS COLUMN we try to make it possible for readers needing information on out-dated, obscure, and unusual radio-electronics gear to get help from *other* readers. Here's how it works: Check over the list below. If you can help anyone with a schematic or other information, *write him directly*—he'll appreciate it. If *you* need help, send a post card direct to OPERATION ASSIST, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. Give the maker's name, the model number, year of manufacture, bands covered, tubes used, etc. Be sure to print or type everything legibly, including your name and address, and be sure to state specifically what you want, i.e., schematic, source for parts, etc. Remember, *use a post card;* we can handle them much faster than letters. Don't send a return envelope; your response will come from fellow readers. Because we get so many inquiries, none can be acknowledged, and POPULAR ELECTRONICS reserves the right to publish only those requests that normal sources of technical information have failed to satisfy.

Schematic Diagrams

Radiotone Inc. Model HR-8 home transcription center, about 1945. (Richard A. Kerr, Jr., 1714 Heritage Ave., Placentia, Calif.)

Link Model 5-FRX surplus transmitter-receiver. (Daniel Turkisher, 6 Pin Oak Lane, White Plains, N.Y. 10606)

Philco Model 10 132 s.w. receiver, chassis 710273, made about 1938-39. Has 5 bands to 22.5 mc. (Mike Glover, 3131 S. Fillmore, Denver, Colo. 80210)

RCA "Radiola Special" 2-band, portable, 1-tube regen. receiver, about 1921. (S. N. Blake, 186 Summer St., Andover, Mass.)

Atwater Kent Model 87 BC receiver, about 1929. (J. P. Anrasko, 223 E. 96 St., New York, N.Y. 10028)

Cleartone AM receiver, series 110, made by Cincinnati Time Recorder Co. about 1925-26. Has Kellog-McCullough "Rectron 213" tubes. (Maj. W. J. Lake, Box 81, Hq. CONAC Robins AFB, Ga.)

GE Model F-53 5-tube BC and s.w. receiver. (Mrs. R. J. Haley, 7035 Arizona Ave., Los Angeles, Calif. 90045)

Echophone Model EC-1B 3-band s.w. receiver. (V. A. Rickard, 434 54 St., W. Palm Beach, Fla.)

E. H. Scott "Phantom DeLuxe" receiver, about 1940. Has 20 tubes, chrome chassis, tunes 540 kc.-60 mc. in 5 bands. (Edward Suhaka, 650 Huff Ave., Manville, N.J. 08835)

E. H. Scott Model RBO-1 receiver, about 1940. Tunes BC and s.w. in 3 bands, has 11 tubes. (J. Martin, 29 S. Joplin, Tulsa, Okla. 74112)

Howard Radio Corp. Model 225250 receiver, ser. 2253608, circa 1938. Tunes BC and s.w. to 18 mc., has 5 tubes. (Fred Studenberg, 1305 E. Norfolk St., Tampa, Fla. 33604)

(*Continued on page 20*)

POPULAR ELECTRONICS
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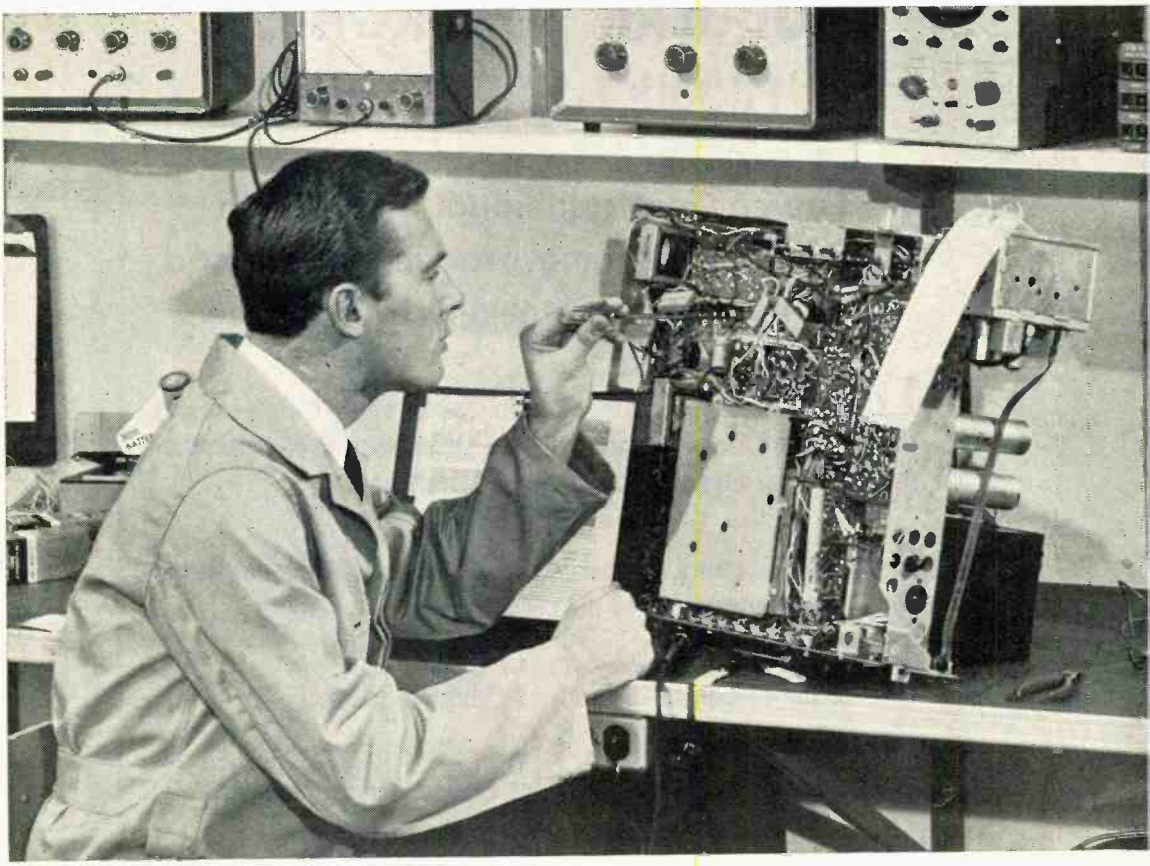

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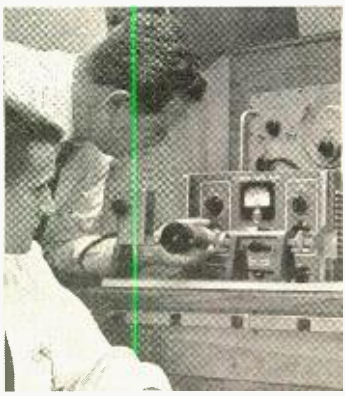

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The Most Trusted Name in Electronics

Operation Assist

(*Continued from page 14*)

O. J. McClure Model B12AC "Picturephone" (2-speed phono with p.a. amplifier), ser. 7992, about 1940. (P.J. Murray, 6220 33 St. N.W., Washington 15, D.C.)

Airline Model 62-12 8-tube superhet receiver, chassis A1019577, circa 1920's or 1930's. Built for Montgomery Ward. (Michael Getzewich, 160 Birch St., Manchester, Conn.)

Delco Model R-1141 radio console, pre-W.W. II. Tunes BC and s.w. bands, has push-button tuning. (R.H. French, 427 46 St., Bellaire, Ohio 43906)

Superior Model TV-11 tube checker. (Aero-Marine Engrg., 208 Melrose Ave., Atlantic City, N.J.)

General Motors Model 140-A radio console, circa 1930-31. Tunes BC, has 8 tubes. (Norman Lederman, 17 Fabyan St., Dorchester, Mass.)

Mullard Model MAS 407/15 9-tube receiver. (Marvin Jacobson, 330 Albany Ave., Brooklyn, N.Y. 11213)

RCA Model 9K3 receiver. Tunes 3 bands to 22 mc., has 8 tubes and tuning eye. (Rodney Dunlap, Rte. 3, Proctor, W. Va. 26055)

Tele-Tone Model N-GD 8 receiver. Tunes BC and s.w. (Michael Muderick, 697 Paddock Rd., Havertown, Pa. 19083)

E. H. Scott Model SLR-12R (or SLR-12B) Navy shipboard receiver. Tunes BC and s.w. bands. (Jack Ames, Box 48491, Briggs Station, Los Angeles 48, Calif.)

Motorola Model T-69-20A 5-tube transmitter. (George Weber, 1405 E. Polk, Harlingen, Texas)

Crosley Model 1055 5-band receiver. (James Weist, 1017 S. 25th St., La Crosse, Wis.)

Triumph Model 830 oscillograph wobbulator. (Thomas H. Edmiston, 7 Juno Rd., Tiburon, Calif. 94920)

Zenith Model 9H081 8-tube, 3-band receiver, ser. A-646015. (K. P. Becker, R.F.D. #1, Box 756, Medford Station, N.Y. 11763)

Zenith Model 5-8-220 5-tube table-model receiver, chassis R332930. Tunes BC and s.w. (Leon Hart, 1548 W. Sonora, Phoenix 7, Ariz.)

No. 19 MK II wireless set, made in Philadelphia, 1944, for Signal Corps. (R. W. Sadowski, 119 Kimberly Rd., Colonia, N.J. 07067)

AN/FRR-3A diversity receiver, surplus, 1944. (John Carter, 951 Breedlove St., Memphis, Tenn. 38107)

Link Model 11 UF DC 30-40 mc. police receiver. Has 11 tubes. (Gene Crisp, Box 336, Spring City, Tenn.)

Airline Model DE12 6-tube receiver. Has separate speaker. (Willis Kroll, Unionville Rte., Helena, Mont.)

Motorola Model 6A-2 AM-s.w. receiver, ser. 217549. Has 6 tubes. (E. Grebow, 215 Autumn Rd., Lakewood, N.J. 08701)

Special Data or Parts

W.W. II Japanese transceiver. UZ-133D tube with 1½-volt filament needed. (Gary Schelske, 116 7th Ave. E., Redfield, S.D.)

Crosley Model 739A BC-s.w. receiver. I.f. coil wanted. (Joe Blum, Rte. #1, New Washington, Ohio 44854)

Philco radio-phono combo, chassis NA13726; may be FM. Any available info and source of parts wanted. (Len Baspaly, 47 Teakwood Ave., Winnipeg 17, Manitoba, Canada)

Mackay marine radio, type 128A4, ser. 07402, made by Federal Telephone & Radio Co.; has 6 tubes, 4-band TRF. Schematic and technical manual wanted. (C. R. French, 460 Huron Ave., Louisville, Ky. 40209)

Silvertone Model R5501 receiver, chassis 101 618 1A, about 1939. Schematic diagram wanted, plus any other available info. (E. D. Dreyer, EMI, USNAS #115, Box 35A, FPO, New York, N.Y. 09593)

General Television and Radio Corp. "Swingmaster" Model 635 radio-phono combo., about 1940-41. Operating manual and schematic needed. (Mike Gunja, 7625 Fisher, Warren, Mich. 48091)

(*Continued on page 22*)

any*

*Yes, in any CB application...you'll outperform 'em all with a

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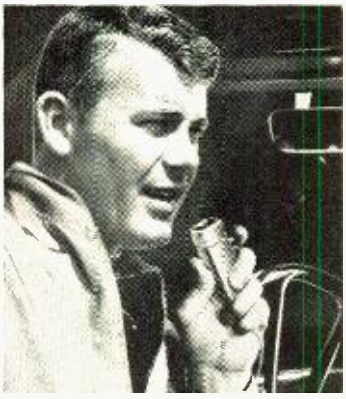

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CIRCLE NO. 14 ON READER SERVICE PAGE

Operation Assist

(*Continued from page 20*)

RCA "Echophone" receiver, ser. 77804. Bandselector data needed. **Coronado** Model C 11A54 console. Power transformer data needed. (Richard Jenneman, R.R. #2, Box 104, Stanley, Wis. 54768)

E. H. Scott "Phantom DeLuxe" AM-FM 5-band receiver with "magic eye" tuning, chrome-plated chassis, separate chassis for amplifier. Schematic and any other available data wanted. (J. Whiteleather, 129 Ogden Ave., Swarthmore, Pa. 19081)

Raytheon Model UM 30-1 receiver and transmitter. Alignment data and schematic wanted. (W. G. Emory, Box 55, Union, S. C. 29379)

Philco Model 40-150 3-band receiver, code 121. Schematic, parts source, and dial stringing info wanted. (Herbert Linn, Catawba, W. Va. 26564)

Hallicrafters Model SX-15 receiver, about 1937. Alignment info and schematic needed. (Robert R. Conner, 1606 Laguna Ave., Farmington, N. Mex.)

Philco Model 37-620 BC-s.w. receiver, circa 1940. Schematic and alignment data needed. (Wesley Maier, 4800 Morena Way, Sacramento, Calif. 95820)

GE Model J-105 BC-s.w. receiver, about 1941. Instruction manual and schematic diagram needed. (Brian L. Sauer, R.R. 1, Box 105, Randolph, Wis. 53956)

RCA Model 155A 3" oscilloscope, Navy surplus; **RCA** Model WR-53A FM sweep generator. Operating manuals and schematics wanted. (Brother J. H. Winblad, Electronics Shop, Brother Rice High School, 10001 S. Pulaski, Chicago, Ill. 60642)

Philco Model 39-25 BC-s.w., 2-band, 5-tube receiver, code 121. Alignment, servicing, and operating data wanted. (Oscar M. Tatum, 709-F Gallatin St., Huntsville, Ala. 35801)

National GPR-90 receiver. Plug-in coils, S-meter, schematic, and any available info wanted. (James Wyma, 4230 N. 31 Ave., Phoenix, Ariz. 85017)

RCA Model AR-67R 3-band receiver; uses 3 type 41's, a 5Z3 and 5 6F7's. Manual, alignment instructions, and schematic wanted. (Michael Swanson, 6436 S. 118 St., Seattle, Wash. 98178)

Osborne Model 300 CB transceiver. D.c. converter needed. (E. Mandich, 304 Chicora St., E. McKeesport, Pa.)

Sothern Toy Co. "Ivexline" BC receiver, circa 1923; powered by wet cells, uses UV-201's. Tubes, parts, operating info and schematic needed. (Ted Simons, 192 Saranac, Buffalo, N.Y.)

Atwater Kent Models 40 and/or 60. Any available info wanted. **Majestic** Model 70-B. UX-226 or CX-326, UX-171A or CX-371A tubes needed. (Dave Gealey, 308 Todd Way, Mill Valley, Calif.)

Heathkit Model O-2 oscilloscope, circa 1948. Power transformer, part 54-19 needed. (Pvt. Theodore Shylovsky, RA 11 435 440, Co. K, TRP COMD, USASCS, Fort Monmouth, N.J. 07703)

Coastwise Electronics Co. Model 730 VOM and signal tracer, ser. 10090. Operating info and schematic needed. (John W. Galbraith, 608 Westhill Dr., Cleburne, Tex. 76031)

Hallicrafters Model S20-R receiver, about 1940. Schematic and parts list needed. (C. Lee, 150 E. Ocotillo Rd., Phoenix, Ariz. 85012)

Hickok Model 550-X tube tester, about 1949. Schematic and individual tube charts wanted. (Jim Keene, 3700 W. Pine, St. Louis 8, Mo.)

National Model BM282 4-band receiver. Coil L1 needed. (Dave Verbil, 43-40 221 St., Bayside, N.Y. 11361)

Hammarlund Model HQ140-X receiver, about 1953-55. Manual needed. (J. J. Poskocil, 2791 Columbia Rd., Westlake, Ohio 44091)

Supreme Model 504 set tester, ser. 438, late 1930's. Manual and schematic wanted. (George Mac Zura, 3815 Highland Rd., E. St. Louis, Ill. 62204)

Link Model 5000-30 UF-C1 high-band FM transceiver, about 1953. Schematic, crystal data, and other available info wanted. (Neal W. Chapman, Box 157, Auburn, Me. 04210)

—30—

New Products

Additional information on products covered in this section is available from the manufacturers. Each new product is identified by a code number. To obtain further details on any of them, simply fill in and mail the coupon which appears on page 15.

AUTO REVERBERATION KIT

Car owners who are also audio enthusiasts will be interested in the all-transistor reverberation kit announced by *Cleveland Electronics, Inc.*, for use with 12-volt negative-ground car radios. Said to give the listener the illusion that he is surrounded by music, the unit incorporates an electromechanical device to reverberate the incoming sound, amplifies it, and plays it through a separate speaker. Two types of kits are available: the Model RU-104 for automobiles that already have a remote speaker and grille; and the Model RU-101 for cars that need a speaker and grille.

Circle No. 75 on Reader Service Page 15

TWO SPEAKER SYSTEMS

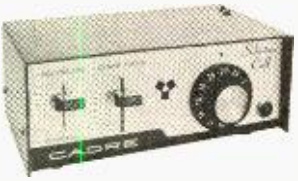
Two new compact speaker systems have been added to the *Sonotone* line: the "Beverly Hills" (Model SE-880, enclosure with two 8" speakers, shown at left), and the "Scarsdale" (Model SE-80, enclosure with one 8" speaker). Constructed of ¾" nonresonant

panels finished in oiled walnut, both enclosures are vented. Acoustic resistance has been added to the port to prevent boominess, and the cabinets are lined with "Tufflex" acoustical material. Frequency response of the "Beverly Hills" extends to 20,000 cycles; power rating, 40 watts or 80 watts peak; impedance, 8 to 16 ohms; size, 11" x 24" x 17½"; weight, 36 pounds. The "Scarsdale" has a response of 45 to 20,000 cycles; its power rating is 20 watts or 40 watts peak; impedance, 8 ohms; size, 11½" x 20½" x 12½"; and weight, 27 pounds.

Circle No. 76 on Reader Service Page 15

SELECTIVE CALLING SYSTEM

Completely transistorized and with negligible current drain, the *Cadre* Model 524 tone control selective calling system is designed to operate with this company's solid-state 5-watt transceivers and other 12-volt two-way radios. The Model 524 provides 24 tone combinations in a unique three-tone sequential system; two-way radios can be equipped to receive only desired calls on an all-unit or a selective basis.



Actually a compact encoder-decoder, the 524 incorporates a special resonant reed relay with a new, reliable tone generator. Under normal conditions, it can be installed in just a few minutes. Price, for base or mobile station, under $70.00.

Circle No. 77 on Reader Service Page 15

66-WATT STEREO AMPLIFIER

Outstanding features of the Model 233 66-watt stereo amplifier introduced by *H. H. Scott, Inc.*, include: speaker switch and front panel headphone outlet for private listening with the speakers silenced, a powered center channel output for an extension of center channel speaker without any additional amplifiers, and heavy-duty output transformers for good bass response even with inefficient speaker

systems. Also incorporated in the Model 233 are separate tone controls for each channel, d.c. on preamp tubes for low hum, and a balancing system to assure equal level from both speakers. Price, less than $190.00.

Circle No. 78 on Reader Service Page 15

ELLIPTICAL STYLUS CARTRIDGE—PLUS

Empire Scientific Corp. has announced a new 880PE elliptical stylus cartridge, plus an elliptical stylus replacement for owners of its 880 and 880P elliptical units. The new cartridge has a frequency response of 8 to 30,000 cycles, an output voltage of 8 millivolts per channel, more than 30 db channel separation, a load impedance of 47,000 ohms, and compliance of

New Products

(*Continued from page 23*)

20×10^{-6} cm/dyne. The stylus is a .2 x .9 mil biradial elliptical hand-polished diamond. Price of cartridge, $29.95. The stylus replacement costs $14.95.

Circle No. 79 on Reader Service Page 15

AUTO GENERATOR/REGULATOR KIT

An easy-to-assemble kit for the home auto mechanic has been designed by *Auto-Kits Products Inc.*

The Model GR contains two d.c. meters, covering 0 to 10 and 0 to 20 volts, and 0-50 amperes. In addition to checking generators and regulators, it will also check batteries, lights, switches, wiring, relays, turn signals, small d.c. motors, and many radio batteries. Price, $15.95, complete with test leads and full assembly and operating instructions.

Circle No. 80 on Reader Service Page 15

60-WATT HEAT CARTRIDGE

Ungar Electric Tools has designed a new lightweight 60-watt heat cartridge for its Imperial soldering iron line. The #6203 long-life cartridge is hermetically sealed within its slim oxidation-resistant stainless steel case. Its threaded end provides maximum heat transfer to Imperial "Mini-Tip" thread-on soldering tips at temperatures that range between 950°F and 1150°F, depending on which tip is used. Because of the ultra-high heat feature of this new cartridge, the manufacturer recommends that only iron-clad, gold-plated Imperial soldering tips be used with it to insure maximum tip life.

Circle No. 81 on Reader Service Page 15

UHF TV CONVERTER KIT

A compact, all-transistorized UHF television converter kit available from *Standard Kollsman Industries* permits customized in-set conversion of VHF-only receivers. The UCT-051 can be used to convert any table model or console, and most portables, so that all UHF channels, 14 through 83, can be tuned. The UHF tuner works into channel 5 or 6 of the VHF tuner, and is shielded physically and electrically to safeguard against interference with other TV sets in the vicinity. Installation is facilitated by a step-by-step instruction sheet; mounting hardware is provided.

Circle No. 82 on Reader Service Page 15

"OMNIDAPTOR"

The "Omnidaptor" is a new 45-rpm spindle adapter available from the *Aldshir Manufacturing Company* which is said to fit almost every automatic record changer. Fully automatic, it holds a stack of 45-rpm records in the same manner as a conventional adapter. A gentle pusher action drops each record into position for playing. Price, about $3.95.

Circle No. 83 on Reader Service Page 15

INSTANT DIODE TESTER

Diode faults such as shorts, opens, and improperly marked polarities can be discovered instantly with the inexpensive Model ID-1017 diode tester recently announced by *Henry Francis Parks Laboratory*. It's a "go—no-go" testing unit; the simple instructions needed to operate it are printed on its front cover. The load placed on a diode or rectifier being tested is that of the #47 indicator lamp used in the instrument; 150 ma. at 6.3 volts, or less than one watt. Therefore, any diode or rectifier which is rated at one watt or more can be tested with the Model ID-1017. Price, $19.95.

Circle No. 84 on Reader Service Page 15

A "THIRD HAND"

A new service aid devised by *General Electric* will hold either small parts or solder, giving the experimenter a "third hand." Essentially a large enameled steel clip, it can be either screwed to the edge of a workbench or positioned on a flat surface. Price, about 35 cents.

Circle No. 85 on Reader Service Page 15

MINIATURE TAPE RECORDER

Craig-Panorama's TR-490 "Electronic Notebook" is a self-contained miniature tape recorder with built-in microphone, VU meter for monitoring recording level and battery life, and push-button control for starting and stopping. These features permit single-hand operation. The TR-490 also features a snap-in tape-pack for recording up to 30 minutes; the nickel-cadmium batteries can be recharged without removing them from the unit. Price, $79.95, including leather carrying case. A kit containing four of the rechargeable batteries and a recharging unit are available as accessories.

Circle No. 86 on Reader Service Page 15

SCOTT'S TOP RATED LT-110 FM STEREO TUNER KIT NOW AT A NEW LOW PRICE...$139.95

"...1.88 uv sensitivity by a home alignment procedure without instruments...an exceptional feat..."

Electronics Illustrated

Here's terrific news for you kit builders! Now, the famous Scott LT-110 tuner kit . . . top rated by every audio expert . . . built by thousands of hi fi enthusiasts . . . is available in handsome new styling at a truly modest price.

Look at the outstanding features of this superbly engineered tuner. It includes a heavily silver-plated front end . . . prewired and tested in Scott's engineering laboratories. The critical multiplex section is also pre-wired and tested with the most advanced multiplex equipment available. Among the LT-110B's many extras: Stereo Separation in excess of 30 db, Sonic Monitor stereo indicator, 60 db Signal-to-Noise ratio, sensitive tuning meter.

Here's what the technical editor of Electronics Illustrated said about the LT-110: "If you have hesitated to go into stereo FM because of imagined complexities and highly technical skills and knowledge that might be required, fear no more. The LT-110 shows you how to enjoy stereo FM the easy way."

LK-72B 80-Watt Stereo Amplifier Kit. This popular amplifier kit delivers enough power to drive any speaker system, and at an outstanding price. Complete range of control features includes switched front panel headphone output, complete recording facilities, and provision for driving a third or center channel loudspeaker system without additional amplification. Only $149.95.

LK-48B 48-Watt Complete Stereo Amplifier Kit. Here's more than enough power for most music systems, and two great new features: Switched front panel headphone output for private listening, and powered center channel output to drive extension speakers. 13 front panel controls. Complete tape facilities. Includes all-aluminum chassis and DC-operated heaters for lowest hum. Only $129.95.

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Price slightly higher West of Rockies. Subject to change without notice.

CIRCLE NO. 30 ON READER SERVICE PAGE

BREAKTHROUGHS

Brief news flashes on recent important developments in the field of electronics

• Radios, TV sets, and other electronic devices of the future may be simply "glued" together instead of soldered if a new family of plastics developed by General Electric finds widespread application. Unlike the plastics developed to date which are excellent insulators, the new synthetic polymers rank midway between common insulators and common conductors in their ability to conduct electricity. While they do not rival metals as carriers of large currents with low losses, the polymers have the advantage of being easy to mold and shape, and can be used as a kind of adhesive paste to replace solder. It is anticipated that one immediate application may be in printed circuits such as those used in portable radios. . .

• Ball lightning—that strange natural phenomenon that has been known to float up and down chimneys, boil water, melt airplane propellers, and come out of oven doors—may be on the verge of explanation. Dr. David Finkelstein of Yeshiva University and Julio Rubinstein, a graduate student, theorize that it is the result of a concentration around a conductor (either ionized air or a solid object) of the high electric fields present during a thunderstorm. A great concentration of current flow occurs at the conductor, producing a glowing ball of fractured atoms and molecules which crackles and appears in different colors. The ball simply drifts around as air currents and electrical forces direct it, causing a concentration of current and field and thus continuing to glow. The ball can adhere to an airplane propeller or the rigging of a ship (where it is called St. Elmo's fire). Ball lightning goes out with a "bang or a whimper," disappearing when the electrical fields become weak, or resulting in a thunderbolt when they become strong. The scientists hope to confirm their theories by creating ball lightning in the laboratory. . .

• A reading machine for the blind that can translate a printed page directly into "electronic braille" is under development by Prof. John G. Linvill of Stanford University. The reading machine rolls freely over a printed page on plastic rollers, while tiny photoelectric cells on the bottom scan the words. The photocells are connected to fine reeds whose tips protrude through small holes in a reading panel on the top of the device. If a photocell sees black, the reed connected to it vibrates. By moving the

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- *Battery-operated 2-Way Radio Station*
- *Talk Up to ¼ Mile Away!*

America's favorite WIRED (not a kit) walkie-talkie . . . at the lowest price anywhere for a transceiver of our quality! It's ready to use; it's fun; and it's a cinch to operate. Great for hunting, boating, sports, construction sites! No license required. Receives and sends to all sets operating on CB Channel 14. Complete with everything you need! #60-3030

9.90
2 for $19.00

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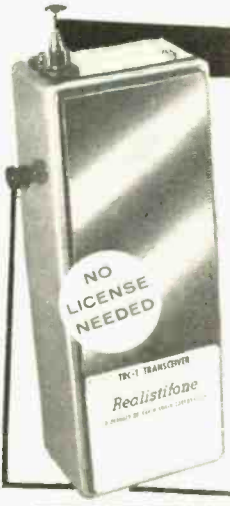

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Radio Shack's 9 transistor TRC-2: dependable communications up to 2 miles! Complete; no "extras" to buy! #21-1001K

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Powerful 12-transistor TRC-3 walkie-talkie: super-het with added RF stage! Built-in squelch! Range to 3 miles. #21-1142

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CIRCLE NO. 27 ON READER SERVICE PAGE

BREAKTHROUGHS

(*Continued from page* 26)

device over the page, a blind person feels the vibrating outline of each letter as his fingertips touch the reeds. Although only a hand-wired model has been built to test the idea, Prof. Linvill foresees a final version the size of a blackboard eraser utilizing microelectronics and penlight cells for power. Already, a blind 12-year-old test subject has learned to read about 25 words a minute after just a few weeks of one-hour practice sessions. . .

• A method of generating sound waves in the 9-gigacycle range—almost a million times higher in frequency than the 10-kc. point where sounds to the human ear become thin, shrill squeaks—was recently disclosed by Westinghouse Research Laboratories. The sounds were generated by thin-film piezoelectric crystals grown inside vacuum chambers by deposition of hot vapors. The crystals, actually crystalline cadmium sulfide, are built up atom by atom in a near perfect fashion. Unlike ordinary crystals—which are imperfect and which would shatter at high frequencies—the thin film crystals are efficient super-high-frequency transducers. The ability to generate sound at these frequencies is important in studying the physical structures of materials such as ruby or sapphire used in lasers. As an additional bonus, the crystals are also expected to have applications in low-noise, solid-state delay lines, and as detectors of infrared radiation. .

• A laser communications system for satellites and deep space vehicles that needs no electrical power or cooling, and weighs less than 20 pounds, has been developed by Electro-Optical Systems, Inc. Sunlight reflected from a lightweight 30-inch parabolic reflector is used to pump a Yttrium Aluminum Garnet (YAG) laser rod, which requires little stimulation to emit coherent light, and much less cooling than other types of lasers. A unique feature of the device is a water-filled glass flask shaped to serve as a liquid lens which is placed over the outside of the two-inch rod to refract solar energy over its entire length and help cool it. The unit—which would have an output greater than one watt in space sunlight—is said to be ideally suited for missions to the Moon, Mars, or Venus, being able to handle more information than present microwave systems with no electrical power requirements. In near space it might be used for satellite communications or as a space rendezvous beacon. . .

—*W. Steve Bacon*

NOW DIRECT CRYSTAL CONTROL TO 160 mc With AOC Plug-In Transistor Oscillators

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- Frequency Markers For Oscilloscopes • Quick-Change Plug-In Oscillators • Accessory Cases

HIGH FREQUENCY (20 mc — 160 mc)

Five transistor oscillators covering 20 mc - 160 mc. Standard 77°F calibration tolerance ±.0025%. The frequency tolerance is ±.0035%. Oscillator output is .2 volts (min) across 51 ohms. Power requirement: 9 vdc @ 10 ma. max.

OSCILLATOR TYPE	OSCILLATOR RANGE	CRYSTAL TYPE	TEMPERATURE TOL. —40 F to 150°F	OSCILLATOR (LESS CRYSTAL) PRICE
OT-24	20-40 mc	CY-7T	±.0035%	$ 9.10
OT-46	40-60 mc	CY-7T	±.0035%	9.10
OT-61	60-100 mc	CY-7T	±.0035%	15.00
OT-140	100-140 mc	CY-7T	±.0035%	15.00
OT-160	110-160 mc	CY-7T	±.0035%	15.00

CRYSTAL FREQUENCY	CRYSTAL PRICE
20-60 mc	$ 6.90
60-100 mc	12.00
101-140 mc	15.00
141-160 mc	18.00

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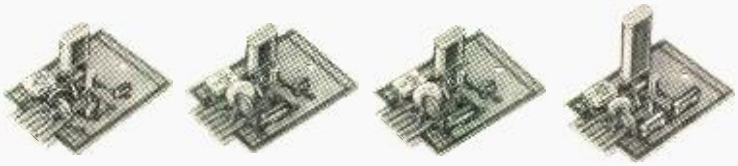


LOW FREQUENCY (70 kc — 20,000 kc)

Four transistor oscillators covering 70 kc - 20,000 kc. Trimmer capacitor for zeroing crystal. When oscillator is ordered with crystal the standard will be ±.0025%. Oscillator output is 1 volt (min) across 470 ohms. Power requirement: 9 vdc @ 10 ma. max.

OSCILLATOR TYPE	OSCILLATOR RANGE	CRYSTAL TYPE	TEMPERATURE TOL. —40°F TO + 150°F	OSCILLATOR (LESS CRYSTAL) PRICE
OT-1	70-200 kc	CY-13T	±.015%	$7.00
OT-2	200-5,000 kc	CY-6T	200-600kc ±.01% 600-5,000kc ±.0035%	7.00 7.00
OT-3	2,000-12,000 kc	CY-6T	±.0035%	7.00
OT-4	10,000-20,000 kc	CY-6T	±.0035%	7.00

CRYSTAL FREQUENCY	CRYSTAL PRICE
70-99 kc	$22.50
100-200 kc	15.00
200-499 kc	12.50
500-849 kc	22.50
850-999 kc	15.00
1,000-1,499 kc	9.80
1,500-2,999 kc	6.90
3,000-10,999 kc	4.90
11,000-20,000 kc	6.90

FOT-20

FOT-10

AOC OSCILLATOR CASES

Small portable cases for use with the OT series of plug-in oscillators. Prices do not include oscillators. (When oscillator and crystal are ordered with FOT-10 case a 77° F tolerance of ±.001% may be obtained at $2.00 extra per oscillator/crystal unit. When oscillator/crystal units are ordered with FOT-20 case, a single unit can be supplied with temperature calibration over a range of 40° F to 120° F. Correction to ±.0005%. Add $25.00 to the price of FOT-20 and oscillator/crystal unit.)

FOT-20 For high accuracy calibration requirements. Includes battery and output jack, output meter circuit and battery check, as well as thermistor temperature measuring circuit. **$87.50**

FOT-10 Basic case with battery and output jack for general wider tolerance applications. **$14.50**

MT-1 Oscillator board mounting kit. **$4.95**

Order direct from International Crystal Mfg. Co.

CIRCLE NO. 13 ON READER SERVICE PAGE

POP'tronics Bookshelf

SPACE COMMUNICATIONS

by Stanley Leinwoll

This book is a "space age" summary of what has happened in the field of satellite communications. The author—a regular contributor to POPULAR ELECTRONICS on propagation subjects—reviews the contribution each satellite program has made; outlines just where we stand today, and what satellites are now in orbit or likely to be launched; and makes a prognosis as to future communications systems. The text flows easily, is nonmathematical, and provides generally concise word pictures of a difficult subject. Project Oscar (operated by radio amateurs) is given feature treatment, but practically all mention of the Soviet satellites has been omitted.

Published by John F. Rider Publisher, Inc., 850 Third Ave., New York 22, N.Y. 166 pages. Soft cover. $3.95.

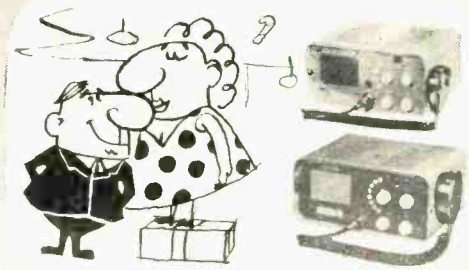
ELECTRONICS DATA HANDBOOK

by Martin Clifford

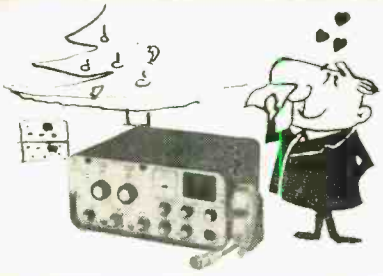
The almost unbelievable number and variety of formulas, specifications, symbols, and terms that plague the field of electronics have—at last—been encapsulated in one volume. The task of finding a necessary piece of information has been simplified by the very logical arrangement of the *Data Handbook.* Starting with d.c., the *Handbook* devotes separate information-packed chapters to a.c., vacuum tubes, transistors, antennas, measurements, and miscellaneous tables.

Published by Gernsback Library, Inc., 154 West 14 St., New York, N.Y. 10011. 160 pages. With soft cover, $2.95. With cloth binding, $4.60.

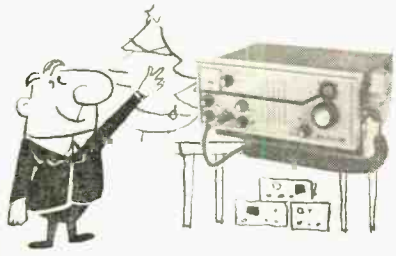
(*Continued on page* 32)



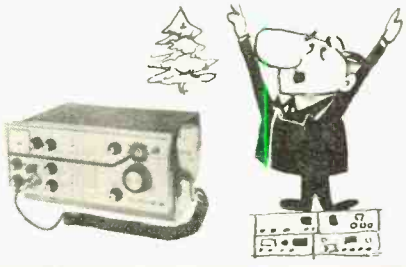
On the 1st day of Christmas my true love gave to me a POLY-COMM "N-4" and "N-8" and kissed me under the tree.



