The Full Story on Electronic Organs for Home Use

ELECTRONICS ILLUSTRATED

By the Publishers of MECHANIX ILLUSTRATED

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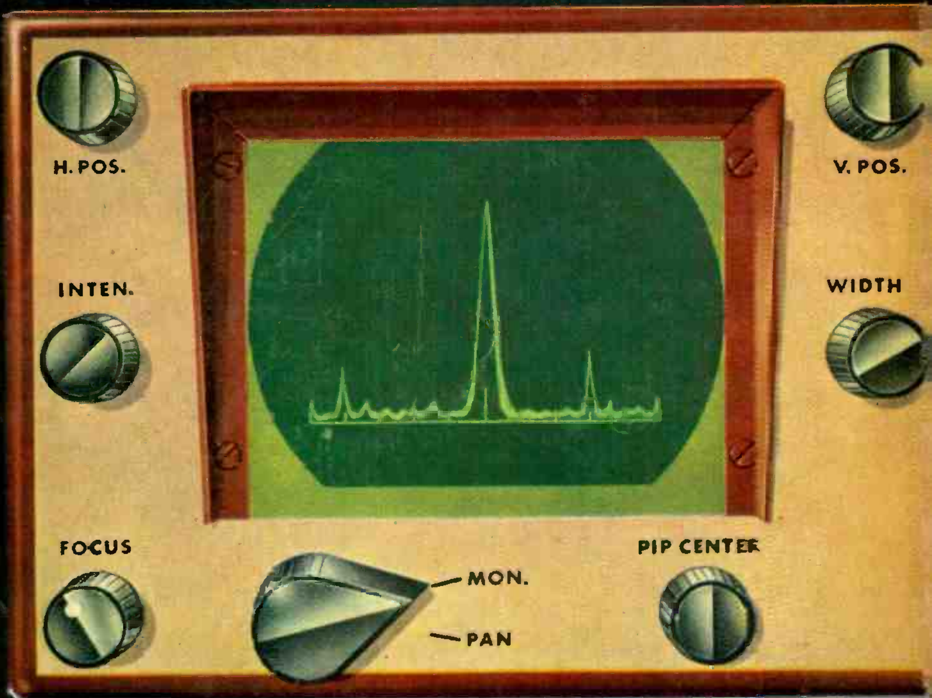
CB SPECIAL



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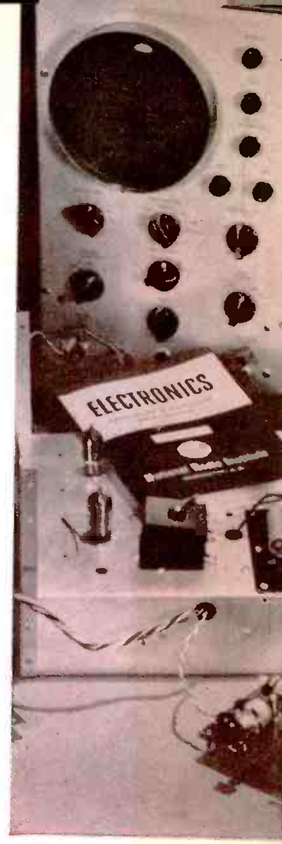

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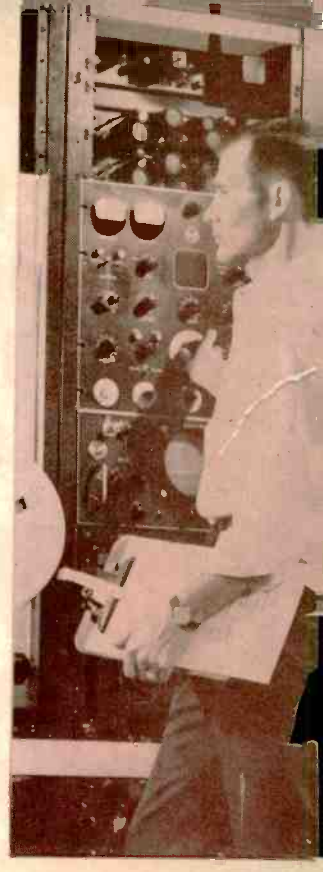

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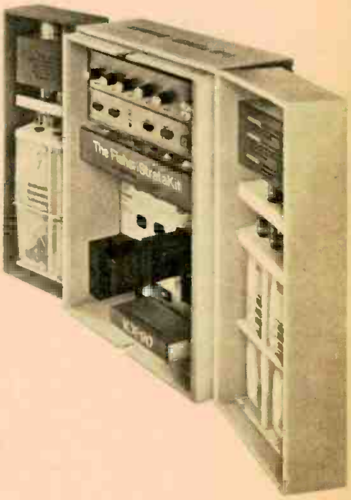

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ELECTRONICS ILLUSTRATED

MAY, 1965 A Fawcett Publication Vol. 8, No. 3

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from our readers

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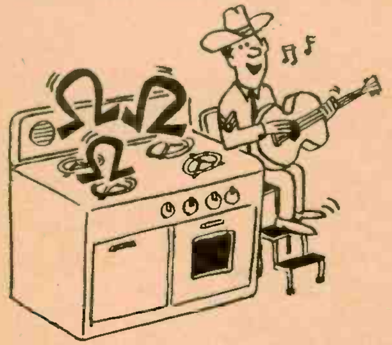
● SONG SEARCHER



The writer, while going through radio school—via the Army Air Force Schools, etc. —recalls a song that was, at that time (1942), quite appropriate and good. It was written (not really, but conceived) by a student at Sioux Falls, S.D., and was to the tune of Home On The Range. The only part the writer recalls is the following:

Where never is heard a discouraging word,
And we're radio students all day.
Chorus:
Ohm, Ohm on the range—
Where the amps and inductances play,
Where never you meet with an audio beat
And we're radio students all day.

Would like to have the complete song. It was good and should have been popular, but have not been able to recall the balance of it, which included several verses. Can you help?

Paul R. Doane
408 E. Home Ave.
Lansing, Mich.

Afraid not, Paul. Can anyone else give him a hand?

● REALIST

I am a subscriber to your rag, Electronics Ill. I am an experimenter in Electronics, no expert in anything. But. So what if they ain't no Santa Claus or easter Bunny. People all ready know that mechanical & electrical don't live up to real sound. Tearing your living room apart (HI-FI TODAY, Mar. '65 EI) ain't gonna make it any realer. That is why some pf the people in our town (St. Joe, Mo.) set on wet grass in the park and swat mosquttos to hear a live orchestra.

W.F.G.
St. Joe, Mo.

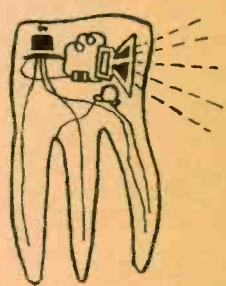
● MOONSHINE BEAM

I've heard of heavy water but never heavy light. How do you explain the droop in the position of that talking light beam (TALK ON A LIGHT BEAM, Mar. '65 EI)?

Gerald Lamont
Montreal, Que.

Better drooped than dropped, G.L.

● MUSICAL MOLARS



My dentist plays music when he works on your teeth. He says it relaxes you. Well it don't relax me none. But after I leave his office and then when I go home I can still here the music. I never told nobody about this until I read that story in Feedback. It was from the man who heard about people listening to the radio on their teeth (FEEDBACK, Jan. '65 EI). You said there could be something to this.

George W.
Tampa, Fla.

What's he put in your teeth, George? You sound relaxed to us.

[*Continued on page* 8]

FEEDBACK

Continued from page 6

● HOLLYWOODONIA

The movies I've seen lately show those bachelor pads that are like way out. You know, Jack Lemmon walks into his apartment and pushes a button. Whammo! The lights dim, the stereo comes on, the blinds close, the ice cubes drop and the bed rolls out. Man, what a way to live. How's a guy go about turning his apartment into one of these electronic bachelor heavens?

Jackson Begg
New York, N.Y.

Ask Lemmon.

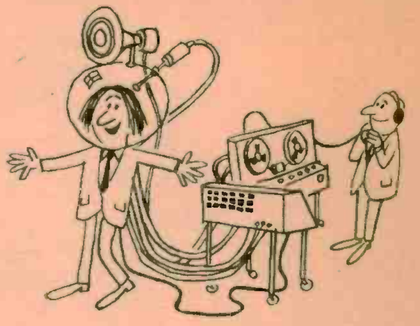
● POINTED

What's the best way to listen to stereo?

Paul C. Caspen
Jacksonville, Fla.

Try your ears.

● MARTIAN MINSTRELS



Your article about the singers that electronics helps sing (GURGLE, CHUCKLE, OINK YEAH! YEAH! YEAH!, Mar. '65 EI) was great. Those jet setters sure had me snowed. Now everytime I hear one of that crowd I can't help but wonder what the recording session looked like. I'll bet half those rock and rollers record with their heads in a space helmet hooked up to some kind of complicated voice-making machine.

John Mills
Harrisburg, Pa.

All's fair in love, war and records, John.

[*Continued on page* 10]

FEEDBACK

Continued from page 8

● KIT QUERY

After I purchase a kit and build it, it doesn't work very well and then I hear through the grapevine that the kit has been modified but the company doesn't tell me. Don't you think they ought to notify us first-run buyers about modifications? We'd be willing to pay.

L.S.
Brooklyn, N. Y.

Most kit manufacturers don't follow up in any way after a kit is sold, though one (at least) will mail you any required modifications free if you hear about it and ask them.

● POWERHOUSE

I would appreciate receiving data pertinent to "free energy" apparatus. Perhaps the term "free energy" is fictitious, though that there exists all about us a total force may ever more become less than supposition.

Alan Y. Wilcox
Fort Lauderdale, Fla.

Let us hear from you sometime, Al.

● HANDOUT

Hoot mon! For years I have pooled my penchant for electronics and purse by salvaging torch batteries, tin cans, radio valves and sundry from neighborhood trash containers. The Scots in me makes me reluctant to do away with my collection but I am at a loss as to what to do with it. Could you tell me?

Mac of Edinburgh

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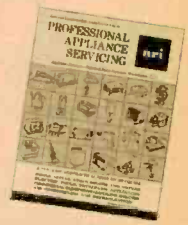

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No matter where you live, everyone owns and *depends on* appliances. And once you know how to service them, the owners depend on YOU!

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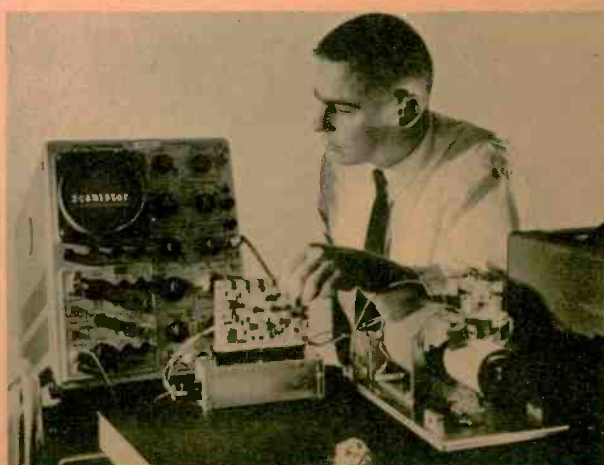
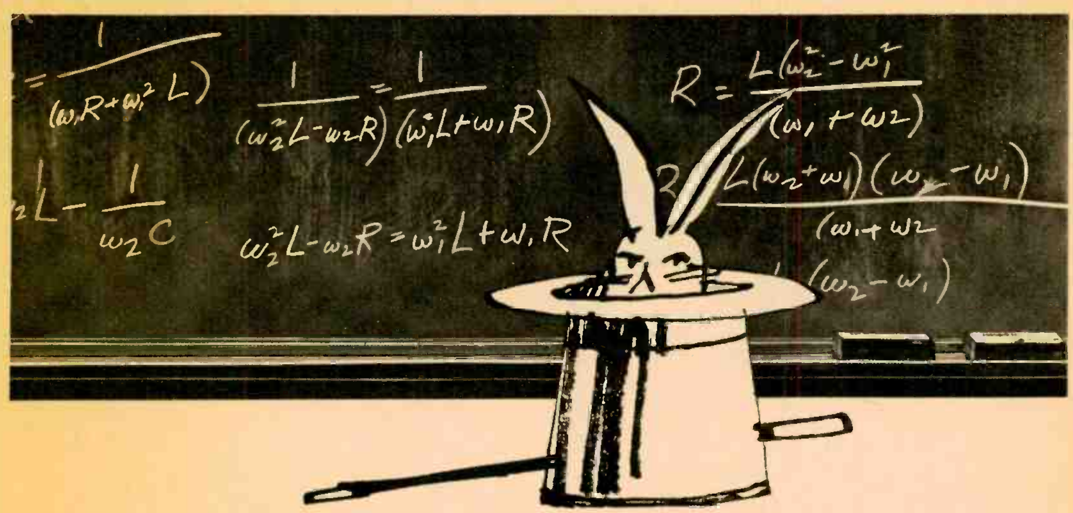
POWER MITE . . . Though this strange-looking gadget could be anything from a glorified heat-sink to a miniature fire hydrant, appearances often are deceiving. In reality, this weirdie is just the kind of gear you'd want to have around if you ever got messed up with an interplanetary power failure. RCA, the manufacturer, calls it a thermionic energy converter and explains that the device can convert nuclear heat directly into electricity. It contains no moving mechanical parts and well may open the way to systems producing hundreds of kilowatts of electricity for spaceship propulsion. Martians, here we come!

...electronics in the news

Bean Jar . . . Time was when the sport was guessing the number of beans in a jar. But nowadays transistors seem to be the rage. Fact is, IBM has reduced the size of transistors to the point where 50,000 will fit inside a thimble. IBM's interest in miniaturization has been stimulated by the size and weight requirements of missile payloads. And with progress like this at hand, it looks as though guessing the number of integrated circuits on a gnat's whisker just might be the next step.

Semicon Scanner . . . A dime-size device called a Scanistor soon may make TV cameras and photocells as old-hat as the 5-cent stogie. Unlike earlier solid-state light-sensitive devices, the Scanistor responds both to the amount and the position of light falling on its surface. Though the unit still is in the experimental stage, it reportedly offers both high resolution and fast response. Add these important features to the usual extras of solid-staters—low power consumption, small size and weight, long life and simple circuitry—and it clearly is evident that the Scanistor may mark a major breakthrough. Our photo shows IBM technician Robert J. Lynch, co-inventor of the Scanistor, demonstrating the unit in an experimental hookup.



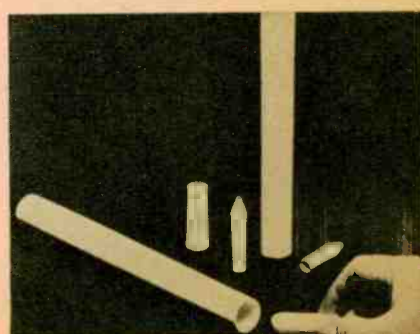



ELECTRONICS

...electronics in the news

Moonlighter . . . It's an odd sort of drill that can double as a transmitter but that's exactly where Raytheon's LE-1 laser stands. Designed especially for repetitive operations on the production line, the LE-1 can drill holes smaller than .0002 in. A microscope is used to aim the beam on the work (arrow). And, when it decides to be a transmitter, the LE-1 is a natural for most optical radar systems.

Like Warm, Man . . . The it-isn't-the-heat-it's-the-humidity line loses its punch when 2,000-degree-plus temperatures are involved. With that kind of scorchery, no one's going to worry about humidity, as engineers at Bell Telephone Labs will be quick to tell you. The problem that the Bell men had to crack was how to make crucibles that could withstand the 2,000° heat for solution-growing quartz crystals. Answer was a product called pyrolytic boron nitride which Union Carbide feels is the perfect no-sweat candidate.



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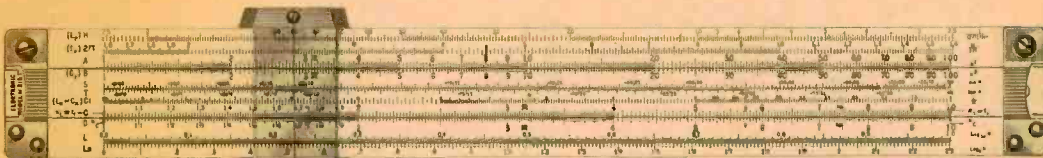
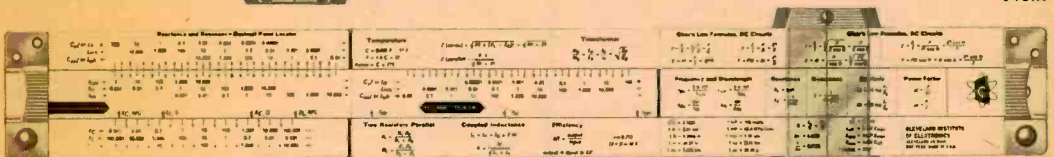


Front



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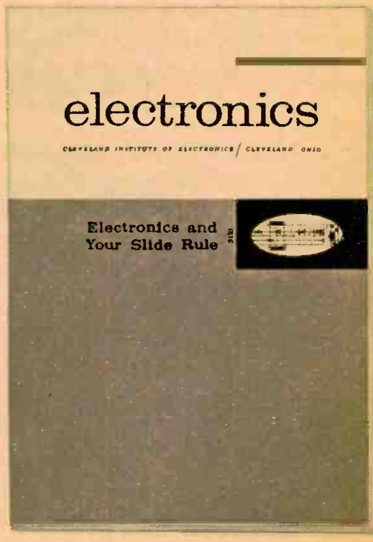

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Anyone who wants to learn more about **thermistors** and their uses should get ahold of Capsule Thermistor Course #9. Copies are available from Fenwal Electronics, Inc., 63 Fountain St., Framingham, Mass. 01701.

Knowing as much as you can about **magnetic tape** is about the only way to select the exact tape you need. Bulletin RS-64-18 describes over twenty of tape's electromagnetic and physical properties in some six pages. Request your copy from Reeves Soundcraft, Great Pasture Rd., Danbury, Conn. 06810.

Bulletin GEA-7678 gives electrical ratings and physical dimensions for seven different types of **nickel-cadmium batteries.** Ask for your copy from General Electric Co., 1 River Rd., Schenectady, N.Y. 12305.

Finding replacements for worn-out **tape heads** is easy with Robins H-764 guide book. It contains specifications and instructions for some 32 heads. The booklet is available for 35¢ from Robins Industries Corp., 15-58 127th St., Flushing, N.Y. 11356.

The National Aeronautics and Space Administration thinks it knows how to prevent cold **solder joints** and it presents its tips in document NPC 200-4. The bulletin costs 45¢ and can be obtained from the Supt. of Documents, U.S. Printing Office, Washington, D.C. 20402.

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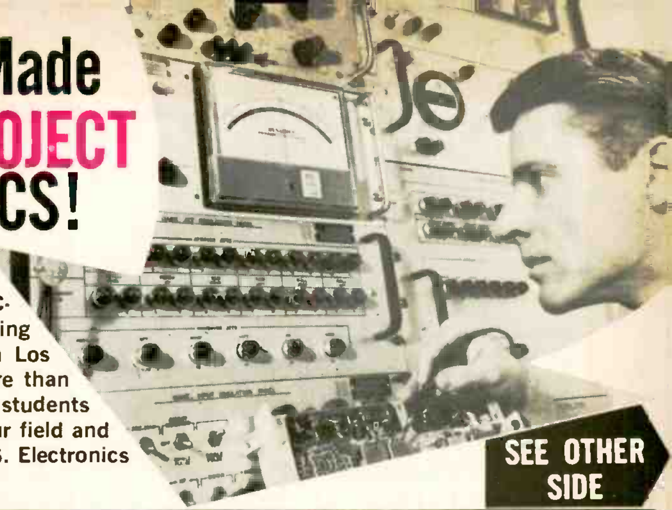

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ELECTRONIC MARKETPLACE

RANGE GETTER . . . The Lafayette HA-115 compressor/amplifier boosts the voice signal of your CB rig and simultaneously clips the peaks that ordinarily

would overmodulate. Result is a signal with more sock and greater intelligence-carrying ability. The unit is equipped for 6VDC, 12VDC or 117VAC operation. $25.95. Lafayette Radio Corp., 111 Jericho Tpke., Syosset, N.Y. 11074.

Mighty Mini . . . Just the thing for frequent mobile/fixed conversions, the CB-10 transceiver rests on an optional, pedestal-type

AC power supply when it's not mounted in a car. The 5½-lb. solid-stater measures only 2⅝ x 6 x 9½ in. $149.95. Hallicrafters Co., Fifth and Koster Aves., Chicago, Ill. 60624.

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MARKETPLACE

Tuneful . . . Point-to-point wiring and three easy-to-use controls help make the AJ-13 stereo-FM tuner kit a good bet for most newcomers to hi-fi. Multifunction tubes provide

the equivalent of 12-tube performance, and an edge-lighted, flywheel-weighted, slide-rule dial makes for easy tuning. Other features include switchable AFC and an indicator which lights when the tuner is receiving a stereo broadcast. According to the manufacturer, response is from 30 to 20,000 cps in mono and 50 to 15,000 cps in stereo. $49.95. Heath Co., Benton Harbor, Mich. 49022.

Ready Rig . . . Novices have it made with the TX-62, inasmuch as the rig is a complete 2- and 6-meter, 75-watt phone and CW transmitter. A triple-purpose meter mounted on the front panel reads final cathode or plate currents, as well as RF output, to let you

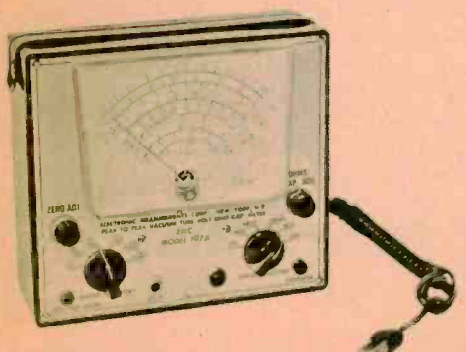
know exactly what's going on. And though there's also a crystal socket on the front panel, you can fire up an external VFO should you wish. The rig has a built-in, solid-state power supply and is TVI suppressed. $149.95. Ameco Equipment Corp., 178 Herricks Rd., Mineola, N.Y. 11501.

MARKETPLACE

Private Number . . . Fully transistorized, Cadre's 524 selective-call accessory offers 24 tone combinations to get you off the CB party line. The unit attaches to any 12V CB rig

and insures that only stations similarly equipped will respond to your call or be able to call you. A compact 8 x 5 x 3 in., the 524 employs a resonant-reed relay and steals its modest power requirements from the CB rig it's used with. About $70. Cadre Industries Corp., Endicott, N.Y. 13760.

Goof Proof . . . Even if you make the mistake of having the probe in the right place at the wrong time, you won't burn out the 107A VTVM. Reason is that a fused meter move-



ment covers up such embarrassing slips. Functions of this circuit analyzer include measurement of AC or DC voltages up to 1,000 volts, decibels to +55db, resistances to 1,000 megohms and capacitances to 5,000 μf. Optional accessories include an RF probe. $36.50, kit; $51.40, factory-wired. Electronic Measurements Corp., 625 Broadway, New York, N.Y. 10012.

EI AT LARGE

Reading the Mail

EDITORS come in all sizes and guises but there's one thing they seem to have in common—a special file labeled *Odd Letters* or *Strange Stories* or *Funny File.* (There also may be one called *Nut Letters,* but that's a different kind of heading.) Into the *Odd Letters* file go the funny or riling or touching cards and letters and press releases that are left over when all the rest of the day's mail has been waded through.

The collector of these strange bits of postal fallout usually plans some day to make a book out of his assortment—and never does. But every so often he stumbles on the file and, while he should be busy doing something else, he sits down and reads through half the folder before he can stop himself.

Our file of oddments is confined pretty much to releases and other commercial-type duds. Offbeat letters from what Damon Runyon called citizens have a way of being not half so funny the second time around.

At the front of our never-to-be-a-book file is a small classic from a public relations operative. "I goofed!" it starts out. "I sent the enclosed release last week without the photo. Was my boss mad! Please publish as soon as possible to get me off the hook." It could be just a clever line, but we doubt that it is. The poor guy probably was telling the truth.

Here's one now that really stopped us. "Stop!" it says. We did.

From Chicago way we once got a missive that has this heading: "Note to Editor—Please Kill This Release." That one, to be sure, did get read.

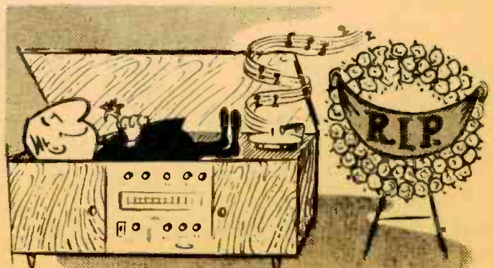
Sandwiched between a couple of less remarkable pieces is one that has an ax to grind, but does it with style. To show how the component type of hi-fi equipment is superior to the big, one-unit console jobs, this blast neither criticizes directly nor boasts openly. Instead, it tells what—besides reproducing sound—you can do with a big wooden-cabineted console. In this case it advises:

Enjoy your stereo often,
Then use it for a coffin.

The trend toward publications that are more and more specialized once led us to keep an announcement of what we thought was the ultimate in specialization. The publication in point was something called The Laser Letter, a new monthly newsletter devoted entirely to developments directly connected with the laser. But, just as *very* high frequencies gave way to *ultra* high and, eventually, to *super* high frequencies, our most-specialized category got wrecked by a press release announcing no less than a Newsletter on Newsletters. You can read a copy of it to find out who is publishing newsletters and on what subjects.

A special nook is reserved for world-shaking announcements, such as this one from a plant at Saltville, Va., that says the price of bicarbonate of soda has gone up to $2.80 for a 100-pound bag. Too bad we didn't buy when the price was only $2.55. Now we can't afford to prepare properly for that coast-to-coast tour of wayside eating establishments.

At the back of our *Odd* file is a disturbing bit of news. It just might push us right out of the word business and into brain surgery or perhaps professional soccer, for the announcement tells about a computer that will, when finally put together, be able to produce books and magazine articles and maybe even press releases. There is one bright side to this announcement, though. It doesn't claim the computer would be up to collecting tidbits for an *Odd Letters* file.—*R.G.B.*



ELECTRONIC SWAP SHOP

EI's Swap Shop provides a way for readers to obtain equipment they want in exchange for items they no longer have use for. Notices must be from individuals, not commercial concerns. Entries must include your name and address as well as a description of what you now have and what you would like in exchange. Address: EI's Swap Shop, ELECTRONICS ILLUSTRATED, 67 West 44th Street, New York, New York 10036

HEATH OM-1 oscilloscope and EICO VTVM. Want SW receiver. Kenneth Westbrook, Box 788, Clinton, Miss. 39056.

ZENITH receiver, 540 kc to 18 mc. Want CW/AM/SSB receiver. Douglas Greenway Jr., Box 192, Linden, Tenn. 37096.

EICO 400 5-In. oscilloscope. Will swap for 20-watt stereo amplifier. Wiley F. Wood, Rte. 5, Box 187A, Elizabeth City, N.C. 27909.

COMPLETE HAM station. Will trade for walkie-talkies or tape recorder. D. Henderson, Box 1352, Sun Valley, Idaho. 83353.

HEATHKIT DX-20 transmitter, other items. Want mobile ham gear. Philip Lupi, 1225 Hillside Place, N. Bergen, N.J. 07047.

ACCURATE INSTRUMENTS 156 genometer, other items. Will swap for transceiver. Stephen Clifton, 800 W. End Ave., New York, N. Y. 10025.

LAFAYETTE TE-44 capacitor checker. Will trade for EICO or Knight AF/RF signal generator. R. Baxter, 30 Overbrook Dr., Wellesley, Mass. 02181.

PHILCO 7170 AM/FM generator, other items. Need guitar, music amplifier, etc. E. F. Duggan, 24 Highview Terr., Dover, N.J. 07801.

SCOTT-GALVIN RDO UHF-VHF receiver, 40 to 1000 mc. Want 540kc-30 mc communications receiver. Stephen Druzak, Rte. 2, Box 2353, Wenatchee, Wash. 98801.

AMERICAN SCIENTIFIC DEVELOPMENT TV-20 television tube tester. Make swap offer. Stephen Edgell, 4820 W. 132 St., Hawthorne, Calif. 90250.

BC-683 RECEIVER with 12-volt Dynamotor. Will trade for Heath DX-60 transmitter or equivalent. Frankie Melvin, Box 7, Clarkton, N.C. 28433.

HALLICRAFTERS SX-28 and converted BC-348 receiver. Will swap for Hallicrafters SX-100 or National HRO-50. Paul Meredith, 1851 Welland Dr., Clearwater, Fla. 33515.

SYNCHRONOUS GEAR MOTORS, 1,600:1 gear reduction. Want AM/FM and stereo/FM tuner. Roger Zimmerman, 827 E. Johnson St., Madison, Wis. 53703.

WEATHERS turntable with tone arm and cartridge. Will swap for Garrard Type A or A70. Steve Miles, 2901 Oak St., Terre Haute, Ind. 47801.

MOTOROLA 6-meter mobile FM station converted for 12-VDC operation. Want Heath SB-10 side-band adaptor or test equipment. Jim Fox, Lewis Field, Apt. 7, Hays, Kan. 67602.

KNIGHT Ocean Hopper SW receiver. Will trade for long-wave superhet receiver. Roy Moore, 307 Nunn St., Hazard, Ky. 41701.

JOHNSON Messenger CB transceiver. Will swap for Hallicrafters SX-140 receiver. J. Louie Oakley, Box 557, Providence, N.C. 27315.

KNIGHT KG-50 AM/FM stereo tuner. Make swap offer. Lee Kieley, 119½ E. 6th St., Grafton, N. Dak. 58237.

RME preselector for 10-80 meter ham bands. Will trade for a RME DB-22A preselector. Warren Mordgren, 2129 Linden Ave., Waukegan, Ill. 60085.

TAPE DECK, 7½ and 3¾ ips, 3 heads, 3 motors, takes up to 10½-in. reels. Will swap for other audio equipment. M. G. Rousselin, 91 Remsen St., Brooklyn, N.Y. 11201.

LAFAYETTE 90-watt transmitter and 4-band SW receiver. Want test equipment. Victor H. Kinson, Jr., 8214 Rosemead Blvd., Pico Rivera, Calif. 90660.

HARVEY WELLS TDS-50A transmitter, other equipment. Want communications receiver, CB rig, etc. W. Gruber, Suite 211, 894 Eglinton Ave. E., Toronto 17, Ont.

RIDER Perpetual Service Manual. Will trade for transmitter or other VHF/UHF gear. Reid Shipp, 525

[Continued on page 24]

ELECTRONIC SWAP SHOP

Continued from page 23

E. Elm, Prescott, Ark. 71857.

EICO 555 VTVM. Want Heath RF signal generator or Knight-Kit Ten-2 CB tester. John Van Osdale, University School, Northern Illinois University, Dekalb, Ill. 60115.

HALLICRAFTERS SX-99 and S-85 receivers. Will trade for Gonset Communicator. Jeffrey Beals, 470 Lafayette Blvd., Long Beach, N.Y. 11561.

HAMMARLUND HQ-110 receiver and Heath Seneca VHF transmitter. Want general-coverage equipment (80-10 meters). Mike Dahlstrom, 1511 Beaver St., Anchorage, Alaska. 99504.

ELECTRO-VOICE 644 microphone and recorded tapes. Will swap for microphone mixer and recorded tapes. Charles Harris, 209 9th St., San Francisco, Calif.

SENCORE TC-114 tube tested and EICO R/C box. Will trade for Novice transmitter. Edward A. Moore 1002 Fauntleroy, Austin, Tex. 78751.

HALLICRAFTERS S-38C. Will swap for CB walkie-talkies or tape recorder. R. N. Kesselring, 111 Falstaff Rd., Rochester, N.Y. 14609.

BC-454 80-meter receiver. Want similar 40-meter receiver. David T. White, 266 Main St., Irvine, Ky. 40336.

LAFAYETTE 4-watt stereo amplifier kit (unopened). Will trade for two speakers. John A. Corsentina, 6012 Eastern Pkwy., Baltimore, Md. 21206.

CHANNEL MASTER 6545 tape recorder. Want stereo tape deck with preamps. Robert W. Conway, 3411 Cedar St., Austin, Tex.

RCA VIDICONS for TV cameras (three). Will trade for broadcast stereo mixer. Ken Kushnir, 2332 31st Ave., San Francisco, Calif. 94116.

SONY 500A stereo tape recorder, other items. Want button telephone and Triplett modulation meter. Don Taylor, 13903 Village Ave., Healdsburg, Calif. 95448.

IF TRANSFORMERS (three). Will swap for power transistors. Don Winsor, 1610 Swan, Ogden, Utah.

SIMPSON 415 signal generator and B&W 504C frequency multiplier. Looking for 152-174 mc FM receiver. Norman Coltri, Grove Rd., Rte. 1, Vineland, N.J.

C&S single-channel R/C receiver. Want 102-in. bumper-mount whip antenna. M. Mijal, St. Marys, Box 6, Orchard Lake, Mich. 48034.

HEATH GC-1A receiver and Grundig AM/FM/SW portable. Will trade for Regency DR-200 and Ameco converter. Norman Clearmont, 315 Hildreth St., Lowell, Mass. 01850.

ANTIQUE RCA crystal radio. Want dwell tachometer. Frank H. Kunik, 148 Burlington Rd., Riverside, Ill. 60546.

NAVY RBM receivers (two). Want mobile gear. R. J. Bunty, Rte. 2, Zion Rd., Parsonburg, Md. 21849.

HEATH GW-10 CB rig. Will swap for Heath audio wattmeter. H. Wolfe, 121-08 236th St., Rosedale, N.Y.

MOTOROLA 12V AM car radio. Will trade for anything of equal value. Francisco Prats, Jr., 1867 N.W. 38th St., Miami, Fla. 33142.

HEATH-KIT AT-1 and Hallicrafters S-38 receiver. Want 2-meter gear. Pat Long, 8078 Marty Paullin Rd., Franklin, Ohio. 45005.

RF PLASMA TORCH. Will trade for M3 Sniperscope. Edward A. Miller, Jr., 12010 Telegraph, S. Rockwood, Mich. 48179.

MINIVAC 601/6010 computer. Want CB Transceiver. Richard Bandelier, 1626 Wells St., Fort Wayne, Ind. 46808.

KNIGHT T-150A transmitter and R-100A receiver. Will swap for SSB transceiver. Howard H. Kilmetz, K3FPC, 923 McDowell Dr., Town Point, Dover, Del. 19901.

KNIGHT-KIT Star Roamer. Will swap for anything of equal value. Arnold Littman, WN3BOH, 2500 Shady Ave., Pittsburgh, Pa. 15217.

BC-312-D RECEIVER, less power supply. Will trade for Novice transmitter. Jim Elliot, 366 N. 27th St., Camp Hill, Pa. 17011.

TBX 4-BAND transceiver. Will swap for transmitter or tape recorder. Gary L. Wieneke, 881 Adams Park Dr., Covina, Calif. 91722.

EICO HF-20 amplifier and HFT-90 FM tuner. Want Norelco 101 tape recorder. Dave Counter, 1020 Key St., Bellingham, Wash. 98225.

TRUETONE tape recorder, other items. Will swap for VHF receiver or other VHF gear. Clarence L. Smith, Rte. #2, Wayne, W.Va.

HEATH IM-13 VTVM. Will trade for transmitter. Agapito Hernandez, Jr., c/o Josefina Quantana, 1458 Williams Ave., Bronx, N.Y. 10459.

SENCORE tube tester and EICO R/C Box. Want Novice transmitter. Moore, 1002 Fauntleroy, Austin, Tex. 78751.

HI-FI equipment. Will swap for 16-in. transcriptions, acetate discs, wire and tape recordings of 1930-1940 radio programs. R. L. Hawks, 814 N. Main, Wichita, Kan. 67203.

KNIGHT-KIT KG-670 resistor/capacitor tester. Will trade for VOM or VTVM. Gregory Hart, 638 E. Calle Del Arizona, Tucson, Ariz. 85705.

CRESCENT tape recorder. Will trade for AM/FM tuner or aircraft-band receiver. Jack Himelfarb, 158-20 80th St., Howard Beach, N.Y. 11414.

HEATH GW-22 transceiver. Make swap offer. Richard Smith, 46 164th Place, Calumet City, Ill. 60409.

WESTINGHOUSE BCB and SW receiver. Will trade for small transmitter. Jerry Linden, Jr., Rte. 2, Box 141, Cedarburg, Wis. 54621.

TUBES—5881's, 6188/6SU7's. Want National MCN vernier dial or AVD-250 planetary dial drive. Joseph M. Agrella, 1416 N.W. 19th Ave., Fort Lauderdale, Fla. 33311.

HEATH QM-1 Q meter. Want SW receiver. Charles S. Alexander, 1225 N. Fig St., Escondido, Calif., 92025.

KNIGHT-KIT Star Roamer. Will swap for BC-946 receiver. Paul Silver, 222 Freeman Pkwy., Providence, R.I. 02906.

PRECISION 120 VOM. Will trade for Heath IM-13 or IM-11 VTVM. Bill Bunner, Bell Run Rd., Fairmont, W.Va. 26554.

EMPIRE 108 stereo and GE VR II cartridges. Make swap offer. Emmett Byrem, 9-G Hall Manor, Harrisburg, Pa. 17104.

KNIGHT Span Master. Will swap for DX-20. Robert B. Tatar, 2547 Balmoral Ave., Chicago, Ill. 60625.

SIMPSON 270 and 260 VOM's. Will trade for stereo amplifier. P. Management, 251 S. Cicero, Chicago, Ill.

BELSONA mono tape recorder. Want 30-mc or 152-mc FM receiver. Richard Southard, 1896 Rockville Dr., Baldwin, N.Y. 11512.

BC-625 2-meter transmitter and BC-624 receiver. Want all-band ham mobile whip or other ham gear. Robert L. Wood, N. Paxson Dr., Apt. 1, Moses Lake, Wash. 98837.

KNIGHT-KIT Span Master receiver. Make swap offer. Jeff Peuner, 1747 N. Peach St., Philadelphia, Pa. 19131.

ARKAY SQ-9 CB transceiver. Will trade for 6- or 2-meter transceiver. Mark Gromardy, 222 Lenox Rd., Brooklyn, N.Y. 11226.

LINK 5FRX FM transceiver and Knight wide-band oscilloscope. Make swap offer. Dan Turkisher, 6 Pin Oak Lane, White Plains, N.Y. 10606.

PILOT BC and SW receiver, Spartan 3-band receiver and RCA 2-band receiver. Will trade for CB gear. James Loniak, 31-65 29th St., Long Island City, N.Y. 11106.

KNIGHT C-22 transceiver. Want Lafayette HE-30, HE-10 or other general-coverage receiver. John Giauque, Box 122, International Falls, Minn. 56649.

RAY-TEL TWR 2 and stamp collection. Want 6-meter transceiver and other ham gear. R. L. Jones, Box 1633, Amarillo, Tex.

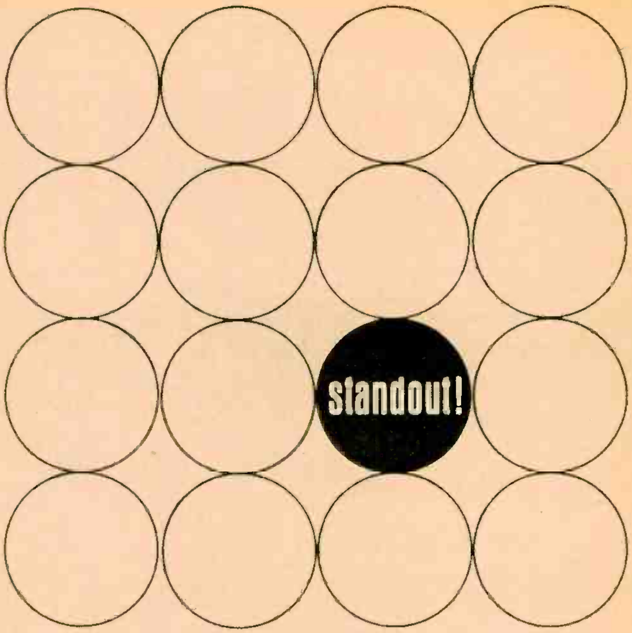
HEATH TS-4 TV alignment generator. Will trade for communications receiver. W. J. Evans, Jr., 16 Mt. Vernon Ave., Irvington, N.J. 07111.

BC-611 walkie-talkie. Will swap for anything of equal value. SP4 Pasquale Lombardi, U.S. 51 496 124, HHC, T/C, Ft. Monmouth, N.J. 07703.

RCA Junior Voltohmyst WV-77E. Will trade for SW receiver or slide projector. David L. Nolt, Rte. 1, Box 197, New Holland, Pa. 17557.

HARMON-KARDON A-230 Ballad stereo amp/preamp. Will swap for more powerful mono equipment. Joe E. Gardner, Jr., E-106 Carlson Terrace Apts., University of Arkansas, Fayetteville, Ark., 72701.

KNIGHT-KIT Star Roamer receiver. Will swap for SW preselector, preamp or Q-multiplier. Ira Stoler, 729 Ave. T, Brooklyn, N.Y. 11223.



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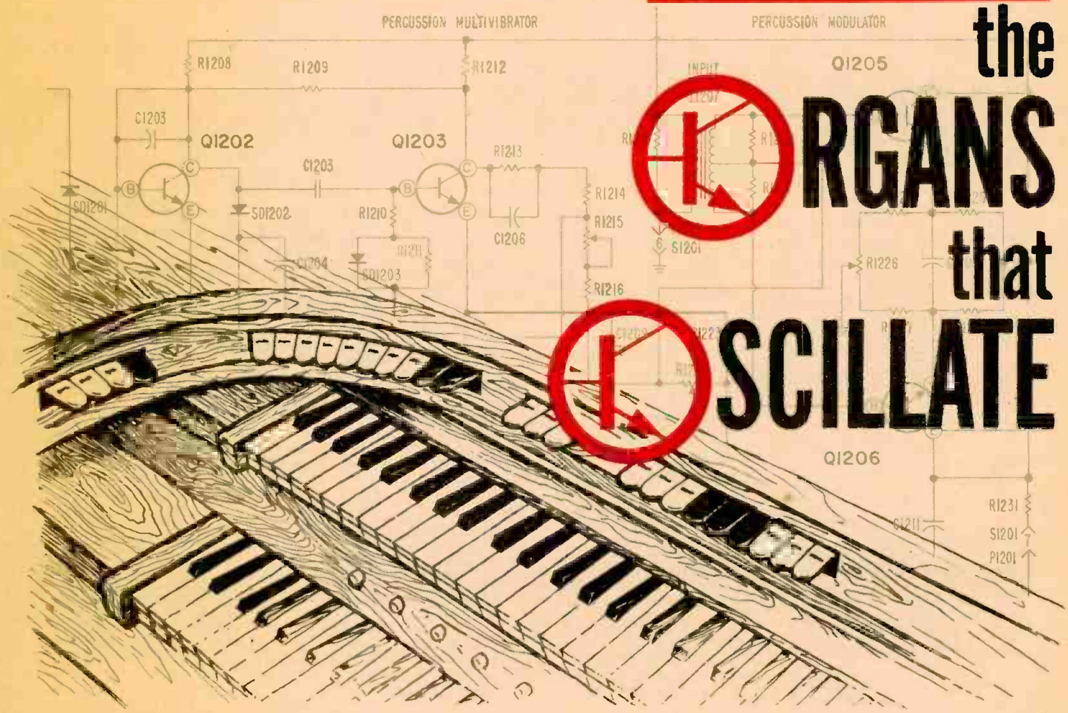


the ORGANS that OSCILLATE

By STEPHEN B. GRAY

THEY laughed when he sat down to play. They roared when he said he built it himself.

But they gasped in admiration when he sounded the first chord.

The basic story was old 25 years ago but the slight twist and the fact that a different instrument is involved give it new meaning. It could even have happened. What he sat down to play, of course, was an electronic organ—one built from a kit.

In just a few years organs have ceased to be the exclusive property of churches and cocktail lounges (now there's a team for you) and have taken up residence in private homes in astonishingly large numbers. We're in the middle of the only popularity boom the organ has known in its long history.

Organs once were priced so high that no man of average means could make a down payment on one, let alone foot the entire bill. Then, too, only an empty factory or a living room of Victorian proportions was big enough to house one.

Behind the boom in organs lies an even bigger boom in another field: electronics. For today's organs are electronic and, in one way or another, they approach, equal or surpass the pipe and reed organs of old. And behind electronic organs stands the transistor, for it is the transistor more than any other single

the ORGANS that OSCILLATE

factor that makes the modern organ possible. Thanks to this button-size wonder, most anyone now can own an electronic organ. Some earlier electronic organs used vacuum tubes (a few still do) but transistors are the mainstay. While vacuum tubes have kept pace with most every other electronic component in the move toward miniaturization, they still can't hold a candle to transistors on this score. The bulky, high-voltage power supplies that tubes require are one reason why the transistor has stolen the show.

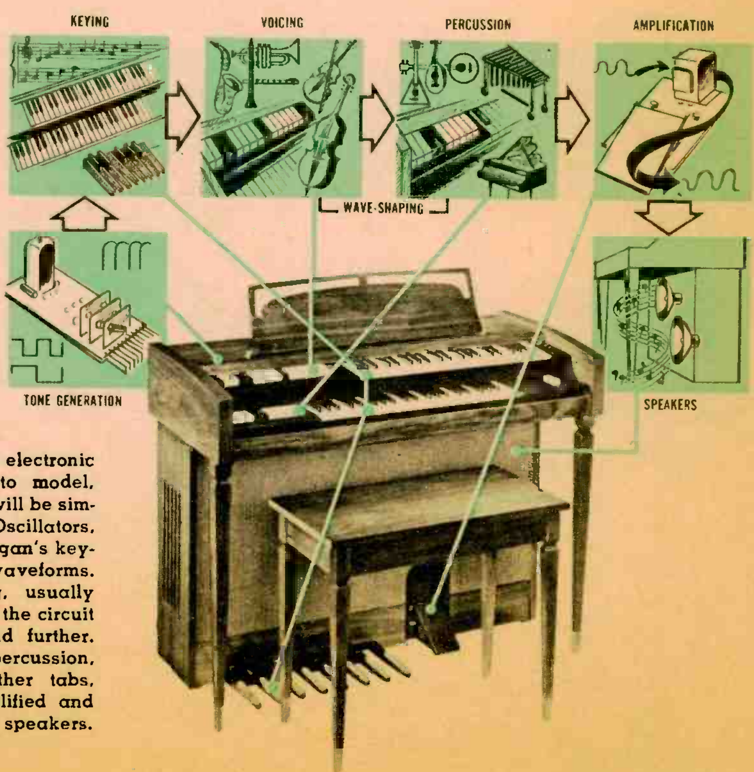
Some of the transistors serve as oscillators, since oscillators form the heart of every electronic organ in existence. A few organs have one oscillator for each note on the keyboard (called a *manual* in organ terminology). Artisan's York organ, for instance, has 159 oscillators, each of which is tuned separately.

But most organs use a master oscillator for each of the 12 notes in the musical scale and obtain other notes by creating multiples or submultiples of the original frequency. Dividing the frequency of a master oscillator by two produces a tone that is eight full steps—an octave—below the original note. Similarly, doubling the master oscillator frequency results in a tone that is an octave above the original note.

It takes more than oscillators to make music, of course. Even so, electronic organs are far simpler than one might suppose. Fact is, there are only five basic parts to an electronic organ:

- Oscillators, to generate the basic waveforms.
- Key switches, to select the desired notes.
- Wave-shaping circuits, to transform the oscillator outputs to waveforms resembling the sounds of musical instruments.
- Controls for special effects.
- An audio system, with amplifier and speakers.

Put these five components together and you have the king of electronic instruments, capable of producing whole orchestras of sound, yet occupying no more space than a piano. Then, too, it will have a piano beat on several other scores.



Working components of an electronic organ vary from model to model, though arrangement often will be similar to that shown here. Oscillators, triggered by keys on the organ's keyboard, generate the basic waveforms. Stop tabs control voicing, usually switching filters in or out of the circuit to color the original sound further. Special effects, such as percussion, are controlled by still other tabs, after which sound is amplified and fed into unit's built-in speakers.

Pressing a piano key produces a sound that soon fades away; pressing an organ key causes a sound that continues as long as the key is held. This means that even a melody picked out slowly on an organ will have an agreeable, sustained quality. Add the fact that the organ also does all the work of tone coloring and it's obvious why most anyone soon can sound like a pro.

Easiest thing in the world for the organ oscillators to generate would be sine waves, though none would sound much like music. Reason is that no musical instrument, save perhaps a solo flute, produces anything remotely resembling a sine wave. Instead, musical tones consist of sounds having a number of harmonics or overtones, which vary both in number and intensity. And it is these which are responsible for imparting a given instrument's characteristic timbre and tone.

Surprisingly enough, electronic organs can deliver the same two types of basic tones that pipe organs can. As it happens, pipe organs employ both closed and open pipes, with each producing its own distinctive tone. A closed pipe creates only odd harmonics; a pipe with one end open produces all harmonics.

Because a square wave contains only odd harmonics, it can be used to produce closed-pipe tones. Similarly, a sawtooth wave contains all harmonics and can be used to produce open-pipe tones.

There are two basic ways to create the complex waveforms that simulate pipe-organ tones. In one, the so-called *additive* method, simple sine waves and their harmonics are generated, then mixed together in the right combinations. This method is used in comparatively few organs and requires that each frequency be created electromechanically. In some of the Hammond organs, for example, serrated tonewheels rotating in magnetic fields form the necessary tones in what might be called more of an electric than an electronic fashion.

The other basic method of producing the complex waveforms is to generate a signal—a square wave or a sawtooth, say—that contains many harmonics, then use filters to select the desired combination. This is the *formant* method, used in almost all electronic organs.

These instruments come in all shapes and sizes, and most are packaged in cabinets having enough style to grace any living room. Smallest and easiest to play of all these tuneful oscillators is the chord organ. Most of these instruments have only one short keyboard for the melody, no pedals and a set of push buttons for the chord accompaniment. Played in somewhat the same manner as an accordion, the chord buttons deliver multinote chords whenever activated.

Though chord organs are easy to play, they leave much to be desired for the more serious musician. It is for this reason that the spinet and the small console have proven most popular for home use. More like the conventional pipe organ, most have two 44-note keyboards with 13 short pedals or perhaps two 61-note keyboards with 25 pedals.

In addition to providing the various notes

ELECTRONIC ORGAN MANUFACTURERS

Manufacturer	Price range
Allen Organ Co. Macungie, Pa. 18062	$2,000-60,000
Baldwin Piano & Organ Co. 1801 Gilbert Ave. Cincinnati, Ohio 45202	850-20,000
Conn Organ Corp. 1101 E. Beardsley Ave. Elkhart, Ind. 46514	1,000-7,300
Electro-Voice Buchanan, Mich. 49107	300-2,000
Electronic Organ Arts (Artisan) 2476 North Lake Ave. Altadena, Calif. 91001	550-3,800
Estey Electronics 2133 Dominguez St. Torrance, Calif. 90500	450-1,700
Gulbransen Co. 2050 N. Ruby St. Melrose Park, Ill. 60160	1,000-5,300
Hammond Organ Co. 4200 W. Diversey Ave. Chicago, Ill. 60639	1,000-4,000
Heath Co. Benton Harbor, Mich. 49023	350-850
Lowrey Co. 7373 N. Cicero Ave. Lincolnwood, Ill. 60646	500-3,500
Magnavox Co. 270 Park Ave. New York, N.Y. 10017	500-2,800
Rodgers Organ Co. 2040 N.W. 272 Ave. Hillsboro, Ore. 97123	5,000-17,000
Seeburg Corp. 1500 N. Dayton Chicago, Ill. 60622	1,300-3,500
Schober Organ Corp. 43 W. 61st St. New York, N.Y. 10023	550-1,500
Thomas Organ Co. 8345 Hayvenhurst Ave. Sepulveda, Calif. 93662	450-10,000
Wurlitzer Co. 959 Niagara Falls Blvd. N. Tonawanda, N.Y. 14120	700-2,400

the ORGANS that OSCILLATE

and tones music is made of, organs frequently offer features all their own. Some of the Lowrey, Estey and Wurlitzer organs, for example, contain a device variously known as a Glide Control, a Vibra-Glide or a Slide. When operated, it causes all the notes being played at that instant to slide downward about half a tone in pitch, thus imitating a trombone's smear or a Hawaiian guitar's glide.

Though organs currently cost more than pianos, prices are coming down. Transistor organs are smaller and less expensive than previous vacuum-tube models, and integrated circuits eventually may drop the cost even more. Right now there are at least two dozen models in the range between $300 and $1,000. And anyone willing to tackle an organ kit can cut the cost by a sizable fraction. The Thomas Largo organ, for instance, sells for $470 but is available as a Heathkit for $350. Or take the Schober Consolette II. Sold completely assembled for $1,475, it also is available in kit form for $850.

Building an organ kit can take from 75 to several hundred hours of your time. But, besides saving you money, a kit organ offers the satisfaction of having built your own king of instruments—and of telling friends you built it yourself. Modesty doesn't seem to be a virtue of organ kit builders.

Chord organs have few controls and thus are easiest to play. This is the Electro-Voice Regency.

Anyone who hasn't heard an electronic organ for some time is in for a surprise since many of the newer models truly are worth crowing about. However, the old rule still applies that the more you pay, the better they sound. Problem, therefore, is to find one with a sound you like at a price you can afford.

For $300 you won't get more than a single-keyboard chord organ, without pedals, and with a couple of voice stops. For $500 there are a few spinets available, with two keyboards, up to a dozen voice tabs and a 13-note pedalboard.

In the $1,000 range you can have a wider choice of spinets, many with up to 20 voices. And for $2,000 you can buy most any spinet and even some of the console organs with 25 pedals and up to 30 voices.

If possible, visit several dealers and try as many makes as you can. In view of the dollars involved, it's plain good sense to listen repeatedly to the ones you like in order to pick your favorite. Even so, electronic organs in the same price range sound pretty much alike and it may be difficult to choose one on the basis of tone alone. Thus your choice may depend on the variety of voices and special effects offered.

If you want to play only popular music, then a spinet or a chord organ should take care of your needs. But if you want an organ for serious classical music you likely will need a console model with at least 25 pedals.

Should the salesman at an organ showroom play for you, lend a careful ear to how the organ sounds. This done, get in the driver's seat and try making like Ethel Smith or E. Power Biggs yourself.

Try the voice stops. They should sound different, with ample tonal variety, rather than somewhat alike. Several stops sounded together should keep their individual characteristics and not blur. And a number of them played in chord fashion should deliver a full-organ tone you find pleasing.

Try out the special-effect controls to determine precisely what they do to the various organ voices. And when you've all but decided on a particular organ, ask for a home trial to see how it sounds away from the showroom. Reason is that room acoustics vary, and it pays to be on the sure side. After all, your king of instruments should satisfy you—as well as last—a lifetime.

KIT EI REPORT

build your own

ELECTRONIC ORGAN

Heathkit GD-983

KITS have been getting larger and more sophisticated over the years. Compare those of 15 years back with the modern big-daddy of them all, an electronic organ, and the contrast is readily apparent.

We became especially aware of this increasing sophistication when the $849 Heathkit GD-983 organ (which, factory-wired, goes as the $1,300 Thomas Coronado BL-3) arrived at our door. Two cartons could be brought in easily. But the third, a mammoth one containing the cabinet and bench, didn't make it and had to be opened outside. Thus, Heath's most ambitious venture into the kit field became our most challenging kit-building experience.

Can the average builder possibly get this large and complex kit working properly? Yes, but there may be some gnashing of the teeth before you finally get the last note tuned up. Heath says that "you don't have to be an electronics wizard to build it. . . ." Maybe so, but kit-building experience is a must before you tackle this one.

Heath goes on to say you needn't be a "professional organist to play it." Perhaps, but you should have either a good background in piano, a natural talent for music or plan to take lessons before you shell out $849. Reason, we feel, is that the GD-983 has great potential as a professional musical instrument which depends on what you can do at the keyboards.

The GD-983 has a lot more to offer than a chord organ. Although the $20 (extra) set of 48 lessons and four LP records will start you in the right direction—they are only a start.

And don't be disillusioned by the 50-cent demonstration record Heath offers for the GD-983. It doesn't do justice to the sound. It would be better to visit a Thomas dealer to get a live demonstration.

Here are a few of the GD-983's features. Others can be found in Heath's catalog. There are two 44-note manuals, 16 voices, 28 notes of chimes, a pedal-keyboard volume control, a Leslie speaker and two 12-inch speakers. The GD-983 is completely transistorized. And one important feature is what's called *diode keying* or switching.

Many other electronic organs employ something known as *buss-bar keying*. That is, when you press a key you close several switch contacts simultaneously.

This isn't what you find when you open the largest carton. So far we'd put in about 20 hours on the pedals, amplifier, percussion- and great-manual cheekblocks and installing the 12-inch speakers. Until you get used to the pedals, you'll wish you had an AAA foot to be able to play them smoothly.

Assemble keys, pins, clips, springs, brackets, felts and screws on a chassis. Add some solder, permagum, grease and you have the lower manual. Align the keys, connect wires and you move on.

build your own
ELECTRONIC ORGAN

This system causes key clicks and service problems. But when you press a key on the the GD-983, you close only one pair of contacts (except on chimes) which applies a voltage to several diodes. This forward-biases them and causes their signals to be fed to succeeding circuits. The advantages to this method are that there will be no key clicks and troubleshooting, if needed, will be simplified.

Does it pay to build a kit this size? That depends on what you do with your spare time. The price difference between the kit and the assembled organ is about $450. Pushing to get the job done, we built the kit in about 70 hours, though it could take ten or 20 hours longer. Our time turned out to be worth about $6 an hour.

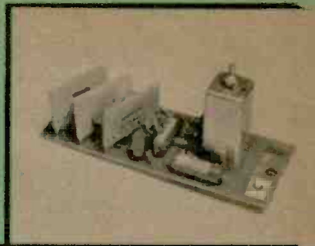
Upon opening the parts carton we found a 1-pound, 11-ounce, 238-page construction manual. Underneath it were six cartons. We started with the pedals which, like the swell- and great-manual keys, are supplied in their most basic form. There are wood naturals (except for the manual keys, which are plastic), plastic sharps, springs, bolts, clips, wire contacts, washers and a large metal chassis on which they are assembled.

After the pedals came the amplifier and installation of the 12-inch speakers. The constant change in pace from mechanical to electronic assembly is something Heath is to be commended for. It goes this way constantly and prevents boredom from setting in. Only problem so far was that the pedal-linkage bar was missing. Heath got it to us quickly and we were not held back.

Next came the great manual (lower keyboard) carton. We did everything here. There was a circuit board, two switch boards and the manual itself. Four O-rings were missing, but we were able to go ahead until they arrived from Heath. After this you start mounting things in the cabinet and the organ begins to take shape.

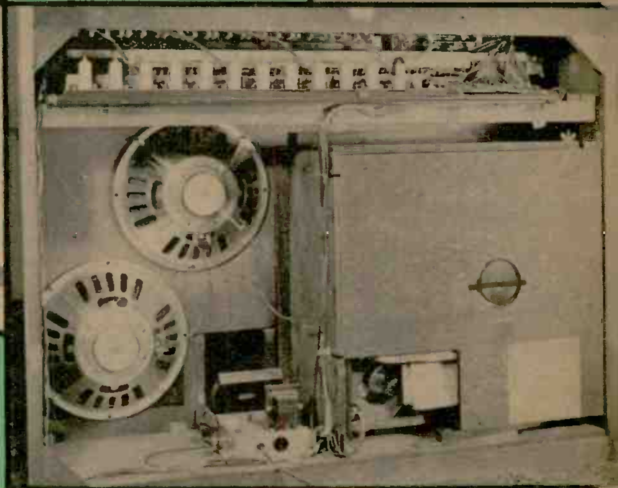
Carton No. 4 contained circuit boards. No problems, but after we finished the organ we realized how important it is to make perfect solder connections on each circuit board. We missed in a couple of places and regretted it later. Some boards can be rather difficult to remove after they are installed and wired to. We felt it would have been wise to spend an extra half hour going over every solder spot with a magnifying glass. Next came the tone generators, and you are supplied an assembled and tuned one to copy.

The fifth carton, the largest, contained parts for the swell manual (upper keyboard). It contained another circuit board, one cable harness and a huge pre-assembled



You're supplied one tone generator assembled and tuned. The other 11 take 5 or 6 hours to build. Each board has an oscillator and three multivibrator frequency dividers.

Top. Swell keyer circuit board (just above lower manual) is supplied assembled. This saves time since it contains almost 300 diodes, 44 packaged electronic circuits and close to 50 capacitors. Frame, which holds swell manual, lifts up on hinges.



Leslie speaker, above, is supplied assembled. Motors in corner turn drum (which is in front of speaker) to create tremolo sound. Completed organ, right. Amplifier looks small but it can deliver up 20 rms watts.

and tested circuit board. The last carton had more circuit boards, switches and cable harnesses. Next came the Leslie speaker which is supplied assembled—you just install it.

At last we got to initial tests and adjustments. The lower manual went quickly, but the upper manual was more difficult because of the chimes. Each chime note has three extra contacts which are tricky to adjust and may have to be gone over several times before they're perfect. After the last contact was adjusted, we turned on power.

Did it work? Yes—but. The sound was strange because it was not tuned. And to our disappointment some keys on the swell manual did not sound when certain stops were depressed. A few hours of trouble-shooting turned up some bad solder connections on the distribution circuit board.

One of the tests told us that the top seven notes on the swell manual would be repeats of the same notes an octave lower when certain stops were pressed. But the construction manual did not mention that the condition also would exist when certain other stops are pressed. We spent a lot of time tracking down what we thought was a goof. Heath advised us that an addenda sheet would be included with subsequent manuals to take care of this oversight. All other tests checked out AOK.

Rough tuning took about 45 minutes. You first play a B- and C-natural together (the C is produced by the pre-tuned tone generator) and adjust the slug of the oscillator coil on the B tone generator until the beat note (an unmistakable throbbing sound) disappears. Turn the B tone-generator slug 1¾ turns and that does it. You do this similarly for the 11 remaining notes in an octave. Tuning isn't half bad at this point.

Fine tuning took about 2½ hours. What you do is play fifths (C and G natural, for example) and adjust an oscillator-coil slug for a specified number of beats in 10 or 30 seconds. A stopwatch and patience help. After several musician friends concurred that tuning was perfect, we considered the job done.

How does the GD-983 sound when played? In a word, spectacular. It has a full, rich and robust tone. We felt it lacked a bit of the brilliance that a few more 4- and 2-foot stops could have given it, but one way of overcoming this is to keep the treble-accent tab on all the time.

We wished there were a few more pedal stops and slightly greater space between each of the pedals. Though the reverb isn't produced with a delay line, the effect is similar. It might better be called short sustain. The sustain and percussion circuits are effective

[*Continued on page* 117]

WOODPECKERS . . . After listening to sideswipers and electronic keyers running wild on the General bands, we find it relaxing to eavesdrop on Novice transmissions. Though beginners send s l o w l y by old-timer standards, they do count their dots and dashes carefully. Result is that their letters conform to the combinations of sounds that form International Morse.

As it happens, this is a refreshing change from the habits of the speed-key artists. These woodpecker ops often as not spew out an uninterrupted string of dots and leave it to you to figure out whether they represent E's, I's, S's, H's, 5's or an error. Seems to us that there's little time difference between a message sent properly at 10 wpm, with no repeats, and the same message sent at 30—if the receiving operator has to come back with a plaintive QSM or QRS request every time.

It's Legal . . . A lad who signs himself SWL/Ham-To-Be writes, "Was tuning quickly through the 40-meter band with a new receiver and heard a lot of music. Thought hams weren't supposed to transmit entertainment. What gives?"

They aren't and they don't. The stuff is short-wave broadcasting and it's there in full accordance with international agreements. Listen some more and you'll find many foreign SWBC stations pumping out heavy-handed propaganda interspersed with the music. But there's precious little we can do about this situation, short of learning to live with it.

Philatelic Note . . . During a recent trip to Europe we heard quite a few complaints from hams there. Seems more than one American amateur has been known to send over U.S. stamps to expedite mailing of QSL cards.

"These are no more acceptable in a London or Rome post office than British or Italian stamps are in New York or Los Angeles," our overseas friends point out. "Is it possible Americans don't know about International Reply Coupons?"