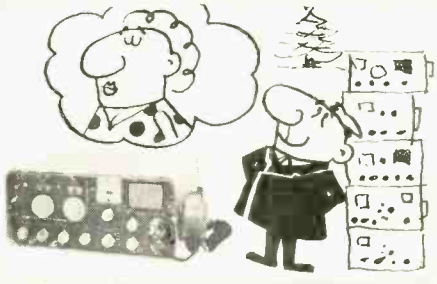
The 2nd day of Christmas my true love gave to me a POLY-COMM "PRO". I have to say, I love her so!



The 3rd day of Christmas my true love gave to me a POLY-COMM "TWENTY-THREE". How happy could I be!

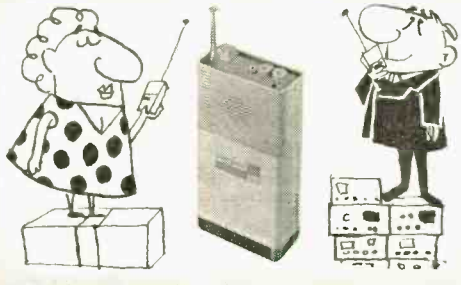


The 4th day of Christmas my true love gave to me a POLY-COMM "SR. 23" with selective listening. Yippee!

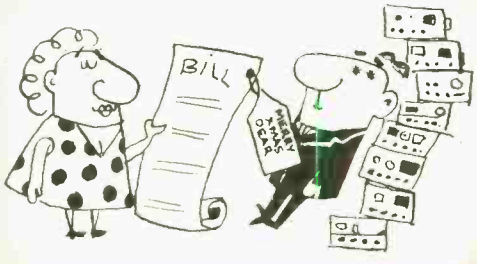


The 5th day of Christmas my true love gave to me a POLY-COMM "6" meter transceiver. Just can't beat her!

The 6th day of Christmas my true love gave to me a POLY-COMM "2" meter transceiver. Want to meet her?



The 7th day of Christmas my true love gave to me a POLY-COMM "120" 1 watt walkie-talkie to talk to me.



The 8th day of Christmas my true love gave to me a real big thrill. She gave me a great big bill.

Bookshelf

(*Continued from page* 30)

ENCYCLOPEDIA OF HIGH FIDELITY (Six Volumes)

John Borwick, General Editor

Readers of that notable British publication, *Hi-Fi News*, will recognize the name of the editor who painstakingly assembled this encyclopedia. It is an important work that summarizes the present knowledge of hi-fi/stereo from a European vantage point. Each of the six volumes is based on a manuscript written by an authority on either amplifiers, acoustics, disc reproduction, radio reception, tape recording, or loudspeakers. This convenient separation of subject matter is an attractive idea and, since individual volumes may be purchased, the reader can select those topics of maximum interest. The material in these volumes has a high technical level, is very comprehensive, and is generally of such quality that these books should be on the shelves of design engineers, advanced audio technicians, and possibly service shops repairing European equipment. Although the art of electronics as practiced in Europe and America is growing closer and closer as years go by, your reviewer must candidly admit that the British authorship is a distinct drawback in this case. Cited equipment is rare or totally unknown to most hi-fi enthusiasts in the U.S.A. Since much of each volume is devoted to discussing the features of excellent equipment that we can neither see nor operate, the encyclopedia has a number of limitations from our standpoint. To use a colloquialism, it's a crying shame.

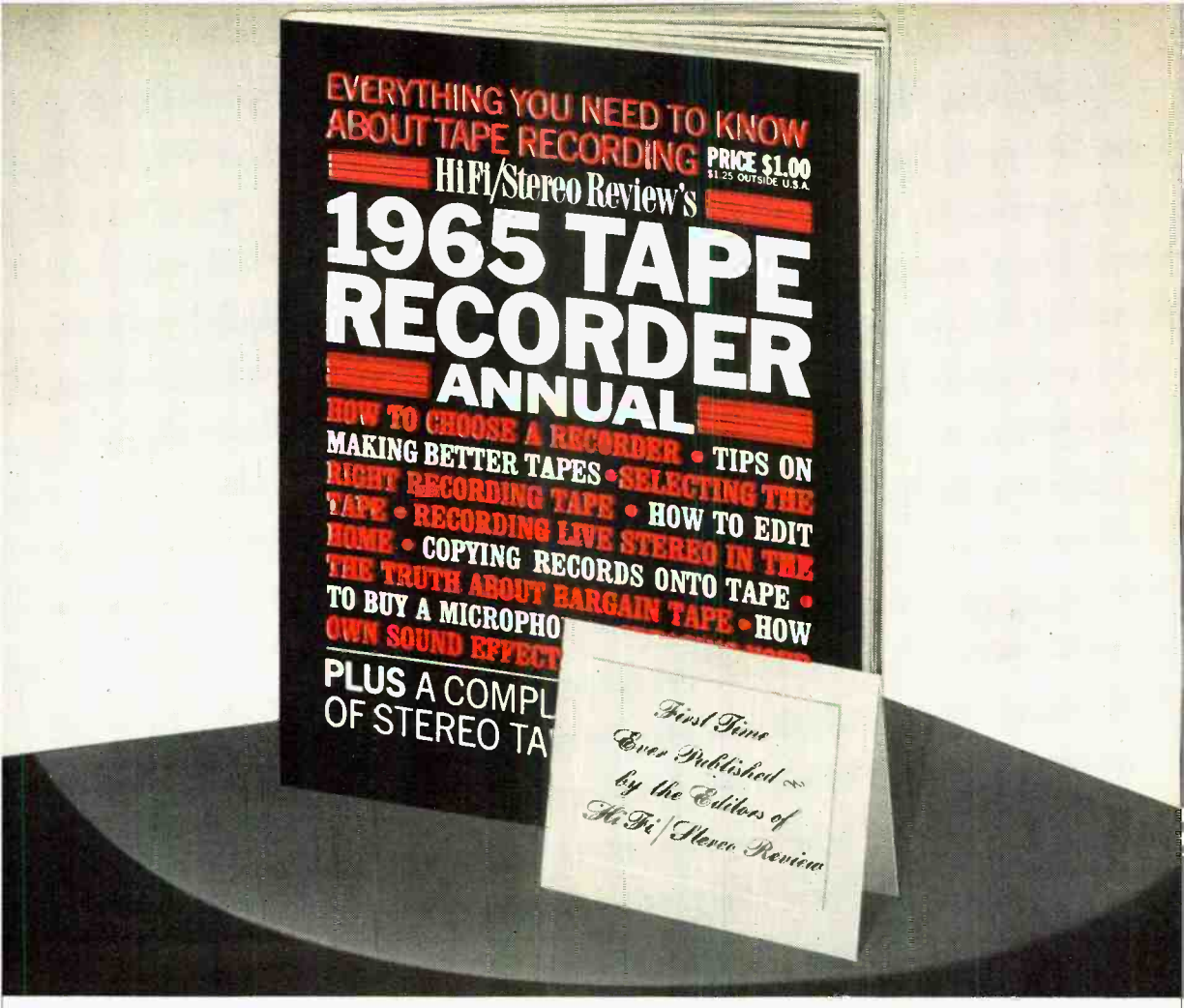
Published by The Focal Press. Distributed in the United States by Pitman Publishing Corp., 20 East 46 St., New York, N.Y. 10017. Six hard-cover volumes. About 1500 pages total. $49 per set; $9.50 per volume.

ELECTRONIC NAVIGATION MADE EASY

by John D. Lenk

If you want to demonstrate your prowess as a sea-going electronic genius the next time that snooty friend takes you aboard his 30-foot cruiser, read this latest book from the typewriter of John Lenk. Although labeled "electronic," this book is really a discussion of just about everything you would want to know concerning navigation. As a reference

(*Continued on page* 38)



Know-it-all.

It's easy to be an authority on tape when you have a copy of *HiFi/Stereo Review*'s **1965 TAPE RECORDER ANNUAL** handy.

Look at the photo above. The special articles listed on the cover of this 132-page factbook are just a few of the **23 complete features!** You get expert tips by the dozens, on equipment—making better tapes — editing — copying — sound — on **everything** you need to know about tape recording. Plus...

...**a complete directory of stereo tape recorders!** Over 100 photos — complete data on 230 models from thirty-three different manufacturers! All the model numbers, specifications, dimensions and prices! All the important information you need to compare the latest tape recorders, and select the finest one in your price range.

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Bookshelf

(*Continued from page 32*)

source on exactly how the Consolan system operates, the book has already proved its worth at the offices of POPULAR ELECTRONICS. It has a question and answer section, and a valuable set of appendices, including a handy glossary. In the usual Lenk style, it is well-written and thoroughly illustrated.

Published by John F. Rider Publisher, Inc., 850 Third Ave., New York 22, N. Y. Soft cover. 176 pages. $3.95.

Free Literature

Up 94 pages over last year, the new 1965 Lafayette catalog contains 516 pages and covers "everything in electronics" for home, industry and laboratory. The equipment of all major manufacturers is featured—stereo hi-fi, CB, ham, test equipment, etc. Write to Lafayette Radio Electronics Corp., P.O. Box 10, Dept. PR, Syosset, L.I., N.Y. 11791 for your free copy . . . A "Condensed Glossary of Electronics Terminology" is now available from the International Resistance Company, 401 N. Broad St., Philadelphia, Pa. 19108. Some 133 terms used in the electronics field are listed and defined in its 16 pages . . . The Sherwood "Information Kit" includes the second edition of *An Introduction to Hi-Fi and Stereo* (64 pages) published by the Institute of High Fidelity, a *Photo File* of music systems, an *FM & FM Stereo Station Finder*, and a *Time-Saver Shopping Guide*. Available free of charge at Sherwood dealers, the "Information Kit" can also be obtained by sending 25 cents in coin direct to Sherwood Electronic Laboratories, Inc., 4300 N. California Ave., Chicago, Ill. 60618.

Expanded lines of transistorized hi-fi components highlight Allied Radio's new 1965 catalog. Thousands of electronics items produced by hundreds of manufacturers are covered in addition to more than 100 Knight-Kits. This 490-page catalog, No. 240, is available free on request from Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680 . . . The 1965 Heathkit catalog illustrates over 250 easy-to-assemble electronic kits. Its 108 pages are said to boast a kit for every interest, every budget—new kits have been added in many categories. A postcard with your name and address on it sent to the Heath Company, Benton Harbor, Mich. 49023, is all that's needed to get a copy. —30—

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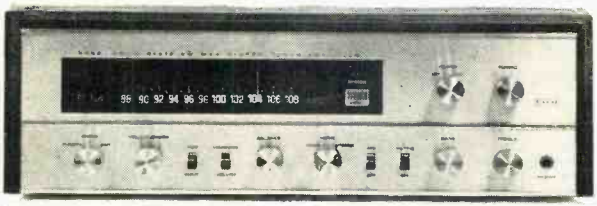

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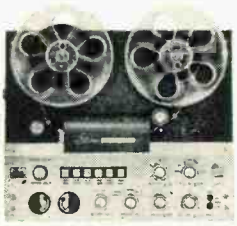

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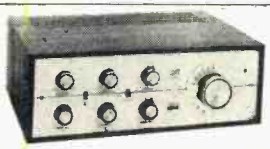

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PE-11

CIRCLE NO. 9 ON READER SERVICE PAGE

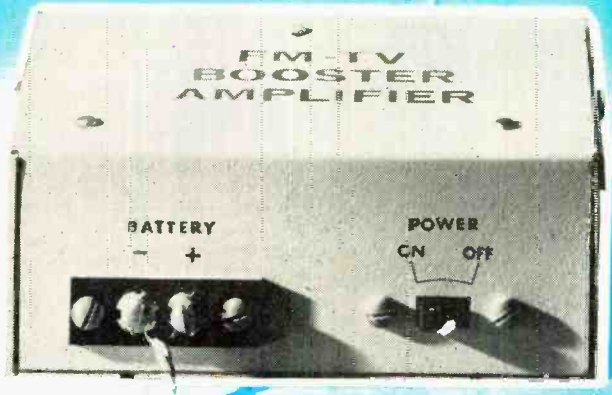
AN EASILY BUILT FM-TV BOOSTER

New low-cost single-transistor circuit can triple strength of all FM and VHF TV signals

By LOUIS E. GARNER, Jr.

IF THE IMAGE on the screen of your TV set lacks contrast or is "snowy" on one or two channels, or if your FM receiver doesn't "pull in" as many stations as it should, this low-cost booster may be all you'll need to clear up your reception problems. It's a broadband r.f. amplifier, providing from 9 to 20 db gain over both VHF TV bands as well as the FM broadcast band. It is designed to operate with standard 300-ohm twin-lead lines.

You don't have to be an electronics whiz to build the booster, nor must you own a bench full of advanced electronics



COVER STORY

BOOSTER

test equipment. The use of an etched circuit board insures proper layout and parts placement, permitting the booster to be assembled using a standard soldering iron (or gun) and ordinary hand tools. No alignment or special circuit adjustments have to be made when the wiring is completed, eliminating the need for a signal generator, VTVM, frequency meter, or similar instrument to place the booster in operation.

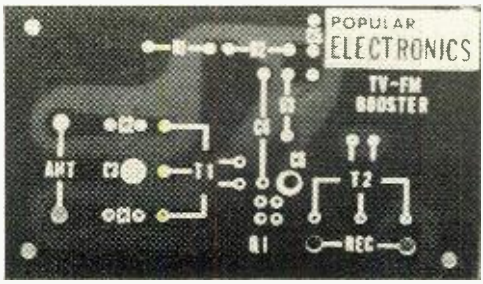
Based on a circuit developed by Motorola Semiconductor Products, Inc., the design features a new 2N3283 germanium transistor. This transistor is a *pnp* unit of the epitaxial mesa diffused-base type (see "Transistors—Types and Techniques," which appeared in the November, 1962, POPULAR ELECTRONICS), with a maximum frequency of oscillation of 2000 mc. Its noise figure is only 5 db at 200 mc.

Construction. Except for the balun coils, *T1* and *T2,* and the UHF transistor, *Q1,* all the components are readily available through most local and mail order parts distributors. The transistor can be obtained from any franchised Motorola Semiconductor dealer,* while the coils are replacement antenna coils for late model RCA TV tuners.

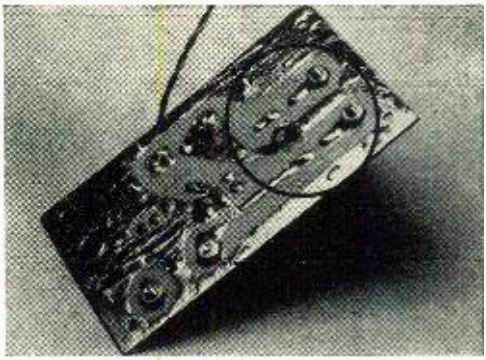
A small—2⅜" x 4"—etched circuit board serves as a "chassis" for the circuit. At the high frequencies involved, the layout of the board is critical. The board can be obtained for $2 from DEMCO, Box 16041, 430 Redcliff Drive, San Antonio, Texas 78216.**

The raw materials needed to make up the circuit board are furnished in the "Printed Circuit Kits" offered by most electronics parts distributors. If you're a typical hobbyist or experimenter, however, chances are you'll already have the materials on hand.

Use a standard-weight phenolic board, copper clad on one side. After cleaning the copper and scouring with a moderately abrasive household cleanser, apply the pattern. Asphalt-based ink, fingernail

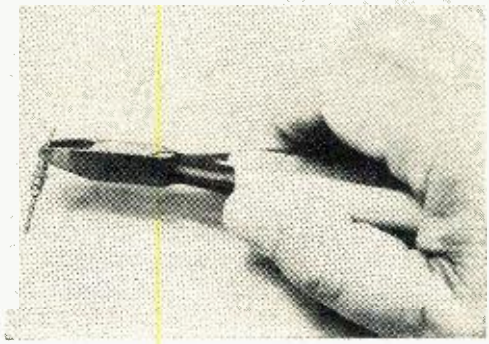


A special printed circuit board was developed for this project. Because of the high frequencies that are involved, its use is recommended.



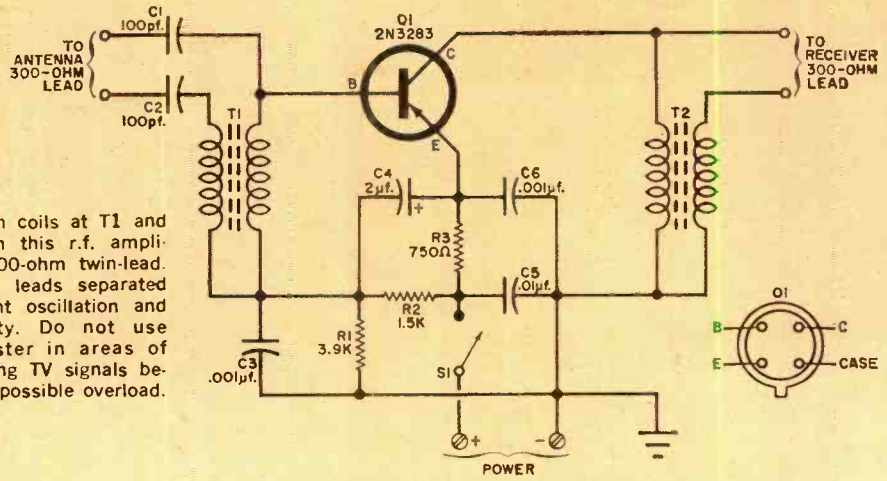
This board was dip-soldered for prototype testing; the builder should use regular soldering techniques. Note how the lead from C3 is bent and soldered to the copper foil.

Capacitors C3 and C6 are special miniature coaxials with the ground side connected to a flange around the body. Clip off one lead of each capacitor and bend the other lead after passing the body through the board.



*Do not substitute for the 2N3283 transistor. Write to POPULAR ELECTRONICS if you are unable to obtain this transistor locally.

**The board plus coils and transistor are also available for $6, or board and coils for $4 from the same address.



The balun coils at T1 and T2 match this r.f. amplifier to 300-ohm twin-lead. Keep the leads separated to prevent oscillation and instability. Do not use the booster in areas of very strong TV signals because of possible overload.

PARTS LIST

C1, C2—100-pf. tubular ceramic capacitor
C3, C6—0.001-µf. feedthrough capacitor (Centralab Type MFT)
C4—2-µf., 12-volt miniature electrolytic capacitor
C5—0.01-µf. disc ceramic capacitor
Q1—2N3283 UHF pnp transistor (Motorola)
R1—3900-ohm, ½-watt resistor
R2—1500-ohm, ½-watt resistor
R3—750-ohm, ½-watt resistor
S1—S.p.s.t. slide switch
T1, T2—Ferrite-core 300-ohm balun coil—see text and bottom footnote, page 42
1—Etched circuit board—see text
1—Two-terminal screw-type terminal strip
1—5¼" x 3" x 2⅛" aluminum case
3—Standoff spacers, about 1" high
Misc.—Machine screws, nuts, wire, solder

polish, lacquer, resist tape, or any similar resist will do the job. Etch carefully using a standard etchant solution, and check the board from time to time to prevent undercutting of the pattern. When the etching is finished, rinse the board thoroughly and remove the resist, cleaning the board with general-purpose solvent.

Except for switch *S1* and the power supply leads, all components are mounted on top of the circuit board. When drilling the component mounting holes, use a small drill compatible with the parts leads. Use a #28 drill for the receiver and antenna terminals as well as for the four board mounting holes. Make sure that the board is adequately backed and apply minimum pressure when drilling to avoid cracking the phenolic.

Components are mounted using conventional etched-circuit wiring techniques. Taking care to observe *C4*'s polarity and *Q1*'s orientation (lead connections are shown in the schematic diagram), place each part in position and insert its leads through the proper mounting holes. Crimp the leads on the reverse (copper) side of the board and solder with a small-tipped, hot, well-tinned iron. Complete each soldering operation as *quickly* as possible to avoid possible heat damage to components or the etched wiring. Use only rosin core solder. As each part is mounted, clip away excess leads with standard diagonal cutters.

Capacitors *C3* and *C6* are of the small feedthrough type. Used because of their low lead inductance, they are mounted through the copper side of the board. Before mounting, prepare each capacitor by clipping the feedthrough lead on one side and bending the other lead as shown at left. Finally, solder them in place by means of the center terminal ring.

Screw-type terminals are provided for the antenna and receiver leads. These are prepared as an integral part of the circuit board by soldering small *6-32* brass hex nuts in position directly on the etched wiring.

The booster is housed in a commercial 5¼" x 3" x 2⅛" aluminum box. Suitable cutouts are made for the 300-ohm transmission lines, as well as mounting holes for *S1* and the power supply terminal strip. If you'd like a professional "fac-

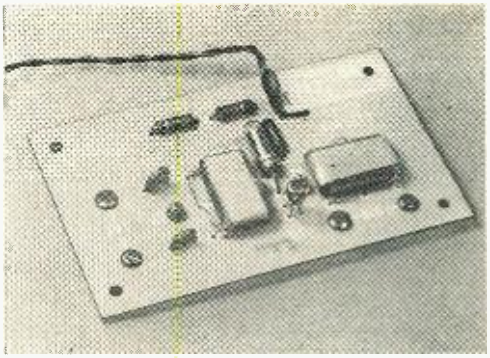
BOOSTER

tory-built" appearance for the finished units, use a prefinished case (or enamel the case in your choice of colors) and apply appropriate decal labels.

With the case finished and the circuit board wired and checked, final assembly takes but a few minutes. Power switch *S1* and the power supply terminal strip are mounted on the case with standard machine screws and hex nuts. A ground lug should be mounted alongside the terminal strip and wired to its negative terminal. The circuit board itself is more or less centered in the case and mounted with long machine screws, standoff spacers, and hex nuts. Ordinary hookup wire is used to connect the board to *S1* and the terminal strip.

Installation. Although the booster can be installed almost anywhere, a little care during this step will result in superior performance. Connect the 300-ohm antenna transmission line to the *ANTENNA* terminals and a length of similar 300-ohm line between the *RECEIVER* terminals and the "antenna" terminals of the FM or TV receiver with which the booster is to be used. If desired, spade lugs can be attached to the ends of the transmission lines to simplify these connections.

Take care that the two transmission lines are kept well separated. Otherwise, coupling between the input and output circuits may occur which, due to *Q1*'s high gain, could result in booster oscillation.



The finished printed circuit board should look something like this. The cable is for battery power.

In most cases, best results are obtained if the TV (or FM) antenna is aligned for maximum pickup of the weakest (or more distant) local stations. The booster, then, serves to strengthen these signals and, at the same time, to bring the stronger signals back "up to par."

Power Supply. The booster is designed for use with an external—rather than a built-in—d.c. power source, permitting the individual builder to follow his own inclinations in choosing a supply. A line-operated power supply can be employed, if available, a multicell battery, or a power pack made up of series-connected flashlight or penlight cells. With battery power, the booster can be used with the new portable transistorized receivers.

The original Motorola circuit was designed for operation on a 15-volt source. However, the author's model performed quite well on supplies furnishing from 9 to as high as 18 volts. If a single battery is preferred, a Burgess K10 15-volt battery can be used where space is at a premium, or a heavy-duty 12-volt lantern battery (typically, a Burgess TW2) if maximum operating life is desired. Finally, if flashlight cells are preferred, from six to ten such cells can be connected in series (for from 9 to 15 volts).

Battery life will depend on a number of factors, including the size of the battery (or cells) chosen, the number of hours of operation per day, temperature, and so on. Typically, however, a set of, say, ten size "D" flashlight cells should provide at least six months of operation, with the booster being used an average of four hours every day. —30—

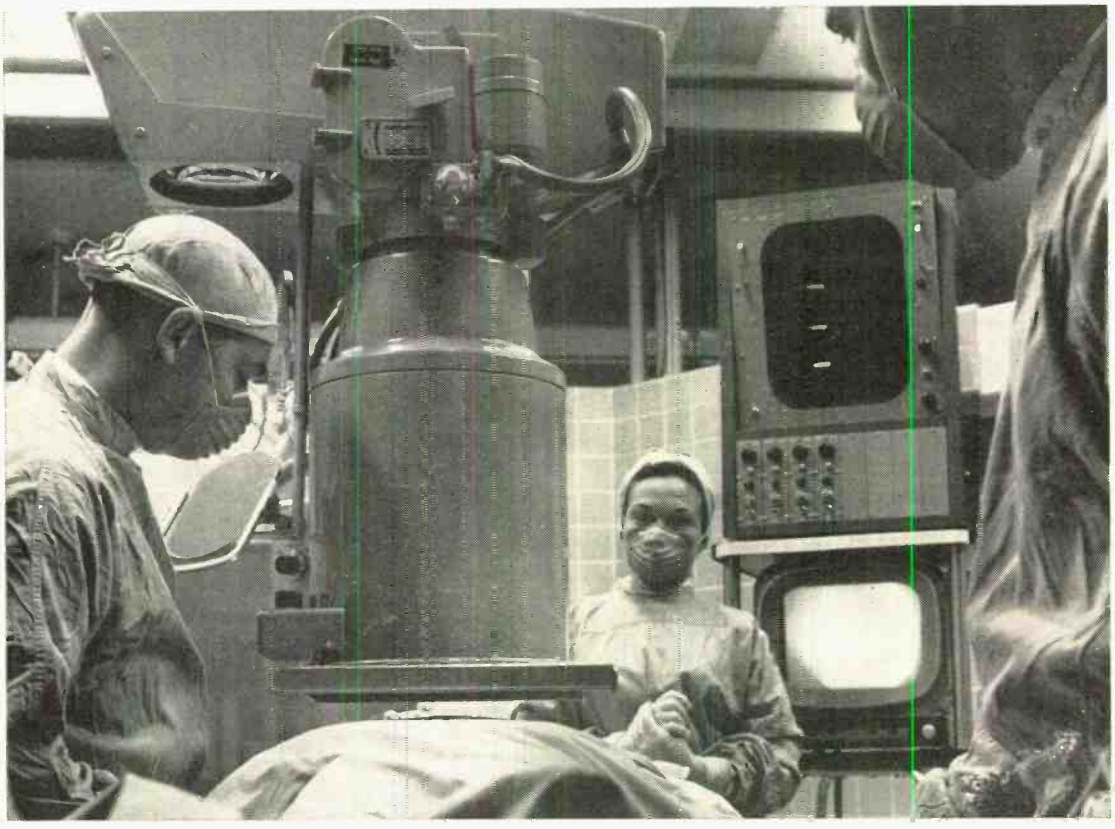
HOW IT WORKS

Transistor *Q1* is used in the common-emitter configuration as a broadband r.f. amplifier. Stabilized base bias applied to *Q1* through *T1's* "secondary" winding is furnished by voltage-divider *R1-R2*, bypassed by *C3*, in conjunction with emitter resistor *R3*, bypassed by *C4* and *C6*. Accidental shorts of base bias by the antenna are prevented by coupling capacitors *C1* and *C2*. Ferrite-cored balun coils (*T1* and *T2*) serve as impedance-matching transformers, providing 300 ohms balanced-to-ground at the input and output circuits, respectively. Half of *T2*'s winding is used as *Q1*'s collector load. Finally, *C5* serves as a power supply bypass and switch *S1* as an on-off switch.

In operation, the antenna signal is coupled through *C1* and *C2* to *T1* and to *Q1*'s base-emitter circuit. The center connection of *T1* is effectively grounded for r.f. by *C3*. The amplified output signal is developed across *Q1*'s collector load. *T2*, and supplied (through a suitable transmission line) to the receiver. Broadband operation is achieved by careful circuit design and through the use of untuned balun coils (*T1* and *T2*) in the base and collector circuits.

SICK?

LET A COMPUTER DO THE DIAGNOSIS



Digitals replacing Doctors? Analogs instead of Analysis? Not yet—but soon

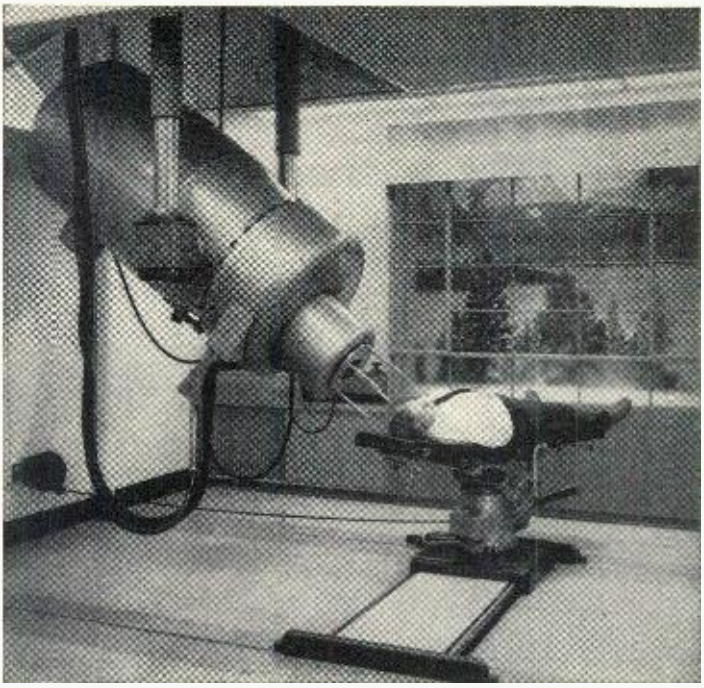
By SCOTT GIBSON

HAVE YOU EVER SEEN a radiation counter that you climb into? A computer hooked up to a man's brain? An analog dog? A TV view of the inside of a beating human heart? Or a giant Van de Graaff generator bombarding a slowly rotating patient with X rays? Thyroid disease diagnosed by machine? Cancer detected by a Wheatstone bridge? These electronic wonders and many more are a daily reality at the University of Florida's J. Hillis Miller Health Center, one of the Southeast's most modern medical research facilities.

In the Center's Department of Radiology, for example, Dr. Clyde Williams uses an IBM 709 digital computer to assist in the diagnosis of thyroid disorders. There is no direct, chemical measure of thyroid malfunction—the doctor must judge about 20 different symptoms that can occur in a multitude of

SICK?

LET A COMPUTER DO THE DIAGNOSIS



Patient lies on table under the Van de Graaff generator. The table and patient can be rotated continuously on an axis passing through his tumor so that surrounding healthy tissues receive a minimum exposure to harmful radiation while the tumor gets a maximum dose of X rays at same time.

patterns. Since thyroid disease is not too common, the average practitioner may see only five or ten cases a year, unavoidably limiting his diagnostic experience.

Dr. Williams has programmed his computer to compare each new case with the details of 1000 correctly diagnosed cases stored in the computer's memory. The machine then types out a statement of the mathematical probability that the symptoms are due to one of three kinds of thyroid disease—accuracy is about 96 per cent. The computer program has been made available to medical men in other parts of the country.

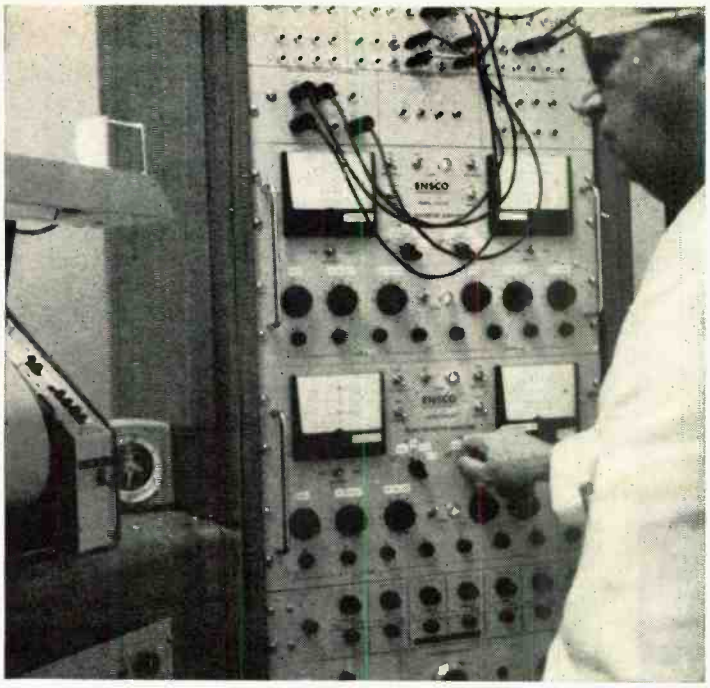
Dog-Gone Analog. Physiological processes may be described by complex mathematical relationships. Electrical processes in electronic circuits follow similar mathematical laws. It is possible, therefore, to draw an analogy between physiological processes and electrical processes. This situation enabled Dr. E. R. Garrett, Graduate Research Professor in the College of Pharmacy, to assemble his electronic analog dog.

The components of a transistorized analog computer are arranged so that they do the same mathematical things to a "dose" of input voltage that a dog's physiological mechanisms do to a dose of drugs. Mathematical operations such as integration, summation, and multiplication are performed by various combinations of the analog computer's basic components: amplifiers, precision potentiometers, and capacitors.

Using this model of a living dog, Dr. Garrett is able to deal quickly and accurately with computations that are extremely cumbersome to solve by classical methods of analytical mathematics. Given data about the static condition of the animal—the amount of calcium remaining in the bloodstream 100 minutes after injection, for example—he is able to arrive at quantitative answers that reflect the dynamic functioning of the animal.

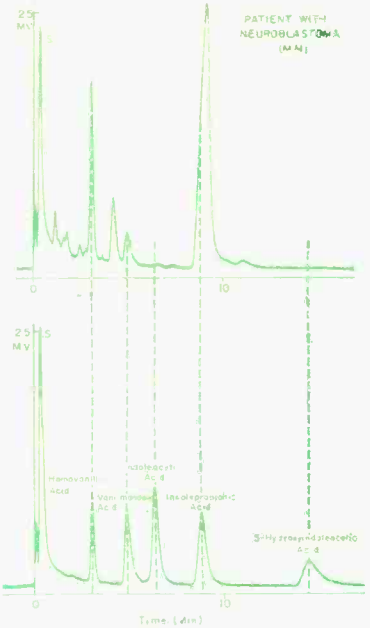
Dr. Garrett is especially interested in the distribution of drugs and now, thanks to the analog dog, he is able to predict "metabolic half life" or how long a drug will "hang around" in the body, foresee which tissues will be excessively saturated with the drug, and evaluate other drug effects. The end result will be better and safer drugs for humans.

Shooting a Tumor. Complex calculations necessary for determining dosages



This equipment constantly monitors blood pressure, heart beat and other physiological functions. Paper record of all data is kept by machine at left. Tape recorder also stores data.

Readout compares patient having neuroblastoma with healthy patient. This disease is a form of cancer that attacks children. Excretion is analyzed, results are recorded.

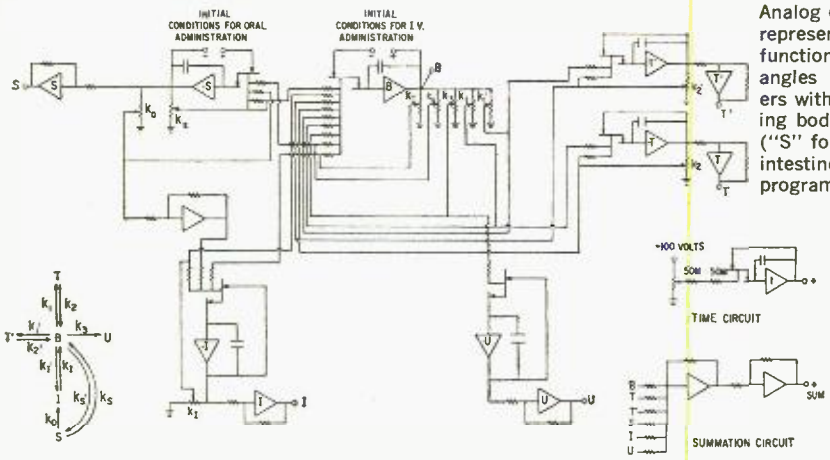


of another kind are now done by Dr. Walter Mauderli with an IBM 709 digital computer. Physicians often use X-ray beams to destroy cancerous tumors, but the beam also damages the healthy tissues it passes through on the way to the tumor. One solution is to shoot the beam into the tumor from a number of different outside points. Surrounding tissues then receive much less radiation while the tumor gets a full dose.

Hours of human calculation are required to estimate the radiation dosage in various areas even when only four or five external aiming points are used, but the computer rapidly calculates dosages even when hundreds of external aiming points are used. In fact, the patient sits in a chair (or lies on a table) which rotates on an imaginary vertical axis passing through the site of the malignancy as a huge Van de Graaff generator continuously fires X-ray beams at him! The physician monitors the treatment via closed-circuit television.

The computer has previously considered the tumor location and the patient's cross-sectional shape at the level of the tumor and produced a "map" showing what percentage of the total X-ray dose will be received in hundreds of points

Dr. Clyde Williams, Radiology Dept., and Mr. Kirkpatrick, mathematician, prepare thyroid program for IBM 709.



Analog computer program represents physiological functions of a dog. Triangles represent amplifiers with letters representing body part equivalents ("S" for stomach, "I" for intestine, etc.). Note that program is dog-shaped.

Dr. John B. Henry operates an electronic enzyme analyzer; the enzymes found in blood and other body fluids are essential to good cell functioning.

in the body. Since the X-ray beams always pass through the tumor, it gets a far higher dose than surrounding healthy tissues do.

Eyeing the Eye. Research in disease of the eye and nervous system is advancing with the help of a specially built computer. Dr. Richard M. Copenhaver, research opthalmologist, working with Gilbert D. Beinhocker, a physicist, has developed a new means of testing human vision and diagnosing neurological disorders by recording electrical impulses in the brain. Previous visual testing has depended entirely upon a verbal report by the subject, impossible to obtain if the patient is in coma, anesthesized, or a young child.

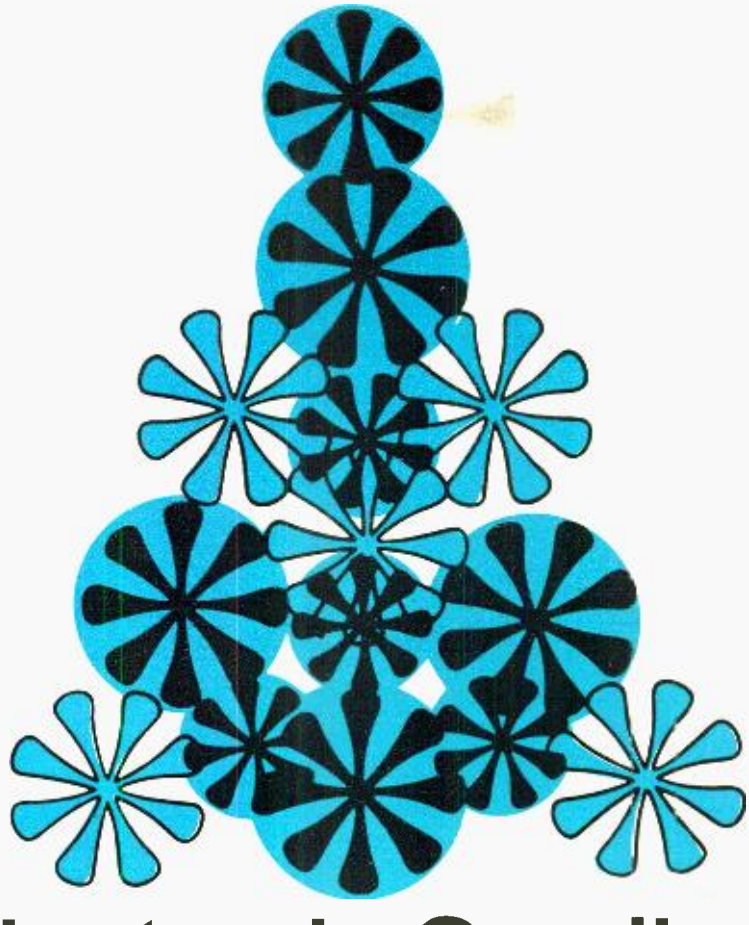
A flash of light causes the eye's retina to generate a 5- to 10-microvolt electric pulse and send it to the visual centers of the brain. This pulse is picked up and led off to the computer by two scalp electrodes. The computer applies mathematical autocorrelation techniques to extract these small signals from noise, which in this case consists of various pulses unrelated to the retinal pulse. Brain waves are a major noise component. The computer electronically inspects incoming data and decides if the critical pulse is present.

The major components of the computer consist of an a.c. preamplifier and several additional amplifiers which receive and amplify the incoming electrical activity about 50,000 times. A variable bandpass filter eliminates frequencies containing little information about the evoked response. An analog-to-digital converter digitalizes the neuro-electric activity, and a digital computer extracts by summation the small retinal pulses from the noise and signals the presence of the detected response.

This new technique for testing visual pathways can also give important clues to the location of severe brain damage as well as aid diagnosis of diseases unrelated to vision, such as traumatic brain injury and brain tumors.

Statistic Compiler. Not every computer in the Health Center does research. The accounting department's IBM 1401 machine records patient admissions, treatment, room number, doctor's name, medications and other ser-

(Continued on page 108)

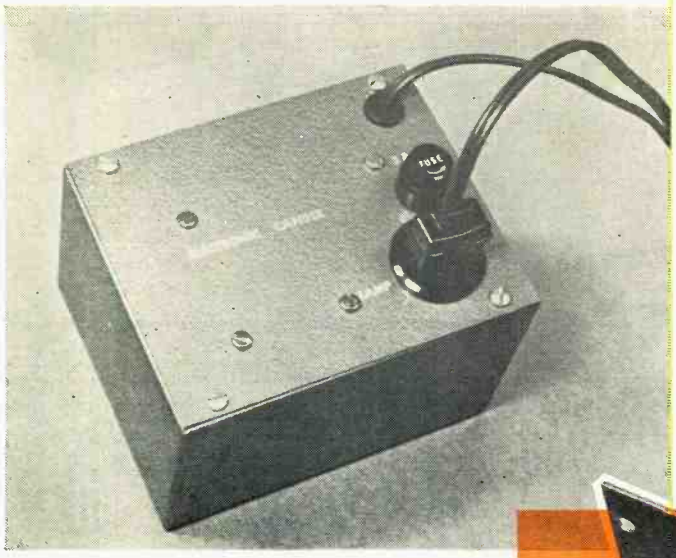


Electronic Candles Dance and Glow

Ordinary incandescent bulbs become sparkling, flickering holiday decorations when they're powered by the Electronic Candlelighter

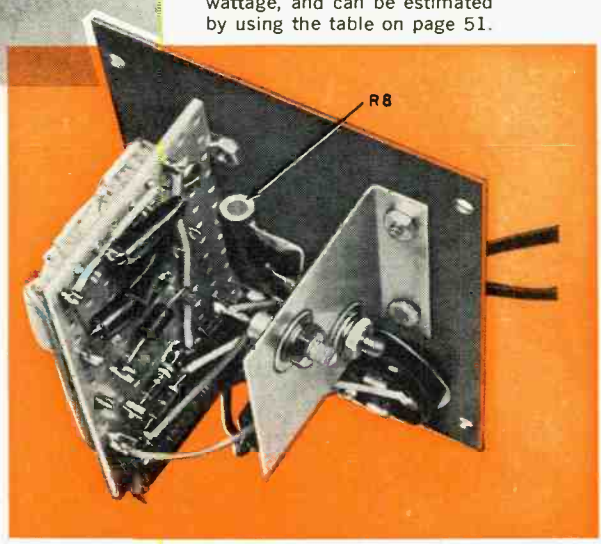
By JEFF H. TAYLOR

THERE'S NOTHING LIKE the warm glow of candlelight for festive occasions. Unfortunately, in modern times, the candle flame with its rhythmic, yet random, light has been largely replaced by the more intense, steady brilliance of incandescent bulbs. This article describes a method of reproducing the effect of candlelight, however, using ordinary electric light bulbs. And, unlike the candle, there's no smoke, melted wax, or fire hazards to contend with. You simply plug a lamp or string of decorative lights into the "Electronic Candlelighter," sit back, and enjoy the age-old effect of flickering, dancing candlelight.



The Candlelighter is built into a 3" x 4" x 5" aluminum box with a fuse and an output socket mounted on top panel for one lamp or a string of lights.

Component layout is shown in the photo below and those on the opposite page. Note R8 mounted to D4 and SCR1 by its leads; the exact value of this resistor depends on the load wattage, and can be estimated by using the table on page 51.



How It Works. The "Electronic Candlelighter" provides a half-cycle sine wave to the lamp(s) continuously, plus other random currents during the remaining half-cycle. These random signals are generated by three neon-bulb relaxation oscillators operating at three slightly different frequencies. The oscillators beat with each other and the 60-cycle line frequency to produce a flicker in the lamp which is plugged into the socket.

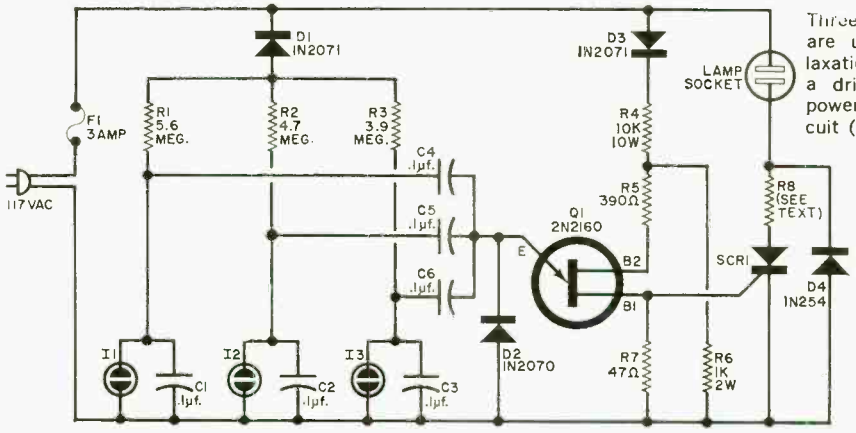
The unit has three basic circuits: the neon relaxation oscillators, the driver, and the power control circuit. The oscillators are capacitively coupled to the driver through *C4*, *C5*, and *C6*. These capacitors prevent oscillator interaction.

The neon lamp oscillators are supplied with a negative charging potential so that when they fire they produce the positive-going waveform necessary to forward-bias unijunction transistor *Q1*.

The driver circuit consists of the transistor (*Q1*) to which the oscillators are coupled. Base 2 of the unijunction is supplied with positive pulses through diode *D3*. The voltage on base 2 has a peak excursion of about 15 volts. The oscillator pulses at the emitter of *Q1* which are in phase with the half-cycle positive pulses on base 2 produce pulses at base 1 which are coupled to the silicon-controlled rectifier, *SCR1*. Diode *D2* provides d.c. restoration without loading the signal portion of the oscillator output.

PARTS LIST

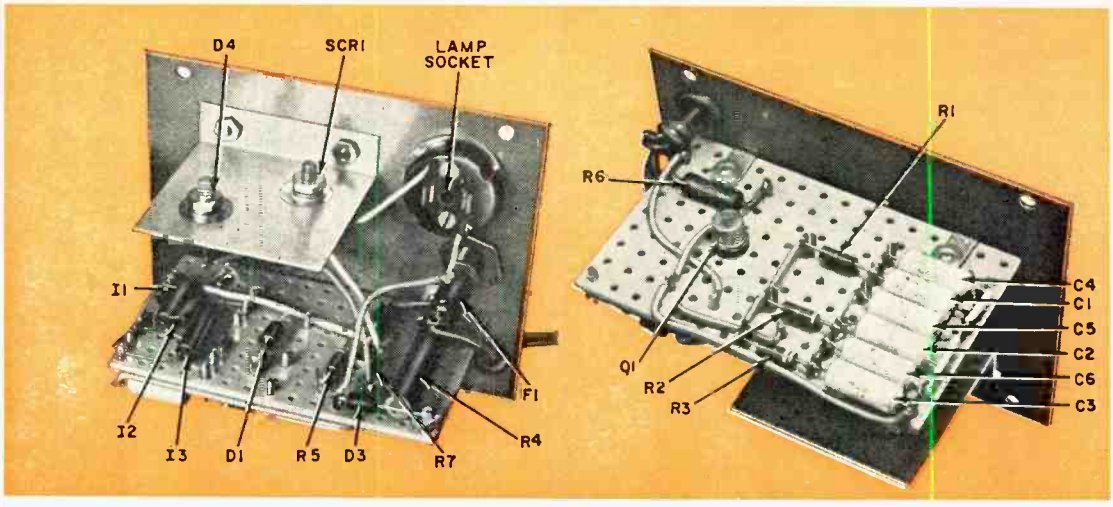
C1-C6—0.1-μf., 200-volt miniature paper capacitor
D1, D3—1N2071 silicon rectifier (T1)
D2—1N2070 silicon rectifier (T1)
D4—1N254 silicon rectifier (T1)
F1—3-amp 3AG fuse in panel-mounting holder
I1, I2, I3—NE-2 neon bulb
Q1—2N2160 unijunction transistor (T1)
R1—5.6-megohm, ½-watt resistor
R2—4.7-megohm, ½-watt resistor
R3—3.9-megohm, ½-watt resistor
R4—10,000-ohm, 10-watt resistor, ±5%
R5—390-ohm, ½-watt resistor
R6—1000-ohm, 2-watt resistor
R7—47-ohm, ½-watt resistor
R8—See text
SCR1—T140A2 silicon-controlled rectifier (T1)
1—3" x 4" x 5" aluminum box
1—2¼" x 2½" piece of light aluminum
1—2½" x 4" piece of perforated phenolic board
1—Panel-mounting a.c. receptacle
Misc.—Transistor socket, line cord and plug, press-in solder terminals, wire, solder, hardware, rubber grommet, decals, etc.



Three basic circuits are used: neon relaxation oscillators, a driver (Q1), and power control circuit (D4 and SCR1).

Bend piece of light aluminum to form heat sink for D4 and SCR1; make sure they're not shorted to it.

Remaining parts are neatly laid out on a phenolic board which is mounted to box with small brackets.



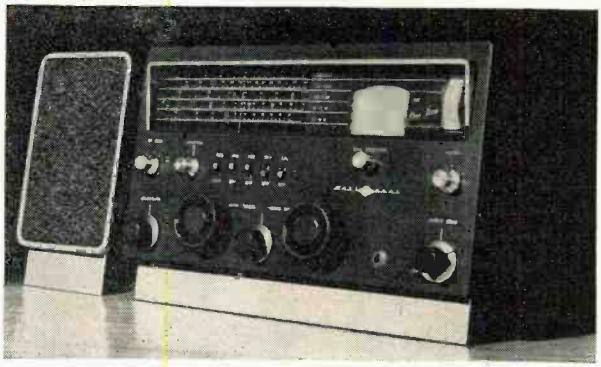
How to Select Resistor R8

To determine the value of R8, use the table below. Choose the lamp wattage you want to use and read across for the approximate resistance value and wattage of the resistor that will give the best candlelight effect. Although no resistor is recommended for loads above 100 watts up to the unit's maximum rating of 300 watts, it may be desirable to use one in some cases, especially with strings of decorative bulbs. Optimum resistor values will range from 1 to 20 ohms at 20 watts.

Bulb Wattage	Resistance (ohms)	Power (watts)
7½	325	1
15	250	2
25	200	5
40	150	5
50	125	5
60	100	10
75	80	10
100	50	10

The power control circuit consists of a conventional rectifier (*D4*) which continuously provides half-cycle a.c. to a lamp load up to 300 watts, and the silicon-controlled rectifier (*SCR1*) which supplies the "flicker" pulses. A resistor selected to match the wattage of the load, *R8*, is placed between the anode of the silicon-controlled rectifier and the load to reduce the magnitude of the flicker, thereby producing a more realistic candle flame effect.

Building the Unit. As with the "Spookin' Light" (a somewhat similar project published in the September, 1964, issue), it is imperative that none of the components in the "Electric Candlelighter" come in contact with the 3" x 4" x 5" aluminum box used as a cabinet, or the



A good-quality receiver helps to sort out BCB stations. In the medium price range, these three receivers are the Hallicrafters SX-110 (top, left) selling at $169.95; Hammarlund HQ-100AC (left) at $199; and National NC-190, priced at $239.95.

or interference from other stations on the air. Once you become familiar with the 535-1605 kc. band, it will seem as cozy as the street on which you live, and you'll meet old friends along the way. After listening regularly for a while you'll be able to tune the band by ear rather than watching the dial, recognizing individual stations by signal strength, QRM, and the familiar voices of announcers. Station spacings are always at 10-kc. intervals, and very few channels are ever quiet.

The clear-channel stations—50,000 watts—are easiest to log simply because they are clear. (A listing of clear-channel stations appeared on page 71 of the February, 1962, issue of POPULAR ELECTRONICS.) Generally, there are only one or two stations per channel in the U.S., and you may soon start digging out the secondary stations (1000 watts or so) under the "clears."

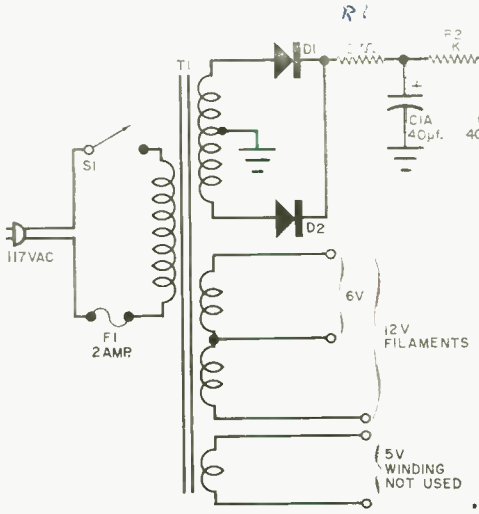
Regional-channel stations (1000 or 5000 watts) are more difficult to hear, for 20 to 30 stations across the country share each of these frequencies. Local channel stations are the most difficult to log, for there are only six channels available (1230, 1240, 1340, 1400, 1450, and 1490 kc.), and each channel has over 100 stations broadcasting simultaneously. With each station allowed 1000 watts during the day and 250 watts at night, the result is an amazing conglomeration of signals.

When to Listen. The nighttime hours are best for DX. Since many local stations leave the air at midnight or 1 a.m., the band clears up somewhat and you can hear more distant stations. But if your schedule precludes late hours, don't despair. Some of the choicest DX can be heard at sunrise and sunset when unusual conditions prevail.

At times, an elusive kilowatt a state away can be heard signing off at sunset, half an hour before the band closes down with interference. Some stations never have late-night frequency checks—an otherwise excellent way to copy many signals usually covered by QRM—and sunrise/sunset listening may be the only way to copy them. Try listening any time between two hours before and after your local sunrise or sunset.

Don't overlook Sunday sunrise DX. Some stations maintain different Sabbath schedules, and you may find an open channel permitting you to copy a station normally covered by a more powerful one. Always be alert for the unusual or unexpected, such as broadcast coverage of a natural disaster or an unscheduled test of the nationwide Emergency Broadcast System.

Even daytime DX can be very interesting. Cold, dry, winter days with no storm activity are often good for some groundwave DX that would give trouble at



Schematic diagram and parts list for suggested power supply to allow the use of an auto radio from standard 117-volt lines.

PARTS LIST

C1a, C1b—40/40 μf., 450-volt dual electrolytic capacitor (Sprague TVL 2764 or equivalent)

D1, D2—500-PIV, 650-ma. silicon rectifier (International Rectifier 1N444B or equivalent)

F1—2-amp 3AG fuse (and holder)

R1—27-ohm, ½-watt resistor

R2—1000-ohm, 5-watt resistor—see text

S1—S.p.s.t. toggle switch

T1—Salvaged TV transformer

Misc.—Suitable chassis, line cord and plug, etc.

night because of the great number of stations coming in all at once. The author, for example, has regularly copied stations in New York City, Nashville, Tenn., and Des Moines, Iowa, from Columbus, Ohio, around noon during winter months. Another daytime DX game is trying to copy all the stations in your state. This is no snap—try it.

Don't ignore the early evening hours, either. While traffic may be heavy from about 8 p.m. to midnight, you'll find much variation from night to night. The author has logged dozens of Caribbean and South American stations at this time. If you regularly have a few free hours in the early evening, make up a *Condition of Frequencies* log. List all channels from 535 to 1605 kc. and note the stations copied each night, logging and writing reports to new ones. You'll soon see a pattern emerge—who's on what channel at what time. It really gets interesting the second time around, for you'll try to dig out the stations *under* the regulars.

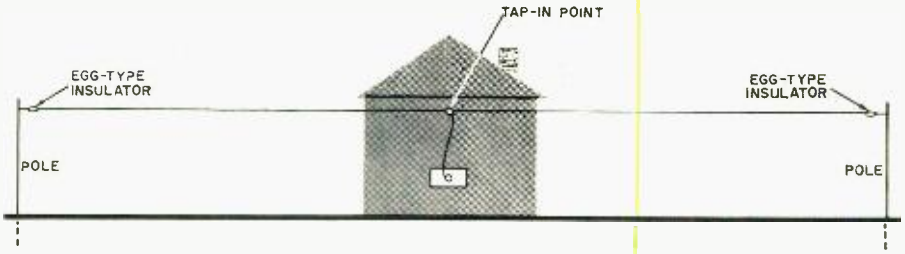
As sunset moves across the continent, you'll find that conditions change, with some stations fading in as others fade out. In the Midwest, for example, Cubans are strong early, but they fade out as the Mexicans come in, and Canadians overshadow both on some channels.

If U.S. stations are difficult to log, broadcasts originating in other parts of the Western Hemisphere are—except for a few—still harder. Try digging out *Radio Mil,* XEOY, Mexico City, behind WCFL, Chicago, on 1000 kc., for example; or the Cubans behind WJR, Detroit, 760 kc., and WGN, Chicago, 720 kc. The table on page 56 lists some of the foreign stations that can be copied from various locations in the United States.

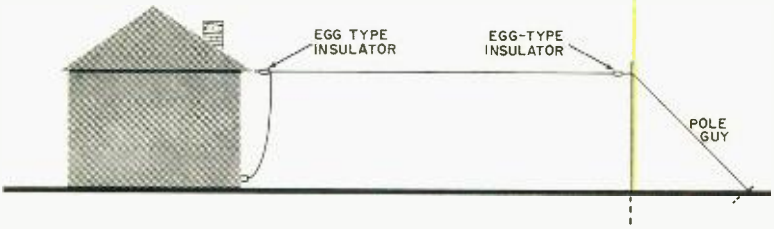
Receivers. While you can use a small table radio as a starter, you will soon want something a bit more elaborate with features that will help you slice through the interference and bag smaller broadcasters. The ultimate step would be to acquire a receiver with double or triple conversion and selectable sideband reception. These features are not available with every communications receiver, and you will find that units so equipped are expensive, some costing in excess of $500.

You can do nicely with a less expensive receiver, one selling for $100-$200. If you can't find a receiver in your price range with the features you'd like, you can always start with a less expensive one and later add such refinements as a Q-multiplier, a preselector, or a Q5'er. One make of Q-multiplier readily adaptable to receivers having an i.f. between 450 and 460 kc. is the Heathkit HD-11. A Q5'er can be made by converting a surplus "Command" receiver, the BC-453, for use with your receiver.

Since the Q5'er is a complete low-frequency receiver covering 190-550 kc., it is an easy matter to tune it to the primary receiver's i.f. frequency; r.f. pickup is usually through a shielded cable connected to two or three turns of wire wrapped around (but not connected to) the plate lead of the last i.f.



Desirable length for a center-tapped "T" antenna is 75 to 100 feet or more. No insulator is used in center; vertical wire is connected directly to horizonal wire.



Inverted "L" antenna should also be at least 75'-100' long; the higher the better.

in the primary receiver. The i.f. signal reaching the Q5'er's antenna terminal is then amplified and reconverted to the unit's 85-kc. i.f. Audio output can be taken from the Q5'er. The end result is a dual-conversion receiver with good selectivity thanks to the relatively narrow passband of the Q5'er's 85-kc. i.f. strip.

The BC-453, still available at some surplus houses, requires some modifications and a power supply to make it usable. For more information, see "Converting Your First 'Command' Receiver" in the June, 1963, issue of POPULAR ELECTRONICS.

Another successful trick used by BCB DX'ers is to obtain an auto radio and adapt it for household listening. These receivers are both sensitive and reasonably selective since auto radio manufacturers must constantly fight a battle to overcome ignition noise and minimum antenna lengths.

With the recent conversion to all-transistor car radios. the old tube-type receivers appear in plentiful supply at local junk yards. The easiest kind to come by are those using vibrator power supplies rather than types using 12 volts on all tube plates or transistor sets. A schematic diagram of a power supply that will operate vibrator-type receivers with the vibrator supply disconnected is shown on page 55. The same supply can also be used to power a Q5'er.

A transformer salvaged from an old TV set is used for the power supply. If the transformer has two 6.3-volt windings, connect them as shown to power the filaments of a 12-volt car radio;

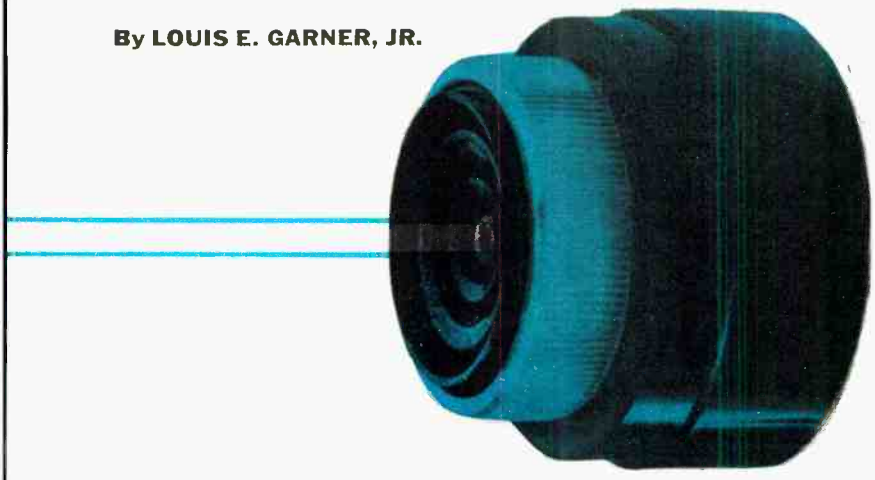
(*Continued on page 98*)

EASY-TO-LOG BCB DX STATIONS IN WESTERN HEMISPHERE

Frequency (kc.)	Station Call-Sign	Location	Frequency (kc.)	Station Call-Sign	Location
540	CBK	Regina, Saskatchewan	940	CBM	Montreal, Quebec
630	CMQ	Havana, Cuba		XEQ	Mexico City, Mexico
690	CBF	Montreal, Quebec	990	CBW	Winnipeg, Manitoba
730	XEX	Mexico City, Mexico	1010	CFRB	Toronto, Ontario
740	CBL	Toronto, Ontario	1160		Radio Swan, Swan Island
800	CKLW	Windsor, Ontario	1180		Radio Marathon, VOA,
	XELO	Ciudad Juarez, Mexico			Marathon Key, Florida
860	CJBC	Toronto, Ontario	1550	CBE	Windsor, Ontario
900	XEW	Mexico City, Mexico	1570	XERF	Ciudad Acuna, Mexico

BUILD THE audiotimer

By LOUIS E. GARNER, JR.

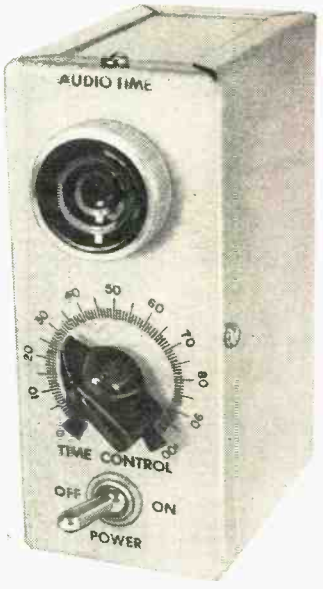


All-electronic metronome uses Sonalert for distinctive audible signaling

THE OLD ADAGE "time stands still for no man" becomes painfully apparent when you attempt to time something with a clock or stopwatch and simultaneously keep your attention on the process being timed. It's like watching a Ping-Pong tournament, and the job becomes both unwieldy and inaccurate.

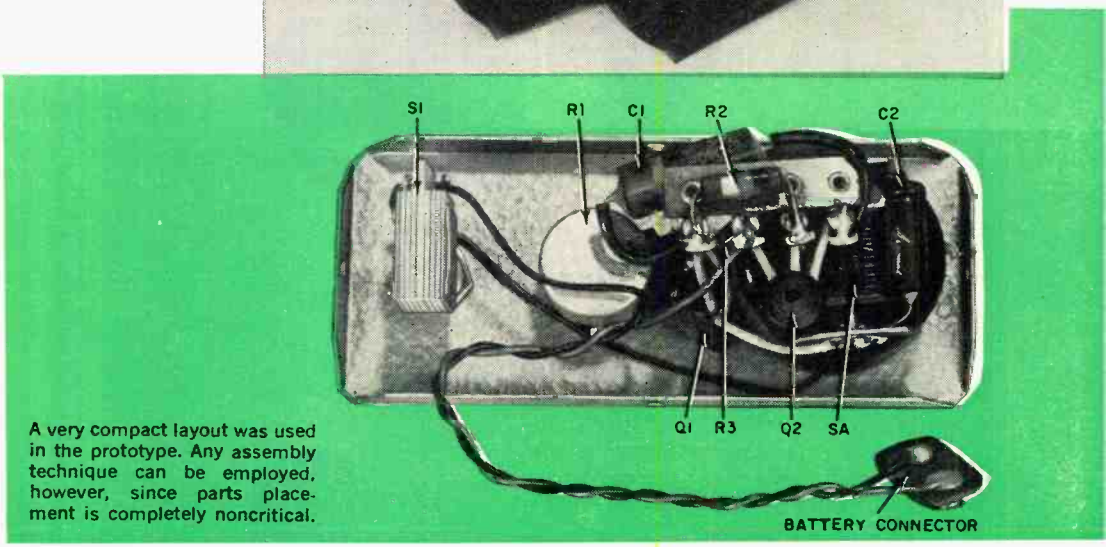
Of the many timing instruments available, only the metronome permits you to give your undivided attention to a project. But the metronome relies on a pendulum's action for its operation and must be kept level while in use. In addition, it has a limited beat range and its size and shape preclude its effectiveness as a portable unit.

If you have a timing problem—along with amateur and professional photographers, chemists, teachers, physical education instructors and coaches, athletes, music students, production engineers, etc.—the "Audiotimer" is for you. The "Audiotimer" combines the advantages of a mechanical metronome with the ease-of-use and portability of



A separate graph is employed to convert dial settings to "pings"-per-second with the author's unit. The range is from three "pings" a second to one every two seconds. Scale shown here is arbitrary.

All photos appearing in this article were enlarged and printed using the audible "pings" from the "Audiotimer." Photographers should find this project of special value.



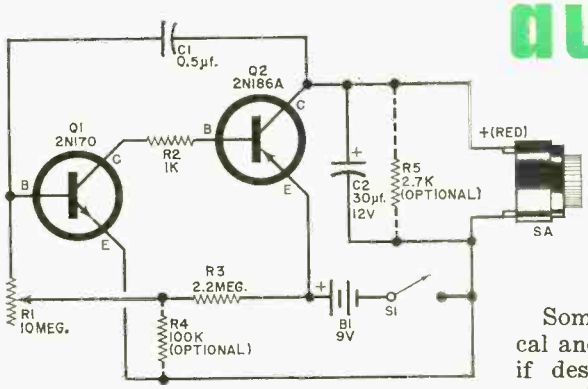
A very compact layout was used in the prototype. Any assembly technique can be employed, however, since parts placement is completely noncritical.

a battery-operated electronic test instrument. Delivering sharp "pings" at preset intervals from a fraction of a second to several seconds in length, the unit has a much wider range than most metronomes and can be used in a variety of applications.

Small, compact, and inexpensive to build, the "Audiotimer" utilizes a relatively new component as its output signaling element: a highly efficient solid-state device dubbed "Sonalert." Developed and produced by Electropac, Inc. (Peterborough, N. H.), this transistorized device utilizes a piezoelectric principle. Its basic operation is achieved by means of an oscillatory circuit driving a special ceramic transducer which is an integral part of the circuit. Tolerating a wide range of supply voltages, the "Sonalert" requires only a few milliamperes for operation and delivers a high-pitched, fixed-frequency output signal.

Construction and Wiring. The author's model was assembled in a commercially available prefinished metal case measuring 2¼" x 5¼" x 3¼" overall. Other builders may prefer to use a case of a different size or shape—typically, a sloping panel meter cabinet, or even a wooden or plastic box. The "Sonalert" is mounted in a single hole measuring 1$^{9}/_{64}$" in diameter and held in place by means of a knurled ring furnished with it. The mounting hole can be made quite easily by using a standard 1⅛" Greenlee tube socket punch and enlarg-

audiotimer



In the text directly below this caption, the author discusses the reasons for the two optional resistors, R4 and R5. Polarity of the "Sonalert" must be observed.

PARTS LIST

B1—9-volt battery (Burgess 2N6 or equivalent)
C1—0.5-μf., 200-volt miniature metallized capacitor
C2—30-μf., 12-volt miniature electrolytic capacitor
Q1—2N170 npn transistor
Q2—2N186A pnp transistor
R1—10-megohm potentiometer
R2—1000-ohm, ½-watt resistor
R3—2.2-megohm, ½-watt resistor
R4—100,000-ohm, ½-watt resistor (optional—see text)
R5—2700-ohm to 4700-ohm, ½-watt resistor (optional—see text)
SA—"Sonalert" Model SC-628
S1—S.p.s.t. toggle switch
Misc.—Metal case, approximately 2¼" x 5¼" x 3¼"; control knob; battery connector; 4-point terminal strip; machine screws, wire, solder, etc.

ing the hole slightly with a half-round file.

With neither layout nor lead dress critical, the instrument is relatively easy to wire and can be assembled without difficulty in a single evening by the average hobbyist or experimenter. Point-to-point wiring can be used as in the author's model, or some builders may prefer to design an etched circuit board.

Good wiring practice should be followed, of course, with all d.c. polarities observed, and care taken not to overheat the semiconductor components when these parts are soldered in position. Use a hot, well-tinned iron and rosin-core solder, completing each soldering step as quickly as possible.

Some part values are not overly critical and a few substitutions can be made, if desired, to permit "on hand" components to be employed. A 470-ohm to 1200-ohm resistor can be used in place of the value specified for *R2*. The value of *C2* can range from 25 to 40 μf. Six penlight cells connected in series make a satisfactory substitute for *B1*. The power switch, *S1*, can be a slide, rotary, push-button, or control type instead of the toggle type used in the model.

Modifications. Two minor circuit modifications may be desirable for some applications. First, if the transistors (*Q1* and *Q2*) are slightly leaky, the "Sonalert" may not be cut off completely between timing "pings." The resulting low, steady background signal is not harmful and may even be desirable in certain cases. It will not detract from the effective use of the "Audiotimer" as a timing device. In a few applications, however, it may be necessary to eliminate any background signal (if present). This can be accomplished—at the cost of reducing "ping" intensity somewhat—by connecting a small fixed resistor in shunt with the "Sonalert," as indicated by *R5* in the schematic diagram. The resistor's value should be determined by experiment but, generally, will be between 2700 and 4700 ohms.

Although the instrument's timing interval range will vary somewhat with component tolerances, the ratio between minimum and maximum intervals is about six to one, i.e., in a typical unit, from about ⅓ second to 2 seconds between "pings," depending on *R1*'s setting. This is satisfactory for most applications. Where a broader range is needed, shunt resistor *R4* can be added. Again, the resistor's value is not critical and can be between 4700 and 100,000 ohms. In the author's model, a 100,000-

ohm resistor gave an effective overall range from five "pings" per second (⅕ second) to one every 5 seconds.