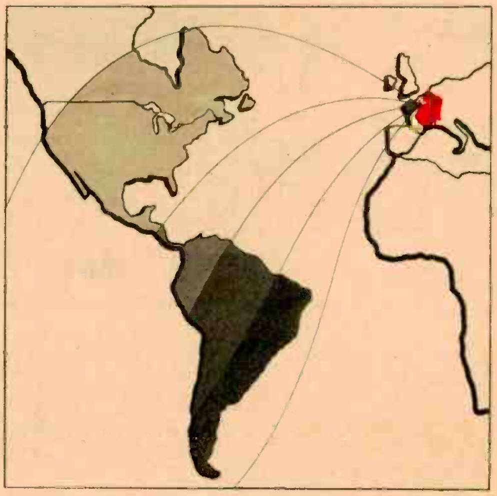
For the benefit of those who don't, we might mention that these coupons cost 15 cents each. They're obtainable at all post offices and can be exchanged in any country of the International Postal Union for domestic stamps of the same value.

We Can Do Without . . . The fone operator who says, "We don't want to hold it too long, old man," and then continues to chatter nonstop for ten minutes. The CW operator who sends, "Ur sigs RST 599," and then requests a repeat of the last transmission. All operators who glibly promise, "Will be glad to swap QSL's," but never do.

A good many shacks pack so much gear that the owner must battle for breathing space, and FG7XT's shack is no exception. Thing is, a tropical climate down FG7XT's way only adds to the heat the gear gives off, so the OM must dress for the occasion. John Wegimont, the genial gent in our photo, works fone, CW and RTTY from Guadeloupe, an island in the French West Indies 350 miles southeast of Puerto Rico.

IGNORED . . . The Office de Radiodiffusion Television Francaise has been toying for some time now with the idea of drastically increasing its international service. Such a move, we suppose, would be in keeping with Premier Charles de Gaulle's vision of France as a major world power. Fact is, R.T.F. carried out an extensive series of tests only a few months ago in a move we suspect was intended to gauge listener response to such increased coverage.

We naturally don't know what these tests indicated to R.T.F., but they may have contained a hidden message for North American SWL's. For while there was a healthy schedule of test transmissions beamed toward the Americas from Canada south to Argentina (see our map), they included not a single word of English. Programs were in Spanish, Portuguese and, of course, French.



Map prepared by R.T.F. shows part of Canada, most of the U.S. and all of Mexico in one zone. French is the only language beamed to this area.

In other words, R.T.F. simply lumped the U.S. and English-speaking Canada together with French-speaking Canada, Mexico and part of Central America. This being the case, it almost looks as though M. de Gaulle has little or no interest in the U.S. listening audience. And the fact that English was beamed to every other part of the English-speaking world makes the omission here all the more interesting.

Let's hope R.T.F. decides to pick up the U.S. and Canada next time round. Meanwhile, if you haven't logged R.T.F., you might try for the regular transmission to Quebec Province (in French, natch) at 1230-1245 EST on 15130 kc. Reports go to 116, Avenue du President Kennedy, Paris XVI.

Sampler . . . Though dyed-in-the-wool DXers have about as much use for an LP record of various SW broadcasts as they do for tips on how to log the BBC, newcomers to the hobby just might like to give such a disc a listen. There is one, you know. It's called Shortwave Listener's Record No. 1 and it contains an S9 sampling of some of the world's more interesting SW stations. Matter of fact, even experienced listeners might profit from some of the rare interval signals and ID patterns the disc contains.

With a total playing time of 40 minutes, the record sells for $3.95 postpaid ($4.75 to points outside the U.S.). It's available from SWL Records, 4017 Jackson Ave., Culver City, Calif. 90231.

Prowess. What makes a DXer? is a question we have been asked more than once. And to answer it briefly, we'd say interest, persistence and, above all, an ear. Reason is that a true DXer can log weak stations through static and QRM that seriously would hamper others' attempts.

For the beginner, most any SW stations provide a first step. For not matter how strong and QRM-free an SWBC station may be, there always is some QSB (fading). This means a novice can take that first step by identifying every strong SW station he can find.

As his ear improves, he naturally will be tackling weaker stations, perhaps even ID'ing stations through QRM and noise. Then one day he will find a true ear is his, and in the process of developing this ear he already will have built up a respectable country count.

Unfortunately, all too many listeners falter before reaching this point. They remain mediocre when they could go on to greatness. And they usually erroneously blame their failings on equipment or location. Thing to remember is that every great DXer bags stations which no one else seemingly can hear. It is his ear that makes the difference.

SPECIAL CB SECTION

This page introduces what has become an annual feature in EI—a Special Section on Citizens Band Radio. For your convenience, an index to our special CB articles appears below.

WHAT'S AHEAD FOR CB

BY DAVID WALKER

THIS is the year of the QRN-busting, bull-horning, semiconducting, walking & talking CB rig. Not enough? Then toss in triple-tone calling, mechanical filtering and sidewinding signaling. Or just be a cube with a new square antenna.

This slug of features in current CB equipment spells change. Much more important, it points the finger toward what's ahead for CB. Playing down last year's shimmering front-panel starburst, the new rigs are business-like on the outside, dead-serious on the inside. And kits are nearly a push-on-the-knobs-and-play proposition. If you can't build one, better stick to surfing.

As for the future, there are sure signs that CB is abandoning adolescence and carving a niche in sober, two-way radio society. Its technology—some notable, some old-hat—is being snatched from everywhere. Five-watt RF transistors come out of aerospace, mechanical filters from the hamming engineers, hot Nuvistors right out of TV tuners and frequency synthesis from the old Navy days. These techniques aren't just show. They help transmit stronger signals and receive weaker ones.

Has anyone come up with the end-all rig . . . reliable as a telephone, economical as a VW? Not yet, but more makers are building rigs with less on the outside and more on the inside.

The sideband situation, which boomed forth a year ago, shows signs of leveling off. The touted changeover to various degrees of sideband—each offering increased power to some extent—has yet to materialize on any significant scale. But there's enough in the offing

Johnson Messenger III's small size belies its 5-watt rating. Note sealed, computer-grade changeover relay (in hand) and top-up speaker mounting.

Regency Romper sports new twist in frequency synthesis. Single crystal plugs into socket below meter, serves both transmit and receive circuits.

International Crystal 750-HB2 comes equipped for instant troubleshooting. Voltages and currents are sampled, then fed to meter jacks at lower left.

USL Contact-All 23 incorporates new mechanical filter, also features built-in speech compressor.

that sideband could boom again any time.

One system, double-sideband suppressed-carrier, proved a bust. Only manufacturer to announce a DSSC unit withdrew it quietly. The new-type transmitter could emit higher power, to be sure, but its signals couldn't be received without a complex adaptor.

There was no false start with the next sideband system, though — the reduced-carrier type. It's now well in evidence on the CB scene, found in such rigs as the Regency Range Gain and the Olson Side-Bander (which is built by Regency, being merely a Range Gain with another name). While these sets offer more punch and are compatible with regular gear, they haven't revolutionized CB. Rather, they have pushed forward the state-of-the-art by a small margin.

Other manufacturers probably feel that reduced-carrier isn't worth the retooling. They've come up with countermoves instead, chief of which is far more audio compression. Lafayette's Range Boost and the keyed audio compression of the Tram-23 are two examples. Such circuits once were the province of add-on accessory makers, but an increasing number now are designed into original equipment. By keeping modulation percentage at healthy levels they make a conventional rig perform just about as well as a reduced-carrier job.

Still another countermove is an effort to pooh-pooh any sideband system. Some producers proclaim loudly that their rigs provide full carrier, implying that sideband (which reduces carrier) cuts out something you need. In any case, the mere appearance of sideband is having a salutary effect on CB by prompting more audio compression in in standard units. The technique costs little but it boosts performance significantly (see STRAIGHT TALK ABOUT TALK POWER elsewhere in this issue).

One rig there isn't any dispute over is the Mark Sidewinder. As a true single-sideband unit, it's the most potent power generator of the lot. Yet the rig stands alone, despite persistent, year-old rumors of similar units on the design boards.

One reason for the holdback could be that sideband never was spelled out in the rules (though the FCC did give it an informal nod). In newer regulations there's no mistake; sideband is approved specifically. Couple this to the success that Mark is having with its unique rig and chances are that more SSB could bow in soon. It is known, for example, that Heath has an SSB rig on the shelf which it may or may not introduce, depending on developments. Utica, too, acknowledges the prospect of more SSB by incorporating an extra oscillator in its new Town & Country III rig—this little extra being one of the things required for detecting sideband signals.

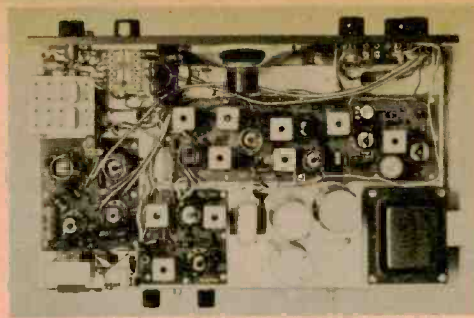
The race to see who has the most channels continues, though most manufacturers are at or near the finish line. Early transceivers went from a single channel to four and more, ultimately leading to the full 23-channel rig. End of the stretch was frequency synthesis, where a few crystals are mixed and matched for full-band operation.

Though there's been no big changeover to 23-channel rigs, there is an interesting offshoot of frequency synthesis. It's a new feature in crystal control introduced on the Regency Romper. Using its own brand of frequency synthesis, the eight-channel rig brings one crystal socket out to the front panel (the others remain inside). This permits the CBer to plug in just one special crystal to change both transmit and receive sections to a new channel.

Other rigs now sport front-panel crystal sockets as an added convenience. These, however, usually are for transmit only; the operator must use his spotting switch to get a continuously-tunable receiver exactly on the transmit frequency. And chances for a continued crystal race may be nipped by the new FCC rules which tend to cut down channel hopping.

Public address is another extra that's coming on strong. Fact is, provisions for PA are being added to new rigs about as fast as S-meters were last year. But it's a solid feature and should be welcomed by many. (The PA idea is especially valuable for a marine-going CBer involved in search and rescue.)

PA works this way. Let's say you're part of net operation helping to control a crowd at a parade. Your receiver speaker barks, "There's a runaway horse tearing down Main Street, headed in your direction!" You quickly switch a front-panel control from *Receive* to *PA*, grab the mike and save the crowd. Your voice is broadcast, PA style, over a bull-horn. The circuit cleverly uses the existing audio

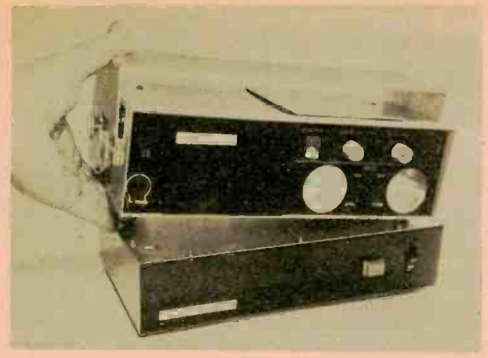


Heath GW-42 transceiver is aimed at CBers who like their kits simple. Builder simply plugs parts into printed-circuit boards, then solders. Much wiring is pre-cut and tied at the factory.

Maxwell Radiocom holds distinction of being only hand-held 5-watt transceiver currently on market. Unit originally was designed for government use.

Sophisticated selective call by Cadre transmits three tones in sequence, producing code that is tough for normal static or heterodynes to crack.

WHAT'S AHEAD FOR CB



Lafayette HB-500 is fully transistorized, has such features as dual-conversion receiver and mechanical filter. Unit beneath rig is AC power pack.

Knight KN-2565 numbers among transceivers with provision for public address. Bull-horn speaker (in hand) mounts on car or other nearby support.

Mark Sidewinder still reigns as only true single-sideband CB rig, though others are in the offing.

amplifier in the rig, plus suitable switching. The only required accessory is the horn.

And even PA isn't without features of its own. Take Allied's new Knight KN-2565 rig, for example. In addition to the PA setup just described, it has a modulation-indicator lamp to monitor audio during both transmit and PA. This feature should prove helpful when the speaker is located some distance from the mike, assuring that the PA system is receiving audio power.

Tiny transceivers have come into their own this year, too. Initial attempts at producing a true three-way portable CB rig—one that could be interchanged among base, mobile and hand-carried modes, yet still provide 5-watt transmit power—proved only partly successful. But they now have evolved into practical, miniaturized full-power rigs.

These Lilliputian sets rely heavily on the rechargeable nickel-cadmium battery and silicon transistor. The new Johnson Messenger III, for example, crams just about every popular CB feature into a case about the height and width of this page. Add a battery pack and a charger and you have a unit fully equipped for field or home use.

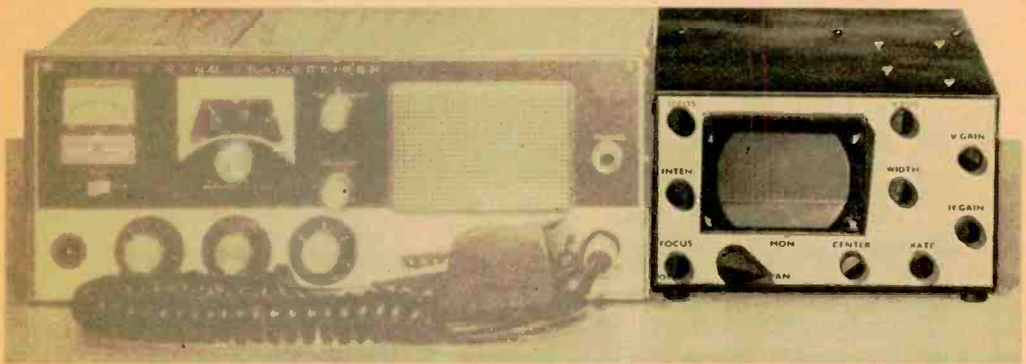
Not to be caught napping, Lafayette Radio recently introduced its candidate for the space age: the tiny 5-watt HB-500. Its 20 semiconductors draw negligible power on receive, which makes the rig a good bet for long monitoring periods with the car engine off. But the most intriguing feature of the unit, besides transistorization, is a rare bird in the CB field. It's a mechanical filter.

Introduced some years ago in expensive ham receivers, this device quickly won an enviable reputation for improving receiver selectivity. For CB work, it should prove its worth in rejecting adjacent-channel interference. Lafayette claims that channels only 10 kc away from the desired signal are reduced some 60db—an extremely high amount of interference rejection. A second rig containing a mechanical filter is the recent USL Contact-All 23.

Small rigs are getting bigger, too, just as big rigs are getting smaller. Matter of fact, the walkie-talkie field is undergoing a decided expansion to higher power. When suitable transistors became available, some 100-milli-

[*Continued on page* 114]

You *see* what's happening on the Citizens Band with a



SPECTRUM MONITOR

By

HARRY KOLBE

WITH the Citizens Band packed solid these days, finding a clear channel often is like looking for a needle in a haystack. An old proverb can give the answer: one picture is worth a thousand words. In much the same fashion, the display on a spectrum monitor connected to your CB transceiver can be worth a thousand turns of the tuning knob to see which channels are clear.

The annoying thing about a congested band is that you never know what's going on—at least not without a spectrum monitor. Since a rig can tune in only one channel at a time, searching for a clear channel is strictly a hit-or-miss proposition. Channel 7, say, suddenly could open up when you're looking for clear space around channel 12. But you never would know it since you normally are tuning blind. The answer is to put a window on your transceiver by building our Spectrum Monitor. It can be added to any rig that has a 1,600- to 1,750-kc IF frequency.

You make a simple modification to your transceiver by connecting a capacitor from the output of the first mixer stage to a jack on the rear of the chassis. Plug in the Spectrum Monitor and you'll be able to see what's happening all around.

We designed the monitor so you can watch nine channels at a time instead of the entire Citizens Band. It's better this way because if you looked at the entire band at once the display would be crowded and difficult to interpret.

The channel you're tuned to will be a pip in the center of the CRT's face as shown on our cover. The marks on the scale in front of the tube correspond to four channels above and below the channel you're tuned to. For example, assume your transceiver is tuned to channel 10. If the pattern looked like that on our cover, you'd know

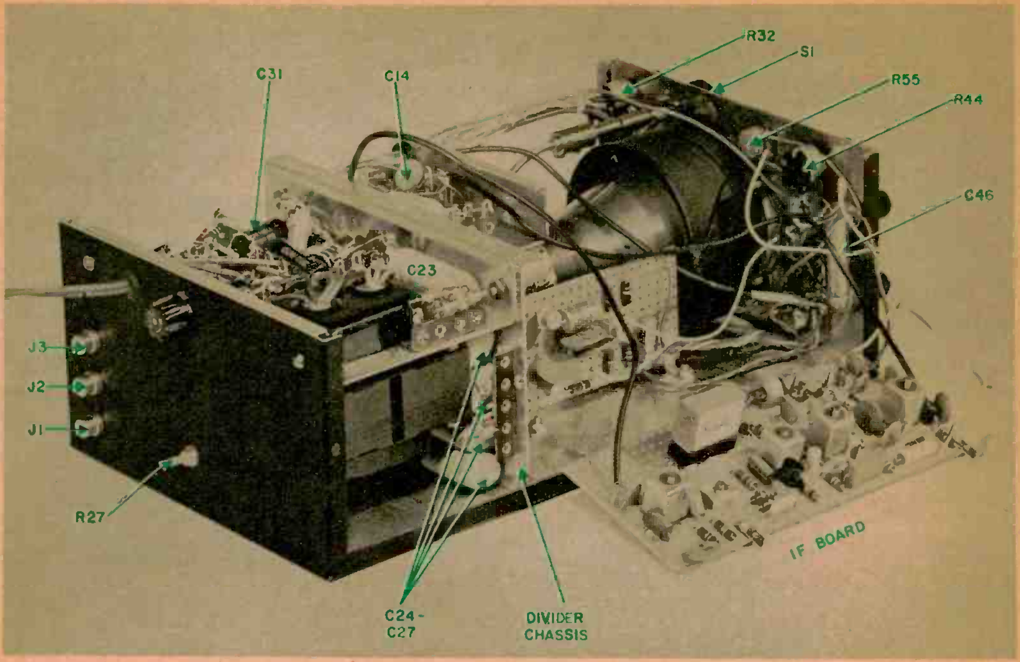


Fig. 1—View of the inside of the Monitor with IF board dismounted. Space around controls at right of CRT is tight; use care when wiring. Mounted close beside CRT neck on two angle brackets is sweep board.

SPECTRUM MONITOR

instantly that channels 7,8,9,11,12 and 14 are clear. When you retune your rig to, say, channel 13, the pip that is over the channel 13 mark will move three marks to the left.

The Monitor is a project for advanced CBers who are looking for the ultimate in a station accessory. It should be tackled only by those who have built large projects before and can wire from a schematic. Or an electronics-minded friend who's up on complicated projects well might be willing to tackle it for you. The monitor contains about $50 in parts and requires a good deal of construction experience to get it working properly. Alignment will require patience as well as familiarity with RF circuits. After using the Monitor for a time, you no doubt will find that it will prove to be your most useful and valuable operating aid.

Construction. We don't show every detail and dimension because you have a great deal of freedom in construction—with the exception of the circuit boards. Our design is compact and makes use of every cubic inch of space. You may build the Monitor in a larger cabinet to make the job easier.

Figure 1 is an overall view of the Monitor (turned upside down) with the U-section of its Minibox cabinet removed. At the back of the cabinet is the power supply/deflection-amplifier chassis. In Fig. 2 you can get a better view of the underside of the assembly.

The assembly in an early stage of construction is shown in Fig. 6. The top photo shows what the assembly looks like from the front—the way it faces when installed in the cabinet. The 2¾x4⅛x1-inch chassis in the front is for deflection tube V1. The vertical divider plate is made from a 5x7-inch aluminum chassis bottom plate whose width must be trimmed to 6¾ inches. After trimming, ½-inch lips should be bent on the 6¾-inch sides. End result is a piece of aluminum measuring 4x6¾ inches and having two ½-inch lips on both sides.

To determine where to cut the 2-inch-diameter hole for the neck of the CRT, temporarily clamp the two chassis and the vertical divider plate together and place them in the cabinet. Note where the CRT is located in Fig. 2. Position it approximately where

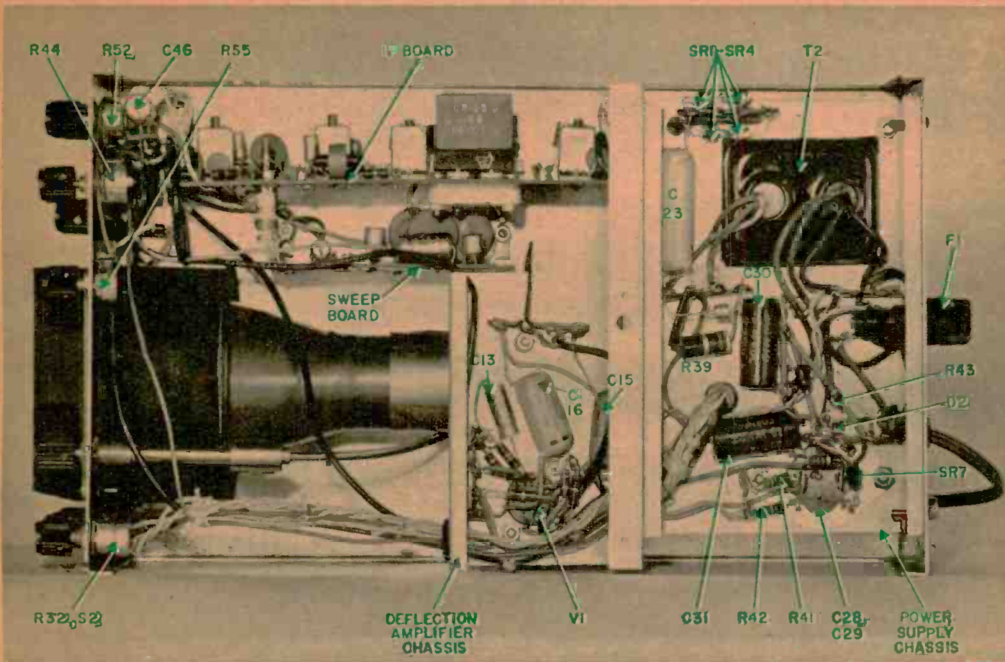


Fig. 2—Head-on view of bottom of Monitor. Position parts in the power-supply and deflection-amplifier chassis exactly as shown. Cable below R39 in power-supply chassis comes from socket on rear of the CRT.

shown and sketch a circle on the vertical-divider plate where the hole should be cut. (Remember, there must space between the CRT and the edge of the cabinet for the horizontal position, intensity and focus controls.)

Mark the front of the cabinet for a hole for the face of the CRT. The hole should be the shape that appears in the photo on the first page of this article. We used a 3-inch-diameter tin can, on which are soldered four brackets, to support the front of the CRT behind the hole. Our scale is ruled on a piece of green plastic. The hood over the front of the CRT is home brew. However, you could use the bezel specified in the Parts List.

Bolt the deflection-amplifier chassis, vertical-divider plate and the power-supply chassis together and mount the transformers, the can electrolytic capacitor, V1's socket, the terminal strips for C24 to C27 (and C24-C27) and pan/mon switch S1.

Best way to connect wires and parts to the CRT is to put a 2½x2½-inch piece of perforated board on the rear of the CRT's socket. Mount the parts associated with the CRT (C19,C20,R29,R26,R34 and R36) on the board and connect long wires to them. Run the wires through the bottom of the power-supply chassis (below R39 in Fig. 2) and connect them to the appropriate points in the circuit.

And don't forget to use high-voltage wire in the places we have marked with an asterisk on the schematic. Drill holes on the cabinet's rear panel for the astigmatism control, the input jacks, the fuse holder and the power cord.

Mount the power supply/deflection-amplifier chassis in place. Build the circuit boards, copying our pictorials carefully, make connections to the boards and mount them in the cabinet.

Alignment. Screw in the slugs on coils L1, L3, L4 and L5 so they are flush with the top of the coil. Then turn each slug counterclockwise the following number of turns: L1—5¼, L3—4, L4—3¼, L5—4.

Turn R1 full clockwise (maximum gain) and adjust all other controls for a sharp horizontal line that is the full width of the CRT. Set rate control R44 to mid-position. Using a short length of RG174/U coax, connect the Monitor's input (J1) to the plate of the transceiver's first mixer tube (or collector of the mixer transistor) through a 15-mmf,

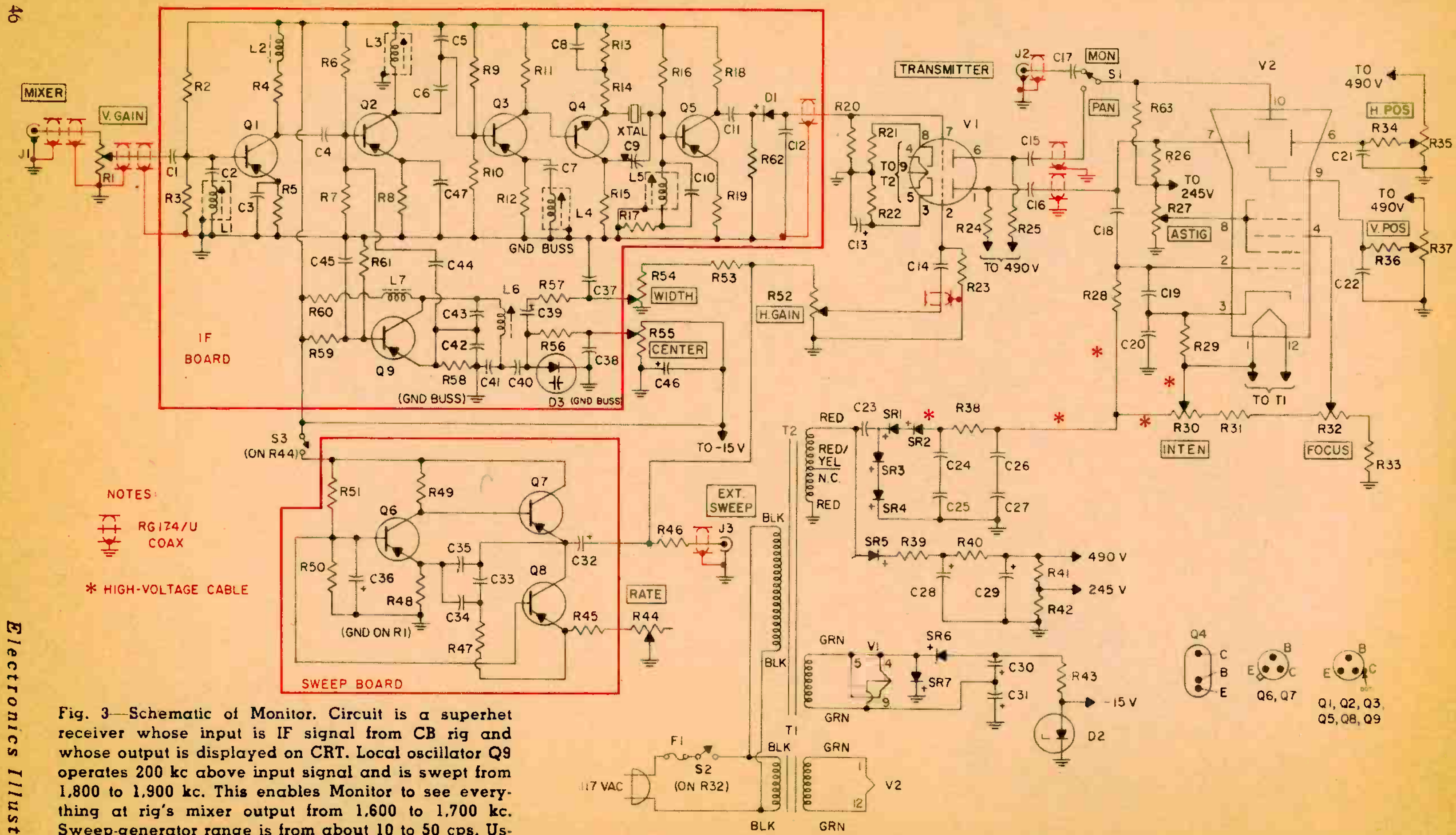


Fig. 3—Schematic of Monitor. Circuit is a superhet receiver whose input is IF signal from CB rig and whose output is displayed on CRT. Local oscillator Q9 operates 200 kc above input signal and is swept from 1,800 to 1,900 kc. This enables Monitor to see everything at rig's mixer output from 1,600 to 1,700 kc. Sweep-generator range is from about 10 to 50 cps. Using parts specified in local oscillator, Monitor will work with transceivers with IF's from 1,600 kc to 1,750 kc.

SPECTRUM MONITOR

PARTS LIST

Capacitors:
C1, C3, C4, C11—.005 mf, 500 V ceramic disc
C2—750 mmf, 500 V silver-mica (Arco-Elmenco type CM-20 or equiv.)
C5—2,500 mmf, 500 V silver-mica (Arco-Elmenco type CM-20 or equiv.)
C6—330 mmf, 500 V silver-mica (Arco-Elmenco type CM-15 or equiv.)
C7, C10—270 mmf, 500 V silver-mica (Arco-Elmenco type CM-15 or equiv.)
C8—22 mmf, 500 V silver-mica (Arco-Elmenco type CM-15 or equiv.)
C9—8-60 mmf, miniature trimmer capacitor (Arco Elmenco type 404 or equiv.)
C12, C17, C18, C19, C21, C22, C37, C38, C45—.001 mf, 500 V ceramic disc
C13, C32, C36—50 mf, 15 V electrolytic
C14—.1 mf, 50 V ceramic disc
C15—.1 mf, 200 V mylar (Sprague 2PS-P10 or equiv.)
C16—.25 mf, 200 V mylar (Sprague 2PS-P25 or equiv.)
C20—.015 mf, 1,600 V ceramic disc (Centralab DD16-153 or equiv.)
C23, C24, C25, C26, C27—.25 mf, 600 V mylar (Mallory PVC-6025 or equiv.)
C28, C29—Dual 40 mf, 500 V electrolytic
C30, C31—250 mf, 25 V electrolytic
C33, C34, C35—.47 mf, 10 V ceramic disc (Centralab UK-10-474 or equiv.)
C39—2 mf, 25 V electrolytic
C40—.001 mf, 500 V ceramic disc
C41—27 mmf, 500 V silver-mica (Arco-Elmenco type CM-15 or equiv.)
C42, C43—470 mmf, 500 V silver-mica (Arco-Elmenco type CM-15 or equiv.)
C44—100 mmf, 500 V silver-mica (Arco-Elmenco type CM-15 or equiv.)
C46—200 mf, 15 V electrolytic
C47—.01 mf, 500 V ceramic disc
D1—1N294 diode
D2—1N3024 zener diode: 15 V, 1 W; (Motorola or International Rectifier)
D3—Varicap diode, 100 mmf @ 1 mc @ 4 VDC Pacific Semiconductor (TWR/PSI) type V100E. Allied stock No. V100E. $3.05 plus postage.
F1—1A, type 3AG fuse and holder
J1, J2, J3—Phono jack
L1—650 microhenry to 1.3 mh shielded subminiature adjustable RF coil (J. W. Miller 9058, Lafayette 34 G 8961)
L2—33 microhenry RF choke (J. W. Miller 70F335A1, Newark Electronics 59F320)
L3, L4, L5—1.3 mh to 3.0 mh shielded subminiature adjustable RF coil (J. W. Miller 9059, Lafayette 34 G 8962)
L6—110 to 187 microhenry miniature adjustable RF coil (J. W. Miller 41A154CB1, Newark 59F171)
L7—2.4 mh RF choke (J. W. Miller 4666, Newark 59F304)
Q1—2N1526 transistor
Q2, Q3, Q5, Q9—2N1632 transistor
Q4—2N1121 transistor
Q6, Q7—2N414 transistor
Q8—2N2613 transistor

Resistors: ½ watt, 10% unless otherwise indicated
R1—5,000 ohm, audio-taper miniature potentiometer (Mallory MLC53A, Lafayette 33 G 1260)
R2—22,000 ohms
R3—3,900 ohms
R4, R40, R58—2,200 ohms
R5—620 ohms, 5%
R6—39,000 ohms
R7—5,600 ohms
R8—1,000 ohms
R9—12,000 ohms
R10, R11, R12, R17, R22, R50—10,000 ohms
R13, R14, R15, R21—3,300 ohms
R16,—150,000 ohms
R18, R49—15,000 ohms
R19, R45—1,500 ohms
R20, R23, R24, R25, R56, R57, R63—1 megohm
R26, R33—3.3 megohms
R27, R32—1 megohm, linear-taper miniature potentiometer (Mallory MLCN16L, Lafayette 33 G 1270)
R28, R46, R51, R53, R61—100,000 ohms
R29, R31, R34, R36—330,000 ohms
R30—1 megohm, audio-taper miniature potentiometer with SPST switch (Mallory MLC16A-S, Lafayette 33 G 1278)
R35, R37—500,000 ohm linear-taper miniature potentiometer (Mallory MLCN55L, Lafayette 33 G 1268)
R38—220,000 ohms
R39—2,700 ohms, 2 watts
R41—68,000 ohms
R42—91,000 ohms, 5%
R43—150 ohms
R44—10,000 ohm audio-taper miniature potentiometer with SPST switch (Mallory MLC14L, Lafayette 33 G 1262)
R47—30,000 ohms
R48—680 ohms
R52—1 megohm, audio-taper miniature potentiometer (Mallory MLCN16A, Lafayette 33 G 1269)
R54—500,000 ohm, audio-taper potentiometer (Lafayette 32 G 7360)
R55—50,000 ohm, linear-taper miniature potentiometer (Mallory MLC54L, Lafayette 33 G 1263)
R59—120,000 ohms
R60—8,200 ohms
R62—470,000 ohms
S1—SPDT rotary switch
S2—SPST switch on R30
S3—SPST switch on R44
SR1-SR7—Silicon rectifier; minimum rating: 750 ma, 750 PIV (Lafayette 19 G 4203 or equiv.)
T1—Filament transformer: 6.3 V @ 1 A (Allied 62 G 030 or equiv.)
T2—Power transformer: 480 V @ 70 ma, 6.3 V @ 3 A. Stancor PM-8419 or Allied 62 G 504 ($4.48 plus postage)
V1—12AX7 tube
V2—3RP1A cathode-ray tube (Also available from distributors such as State Labs., Barry Electronics and others.)
XTAL—200-kc crystal, series mode, in FT-241 holder and socket. (Texas Crystals, 1000 Crystal Dr., Fort Myers, Fla.)

Misc.—12x7x4-inch Minibox (Premier PMC-1011); deflection-amplifier chassis, 2¾x4⅛x1 inch (Premier ACH-1353); power-supply chassis, 4x6⅛x1 inch (Premier ACH-1360); vertical divider, made from 5x7-inch Premier ABP-423 bottom plate
9 round knobs, Raytheon 50-1-1G (Newark 26F195)
1 pointer knob, Raytheon 70-4-2G (Newark 26F157)
CRT clamp, Millen 33087E (Newark 28F954)
6-inch flexible shaft, E. F. Johnson 115-254 (Allied 46 H 412)
Panel-bearing assembly, H. H. Smith (Allied 44 H 094)
Shaft coupling, ¼" to ¼" (Allied 41 H 105)
CRT socket, Cinch-Jones 3M-12 (Newark 29FX714)
CRT bezel, Millen 80073 (Newark 97F283)
RG174/U coaxial cable, high-voltage cable (Belden No. 8869)

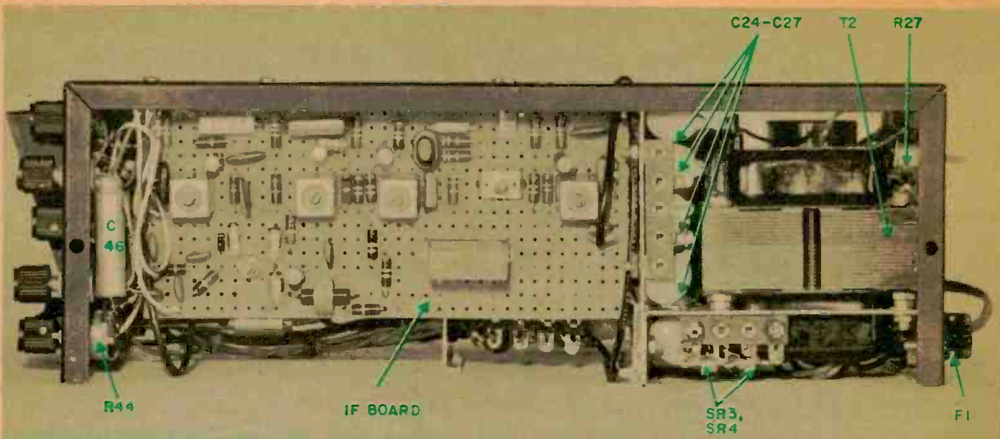
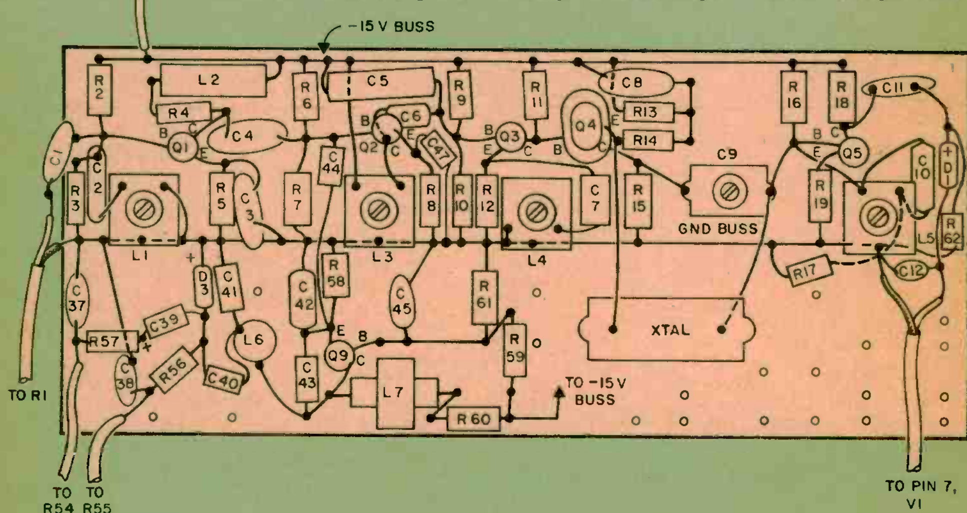


Fig. 4—Right side of monitor. IF board is held to top of cabinet with two small brackets. Leads connecting board to other circuits should be long enough so it can be removed for alignment and adjustment if necessary. All parts except C40 (on IF board below) are mounted on top. Try to follow our parts arrangement carefully and use the ground buss to prevent oscillation problems.



SPECTRUM MONITOR

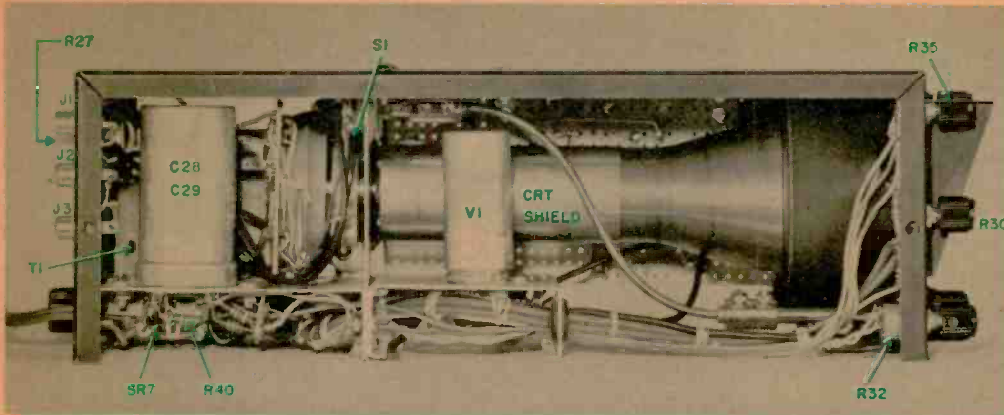
500-V capacitor. Set center control R55 so the voltage (measured with a VTVM) between its wiper contact and ground is −9½ volts. Turn width control R54 full clockwise. Now, connect the VTVM from the junction of D1 and C12 to ground.

Turn L6's slug-adjustment screw full counterclockwise, then turn it clockwise 10½ turns. Tune in the signal from a transceiver several feet away and adjust L6's slug slightly until you see a pip in the center of the screen. To be certain you're tuned to your own transceiver and not some other signal, turn your transceiver on and off. The VTVM should drop to zero when the transmitter is off.

Turn the transmitter on and adjust the slugs of L3, L4 and L5 again for highest meter indication. But as you touch up each slug, turn gain control R1 down so the VTVM indication never exceeds −0.2 V.

Touch up C9 for narrowest pip base (smoothest base line). The adjustment should be no more than ¼ turn from the original setting.

Set the transmitter to a different frequency



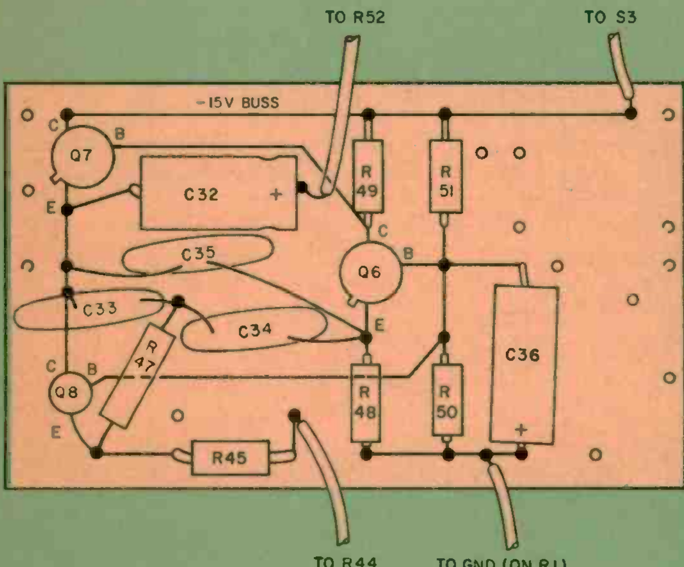


Fig. 5—View of left side of Monitor, above. Wrap a shield made of aluminum foil or tin around CRT's neck. We recommend cabling wires from rear chassis to front-panel controls. Build sweep generator, left, on 3⅝x2⅛-inch piece of perforated board. Leads of parts can be soldered together, making it unnecessary to use flea clips or eyelets for tie points.

—say three channels higher than the one it was formerly on. Turn the transmitter on and adjust the width control so the pip is exactly three markers to the right of the center marker. Calibrate the width control by putting a mark on the front panel opposite its pointer.

The width control establishes the bandwidth of the RF spectrum that can be viewed at the output of your rig's mixer stage. In one rotation extreme it will allow you to see up to nine channels at once. Turn it the other way and you will see fewer channels.

In our July issue, we will publish plans for an adaptor that plugs into jack J2 to allow you to monitor your transmitter's modulation.

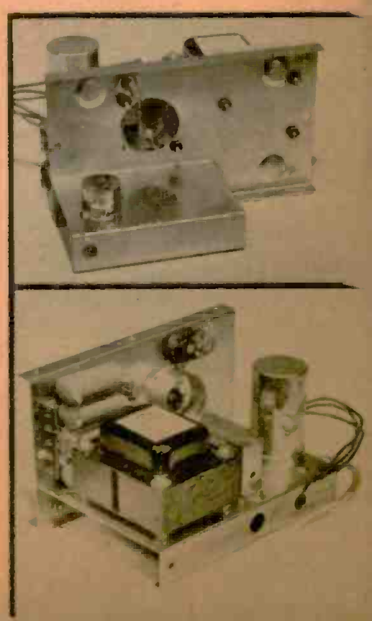


Fig. 6—Power supply and deflection-amplifier subassembly must be completely wired before installation in main cabinet. Top photo is of deflection-amplifier chassis. Vertical plate with 2-inch diameter hole for CRT neck is made from a 5x7-inch chassis bottom plate. Lower photo is of rear of power supply. Capacitors at left are C24-C27. Pan/mon switch S1 is at top.

CB CORNER
BY LEN BUCKWALTER KBA4480

THE STARTLING TRUTH

IT NOW is known that the FCC really does think what we all thought the FCC thought—that it hopes CBers engaging in ham-type chit-chat on the 23 channels of yore will strangle themselves on the seven channels on which they now are finding themselves under the new rules. Even more startling, perhaps, is the fact that this move on the part of the Commission isn't without backing from CBers, as we shall see shortly.

Though many CBers cried "Ouch!" when the FCC proposed its rules-tightening way back in November 1963, the Commission was to hear other voices before the round was over. Initially, CBers seemed vehement in their complaints against the sweeping restrictions, especially the one limiting talk between different stations to just seven channels. But in light of certain developments, the new rules are making friends. A core of CB operators, barely heard amid the clamor, wanted the new rules to go into effect without delay. And their number appears to be growing.

One barometer of CB reaction is the mail sent to FCC headquarters. And one indication of how CBers feel about the new rules is the fact that the Commission's mail did an about-face during the time the rules changes were under consideration. In the beginning, CBers voiced opinions against the proposals when the FCC was soliciting comments. Then a new trickle of new opinion was touched off by a second announcement. This one was designed to take the rules out of the proposal stage and make them law. A notable trend became apparent. More letters were saying thank you to the Commission for doing something about the mess on the band.

But the big surprise came on the heels of the third announcement. In response to a legal move by two manufacturers and several CB clubs, the FCC postponed the effective date for the new rules. Again, CBers took to their pens to register their opinions with the Commission. This time an even more remarkable pattern developed.

Unlike earlier correspondence—where the nays dominated — percentages shifted the other way. It is estimated that at least half the letters revealed impatience, actually objecting to the delaying action. This turnabout seemed to reflect the attitude of numerous CBers: "What are we waiting for . . . let's get on with it!" The emerging of this once-hidden opinion could affect CB's future, especially from the enforcement angle.

Here's why. Much in the new laws is designed to make the FCC's enforcement job easier. As we've noted, that channel-restriction rule is intended to shove the rag-chewing hobbyist onto fewer frequencies where heavy QRM well could strangle his operations. Yet the monitoring job still won't be a snap.

True, it is easier to monitor fewer channels, but that doesn't mean that an illegal operator necessarily will stay on fewer frequencies. The Commission still will have to search all 23 channels for violations. Can it expect help from that rising number of CBers who appear to favor the new rules?

Presumably, it can—and will. On the one hand, of course, the Commission hopes each CBer will be model operator enough not to encourage others into hobby-type activities. But it also likely will rely to some degree on monitoring by law-abiding CBers.

Only catch here, of course, lies in reporting violations. The FCC cannot act directly on a complaint like "Joe Zilch is saying nightly xxxx xxxx on Channel 9." Reporting anything Zilch said to the FCC would be disclosing his communication to a third party—an open violation of the secrecy provision of the Communications Act of 1934.

We suspect, however, that the FCC will not be hamstrung by the secrecy provision. For, while the Commission can't act directly on the complaint, it can use such information to start its own investigation. Equipped with its monitoring facilities, it then can get the needed transcript to prove that a violation has been committed.

Tie Your Telephone to Your Transceiver with a

PHONE PATCH

By AL TOLER

TELL a CBer that it will now be possible for him to engage in worldwide communications and he's likely to say you're off your rocker. But long-range CB can be a reality because the new CB regulations don't specifically outlaw phone patches, which are devices that enable you to connect your transceiver to your telephone line. They're long familiar to amateurs but never have been used much in Citizens Band communications.

Suppose your sales territory and home are several hundred miles from your firm's main office. While you happen to be on the road in the area near your home the boss has urgent need to talk to you. All he has to do is call your home. Your wife answers, flips a switch on your phone patch and the call will be transmitted via CB to the rig in your car.

If you're on the road and have to talk to your boss or a client, you just contact your home via CB and ask your wife to make the call. After the telephone contact is established, she flips a switch and you start talking.

Hams have been using patches for years to make long-distance phone calls cheaply by means of radio. For example, if a serviceman overseas wants to talk to his family in the States he establishes radio contact with a ham near his home. The ham calls the serviceman's family and uses a patch to tie his transmitter and receiver to the telephone line. The fact that phone patches are used in ham communications is familiar to the various operating telephone companies.

CBers, who have a limited *radio* range, can use patches in a way almost opposite to that of the hams. Here the long-range part of the contact would be by *phone* in the form of a long-distance call.

Our patch is designed specifically for CB since ham patches are difficult to adapt to CB rigs. The patch requires a minimum number of modifications to the transceiver—if you call opening a single speaker lead a modification. You use your CB rig and its PTT (push-to-talk) just as you did before. And the patch in no way affects speaker-controlled electronic switching.

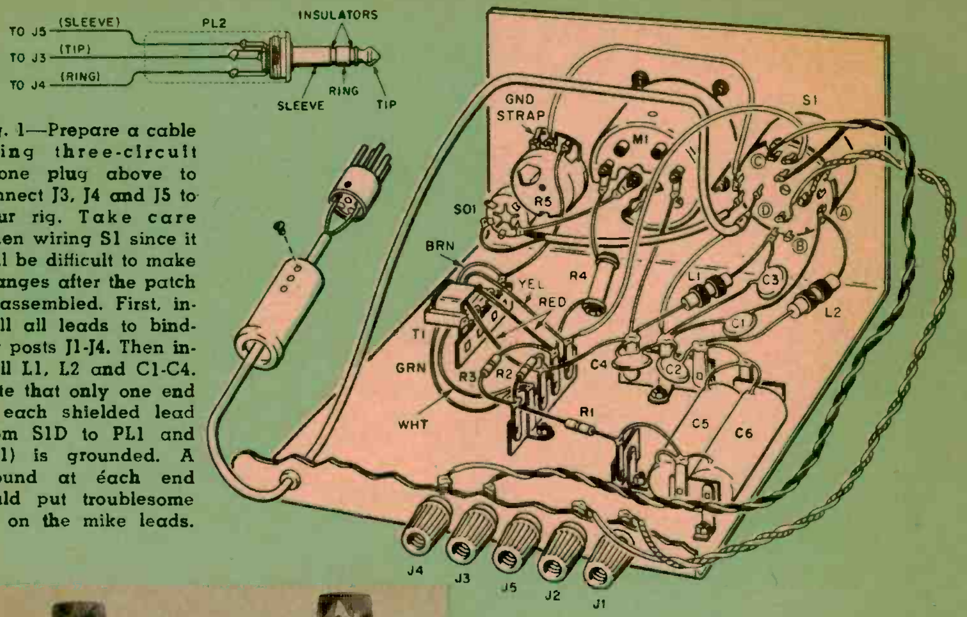


Fig. 1—Prepare a cable using three-circuit phone plug above to connect J3, J4 and J5 to your rig. Take care when wiring S1 since it will be difficult to make changes after the patch is assembled. First, install all leads to binding posts J1-J4. Then install L1, L2 and C1-C4. Note that only one end of each shielded lead (from S1D to PL1 and SO1) is grounded. A ground at éach end could put troublesome RF on the mike leads.

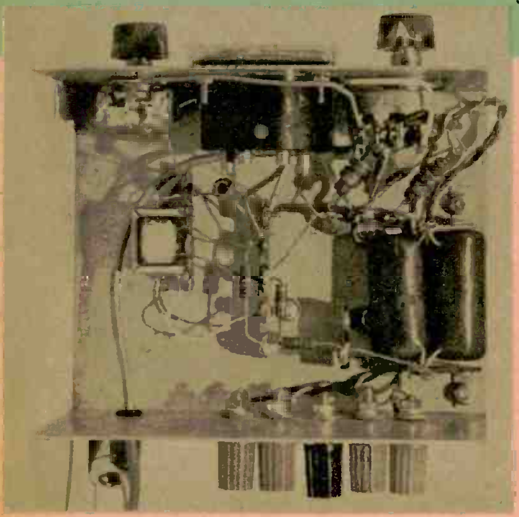


Fig. 2—Transformer T1 is mounted at the left by soldering its tabs to lugs on a terminal strip. Connect the PTT wires directly from PL1 to SO1.

PHONE PATCH

Construction. The patch should be built in the U-section of a 3x4x5-inch Minibox. Parts layout and wiring are not critical but try to follow the pictorial. And be sure to tie all components to terminal strips. Telephone companies get extremely nasty if their lines (connected to J1 and J2) are shorted by a loose connection.

Capacitors C5 and C6 can be replaced by a single 2-mf, *non-polarized* capacitor. Under no circumstances use electrolytic capacitors for C5 and C6. Mount transformer T1 by fitting its tabs through two lugs of the terminal

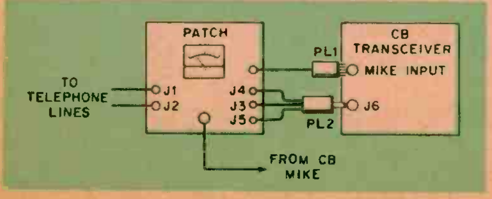


Fig. 3—Follow this diagram carefully to connect the patch to your rig and to your telephone lines.

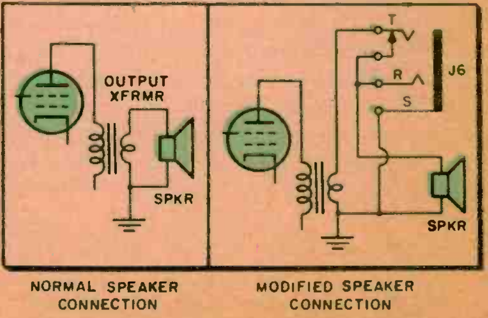


Fig. 4—CB rig modification. T, R and S on J6 correspond to PL2's tip, ring and sleeve contacts. Removing PL2 restores normal speaker operation.

strip, bend the tabs, then solder them. T1's black primary lead is not used and should be cut short.

Socket SO1, a female chassis connector, should mate with your transceiver's mike plug. PL1 should be the same as your CB mike plug. Since PTT wiring is different in every transceiver, we do not show these connections. Just connect the PTT leads from SO1 to PL1. Resistor R4 usually is supplied with the VU meter. If it is not, use the value specified in the Parts List.

Only C1-C4, J5 and T1's green and white leads are grounded. Be sure that there are no other cabinet grounds or your phone will have excessive hum or may not work at all. The only modification required to the transceiver is in the speaker circuit shown in Fig. 4. Mount a three-circuit phone jack, J6, on the transceiver's rear chassis apron, break the ungrounded speaker lead, then connect the leads as shown.

Connect the patch to your telephone line and rig as shown in Fig. 3. Binding posts J1 and J2 are connected to the telephone talking-pair wires. If you have a three-wire (party line) phone, one wire—usually yellow—is ground. Connect J1 and J2 to the other two wires (usually red and green). Plug your mike into SO1, connect PL1 to the transceiver input and plug PL2 into J6.

With S1 set to *off* the transceiver operates in normal fashion. To use the patch, first dial the number and speak to the answering party, then set S1 to *on*. Under no circumstances set S1 to *on* before the telephone connection is made or you will broadcast dial pulses, ringing or conversations with the operator.

When the patch is *on* you speak in the telephone handset mike. The earpiece can be used for monitoring. You still must use the CB mike's PTT switch to control the transceiver. To transmit the incoming telephone

[*Continued on page* 116]

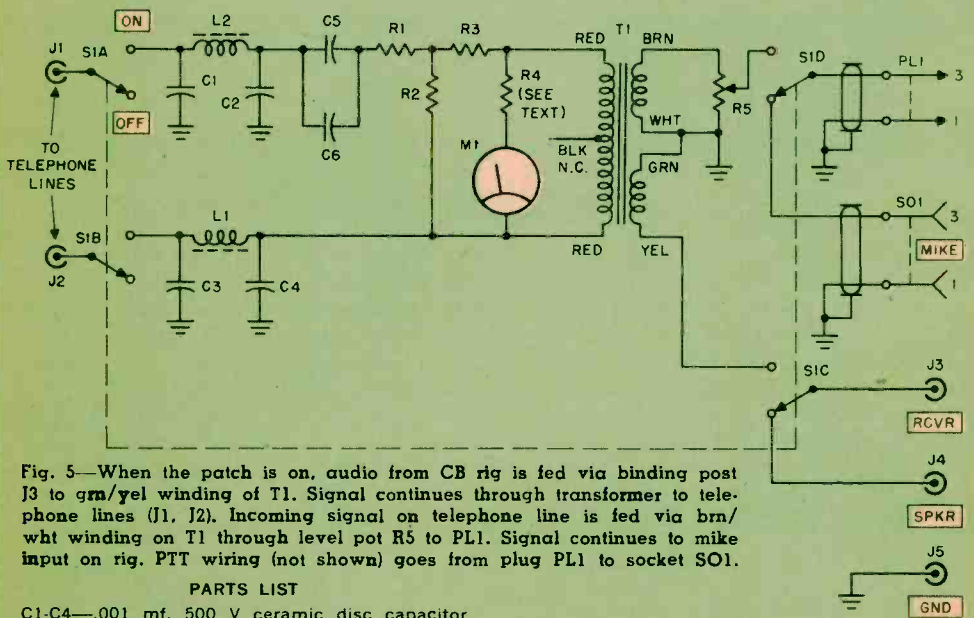


Fig. 5—When the patch is on, audio from CB rig is fed via binding post J3 to grn/yel winding of T1. Signal continues through transformer to telephone lines (J1, J2). Incoming signal on telephone line is fed via brn/wht winding on T1 through level pot R5 to PL1. Signal continues to mike input on rig. PTT wiring (not shown) goes from plug PL1 to socket SO1.

PARTS LIST

C1-C4—.001 mf, 500 V ceramic disc capacitor
C5, C6—1 mf, 100 V non-polarized capacitor (Arco-Elmenco 1DP-5-105. Lafayette Stock No. 34 G 6727)
J1-J5—Five-way insulated binding posts
J6—Three-circuit phone jack (Switchcraft type 13B)
L1-L2—.24 mh RF choke (J.W. Miller No. 4626, Allied Stock No. 63 G 839)
M1—VU meter (Lafayette 99 G 5024)
PL1—Plug to match mike socket on CB rig
PL2—Three-circuit phone plug (Switchcraft 297)
R1, R3—160 ohm, ½ watt, 10% resistor
R2—680 ohm, ½ watt, 10% resistor
R4—3,600 ohm, ½ watt, 10% resistor (see text)
R5—3,000 ohm, linear-taper potentiometer
S1—4PDT rotary switch (Mallory 3242J)
SO1—Socket to match CB mike plug
T1—Modulation and audio-output transformer: 500-ohm center-tapped primary, 8-ohm and 3,000-ohm secondaries (Lafayette 99 G 6132)
Misc.—3x4x5-inch Minibox

what you should know about PHONE PATCHES

MOVING ALONG in his car or boat, even sitting sedately at home, the CBer ordinarily can contact only one select group: other CBers. But one way he can break this barrier is with a phone patch.

Let's say Sam Spark is mobile and wants to talk to someone outside the CB orbit. Sam gets on the air and raises another CBer known to have a phone patch at his home station.

"Patch me into the landline," says Sam, and the other CBer switches his patch into the telephone line. Sam now can talk to anyone in the world who has a telephone.

As you already may be aware, the patch itself is a simple matching device. And it has the same effect as holding a telephone close to a loudspeaker, though it does a much better job. And there's no need to hold the phone in front of a speaker, since all connections are through wires between phone and rig. The patch also provides an important impedance match between systems. And it even has level controls which prevent overloading of the phone line or overmodulating the rig.

That direct tie into the phone line, strictly speaking, is not condoned by the telephone company. Search through the opening pages of your phone directory, and you'll find the explanation in wording like, "No device or apparatus not furnished by the Telephone Company may be attached to its facilities."

In the case of large, inter-state companies, this rule is backed by the Communications Act of 1934 and administered by the FCC. Small phone companies lying solev within the borders of single states are regulated by the state's public utilities commission but it, too, has a similar ruling. In short, no matter where you are, there's a law about foreign attachments.

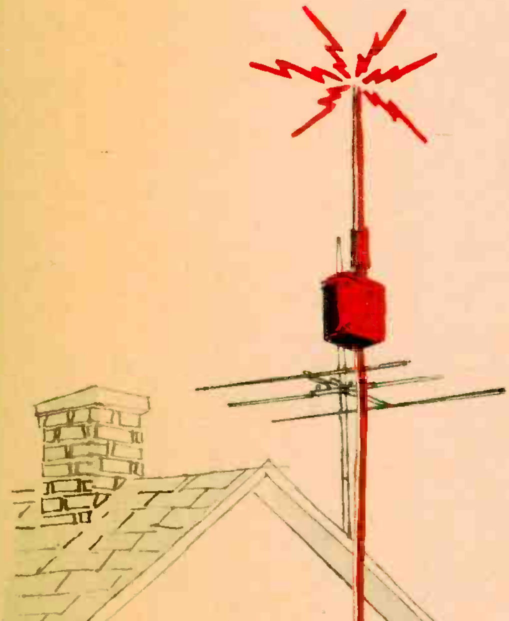
The patch hookup obviously fits this category. Wires must connect from the device to the telephone terminals. (These terminals usually are inside a small box, screwed to the baseboard, which also receives the cable from the telephone itself.) The other connections are to the CB rig. The patch ties into the rig's mike input (to put a phone call over the air) and to the loudspeaker circuit (so the rig can feed the received radio signal into the phone line).

One odd quirk to the law is that CB regulations don't specifically forbid phone patches. In the recent rules change, the FCC did propose such a restriction. But it was dropped

[*Continued on page* 114]

part 15 powerhouse

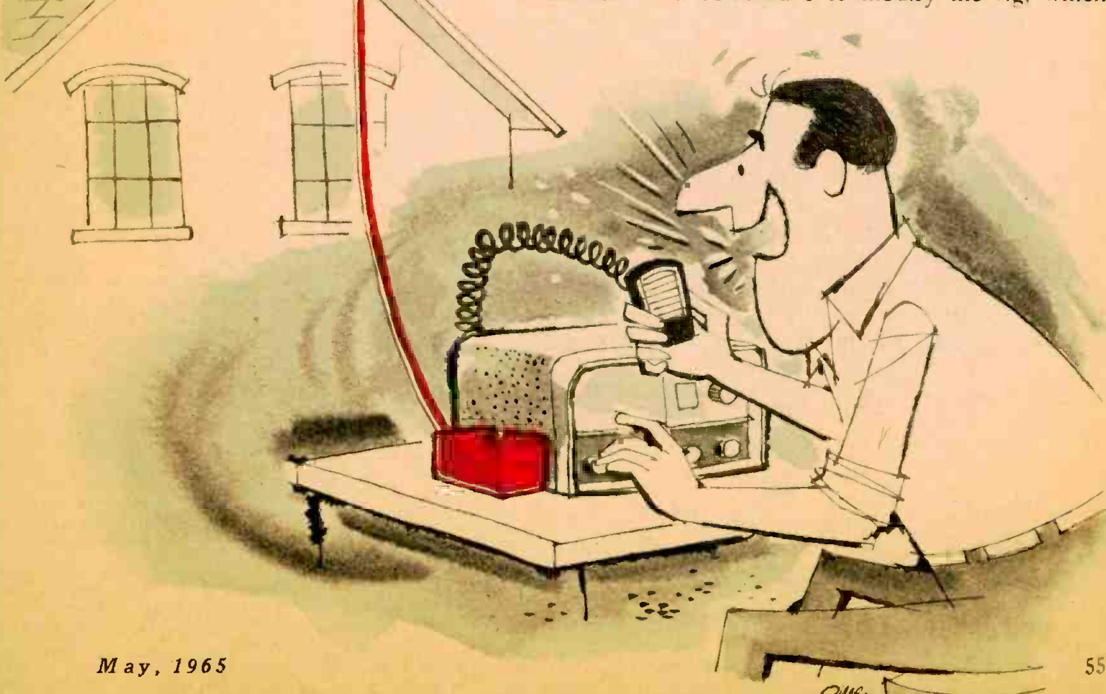
By VERNON SIMMS



NOT being permitted to call CQ or to chew the rag are big frustrations for many CBers. But on the Part 15 License-Free Band (where, for one thing, input power is limited to 100 mw) you can yack and call CQ to your heart's content. And it isn't necessary to use a call or to observe silent periods, either.

Since the License-Free Band for all practical purposes coincides with the Citizens Band, you might feel it would be a simple matter to use your 5-watt rig for License-Free Band operation. It is possible but there are one or two gimmicks. For one, the License-Free Band restricts your antenna to a single element no longer than 5 feet.