Calibration and Use. After being assembled, the "Audiotimer" should be calibrated. The author used a standard decal dial for the *TIME CONTROL* on his model. Where this type of dial is used, the arbitrary scale markings can be correlated with actual time intervals by means of a simple calibration chart. This chart can be prepared by using a watch with a sweep second hand, a stopwatch, a metronome, or any similar standard. You simply determine *R1*'s dial settings for intervals of, say, ¼ second, ½ second, 1 second, 2 seconds, and so on. If the instrument is to serve as a metronome, the calibration can be in terms of "beats per minute."

If preferred, of course, a special hand-drawn scale can be used instead of an arbitrary dial, eliminating the need for a separate chart.

In practice, *R1* is simply adjusted for the time intervals needed. Where relatively long intervals are required, the operator can count (mentally) the proper number of timed "pings." For example, a photographer timing print exposures which might range between 2 and 10 seconds could set the control for, say, 1-second intervals. Afterwards, he could time each exposure by counting two, three, four or more "pings," as needed.

Since the "Audiotimer" does not depend on mechanical means for its operation (such as a pendulum), and since it operates on a self-contained battery, it can be used in any position and in virtually any location, whether or not line power is available. For field or sports use, the instrument's case can be fitted with a simple belt loop. —30—

HOW IT WORKS

The "Audiotimer" uses *npn (Q1)* and *pnp (Q2)* transistors in a common-emitter configuration. It is essentially a complementary *RC*-coupled low-frequency relaxation oscillator. Component values are chosen to obtain nonsymmetrical operation, with *Q2* in a conducting state for short intervals and in a nonconducting state for relatively long periods. The collector load of *Q2*, the "Sonalert" device, shunted by *C2*, is energized only when *Q2* conducts.

In operation, *Q1*'s base bias is furnished through *R1* and *R3*, while *Q2*'s bias is supplied by *Q1*'s collector current, applied through series-limiting resistor *R2*. The base-emitter circuit of *Q2*, then, becomes (with *R2*) *Q1*'s collector load. The feedback signal necessary for oscillation is coupled from *Q2*'s collector back to *Q1*'s base through *C1*. Operating power is supplied by *B1*, controlled by *S1*.

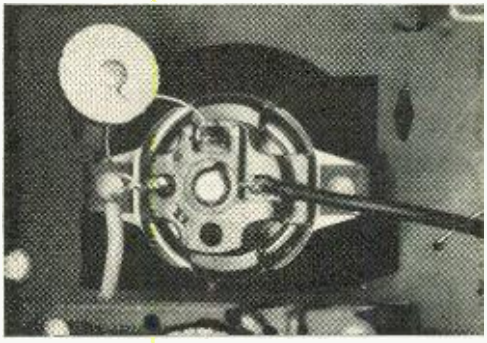
The relaxation oscillator's repetition rate is determined by the *RC* time constant of the feedback network, which includes *C1*, *R1*, *R3*, and *Q1*'s base-emitter circuit (and *R4*, if used). Since *R1* is an adjustable resistor, it can be used to vary the *RC* time constant, thus serving as the instrument's *TIME* or "rate" control. The primary function of *R3* is simply to limit *Q1*'s maximum base bias when *R1* is turned to its minimum resistance position, thus protecting both *Q1* and *Q2* against excessive collector currents.

Prolong Projector Lamp Life

PUT your electronics knowledge to good use and save several dollars by adding a thermistor to the lamp circuit in your slide or movie projector. Thermistors are readily available in various resistance and current ratings.

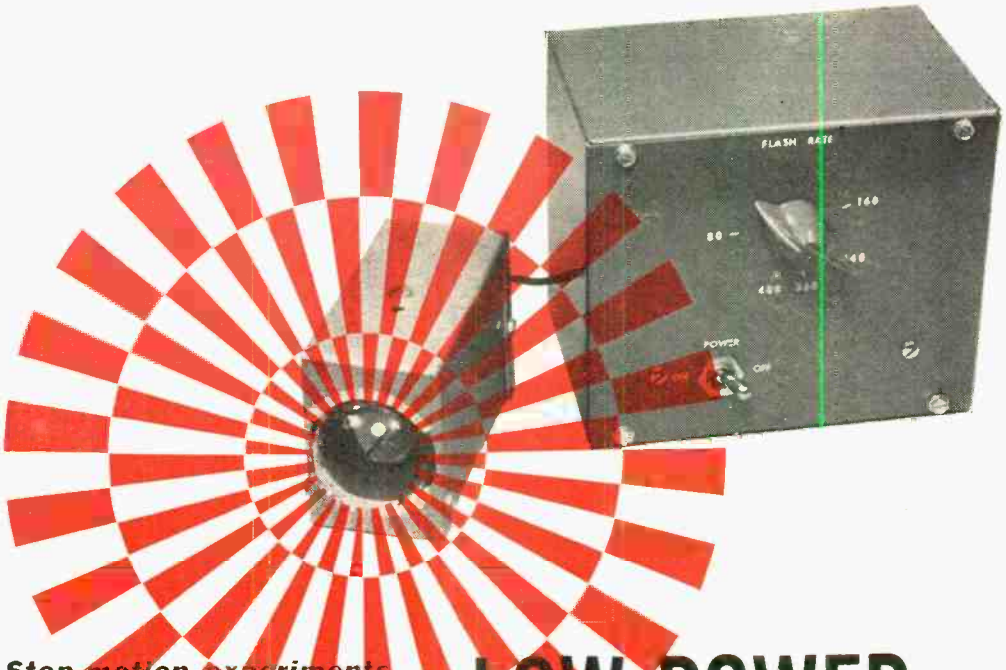
The coiled filament of a 500-watt projector lamp is subjected to severe heat and magnetic stresses. When the lamp is switched on, high current surges through the cold filament—the current decreases as the filament heats up. Magnetic stresses are particularly damaging as they tend to push and pull the coiled filament until it breaks.

You can minimize the current surge



and also reduce the pushing and pulling by inserting a negative-temperature-coefficient thermistor in series with the filament. The author used a Workman FR6 "Globar Resistor" for a 500-watt lamp, with only a 3% drop in voltage.

—Elmer C. Carlson



Stop-motion experiments can be performed with an easily assembled strobe using a large neon bulb

LOW-POWER STROBOSCOPE

By **STEPHEN AUYER**

A STROBOSCOPE is a handy device that can fill a number of needs. It will seem to stop oscillating or rotary motion, permitting you to examine oscillating or rotating parts while they are in action. If you calibrate the strobe, it can tell you the speed at which such objects are moving. Commercial strobe units are used for checking the timing on automobiles, for example.

Commercial units are prohibitively expensive, however, and faced with this fact, the experimenter must either do without or build his own. The inexpensive unit described here is easy to assemble, and while it may lack certain features of more costly laboratory instruments, it has a wide range of applications.

Building the Strobe. The unit is built into a 4″ x 5″ x 6″ aluminum box as shown in the photos. Parts placement is not critical, and no ventilation is required. The neon lamp (*I1*) is mounted in a separate Minibox, for the sake of convenience, at the end of a four-foot, three-conductor plastic-sheathed wire. The third conductor serves as a common ground between the two boxes. A capacitor clamp holds the lamp to the box. Proper alignment of the lamp is achieved by mounting the capacitor clamp atop a ¾″ threaded metal spacer. A 1¾″ hole is cut in the end of the box for the lamp.

If difficulty is encountered in obtaining the lamp specified, you can directly substitute an NE-32 or an NE-42. An AR-2 argon lamp could be used instead, but objects illuminated with the blue argon glow will not be as clear as with a neon type. Other neon types that

will work are the NE-30, NE-32, NE-34 and NE-40. These four types each have a screw-in base with a built-in resistor. The base (and resistor) must be removed before any of them can be used in this circuit.

Place a piece of plastic channel in the lamp hole to protect the bulb against mechanical shock. You will notice that the glass bulb is directly in the path of the cover-mounting sheet metal screws. New holes will have to be drilled closer to the bottom of the box in order to avoid driving the screws into the lamp. As no socket is used for the lamp, connections are made by soldering directly to the two base terminals. Do not use excessive heat, and be sure the terminals are not short-circuited.

To assemble the control box, first prepare an aluminum chassis about 2″ x 3½″ x 4½″. Punch holes in the top for the two tube sockets, and punch a ½″ hole in the front lip for switch *S1*. Two additional holes are drilled on this front lip for machine screws to hold the chassis to the panel.

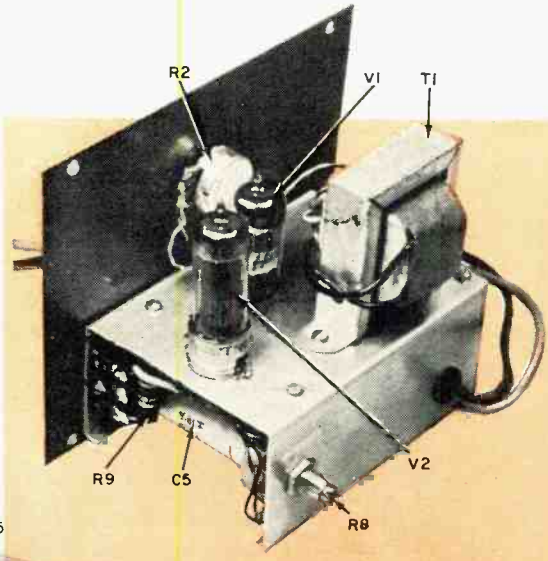
Using the mounting tabs of transformer *T1* as a template, locate and drill holes to mount the transformer. Add another ½″ hole at the top, near the transformer, to hold a grommet and provide a means of conducting the transformer leads and wiring from potentiometer *R2* below the deck.

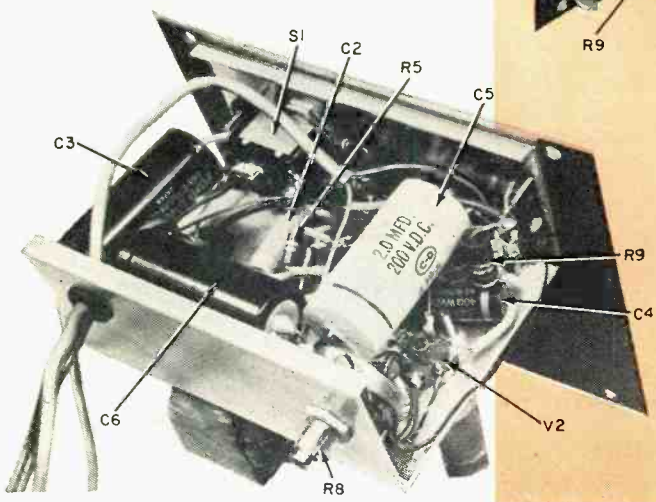
On the rear lip, two ⅜″ holes are drilled, one for a grommet for the a.c. line and the lamp-cable, the other for potentiometer *R8*, the intensity control. Potentiometer *R2* is mounted on the front panel of the cabinet, above the chassis.

Using the chassis as a template, locate mounting holes for it on the front panel. After drilling these holes, mount the chassis on the panel and then mount the major components on the chassis.

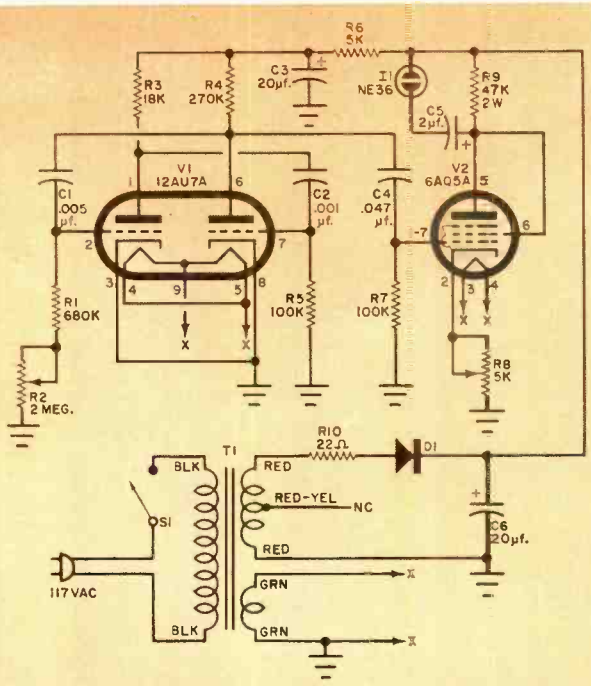
Follow the schematic diagram on page 63, using terminal strips as necessary.

How It Works. A half-wave rectifier (*D1*) supplies voltage to the circuit, with about 325 volts d.c. across *C6*. Tube *V1* is a variable frequency multivibrator whose frequency is determined by the setting of rate potentiometer *R2*. The grid of tube *V2* is highly negative so that little current flows through *V2*





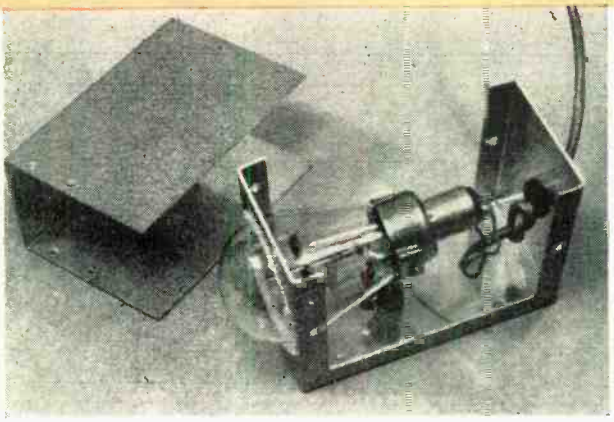
Parts locations are shown in top and bottom views of strobe above and at left. Two wires from grommet on rear of the chassis are a.c. cord and a three-conductor cable to lamp.



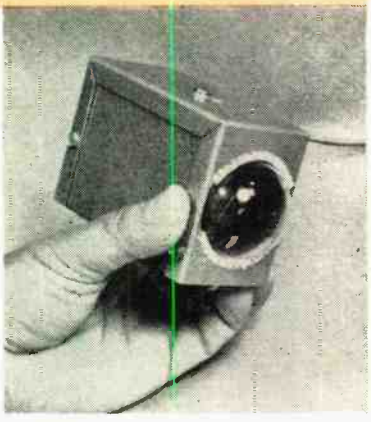
Schematic diagram and parts list for the stroboscope.

PARTS LIST

C1—0.005-μf., 400-volt capacitor
C2—0.001-μf., 400-volt capacitor
C3, C6—20-μf., 450-volt electrolytic capacitor
C4—0.047-μf., 400-volt capacitor
C5—2-μf., 200-volt capacitor
D1—Silicon diode, 500-ma., 400-PIV (RCA 1N1763 or equivalent)
I1—NE-36 neon lamp or equivalent—see text
R1—680,000-ohm, ½-watt resistor
R2—2-megohm linear taper potentiometer
R3—18,000-ohm, ½-watt resistor
R4—270,000-ohm, ½-watt resistor
R5, R7—100,000-ohm, ½-watt resistor
R6—5000-ohm, 1-watt resistor
R8—5000-ohm linear taper potentiometer
R9—47,000-ohm, 2-watt resistor
R10—22-ohm, ½-watt resistor
S1—S.p.s.t. toggle switch
T1—Power transformer; primary, 117 volts; secondary windings, 250 volts CT @ 25 ma., and 6.3 volts @ 1 ampere (Allied Radio 39A937D or equivalent)
V1—12AU7A tube
V2—6AQ5A tube
1—7-pin miniature socket
1—9-pin miniature socket
1—4" x 5" x 6" aluminum utility box
1—2" x 2¾" x 4" aluminum Minibox
1—2" x 3½" x 4½" aluminum chassis
Misc.—¾" threaded metal spacer, capacitor clamp, 4' three-conductor wire, hardware, solder, wire, etc.



Relocate cover screws to avoid driving them into neon lamp.



Plastic channel protects the lamp.

and a low voltage is produced across resistor *R9*.

Positive pulses from one plate of *V1* are applied to the grid of *V2* through coupling capacitor *C4*. These cause *V2* to conduct in short bursts, producing a voltage across *R9*. This voltage, coupled to neon lamp *I1* by capacitor *C5*, causes the lamp to fire. Intensity potentiometer *R8* controls the grid bias voltage of *V2*, determining the intensity with which the lamp will fire.

Calibration. If you want to calibrate the stroboscope, you'll need a motor with a known, constant speed. Cut a black paper disc and draw a white line from the center to the edge. Mount the disc on fairly heavy cardboard, and attach the disc to the motor.

After the strobe has warmed up for about five minutes, turn on the motor and shine the light from the strobe on the rotating disc. Adjust the rate con-

(*Continued on page* 107)

For Better Sound

Great for either stereo or mono listening, this

By DAVID B. WEEMS

HERE is a versatile, labyrinth speaker system that gives you an almost unlimited choice of speakers because matching them to the enclosure is not critical. This is a real virtue if you decide to switch to a transistorized stereo system and want to make a speaker change. Or, at a later date, you may want to upgrade your speakers or change simply for the sake of change—you can go right ahead and do so, and keep the "Bi-Coupler" enclosure. The only limitation is that you will have to stick to 8″ speakers, and, we hope, good ones.

Stereo? One Bi-Coupler can certainly be used as a complete stereo system. The sound will be very satisfactory—quite realistic in fact, since that old "hole in the middle" is nicely filled. While you may ultimately want to add another Bi-Coupler in the interests of greater channel separation, one will serve until you're ready to do so.

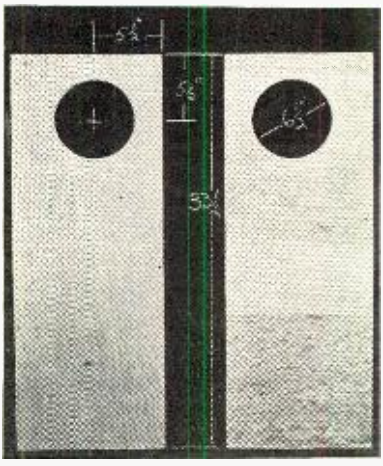
Build the Bi-Coupler

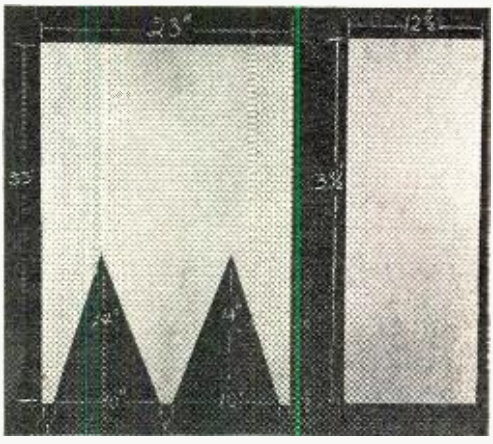
flexible little system features two full-range speakers

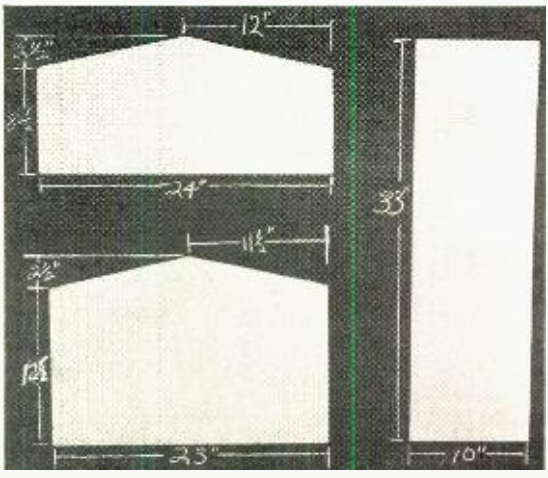
Theory. The labyrinth type enclosures have other virtues but they seem to have fallen by the wayside, although some manufacturers used them for years. The Bi-Coupler is a modified labyrinth with some special features. First, as you might guess from the name, it is compartmentalized. The benefits of multiple full-range speakers are well known, but when more than one such speaker is mounted in a single compartment, there is no guarantee that optimum results will be obtained.

The phase relationship of sound waves on a single baffle gets pretty confusing with more than one speaker, particularly behind the speakers where reflections play an important role. Instead of mutual coupling, the result is likely to be mutual cancellation at some frequencies. The midrib in this enclosure separates the speakers, insuring that they are in phase on the rear wave which produces bass reinforcement.

Good high frequency dispersion is obtained from the angled baffles, which also reduce midrange peaks due to reflections from the rear walls. A less obvious advantage to treble reproduction is contributed by the outside shape of the enclosure. A cabinet with corner angles greater than 90° theoretically reduces diffraction effects which, again, are a source of phase distortion and can-







The basic parts of the Bi-Coupler are shown in these photos along with their dimensions. The two front pieces, above, are each 12½" x 33½"; note spacing and diameter of speaker cutouts. At right, above, is the rear partition and one of the two sides; the diagonal cutouts in the partition create labyrinth effect. Directly at right is the top, bottom, and the midrib. All parts (including a cabinet back if desired) are cut from a single sheet of 4′ x 8′ x ½″ plywood.

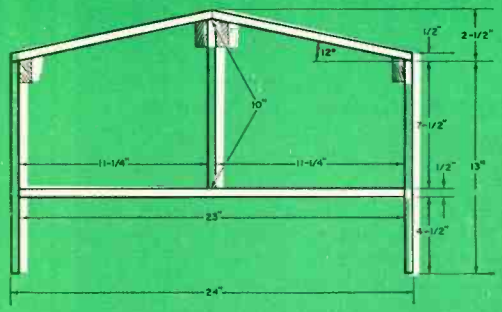


Diagram of the top of the Bi-Coupler's enclosure shows how it is assembled. The front edges of each side, those of the four cleats, and both edges of the front baffles are cut to a 78-degree angle.

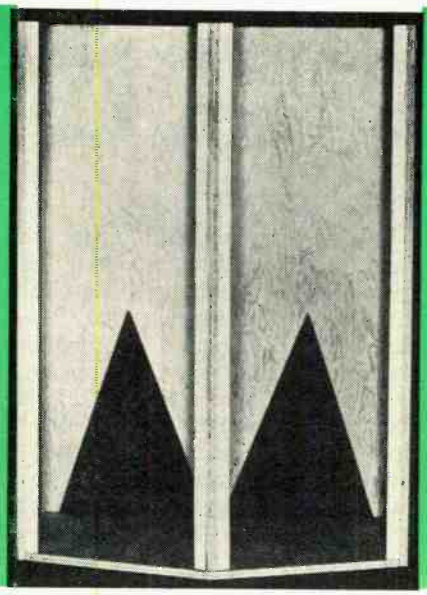


Photo at right shows the rear partition, the sides, midrib, and four long cleats mounted to the bottom.

cellation. Finally, the front of the enclosure approximates the same shape a sound wave assumes when it is emitted from a point source, an aid in coupling the speakers to the air.

Panel vibration should be avoided in any type of enclosure. In this case, the specified ½" plywood is adequate because an open "pipe" is subject to less pressure build-up than a "box," and also because the panels are narrow and well braced. You may question the advisability of using ½" material for the midrib which is subject to stress produced by both speakers. Reconsider. The speakers are mounted symmetrically with regard to that panel, which means that if they are connected in phase the change in pressure from one speaker should exactly cancel the change in pressure from the other speaker! It's an imperfect world, but that was the plan.

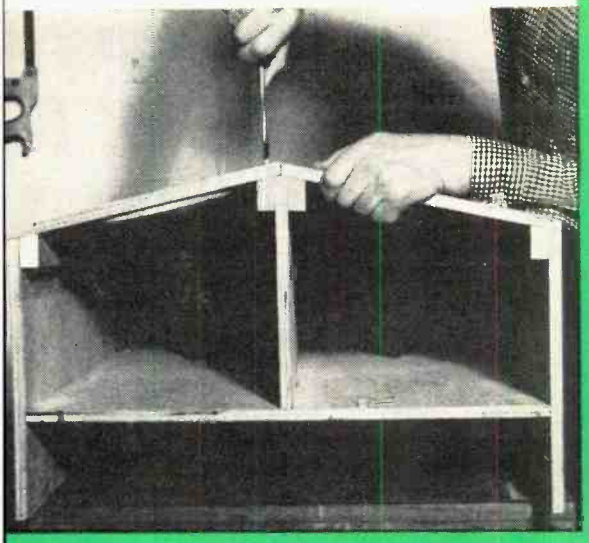
Bi-Coupler Construction. The parts for the enclosure can be cut from a single 4' x 8' sheet of plywood with enough left over to make a back if desired. The back was not needed for the author's version because the sides fit tightly against the walls of the room in which it is installed. By placing the cabinet on its back on a rug, you can quickly compare the possibilities—complete or backless.

The sides and front pieces of the enclosure are first cut to a width of 12½", but the front edge of each side is then cut or planed to an angle of 78° as shown in the illustrations. The 1" x 2" cleats should also be cut to this angle. If a power saw is used, set the saw blade at 12°, since 0° gives a cut of 90°. Both edges of the front baffles are later cut at the same angle.

Assembling the Cabinet. For a solid job, use glue, screws, and nails. First, glue and nail the 1" x 2" cleats to the midrib, then glue and nail the midrib on a line down the center of the partition (the section with the diagonal cutouts), adding screws when it's in position. Glue and nail the bottom to the partition and midrib. The 1" x 2" cleats can now be glued and screwed to the sides; glue and screw the sides to the bottom and rear partition.

Speaker holes should be cut in each front baffle and then the angled cuts made at the baffle edges. It may be necessary to take off a small amount at each edge to secure a proper fit for these parts. When fitted, glue and screw the front baffles in place. Then locate the speaker mounting bolts, which can temporarily be secured with glue.

The next step is to place the top in position. By reaching in through the speaker holes, an outline of the sides, "fronts," midrib, and partition can be marked under the top with a pencil. The short cleats can be glued and screwed to the underside of the top in the prop-



Nails, glue, and screws are used to tightly bond the parts of the enclosure together, and eliminate vibration.

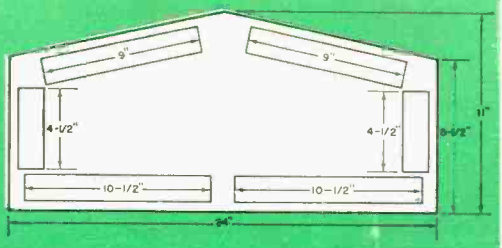
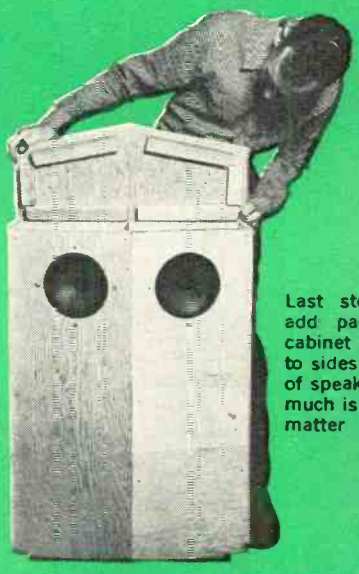
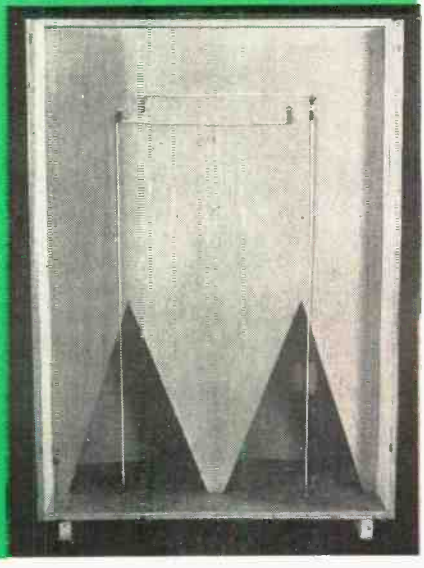


Diagram above shows placement of top cleats; these are positioned ½" from edges.



Last step is to add padding in cabinet top, and to sides and rear of speakers. How much is mostly a matter of taste.

Terminals permit the speakers to be connected in series, parallel, or separately.



BILL OF MATERIALS

Cut from one 4′ x 8′ x ½" plywood sheet:

4—12½" x 33½" pieces for sides and fronts
1—10" x 33" piece for midrib
1—23" x 33" piece for rear partition
1—11" x 24" piece (less cut-offs) for top
1—15" x 23" piece (less cut-offs) for bottom

Cut from 1" x 2" lumber (actual material size approx. ¾" x 1½"):

4—33" pieces for front and side cleats
2—10½" pieces for top cleats
2—9" pieces for top cleats
2—4½" pieces for top cleats
1—21" piece for foot (optional)
2—10½" pieces for foot (optional)

Misc.—Four dozen #6 x 1½" screws, 6-d box nails, glue, eight 3/16" x 1½" bolts for speakers, grille cloth

er position to receive screws from the outside of the cabinet.

It is a convenience to have an outside connection for each speaker post. In the prototype, this was done by drilling holes in the rear partition and running wires from the speaker terminals to bolts on the back. Thus, the speakers can be connected in series, parallel, or to separate circuits as desired without tearing into the cabinet. When the speakers are mounted, a test should be run to determine how much padding is necessary.

(*Continued on page* 111)

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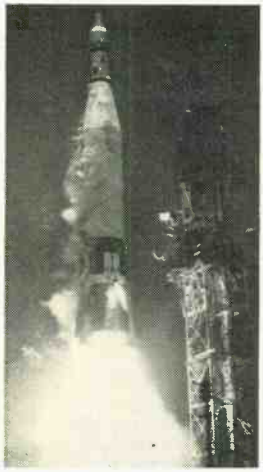

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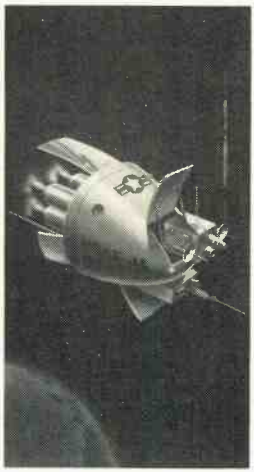

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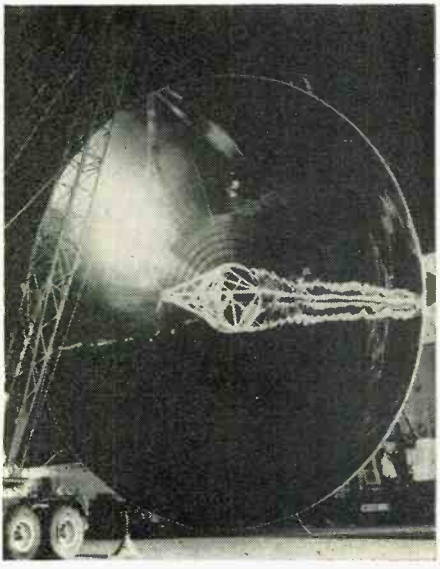
POPULAR ELECTRONICS news

LIFEBOAT RADIO—A complete station, ITT's new hand-cranked transistor survival set, "Solas 11," transmits Morse code or speech on three frequencies, includes tunable receiver. It floats in water.

VIDEOFILE—A system of recording documents on magnetic tape, Ampex Corp.'s first Videofile will go to NASA. User can retrieve data as TV images or printed copies, update material or add new by simply feeding it into a TV camera.

LASER "STAR"—Scintillating like a star, laser light travels over a mile through air at Bell Labs, Holmdel, N.J. Scientist Ta-Shing Chu is studying attenuation of beam due to rain (30 db), fog and snow (80 db), which may make it necessary for laser communications systems to function through underground "light pipes."



FIRE DISH—A solar collector so large that it can be moved only at night due to danger of its beam setting flash fires was designed by Goodyear to test feasibility of using solar energy as a source of electricity for spaceships; 45′ dish is plastic-stiffened aluminized film.

Skip, Hop, and Jump

A review of the DX phenomenon—ionospheric propagation

—plus a band-by-band analysis of predicted DX conditions

By STANLEY LEINWOLL, Radio Propagation Editor

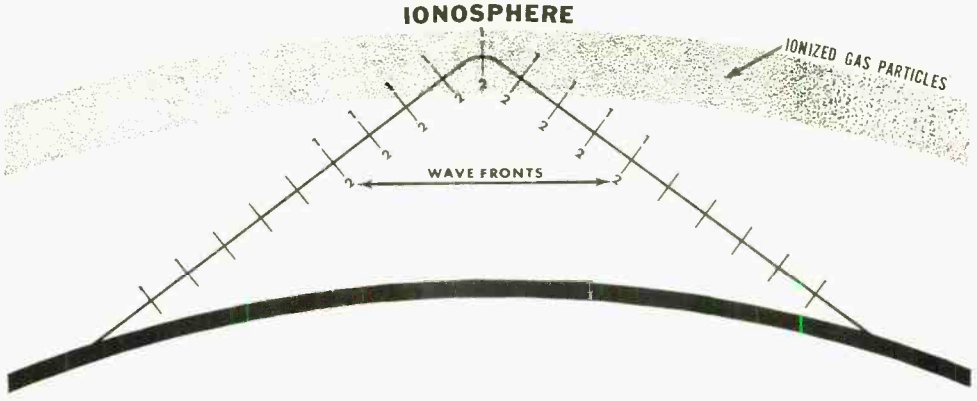
WHEN a radio wave leaves a transmitting antenna, it travels outward in all directions. Part of the signal travels along the ground and is called the *ground wave*, or *surface wave*. Part of the signal travels through the lower atmosphere in a direction nearly parallel to the surface of the earth. This component of the signal is called the *space wave*, or the *tropospheric wave*. Still another part of the signal travels upward and outward at an angle to the earth. This component is generally referred to as the *sky wave*, or the *ionospheric wave*.

In the high-frequency portion of the radio spectrum (3-30 mc.), the ground and space wave components travel short distances, rarely exceeding 25 or 30 miles. The sky wave component of the signal can be propagated to great distances, making long-distance short-wave communication possible. As the sky wave leaves the transmitting antenna in a direction toward outer space, it is traveling in a straight line until it reaches a region of electrified gases beginning at an altitude of approximately 60 miles. This region is called the *ionosphere*. Rocket and satellite measurements have shown that the ionosphere extends to many hundreds of miles above the surface of the earth.

Refraction and Reflection. The ionosphere is formed primarily by ultraviolet radiation reaching it from the sun. As this radiation interacts with the gases in the upper atmosphere, these gases, which consist mainly of neutral molecules, absorb the ultraviolet energy, and in the process lose an electron. This leaves free electrons and positively charged gas molecules, which are called *ions*. The formation of ions is called *ionization*. The ionosphere has the unique property of being able to bend radio waves and return them to earth at considerable distances from the point of transmission.

On entering the ionosphere, radio waves impart their electromagnetic energy to the free electrons in the region, and these in turn begin to vibrate and reradiate this energy, the same way the electrons in a transmitting antenna radiate energy. As the wave penetrates more deeply into the ionosphere, it begins to bend downward.

As a radio wave strikes the underside of the ionosphere, the velocity of the wave is altered according to the ionic and free electron density of this rarefied region. In the highly simplified presentation below, the top of the wave front (designated "1") starts to speed up as compared to the bottom of the wave front (designated "2"). This speedup causes the wave front to bend and emerge from the bottom of the ionospheric layer. Although it is technically a "refractive" process, this mirror-like action (in radio-wave propagation) is always referred to as "reflection."



As a result, this bending, or *refraction,* may eventually change the direction of the wave so completely that it is returned to earth at some distant point. This process is commonly referred to as *reflection.*

The ionosphere is not a single region; it actually consists of several distinct layers, and the characteristics of these layers vary, depending on many factors. One of the layers, the F-layer, is of primary importance, and most of the world's long-distance high-frequency communication takes place by means of reflection of radio waves from this region of the ionosphere. The F-layer is about 175 miles above the earth.