The other rub is that the transmitter final's *input* power cannot exceed 100 mw. The antenna problem can be solved easily—the power problem is a different matter. You cannot just attenuate your CB transmitter's power at its output connector to *produce the effect* of lowering input power. Part 15 rules clearly state that the final's *input* power must actually be 100 mw or less. To modify your rig to cut its input power from 5 watts to 100 mw is a big job. The simplest and legal way to use your CB transceiver on the License-Free Band is to connect the Part 15 Powerhouse to the rig's antenna connector. You don't have to modify the rig, which



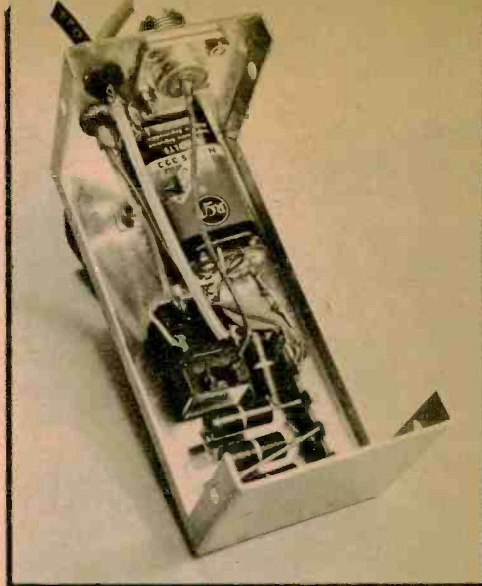
part 15 powerhouse

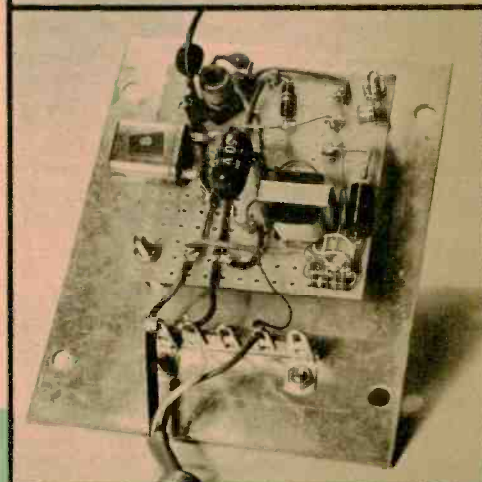
can be restored to CB operation in a moment.

The Powerhouse actually becomes your new final. Therefore, it turns your CB rig's final into a driver stage. And there's nothing in the rules that limits the input power of a driver stage.

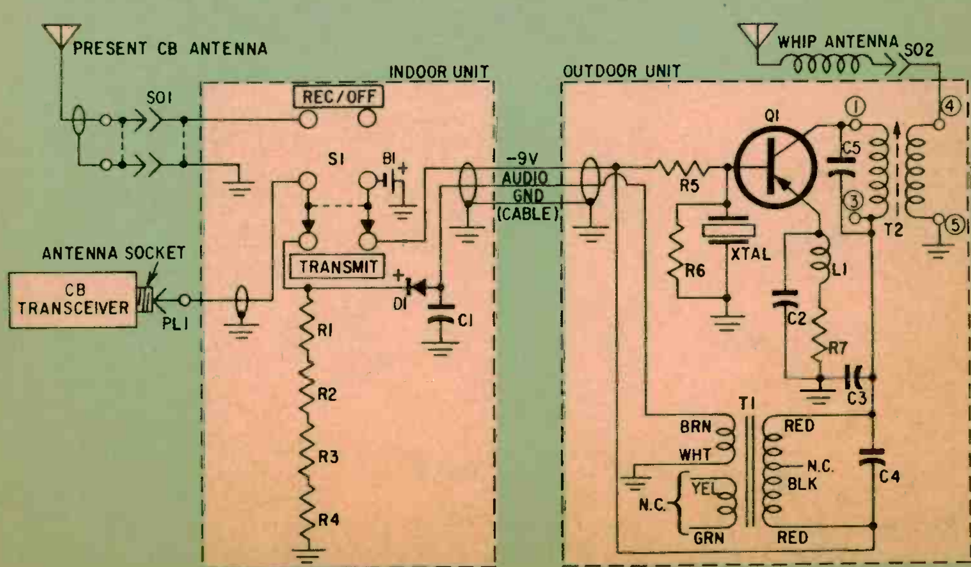
The Powerhouse consists of two units. The indoor, or power, unit contains a 9-volt battery which powers the crystal-controlled 100-mw transistor transmitter up on the mast. There also is a four-resistor dummy load in the indoor unit in which the output of your CB rig is dissipated. A detector diode in the indoor unit turns part of the CB rig's RF into audio. The audio signal is then fed up a cable to modulate the 100-mw transmitter in the outdoor unit on the mast. Hence, there is little or no loss of RF in a transmission line.

Your signal is radiated by the whip antenna on top of the outdoor unit. But your rig and CB antenna receive License-Free Band transmissions automatically when you

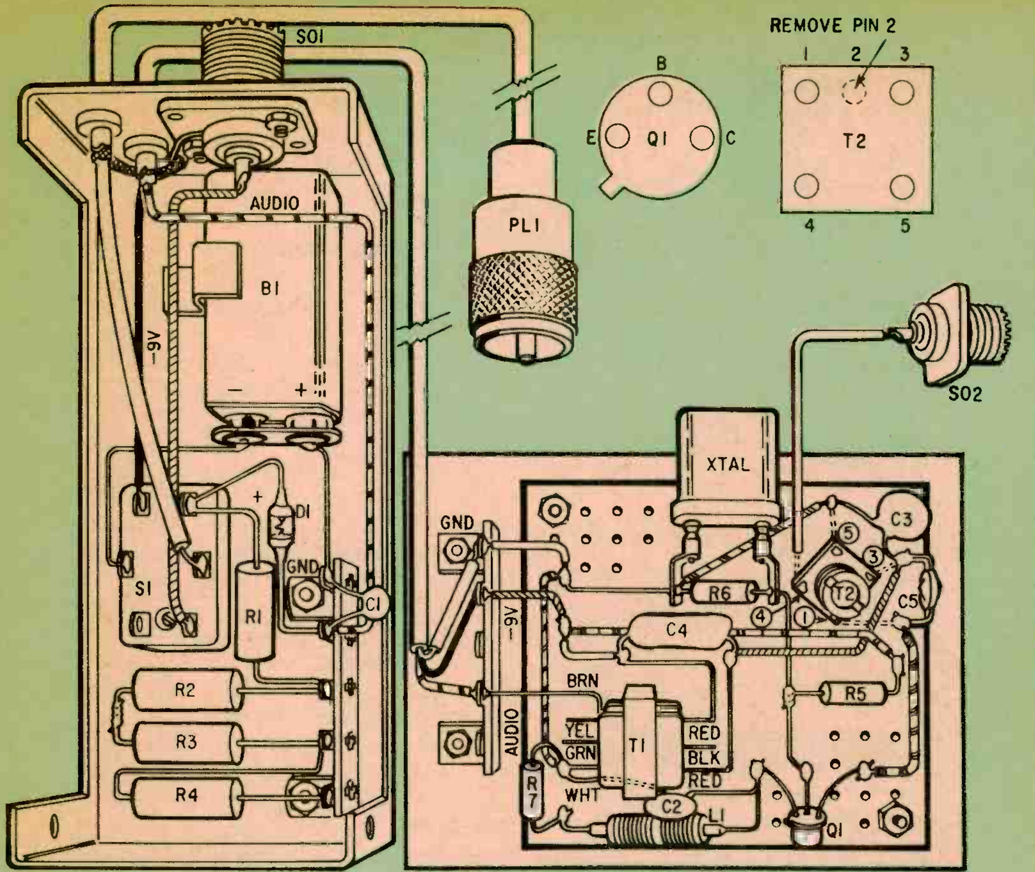




Top photo is of indoor unit. Put a solder lug under one of SO1's mounting screws and connect the shields from both cables to it. Power resistors at bottom of box are supported by their own leads. Use ½-inch-long spacers to keep the circuit board in indoor unit (bottom photo) above metal plate.



Switch S1 is in transmit position. Signal from CB rig is fed to dummy load (R1-R4) and also is detected by D1. Audio from D1 is sent up cable to T1, which modulates the 100-mw transmitter.



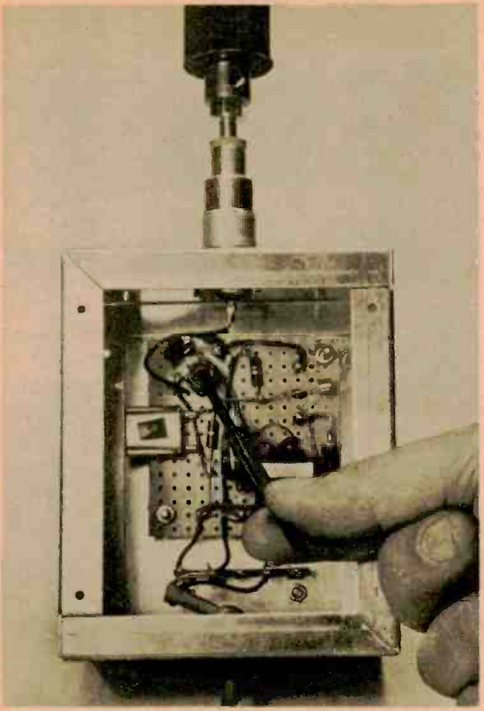
Indoor (left) and outdoor (right) units. Wiring shown in broken lines near T2 is on back of board. T2 is mounted by fitting its pins through holes and bending them slightly. Mount other parts on top of board, using flea clips as tie points, before attaching board to cabinet with ½-in. spacers.

PARTS LIST

B1—9 V Battery (RCA VS 323 or equiv.)
C1, C3—.001 mf, 75 V (or higher) ceramic disc capacitor
C2—25 mmf, 75 V (or higher) ceramic disc capacitor
C4—.15 mf, 75 V (or higher) tubular or ceramic disc capacitor
C5—4.7 mmf, 75 V (or higher) ceramic disc capacitor
D1—1N34 diode
L1—22 microhenry choke (J. W. Miller No. 9320-36. Or, evenly wind 50 turns of No. 32 enameled wire on a 500,000-ohm, or higher, 1-watt resistor. Solder wire to resistor leads)
PL1—PL-259 coax connector
Q1—2N963 transistor
R1-R4—12 ohm, 2 watt carbon resistor
R5—22,000 ohm, ½ watt resistor
R6—2,200 ohm, ½ watt resistor
R7—270 ohm, ½ watt resistor
S1—DPDT toggle switch
SO1, SO2—SO-239 coax connector
T1—Modulation and audio output-transformer; primary: 500 ohms, center tapped; secondaries: 3,000 ohms and 8 ohms (not used) Lafayette 99 G 6132.
T2—CB transmitter output coil (Lafayette 99 G 6204)
XTAL—Third overtone CB transmit crystal. Any CB channel except channel 1.
Misc.—45-inch Whip antenna (Lafayette 99 G 3015), 2-conductor shielded wire, length RG58/U coax, 4x5x3-inch aluminum box (Premier PAC-453), 5x2¼x2¼ aluminum box (Premier PMC-1004)

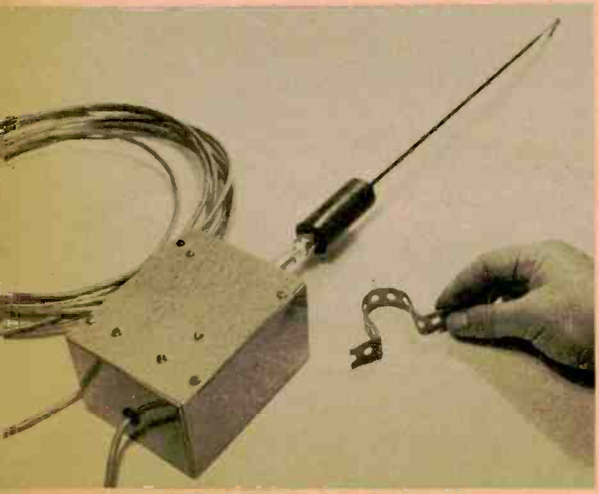
set S1 to receive.

Communication range with the Powerhouse should be somewhat better than with a 100-mw walkie-talkie. One reason for this is the antenna's height. The other reason is because you use your CB rig's receiver, which is considerably hotter than a walkie-talkie's receiver. Range could be from a half-mile to a mile—possibly more under optimum conditions.



After installing SO2 at top, put gasket material on edges of box and attach metal plate with circuit board. Insert cable, knot it, then solder its leads to terminal strip. Now connect SO2 to T2.

part 15 powerhouse



Outdoor unit (transmitter) ready for installation on mast. Clamp can be made from a piece of scrap aluminum. Varnish all joints to keep out moisture.

Construction. Build the outdoor unit on a small piece of perforated board as shown in the pictorial and photos. To mount transformer T2, clip off pin 2, insert the remaining pins in the board's holes as shown and bend them slightly.

Mount transformer T1 by forcing its mounting tabs through enlarged holes in the board. Clip off the leads that are not used. Use contacts from a discarded 7- or 9-pin tube socket to hold the crystal. Further construction details are in the captions.

First check of operation should be made indoors with the units near each other and with the whip antenna extended fully. Tune your CB rig's receiver to the same frequency as the outdoor unit's crystal. Flip the Powerhouse's transmit/receive switch (S1) to transmit. Now, adjust T2's slug with a plastic alignment tool and watch the S-meter. At some point it will begin to move up-scale, indicating oscillation has started. But do not tune T2 for highest S-meter indication or the transmitter will be unstable.

The best tuning point is where the crystal oscillates each time S1 is set to transmit. Flip S1 back and forth to make sure the oscillator starts each time. The most stable oscillation point can be found by tuning T2 for highest S-meter indication, then back off about one turn.

Check oscillator operation again with the outdoor unit mounted on the mast. When you're satisfied with operation, seal the box with gaskets and varnish.

[*Continued on page* 114]

Cut out this certificate, sign it and paste it on the side of the indoor unit before transmitting.

CERTIFICATE OF COMPLIANCE WITH FEDERAL COMMUNICATIONS COMMISSION REGULATIONS. PART 15. PARAGRAPH 205

ELECTRONICS ILLUSTRATED certifies that this low-power transmitting device can be expected to comply with the requirements of Paragraph 15.205 of the FCC Regulations under the following conditions:

(a) When this device is assembled with components of the specified values and according to the diagrams and instructions published in this magazine.

(b) When used for the purpose and in the manner indicated in the instructions.

(c) When operated on a frequency between 26.97 and 27.26 megacycles and using an antenna limited to a single element not more than 5 feet long.

Robert G. Beason

ELECTRONICS ILLUSTRATED, New York, N. Y.

dated: December 22, 1964

I hereby certify that I have assembled and adjusted this device in strict accordance with the above.

Owner's signature ....

Date ....

TOUGH GOING FOR CB

CITIZENS BAND radio has faced some pretty rough assignments but the U.S. Department of Agriculture has come up with one that must take some kind of prize. Fact is, the people in the USDA's Soil Conservation Service are giving CB some of its toughest going ever—making maps in Vermont's mountains.

Time was when the USDA's map makers used most every means short of smoke signals to communicate with one another. Let a worker be stationed 1,000 feet or so from his partner and he well might have to scream, jump and wave his arms to get his message across hilly and rocky terrain. But thanks to CB, giving detailed instructions to a USDA rodman these days is as easy as electronics can make it. And this is the case even when the gent is standing behind a 10-ft. outcropping with nothing in view but his survey rod.

Since the little 1-watters being used in Vermont sport a range of about five miles, they fill the bill nicely for the USDA. The rigs reach out at least a mile even under adverse conditions and surveyors normally don't sight more than 2,000 ft.

One of the SCS men, Noah Hudson says the radios have helped in more ways than originally hoped for.

"A rodman on the other side of a flood plain often spots a land feature hidden from our view," he explains. "With direct voice communications, we can easily decide whether we need this information."

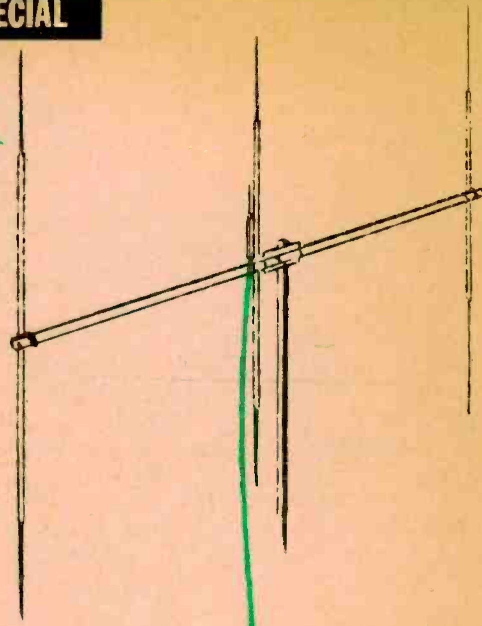
But the big extra CB offers the USDA is plain communications.

"For instance," says Hudson, "can you imagine hand-signaling an inexperienced man standing 2,000 feet away to tell him his stadia board rod is upside down?"

But now there's no need to—since CB is on the scene. *—Robert Levine*

Rough terrain demands gear that can take it, and the USDA's CB transceivers have proven they can. Though it's possible to fly them out for overnight repair, the rigs thus far have needed only a nightly recharging.

Skyhook Doctor



Antenna ills are the specialty of our electronic diagnostician.

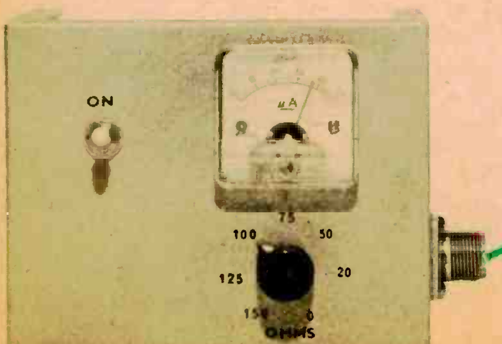
By BERT MANN

MANY are the CBers who get told that their 5-watt rig sounds like a 100-mw walkie-talkie with a collapsed antenna. What gives? Well, first thing to remember is that a set with a 5-watt input will give you only about 3 watts out. And next thing to bear in mind is that this 3 watts can disappear mighty quickly if your antenna system isn't tuned perfectly.

There are two good reasons why your 3-watt output can fizzle away to practically nothing. The first is that the antenna impedance may not match the transceiver's output impedance. The second is that when your transmission line or matching section *must be* an exact *electrical* half or quarter wavelength, it may not be.

When you cut the line you can't just calculate its length, measure it with a yardstick and then cross your fingers when you cut. The only reliable way to tune up your antenna system is with EI's Skyhook Doctor.

The Doctor is specifically designed for CB antenna systems. It will tell you an antenna's radiation resistance, determine the exact electrical length of transmission lines and indicate whether an antenna is really resonant in the Citizens Band.



The Doctor is different from other antenna analyzers because it has a built-in RF generator which makes it self-contained. This means you don't need a grid-dip oscillator (GDO) for a signal source. And to make sure measurements will be accurate, the built-in oscillator is crystal controlled.

Unlike other analyzers, which crowd the low impedances used in CB into a small part of the scale, the Doctor spreads its 0-to-150-ohm range over the entire potentiometer rotation.

Construction. The Doctor should be built in the main section of a 3x4x5-inch Minibox. Parts layout is critical and the pictorial must be followed exactly. The values and the type of components specified are critical; substitutions must not be made. Keep all leads short and do not square off leads where they bend.

The transistor's leads must be especially short. Therefore, use a heat sink—such as an alligator clip—on them when soldering.

Coil L2 is used as supplied except that you must cut off the center-tap lead. Potentiometer R6 must be insulated from the cabinet with ⅜-inch fiber shoulder washers to reduce the capacity between the control's case and ground. Also, make certain R6's knob setscrew is recessed so your fingers won't touch it.

Check-Out and Calibration. Plug in a

PARTS LIST

B1—9 V battery
Capacitors: 500 V ceramic disc
C1—150 mmf   C2—100 mmf
C3—250 mmf   C4, C5—500 mmf
D1—1N34A diode
J1—SO-239 coax connector
L1—20 microhenry video peaking coil (J. W. Miller No. 6152, Allied Stock No. 61 G 107)
L2—CB oscillator coil (Lafayette 32 G 0909)
M1—0-50 μa meter (Lafayette 99 G 5049)
Q1—2N706 transistor
R1—5,600 ohm, ½ watt resistor
R2—1,000 ohm, ½ watt resistor
R3—82 ohm, ½ watt resistor
R4, R5—100 ohm, 1% carbon resistor
R6—150 ohm, linear-taper potentiometer (Ohmite type AB, No. CU-1511)
R7—4,700 ohm, ½ watt resistor
S1—SPST switch
Misc.—3rd-overtone CB crystal and socket

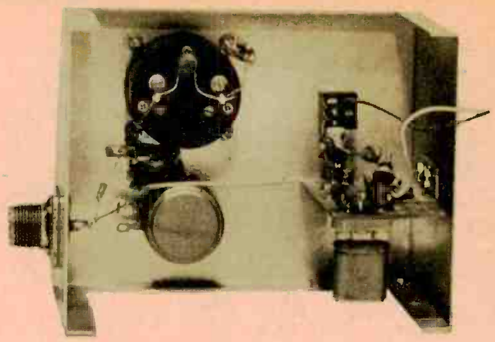


Fig. 3—Before installing the circuit board on the right side of the cabinet, mount all components shown on the left side of the photo. Duplicate our layout and you shouldn't run into any problems.

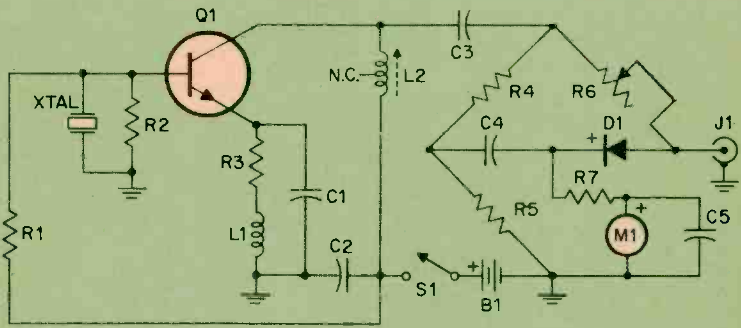


Fig. 1—Output of RF oscillator Q1 is applied to bridge and antenna. When resistance of R6 equals impedance of antenna system, bridge is balanced and M1 nulls. Coil L2 is resonated by the distributed capacitance of the circuit, hence there is no capacitor in parallel with it.

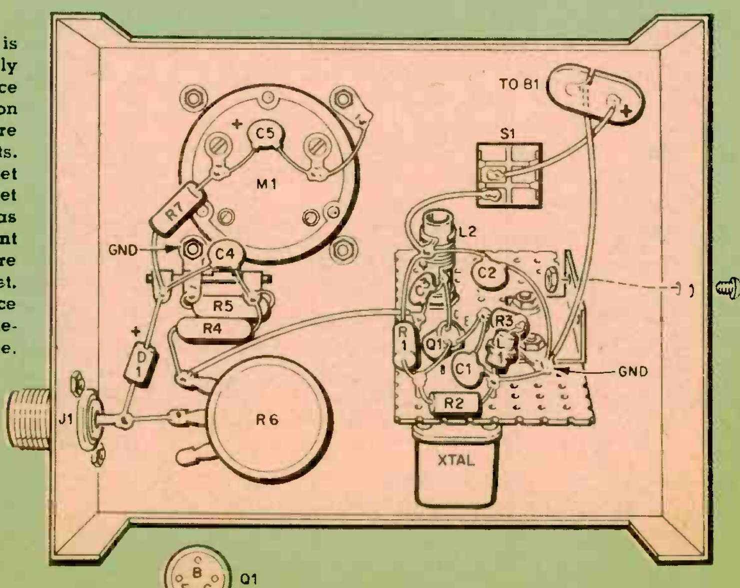


Fig. 2—RF oscillator is built as subassembly on a 2⅞x1⅛-inch piece of perforated board on which flea clips are used for tie points. Board is held to cabinet with a metal bracket which also serves as circuit ground. Mount parts on board before installing it in cabinet. Battery is held in place with another home-brew bracket or tape.

Skyhook Doctor

third-overtone CB transmit crystal (preferably a center-band channel) and rotate L2's slug clockwise until it is all the way *in* the coil. Then back the slug out so ⅛-inch protrudes. Next, turn S1 to *on*. If the oscillator is working, M1 will indicate about half scale. Using an insulated alignment tool, adjust L2's slug for highest meter indication.

If M1 does not move, check the oscillator by holding the Doctor near a CB transceiver tuned to the crystal's frequency. You should hear the signal. If you don't, try backing the slug halfway out. If you still can't pick up the signal, there's probably a wiring error or B1 is installed incorrectly.

Next, set R6 full clockwise and put a zero on the panel opposite the knob pointer. This point will serve as a reference should the knob be removed. Then select an assortment of *carbon* resistors such as 20, 50, 100 and 150 ohms. Cut the leads short, connect each resistor (one at a time) across J1 and rotate R5 for a meter null (zero). Then mark the resistance opposite the knob pointer.

Using the Doctor. All antenna tests should be made using a section of transmission line that is an exact electrical half-wavelength long. Using the setup in Fig. 6, cut the line slightly longer than its calculated length and connect one end to J1. Set S1 to *on* and turn R6 to zero. Clip off a small piece of the open end of the cable and short the inner and outer conductors. If the meter doesn't drop to zero, clip off another small piece of line and try again. When the meter indicates a null (zero), the cable is exactly an electrical half-wavelength (or multiple) long.

To determine the exact electrical length of quarter-wavelength sections (or *odd* multiples thereof) use the setup in Fig. 5. Again, set R6 to zero and leave the free end of the transmission line *open*. When the transmission line is exactly a quarter-wavelength long (or *odd* multiple) the meter will indicate zero.

To measure your antenna's radiation resistance, connect the Doctor to the antenna with a half-wavelength (or multiple) section of 52-ohms coaxial cable as shown in Fig. 4. The resistance opposite R6's pointer when the meter nulls is the antenna's radiation resistance. And remember, if your transceiver is designed to match 50 ohms, it will not transfer all its power if the antenna's radiation resistance is not 50 ohms.

Regardless of the indicated antenna radiation resistance, it must be *resistive*. An antenna which is resonant at the operating frequency should look like a pure resistive load to the transceiver. This is indicated by a complete meter null. If the meter nulls above zero, there is some reactance and the antenna is not resonant on CB frequencies. By trimming the antenna length, the radiation resistance will fall to a resistive 50 ohms, indicating resonance.

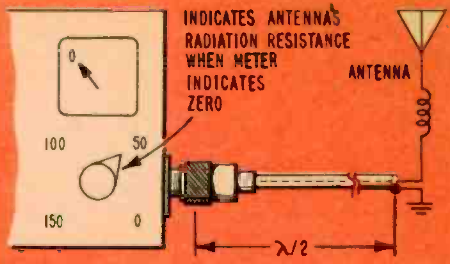


Fig. 4—To measure antenna's radiation resistance, line must be half-wavelength long.

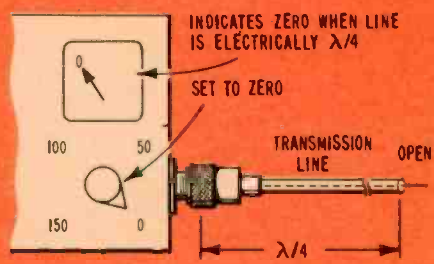


Fig. 5—Open-end transmission line is quarter-wavelength long when the meter nulls.

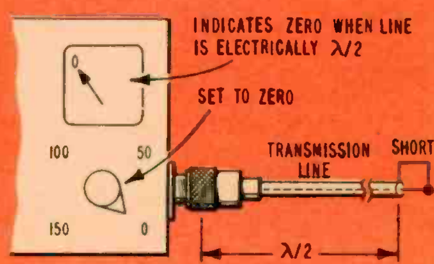


Fig. 6—Shorted transmission line is half-wavelength long when meter indicates zero.

SIDEBAND SCORE CARD FOR CB

By CHET STEPHENS

YOU can't tell the players without a score card, or so say the baseball fans. And the truth is, it's got so you can't tell sideband without a score card, either. For, depending on how you see it, sideband comes in any one of five different forms. It can be single or double, and with either suppressed or reduced carrier (the latter being the *sc* and *rc* on our score card). That takes care of four. The fifth is plain old AM with full carrier (the *fc* on our score card), though many's the CBer who'll tell you that *that* is old-hat.

What gives? Mostly, it's a play on a word, *sideband,* which for all its current glamour doesn't mean much in itself. (Even old-hat AM transmitters utilize a sideband or two.)

What most people mean by sideband is listed at the top of our score card—single-sideband, suppressed carrier. And, though Heathkit's Neil Turner didn't tack on the frills recently when he said, "I don't see any alternative to sideband on the Citizens Band," it's pretty safe to assume he meant *single* sideband (SSB), presumably with suppressed carrier. One thing he didn't mean is double sideband, full carrier, since that's precisely what we have now.

Once upon a time when you heard somebody talking about sideband you could be pretty sure about what he meant. If he was a ham he'd talk about DSB (suppressed carrier) or single-sideband (sometimes he'd talk about upper or lower sideband but SSB always meant a suppressed carrier). If military equipment was involved, it almost always was pure SSB. CB has changed all that until now when you hear of sideband rigs you always have to ask, "What *kind* of sideband?" The hard facts on sideband are these:

- The ultimate form of sideband transmission—single sideband—has no carrier. Therefore, it can't produce heterodyne interference. This means there'll be none—*if* all stations on a given channel utilize this brand of sideband.
- A second important feature of SSB is that only one sideband is transmitted—the upper or the lower. Advantage of this one is that there's room for a second, interference-free signal on every channel.
- Last, but certainly not least, is the fact that the power which formerly went into the carrier and two sidebands now can be placed in a single, intelligence-carrying sideband. Result is a rig with coverage considerably greater than that of a conventional AM transmitter.

There's no denying that something big would happen if every CBer used that No. 1 form of sideband. First off, there would be no heterodynes. More importantly, given the use of both upper and lower sideband, universal SSB operation would allow the present 23 CB channels to carry more than twice the number of readable AM signals they do now.

But exactly what is a CBer going to end up with when he buys something called a sideband transceiver? An amateur gets sideband equipment that's plainly marked. It's either double-sideband (suppressed carrier) or single-sideband (again with suppressed carrier and usually with an option of upper

SIDEBAND SCORE CARD FOR CB

or lower sideband, as we said). But for the CBer, sideband seemingly can mean whatever the guy who writes the promotion pieces thinks will get him to buy.

Initial attempt at sideband for CB was an adaptor for the General CB transceivers. This item converted what had been a standard CB transceiver into a double-sideband, suppressed-carrier rig. Unfortunately, like most adaptor equipment, this item never fired the CBer's interest.

CB's first commercial sideband success was and is Regency's Range Gain transceiver. A double-sideband rig, it differs from what the ham world would expect in that some of the carrier is transmitted. Reason is that Regency wanted its rig to be compatible with conventional AM equipment.

Because only a small amount of carrier is transmitted the carrier power saved is added to the sideband power (this system is the double-sideband, reduced carrier on our score card). Net effect at the receiving end is about the same as that of an AM transmitter with enhanced modulation.

Is the Regency effective? It is, and you can count on some extended coverage, too, since an increase in modulation effectively is equal to an increase in transmitter power. (The Regency idea caught on quickly and several dealers, Allied and Olson Radio among them, offer the same type rig with a few variations.)

But is the Regency sideband? A ham wouldn't call it sideband, nor would the armed forces. The Regency still has a carrier and a carrier means heterodyne interference, the major CB problem and the exact thing that can be cured with true sideband transmission. And there still are two sidebands using the entire channel bandwidth. Even if every CBer used a Regency, interference would be just as bad as it is today.

Since the sideband idea fired the imagination of many CBers, it was only logical that buyer interest could be developed through use of that magic word. The Lafayette HB-333, for example, soon was described as, "Double sideband with full carrier . . . 20 watts PEP input . . . full carrier at all voice levels." Read that one again and you'll discover about the best description of a conventional 5-watt AM transmitter you're ever going to see (we call this one *AM, fc* on our score card).

True, the Lafayette employs a speech clipper to raise the *average* modulation percentage and thus give enhanced modulation. Result is that coverage is extended just as though transmitter power had been increased. But is it sideband? No.

For honest-to-goodness sideband we must look to the Mark Sidewinder, a true sideband rig with suppressed carrier and a choice of upper or lower sideband. With only sideband on a given channel, several Sidewinders simultaneously could utilize the channel without causing objectionable interference with each other. Within the realm of crystal frequency tolerance, the conversation-carrying capacity of each channel could be increased four times, maybe more.

Looking at it another way, if every CB station were true single-sideband, the seven channels now allowed for inter-station communications could carry more readable signals than all 23 channels with AM.

The important question is: do *you* need sideband? Assuming you're after just a little extra coverage, the Regency or the Lafayette perhaps is the proper choice. And if you need a new transceiver, they may be the answer. But if your present gear still is good, a fully directional beam will give you a lot more extended coverage than you'd get from enhanced modulation.

In systems where getting the message through is of vital importance, true sideband has something to offer. Power for power, single sideband still will be readable after ordinary AM long since has flopped into the noise level.

On the other hand, if you insist on sideband for run-of-the-mill applications, you're in for a disappointment. Remember, the receiving station must be equipped to receive sideband or your signal will sound like a barrel of monkeys fighting over one banana. Further, all you need is just one ordinary AM station on the channel to jam sideband reception. If everybody had SSB there'd be no such jamming, but that's not the case—and isn't likely to be for a long time to come. ◆

Now You Can

MAKE ANY 5-WATTER PORTABLE!

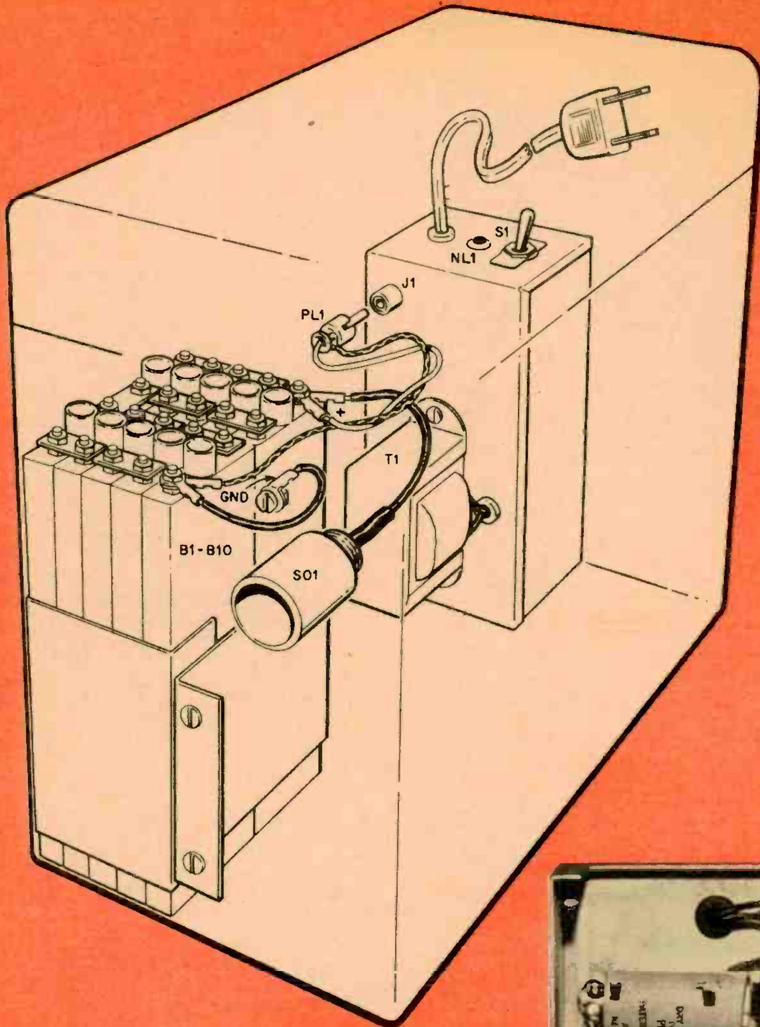
EI's lightweight power supply puts your big rig on the air anywhere.

By HERB FRIEDMAN, KBI9457

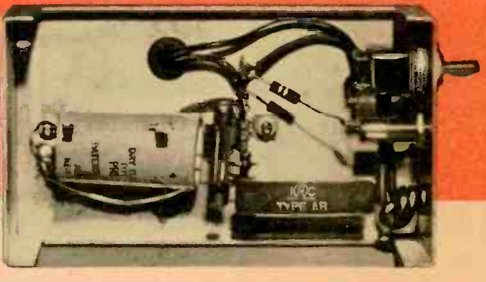
COMMUNICATING in the field with 100-milliwatt walkie-talkies can be a chancy affair because of the limited power and short range of the palm-size rigs. Your chances for getting solid coverage improve with the 1-watters and 2-watters but your best insurance still is a full 5-watt transmitter. Only trouble is a power supply.

Unless you have long extension cords attached to your car, full 5-watt operation is limited to where you can drive (assuming you don't care to lug along a gasoline-powered generator). But with EI's Power Pack you can operate your 5-watt rig any place—at the beach, in the jungle or on the top of a mountain. And you don't have to lay out a lot of cash for a high-power mobile transceiver. Just take your base rig along.

The Power Pack is a lightweight battery/charger combination specifically designed for powering 5-watt transceivers. And it's only a fraction of the weight of a car battery. The battery in the Power Pack is a handful of high-efficiency nickel-cadmium cells which will power the most complex transmitter continuously for at least an hour. Run of the mill transceivers can be powered continuously for an hour and a half to two hours.



The charger and battery pack are housed in a letter file cabinet which can be obtained at most stationery stores. The battery pack is held in place with a bracket made with scrap aluminum or tin. Make certain the bracket doesn't cover the liquid-level marks. To prevent the battery pack from rattling around, put pieces of sponge rubber between it and the bracket. The charger is held in position with two sheet-metal screws passed through the file cabinet. To prevent damage to the battery pack, do not connect PL1 until everything is mounted. Below is photo of inside of charger.



5-WATTER PORTABLE

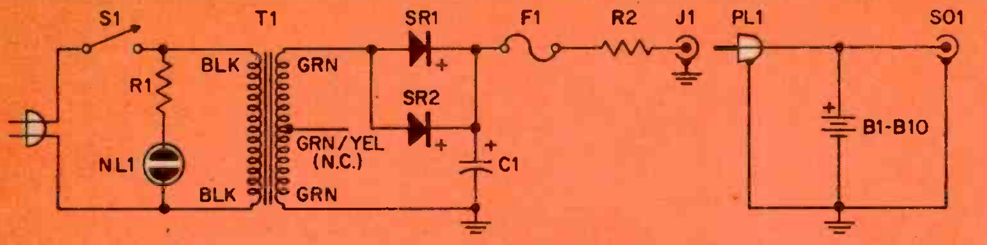
Transistor rigs can be powered for four to eight hours.

The Power Pack is designed to be worry-free. Instead of using a high charging rate, which would cause the battery cells to give off a lot of hydrogen gas, we use a ten-hour trickle charge. This prevents damage to the cells. Plug the charger in at night and the battery will be at full charge in the morning. If you exceed the ten-hour charge time the battery won't be damaged.

Construction. The battery pack consists of 10 nickel-cadmium cells which deliver a nominal 14 volts. The cells we specify are

PARTS LIST

B1-B10—1.25 V nickel-cadmium cell (10 reqd.) Available from ESSE Radio Co., 368 S. Meridian St., Indianapolis, Indiana 46225 Prices plus postage; new, Stock No. AH4R ($2.49). Used, Stock No. AH4C ($1.49)
C1—500 mf, 25 V electrolytic capacitor
F1—1 A slo-blo pigtail fuse
J1—Phono jack NL1—Neon lamp assembly
PL1—Phono plug
R1—120,000 ohm, ½ watt, 10% resistor
R2—3 ohm, 10 watt wirewound resistor
S1—SPST toggle switch
SO1—Cigarette lighter socket (see text)
SR1,SR2—Silicon diode, minimum ratings: 750 ma, 25 PIV
T1—Filament transformer, 12.6 V @ 2 A (Allied Radio 61 G 420 or equiv.)
Misc.—Cigarette lighter plug (Lafayette 32 G 0931 or equiv.), letter file cabinet, 5¼x3x2⅛-inch Minibox



Schematic of the Power Pack. The charger consists of step-down transformer T1, parallel-connected diodes SR1, SR2 (connected as a half-wave rectifier), filter capacitor C1, fuse F1 and current-limiting resistor R2. Output goes to battery pack consisting of 10 series-connected nickel-cad cells.

guaranteed surplus and either $2.49 new cells or $1.49 used cells can be employed. The cells are connected in series with links made from scrap aluminum. After they are connected, wrap them tightly with tape, taking care not to cover the red liquid-level lines.

Don't worry if the new cells appear to be bone-dry. They are supplied discharged and the electrolyte is in the plates. *Don't* try to fill the cells.

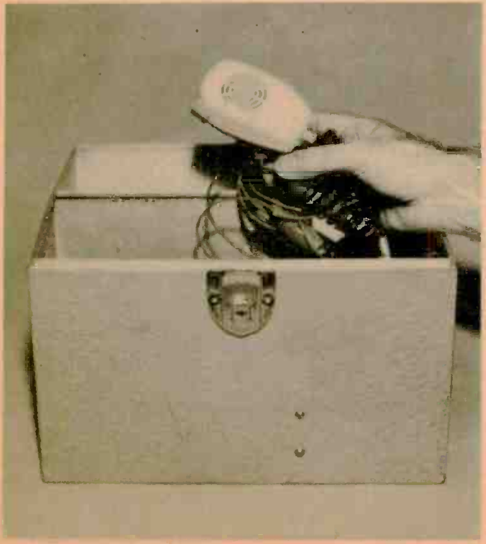
The charger is built in a 5¼x3x2⅛-inch Minibox. Under no circumstances change C1's value, since it determines the charger's output voltage. And don't change the location of fuse F1 in the circuit. SO1 is a standard cigarette-lighter socket. For good contact, screw it tightly to the cabinet.

Battery Care. Though the low charging rate sharply reduces gas generation, some is still given off during charging. Therefore, each cell must be vented to prevent the internal gas pressure from cracking the plastic case. Before charging, loosen the filler-cap screws one or two turns. After charging, tighten the caps. Since these cells retain their charge a long time, you can charge them several days—or even weeks—before use.

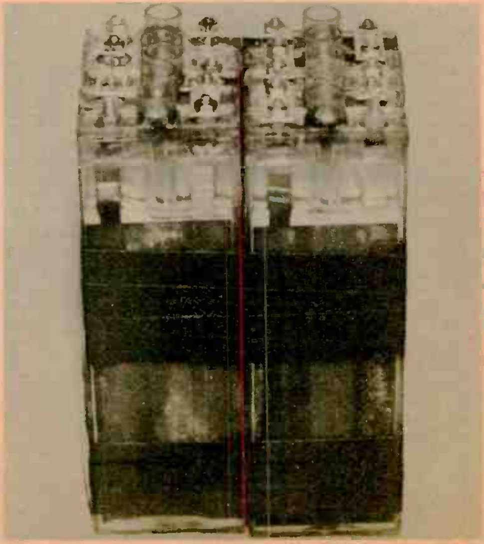
After using the Power Pack three or four times, check each cell's electrolyte level. If it has fallen below the red line *after* the battery is fully charged add only enough distilled water to bring the level slightly over the line. *Never* add electrolyte.

[*Continued on page* 117]

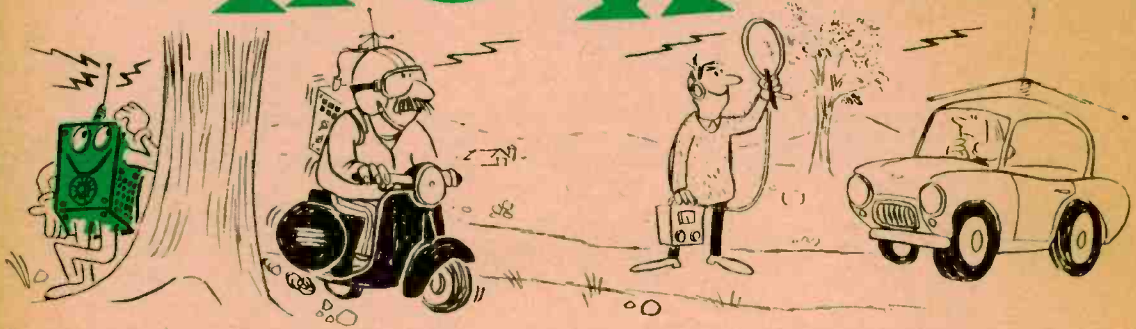
Finished and ready to go. There's plenty of room in the cabinet for a CB transceiver's accessories.



Battery pack is made up of 10 nickel-cad cells connected in series and taped together tightly.



THE TRANSMITTER THAT HOWLS



You hide it. They find it. Here's a game that puts life into CB gatherings!

By R. L. WINKLEPLECK, KHA1353

CITIZENS BAND picnics and club meetings have a way of becoming tedious affairs. First come the long-winded discussions of current news, future activities and the latest equipment. Then after hours of socializing and beer guzzling the crowd breaks up and goes home. You wonder why you attended.

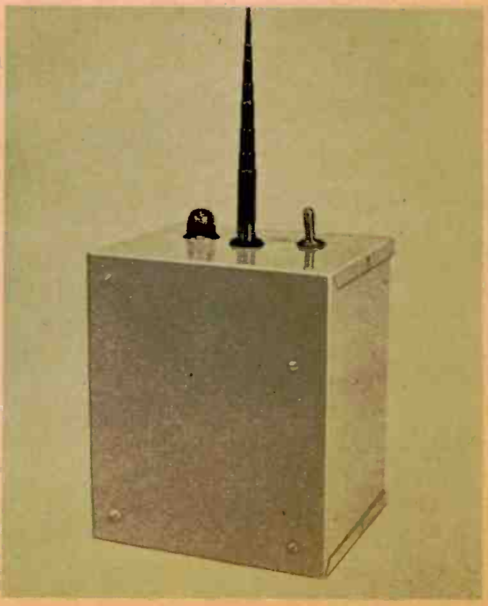
It's not the subject or the company that gets boring. It's the routine. Instead of offering sympathy, we suggest a routine-breaker—a game with the Transmitter That Howls. Tell everyone ahead of time that the Howler will be used for a hidden-transmitter hunt after the meeting.

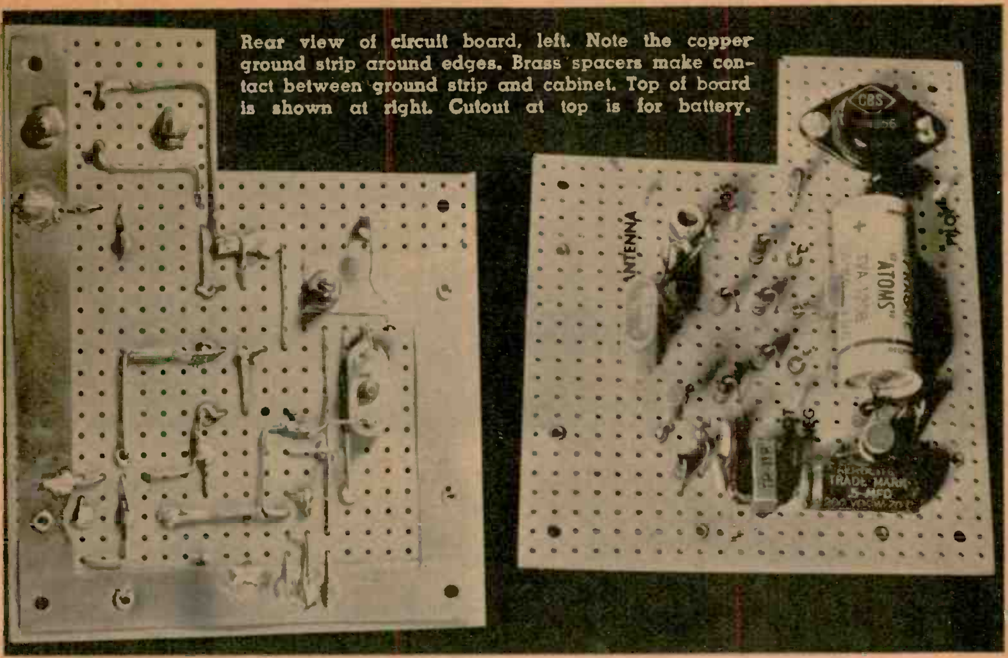
The object of the game is simple—find the Howler. It's hidden somewhere and is transmitting a 4-second, tone-modulated signal every 12 seconds. After the Howler has been planted and turned on, the mobiles are set loose to find it. Contact between mobiles is permitted, but the Howler's channel should be kept clear. Though the mobiles are working as CB units, the Howler, because of its type of signal, is operating on the parallel License-Free Band and has an input of 100 milliwatts or less—which makes such hunts legal.

Direction finders usually are outlawed in hidden-transmitter hunts. But you can get an idea of the Howler's location by keeping your eye on your S-meter or adjusting the receiver's squelch so the signal just breaks through when it is strongest.

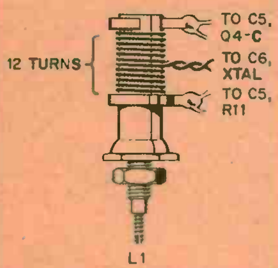
Another trick is to place the Howler in the auto of a non-CBer and connect the Howler's antenna to the auto-radio antenna. Thus, identification of the car is not possible. Only the signal itself will be a clue. The auto should

Ready to be hidden. Pilot lamp to left of antenna lights during 4-second time transmitter is on.

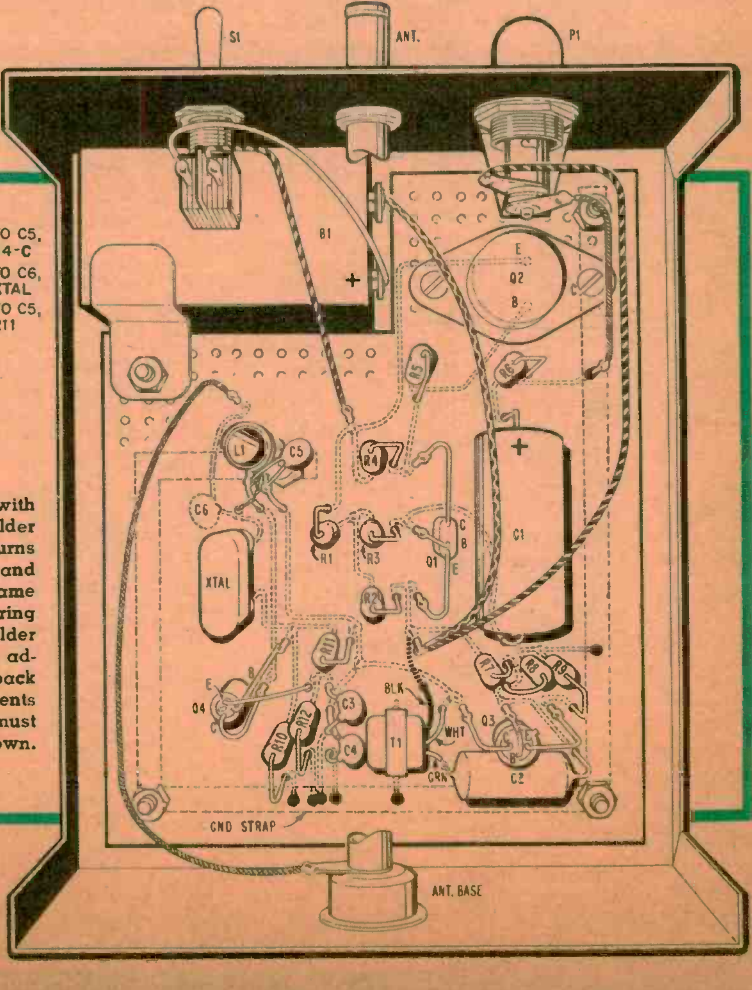




Rear view of circuit board, left. Note the copper ground strip around edges. Brass spacers make contact between ground strip and cabinet. Top of board is shown at right. Cutout at top is for battery.



Mount ring supplied with form at top then solder wire to it. Wind 6 turns evenly, pull out loop and wind 6 more turns in same direction. Slip other ring against winding and solder wire to it. Mount coil so adjustment screw is on back of board. RF components on left side of board must be positioned as shown.



THE TRANSMITTER THAT HOWLS

be driven through a congested area of town and must be kept moving.

A mobile operator who has located the quarry calls in the make of the car and its license number to the master of the hunt. He wins the prize if his identification is correct. If he's wrong he's out of the game.

The Howler is made to order for CB Civil Defense searches and rescue drills. A county can be divided into sectors and a mobile team assigned to each sector. Under the guidance of the radio officer operating a controlled net, the search teams are dispersed. Reports are returned and the teams zero in as the first weak signals from the Howler are picked up. Then the final intense search is made.

The Howler is battery powered for portability and transistorized for ruggedness. Using the parts specified and a 9-volt battery the Howler's input power is 35-40 mw. If you use a 12-volt battery (put a 560-ohm resistor in series with P1), input power is 100 mw.

One reminder: if the Howler and the hunt begin to interfere with normal CB communications on the chosen channel, the hunt must be called off to comply with the FCC's non-interference rules.

Construction. The Howler doesn't contain many parts. Therefore, it can be built in a small box. We were able to fit all parts on a 4½x5½-inch piece of perforated board which was installed in a 4x5x6-inch Minibox. Brass eyelets were used for tie points but you could use flea clips.

Layout is not critical although short leads are a must in the RF-oscillator section. As you can see in the pictorial and photos, we used a copper strip around the edge of the board for ground connections. The frame of T1 and L1's mounting collar should be grounded to the strip.

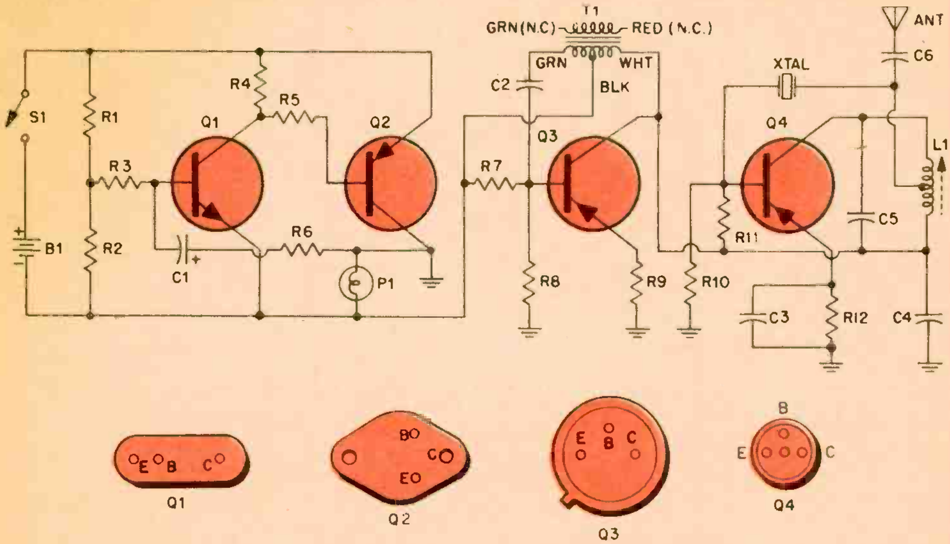
We suggest you first build the pulsing circuit, which consists of transistors Q1 and Q2 and associated components. When this much is completed, turn on power to see whether the lamp flashes properly. If it stays on, increase the value of R1. If it won't light, increase the value of R2. Next, add the audio oscillator (Q3 and associated components). Apply power and check its operation with a scope or a pair of phones. You should be able to pick up a signal at the collector of Q3.

RF oscillator coil L1 consists of 12 turns of No. 22 enameled wire closewound on the form specified in the Parts List. Wind the coil on the end of the form farthest from the mounting collar. The ends of the coil get soldered to the terminal clips supplied with the form. The center tap is a twisted loop of wire pulled off after the sixth turn.

When the RF stage is completed it should be tested by connecting the negative battery lead to the black lead of T1 and the positive lead to the ground strip. Insert a crystal and use a short length of hookup wire for an antenna. If the RF oscillator is operating you'll hear an audio tone in a nearby CB transceiver tuned to the crystal frequency. Adjust L1's slug to a point just below peak output for most dependable operation. An S-meter on the receiver will aid you in finding the best setting for L1's slug. But you will have to readjust the slug after the 52-inch antenna is installed.

PARTS LIST

B1—9 V battery (Eveready No. 246 or equiv.)
C1—250 mf, 25 V electrolytic capacitor
C2—.5 mf, 100 V tubular capacitor
C3, C4, C6—.001 mf, 75 V ceramic disc capacitor
C5—39 mmf, 500 V ceramic disc capacitor
L1—Coil: 12 turns (center tapped) No. 22 enameled wire close-wound on J. W. Miller No. 4500 (Lafayette stock No. 34 G 8952) coil form.
P1—No. 47 pilot lamp and socket
Q1—2N35 transistor
Q2—2N256 transistor
Q3—2N107 transistor
Q4—2N274 transistor
Resistors: ½ watt, 10%
R1—12,000 ohms
R2—1,200 ohms
R3, R7—8,200 ohms
R4—1,000 ohms
R5—220 ohms
R6—5,600 ohms
R8—2,200 ohms
R9—47 ohms
R10—10,000 ohms
R11—100,000 ohms
R12—100 ohms
S1—SPST toggle switch
T1—Audio transformer: 500-ohm center-tapped primary, 8 ohm (not used) and 3,000-ohm secondaries (Lafayette 99 G 6132)
XTAL—Third-overtone CB transmit crystal
Misc: 52-inch telescoping antenna (Lafayette 99 G 3008 or equiv.), 4x5x6-inch Minibox.



Pulser (Q1, Q2) is a complementary-symmetry amplifier that oscillates on and off because of feedback through C1 and R6. When Q2 conducts, P1 (Q2's load) lights. The voltage drop across P1 is applied to the modulator (Q3) and turns it on. The voltage also causes RF oscillator Q4 to start.

Install the circuit board in the Minibox, using ¾-inch-long spacers to keep its backside above the inside of the box. Next, install the antenna, pilot light and switch. The antenna extends through a hole in the top of the box in which a grommet is installed. Secure the battery with a bracket and the job is finished. Happy hunting!

CERTIFICATE OF COMPLIANCE WITH FEDERAL COMMUNICATIONS COMMISSION REGULATIONS, PART 15, PARAGRAPH 205

ELECTRONICS ILLUSTRATED certifies that this low-power transmitting device can be expected to comply with the requirements of Paragraph 15.205 of the FCC Regulations under the following conditions:

(a) When this device is assembled with components of the specified values and according to the diagrams and instructions published in this magazine.

(b) When used for the purpose and in the manner indicated in the instructions.

(c) When operated on a frequency between 26.97 and 27.26 megacycles and using an antenna limited to a single element not more than 5 feet long.

Robert H. Beason

ELECTRONICS ILLUSTRATED, New York, N. Y.

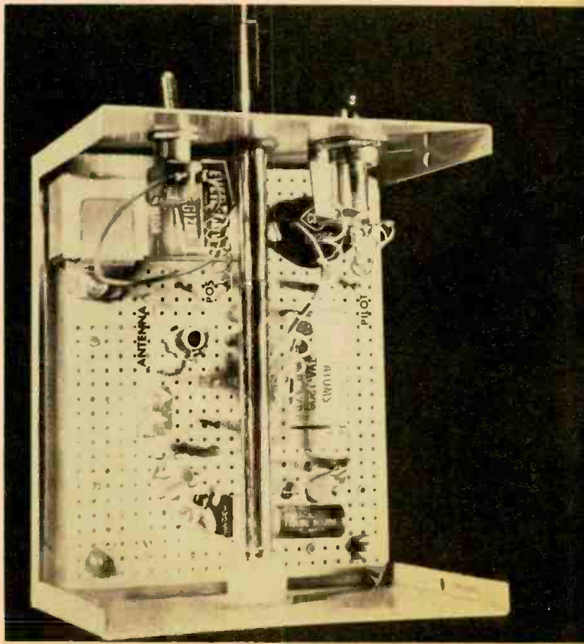
dated: December 22, 1964

I hereby certify that I have assembled and adjusted this device in strict accordance with the above.

Owner's signature ....

Date........................

Cut out this certificate, sign it and paste it on back of transmitter before you start the hunt.



Inside view of completed transmitter. Telescoping antenna fits through grommet in top of box and mounts in an insulating block at the bottom.

MOBILE

There are tricks to all trades and mounting

By **REID ETTA** Give yourself the little additional time it takes, cough up ten bucks and you can have a worry-free, reliable, professional-type mobile installation. You'll have no more transmission lines that snag a pants leg or get torn out of a connector, no more shaking the guts out of tubes with the resulting need for replacement, no more half-sick signals stemming from a heater voltage that just about lights the tubes. Instead, you'll enjoy sharply reduced signal flutter from mobile-in-motion. And best of all, you just may end up with every last iota of RF output your rig is capable of delivering.

A pro type installation starts with a rigid transceiver mount. Note that word *rigid;* the rig must become an integral part of the car, which in most instances means the dashboard. Though transceivers are made to withstand the jogs and jolts that form an inseparable part of everyday driving, they aren't designed to vibrate constantly due to weak or springy mounting. Fact is, it's constant oscillation rather than sharp jolts that shakes the life out of tubes and other components. It's also oscillatory motions that normally loosen mounting screws.

Pick a location under the dash which doesn't interfere with the driving controls and mount the mobile bracket with ¼-in. hex-head bolts. (If your rig came with hardware smaller than ¼ in., you'd best discard it and go for the bigger size.) And be sure to use internal starwashers under the nuts. The ¼-in. hardware will allow you really to tighten the mount to the dash, and the hex-heads will permit you to use a socket wrench rather than a screwdriver. Reason you need a socket wrench is that it will give you a lot more leverage in the tight confines under the dash.

Next comes the power-supply cable. And the importance of this nondescript feeder shouldn't be underestimated, since right here you can lose a healthy part of your RF output. Topflight receiver performance also can go down the drain unless this part of the installation is 100 per cent AOK.

If you cut into the existing auto writing and make a sloppy high-resistance splice, the voltage at the transceiver well may fall to 11 or even 10 volts. Result will be reduced heater voltage and a lower-than-normal B+.

And even if you're adept at splicing, auto wiring can be deceiving. What appears to be a heavy, high-current-handling conductor easily can turn out to be a relatively thin wire

Under-the-dash mounting provides support enough for most modern transceivers. Use tungsten-carbide bits and medium-speed drill for best results.

Tight quarters make screwdrivers the wrong tool for the job. Best bet is a socket wrench and biggest hex-head screws mounting bracket can accept.

MAGIC

a mobile rig assuredly is no exception.

with heavy insulation. Hook into a wire like this and it like as not will be unable to carry the extra transceiver current without a big voltage drop.

For several reasons the best place to tap the battery is at the ignition switch. Here you ordinarily have a battery terminal, a starter terminal, an ignition voltage terminal and an accessory terminal (sometimes two). The accessory terminal is designed to handle high currents of the sort transceivers ordinarily require and its use precludes unauthorized operation of your CB gear—by the car jockey at the local garage, say. Since the accessory terminal is operative only when the ignition key is inserted, you also are assured that the CB gear won't be left on overnight.

For those unable to snuggle under a compact car's dashboard in order to get at the ignition switch, the battery-clamp terminals themselves are a convenient power source. Use a heavy wire—No. 12 or, better still, No. 10—and slip the wire between the clamp and the nut (not between the clamp and the screwhead). Be sure to place a washer between the nut and the wire.

Run the grounded power lead directly to the car frame, keeping it as short as humanly possible. Don't depend on the coax cable's shield or the mounting bracket to provide the ground connection since you easily can get a high-resistance ground. Further, many transistorized transceivers plain don't use the chassis for the negative battery connection.

Next comes the antenna, of which there are three basic types: the bumper mount, the communications-style body mount (the kind the cops use) and the loaded-coil body mount which resembles a standard auto-radio antenna.

Bumper mounts require bumper guards. Should a bumper mount stick out all by its lonesome, it's likely to shear off if you kiss bumpers while backing into a parking space. This mount needs the protection of a bumper guard and for maximum protection the mount must be as close as possible to the guard. Even this protective device will do you no good if the antenna is positioned on a part of the bumper that sticks out past the guards.

Body mounts have their own special problem: auto manufacturers. Car bodies are as thin as the makers can get away with and even the best body-mount installation is going to deform the metal at high speeds (like 20 mph). The minimum amount of metal must be removed from under the body mount, but hacking away with a can opener or saw is not

Transceiver must fit snugly in bracket if unnecessary vibration is to be avoided. Lockwashers under thumbnuts often make for increased rigidity.

Microphone can be replaced with handset for maximum convenience. Lifting handset from cradle cuts speaker, feeds audio into handset earpiece.