Radio signals that are reflected by the F-layer may be returned to earth at distances as great as 2000 miles from the transmitter. At the point where a signal returns to earth, it may be reflected by the ground and returned once again to the ionosphere where the process of refraction is repeated and the signal is returned to earth a second time. The process may be repeated many times, and, although the signal weakens with each "hop," signals are often transmitted to remotely distant points by means of this multiple-hop method of propagating radio waves.

The Skip Zone. Close to the transmitting antenna the ground and space wave components are strongly received. The signal strength drops off very rapidly as the distance from the transmitting antenna increases, and within a relatively few miles they are too weak to be received. Beyond the limit of ground and space wave reception lies a zone of silence in which the signal cannot be heard. This is called the *skip zone.* Then, at a still greater distance, a strong signal suddenly is received again. This is where the sky wave component of the signal first returns to earth after being reflected from the ionosphere. The distance between the transmitting antenna and this point is called the *skip distance.*

Skip zones, except for the initial one, seldom occur during multiple-hop propagation, since the radio energy is widely dispersed by both the ionosphere and the earth itself.

When a radio signal enters the ionosphere, it will be either reflected back to earth, penetrate through and be lost in outer space, or be so weakened that it dies out entirely. The effect of the ionosphere on the signal depends primarily upon the frequency of the radio wave, the angle at which it leaves the antenna, and the state of the ionosphere—which is subject to wide variation.

With few exceptions, the ionosphere will reflect a range of frequencies, this range depending on the degree of ionization in the ionosphere. Frequencies above the maximum of this range will penetrate the ionosphere and continue into outer space. Frequencies below the minimum will be absorbed within the ionosphere. In either case, long-distance communication via the ionosphere is not possible.

The highest frequency that the ionosphere will reflect between two points is called the *Maximum Usable Frequency,* or *MUF.* The lowest frequency is called the *Lowest Useful Frequency,* or *LUF.*

Ionospheric Variations. Because ionization is dependent primarily upon the effects of the sun, changes in the position of the earth with respect to the sun (due to its annual rotation and daily revolution), cause corresponding variations in the ionosphere. The intensity of ionization, and hence the degree to which radio waves are reflected, varies considerably from day to night, from season to season, and geographically.

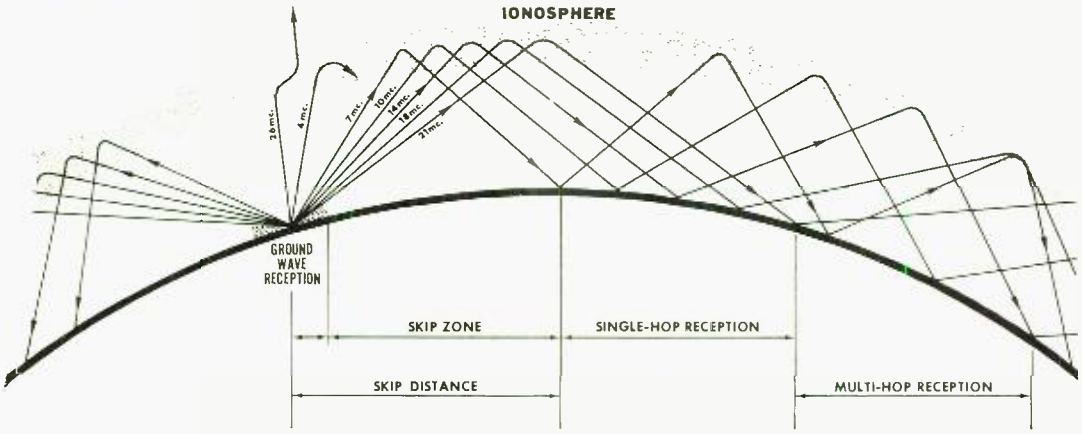
Because ultraviolet radiation is at a maximum during the day, ionization is most intense then, and the range of frequencies the ionosphere can reflect is relatively broad. At night, in the absence of sunlight, the ionosphere weakens because no new ions are being formed and those already formed tend to recombine with free electrons to become neutral gas molecules once more. As a result, *lower* frequencies must be used during the hours of darkness than during the daylight hours. If daytime high frequencies were used at night, the signal would penetrate the weakly ionized nighttime layers and not return to earth.

During the daylight hours of the winter months the maximum frequency the ionosphere can reflect is generally *higher* than during the daylight hours of the summer months, because the sun is closer to the earth in the winter (the fact that the northern hemisphere is colder is due to the sun's lower *zenith angle*), and the intensity of ultraviolet radiation sweeping the upper atmosphere is much greater.

During the nighttime hours of the winter, however, the situation is reversed. Due to the long winter nights, there is much more time available for recombination to take place, as a result of which the winter nighttime ionosphere weakens considerably, resulting in much *lower* useful frequencies than during the summer nighttime period.

Winter Band Conditions. The following is a general summary of band conditions expected during the winter months.

11 Meters. The short-wave broadcasting station schedule changes which go into effect November 1 will once again show no use being made of this band. DX will be nil.



The conditions portrayed in the simplified drawing above are those found on a typical winter morning. A high frequency (such as 26 mc.) is not reflected back to earth but passes out through the top of the ionosphere. A low frequency (such as 4 mc.) is reflected but, because of the ionic density, much of the signal is absorbed before it can emerge from the ionosphere. Frequencies between 7 and 21 mc. are reflected at different angles because, for a given amount of ionic density, the higher frequencies must travel further in the ionosphere before being reflected back to earth. The highest frequency that can be propagated depends not only upon the ionic density, but also upon the angle at which the high-frequency wave front strikes the ionosphere. Since the earth is curved, this angle may be impossible to attain: as shown here, the useful reflection frequency spectrum is between 7 and 21 mc. Note how the "skip zone" is created, and how receivers in the multiple-hop reception zone may be able to pick up signals arriving from a variety of single, double, and triple hops, depending upon frequency.

13 Meters. Less use will be made of 13 meters by international broadcasters than at any time during the past ten years. Nevertheless, 21-mc. band frequencies have been scheduled for use by many of the world's major broadcasters, such as VOA and BBC. Reception in this band will generally be limited to the morning and early afternoon hours, with most of the programs scheduled between 1000 and 1600 GMT (5 a.m. to 11 a.m. EST).

16 Meters. Fewer openings are expected to occur on 16 meters this winter than in previous years when sunspot activity was greater. But all major broadcasters have scheduled transmissions in this band, and DX will vary from fair to very good, depending upon daily changes in propagation conditions. Transoceanic openings should take place every day of the month unless conditions are severely disturbed. More frequent openings will occur on paths from transmitters south of the border and from Africa. Best reception will be during the daylight hours, from early morning to late afternoon.

19 Meters. This will continue to be the best band for DX during much of the winter, although crowded band conditions during the peak daytime periods may result in some interference (QRM). In general, there should be some DX every day between sunrise and late afternoon, and on good days the Latin Americans should come in for even longer periods than that.

25 Meters. During the winter months, the range of useful MUF's is at a maximum, being relatively high during the daylight hours, and quite low at night. Both the 25- and 31-meter bands, therefore, are "caught in the middle," being too low during the day and too high at night for any sustained periods of DX. Transoceanic openings will be limited to several hours a day, particularly around local dawn and sunset, during "transition" periods when conditions are changing. The best and most consistent DX will be from South America in the evening.

31 Meters. As just mentioned, 31 meters will also be too low for good DX during the day, and generally too high for stations other than from Latin America and Africa during the evening. There will be a considerable improvement next spring, however.

41 and 49 Meters. These bands will open for DX late in the afternoon and continue to be open from one part of the world or another throughout the night, until dawn or shortly afterward. Noise levels during the winter nighttime period are at

(*Continued on page* 119)

THE ELECTRONIC

THE FALL SEMESTER was well under way at Parvoo University. It was a beautiful autumn day, and while Jerry was straightening out an assignment with one of his professors, Carl rode around the campus looking at the new eight-story residence halls and the new ten-story graduate house. As an engineer, he was especially intrigued by the novel way more than ten thousand new seats had been added to the capacity of the football stadium. The floor of the stadium had been excavated to a depth of ten feet, thus making room for thirteen rows of new seats along both sides and one end.

Jerry was not in the room they shared in Residence Hall H3 when Carl returned, but Carl knew where to look for his friend. Sure enough, Jerry was in the Electronics Laboratory examining a new piece of equipment that had come in for study and evaluation. The device resting on the bench in front of him consisted of two units. One was a case with a couple of jeweled indicator lights and a meter reading 0-100 ppm. on the front of it. Attached to this by a long, flexible, multiwire cable was a strange-looking object from which Jerry had removed a protective metal cover with ventilated ends.

Two small vertical chassis were mounted about a foot apart on a metal base plate, and a metal rod and a sealed glass tube about an inch in diameter reached across from one chassis to the other. A small glass tube was mounted on the outside of the left-hand chassis behind a round hole, and some sort of lamp bulb was mounted directly opposite behind a similar hole in the right-hand chassis. A combination reflector and protective shield was around this lamp, and directly beneath the shield were two small electric motors. One looked like a phono motor with a ventilating fan on its shaft; the other had the appearance of a timer motor.

"What the heck's that?" Carl asked, pulling a stool up to the bench.

"Can't you read?" Jerry teased, pointing to the neatly lettered PER-TECTOR legend on the front of the instrument.

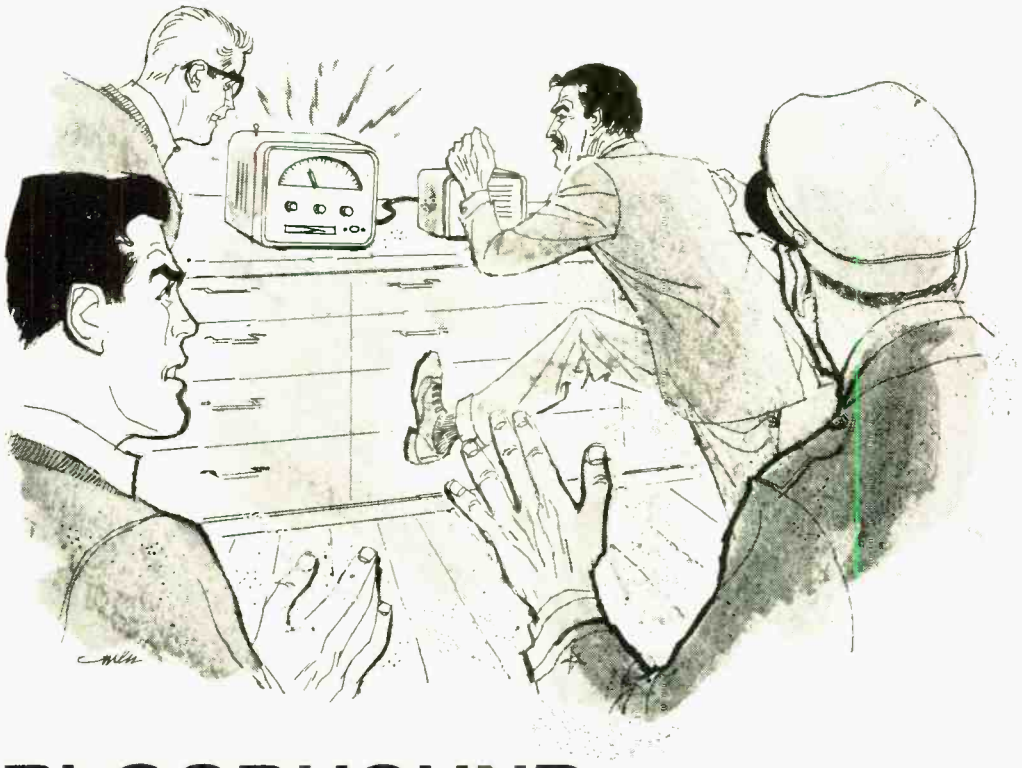
"So what's a 'Per-Tector'? What does it 'pertect' against?"

"It's a gadget brought out by the Apparatus Controls Division of the Honeywell Company in Minneapolis to detect the presence of perchlorethylene, a toxic gas used in dry cleaning. It'll be installed in coin-operated dry-cleaning plants and will automatically turn on extra exhaust fans whenever the gas concentration at this detector unit—which can be mounted away from the amplifier and control unit—reaches 40 ppm., well below the danger point for human beings."

"O.K. How?"

"This little tube behind the hole in the left-hand chassis is a sensitive ultraviolet radiation detector. Opposite it behind the matching hole in the right-hand chassis is a special ultraviolet lamp focused on the detector tube. The output of the detector is amplified and used in a kind of bridge circuit so that when the full and unobstructed radiation from the lamp falls on the detector the circuit is balanced and the meter reads zero.

"But this little fan is constantly drawing in air from the room and pushing it through the space between the lamp and the detector. Since perchlorethylene gas molecules have the ability to absorb ultraviolet radiation, if any of this gas is present in the air the instrument is 'sniffing,' even as little as one ppm., the



BLOODHOUND

By JOHN T. FRYE, W9EGV

presence of the gas will cut down on the radiation reaching the detector and produce a reading on the meter. This instrument is adjusted so that when the gas concentration reaches 40 ppm. a relay turns on the ventilating fans. It could be adjusted, though, so that this would happen when the concentration was as low as 10 ppm."

"What's the purpose of that long glass tube and the other stuff?"

"It's part of a really clever idea. Over a period of time, dust, dirt, and oily particles may collect on the lamp and sensor tube. To compensate for the loss of ultraviolet energy transfer this produces, the gadget automatically recalibrates itself. That long glass tube is filled with a specified concentration of perchlorethylene. Once every twenty-four hours, this little motor turns the steel shaft and rotates the gas-filled tube into place between the ultraviolet source and the detector and switches on calibrating circuits inside the amplifier.

"The balancing circuits adjust automatically for the proper reading for that concentration of the gas. After calibration, a latching mechanism that has been holding the tube in place releases and this counterweight pulls the tube out of the path of the ultraviolet beam. If the dirt accumulation is so heavy that proper compensation is impossible, this warning light on the amplifier comes on and tells the operator to clean the lamp and sensor."

"Don't other substances besides perchlorethylene absorb ultraviolet radiation?"

"Sure. The device can detect fumes from gasoline, paint, lacquer, ammonia, styrene, foam rubber, tear gas, acids, ripe bananas or apples, liquor, and even vodka! It can't tell the difference between these various odors the way the human nose can, but it can react quantitatively to any of them; and, up to a point, it can be made especially sensitive

(*Continued on page* 100)

The CB Dilemma—

FRIENDS tell me that one of my pet expressions is, "Let's look at this thing objectively." Most certainly, objectivity is required in order to resolve the dilemma presently facing the Federal Communications Commission and the Citizens Radio Service (popularly called CB). The release by the FCC in late July of numerous changes in CB Rules and Regulations has set off a chain reaction unlike anything seen in electronics in the past ten years.

CB—Where Did It Come From? There are many stories circulated as to just how CB was developed by the FCC. Hams and old-timers in electronics will remember the numerous attempts in the 1930's to introduce a "code-free" amateur radio license. During World War II there were scores of meetings in Washington on post-war frequency utilization. During one of these meetings, according to a popular version, Dr. Daniel Noble, vice president of Motorola, introduced the concept of a new business radio service. Looking to the future, Dr. Noble felt that there would be a call for a low-cost, short-range, two-way radio communications service. Little did anyone suspect that this still-unborn CB service would in six years (1958-64) grow to well over 700,000 licensed call-signs and probably 2,500,000 radio stations. Nor did anyone suspect that the "code-free" ham license advocates would swarm to CB as their natural habitat.

It is now possible to "second-guess" that the original Part 19 Rules were too loosely worded, and that even the name, "Citizens Radio Service," was a misnomer. Nevertheless, CB does exist and the incredible number of licensed stations cannot be wished away. The possible implementation of the new Part 95 CB Rules changes (see October issue, page 55) should afford all interested parties an opportunity to seek solutions to the CB dilemma.

Where CB Stands Today. Acting within the purview of the Communications Act of 1934, the FCC has redefined its Rules governing CB. These new Rules emphasize the personal business aspects of CB—as opposed to using CB for undefinable "hobby" purposes. As this is written, various groups have petitioned the FCC to set aside the November 1, 1964, deadline for the new Rules to go into effect.

One of the first actions was taken by Representative Ken Hechler (Dem., W. Va.) in a resolution offered in the House of Representatives. Congressman Hechler's resolution called for the FCC to undertake immediately a study of the CB Rules and to report back to both Houses of Congress on or before February 1, 1965. However, this resolution has been sidetracked in the Interstate Commerce Committee and may remain there until after the election.

Filings before the FCC for re-hearing include those of the KYOVA Citizens Radio Club, the California Citizens Band Association, Lafayette Radio Electronics in conjunction with Polytronics Laboratories, and the National Association for CB Radio. These filings contain important objections to the issuance of the new Part 95 Rules. At least one petition argues that the proposed Rules changes are invalid because of "points of law." Such arguments carry heavy weight and it is likely that the FCC may temporarily stay implementation of the Rules until such points can be clarified.

What Can Be Accomplished? Regardless of the strength of numerous arguments to continue CB in the same manner of operation as in the past, it is extremely doubtful that the FCC can or will greatly alter its current position. Washington pundits stress that the best CB'ers can hope for is a reversion to the old 5 minutes on and 2 minutes off (instead of the 5 and 5 imposed by the new Rules), and a modest increase in the number of interstation channels from 7 to 9.

In effect, those filing proposals with the FCC are fighting a delaying action.

By **OLIVER P. FERRELL,** Editor

—A Solution

In this Editor's opinion, the time and effort involved could be used to much greater advantage. Staving off final implementation of the Rules does not focus attention on the real problem.

The number of CB'ers that want to have a personal two-way radio system is enormous. It is obvious that, under the Communications Act of 1934, plus International Treaty arrangements, such personal radio systems are within the province of the Amateur Radio Service. However, the Amateur Radio Service has been in existence for decades—the CB service for only six years. The flood of applications for CB licenses during these few short years would seem to indicate that the Amateur Radio Service (as presently constituted) does not suit the needs of a special group of private citizens applying for CB licenses.

The "Communicator's" License. Any student of political science and electronics experimenting can point out that the radio frequency spectrum is a limited natural resource. In a democracy, the ownership of this resource must be invested in the private citizens of this nation. The number of CB licensees would certainly indicate that hundreds of thousands of citizens are not being given due and proper consideration.

To solve the *CB Dilemma*, the FCC should consider instituting a new class of amateur radio license—the "Communicator's License." With this license classification, the FCC could capitalize on the experience gained from administering the CB service.

It is obvious that CB'ers are far more willing to suffer the trials and tribulations of channel crowding and interference than any other radio communications service. Also, CB'ers are not technically qualified in depth to build or drastically modify their equipment. In the main, CB'ers are willing to use "Type-Approved" equipment of low power input on assigned frequencies. Arguments pro and con CB do not involve any of these factors—only the nature and contents of broadcasts, which must be classified as amateur radio.

This new type of ham radio license could be made "code-free" and not violate international treaty. In fact many readers may be surprised to learn that somewhat similar licensing arrangements (code-free ham tickets) currently exist in England, New Zealand, and Australia! The United States should go these countries one better and establish a block of assigned channels for a "Communicator's License." The authority to do so is contained in the International Radio Regulations, Geneva, 1959, Chapter X, Article 41, paragraph 1463, which states:

> (1) Any person operating the apparatus of an amateur station shall have proved that he is able to send correctly by hand and to receive correctly by ear, texts in Morse code signals. *Administrations concerned may, however, waive this requirement in the case of stations making use exclusively of frequencies above 144 mc.* (The italics are ours.)

A small block of frequencies within the 4-megacycle breadth of the 2-meter radio amateur band (144-148 mc.) is an ideal locale for the CB'er whose sole desire is simply one of communication. The FCC could continue its policies of frequency assignments, limiting input to 5 watts, and antenna height restrictions, and not adversely affect the transmitting range of signals. Manufactured equipment for this band is now available which is only slightly more complex than equipment for the 11-meter CB channels.

Rather than disenfranchise hundreds of thousands of CB'ers because of a misunderstanding, let's resolve the *CB Dilemma* by making greater use of radio services and frequencies presently available. —30—

On the Citizens Band

with **MATT P. SPINELLO,** KHC2060, CB Editor

MANY CB CLUBS throughout the United States, whether newly formed or several years old, may be unaware of the advantages that incorporation brings. If you belong to, or are an officer of, a club that is not incorporated, you might want to consider obtaining legal advice on the matter.

As we understand it, each member of an *unincorporated* CB club is legally responsible for every other member's actions during any activity or service conducted by the club, and is liable for any action taken against the club—whether it's to collect an overdue printing bill for the club newspaper or a damage suit created through the negligence of any one member.

CB CLUBS AND THE LAW

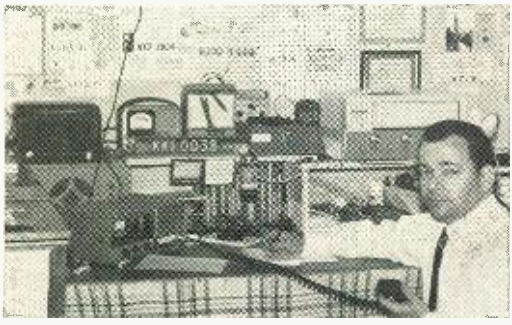
Say that the local hot-rodder unfortunately happens to be a CB club member and while on an organized patrol decides to show onlookers that his Hurricane-8 will do 95 m.p.h. in a block and a half. He ends up smashing through a $758.97 plate glass window. All of the other club members could be held financially responsible for a brand-new hunk of glass. Or say that a particular CB'er turns out to be the burglar of the year, and absconds with the club treasury when certain bills are due—the other members of the organization might have to pay those bills.

On the other hand, a corporation is an entity separate and distinct from its members. The law imposes no liability or responsibility on the individual for the debts or obligations of the corporation. One member is not liable for the acts, negligence, or carelessness of other members. In the cases we just mentioned, if the imaginary CB club involved were incorporated, only the corporation could be sued for non-payment or for the replacement of the expensive window. The individual CB'er would have to sell his CB unit or his boat to settle the damages.

We don't mean to suggest that the smaller unincorporated clubs should disband any more than we would expect them to go broke through the cost of incorporating. It's a good idea, however, to discuss these matters with an attorney, or better yet, invite one to speak at an upcoming meeting to fill in the membership on all the legal details.

FCC Returns Fee. It appears that Craig Norman, aged 14, of Albert Lea, Minn., and some 400 other boys in the nation are about to be issued checks for $8 each by the FCC as the result of a case that came to the attention of Minnesota Senator Hubert Humphrey. Craig applied for a Class

Photos by John F. de Huarte



D Citizens Band license enclosing the prescribed $8 fee. In answer to question 17 of the application which asks: "If applicant is an individual or a partnership, are you or any partner less than 18 years of age?", Craig's logical answer was "yes."

The FCC informed Craig (referring to Part 95, Sec. 95.13) that the Commission's Rules require an applicant to be 18 years of age and that the fee which he submitted with his application was not refundable and could not be transferred to another application. Craig's father then complained to the Commission that the age limit was not so stated on the license application form and requested that either a check be made out to his son or a reasonable explanation given as to why his 14-year-old's money should not be returned. He forwarded a carbon copy of his letter to Senator Humphrey.

Senator Humphrey wrote to Craig's father agreeing that the processing charge was unfair but, as presently stated, the Rules indicated that the application fee was not refundable. In another letter, Humphrey told Craig he would get his $8 back and that, as a result of his case, the license forms would be changed so other teen-agers under the age limit would not be faced with the same set of circumstances. Then, in still another letter—to the FCC this time—Humphrey asked that the Commission find a way to refund Craig's money.

Commissioner Loevinger informed Senator Humphrey that the filing fee system had just recently been instituted by staff administrators and that about 400 other underage applicants were in the same situation as Craig. Loevinger stated that he had brought the matter before the FCC Board as a special item of business, and all the boys would get their money back. He further stated that he agreed with the Senator that the original determination to keep the money was an unreasonable application of the Regulations.

Tidbits from Club Bulletins. Via the *VE1 Newsletter* published by VE1RT, we have learned that the 27-mc. band is not all "CB" in Canada. Canadian amateurs are allocated 40 kc. in that band. The *Newsletter* also reports that a public opinion poll sponsored by Canadian manufacturers revealed a "disappointing" lack of interest by the general public in the General Radio Service (that's the official name for CB in Canada).

It's news to us, but *Collector and Emitter* of the Oklahoma City Aeronautical Center Radio Club, Inc., reports that "Hertz," abbreviated "Hz," is now the official U.S. standard term for "cycles per second." So if you start seeing KHz and MHz in various electronic journals, the terms are your old friends "kc." or "kc/s" and "mc." or "mc/s" in their new clothes.

Club Chatter. Running up and down the aisles of a 450-car-capacity parking lot to see where empty spaces are available is not the most efficient way to handle such a situation. At the Saskatoon Industrial Exhibition last July in Saskatchewan, Canada, members of the Saskatchewan Citizens Band Radio Club found that the job could be done in much less time using walkie-talkies, with less wear and tear on shoe leather to say nothing of the physical exertion involved. They "handled traffic" in this way for a full week. The SCBRC members also were instrumental in nabbing a few would-be "non-payers" trying to make their way into the "exit" gate.

Donna Kirkpatrick, 10Q2258, Lubbock, Texas, informs us that she is a member and reporter for "one of the best CB clubs in the area." The club, the Hub City Radio Association, was organized in November, 1961, with a charter membership of 17. Their main purpose is to promote CB in all walks of life and to educate the general public in its everyday use. Mem-

(*Continued on page* 112)

A simulated search demonstration was held recently by Washington, D.C., REACT members in conjunction with the Suburban Citizens Radio Association jamboree at Bladensburg, Maryland. Participating in the search were REACT mobiles, walkie-talkies and aircraft CB units. Shown in photo at far left is press photographer and CB'er John F. de Huarte, KKI0038. The search was directed by Chief Robert Bajanski from the mobile of Bob Bridges, KCG2486 (second photo), which could be called a "roving base station"; his car is equipped with a 23-channel CB transceiver, p.a. system, sound system, police and fire call monitors, and a 117-volt a.c. power supply, all neatly mounted under the dash. Immediately at left are some of the members of the ground crew who took part in the event.

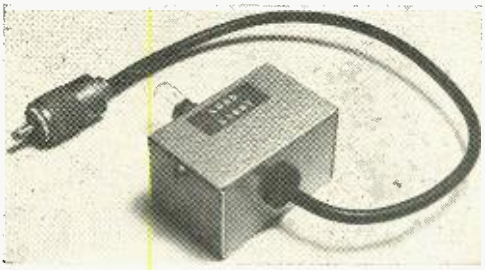
Stable Load Light for CB

THE time-honored practice of using a light bulb as a dummy load when tuning up a CB transmitter has one serious drawback: The light bulb does not represent a 52-ohm impedance and, as a matter of fact, its impedance changes with brightness. On the other hand, a light bulb does give a visual indication of transmitter output.

The "Load Light" combines the best features of a light bulb and a resistive load. As shown in the schematic, a pilot light is connected across one resistor in a voltage divider. While the lamp does change impedance slightly, the resistive network serves to keep the load at a relatively constant impedance. A small Minibox serves as a shielded chassis.

Designed strictly for low-power CB transmitters, the "Load Light" will give you a quick, accurate way to tune up your rig—off the air.

—Ken James



Mount pilot bulb in socket or grommet at one side of box; 52-ohm coax is fed in other side. Keep all component leads short.

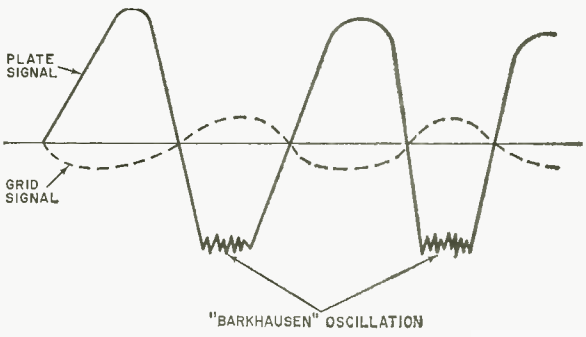
Improving Audio Quality

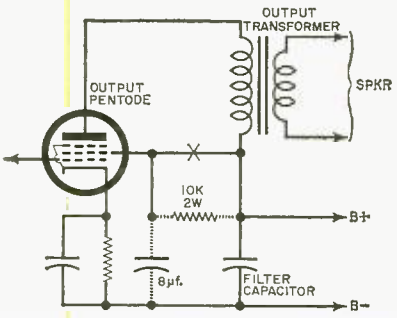
MANY inexpensive receivers, equipped with a single-ended pentode output stage, have reasonably good audio quality at low levels, but suffer from "tinfoil in the piano" distortion as the volume is increased. If the difficulty is due to a hopelessly inadequate output transformer and/or speaker, replacement with better quality components is the only remedy.

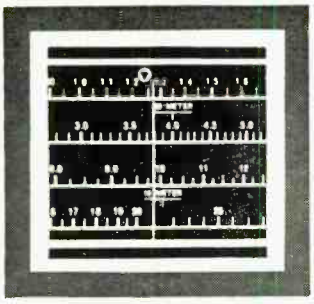
In some sets, however, the trouble is much less serious, being simply a question of "omitted" components: a resistor to reduce the screen voltage, and a screen bypass capacitor. The result is that when a strong positive pulse on the control grid drives the tube toward saturation the screen is momentarily more positive than the plate, so that weak "Barkhausen" oscillation sets in, distorting the signal. A typical waveform showing what happens appears below.

To cure the problem, simply break the direct connection between the B-plus and the screen and insert a 10,000-ohm, 2-watt resistor. Then, add an 8-μf., 150-volt capacitor at the screen (these two components are shown in dotted lines in the schematic diagram). Further improvements can sometimes be made by shunting the primary of the output transformer with a small (0.001-μf.) capacitor, if this component has also been omitted.

—Ronald L. Ives







Across the Ham Bands

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

PHONY PHONETICS

MOST skilled operators recognize the value of phonetic words in getting call letters and difficult words through on phone under poor conditions. Not all hams believe in them, however. The other day, for example, I tuned across a certain W2 with a two-letter call (and a broad signal) transmitting CQ. No phony phonetics. No "Whiskey-Bravos." No "this" and no "that," and any ham who had the temerity to use phonetics while calling him got a tongue-lashing for his pains.

Although this ham's operating procedures leave much to be desired, you have to sympathize with him when you hear something like the following: "Calling the figure five, N for Nebraska, the figure two, J for Johannesburg, E for Elizabeth, H for Honolulu. This is W for Washington, the figure nine, E for England, G for Guatemala, Q for Quinine." When this is repeated many times (even after contact has been established), you may even become a confirmed hater of phony phonetics.

Of course, using phonetics when they are not needed—and no ham needs phonetics to recognize his *own* call letters—is irritating to other operators and a waste of time. Even worse is to use nonstandard and constantly changing phonetics for the same letter. This quaint habit is more likely to confuse the listener than to help him.

To illustrate what can happen with the wrong phonetics, I recently heard a U.S. ham with call letters ending in "YCP" raise a DX-pedition station in Luxembourg for his first "LX" contact. Unfortunately, the "LX" copied his call letters as "YTP." So "YCP" worked valiantly to get them corrected by repeating "Y for Yukon, C for Chicago, P for Portugal" many times. Eventually, the "LX" got the message, changed the call letters to "*U*CP," and signed off much to the frustration of "YCP."

If you say "Yukon" aloud a few times, it becomes obvious why it is such a poor phonetic for "Y," especially for a foreign ham who knows little English.

International Phonetic Alphabet. Actually there is little reason to choose phonetic words haphazardly when the International Phonetic Alphabet is available. This list is used in virtually all domestic and international commercial and military radiophone communications circuits, and it is

Amateur Station of the Month

Amateur radio is the kind of hobby you can take up at practically any age. Ira C. Shultz, W3CEF, of Lancaster, Pa., a retired mail clerk, was 65 when he started—some nine years ago. He got his ham license the same year he retired. W3CEF operates both fixed and mobile on all amateur bands from 80 through 2 meters. He will receive a one-year subscription to POPULAR ELECTRONICS for submitting the winning photo for November in our Amateur Station of the Month contest. If you want to enter the contest, send us a clear picture of your station—preferably showing you at the controls—along with some information about yourself, your equipment, and your operating achievements. If you don't win, we'll try to publish your picture anyway, as space permits. All contest entries should go to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, Box 678, Gary, Indiana 46401.

Larry Fritz, WN8LHY, of Cleveland, Ohio, dressed up his station by building a single cabinet to house both his transmitter and receiver. The transmitter (on the right) is also home-constructed, and has worked 44 states and Canada in about three months.

Don Adams, W5IFX, of Albuquerque, New Mexico, managed to put 43 states, Canada, Puerto Rico and Mexico in his logbook before he knocked the "N" out of his call.

rapidly replacing other phonetic lists in the amateur service.

Some hams feel that using standard phonetics eliminates some of the "color" from amateur radio by eliminating the clever phrases like, "AMD—A Million Dollars," "BBW—Big Bad Wolf," and "KMM—Kiss Me Madly" (used by a YL) that they have devised to fit their call letters. We believe, however, that when conditions are bad enough to require phonetics, these clever phrases seldom get through unless they are printed on a QSL card.

FCC News. With the FCC's determination to stamp out all hobby-type operation in the CB service clearly spelled out in the new CB regulations effective November 1, now is the time for individual amateurs and amateur clubs to help sincere CB operators obtain their ham licenses. Make no mistake about it: many of them are potentially fine radio amateurs. Don't worry about the few irresponsible, something-for-nothing boys becoming amateurs—the extra effort needed to get a ham license will wash this type out pronto.

International Phonetic Alphabet

A—ALPHA	M—MIKE	Y—YANKEE
B—BRAVO	N—NOVEMBER	Z—ZULU
C—CHARLIE	O—OSCAR	1—WUN
D—DELTA	P—PAPA	2—TOO
E—ECHO	Q—QUEBEC	3—TH-UH-REE
F—FOXTROT	R—ROMEO	4—FOWER
G—GOLF	S—SIERRA	5—FI-IV
H—HOTEL	T—TANGO	6—SIX
I—INDIA	U—UNIFORM	7—SEV-EN
J—JULIET	V—VICTOR	8—AIT
K—KILO	W—WHISKEY	9—NIN-ER
L—LIMA	X—X-RAY	0—ZE-RO

In mid-July, the Federal Court of Appeals in Chicago ruled that the FCC had the legal right to impose radio license fees (which the Commission had been collecting and holding in escrow pending the outcome of the court hearing). This action apparently concludes the matter unless the ARINC and other petitioners attempt to carry their protests to a higher court.

Also in July, the Commission relieved amateur radioteletype (RTTY) stations of the necessity of transmitting the call letters of the station being worked in the radiotelegraph code as well as in the RTTY code. However, normal identification procedures must be followed on RTTY and the transmitting station's call letters must be transmitted in the radioteletype code at a moderate speed at least once every ten minutes.

WW DX Contest. With the arrival of fall, every weekend supports some kind of a QSO contest. Coming up shortly are two of the biggest: *CQ*'s "World-Wide DX Contest" and the ARRL's "Section Sweepstakes."

The phone section of the WW DX Contest starts at 7 p.m., EST, Friday, October 23 (0000, GMT, Saturday) and ends 48 hours later. The c.w. fray covers the same time period starting at 7 p.m., EST, November 28.

You operate on one or several amateur bands and work as many DX stations as possible, exchanging RS/RST reports and DX "zone" numbers with each one. The same station may be worked once per band. North American hams earn three points per contact outside North America and two points per contact with DX stations on the continent. Stations in one's own country can be worked for zone and country multipliers but not for contact points. Your total

(*Continued on page* 114)

Equipment Report

LAFAYETTE HB-400

New CB transceiver features built-in speech "Boost"

HOW CLOSE can manufacturers get to the ultimate refinement of a tube-type, 23-channel, straight AM transceiver? After taking a long, hard look at the brand-new $169.50 Lafayette HB-400 (Lafayette Radio Electronics, 111 Jericho Turnpike, Syosset, L.I., N.Y. 11791), it doesn't seem possible that there is anywhere left to go, or anything left undone.