MOBILE MAGIC

the way to do it. Cut the mounting hole with a radio chassis punch that produces a hole exactly the size specified by the antenna manufacturer. Keep in mind that a punch only ⅛ in. oversize will remove a substantial part of the supporting metal.

No matter how well you cut body holes, any hole in a late-model car reduces its trade-in value. Should this worry you, a loaded antenna body mount can be used. This mount resembles a standard car-radio antenna and can be left on the car at trade-in time.

If you use a communications-style body mount or a bumper mount, invest a few extra dollars in a heavy-duty spring and a stiff whip. Most signal flutter is caused by soft springs and whips which allow the antenna to bend sharply at moderate to high speeds. Heavy-duty springs and whips, in contrast, keep the antenna almost vertical under most driving conditions. And don't be misled. A spring isn't meant to give under a small impact; it should protect only against shocks that literally would tear the antenna and mount off the car.

For CBers with low garages and high whips, a device known as an *easy-off* or *quick-release* is a must. Placed between the whip and spring, it permits the whip to be removed with a flick of the wrist.

Finally we come to the transmission line. All too often it lies on the floor, getting stepped on, tangled up with passengers' feet and legs or perhaps crimped under the back seat. But since the rest of the car wiring is hidden and protected, why not the transmission line?

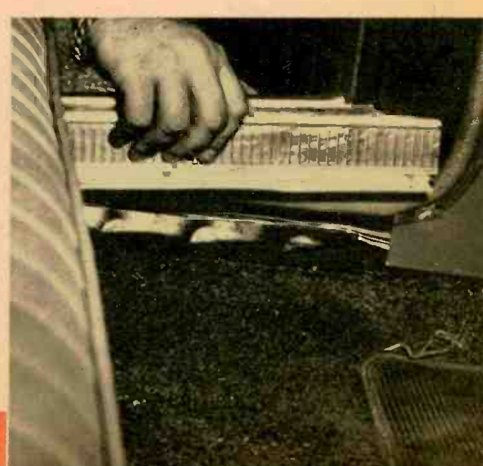
Cars ordinarily have a wiring channel from the firewall to the trunk which carries the manufacturer's wiring, and there's more than room enough in the channel for a coax cable as well. Usually the channel is under the door kickplates on the driver's side. Unscrew the metal kickplate from the front and rear doors and lay the cable in the channel or behind the wiring clips.

If you can't get past the back seat, try unfolding a metal coat-hanger and jamming it past the seat from the trunk side. This done, you should be able to tape the coax to the hanger securely and carefully pull it through to the trunk.

Make certain that the coax lies free of obstacles in the channel, then replace the kickplates. End result of your labors should be an installation so good that even your best friend would be hard put to tell you where the coax is.

If by chance the manufacturer has concealed the channel so skillfully that it can't be located, the coax often can be pushed under the kickplates. It then can be retained with short strips of tape.

Chassis punch is required to cut hole for body-mount antenna. Punch makes hole to precise size, insures car will possess maximum trade-in value.



Wiring channel can be exposed by removing front and rear door kick-plates. If present, channel offers ideal way to hide coax transmission line.

CB SPECIAL

those TOTABLE TRANSCEIVERS

By HANK FISCHER

JUST a few years ago the term "walkie-talkie" conjured up a certain picture every time it was heard—a picture of a dogface trudging along with a 40-lb. transceiver strapped to his back. After the war came a civilian version of the famous two-way radio set but it was no more portable than its pappy and its ability to burn up expensive batteries was unimpaired. But, thanks to transistors, the modern walkie-talkie is a true midget. It fits in a jacket pocket and it lunches modestly on a few penlight batteries or perhaps a 50-cent transistor energizer. And a basic model can cost as little as $10. Its new image has almost no relation to the old one.

For the potential user who needs a rig with plenty of sock, there even are full-feature 5-watt walkie-talkies. Powered by a rechargeable nickel-cadmium battery that's good for nearly half a day's continuous operation, these units are small and light enough to be tucked into a camper's knapsack. And somewhere in and between the two extremes are models designed for just about every purpose.

But this superfluity presents a problem of its own. There are so many transceivers on the market that it's well-nigh impossible to determine which

TOTABLE TRANSCEIVERS

one is for you. Should you need a rig that will transmit a few blocks, it would be silly to spend $100 when a $10 job would do. On the other hand, under-buying (purchasing a low-cost unit which simply won't put your voice where it's needed) also deserves a dunce cap. Only way you can determine which is the right model for you is by considering carefully all the walkie-talkie types presently available.

The basic walkie-talkie is the so-called license-free, 100-milliwatt job. Any unit operating on the CB frequencies with an input power of 100 mw or less to the last RF amplifier falls in the license-free category. These units can be used by anyone, regardless of age. But there is one catch: a CB license must be obtained if they are used to communicate with a licensed CB station. Matter of fact, all standard CB rules then apply.

Bottom of the 100-mw class starts at about $10. These low-price units usually have three transistors—occasionally four—and use a standard 9-volt transistor-radio battery. Though they fall under regulations governing 100-mw units, their input power usually checks out more in the neighborhood of 30 mw. This results in a reliable working range of two or three city blocks or roughly a quarter-mile. (Some units claim a range of ¾-mile or more and this is possible—if the two units happen to be on adjoining mountain peaks.)

The transistors in these units double in the receive mode as a superregenerative receiver having good sensitivity but virtually no selectivity. More often than not, the ability of those sets to reject adjacent-channel interference is so poor that a strong signal on any of the 23 CB channels will be heard. But don't pass

A QUICK LOOK AT WHAT'S WHAT

100-mw TRANSCEIVERS

Company	Model	Price	Special Features *
Allied Radio	Knight C-100	$8.88	R/K
	Knight C-555	17.88	K
	24SC161-G	35.95	BCB radio
	24SC175-G	33.95	N
	24SC162-G	59.95/pr.	Battery-condition indicator
American Character	Ranger		
Cadre	C-60	59.95	NB
Concord	TG-093		
Electrosolids	Spacephone S-2100	9.95	R/K
	Spacephone MK II	15.95	R
EICO	740K	59.95	NC/K
Fannon	FCB-9	64.95	
Hallicrafters	CB-6	59.95	
	CB-11	79.95/pr.	
Heathkit	GW-31	19.95	R/K
	GW-21	49.95	N/S/K
Johnson	Personal Messenger	109.50	N/S/NB
Lafayette	HA-70A	10.95	R
	HA-85	19.95	
	HE-29C	25.95	
	HA-60	33.95	Separate mike and speaker
	HE-100	39.95	S/Separate mike and speaker
Magnavox	WT-101	49.50	
Matsushita	Panasonic T-1	129.95/pr.	
Midland	Triumph 10	34.95	
Olson	RA-639	9.99	R
	RA-638	29.99	
	RA-645	32.95	
Philmore	WT-3	11.50	R
	Portophone TC-95	39.95	
Radio Shack	60-3030	9.90	R
	TRC-1	21.95	
	TRC-2	29.95	
	TRC-3	37.95	N/S
Ross	200	69.50	
Sony	CB-106	149.95	
Toshiba	ZS-2161A		
Vangard	Mark I	59.98	R/4-channel
WRL	WT-100	10.95	R
	Spacemate	34.95	

the walkie-talkies by on the grounds that they're little more than toys. For short-range work in an area of low CB activity—in open country or on a farm, say—they are convenient, efficient and have low upkeep (battery cost).

Next price class is $20 to $30 and here things get a bit sticky. Reason is that the manufacturer usually offers an improvement in the transmitter or receiver, though rarely in both. Most common improvement is in the receiver; instead of the easily jammed superregen, a simple superheterodyne circuit is used. And while this isn't much better than the superregen, selectivity is improved to the point that only signals on channels immediately adjacent to the one you are using likely will cause interference. For units at the top of this price range, you are entitled to expect a receiver with at least two IF amplifiers and possibly an RF stage.

As for the transmitter, *that* is a steed in another stable. At the $20 to $25 price level, the transmitter is perhaps a shade better than that in the ten-buck versions. But most of the extra money has gone into the receiver, leaving a transmitter with an input of 25, 60 or *maybe* 100 mw. (At the $25 level and beyond the transmitter likely will run the full 100-mw input.)

As a rule of thumb, a transmitter using two transistors is superior to one with but a single transistor. The extra transistor usually means a higher input power or a better match between transmitter and antenna. However, never sacrifice the transmitter for the receiver. In other words, if the choice ever is between a two-transistor transmitter and a double-IF-plus-RF receiver, by all means go for the unit with the better receiver. The old if-you-can't-hear-'em-you-can't-work-'em rule applies even to walkie-talkies.

Between $35 and $60 you've a right to expect hot performance in both transmitter and

IN TOTABLE TRANSCEIVERS

HIGHER-POWER TRANSCEIVERS

Company	Model	Price	RF Watts	Special Features *
Allied Radio	Knight KG-4000A	$59.95	1	N/S/NB/K
Cadre	C-75	99.95	1.5	N/S/NB/2-channel
Hallicrafters	CB-8	99.95		NC/N/S/2-channel
Heathkit	GW-52	79.45	1	N/S/NC/K
Lafayette	HE-75	59.95	1	N/S/NB
	HA-150	79.95	1	N/S/2-channel
	HA-300	99.95	2	N/S/NC/2-channel
Johnson	Personal Messenger	129.50	1.5	N/S/NB
Midland	13-133	89.50	1	N/S/2-channel
Osborne	Duo-Com 120	129.50	1	N/S/NB
Radio Shack	21-1137	79.95	1	N/S/2-channel/BCB radio
Raytheon	TWR6	118.88	2	N/S/NC/2-channel
Telcon			1	N/S/2-channel
Webster	WT-2	119.50	2	N/S/NC/2-channel
Vangard	Mark II	79.98	0.2	4-channel

FULL-FEATURE 5-WATT TRANSCEIVERS

Company	Model	Price	Power Source	Channels
Cadre	525A	$249.95	Built-in battery	5
	520A	169.95	12VDC	5
	515A	185.00	12VDC, 117VAC	5
	510A	199.95	12VDC, 117VAC	5T, 23R
Hallicrafters	CB-10	149.50	12VDC	5
Lafayette	HB-500	139.50	12VDC, 117VAC O**	12T, 23R
Johnson	Messenger III	189.50	12VDC, 117VAC O**	11
Raytheon	Ray-Tel	179.50	12VDC, 117VAC O**	11
Webster	550	179.50	12VDC, 117VAC O**	11

**Special Features Key: K—kit (wired versions usually available), S—squelch, N—noise limiter, NC—nickel-cadmium battery, NB—nickel-cadmium battery or drycell, R—regenerative receiver.*

*O**—optional 117VAC power supply available.*

TOTABLE TRANSCEIVERS

receiver. This is the price range where the numbers gambit comes into play; one unit lays claim to ten transistors while another claims 11 transistors, three diodes. Point is that numbers have nothing to do with performance unless you know what circuits they buy.

At the top of this price range your money should give you a transmitter with at least two transistors, a receiver with two IF stages and an RF amplifier and probably a few extras like an earphone outlet and maybe a noise limiter. A noise limiter, by the way, is a must if you expect to use the walkie-talkie near heavy traffic. Otherwise, ignition noise will all but drown the strongest of signals.

Prices on the 100-mw rigs more or less are a free-for-all. Until mid-1964 the 100-mw units seemed to be priced at whatever the traffic would bear. A multitude of imported models was sold under various brand names and at prices which depended on who made the purchase and where. It wasn't unusual to find walkie-talkies with the same guts but different cases selling for anything from $40 to $80. But fierce competition, particularly from the major mail-order distributors, forced prices down to where they belong. Result is that top-of-the-line units now go for about $50.

With the drop in price came a change in styling, though the units offered virtually the same equipment in new cabinets. But many models still are floating around with price tags in the $80-$100 range and not all are sharply discounted. It therefore pays to be wary of any 100-mw unit priced higher than $50, give or take a few bucks. Most offer nothing extra in performance.

There is one exception to this $50 rule, however. Units which utilize a nickel-cad battery often must exceed the $50 price for the simple reason that such batteries are expensive. But since they are rechargeable, you'll have no need to buy new batteries. If you find the rechargeable - battery feature an important convenience, by all means spend the extra money.

When extended range and superior performance are required, a licensed walkie-talkie is the answer. The licensed units run 1 to 5 watts input so the user necessarily must obtain a Class-D CB license.

There are two basic groups of high-power walkie-talkies. The first is the hand-held models which include anything with a built-in telescopic antenna and a battery compartment. Depending on the model, they have an input power of 1 to 3 watts. Most also are full-feature; that is, they have all the features of the standard 5-watt CB gear: noise limiter, squelch, excellent sensitivity and selectivity and good receive and transmit audio quality.

In open country such units have a reliable working range of up to 5 miles, sometimes 10. In congested cities where 100-mw units are stopped cold at four or five blocks, these powerhouses often prove capable of a solid half-to-a-full-mile range. All present models have built-in or optional nickel-cad batteries, and some models permit instantaneous switching between nickel-cad and standard flashlight types. (Should a nickel-cad poop out in the field, you can throw in flashlight batteries.)

Where the absolute maximum in portable performance is required, an all-transistor, full-feature, 5-watt transceiver is the answer. These units give performance almost identical to that of tube transceivers, though they require an amp from the power source. They work off any 12-volt battery and a small pocket-size nickel-cad pack will power one for four or more hours of continuous operation.

Working range, [*Continued on page* 116]

Straight talk about TALK POWER

By F. DAVID HERMAN

ONE TOPIC hams and CBers forever are mulling over is a little something called *talk power*. Transmitters with lots of talk power are referred to in glowing terms. Rigs that lack talk power are modified until they have this magic extra.

But what exactly *is* talk power? There is no known test to determine when or where it exists. It can't be measured with instruments and it can't be specified in figures (no one we know claims a transmitter with a talk power of 50%, 100% or any other quantity, odd or even). Yet we all know this splendid something exists.

The TV commercial that comes on like the roar of a .45 *is* talk power. (No, the engineer doesn't crank up the commercial's volume—the commercial peaks at the same 85% modulation level as the program.) The CB signal that can be heard when there is no carrier present also is talk power. In short, there *is* something called talk power whether it can be measured or not.

The word *hear* is the key to understanding talk power. For, though it's hard to pin down, talk power might be defined as a combination of voice and modulator characteristics that delivers an overpowering sound to the receiving operator's ear. It encompasses many things, from the operator's voice characteristics to the modulator's frequency response. And talk power starts with the voice.

As you can see from Fig. 1, an average voice is anything but flat when charted on a sheet of graph paper. All frequencies don't come out with the same intensity any more than all boxers pack the same kind of punch. Maximum voice power occurs in the range of about 200 to 500 cycles and falls off sharply above about 500 cycles.

The intelligence bar in Fig. 1 reveals something else of interest: 80% of the intelligence occurs in the frequency range between 500 cycles and 5 kc. And here's the real clincher: more than 50% of the voice's power is used for the frequencies below 500 cycles, yet these same frequencies contain only 10% of the intelligence.

What this really means is that fully 50% of our power is being used to transmit naturalness, that quality by which we recognize who is speaking. Further, if our voice is applied to a modulator system which reproduces (transmits) the sound exactly as spoken, the intelligence-carrying frequencies—centered on 2 kc—will be at a modulation level of approximately 30%. Now this might be great hi-fi modulation but in communications we aren't interested in fidelity. What we are interested in is getting those intelligence frequencies into the receiving operator's ear so he can understand what's being said.

This being the case, suppose we alter the frequency response of the modulator or the

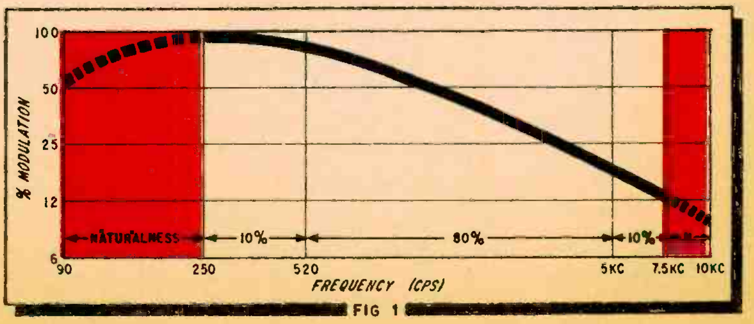


Fig. 1. Though most of the power in the average person's speaking voice falls in the frequency range below 500 cycles per second, these frequencies contribute little to intelligibility. Fully 80% of the sounds that make speech understandable lie in the frequency range above 500 cycles.

TALK POWER

microphone so that we attenuate frequencies below 500 cycles. Having done so, we now can apply all the modulating power formerly used for the low frequencies to the intelligence frequencies. And with proper modulator design the intelligence frequencies can be boosted 6db. Our transmitted sound now will resemble Fig. 2, where the intelligence frequencies are at almost 100% modulation.

End result of this move is an increase in talk power. Place two identical transmitters side by side—one with a so-called hi-fi modulator and one with frequency correction—and you won't have to be shown the difference. Let the signals fall into about the noise level and the frequency-corrected modulator still will be readable. The hi-fi modulator, in contrast, will be able just barely to get a word through now and then.

Talk power also depends on the *average voice energy*, an old concept never fully appreciated until low-power transceivers became popular. As shown in Fig. 3 the human voice has two components, peak power and average power. And while peak power determines percentage of modulation, the ear itself responds only to average power—which is some 6 to 10db less than the peak power level. In other words, when the transmitter is 100% modulated, the ear hears 50% or less modulation.

Just in case you're confused by this peak-vs-average power bit, let's take time out to explain.

You know that when you build a power supply you rectify an AC voltage to get a DC voltage which can do work. If you rectify, say, a 100-volt-rms sine wave, you get a series of pulses, each having a peak of 141 volts. You then smooth out the peaks with a filter to get a DC voltage which can do work, such as power an amplifier.

Under normal conditions, the DC voltage always is less than the AC peak. For, though you started out with a high peak voltage, the actual working voltage never measures up to the peak. Same thing with the human voice. Though the human voice has a peak power, the actual working power—the power that stimulates the ear—is 6 to 10db less than the peak power. This working voice power is called the average power.

It should be obvious at this point that eliminating peaks will permit the average voice power to determine the modulation percentage. And a clipper is just the device we need to eliminate the peak power. For proof, take a look at Fig. 4. It shows the same voice power as Fig. 3 but with 6db of clipping. Note that a ceiling has been created beyond which voice power cannot go.

If extra amplification is applied to the microphone signal, the clipping level—which was the old average power of 50%—now can be raised to the 100% modulation point. This stacks up as a 6db increase in talk power, though the receiving operator knows only that the signal *sounds* louder.

An interesting side effect of clipping is the simulation of increased RF power output without the disadvantage of increased RF. When 6db clipping is employed, the receiving operator actually hears a 6db increase in volume. On the other hand, if clipping isn't used and the RF power is increased 6db instead, the receiving operator won't hear a 6db increase. The receiver's automatic volume control (AVC) will take up most of the 6db power gain and the receiving operator will hear a change of only 2 or 3db.

Another means of increasing talk power

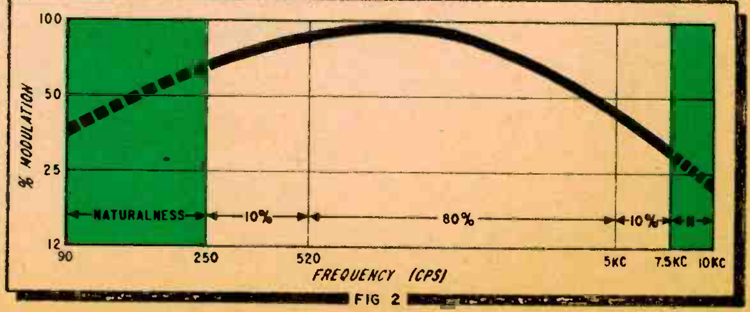


Fig. 2. Since those frequencies most necessary for intelligibility fall off markedly in the average speaking voice, boosting this band of frequencies can make communicating easier. A 6db/octave boost applied above 1,000 cycles will keep them at or near the 100% modulation mark.

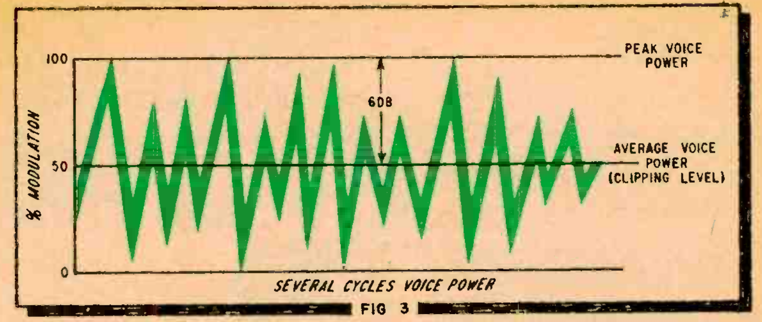


Fig. 3. Still another way human speech stacks the tables against intelligibility lies in the difference between peak and average voice powers. Though voice power peaks determine the per cent modulation, the ear responds to the average power, which runs some 6 to 10db below peak-power levels.

is through the use of speech compression. When a person speaks, some words and syllables always are louder than others. Fact is, the voice level in any normal conversation varies over a wide range. For example, try saying the phrase: "They are going." Note that however you emphasize the words, one usually is stronger than the other two and that it's almost impossible to say all three words with the same intensity. This variation in level is called dynamic range.

Since a transmitter is adjusted for 100% modulation on the loudest sounds, a considerable part of the modulation is composed of weaker sounds. But by using a compression amplifier, much of the dynamic range can be compressed so there are no strong and weak sounds—only strong and nearly-strong sounds.

Most compression devices rely on variable-gain amplifiers. Normally the amplifier works at full gain so the weak sounds get full amplification. Should you raise your voice above a preset level, the amplifier gain is reduced. And the louder you speak the more the gain is reduced.

It's important not to confuse compression and limiting (which is a form of compression) with clipping. A clipper works on each peak, establishing a ceiling beyond which the sound level cannot pass. A compressor, in contrast, works over a long time base—several syllables—and adjusts only relative level. It doesn't establish a ceiling, since a sudden peak of voice power can go right through the compressor without a reduction in gain.

If we compare a straight modulator/microphone setup against all the voice correction which gives that magic something called talk power, we get a clearer picture of exactly what talk power is. First, we can pick up at least 6db talk power with frequency correction of the intelligence frequencies. Add another 6 to 10db through clipping and we get a whopping increase of at least 12db in talk power. Or toss in compression, and you can shrink the dynamic range 20 to 30db before intelligence falls off. But remember that all of this bonus shows up in the way things sound to the receiving operator. The transmitter's modulation meter still will indicate the same 85% to 100% modulation.

No matter how you increase talk power, you'll never find a modulation meter which will show it. Only your best friend—the receiving operator—can tell you where the difference lies.

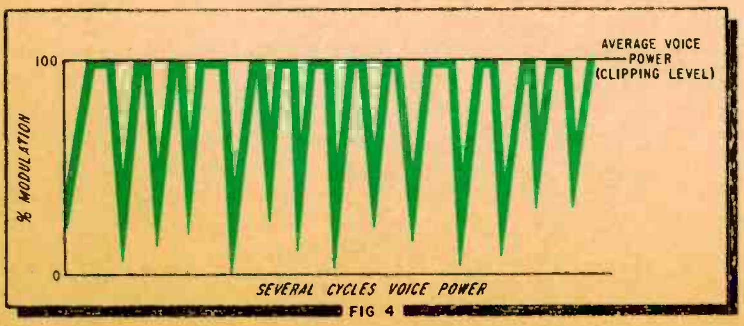


Fig. 4. Since the ear really does not require voice power peaks, intelligibility can be improved by clipping them. Reason is that the intelligence-carrying average power levels then can be brought to the 100% modulation mark without danger of overmodulating the transmitter involved.

DOUBLE-CONVERSION CB TRANSCEIVER

EICO 777

KIT: EICO 777 CB Transceiver
MANUFACTURER: Electronic Instrument Co. Inc., 131-01 39th Ave., Flushing, N.Y. 11352
PRICE: $99.95, kit; $149.95, factory-wired
CONSTRUCTION TIME: about 25 hours

ASSEMBLING a CB transceiver is something we suspect a good many non-CB hobbyists would like to see required of every CBer. The thinking would be that a CBer might familiarize himself with electronic components and circuits. Then, too, in the process he would learn something about what's inside his own gear.

In the CB transceiver which it has dubbed the 777, EICO has come up with a kit any CBer might want to build. For, though it contains tubes rather than transistors, it incorporates most features found in third-generation CB equipment. A dual-conversion receiver with a 262-kc second IF reduces adjacent-channel interference to a minimum. And the rear of the chassis includes a jack for connecting a selective-call device (though the manuals fail to specify which unit the designers may have had in mind).

The power supply is the usual three-way type in that the rig will operate on 6VDC, 12VDC or 117VAC. The transmitter offers six crystal-controlled channels, while the receiver can be crystal-controlled on six channels or variable-tuned throughout all 23 on the band. A channel-spotting switch is provided, as well as the usual S-meter.

To comply with FCC regulations, which prohibit unlicensed technicians from making adjustments in the transmitter oscillator (which well could result in off-frequency operation), the oscillator and final RF amplifier are supplied not only prewired but sealed.

EICO supplies two manuals for this particular kit, splitting assembly and operation right down the middle. The rig first is assembled, following instructions in the assembly manual. It then is aligned and operated, as detailed in the operation manual.

Construction. Putting the unit together took our careful though experienced builder about 25 hours. Approximately two of these hours were spent in unpacking and identifying parts. All proved present and accounted for with the exception of one tube shield. Even so, some of this time might have been saved had the parts list been specific enough to enable positive identification of each part. Further, while parts were packed carefully, they also were packaged illogically. There just didn't seem to be any connection between what was in a particular bag and its use or place in the circuit.

About four hours of the total time mentioned were given to mechanical assembly, which seems about right for a rig of this complexity.

The assembly manual was relatively easy to follow, though a lot of the wiring and mechanical steps seemed unnecessarily difficult. In addition, this manual proved to contain a number of small errors, some of which contradicted the schematic. The pictorial diagram identified as Fig. 20, for example, shows at least one connection to terminal strip TB5 which is at variance with the schematic. We assumed the schematic was correct and followed it whenever there was a choice.

Other errors in the manual seemed so

minor that it was difficult to understand how they could have been committed, given reasonable care. As a case in point, tube V4 is identified throughout as a 6EK8. To our knowledge, no such tube exists, and it is obvious that EICO intended to call out a 6KE8, which is the tube supplied. (An addendum sheet corrects this error on a page of the operating manual, though the designation also appears on the schematic and elsewhere.)

Assembly finished, we turned to the operation manual, only to discover that EICO had not supplied the few essentials needed for checkout and alignment. In addition to the missing shield mentioned earlier, there was no UHF connector or dummy load for transmitter check-out. No receive crystal or alignment tool was furnished, either, nor was the Switchcraft 470 tiny plug present which the transmitter check-out instructions call for.

How It Performed. The rig worked well the first time we turned it on. Only problem we experienced was with the spotting switch, which didn't seem to work at all as intended. It indicated several spots on the band and left it up to us to figure out which was strongest. We proved wrong roughly 50 per cent of the time. We also proved unable to determine the cause of this malfunction, though we suspect a wiring error was at fault.

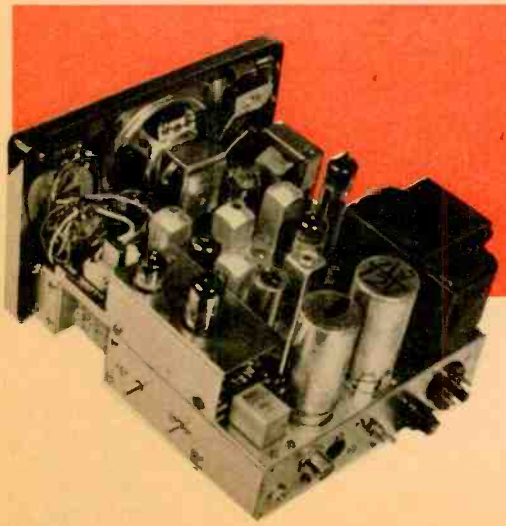
The pi-net output on the 777's transmitter delivered slightly over 2.5 watts both into a dummy load and into an antenna, which speaks well for the ability of the net to match most any load. Modulation is limited to 100 per cent in compliance with FCC regulations, and the limiting proved effective.

Microphone gain seems to be preset for an average voice speaking close into the mike. This feature presumably is aimed at the mobile CBer who, after all, normally does close-talk. However, the more relaxed atmosphere of a base station well might result in greater mouth-to-microphone distance and consequent under-modulation. Simulated tests conducted with this factor in mind resulted in modulation levels under 50 per cent.

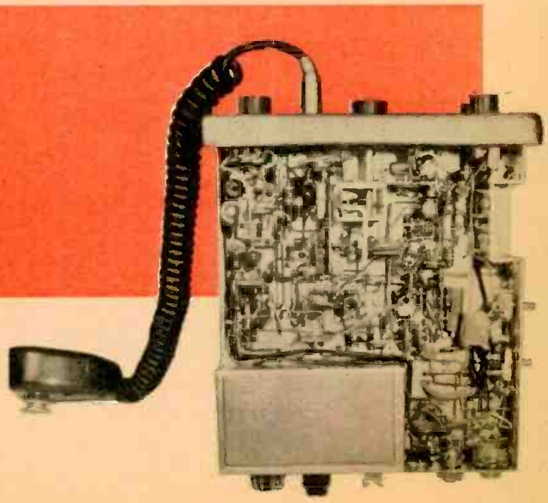
Though the receiver section has a usable sensitivity of better than 1 μv, it also proved to have a high apparent noise level. This tended to interfere with intelligibility on extremely weak signals.

Unlike some other of the newer CB rigs, the 777 has no crystal socket on its front panel. However, a quick-release trap door on the right side of the unit exposes both the transmit and receive crystal sockets for four of the six crystal-controlled channels.

Summing up, the 777 proved to be a compact unit that looks as though it's built to last. Its technical design also proved good and its performance was more than adequate. Our only reservations about an inexperienced CBer putting it together stem from the fact that the assembly manual isn't as accurate as it should be.



Fully wired transceiver. Socket to right of coax connector is for optional selective call accessory.



Wiring is point-to-point but transceiver is rugged enough to withstand plenty of rough treatment.

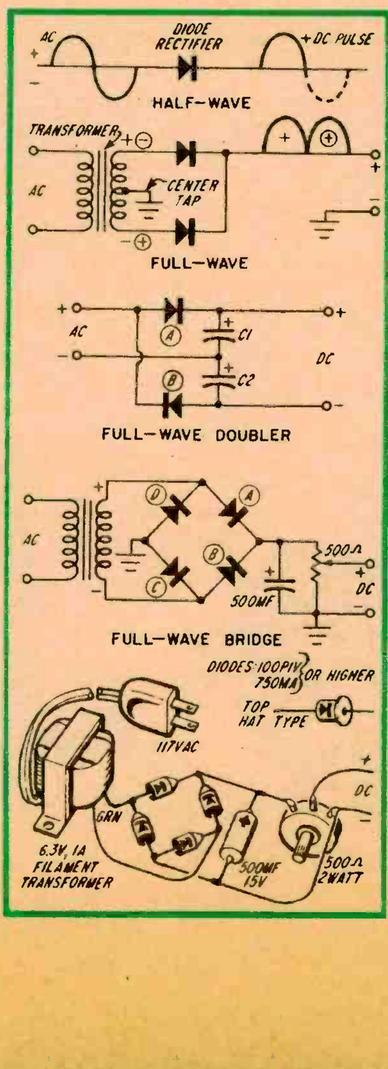
Tubeless Power

PRACTICALLY all electronic devices need DC for operation. Portable radios get DC from batteries. But other electronic equipment uses rectifiers to make DC from AC. Let's see how four semiconductor rectifier circuits do this job.

The simplest rectifier is the half-wave type (top schematic). Because the diode conducts only when its anode (arrowhead) is positive, only the top, or positive, half of the AC cycle gets through. This gives us DC, a flow of current in one direction only. But it's 60 rough pulses of DC per second—a far cry from useful smooth DC.

A full-wave rectifier with a transformer and a second diode produces smoother DC. When AC is applied, the top half of the secondary is positive with respect to center tap (ground) for the first half of a cycle. Electrons then flow out of the center tap, through the load (not shown) at the output terminals, through the top diode and back to the top of the secondary.