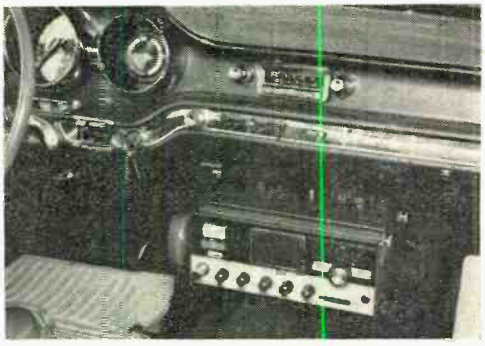
POPULAR ELECTRONICS put one of the first 20 transceivers of the HB-400 series through its paces for three weeks. As a base station, the HB-400 had impressive receiver sensitivity. On a quiet channel and with a Hy-Gain Model VP-1 antenna, signals 50-55 miles away could be easily read. With the unit set up for mobile operation, the 23-channel convenience proved invaluable time after time in driving around metropolitan New York.

The HB-400 has two very special features. With any transceiver using a frequency-synthesis circuit, there must be some way to tune in those other stations slightly higher or lower than the channel frequency; in the HB-400, this is done via crystal control—one crystal on frequency and two other crystals set 2500 higher and lower, respectively. On transmit, the operator can put a built-in speech clipper into operation (called "Boost") from the front panel, effectively upping the percentage of modulation for greater readability at longer distances.

All in all, it's a tough one to beat. —30—

Circle No. 87 on Reader Service Page 15

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



Mounted below the dash in a 1959 Pontiac station wagon, the HB-400 was bounced around for 500 miles with absolutely no ill effects.

Transistor Topics

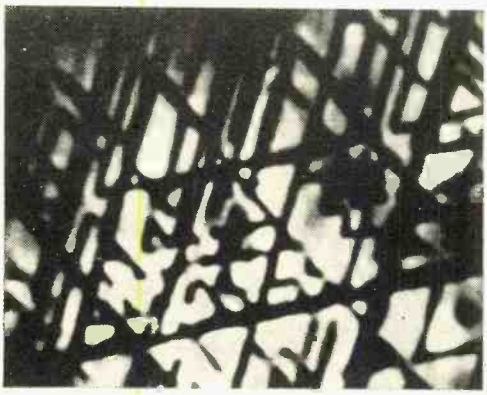
By **LOU GARNER,** Semiconductor Editor

A BETTER UNDERSTANDING of semiconductor crystal structure may result from a new inspection technique developed at Bell Telephone Laboratories. This knowledge, in turn, could lay the foundation for the production of improved transistors and related devices, and even lead to the development of totally new members of the semiconductor family.

The new technique employs a scanning electron microprobe to enable scientists to study internal crystal defects in semiconductor junctions without damaging the specimens or requiring special treatments. Using an electron beam in much the same way as an optical microscope uses rays of light, the electron microprobe is a standard research laboratory instrument. In conventional uses, an electron beam is scanned across the surface of the sample being studied. As the beam strikes the surface, a picture is produced by collecting the X rays or electrons emitted. With the Bell Laboratories technique, however, the electron beam penetrates the material and a picture is produced by collecting the charges generated in the material by the beam. Opaque materials can be examined using this new method.

The basic technique is illustrated in Fig. 1. A finely focused electron beam (A) probes and scans the semiconductor specimen (B), penetrating it to a depth determined by the energy of the beam—the greater the energy, the deeper the beam penetration.

As the beam probes and scans the sample under test, it generates hole-electron pairs in the semiconductor materials. When these pairs reach the electric field region of a *p-n* junction, they separate into positive and negative charges, giving rise to a current. In a region of crystal defects, the charges recombine and thereby reduce this response current. The current is fed through an amplifier (C) to the grid of a cathode-ray tube (D). The CRT's vertical and horizontal sweeps are at the same rate as that of the scanning probe. Result: a map-like display of the diode's response current on the CRT's



Highly magnified internal views of crystal imperfections in a silicon diode above and at right were taken at Bell Laboratories (perpendicular to three different crystal planes) using a scanning electron microprobe.

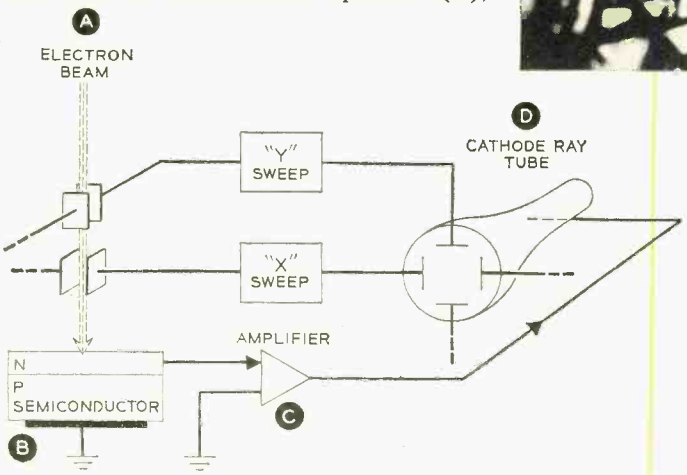


Fig. 1. Basic technique developed by Bell scientists for studying the internal imperfections in semiconductor crystals.

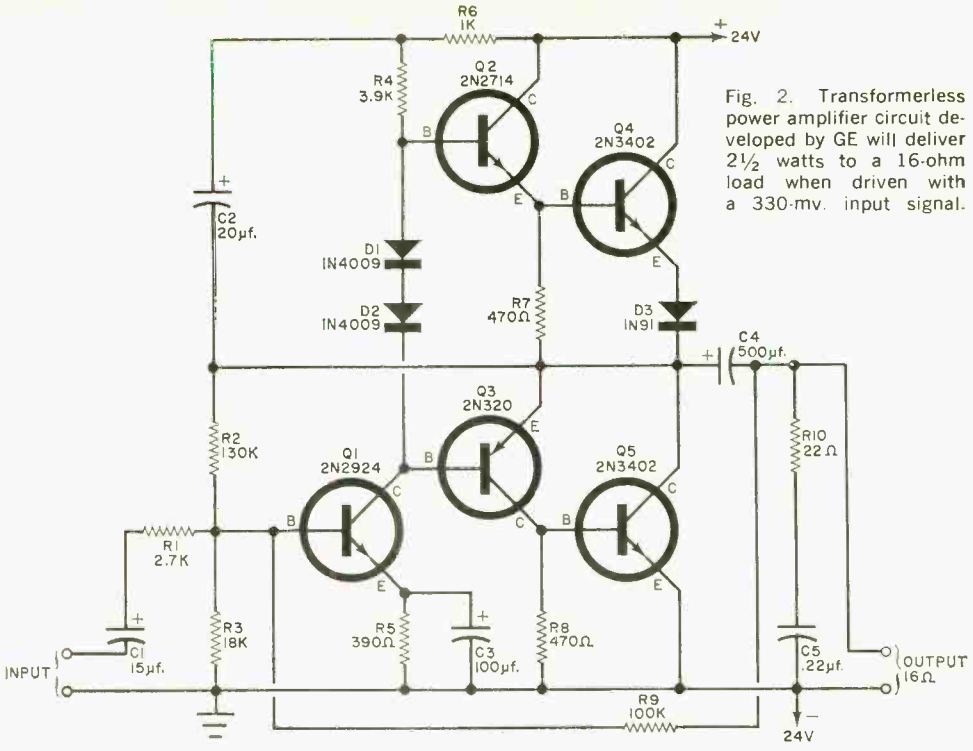
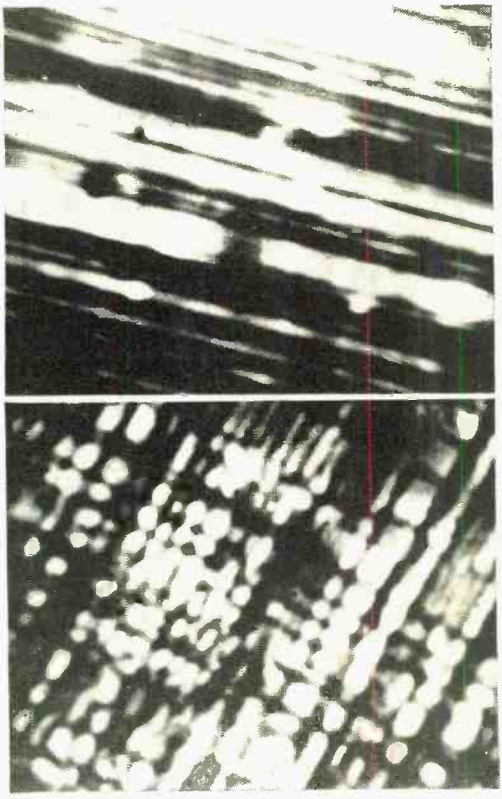


Fig. 2. Transformerless power amplifier circuit developed by GE will deliver 2½ watts to a 16-ohm load when driven with a 330-mv. input signal.



screen, with internal crystal imperfections appearing as dark regions in the picture.

The accompanying photomicrographs, typical of those obtained with the new technique, show three different internal views (perpendicular to three different crystal planes) of imperfections in a silicon diode. A large number of structural phenomena have been observed while studying semiconductor diodes. Thus far, two basic types of internal defects have been identified: (1) arrays of impurities, and (2) bundles of dislocations called "slip planes."

James J. Lander, James R. Mathews, Herbert Schreiber, Jr., and Thomas M. Buck of Bell Laboratories developed the new test technique and performed the initial studies. Wolfgang Czaja, also of Bell, is conducting current studies.

Manufacturer's Circuit. Favorable reader response to the hi-fi preamplifier circuits featured in the September and October columns prompted your Semiconductor Editor to search his files for a suitable power amplifier schematic. Considerable digging turned up the one shown in Fig. 2.

Like the preamps previously discussed, this circuit was developed by General Electric (Semiconductor Products Dept., Electronics Park, Syracuse, N. Y.) to demonstrate the use of their low-cost silicon transistors. A transformerless design, the circuit

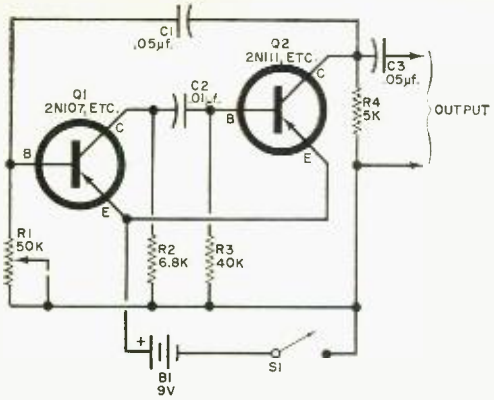


Fig. 3. The "signal injector" circuit submitted by reader Luis Diaz can be employed in testing both audio amplifiers and radio receivers. Although the unit's basic output signal is at an audio frequency, its harmonics extend well up into the r.f. spectrum.

can deliver 2½ watts output into a 16-ohm load when driven with a 330-mv. input signal. At this power level, the total harmonic distortion at 1 kc. is less than 1%, while the IM distortion is less than 2%. With an output impedance of about 1 ohm, the amplifier's frequency response is flat over the entire audio spectrum and well beyond.

Transistors *Q1, Q2, Q4* and *Q5* are *npn* types and *Q3* is a *pnp* type. Direct-coupling is used between stages. In operation, *Q1* serves as a pre-driver and *Q2-Q3* as a series-connected phase inverter driving the single-ended "push-pull" power output stage, *Q4-Q5*. Transistor *Q1*'s stabilized base bias is furnished through voltage-divider *R2-R3* in conjunction with emitter resistor *R5*, bypassed by *C3*. With direct-coupling used, *Q1*, in turn, effectively establishes the base bias conditions for succeeding stages. Resistor *R9* provides a feedback loop around the entire amplifier, while *C4* serves as an output coupling capacitor and *R10-C5* as an equalization network.

Standard components are used. Transistor *Q1* is a 2N2924, *Q2* a 2N2714, *Q3* a 2N320, and *Q4* and *Q5* are 2N3402's. All resistors are ½-watt units. Capacitor *C5* can be paper or ceramic, while all the other capacitors are electrolytics; *C1* and *C4* have a 15-volt rating, *C2* a 25-volt rating, and *C3* a 3-volt rating. Diodes *D1* and *D2* are 1N4009's and *D3* is a 1N91.

The amplifier can be assembled either on a conventional metal chassis or on an etched circuit board. A "clean," well-planned layout should be used and, of course, all d.c. polarities must be observed. Suitable heat sinks should be provided for the output transistors, *Q4* and *Q5*. A standard shielded phono jack can be used as the input connector, and a conventional screw-type terminal strip for the (speaker) output.

Designed for operation from a 24-volt d.c. power source, the amplifier requires 150 ma. It can be powered either by conventional dry batteries (preferably heavy-duty types for maximum life), or by a line-operated d.c. power supply.

Readers' Circuits. The *test instrument circuit* in Fig. 3 was submitted by reader Luis Diaz (860 Columbus Ave., New York 25, N. Y.). Delivering a strong output signal rich in harmonics, the self-contained unit can be used for signal injection tests of both audio amplifiers and radio receivers.

Referring to the diagram, *pnp* transistors *Q1* and *Q2* are used in common-emitter configurations. The instrument is essentially a collector-coupled multivibrator. The base bias of *Q1* is supplied through *R1* and that of *Q2* through *R3*. Resistors *R2* and *R4* serve as collector loads for *Q1* and *Q2*, respectively. Interstage coupling is provided by *C1* and *C2*, while *C3* serves as an output coupling capacitor. Operating power is furnished by *B1*, controlled by s.p.s.t. switch *S1*.

In common with most multivibrator circuits, the instrument's operating rate (or frequency, if you prefer) is determined by the *RC* time constants of its coupling networks. A change in the value of any of the components making up these networks will cause a corresponding change in frequency. This characteristic permits *Q1*'s base resistor, potentiometer *R1*, to serve as a frequency control.

The parts are readily available. Except for *R1*, the resistors are half-watt units, while the capacitors can be either ceramic or tubular paper types. Transistor *Q1* is a general-purpose *pnp* type, and can be either a CK722, a 2N107 or a 2N1265, while *Q2* can be a 2N111, 2N139, 2N218, 2N409, or any similar *pnp* type. A Burgess 2N6 or 2U6 is suitable for *B1*, a slide, toggle or rotary switch for *S1*.

Neither layout nor wiring should be critical. The circuit can be assembled on either a small metal chassis or a phenolic circuit board and housed in a plastic, wooden or metal case. An empty frozen fruit juice can may serve as a case if a probe-type instrument is preferred.

In practice, the "signal injector" is used for stage-by-stage equipment operational tests. Although the unit's basic output signal is at an audio frequency, it contains high-frequency harmonics extending well into the r.f. spectrum. Thus, the instrument is suitable for checking, say, all the stages in a small broadcast-band receiver.

(*Continued on page* 117)

Monthly Short-Wave Report

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

SPECIAL DX BROADCAST!

On Monday, November 16, the first of a series of DX broadcasts to be conducted at our special request will be transmitted over CJCX, Sydney, Nova Scotia, Canada, on 6010 kc. This station, operating with 1000 watts, will be on the air from 0400 to 0525 EST, and the program will feature popular music and frequent identifications. The same program can be heard on CJCB, 1270 kc. (10,000 watts), and on CJCB-FM, 94.9 mc. (1000 watts).

Reception reports for any of these three outlets should be mailed to: QSL Card Department, POPULAR ELECTRONICS, One Park Avenue, New York, N. Y. 10016. No announcement of this address will be made on the air. Only those who read this notice and send correct reports to us will be eligible to receive the special CJCB/CJCX QSL Card to be issued exclusively for this transmission.

The second in this series of special broadcasts will be announced shortly. We would welcome suggestions from interested DX'ers as to which stations you would like to have carry similar DX programs.

TUNING IN THE "BEAST OF THE AIRWAYS"

IN RECENT YEARS a new form of broadcasting has been developed known as "single sideband." The 75-, 40-, and 20-meter amateur bands are loaded with such signals, and a great number of commercial radiotelephone stations also employ SSB, or a modified form of it, on their overseas communication channels. Reception of an SSB station on a conventional radio is impossible. The signal has no steady carrier—simply bursts of energy representing one sideband—and a speaker sounds, roughly, as though he were trying to talk with his mouth full.

With patience and practice, however, the sidebanders can be conquered by short-wave listeners almost as easily as the conventional AM emissions. What many SWL's consider to be the "beast of the airways" can be tamed and turned into easily read signals by proper use of the BFO control to put the carrier back in the signal. This applies to both the ham stations and the commercial overseas stations.

There are two methods of tuning in SSB stations, both of which are performed with the BFO switch in the "on" position. The

One of our regular reporters in South America is Jack Perolo, PY2PE1C, of Sao Paulo, Brazil. Jack's equipment includes a modified National NC-190, a Hammarlund HQ-180, a Fujiya tape recorder, a home-built crystal oscillator, and a 42-foot long-wire antenna 150 feet high! To date he has logged 165 countries, with 151 of them verified.

Jeff Maltz, WPE2LWO, of Newark, N.J., listens on a Zenith "Trans-Oceanic" receiver. His record so far: 38 countries logged, 36 verified.

first method is to center the desired signal in the receiver passband (i.e., tune for the strongest peaks), then slowly vary the setting of the BFO control until the speech becomes intelligible. Generally, SSB signals are tuned much like c.w. signals—that is, with the audio gain full up, and the i.f. or r.f. gain control at a lower setting.

The second method of tuning SSB is to set the BFO control in the correct position (as determined by the first method), and tune across the signal slowly and carefully with the bandspread dial. After experimentation, you will find that there are *two* "correct" BFO settings—one for stations using the

(*Continued on page 126*)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

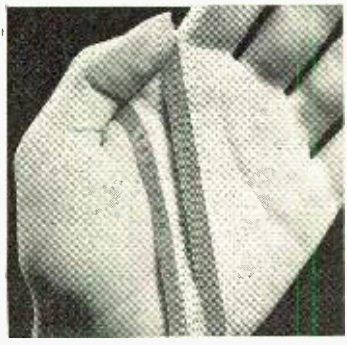
All of the stations below specifically beam English-language newscasts to the U.S.A. The times may vary a few minutes from day to day.

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Argentina	Buenos Aires	11,780, 9690, 6090	2200, 0100 (Mon.-Fri.)
Australia	Melbourne	17,840, 15,220	2030, 2130, 2230
		9580	0745
Bulgaria	Sofia	9700	1900, 2000, 2300
		7290	1630
Canada	Montreal	15,190, 11,760, 9585	1800 (Caribbean)
		9625, 5970	0215, 0300 (W. Coast)
Congo (East)	Leopoldville	11,755	1630
Congo (West)	Brazzaville	15,190	1430
Czechoslovakia	Prague	11,990, 9795, 9550, 7345 (also 15,285 at 2030; 11,990 at 2230)	2030, 2230
Denmark	Copenhagen	15,165	0700
		9520	2100
Finland	Helsinki	15,185	1530 (Mon.-Fri.)
West Germany	Cologne	11,945, 11,795, 9735	1010
		9640, 6075	2035
		11,795, 9735, 9575, 6145	0000
Hungary	Budapest	11,905, 9833, 7215	1930
		9833, 7215, 6234	2030, 2200, 2330
Italy	Rome	9575, 5960	1930, 2205
Japan	Tokyo	15,285, 15,135, 11,780	1900
Jordan	Amman	9555	2015
Lebanon	Beirut	9625	2130
Netherlands	Hilversum	17,810, 15,425	0930 (Tues., Fri.)
		15,425, 11,730	1535 (Tues., Fri.)
		15,425, 11,730	1630 (exc. Sun.)
		9715, 6085	2330 (exc. Sun.)
Portugal	Lisbon	6185, 6025	2105, 2245
Romania	Bucharest	11,810, 9510, 7225, 7195, 6190, 5990	1730
Spain	Madrid	11,715, 9615, 6140	2200, 2100, 2000
Sweden	Stockholm	15,240	0900
		11,805	2215, 2045
Switzerland	Berne	11,865, 9665, 9535	2015, 2315
U.S.S.R.	Moscow	9700, 9680, 9660, 9650, 9640, 9620, 9610, 9570, 7440, 7390, 7360, 7310, 7290, 7240, 7170, 7150 (may not all be in use at any one time)	1730, 1900, 2000, 2100, 2300, 0040
Vatican City	Vatican City	11,740, 9645, 7250	1950

Some plain talk from Kodak about tape:

features and conveniences that result in better use characteristics

It's amazing what good things can happen when you've got a hobby. A lot of our scientists working on KODAK Sound Recording Tape have hobbies. And in almost every case, coincidentally, the hobby is tape recording. And engineers being the sort of restless, dissatisfied people they are, all kinds of off-hours research projects are in work to give Kodak tape a few extra features in terms of handling ease. One of our boys, for example, decided that he wanted to know just what kind of tape he was using in terms of thickness and base type, even when it was separated from its box. And he wanted



to know it at a glance. Another engineer decided that nothing would be more valuable from a quality-control standpoint than a method of knowing just when a given roll of tape was made. And even what part of the master web it came from. This led to a virtual revolution in the tape business. In an age when more and more companies are taking their names off their products and furtively selling them in unmarked white boxes, we are so proud of the quality and uniformity of our product that we are putting our name right on the back of the tape itself.

And not just our name. The kind of tape, too. Won't it be nice to know that you are using half-mil-polyester-triple-play every time you are using half-mil-polyester-triple-play? This means that even when you are using Kodak tape on an unmarked reel, you can still identify it.

Familiar with our Thread-Easy Reel? It's really worth knowing about because it cuts fumbling time down to zero. Here's how: you just take the end of the tape and drop it into the slot in the reel. Half a turn and it's engaged . . . securely. That's all there is to it. Not a worry about manhandling your tape, either. This reel's a real gentleman! Smooth surfaces. Bevelled edges. Dynamic balance. And notice, too, that each Thread-Easy Reel has a built-in splicing jig. That, plus the fact that it is calibrated on both sides, adds a few extra fillips well worth having.

If you've been really keen-eyed, you have probably noticed that we have been referring to Kodak tape where in previous ads we have always called it Eastman tape. There's a good reason for that. We've changed the name. Goodbye good old Eastman tape. Hello good old Kodak tape. This brings up a small problem. With the name change there are also number changes. And so you'll know just what to ask for, here's how the nomenclature looks (old Eastman tape numbers are in parentheses) :

KODAK TAPE	BACKPRINTING CODE		
Type 31A (Type A303)	DUROL Base	1½ Mil	Std Play
Type 34A (Type A304)	DUROL Base	1½ Mil	High Output
Type 21A (Type A203)	DUROL Base	1 Mil	Extra Play
Type 21P (Type P203)	Polyester Base	1 Mil	Extra Play
Type 11P (Type P103)	Polyester Base	½ Mil	Double Play
Type 12P (Type P105)	Polyester Base	½ Mil	Triple Play

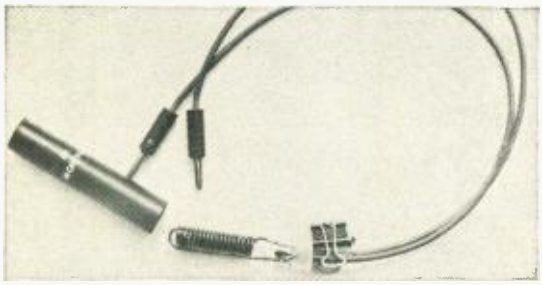
Note that the above list contains a pretty broad spectrum of recording tape. That's another nice thing about the Kodak line. You can get just about anything you need.

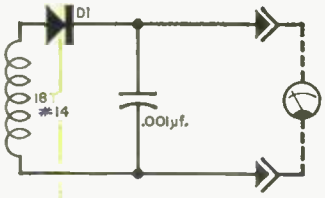
KODAK Sound Recording Tapes are available at all tape outlets—electronic supply stores, camera stores, specialty shops . . . everywhere. Oh, by the way, why did we change the name from "Eastman" to "Kodak"? Don't know, just thought it was a good idea at the time.

EASTMAN KODAK COMPANY, Rochester, N.Y.

CIRCLE NO. 10 ON READER SERVICE PAGE

CB R.F. Monitor / FS Meter





Wire the coil, diode, and capacitor together as shown, bringing two leads out of probe to meter.

IF YOU'VE ever tried loading up a mobile CB or ham antenna while working alone and found yourself without a field strength meter or other tuning indicator, you can appreciate the author's predicament. A tuning indicator in the front seat of the car was needed, and the parts available to throw one together were those that happened to be in the junk box.

As an r.f. pickup, an 18-turn coil of #14 wire was close-wound on a wooden pencil, and then the pencil removed. A diode (the author used a 1N277, but a 1N34A or other general-purpose type would work) and a 0.001-μf. filter capacitor were added to the coil, and the whole works stuffed into a small plastic tube which happened to be lying around. Two leads were brought out for connection to a VOM.

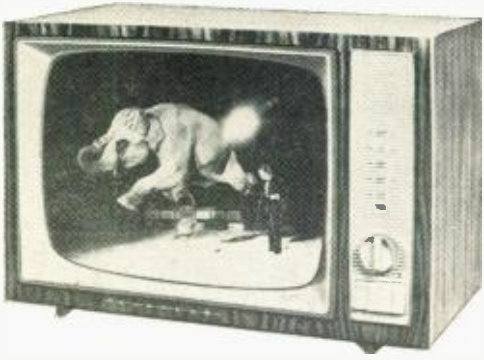
To use the r.f. probe, simply secure it somewhere near the antenna, and set the VOM on a high microamp range. You can, of course, increase meter sensitivity by switching to lower ranges, but it's best to start high and work down.

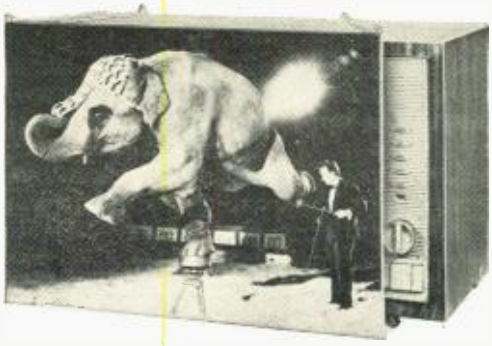
—Bob Apperson, 7W1866

TV Magnifier Uses New Principles

DESPITE the fact that TV magnifiers are almost as old as TV, not much has been done with them since the early days of video when the 7-inch picture tube reigned supreme. If a German firm has its way, however, the magnifier may make a comeback. Virtues claimed for their device, dubbed "Scopemaster," are double magnification, reduction of the scanning line pattern, and tinting (blue) of the picture. The magnifier is said to contain 1000 concentric circles in its grinding pattern, each at a mathematically determined angle. The firm, located in Westfalia, West Germany, is represented in this country by Scope Giant Co., Beverly Hills, Calif.

—Hans F. Kutschbach

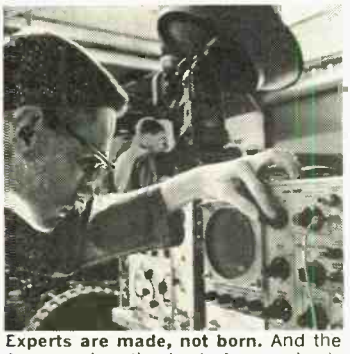




TV set with and without magnifier (right and above). Degree of magnification with unit, which is made of acrylic glass, depends on its distance from the set.

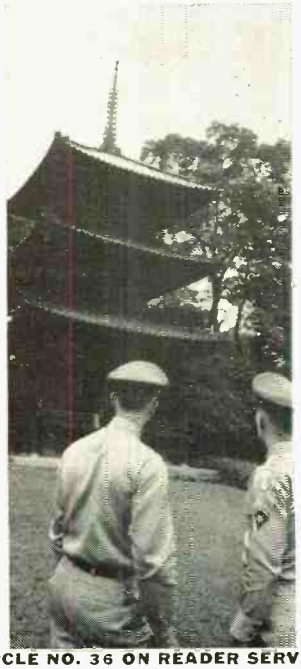
Share great moments with other great guys

Get a new set of wheels in the Army. Ten feet across or scooter size, there are more wheels in the Army than in any other organization in the Free World. Some are an adventure to drive, others take you to adventure—and, if you want, you can learn what makes each one roll.



Experts are made, not born. And the Army makes the best. Army schools teach hundreds of different specialties. If you qualify, you can sign up for the one you want before you enlist.

It's different from your home town. And who wouldn't expect it to be? After all, one of the reasons you join the Army is to see the world of differences.



You're not alone in today's action Army. Every experience you have is shared with other great guys. Regular guys who are learning, earning, growing, going, serving our Country, developing themselves. Just as you are.

But the wonder of these experiences is yours alone. No one can tell you how great it feels to master a difficult specialty like computer programming, missile repair, electronics, or construction. No one can live the excitement of landing in a foreign country for you. No one can know what *your* great moments in the Army will be. But you can be sure your life in today's Army will be full of great moments. Enough to add up to a great life.

Talk to your local Army recruiter. Let him tell you what the Army can do for you... and what you can do for the Army. Let him help you to that great moment, the moment you realize that... if you're good enough to get in, a proud future can be yours in today's *action*

Army

CIRCLE NO. 36 ON READER SERVICE PAGE

Tips and Techniques

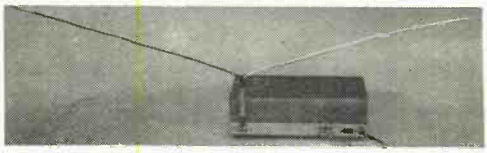
EASY WAY TO MOUNT PHONO JACK ON P-C BOARD

Here's how to mount a phono jack at right angles to a printed circuit board with a minimum of fuss. You'll need a crimp-on closed-eye-terminal for a ¼" stud and a Cinch-Jones Y-142 adapter (available for about three cents from any distributor). Cut the terminal just at the ferrule so you have a ⅛" tab projecting from the original eye. Flatten the Y adapter. Now mount the terminal and adapter near the edge of the board facing each other and about 7/16" apart. Insert the phono jack, tighten the nut, and solder the connections. The resulting mount is compact, neat, and surprisingly rugged.

—Don Lancaster

"QUICKIE" ANTENNA FOR YOUR FM TUNER

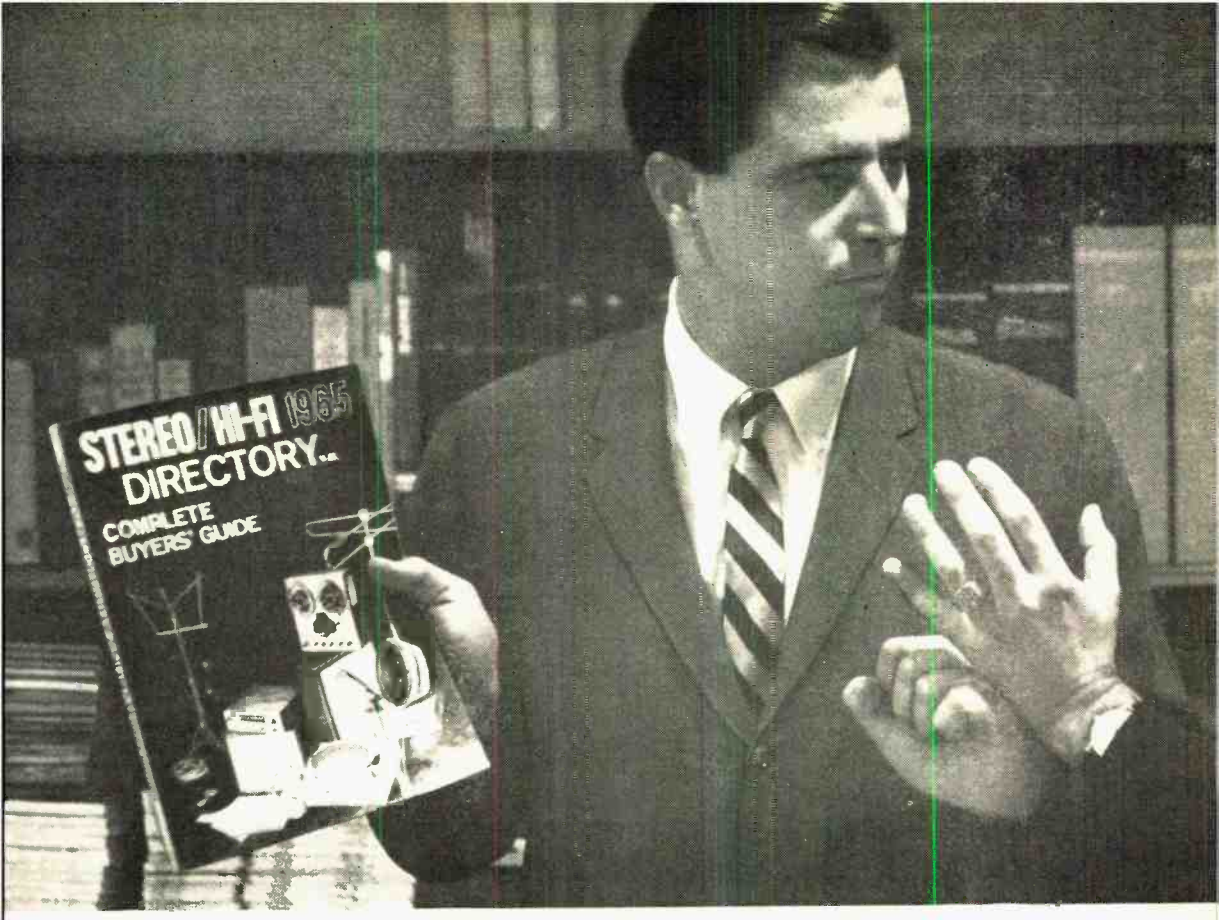
Want to make a "quickie" but efficient antenna for your FM tuner or your portable FM radio? Cut a length of #12-2 duplex solid-conductor power cable to about 36 inches. Remove 30 inches of the outer insulation and bend the two conductors in opposite directions. Now attach the stripped ends of the still bonded conductors to the antenna terminals, and you have your "rabbit-ears."



—Jon H. Larimore

WIRING WRINKLE

If you have a long run for an extension cord and don't want to clobber the wall with insulated "U" staples, try this wiring wrinkle. Put a dab of epoxy cement be-



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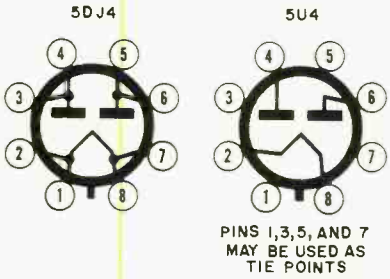
Tips

(*Continued from page 94*)

tween the wall and the wire, and hold the wire in place with a strip of masking tape. When the cement dries, peel the tape away and you'll have an invisible bond between wall and wire. —*B. G. Waterman*

SUBSTITUTING RECTIFIER TUBES

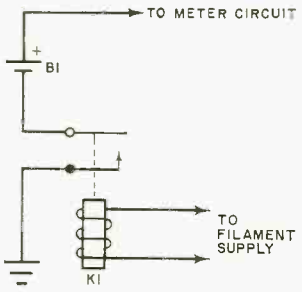
Be wary about replacing a rectifier tube such as a 5U4 with a 5DJ4 or similar tube. While at first glance the tube pin numbers and specifications may seem similar, many manufacturers utilize unused socket terminals as convenient tie points for components



that may not even be a part of the rectifier circuit. The 5DJ4 has internal connections to tube pins that are not normally used in the 5U4. For example, if your set has a 5U4 rectifier socket with pin 5 as a ground, you'll have real trouble substituting a 5DJ4! —*Carleton A. Phillips*

VTVM BATTERY SAVER

The battery in a VTVM is used for measuring resistance and often, if the switch is in the ohms position and the leads touch, as may be the case in a tool kit, the battery can run down. To avoid this situation, install an s.p.s.t. relay with a 6-volt a.c. coil *(K1)* so that the contacts are in series with the meter battery. The coil is then connected to the 6-volt filament transformer in the meter. With the meter unplugged or turned off, the relay will open, disconnecting the battery from the meter circuit. In all other respects, the VTVM operates normally.—*Edwin C. Storey*



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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 Tester that comes with the Kit is really swell, and finds the trouble, if there is any to be found."

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CIRCLE NO. 26 ON READER SERVICE PAGE

Broadcast Band DX

(*Continued from page* 56)

use one winding (the one with heavier wire coming from the transformer) for a radio with 6-volt tubes. Connect the 5-volt and 6.3-volt windings together to power 12-volt tubes if the transformer has only these two windings; filament voltage will still be adequate. When connecting filament windings in series, remember that they must be in phase. Reverse the leads from one winding if you get little or no output.

Antennas. The old adage with regard to antennas is "the longer and higher, the better." For BCB DX you need plenty of sky-wire. If you have the space available, you can erect an inverted-L (a long-wire with a vertical lead-in at one end), or a T-antenna (center-tapped long wire). Plan on putting at least 75 to 100 feet of wire in the air exclusive of the single-wire lead-in.

Stranded antenna wire provides good strength with flexibility, but copper or copper-clad steel wire (#12, #14, or #18) can also be used. The latter type is somewhat more difficult to handle. Try to avoid kinks when hanging the wire, and terminate each end in an egg-type strain insulator. Run pieces of wire through the other insulator holes, and attach them to a mast, tree, chimney, etc. An excellent mounting arrangement is to run one supporting wire through a pulley anchored to a tree or pole. Attach the end of this wire to a sash weight, a piece of masonry, etc., so that when the wind blows the antenna will adjust and not break.

Grounds. Whatever type of antenna you use, be sure to protect your equipment with a gap-type lightning arrestor and a grounding switch. Any long sky-wire will pick up static electricity charges which can damage your receiver. When the receiver is not in use, a d.p.d.t. switch should be provided to disconnect the antenna wire from the receiver and connect it directly to ground.

A good ground serves a double purpose. In addition to providing a safety factor, it usually improves reception of BCB signals. Scrape a cold water pipe

clean and make your ground connection to it, preferably near the point where the pipe enters the soil. Alternately, you can use an 8′ or 10′ ground spike, preferably two or three. Install it as close as possible to the receiver, and use a heavy piece of wire to connect it to the receiver ground post.

If your receiver is a transformerless (a.c.-d.c.) type, *do not attempt to ground the chassis,* as you're liable to get a shock, and may blow a fuse.

Verifications. The ultimate object of any listening, whether it be short-wave or broadcast-band, is the receipt of a verification from the station you heard. This positively proves that you heard and properly identified the DX station.

Unfortunately, the day when every BCB station was anxious to receive such reports has passed. Today some reports are either ignored completely or answered purely as a courtesy. However, if you provide an honest, informative report, are polite in your request, and include return postage, many BCB DX stations will verify.

Be brief but thorough in your report, giving the date, the station's local time, and identifying information such as program title and material, etc.

Clubs and Publications. Joining a radio club will do much for you. For one thing, most clubs provide a regular bulletin informing you of what other members are doing and advising you of what is best to listen for and where. Many clubs maintain a verification card clearing house, and will forward any cards you receive. The following three clubs all recognize and cooperate with BCB DX'ers: National Radio Club, Box 63, Kensington Station, Buffalo 15, N. Y.; Newark News Radio Club, 215 Market St., Newark 1, N. J.; and Canadian DX Club, 24 Briscoe St., W., London, Ontario, Canada.

Some helpful publications include the *North American Radio-TV Station Guide* by Vane A. Jones (available from Howard W. Sams Co., 4300 W. 62 St., Indianapolis 6, Ind., $1.95); the weekly *Broadcasting* Magazine (1735 DeSales St., Washington, D. C., $7 per year); and the *World Radio-TV Handbook* by O. Lund Johansen, Ltd. (Gilfer Associates, Box 239, Park Ridge, N. J., $4.95).

Happy hunting! -30-

The Electronic Bloodhound

(*Continued from page 77*)

to a particular substance. For some reason, one fact that determines which gas the device will be most sensitive to is the distance between the detector and the source of radiation. Honeywell is experimenting along this line at the present time. The possibilities are limitless."

"Let's see it do something," Carl requested, intrigued in spite of himself.

"O.K. I'll put the cover back on the detector unit so air drawn in by the fan will pass between the detector and the lamp. Notice that this electric bell takes the place of the exhaust fans the unit would normally control. See? Nothing happens when the unit is turned on and inhales only room air, but watch as I uncork this little bottle of perchlorethylene down here at the end of the bench."

Only seconds after the bottle of cleaning fluid was opened, the meter pointer started to climb. As it went past the "40 ppm." mark, the bell started ringing and continued to ring while the meter pointer went over against the peg even though Jerry had corked the bottle again. Then, slowly, the pointer came back down, and around mid-scale the bell ceased to ring.

IN the comparative quiet that followed, the boys heard loud voices outside the laboratory. When they went to a window, they saw a police squad car headed into the curb with its rotating top light still flashing. Two uniformed officers stood on the sidewalk holding the arms of a squirming little man so that he faced a well-dressed civilian getting out of the squad car. The boys rushed outside to see what was going on.

"Is this the man who robbed you, Mr. Garland?" one of the officers asked the well-dressed man. "Bugsy here has quite a record with us."

"Yeah, you dumb cops are always leaning on me," the squirming little man said, his weazened face distorted with hate. "What's the beef this time?"

"I—I can't be certain," Mr. Garland said, staring intently at the bat-eared hard-eyed man in dirty shirt and tattered trousers. "He had a handkerchief over his face, and all I could seem to see was that long, sharp, switchblade knife in his hand. I've always had a kind of thing about knives, and I could almost feel it making shish kebab of my liver."

"Let's see if he has a knife, Mac," one of the officers suggested.

In spite of Bugsy's loud and profane protest, they turned his trouser pockets inside out. From the left pocket came a couple of crumpled dollar bills. The right pocket yielded a total of eighty dollars in neatly folded fives and tens. That was all. There was no knife.

"He could easily have gotten rid of it, Dolan," Mac said. "Mr. Garland, do you know how much money he took?"

"It happens I do," Mr. Garland answered. "While home for lunch I spilled some coffee on my trousers, and I changed into a suit the cleaner had just delivered. When I emptied my pockets I noticed I had exactly eighty dollars in bills. These were not in a wallet. I have a bad habit of carrying bills folded together and shoved down into my pocket.

"I drove downtown, parked the car in a parking lot, and took a shortcut through an alley toward my office. That's where the man stepped out from behind some packing cases with the knife in his hand and demanded my money. I gave it to him. He ran on into the alley, and I ran toward the street and hailed your squad car. This fellow looks very much like the one in the alley, but I can't be sure. I don't want to make a mistake."

"Bugsy," Officer Dolan demanded, "where did you get all that money?"

"Won it in a crap game!" the unkempt man snarled, "all eighty-*two* dollars of it. Why don't you two give up? Unless this character had his bills marked, you're out of luck. You heard him say he couldn't identify me. I don't have a knife. I'm carrying more money than he said he lost. If I'm rousted again by you dumb flatfeet, you're going to be up before the judge on false arrest charges."

Jerry suddenly plucked Officer Dolan's sleeve and whispered to him at some length. The policeman, with a puzzled look on his face, finally turned to his fellow officer and said, "Mac, this guy thinks maybe he has a way of telling if

that money is Mr. Garland's or not. I don't understand how, but it's worth a try. Bugsy, come along with us into the laboratory and absorb some college atmosphere—you can use it."

AS they reached the door of the laboratory, Jerry took Mr. Garland by the arm and stopped him. "Stay here by the door if you don't mind," he said. "You'll soon see why."

He switched on the Per-Tector and turned to the policemen who were still keeping Bugsy between them. "This is the machine that might tell us if any or all of the bills came from Mr. Garland's pocket," he said. "It's very sensitive to cleaning fluid such as may have been used in cleaning Mr. Garland's suit. Since that suit is fresh from the cleaner, I'm hoping anything carried in the pockets will have picked up enough of the cleaning fluid fumes to register on the meter. We'll soon know. First, let's try this handkerchief of mine which has *not* been exposed to cleaning fluid."

He placed the handkerchief directly in front of the air intake of the Per-Tector, but the meter pointer never budged.

"Now, Mr. Garland, let's have your handkerchief," he said. "I'll come get it. I don't want the machine to 'smell' your freshly cleaned suit."

Mr. Garland took a handkerchief from a hip pocket, and Jerry picked it up with a pair of plastic tongs and laid it in front of the sensor unit. Instantly the meter pointer moved clear to the right, and the electric bell began to ring.

"Looks like we're in business," Jerry said triumphantly, returning the handkerchief. "Now I wish one of you officers would place the bills from Bugsy's pockets, one at a time, in front of the air intake of the machine and watch what happens to the meter pointer. After each reading, remove the bill and let the pointer go back to zero before trying another."

Officer Dolan did exactly as Jerry suggested, and the results were dramatic and damning. Each of the five and ten dollar bills caused the meter to peg and the bell to ring, but when the one dollar bills were offered to it one at a time, the meter pointer did not budge.

(*Continued on page* 107)

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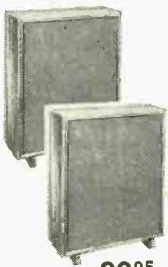

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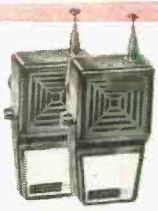

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CIRCLE NO. 16 ON READER SERVICE PAGE

"We-l-l-l, Bugsy?" Officer Dolan said.

"O.K., O.K.! So I heisted the character. But you're not going to pin no armed robbery rap on me. That 'long, sharp, switchblade knife' he was yapping about was nothing but a rubber imitation they sell for kids to play with. You'll find it in a trash can back in that alley."

As he finished speaking, he suddenly lunged toward the bench holding the Per-Tector and tried to raise his foot high enough to kick the sensor unit, but the alert officers grabbed him in time. As they led him toward the door, he turned his head for a last malevolent look at the boys and the electronic bloodhound that had been his undoing. "You lousy, stinking finks!" he snarled at them.

As if in answer, there was a whirring of the motor and the glass tube moved into position for automatic recalibration.

"The poor devil didn't even have the last word," Carl said softly as they heard the calibration tube rotate out of the ultraviolet beam. -30-

Low-Power Stroboscope

(*Continued from page* 63)

trol (*R2*) until the line seems to stand still. If two lines appear, the flash rate is twice the motor speed, and so on. For example, if the motor is rotating at 1000 rpm, and six lines appear, the rate is 1000 times six, or 6000 flashes per minute (100 flashes per second).

In this way, *R2* can be calibrated at a number of points. The calibration may change slightly for different settings of *R8*, the intensity control, or with variations of line voltage, etc.

The flash-rate range of the stroboscope using the values shown is approximately 100 to 400 flashes per second. You can decrease this rate by using a larger capacitor in place of *C1*, or you can increase the flash rate by using a smaller value for *C1*. If you prefer to have an assortment of ranges on your unit, add a switch and a variety of capacitors to be selected by the switch to cover the desired ranges. -30-

Let a Computer Do the Diagnosis

(*Continued from page* 48)

vices rendered, then presents him with an itemized bill upon discharge. It keeps a running inventory of supplies and bills the appropriate medical department when an item is removed from stock, and will compile elaborate statistical reports when required. The 1401 typewrites its reports at 600 *lines* per *minute!*

Heart of the Matter. In the new heart catheterization laboratory doctors watch a TV screen showing a fluoroscopic view of a man's heart. The patient lies on a table over an X-ray source. The large X-ray receiver positioned over his chest contains an image intensifier, a 16-mm. movie camera, and a TV camera tube. The image intensifier amplifies the fluoroscope light as much as 3000 times, permitting a bright image for the TV camera while using only 1/30th the X-ray radiation that was required a few years ago.

The surgeons insert a thin plastic tube into a vein and push it through the vein and finally into the chambers of the heart itself. When the TV receiver shows the catheter to be in the heart and a second oscilloscope, displaying other physiological data, shows that all is well, a precisely timed and measured squirt of radio opaque liquid is delivered into the catheter by an electromechanical angiography injector. This liquid is also visible in the televised X-ray view and as it passes through the heart any defects in heart action can be seen.

During the above procedure, racks full of electronic equipment monitoring blood pressure, blood oxygen level, and electrocardiogram are operated by technicians. The gathered information is recorded on both a pen-and-ink paper recorder and a Sanborn/Ampex tape recorder. In another room down the hall medical students are watching and hearing the procedure via closed-circuit television. This approach to cardiovascular diagnosis is unique in the United States.

Two more X-ray fluoroscopy rooms are under construction. The first will permit a complete fluoroscopic examination by remote control, thanks again to the image-intensifier—CCTV combination; this will enable the examining physician to see the patient's insides on a high-resolution 837-line TV screen. A second room will permit a three-dimensional, stereoscopic X-ray examination of a patient's brain.

More "Inside" Information. Most of us have heard of the medical use made of radioactive tracers. Small quantities of radioactive isotopes are injected into the bloodstream and their progress through the body is observed. The rate at which these compounds are removed from the blood is an important clue to kidney functioning, for example. The degree to which they are absorbed by the tissues can reveal the presence of a cancer. The problem, then, is one of detecting and measuring small quantities of radioactive material.

An "auto gamma spectrometer" is something like an extraordinarily sensitive Geiger counter. It looks like a floor safe. A small door opens in front revealing a hole about 18 inches deep and 4 inches in diameter.

To illustrate the sensitivity of this electronic counter, a one-pound bottle of ordinary potassium chloride was inserted. The machine sprang to life, its red-eyed counters blinking rapidly, telling of the presence of the very, very few atoms of naturally occurring radioactive isotope K-40 present in the sample of normal K-39! The hole is big enough for a patient to stick his arm into. The counter will then indicate the radioactivity in that part of the circulatory system contained in one arm, and from this figure, the total radiation in the entire circulatory system can be estimated.

But doctors are already seeking a more sensitive instrument. The answer is the "total body counter." Construction has been ordered and when it is completed the patient will climb inside the machine itself while it measures the total amount of radioactive material in his body! This extraordinary procedure will eliminate the error inherent in estimations based on a small sample.

Potassium-39 is present in all muscle; so too is a tiny quantity of naturally occurring radioactive isotope, potassium-40. The whole body counter is so extremely sensitive that it can detect and measure these few radioactive atoms. The doctors know the natural proportion of radioactive potassium to normal potassium; they know the amount of normal potassium in every ounce of muscle; and therefore they can immediately calculate the total weight of muscle in the body, and from this derive a muscle-to-fat ratio.

Certain muscle-wasting diseases will be manifested by a change in this ratio. Similarly, the effectiveness of treatment given for such muscle-wasting diseases will be indicated by an improvement in the ratio, showing that the treatment is actually resulting in an increase of muscle mass. The total body counter will also reveal any slow bodily accumulation of radioactive cesium from nuclear fall-out.

Cancer Locator. Neuroblastoma is a cancerous disease second only to leukemia as a malignant child killer. Dr. Clyde Williams (the thyroid computer man) and Dr. Melvin Greer, knowing that bodily quantities of aromatic acids HVA and VMA are sharply increased when the disease is present, employ electronics to quickly indicate the presence and quantity of the two compounds. They use the method of gas chromatography to detect and measure HVA and VMA levels in the patient's excretions. Here's how electronics gets into the act: A sensing device measures the heat of conductivity of a moving stream of pure helium and converts it into voltage which is applied to one side of a Wheatstone bridge. A second stream of helium, mixed with the gas being tested, undergoes the same procedure, and the resulting voltage is applied to the other side of the bridge. The second voltage will vary because the heat of conductivity of the helium has been changed by the addition of a second gas or volatilized material, and consequently the degree to which the bridge circuit is unbalanced will also vary. This electrical imbalance is easily measured and reveals the quantity and identity of the tested gas or vaporized sample.

This electronic technique also measures the effectiveness of treatment for neuroblastoma: improvement is reflected by decreasing levels of HVA and VMA. The method is also being extended to the diagnosis of other baffling diseases.

Electronic Analysis. The Clinical Pathology Laboratory performs 350,000 analyses and measurements per year, over half of them with automated electronic equipment. Body levels of sodium, potassium, chloride, carbon dioxide, glucose, and creatinine are important indicators of health. Solutions are tested for concentrations of these substances by atomizing them and blowing them into a flame. The flame excites the electrons and they give off light at a certain wavelength which is detected and measured by phototubes.

Similarly, the acid-base level of blood is an important measure. Tiny (.02-milliliter) blood samples are measured for hydrogen ion concentration by measuring how well an electric current is conducted by the sample. Conductivity will be proportional to the number of

hydrogen ions present, which in turn indicates how acid the blood is.

Enzyme analysis is accomplished by placing the sample in front of a light of known wavelength. Phototubes convert the light passing through the solution into voltage which represents both concentration and identity of the enzyme molecule.

An analysis of protein levels in blood is a valuable diagnostic tool. This test once took over 18 hours, but it is now accomplished in 17 minutes by electrophoresis. The blood sample is put in a tube with electrodes at each end. Some 350 volts at 22 milliamperes flows through the solution for a few minutes, and the proteins present distribute themselves in a certain order between the two poles. The smallest, most negatively charged molecule is closest to the positive pole, and the largest, most positively charged molecule is nearest the negative pole. Other molecules are strung out in between. An ink-recorder read-out shows a peak at each group of molecules. An unusually high or low peak indicates a pathologic condition.

Blood cells and bacteria are counted by a Coulter counter. A liquid sample is placed in a test tube with a small hole in its side. This tube is placed inside a larger tube also containing a fluid. An electrode is placed in each tube and a potential applied across them. Current is conducted since the two fluids flow together through the small hole in the inner tube. When a blood cell or bacteria pass through the hole, the current flow is momentarily altered, and a counting circuit keeps track of these current variations. The counter can be adjusted to count only certain size objects passing through the tiny hole, hence can count only the small bacteria in a mixture containing both small and large bacteria.

Other Applications. Briefly, a few other medical uses of electronics:

● An electronic photographic contact printer makes perfect prints from imperfect X-ray negatives—the exposure is continuously adjusted to suit variations in negative density.

● A psychogalvanic skin response meter—a kind of high class ohmmeter that registers changes in skin resistance—indicates when a child or mute person is hearing sounds.

● Brain tumors are located by sonar. A transducer placed against the temple locates the brain midline cleavage and the far temple. If the midline is not in the middle, trouble is indicated. Tumors are also spotted.

● Surgeons perform extraordinarily delicate operations inside the ear while watching the progress of their remotely controlled instruments on a TV screen.

Readers interested in turning their electronic hobby skills into an exciting, useful, and well-paid vocation are urged to consider medical electronics as a profession. Mr. O. R. Gano, electrical engineer in charge of the J. Hillis Miller Health Center's Bioelectronic Shop which maintains all this equipment, states that a solid understanding of basic electronic circuits is the best background for the technician who wants to work with medical electronic equipment. Even though the equipment may be unusual in what it does, it is inevitably constructed of the usual electronic building blocks: transducers, detectors, amplifiers, oscillators and power supplies. —30—

Build the Bi-Coupler

(*Continued from page* 67)

The area at the top, sides, and rear of each speaker should be padded, but anything beyond this is a matter of taste. The top is screwed into place through the sides, fronts, and rear partition—don't use glue here, as you may want to make the speaker change for which this enclosure was planned.

The final touches are up to you. The author's Bi-Coupler was wrapped in grille cloth and wood trim was added at top and bottom as shown in the photos.

Hooking-Up. Assuming your speakers are 8-ohm units, you can connect them in parallel to match your amplifier's 4-ohm output, or in series for a 16-ohm output. For stereo, of course, each speaker goes to its individual 8-ohm output. Again, for optimum separation, you may want another speaker for stereo, but you can settle back and enjoy your first Bi-Coupler until your system grows its second one. —30—

convenient headphones, and listen.

mounting, the clock is self-starting and U.L.-approved. When the on/off switch at

Across the Ham Bands

(*Continued from page 84*)

score is the total number of contact points multiplied by the sum of the different countries and zones worked.

(In the U.S. and Canada, the DX zones are as follows. Zone 3: U.S. 6 and 7 call areas—except Montana and Wyoming which are in Zone 4—and VE7. Zone 4: U.S. 4, 5, 8, 9, and Ø call areas, plus Montana and Wyoming, VE3, 4, 5, 6. Zone 5: U.S. 1, 2, 3, and 4 call areas, VE1, 2, VO1. Zone 2: VO2 and far northern VE2. Zone 1: KL7, VE8. Zone 31: KH6 (KH6 and KL7 count as separate countries).

Send your score to *CQ*, 14 Van Derventer Ave., Port Washington, L.I., N.Y. Contest log sheets are available from the same address.

Annual Sweepstakes. The annual ARRL "Sweepstakes" (SS) Contest is undoubtedly the most popular of all U.S. amateur contests, because even the most modest station can participate and make many contacts. This, unfortunately, is not always true of DX contests.

The contest periods are as follows. Phone: 7 p.m., EST, (2400, GMT) Saturday, November 14, to 7 p.m., EST, Sunday, November 15. C.w.: same time period starting at 7 p.m., EST, Saturday, Nov. 21. You exchange message preambles with different stations in the 73 ARRL sections in the U.S. (including the Canal Zone, Puerto Rico, and the Virgin Islands) and Canada. (See any issue of *QST* for a list of the ARRL sections.)

Each message preamble consists of the following: number (of the contact), station call, "CK" (last two digits of year first licensed), ARRL section, time (in GMT),

Here's an example of contest operating in style! This is Don, K8YNQ, shown working the 1963 annual ARRL "Sweepstakes" with the aid of a "logger."

date of birth (day and month only). One point is earned each time a complete preamble is sent or received, and the total score is the number of points multiplied by the number of sections worked, multiplied again by 1.5 on phone or 1.25 on c.w., if your transmitter power input is not over 150 watts.

All classes of licensees may participate on all frequencies they are authorized to operate, but only two points per station can be earned. Send your score to: ARRL, 225 Main St., Newington, Conn. 06111. Contest log sheets are available on request from the same address.

News and Views

Congratulations to the 7586 amateurs who worked AIR, NPG, NSS, or WAR on Armed Forces Day, May 15, 1964, and to the 742 who submitted perfect copies of the Secretary of Defense's message to radio amateurs, which was sent on c.w. at a speed of 25 wpm. Eight of the hams making perfect copy held Novice tickets! . . . Congratulations also to **Roberta Kroulik, K9IVG,** Michigan City, Ind., for being awarded a beautiful plaque inscribed "Indiana's Outstanding Amateur—1964" by the Indiana Radio Club Council at the IRCC's annual picnic/hamfest at Indianapolis in August. Our thanks to *The Bison,* the IRCC paper, for the latter item.

Paul Rubinfeld, WB2JNS, 97 Mountainview Rd., Millburn, N.J., claims that having a good receiver with a low-power transmitter can be a trying experience, because you can hear so much more than you can work. But he should try it the other way around if he wants to suffer real frustration. At any rate, Paul's shack houses a Drake 2-B receiver and Heathkit DX-60 transmitter and HG-10 VFO. A Hy-Gain four-band doublet and an 80-meter dipole take care of the outside work—quite well, too, if his record of 38 states, Brazil, Canada, and Puerto Rico (all confirmed) means anything . . . **Dan Weinstein, WA9FZQ,** 1134 Waban Hill, Madison, Wis., has been using a Drake TR-3 SSB transceiver feeding a Mosley TA-33, Jr., tri-band beam for about four months. With this combination, he has worked 40 countries in all continents. He rates Central African Republic (TL8) as his rarest catch but admits he likes chatting with the less rare countries as much as diving into the "pile-ups" after the really rare ones. WA9FZQ thinks it is time your Amateur Radio Editor took a definite stand on the "incentive licensing issue." There is no mystery about it: I am strongly in favor of the idea.

Gerald Georgopolis, WN1ATH/WPE1EWG, 75 Cross St., Lawrence, Mass., closed out his Novice career with 42 states and three Canadian provinces worked on 40 meters. A Heathkit HX-11 feeding an inverted-V antenna and a National NC-60-B receiver were his tools. Now onward with a General ticket . . . **Jerry Grove, WAØFFU,** Finland, Minn., sticks to 75 and 80 meters using a Knight-Kit T-60 transmitter driven by a Knight-Kit V-44 VFO and driving an inverted-V antenna, 40'

high; a Knight-Kit "Star Roamer" receiver with a home-built, transistorized BFO for c.w. and SSB reception . . . **Chip Margelli, K7VPF,** 2806 North Union, Tacoma, Wash., started his amateur career as an 11-year-old Novice and is now a 12-year-old General. The weight of his years has not prevented him from working 29 states (including Alaska and Hawaii), Australia, Japan, Canal Zone, Mexico, and Venezuela. Two transmitters—a Heathkit DX-40 and an HX-11, a Hammarlund HQ-110 receiver, and an inverted-V antenna cover the 80-through-15 meter bands.

Phil Serafinas, K3FOD, 925 Coleridge Rd., Baltimore, Md., finished as a Novice with 41 states and four countries, a 20-wpm code certificate, and membership in the RCC. As a "General" with a VFO, watch Phil's smoke . . . **Bob Johnson, K3QGZ,** 317 Woodmont Circle, Berwyn, Pa., has a fine arrangement for financing his ham station. His dad advances the money, and Bob works off the debt with house chores at the rate of a dollar an hour. As the result of the recent purchase of a Heathkit HW-32 20-meter SSB transceiver, Bob owes his father 89¾ hours! . . . **Bob Bly, WB6KHB,** 6874 Capistrano Way, Riverside, Calif., went from Novice to General in two months. During the trip, Bob's Heathkit DX-40 transmitter, National HRO-5TA1 receiver, and separate inverted-V antennas for 80 and 40 meters worked 15 states and 6 countries. (The 40-meter antenna works well on 15 meters.)

Rodger Biggs, WAØJKI, Hankinson, N. D., let his Novice license expire before he was ready to pass the General test. As a result, he "lost" his old WNØCYV call letters. But Rodger isn't complaining; the important thing is that his Hallicrafters HT-40 transmitter and SX-140 receiver are back on the air . . . **Bob Williams, WA4DYK,** RFD 2, Rockmart, Ga., keeps his Heathkit DX-40 transmitter and Hammarlund HQ-145X receiver mostly on 15 meters, probably because he has a 15-meter beam. WA4DYK has 49 states worked and confirmed but "doubts" that there are any hams in Maine.

Will we see *your* "News and Views" or photograph in these pages next month? And if your club publishes a newspaper or bulletin, we would appreciate being put on its mailing list. The address is: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Ind. 46401. 73,

Herb, W9EGQ

ODDS 'N' ENDS

The annual Terry County (Texas) Amateur Radio Club's "Free Swapfest" will be held at the National Guard Armory in Brownfield, Texas, on November 15. The chairman of the Prize Committee, E. C. Pool, W5NFO, reports that more than 600 attended last year, many traveling over 500 miles to get there. For details, contact W5NFO at 1003, E. Buckley St., Brownfield, Texas.

Transistor Topics

(*Continued from page 88*)

The interesting *audio amplifier circuit* in Fig. 4 is one of several suggested by Ronald Cook (7 Montgomery St., Saugus, Mass. 01906). According to Ronald, the amplifier will give good results with any audio source capable of supplying a $\frac{1}{16}$-volt output signal . . . typically, a small receiver or CPO designed to drive standard headphones.

Using *pnp* transistors *Q1* and *Q2* as common-emitter amplifiers, the circuit features *RC* coupling between stages and a transformer-coupled output stage. Transistor *Q1*'s base bias is furnished through *R1* and *Q2*'s through *R2*. Resistor *R3* serves both as *Q1*'s collector load and as a feedback coupling element, for it is returned to *Q2*'s collector. Transformer *T1*'s primary winding acts as *Q2*'s collector load while the secondary of *T1*, in turn, matches *Q2*'s moderate output impedance to the speaker's voice coil. Capacitor *C1*, controlled by *S1*, serves as a tone switch, and *C2* as the interstage coupling capacitor.

Standard, low-cost components are used. Transistor *Q1* is a 2N1623 and *Q2* is a general purpose "four-for-98-cents" *pnp* unit. Capacitors *C1* and *C2* are both 50-volt electrolytics. All resistors are half-watt units. As indicated, *S1* is an s.p.s.t. toggle or slide switch. Output transformer *T1* should have a 10,000-ohm primary and a secondary to match the speaker's voice coil winding. Almost any standard PM speaker will do the job although, generally speaking, larger speakers (6″ or more) are more efficient than smaller units.

Ronald suggests that the amplifier be assembled either breadboard style or on a metal chassis, but indicates that a printed-circuit layout would be satisfactory, if desired. Neither parts arrangement nor lead dress should be critical, but good wiring practice should be followed to prevent coupling which might result in oscillation. A 15- to 27-volt d.c. source is required—either series-connected batteries or a line-operated power supply.

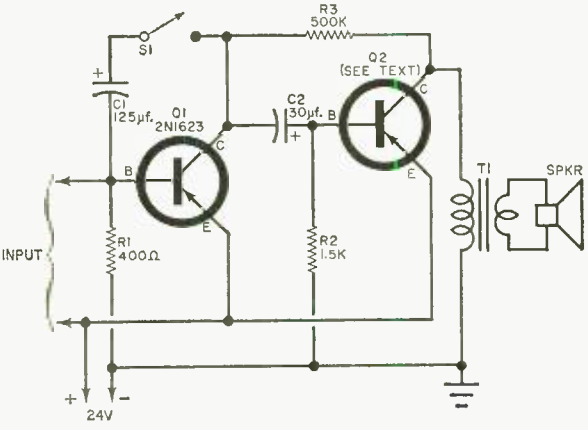


Fig. 4. Ronald Cook's audio amplifier circuit features RC coupling between stages and a transformer coupled output stage.

Transitips. With close to 3000 different transistor types available, many readers are curious as to how design engineers pick a particular type for a specific circuit application. The average hobbyist, of course, tries to "make do" with whatever types he has on hand . . . or, if he is assembling a project described in a magazine article or book, he obtains the specified type. Although space limitations prohibit our giving a detailed explanation of an engineer's design procedure, the general technique is relatively simple, and should be of interest to nearly

every experimenter, for similar methods can be followed when, say, selecting transistors for a project from units on hand.

The first step, of course, is to determine the application, i.e., whether the intended circuit is for an instrument preamp, an audio amplifier, a video amplifier, an i.f. stage, a mixer-oscillator, a regulator, or a power amplifier. The planned application will establish the frequency range of the transistor needed . . . audio, r.f., VHF or UHF. This step will narrow the engineer's choice to, at the most, a few hundred types. If a VHF or UHF type is needed, his choice may be limited to only a few score units.

Once the general type of transistor is selected, the next step is to determine the power level required, and whether or not suitable units are available to deliver the needed output. This step will narrow his choice still further and, in some cases, he may find that there are no commercial types available capable of delivering the power needed. In such a case, he may have to plan on using several transistors in his circuit—either in push-pull or parallel—to obtain the output level needed.

With possibly two or three dozen types available having both the frequency response and power dissipation required, the designer must then determine whether a low-, medium-, or high-gain unit should be chosen. He will be guided in his choice by such factors as comparative costs (two low-gain types may cost less than a single high-gain unit), available space for the circuit, and needed performance specifications. A transistor used as an emitter-follower or oscillator may not, in many cases, need to deliver as much gain as, say, a similar type used as a preamplifier.

By now, the design engineer has a pretty good idea of *which* transistor he'll use. His final choice, however, will be determined by the *critical* factor(s) in the planned application. He will examine such things as noise figure, temperature characteristics, maximum breakdown voltages, interelectrode capacities. lead inductance, and so on. Quite often, a compromise may be necessary . . . he'll have to choose a lower gain transistor than he would like in order to obtain a satisfactorily low leakage specification. And price is often a deciding factor, especially in the design of commercial (consumer) products; the "best" transistor for a particular application may be too costly.

In many cases. the designer may not be able to make a final choice until *after* he "breadboards" his planned circuit. At this point, he may try several different possible types in the circuit, adjusting component values for best performance with each type, and comparing the test results. He may discover, of course, that the transistor type de-

livering best performance requires close-tolerance components and a regulated power supply. If these conditions are not anticipated, the engineer may have to make another compromise, trading performance for less critical operation.

Occasionally, the designer may be unable to obtain a transistor type which meets all his needed specifications. If the anticipated quantities are large (as in a transistor for a mass-produced TV set), he may be able to persuade a semiconductor manufacturer to develop a *new* type for his specific application. This, naturally, would add another unit to the ever-growing list of available types.

In the final analysis, however, the design engineer (and the hobbyist) must base his final choice on a series of compromises.

—*Lou*

Skip, Hop, and Jump

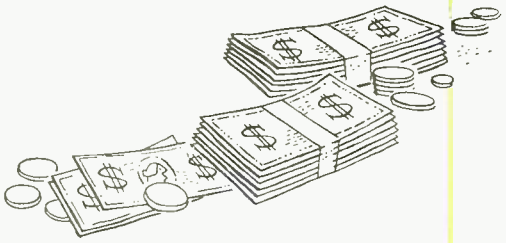
(*Continued from page* 75)

their lowest, as a result of which exceptionally strong signals are possible. However, a combination of low sunspot activity and a record number of users will result in extremely crowded conditions, so that interference levels, particularly during the evening hours, will be very severe. Although there will be many stations transmitting, only the strongest will be intelligible for much of the time.

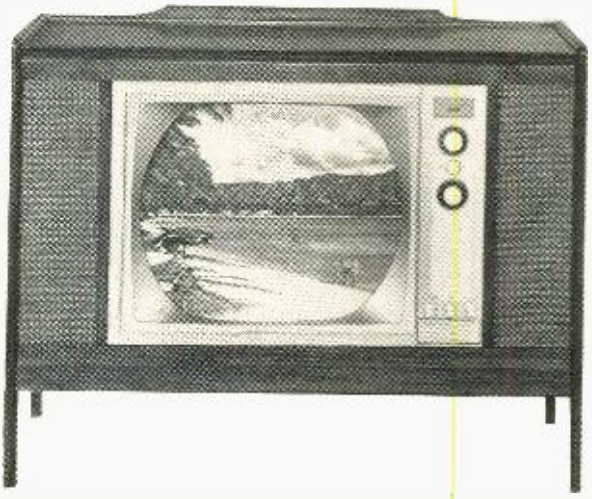
60 and 90 Meters. Openings will occur from shortly after sunset to before dawn, and conditions in the band should be better than they were last winter when they were the best they have been in a decade.

Standard Broadcast Band. This is the winter that medium-wave DX'ers will be talking about for years to come. Conditions in the coming months should be even better than they were last winter, when a record-breaking number of listeners reported their first transatlantic regular AM broadcast-band DX. These conditions will be the result of low MUF's due to the minimum of the sunspot cycle being at hand, low nighttime noise levels during the winter, a record number of stations on the air, and an unprecedented number of medium-wave listeners. We would be very much interested in receiving reports from medium-wave DX'ers this winter. Send them to Stanley Leinwoll, Radio Propagation Editor, POPULAR ELECTRONICS, 1 Park Avenue, New York, N.Y. 10016. —30—

Regardless of what you pay for other Color TV



it can't perform as well as this one...



and yet a Heathkit® set costs as little as $399!

Exclusive Heath Features For Unequalled Performance! That's right. No matter how many of your hard-earned dollars you pay for another brand of color TV, *none* can equal the performance of the Heathkit All-Channel, High Fidelity 21" Color TV! Why? *All* color sets require minor periodic adjustments to maintain peak picture performance. The Heathkit GR-53A is the *only* set with a "built-in service center" that provides facilities for perfect picture adjustments. Heath's simple-to-follow instructions and detailed color photos show you exactly what to look for and how to achieve it . . . quickly, easily! You become the expert! Results? Beautiful, true-to-life color pictures day in and day out . . . and *no* costly color TV service calls for simple picture alignment.

But don't take our word for it. See the special articles on the Heathkit GR-53A in the May issue of **Popular Electronics,** June issue of **Radio-TV Experimenter,** February issue of **Popular Mechanics,** April issue of **Science & Mechanics,** and the August issue of **Radio-Electronics.**

Then tear out the coupon and order yours now!

Kit GR-53A, chassis, tubes, mask, VHF & UHF tuners, mounting kit, speaker, 127 lbs. $399.00

THE ONLY COLOR TV YOU CAN INSTALL 3 WAYS!

1. **In Heathkit walnut-finished hardboard cabinet (Illust. opposite), Model GRA-53-6, 52 lbs. $49.00**
2. **In Heathkit Deluxe Walnut Cabinet (Illust. above), Model GRA-53-7, 85 lbs. $115.00**
3. **In a wall, bookshelf, or custom cabinet!**

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SAVE $449...

Kit GD-983
$849.00
Includes Bench

On This NEW Heathkit® Version Of The Thomas "Coronado" All-Transistor Organ!

A Professional Organist's Dream With A Beginner's Simplicity! Has every deluxe organ feature you've ever dreamed of for complete playing versatility . . . 17 beautiful true organ voices, plus chimes, reverb, sustain, vibrato, attack & repeat percussion and treble accent to create an infinite number of thrilling musical effects! And it's all wrapped up in a luxurious piece of walnut furniture that enriches any surroundings. It's all yours to enjoy at a savings of $449.

Simple To Build, Simple To Play! You don't have to be an electronics wizard to build it, nor a professional organist to play it! Famous Heath "Engi-nuity" has reduced assembly to simple-to- perform steps that require *no* special talents, background or tools. And the famous Thomas "Musical Fun Book" starts you easily playing many favorites. Get the full story free—tear out & mail the coupon now!

Kit GD-983, 290 lbs., organ & bench $849.00

COMPARE THESE FEATURES!

• 17 rich organ voices • Two full-size 44-note keyboards • Built-in 2-speed Leslie plus 2-unit main speaker systems • 28 notes of chimes • 13-note heel & toe pedal board, range C thru C • New stereo chorus for exciting "stereo" effects • Color-tone Attack & Repeat Percussion • Sustain • Treble Accent • Reverb • Manual Balance • Pedal Volume • Expression pedal • Headset outlet for private play • 5-year warranty on transistor tone generators, the heart of the organ • 75-watt peak power amplifier • Hand-crafted, full-bodied, walnut-finished cabinet, completely assembled • Matching bench included

HEAR IT YOURSELF!

Convince yourself by sending for a 7", 33-1/3 demonstration record! Order No. GDA-983-2 for Deluxe GD-983 organ, GDA-232-5 for low-cost GD-232A organ. Each record 50c. Do it now!

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☐ Please reserve GD-983 Organ for Nov. delivery.

☐ Enclosed is _____ Please send demo record (s) _____

☐ Please send Free 1965 Heathkit Catalog.

Name _____
(Please Print)

Address _____

City _____ State _____ Zip _____
CL-192

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CIRCLE NO. 12 ON READER SERVICE PAGE

ODDS 'N' ENDS

Our "Letters from Our Readers" Editor has accumulated over the years a large file drawer of unprinted or unprintable missives complete with answers. Recently, in a moment of weakness, he let go of the following little gems:

"I picked up a 107.9 mc. FM station in the 10 and 15 meter bands. I picked it up three or four times. Can you explain this?"

—D.B., Ohio

Nope. Better put it down while you have the chance.

"I was fiddling with a radio that was unplugged, and every time I touched a tube, a radio in another room got louder. How come?"

—D.E., Illinois

Say! How about that!

"My friend and I have been able to key our receivers and communicate with each other. A ham, who lives half a mile away through a thick forest, gave us an S9 report. Is this legal?"

—J.P., North Carolina

Speaking of forests, remember Little Red Riding Hood. And besides, Grandma's initials are F.C.C.

"I've heard of radio signals being picked up on hi-fi sets and tape recorders, but when I relax, I seem to hear a station on 890 kc. Are sound waves coming into my brain? Are my teeth acting as antennas?

—D.D., Illinois

Yeah—and your nose is a volume control.

"Is there any way to change a high-voltage, low-frequency transformer into a low-voltage, high-frequency transformer without special equipment?"

—M.M., Indiana

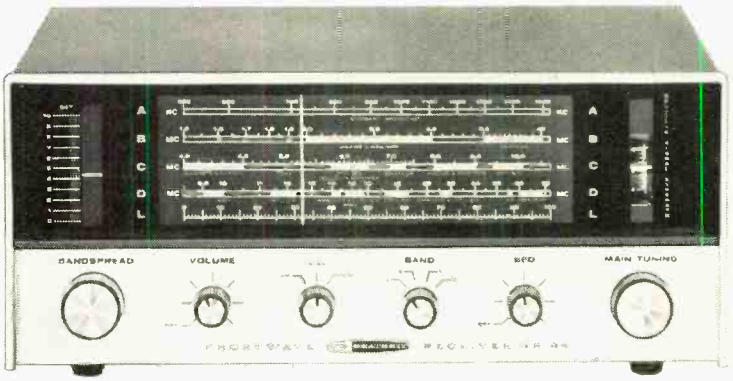
Sure. Find a guy who has a low-voltage, high-frequency transformer and wants a high-voltage, low-frequency transformer.

"Is it dangerous to retune i.f. transformers? I've been doing it for over a year now..."

—J.R., West Virginia

It's dangerous because you might get hysteresis dust on your fingers, or the eddy currents might flow out of the coil.

How To Get Improved SWL Performance At The Same Low Price...



Buy The New Heathkit® GR-64... Only $39.95!

You'll Like Its New "Lowboy" Styling, Too!
Masculine gray, sleek-silhouette metal cabinet with a midnight black front panel accented by green & white band markings and silver trim . . . makes the new Heathkit GR-64 a truly attractive Shortwave Receiver you'll be proud to use anywhere in your home!

New Circuit Features For Improved Performance!
Like the larger 5" round speaker for better sound . . . a built-in rod antenna for broadcast band reception plus unbalanced input for external antenna . . . a high voltage, transformer-operated power supply for peak receiver efficiency . . . parallel filaments for longer tube life . . . new, easier-to-read & lighted bandspread tuning bar and relative signal strength indicator . . . and a one-piece molded dial for faster, easier construction!

Covers 550 kc To 30 mc in 4 Bands!
Includes broadcast plus 3 shortwave bands. The lighted 7" dial also has a logging scale for quick, easy station selection. Features BFO for receiving code & SSB transmissions . . . 4-tube superhet circuit . . . "velvet touch" 16 revolution tuning knob . . . electrical bandspread for maximum station separation . . . and a headphone jack for private listening.

Ideal For Novices & Avid Shortwave Listeners!
Goes together quickly, easily with fast circuit board construction & simple-to-follow instructions.
And at the low price of only $39.95, you won't find a better SWL value around . . . choose the new GR-64 now!
Kit GR-64, 13 lbs. $39.95

Deluxe Portable Heathkit® "Mohican" Shortwave Receiver... Only $95.00!

• Reliable 10 transistor, 6 diode circuit • Fixed-aligned ceramic IF "Transfilters®" • Covers 550 kc to 32 mc in five bands • 50-inch telescopic whip antenna • Zener diode voltage regulation • Smooth, easy flywheel tuning • Built-in 4" x 6" speaker • Large, slide-rule dial for easy station selection • Headphone jack for private listening • BFO for code & SSB transmissions • Compact & battery powered for portability, yet can operate on 117 v. AC with optional XP-2 accessory @ $9.95
Kit GC-1A, 18 lbs. $95.00
Assembled GCW-1A, 20 lbs. $165.00

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CIRCLE NO. 12 ON READER SERVICE PAGE

Short-Wave Report

(*Continued from page 90*)

upper sideband and one for stations using the lower sideband. Purely by convention, most 80- and 40-meter SSB ham stations use the lower sideband, while stations on 20, 15, and 10 meters use the upper sideband. When tuning one of these bands, simply set your BFO at the correct position (for *either* the upper *or* the lower sideband), and do all of your future tuning with the receiver bandspread dial!

Incidentally, your receiver should be warmed up ahead of time to eliminate as much frequency drift as possible—it is no closely guarded secret that the BFO in some of the lower-priced receivers is none too stable. If, when you tune the receiver lower in frequency, the voice becomes lower, the station is using the lower sideband. If the upper sideband is being employed, the reverse will be true.

Tuning in SSB stations with the BFO control works quite well with some receivers where the BFO tuning rate is actually slower than the dial tuning rate. Tuning on 40 and 80 meters is considerably easier than on 20 meters and above with inexpensive receiv-

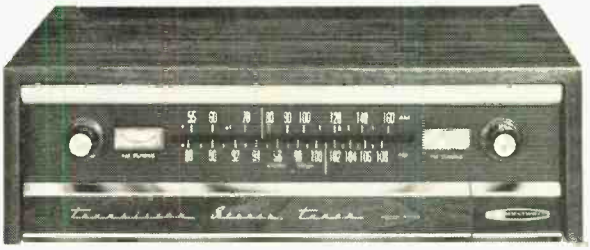
DX Country Awards Presented

To be eligible for one of the DX Country Awards designed for WPE Monitor Certificate holders, you must have verified stations in 25, 50, 75, 100, or 150 different countries. The following DX'ers have recently received the 25 Countries Verified Award.

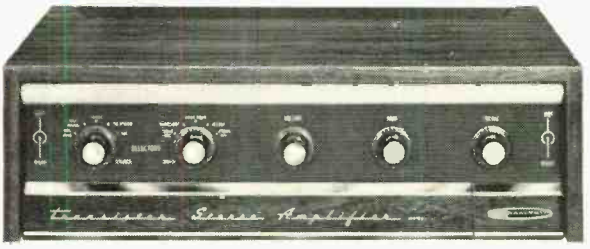
Twenty-Five Countries Verified

Paul J. Larsen (WPE9DYE), Tinley Park, Ill.
Wayne Leman (KL7PE3B), Ninilchik, Alaska
Merritt Cordray (WPE3EXT), Baltimore, Md.
Edward Mohrman (WPE9FRF), Chicago, Ill.
Richard Witkowski (WPE2GQY), Jersey City, N. J.
Raymond Reynolds (WPE1EXT), Lowell, Mass.
Bill Tomkiewicz Jr. (WPE2FZJ), Elizabeth, N. J.
Emmett Murphy (WPE7VEF), Butte, Mont.
Aldridge Salisbury (WPE4HLD), Arlington, Va.
Henry McDonagh (VE3PE1US), Ansonville, Ontario, Canada
Russell Steenrod (WPE2KEM), Oneonta, N. Y.
Bruce McNair (WPE2LEP), Fords, N. J.
Kenneth M. Stern (WPE3FDZ), Philadelphia, Pa.
Richard Markell (WPE6DXC), Los Angeles, Calif.
Richard Ferguson (WPE2FVH), East Aurora, N. Y.
Conrad Durocher (WPE2ASP), N. Smithfield, R. I.
Howard Lyhte (WPE2FYB), New York, N. Y.
Charles J. Baer (WPE2CKM), Brooklyn, N. Y.
Emil Kasprzyk, Jr. (WPE5IE), Floresville, Texas
John Seemann (WPE2ETJ), Bronx, N. Y.
John Ophaug (WPEØDSR), Wayzata, Minn.
Norbert Juneau (VE2PE6S), Sillery, Quebec, Canada
Greg K. Foley (WPEØDJA), Mason City, Iowa
James E. McDonald (WPEØDYR), Mason City, Iowa
Stanley Rowin (WPE2LEI), Brooklyn, N. Y.
J. F. Clarke (WPE3ETW), Ashland, Pa.
Roger Bowman (WPE4ESK), Winter Park, Fla.
Allen Brostowski (WPE2LWG), Wallington, N. J.
Richard Brodeur (WPE1ECM), Chicopee Falls, Mass.
Richard Farrell (WPE4HLL), Clearwater, Fla.
Tracy Resch (WPE9GFN), Casey, Ill.
John Pirnat (WPE8FWO), Euclid, Ohio
Douglas Stark (WPE3FSX), Bethesda, Md.
Steve Weinstein (WPE3FNL), Pittsburgh, Pa.
Allan Jankowski (WPE8HGI), Campbell, Ohio
Ronald J. Shopinski (WPE3DKA), Mt. Carmel, Pa.
Rudy Schleinkofer (WPE3FQV), York, Pa.
Robert Ulmer (WPE2LRG), Bloomfield, N. J.
R. S. Crowell (WPE4HKO), Fort Walton Beach, Fla.
James Dell (WPE8HSY), Dayton, Ohio
Kenneth Alyta, Jr. (WPE4FXB), Charlotte, N. C.
Van Martin (WPE6FIM), N. Hollywood, Calif.
Anthony LoPresto (WPE2JHB), Brooklyn, N. Y.
Joe Pierson (WPE2JZT), Newark, N. J.
Walter McCabe (WPE3EPW), Williamsport, Md.
Martin Franks (WPE9FPC), Michigan City, Ind.
George Winingder (WPE4HJY), Atlanta, Ga.
Carl Luckett (WPEØDVN), Overland, Mo.
Jay Tanen (WPE2JSW), New York, N. Y.
Richard S. Newman (WPE3ECF), Danville, Pa.
Richard Daniel, Jr. (WPE3EXJ), Swarthmore, Pa.
Reinhold Schlegel (WPE9RWS), Richford, Ill.
Bob Wallenhorst (WPE8HFM), St. Bernard, Ohio
Gary Tietz (WPE5DNR), Metairie, La.
Alan Brix (WPE9EUZ), Decatur, Ill.
William Bowe (WPE2KOI), Woodbury, N. J.
Marshall Rowley (VE7PE7S), Vancouver, B. C.
Edward Allen (VE1PE8V), Hantsport, Nova Scotia
Warren Leach (WPE8HOK), St. Clair Shores, Mich.
Trever Clegg (WPE6FAF), Fresno, Calif.
Robert Ramlow (WPE9FTQ), West Allis, Wis.
Wayne Winston (WPE9FSI), Chicago, Ill.
Michael Fletcher (WPE4DPS), Waco, Tex.
Steven Rarola (WPE2JUV), Audubon Park, N. J.
Stephen Schmidt (WPE2IXG), Webster, N. Y.
Francis Powell (VØ5PE1A), Jamaica, West Indies
Pete Hartquist (WPE6FNY), Fairfield, Calif.
Melvin Granick (WPE2GAT), Queens, N. Y.
Edward Aiston (VE3PE2BD), Carleton Place, Ontario, Canada
Leon Johnson (WPEØDWV), Holland, Mo.
Ralph Shankland (WPE6ERL), Arcadia, Calif.
Bobby Conder (WPE4HQT), Winston-Salem, N. C.
Steve Curfman (WPE9FWK), East Alton, Ill.
David Thompson (WPE6HP), Suisun, Calif.
Jack Kallmeyer (WPE8BYZ), Kettering, Ohio
Richard Wallace (WPE2MJY), Flushing, N. Y.
Augustin Monasterio (XE1PE1G), Mexico City, Mexico
Marshall Salt (WPE3ERC), Reading, Pa.
Tom Rupe (WPE9DJH), Park Ridge, Ill.
Gerald Ogor (WPE9FFZ), Riverdale, Ill.
Pat Tuvell (WPE8GFC), Dayton, Ohio
David Pyatt (WPE9GIJ), Indianapolis, Ind.
James Bennett Jr. (WPE3FOW), Conyngham, Pa.
John Parnell (WPE6CNR), Sacramento, Calif.
Paul Johnson (WPE9GYP), Monmouth, Ill.
Mrs. H. L. Young (WPE9ERX), Elgin, Ill.
Edward Zebrowski (WPE1FTG), Holyoke, Mass.
Richard Jones (WPE4EFG), Fairfax, Va.
Neil Hauser (WPE2LQQ), Great Neck, L. I., N. Y.
David Begue (WPE5PB), Houston, Tex.
Thomas Siolek (WPE2HKG), Brooklyn, N. Y.
Larry Kopriva (WPE6FIL), Huntington Park, Calif.
Neal Bates (WPE8EPN), Painesville, Ohio

For The Stereophile With An Eye...



As Appreciative As His Ear...



New Heathkit® Deluxe Transistor Stereo!

Luxurious New Walnut Cabinet Styling!

Do you consider appearance as carefully as performance when choosing stereo components? If you do, then you'll delight in this new look of Heathkit Deluxe Transistor Stereo. Sleek, richly warm walnut cabinets. Clean, uncluttered charcoal gray upper front panels. Soft refracted panel lighting. Hinged lower front panels (to neatly conceal all secondary controls and avoid accidental system setting changes). Beautiful enough to capture the spotlight in any room!

And The Sound?

As modern and beautiful as the new styling. Transistor sound with its broad, crisp, clean, unmodified response . . . no compromising here! Add cool, instant operation, simplicity of assembly, and Heath's low prices . . . you have the best value in transistor stereo today!

Inside These Beautiful Cabinets . . .

In the magnificient Heathkit AJ-43 Stereo Tuner, you'll find advanced solid-state circuitry . . . 25 transistors & 9 diodes in all! You'll find wide-band AM, FM, FM Stereo . . . automatic switching to stereo . . . filtered left & right channel outputs for direct, beat-free stereo recording . . . automatic stereo indicator . . . separate AM & FM tuning meters . . . automatic frequency control . . . automatic gain control . . . adjustable FM squelch . . . and stereo phase control for maximum separation, minimum distortion.

The matching Heathkit AA-21 Stereo Amplifier features 26 transistor, 10-diode circuitry to produce 70 watts continuous, 100 watts IHF music power at ± 1 db from 13 to 25,000 cps . . . complete freedom from microphonics, effortless transient response, cool, quick operation. In addition, there are complete controls, plus all inputs & outputs to handle any program source and most speaker impedances. With its encapsulated, epoxy-covered circuit modules and five stable circuit boards, assembly is fast, simple and fun . . . requires *no* special skills or knowledge!

Please Your Ear, Your Eye & Your Sense Of Value!

Choose this matched Heathkit Transistor Stereo pair now for better appearance and better performance at lower cost!

Kit AJ-43C, tuner, 19 lbs. *$129.95*

Kit AA-21C, amplifier, 29 lbs. *$149.95*

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CIRCLE NO. 12 ON READER SERVICE PAGE

ers, due to the fact that so much more of the spectrum is covered with one small nudge of the receiver dial on the higher bands. In any event, the most important thing to remember is to take it s-l-o-w-l-y . . .

Current Station Reports

The following is a resumé of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 333, Cherry Hill, N.J., 08034, in time to reach your Short-Wave Editor by the eighth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver.

Algeria—*R. Algiers* now broadcasts a program in French on 11,835 kc. weekdays at 0130-0400, 0600-0930, and 1200-1800, with news bulletins at 0230, 1430, and 1745. The Arabic service is transmitted on 9510 kc.

Andorra—*Andorra Number 1 - Radio Des Vallees* is now relaying programs of *R. Monte*

DX STATES AWARD RULES

Are you eligible to apply for a 20, 30, 40, or 50 States Verified Award? Here is a brief resume of the rules and regulations.

(1) You must be a registered WPE Short-Wave Monitor and show your call on your application.

(2) You must submit a list of stations (any frequency or service) for which you have received verifications, one for each state heard. You must also supply the following information in tabular form: (a) state heard; (b) call-sign or name of station heard and location; (c) frequency; (d) date the station was heard; (e) date of verification; (f) whether broadcast was a normal transmission for the class of station received, or a test. All of the above information should be copied from the station's verification. Do not list any verifications you cannot supply for authentication on demand. Do not send any verifications at this time. Should any verifications need to be sent in for checking, we will notify you and give you instructions on how to send them.

(3) A fee of 50 cents (U.S. coin) must accompany the application to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible. Applicants in countries other than the U.S. may send the equivalent of 60 cents (U.S.) in coins of their own country if they wish. Please do not send International Reply Coupons (IRC's) when applying for an award.

(4) Apply for the highest DX award for which you are eligible. If, at a later date, you are eligible for a higher award, then apply for that award.

(5) Send your application, verification list, and fee to: Hank Bennett, Short-Wave Editor, P. O. Box 333, Cherry Hill, N. J. 08034. Do not include an application for a Short-Wave Monitor Certificate (you are not eligible for any of the awards until you have a Short-Wave Monitor Certificate in your possession). Reports, news items, or questions should be mailed in a separate envelope.

Carlo. Monaco, in addition to its own programming on weekdays at 0530-0600, 1100-1230, and from 1600, and on Sundays at 0205-0300, 1200-1235, and from 1630 on 818 kc. There is still no mention of the inactive outlet on 6305 kc.

Australia—Keith Glover of *R. Australia* reports that there are no FM stations in that country at the present time nor are there plans for any. *R. Australia* will celebrate its 25th anniversary on December 20; a special verification card has been printed and is being issued to confirm reception of the station until December 31.

Austria—Here are some frequency changes from Vienna. The 0600-0900 xmsn is now on 17,795 kc. The 1200-1500 xmsn on Mondays, Saturdays, and Sundays is on 11,840 kc., replacing 11,785 kc. The 0000-0200 xmsn to India has been moved to 17,805 kc. The 1000-1300 xmsn on Mondays, Wednesdays, and Fridays for S. Africa is now on 17,880 kc. A German language course is given on 9525 kc. at 1930.

Bechuanaland—According to previous reports, ZNB, Mafeking, 5900 kc., left the air on September 30, 1963. However, a new list of active stations includes ZNB, 5900 kc., 1 kw., at 0600-0700 and 1200-1430 (Sundays at 1300-1430), and ZND, Lobatsi, 3356 kc., 1 kw., at 1030-1140 Monday to Friday in Tswana. This country reportedly will have a 10-kw. station in service before the end of the year.

Bolivia—Station CP81, *R. Pio XII*, Llallagua, has moved down to 5958 kc. where it has been noted around 0445 with anmts in Spanish, many commercials, and music.

The long-inactive CP5, *R. Illimani*, La Paz, 5878 kc., has been noted prior to 2245 with a Spanish xmsn supplied by *Deutsche Welle*. The current s/off time on weekdays is 2300.

Another seasonal station is CP9, *R. Amauta*, La Paz, 6257 kc., strong at times with world news headlines in Spanish at 1945-2015 followed by usual Latin American programming and commercials until about 2300.

Bonaire—Station PJB, *Trans World Radio*, 800 kc., at time of writing, is still testing evenings and inviting reports. This station operates with 525,000 watts and is easily heard, at least in eastern areas. The first QSL that we've seen came in letter form (". . . our cards will be available soon . . .") signed by William P. Mial, station manager. The on-the-air address is *Trans World Radio*, Bonaire, Netherlands Antilles.

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	QRM—Station interference
c.w.—Morse code	QSL—Verification
Eng.—English	R.—Radio
ID—Identification	s/off—Sign-off
IS—Interval signal	s/on—Sign-on
kc.—Kilocycles	xmsn—Transmission
kw.—Kilowatts	xmtr—Transmitter
N.A.—North America	

Brazil—Sao Paulo broadcasts a "live" morning concert with anmts in Eng., Portuguese, and German on Sundays at 0700-0915 over *R. Difusora de Sao Paulo*, *R. Tupi*, and *R. Cultura* on 17,815, 15,155, 11,765, 9745, and 6095 kc.

Radio Globo, ZYZ36, Rio de Janeiro, 11,805 kc., is strong around 1900 to past 2230 with Brazilian and N.A. music; newscasts in Portuguese are given at 2000 and 2100. This station may even override *R. Sweden* at 2215 to N.A.

Other stations reported include ZYB22, *R. Rio Mar*, Manaus, 9690 kc., with pop music at 1230, and ZYV71, Governador, 2390 kc., to 2000 s/off on a Sunday.

Chile—Station CE604, listed as *R. Libertad*, is now ID'ing as *R. Presidente Balmaceda* and has apparently moved from 5975 to 6040 kc., where the s/off varies from 0005 to 0100, in dual to 9600 kc.

Colombia—Station HJFQ, *La Voz del Pueblo*, Pereira, has been logged on 5995 kc. with local news at 1955.

Congo (East)—The French Network from Leopoldville on 9658 kc. has news in French at 0030-0045 and French music to past 0100. The 9624-kc. outlet has native-language network programs at the same time.

Dominican Republic—Station HIBB, *La Voz del Papayayo*, La Romana, 5030 kc., is noted irregularly around 1630 with news and music.

R. Santo Domingo's short-wave outlets are now listed as HI3SD, 3215 kc., and HI4SD, 5960 kc., both rated at 7500 watts and both in Santo Domingo, and HI3W, 3285 kc., 1 kw., Santiago. Cultural programs are listed for 3325 and 860 kc., with s/off at 2200.

Ecuador—Possibly new stations are HCWN1, *La Voz Del Triunfo*, Santo Domingo de los Colorados, 3835 kc., noted around 2100 with

SHORT-WAVE CONTRIBUTORS

Jonathan Hoyt *(WPE1DRV)*, Clinton, Conn.
Nick Oliviero *(WPE1FMD)*, New Britain, Conn.
Bill Smith *(WPE1FZ)*, Uxbridge, Mass.
Irwin Belofsky *(WPE2BYZ)*, Brooklyn, N. Y.
Kenneth Gerston *(WPE2DSG)*, Brooklyn, N. Y.
Leo Fleury *(WPE2KUR)*, New York, N. Y.
Perry Brainin *(WPE2KVK)*, Bronx, N. Y.
William Graham *(WPE2LMU)*, Binghamton, N. Y.
Ken Cayne *(WPE2LSI)*, Long Beach, N. Y.
Robert Osowicki *(WPE2LVD)*, Amsterdam, N. Y.
Saul Ash *(WPE2MDT)*, Far Rockaway, N. Y.
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pop music and frequent ID's, and HCJT1, *R. Tulcan*, 3680 kc., heard with Ecuadorian music, ID and a time check at 2135.

Egypt—Cairo has been noted on a previously unreported frequency of 9520 kc. at 1645-1655 with Eng. news and pop music.

Grand Turk Island—Station VSI8, 4560 kc., has Eng. news from 1330 to 1340, with a tone signal at the start and end of the xmsn. Does anyone have additional information on this station?

Indonesia—*R. Republik Indonesia* currently operates on the following frequencies: Djakarta on 6045, 7165, 7220, 7270, 9585, 11,785, 11,770, 11.795 15.150, 17.810, and 17,860 kc.; Bandung on 4945 kc.; Jogjakarta on 5047.5, 7105, and 7255 kc.; Surakarta on 4875 kc.; Semarang on 7210 kc.; Surabaja on 6120 kc.; Medan on 7440 kc.; Pakanbaru on 5955 kc.; and Padang on 6195 kc. There are also unidentified stations on 4940 and 7190 kc.

Iran—*R. Teheran*, after working on 15,125 and 15,135 kc., is now down to 15,095 kc. It was noted at 1425 with Eastern music, at 1430-1455 with dance records (Eng.), in French to 1526, Eng. to 1558, and native language to 1657 s/off.

Japan—Station JOZ, 3925 kc., and JOZ4, 3945 kc., were both noted at 0535-0600 with light and classical music and Japanese lessons.

Lebanon—In addition to the schedule listed last month, Beirut also has omnidirectional xmsns at 2330-0230 and 1115-1330 on 5980 kc. and at 0430-1100 on 9545 kc. English to N.A. continues at 2130-2200 on 9625 kc.

Luxembourg—*R. Luxembourg* hopes to extend its Eng. service if a suitable frequency can be found. The present short-wave schedule is 1300-2000 on 6090 kc. The long-wave xmtr (frequency not specified but presumably 233 kc.—*Ed.*) is to be increased in power to 1,250,000 watts!

Mali—*Radiodiffusion Malienne*, Bamako, has moved up to 4780 kc. and is heard at good level from 0100 s/on; there is a newscast in French at 0200-0210, dual to 4835 and 9745 kc.

Mexico—Station XEXQ, *R. Universidad Potosina*, San Luis Potosi, is a newly reported station on 6045 kc. It has been noted with classical and operatic music and anmts in Spanish from 0000 to 0120 s/off.

Netherlands—*R. Nederland* now broadcasts to Australia and New Zealand at 0200 on 9525 and 9715 kc. A language xmsn is noted on 21,665 kc. from 1355 with a Dutch newscast. *R. Nederland* does *not* relay the 2300 xmsn to N.A. via Bonaire as some people have thought.

New Guinea—A new station is VL8BK (or VL8VK), Karema, 3245 kc. This is reportedly low-powered and may be rough to log. It is said to carry *R. Australia's* news bulletin at 0300 and 0400. The schedule is 2130-0600, with Eng. during the last half hour.

Peru—A new outlet is *R. Huamanga*, Huamanga, 6123 kc. It has been heard from 2245 to 2350 closing with Latin American pop tunes and frequent ID's. Other loggings: OAX8F, *R. Loreto*, Iquitos, up to 9500 kc., at 2015 with pop music; *R. Nacional*, 9550 kc., around 0630 at good level; and *R. Atlantida* on 5180 kc., noted at 2033-2115 with Spanish vocals and talks. There is also an outlet on 9560 kc. that sometimes operates dual to 9550 kc.

Portugal—Lisbon is heard over CSA24, Lisbon, on 9670 kc. at 1705 with news in Portuguese, at 1718 with piano music, and at 1725 with an ID; then Portuguese to later than 1730.

Portuguese Guinea—*Emissora da Guine*, Bissau, was logged on 5041 kc. at 1824-1830 with Eng. and Portuguese pop tunes.

Rwanda—According to *R. Australia*, the *Deutsche Welle* relay station at Kigali will boost its power to 250 kw. in 1965.

Solomon Islands—The 4770-kc. outlet from Honiara will *not* go back into service due to the success of the 3995-kc. unit. The present schedule reads: Monday to Friday at 0230-0610, Saturdays at 0400-0615, Sundays at 0400-0620 on 3995 and 5960 kc.

South Africa—*R. South Africa*, Paradys, is noted on 3285 kc. from 2350 to 0030 fade with dancing lessons, news, weather, and stringed instrumentals.

Sweden—Stockholm carries Eng. on 15,445 kc. at 0945 with news, at 0955 with folk music, at 1000 with a "Mailbag"; after 1015 the station transmits in Swedish.

Tahiti—*R. Tahiti* continues to get good reception in western areas on 6135 kc. with native-language programs to 0000, followed by French. The station IS consists of a flute and drums.

Uganda—A station believed to be *R. Uganda*, Kampala, has been logged on 3340 kc. with Eng. news at 0100-0112 and native music to 0123. Very difficult receiving conditions made a positive ID impossible. This is the only logging of this station reported in many months. East Coast DX'ers might watch for it although it will be accompanied by severe QRM from c.w. and teletype stations on the same frequency.

U.S.A.—Since January, 1964, WWV and WWVH have been broadcasting geophysical alerts at seven words per minute (c.w.) on

Beacon Stations

This is the conclusion of the list of beacon stations that was started in the August issue. With careful tuning and patience, you may be able to log a number of these stations. For the most part, they are low-powered and do not operate continuously. They identify in slow-speed Morse code by call-sign. Located in Central and South America, the stations are listed by frequency in kilocycles.

1500	JUI, Juanjuri, Peru
1608	VSA, Villahermosa, Mexico, 1200 watts
1613	RAB, Rabinal, Guatemala, 1200 watts
1615	BOB, Bobures, Venezuela, 300 watts
	MIL, Quincemil, Peru
1618	TUL, Tulancingo, Mexico, 1200 watts
1620	IZT, Ixtepec, Mexico, 1200 watts
	LAV, Tumeremo, Venezuela, 50 watts
	NLD, Nuevo Laredo, Mexico, 50 watts
	URM, Uriman, Venezuela, 50 watts
1625	CZM, Cozumel, Mexico, 1200 watts
	MZT, Mazatlan, Mexico, 1200 watts
1638	CME, Carmen, Mexico, 1200 watts
	MTT, Minatitlan, Mexico, 1200 watts
	ZCO, Cuzco, Peru, 450 watts
1648	OAX, Oaxaca, Mexico, 1200 watts
	TIJ, Tijuana, Mexico, 1200 watts
1658	CPE, Campeche, Mexico, 50 watts
1662	PZA, Puerto Cabezas, Nicaragua
1668	GDL, Guadalajara, Mexico, 1200 watts
	HMO, Hermosillo, Mexico, 1200 watts
	MID, Merida, Mexico, 1200 watts
1675	TOR, Tournavista, Peru, 1000 watts
1688	PPE, Punta Penasco, Mexico, 1200 watts
	PVR, Puerto Vallarta, Mexico, 1200 watts
1698	REX, Reynosa, Mexico, 50 watts
	SDM, Santo Domingo, Mexico
	TGZ, Tuxtle Gutierrez, Mexico, 1000 watts
1704	TGU, Tegucigalpa, Honduras, 150 watts
1708	MXL, Mexicali, Mexico, 1000 watts
	TAM, Tampico, Mexico, 1200 watts
	TAP, Tapachula, Mexico, 1200 watts
1718.5	MZL Manzanillo, Mexico, 1000 watts
1740	PO, Popton, Guatemala, 50 watts

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WPE9CXR	WPE9GGY	WPEØCXW
		WPEØCYD

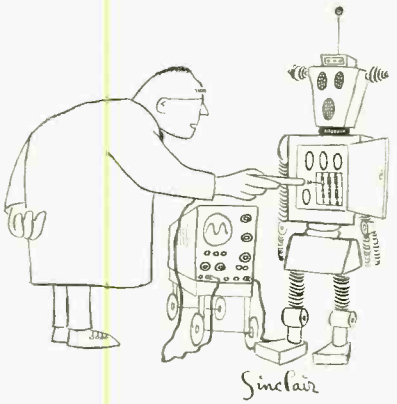
the 19th minute past each hour. The alerts read in this manner: "GEO M" (magnetic storm); "GEO N" (magnetic quiet); "GEO C" (cosmic rays); "GEO S" (solar activity); "GEO Q" (solar quiet); and "GEO E" (no alert issued).

U.S.S.R.—Moscow is using a new ID *(Radiostantsi Atlantica)* in its xmsns to Russians overseas as noted on its 0730-1100 xmsn on 15,150 kc. A registered letter from Yerevan states that there will be a xmsn to N.A. at 1430-1530 on 11,690, 11,755, 9540, and 9725 kc.

Venezuela—Station YVCN, *Escuelas Radiofonicas,* San Fernando, has been testing on 2430 kc. with s/off at 2130. They say they will begin regular xmsns "soon."

A rarely heard station is YVMO, *Radiodifusora Occidental,* Barquisimeto, 4940 kc., due largely to severe teletype QRM. It has been noted from 2000 to 2130 s/off with musical programs and frequent time checks and ID's.

Clandestine—*Radio Peyk-e Iran* has been heard on 11,696 kc. in Azerbaijani and Persian at 1200-1255. Meanwhile, the *Kiss Me Honey* station, on the same frequency, has been heard at 0835-0945 and 1235-1345 (and to 1447 while typing this column—*Ed.*) with fair to strong signals. *R. Sweden* says this station is not located on Formosa but somewhere in the Near East. It is on the air to jam the communist *Radio Peyk-e Iran* listed above. —30—



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CIRCLE NO. 28 ON READER SERVICE PAGE

NOW from KLH . . .

The Model Seventeen

If you know what it takes to build a fine speaker system, you will truly appreciate KLH's new Model Seventeen. Here is a speaker that delivers a quality of performance we believed unattainable at a price we considered impossible just a few years ago. At $69.95*, the Seventeen brings together all of the know-how, all of the advances in speaker design which KLH has pioneered in the past several years.

Model Seventeen is an 8 ohm, full-range, two-way, acoustic suspension loudspeaker system. It has a 1¾" direct radiator tweeter with elastomeric suspension and a 10", long-excursion woofer. The enclosure is handsome oiled walnut — 11¾"W x 23¾"H x 8¼"D. The Seventeen is field serviceable. The grille cloth can be changed in a snap. The LCR crossover network is designed as an integral part of the system and permits an increase or decrease of 2.5 db in the high frequency level without acoustical 'shelving'. The Seventeen has, by far, the lowest harmonic distortion in the bass of any speaker in its price range.

But no description of the Seventeen, no matter how detailed, can tell you how it sounds. You've got to hear it. Only then will you be able to understand what an unusual achievement the Seventeen is, in high performance at low cost. The Seventeen is at your dealer's now. Listen to it. We think you'll agree it's the breakthrough speaker of the year.

**Suggested retail; slightly higher on the west coast.*

KLH RESEARCH AND DEVELOPMENT CORPORATION
30 CROSS STREET, CAMBRIDGE 39, MASSACHUSETTS

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