This produces the DC pulse with the uncircled + sign in it. During the next half of the cycle the transformer polarities are shown circled and the bottom half of the secondary is positive with respect to the grounded center tap. Electrons now flow out of the center tap, through the load and back to the transformer through the lower diode. Thus, we've put the lower half of the cycle (circled + sign) to use. The output is smoother because there are twice as many for every complete cycle of AC input.



In the full-wave doubler, assume that the AC is positive at diode A's anode as shown. Electrons will now flow from the negative side of the line up through C1, charging it with the polarities shown, through diode A and back to the positive side of the line. During the next half of the cycle, the polarity markings on the input leads are reversed. Electrons now flow in through diode B, up through C2, charging it with the polarities shown, and out through the bottom input line. Since C1 and C2 are in series, the voltages across them add.

When the top of the secondary of the full-wave bridge rectifier is positive, electrons will flow up through diode C, out through the ground connection, up through the 500-ohm pot, then through diode A to the top of the transformer.

During the next half of the cycle, polarities on the secondary change and electrons flow down through diode D.

The output of the full-wave *bridge* looks like the output of the full-wave rectifier. The 500-mf capacitor smooths the DC by discharging between pulses. Although the transformer is rated at 6.3 V, the DC output is higher. Reason is, the 6.3 V rating is rms, but the capacitor charges to the AC peak. The full-wave bridge will power a transistor radio. Adjust the pot for proper voltage with the radio tuned between stations. *H. B. Morris*

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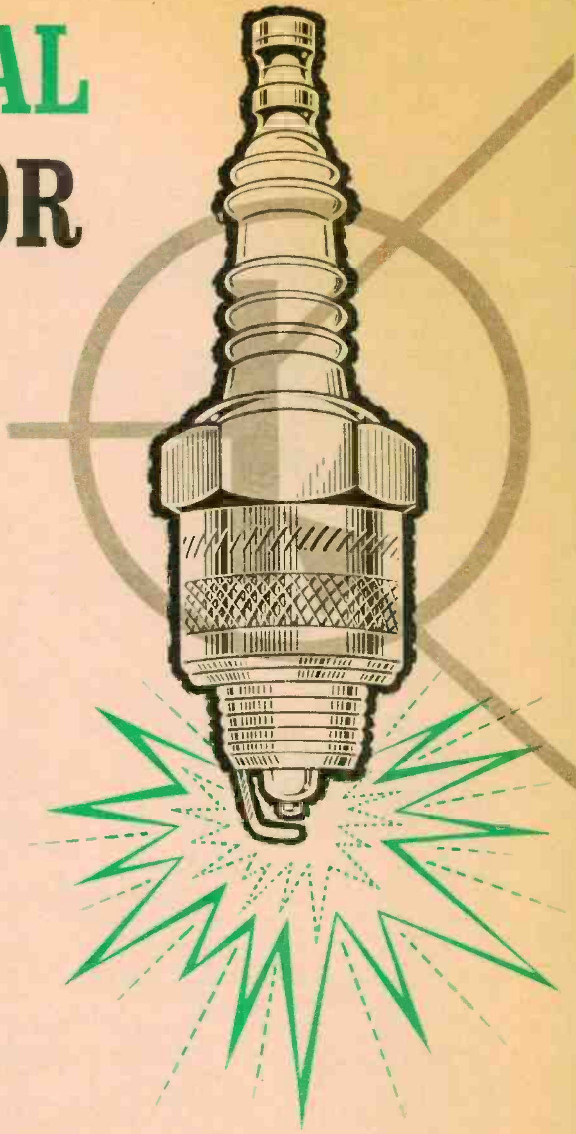
A PRACTICAL TRANSISTOR IGNITION



. . . for better engine performance at low cost and for long-term reliability.

By WALT HENRY and WOODY POPE

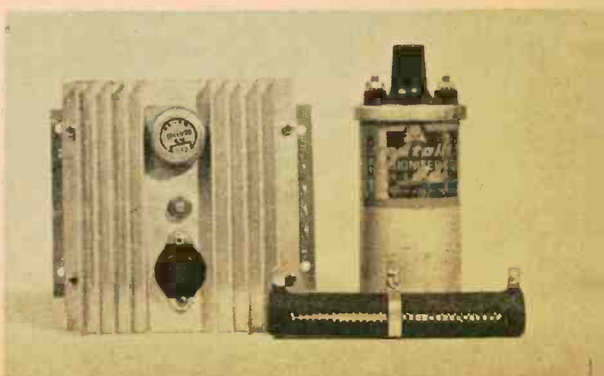
OVER the past several years we at EI have been telling readers that we intend to publish an article on how to build and install a transistor ignition (TI) system for cars when such a project appears practical. In the beginning, TI's required special and expensive components that made them impractical from a cost-performance standpoint.

Happily, new circuit designs and components now have reduced both the cost of TI's and the need for special parts. We now present what we consider the most *practical* TI currently possible, taking into account construction and reliability.

Should you install a TI in your car? The answer is not an automatic yes—or no. The benefits from TI go like this: point and plug life are increased many-fold; engine efficiency is improved, giving you slightly better gas mileage; idling is smoother and cold-weather starts are easier.

For the real car fanatic, there are some additional glories in a TI. At extreme high-speed driving, ignition tends to break up and the engine misses with a conventional system. With a TI, ignition and engine operation are smooth right up to the top of the speedometer. This is important to racing cars (all of which are equipped with TI's)—or if you plan to cruise regularly around 100 mph.

The disadvantages of TI's are not often discussed. For the more expensive TI's you can blow $50 (or much more) for an installation. For this money, you can buy a lot of points, plugs and fuel so it will take a long



time to get back your investment.

Two other disadvantages we discovered in our research are not so well known. A TI, we found, consumes about twice as much power as a conventional system. An average ignition draws about 5 amps, a TI will draw about 9 A (figuring a 50 per cent duty cycle, the comparison is roughly 30 watts average for conventional, 55 watts average for TI). The meaning here is clear; your generator or alternator, battery and voltage regulator must be kept in top-flight condition with a TI.

The final problem we discovered concerned servicing. We found, unfortunately, that the average garage mechanic knows little about TI's. If you have ignition troubles he's likely to rip out everything which he considers junk and reconvert your car to conventional ignition.

If your engine is tuned up before a TI installation, you won't notice a change in performance except, perhaps, at high speeds. Also, there will not be an immediate change in gas mileage.

But once the engine is tuned up it will stay that way much longer because point current is greatly reduced. And longer point life keeps your engine timed correctly longer. This gives you more thorough consumption of fuel, which effectively increases gas mileage. Because the coil in conventional ignition systems does not produce a fast rise time

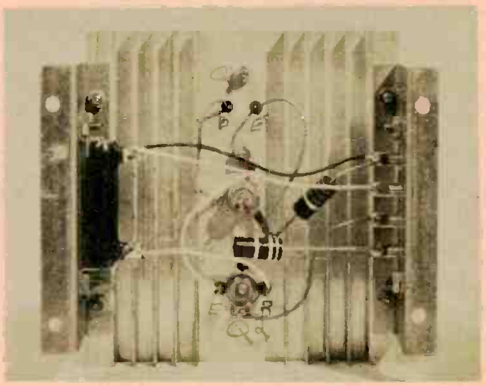


Fig. 1—Underside of our TI. Resistors R1 and R4 are mounted at the left, away from transistors. Terminal strip is mounted on bracket at right.

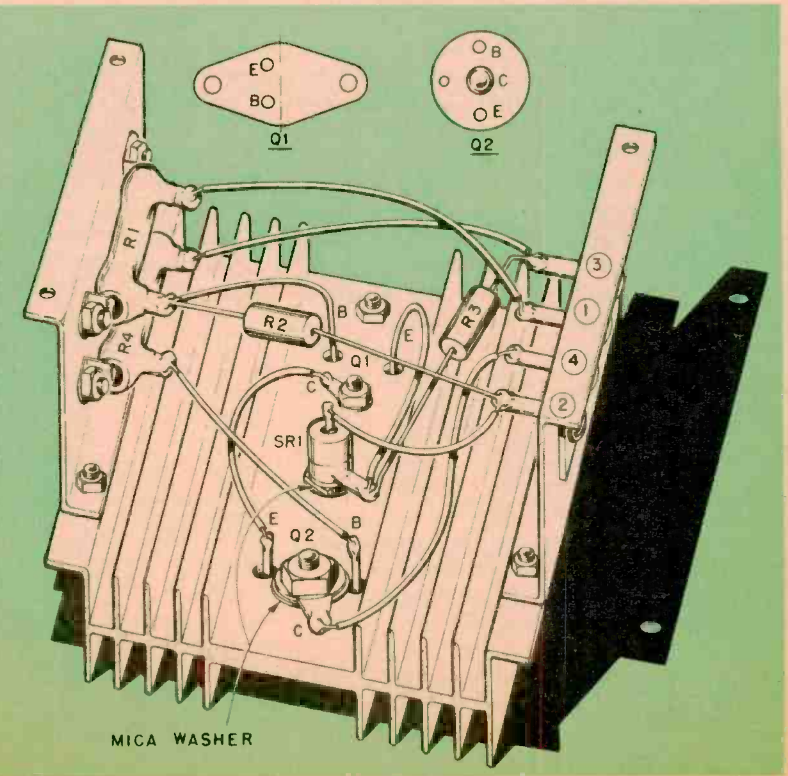
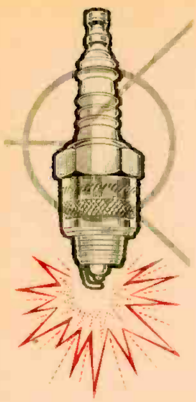


Fig. 2—Our TI was built on a finned heat sink, on the sides of which were attached brackets for mounting resistors R1, R4 and the terminal strip. You can build a heat sink resembling this one with a piece of 10x6x⅛-inch-thick aluminum. Be sure Q1, Q2 and SR1 are insulated from sink with mica washers.



when developing the spark, more energy is needed to produce a spark. Special TI coils, such as ours, produce a fast rise time, which gives you longer plug life and less plug fouling.

The secret of our TI's high reliability and operation without a zener diode is in the mode of operation of transistor Q2. This transistor, which switches the coil current instead of the points, is connected in what is called a common-base configuration. In this mode the breakdown voltage rating between its collector and base junction (BVcbo) will not fall, or derate, at high collector voltage and current. This is just the opposite of what will happen if a transistor is operated as a switch in the common-emitter mode (see transistor Q1 as an example), as is the case in many commercial TI's. In the common-emitter configuration, the breakdown voltage rating between the collector and emitter (BVceo) decreases as collector current increases.

Ratings on transistor data sheets are given for collector currents of only a few ma, while TI's usually switch in the neighborhood of 10 amps. This 10 A continues to flow for a short time after the points open. And when the points open there is both high voltage (kicked back by the coil) and high current across the transistor at the same time. This will cause a transistor in the *common-emitter* mode to break down. The breakdown lasts for only a short time and does not cause the transistor to fail immediately.

But over a long period failure will result. A zener across the emitter and collector of common-emitter-connected switching transistors reduces the high kickback voltage but it also reduces voltage to the coil. The zener also prevents damage to the TI if the distributor wire is removed. (The distributor wire in our TI can be removed without causing trouble.) But because Q2 is connected in the common-base mode in our TI, it will stand up under the high current/voltage condition when the points open—and without a zener.

Transistor Q1 is required to obtain current gain because transistor Q2 has only unity

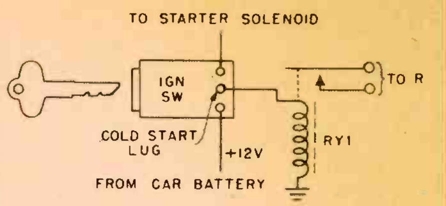


Fig. 3—For better cold-weather starts, add this relay (Guardian type 905-2C-12VDC) to short out ballast resistor R5 temporarily.

TROUBLESHOOTING		
Symptom	**Cause**	**Check**
Hard starting but engine runs	Q1,Q2 not saturating	Coil current. R1 and R4 for correct resistance
	Incorrect engine timing	Set timing in accordance with instructions in car service manual
Engine will not start	Q1,Q2 shorted	Replace
	SR1 open	Replace or short out until it can be replaced
Engine runs but misses under load	Dwell angle incorrect	Set dwell angle correctly
	Cracked distributor cap	Replace
	Bad or cracked ignition wires	Replace

VOLTAGE TABLE		
Condition	**Component**	**VOM reading across component**
Points open	SR1	0.5 to 0.6 V
Points closed	R5	0 V
	SR1	0.7 to 1.0 V
	Q1 or Q2 collector to emitter	less than 0.7 V
	T1	Approx. 2.0 V
	R5	Approx. 6½ V

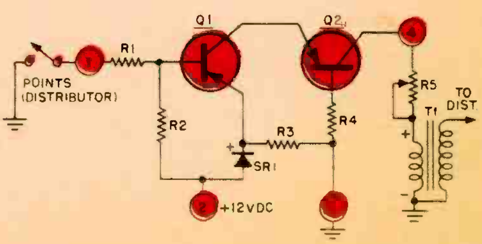


Fig. 4—TI schematic. Since switching transistor Q2 is in common-base configuration, it can handle high voltage and current from base to collector.

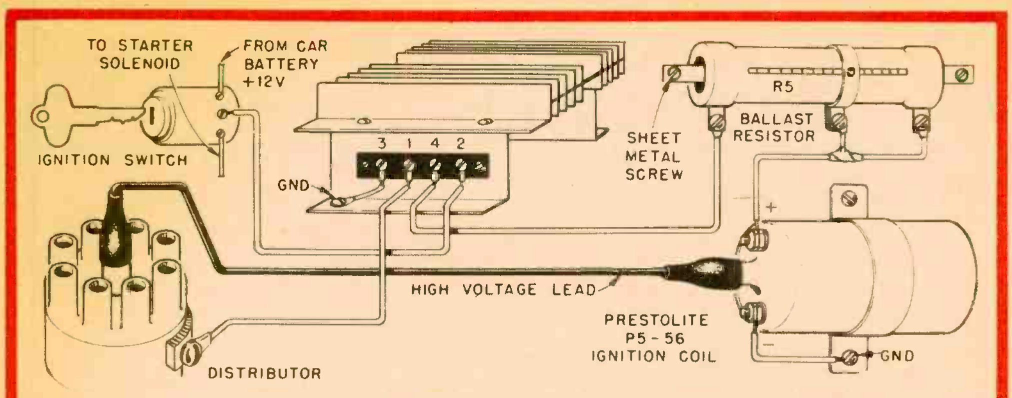


Fig. 5—Installation diagram. Wire from lug 1 to distributor can be No. 20. All other wiring should be at least No. 16. Use lugs, rather than solder, to connect wires to ballast resistor R5.

current gain in the common-base mode. Q1 does not have a high voltage rating since it switches only Q2's emitter current and not the coil current. (And there is no coil kick-back voltage across it.)

The layout of the T1's parts isn't critical but Q1, Q2 and SR1 *must* be mounted on an aluminum heat sink whose area is at least 60 square inches. A finned heat-sink such as the one we show is preferred. Further construction details are in the captions.

Installation. The capacitor across your points may or may not be removed—as you wish. Use factory-recommended settings for points and timing. Plug points may be opened to .050 inches for extended life. We suggest replacing graphite string-type ignition wire with copper-conductor ignition wire.

Adjust R5's slider so its full resistance is in the circuit. Now, disconnect the lead between the coil and R5 and connect a 10-A DC ammeter in its place. Turn the ignition switch on but do not start the engine. Adjust R5's slider so the current is 8½ A, then reconnect the wiring. If there is no indication on the ammeter, ground the lead going to the distributor and set R5 so the current is 8½ A. If an ammeter isn't available, adjust R5's slider so .75 ohms is in the circuit. Hit the starter. If the engine doesn't start immediately, check your wiring.

For six-volt negative-ground cars, change R1 to 10 ohms and R5 to 5 ohms. Their wattage ratings must be the same. R5 should be adjusted for a coil current of 8 A when the engine is not running.

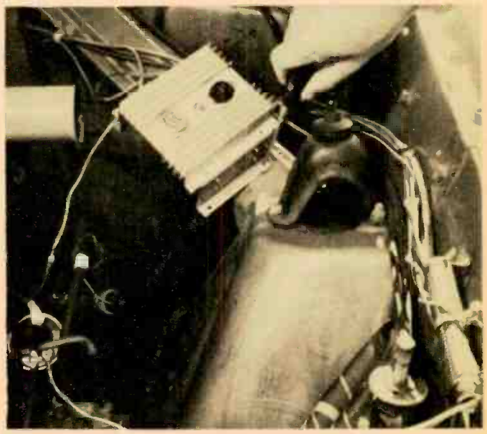


Fig. 6—Installation in car. Note how heat sink is mounted to permit air circulation. Ballast resistor R5 is mounted far away, at the lower right.

PARTS LIST

- Q1—2N1558A transistor (Motorola)
- Q2—2N1970 transistor (Motorola, Delco)
- R1—20 ohm, 10 watt wirewound resistor
- R2—39 ohm, 2 watt resistor
- R3—220 ohm, 2 watt resistor
- R4—10 ohm, 10 watt wirewound resistor
- R5—1 ohm, 75 watt adjustable wirewound resistor (IRC type 5EA or equivalent)
- SR1—Silicon power rectifier; 12 A, 50 PIV, stud mount (Lafayette 19 G 5003 or equiv.)
- T1—Ignition coil; 320:1 (Prestolite Transigniter No. P5-56. Write to the Prestolite Co., Toledo, Ohio, for a copy of its Authorized Service Station Directory which lists firms from whom the coil can be obtained.
- Misc.—Mounting kit for Q1 (Allied Stock No. MK-15, 23¢ plus postage, mica washers for Q2 and SR1, heat sink (Wakefield engineering No. NC423K Newark Electronics Stock No. 58F511, $3.85 plus postage.)

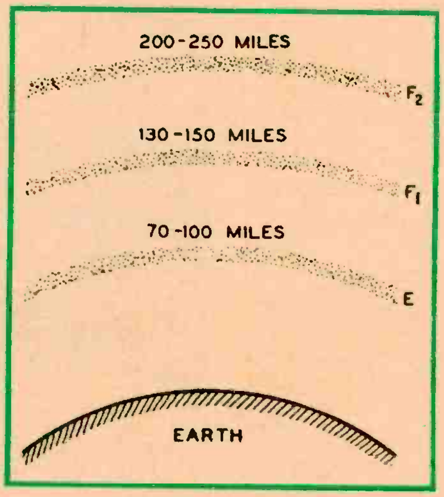
GOOD READING

By Tim Cartwright

THE RADIO AMATEUR'S HANDBOOK. By A. Frederick Collins. Revised by Robert Hertzberg. Thomas Y. Crowell, New York. 374 pages. $4.95

If this book isn't the potential ham's bible by now, it's about as close as any ever will get. This latest edition, the eleventh, has been updated by Bob Hertzberg (who needs no introduction to EI readers) and it's more valuable than ever.

Among other things, a chapter on solid-state devices now has been included. And the book's well-proven combination of theory and practice has been bolstered by a new and ultra-readable format. Any minor topic not covered in the text can be found in one of the appendices, and there's a glossary of electronic terms no ham should be without.



Ionized layers are old-hat to old-timers, but newcomers have a lesson to learn. Our illustration, taken from The Radio Amateur's Handbook, discussed here, shows the principle ones.

CLOSED-CIRCUIT TELEVISION HANDBOOK. By Leon A. Wortman. Howard Sams & Bobbs-Merrill, New York & Indianapolis. 286 pages. $6.95

This volume is timely by any standard, since closed-circuit TV—from the operating amphitheater through the grade-school classroom to the apartment-house corridor—is an increasingly important part of today's world. Its author has been writing about electronics for nigh onto a quarter-century. And he not only knows CCTV but covers his subject like the proverbial blanket, organizing his material well and discussing application upon application.

A final chapter on servicing, if not all-inclusive, serves as a good primer for those who would like to get into a lucrative field. Illustrations are excellent throughout.

ADVANCED SERVICING TECHNIQUES, Vol. 1: Color & Black-and-White Television. By Paul Zbar and Peter W. Orne. John F. Rider, New York. 298 pages. $8.25

This is Volume 1 of a two-part project by the Electronic Industries Association (EIA). The aim here, of course, is to upgrade the level of competence of the busy repairman, supplying him with enough basics to tackle today's TV sets with reasonable confidence.

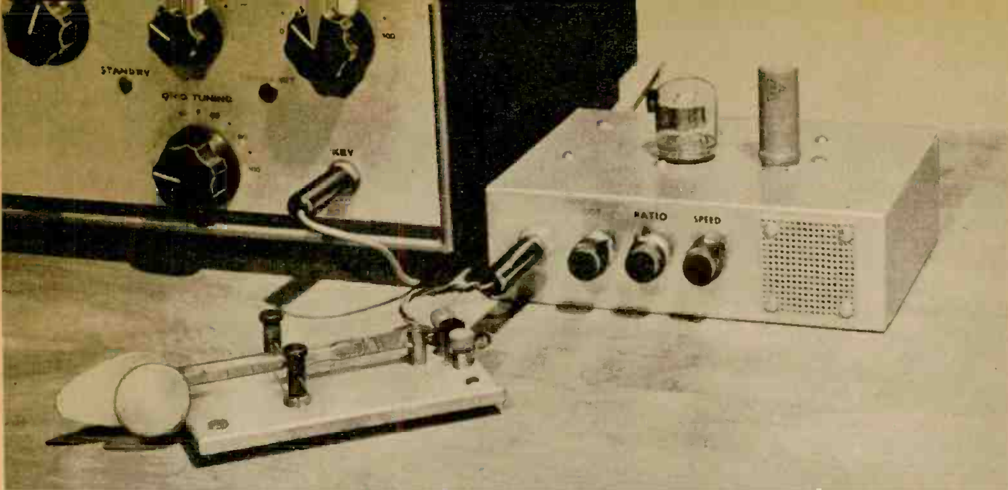
All things considered, this first book is a success. Practically everything of importance is present and the book's format (if a bit imposing) is easy to use. And don't let that price keep you from making the plunge. This volume is a good bit more valuable than a dozen cheap tomes of recent vintage.

ADVANCED SERVICING TECHNIQUES, Vol. 2: Amplifiers, FM and FM Multiplex, Record Changers, Tape Recorders, Intercoms, Receivers. By various EIA members. Rider, New York. 178 pages. $5.95

This one just isn't up to Volume 1 of the EIA project (see above). To be sure, there's valuable material here for the serviceman with little or no audio experience. But it's all just a bit *too* basic, and there are a few glaring inaccuracies. The section on FM multiplex is the best, but even this subject is covered better in other recent books.

And make note of . . .

RCA RECEIVING TUBE MANUAL. 608 pages. $1.25



1-TUBE ELECTRONIC KEYER

Automate your fist and code will be faster, cleaner and perfectly even.

By HERBERT S. BRIER, W9EGQ

WHEN it comes to developing code sending speed, beginning hams get the prize for perseverance. But in their quest for faster dits and dahs they often forget that code also must be clean and even. If there isn't a consistent relationship between the length of dits, dahs and the space between them, speed hardly matters.

Admittedly, you should first learn to send well with an ordinary key. But after you have mastered that skill, why not relax and let our electronic keyer do all the work of generating perfect dits and dahs? Hold the paddle of its sideswiper key to the right and the keyer produces a continuous string of dits. Hold the paddle to the left and you get a clean string of dahs.

Commercially made keyers are quite expensive. But ours will set you back about $20 and this includes a built-in monitor that lets you hear your fist. Depending on your skill, the keyer will send from about 7 wpm up to a speed where the dahs sound like a blur of high-speed dits.

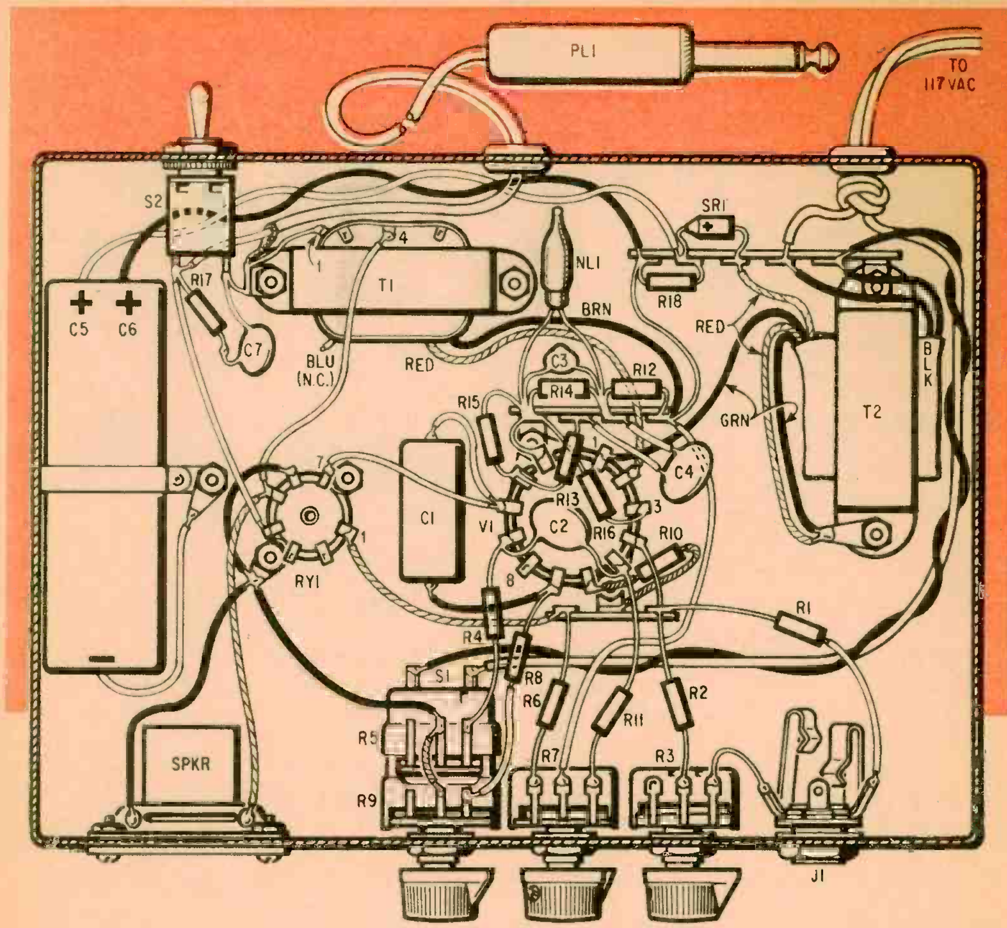
Construction details are explained in the caption on the next page. Here are a few important points to keep in mind. The base of relay RY1 looks just like a 7-pin tube and fits in a 7-pin tube socket. Don't attempt to wire directly to RY1's pins. And do not substitute a different relay for the type we specify. Other relays may not operate fast enough in this circuit.

Key-click filter C7 and R17 are connected across RY1's contacts to prevent them from sticking and to prevent clicks from being transmitted. The exact values of C7 and R17 may require some juggling for best results with your transmitter. But don't omit them or you may weld RY1's contacts together. Install the same values you use across your present key or use the values specified in our Parts List.

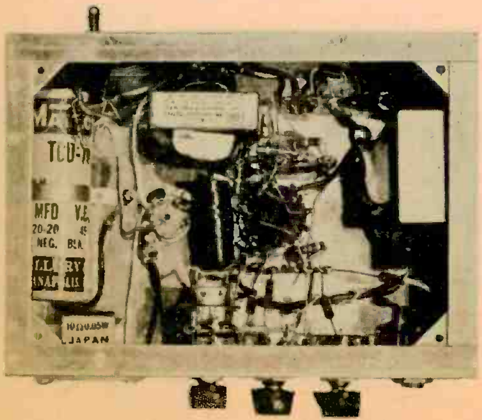
Resistor R14 should be connected only if the keying monitor doesn't work without it. Remove RY1 and turn the keyer on (do not close the key). If you don't hear a loud tone, connect R14. Plug RY1 into its socket and the tone should stop. If it doesn't, check for a wiring error. With RY1 installed the tone should be heard only when keying.

If the monitor volume is too loud it can be reduced by decreasing R15's value. It is normal for T1 to emit a slight whistle when the monitor is off (not keyed).

Adjustment. With speed control R5/R9 in its lowest-speed position and ratio control R7 set to mid-position, move the key to the right to produce a string of dits. Adjust dot-length control R3 until the length of the dits and the spaces between them sound equal. Count the number of dits in a 10-second interval. Next, produce a steady stream of dahs. Adjust R7 until about one half as many dashes are produced in a 10-second interval. After each adjustment of R7, send another string of dits



Our keyer is built in a 5x7x2-inch chassis. Layout isn't critical but to simplify construction, try to duplicate our model. Mount the speaker as far to the side as possible to allow room for the controls and J1. The speaker hole can be cut with a 1½-inch chassis punch. And connect leads to the speaker and to T1 before mounting them. Complete all wiring before installing small parts.



1-TUBE ELECTRONIC KEYER

and readjust R3 to keep the dot-space ratio at 1:1.

If R7 should reach the limit of its rotation before you achieve a 3:1 dit/dah ratio, decrease the value of R6 or R11 and increase the value of the other resistor. The object is to produce a 3:1 dit/dah ratio with R7 set mid-range. Resistor R1 also has an effect on the dit/dah/space ratio but it should not be necessary to change its value.

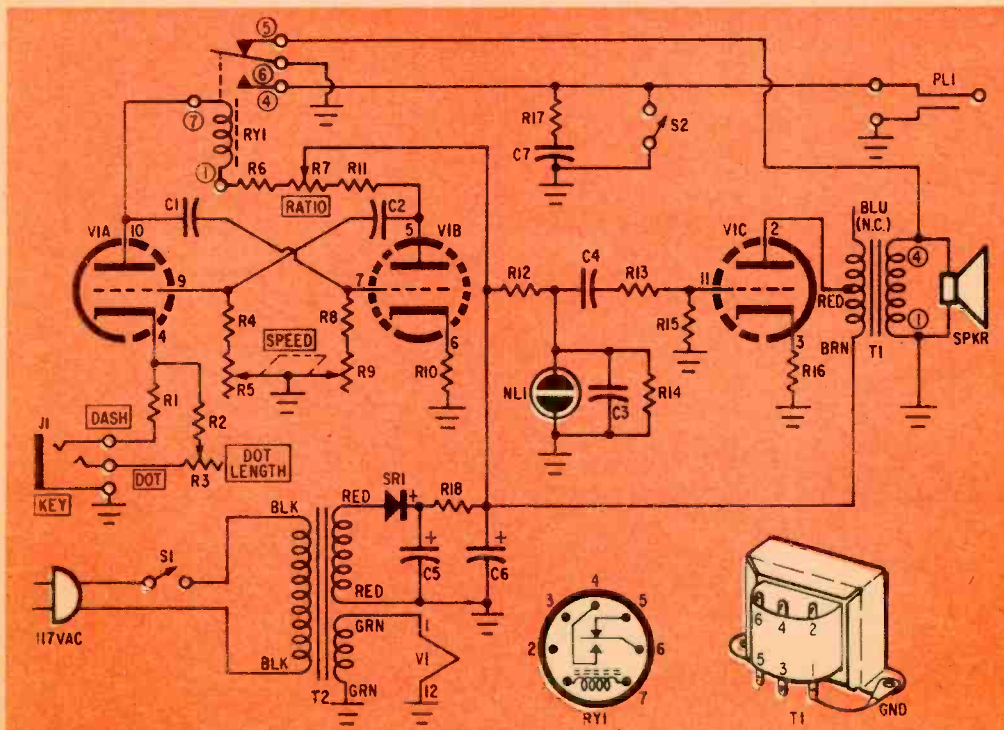
To check operation, connect a 10-ma DC milliammeter, a 1½-volt battery and a 200-ohm potentiometer in series across PL1. Close S2 and adjust the 200-ohm potentiometer for a full-scale meter indication. Set S2 to *off* and send a string of dits. The meter needle should hover around half-scale. Then produce a string of dahs. The needle should hover around the ¾-scale point or full-scale.

To shift the speed range of the keyer downward, replace R4 and R8 with 220,000-ohm resistors. The tone of the keying oscillator can be varied by changing the value of C3. Increase the value of C3 to lower the tone and vice versa. If you prefer a control to vary the volume of the monitor, replace R13 and R15 with a 2-megohm potentiometer. Ground one side of the pot, connect the other side of the pot to C4 and connect V1C's grid to the pot's wiper contact.

For a good, inexpensive sideswiper key see LOW-COST SIDESWIPER FOR EI's ELECTRONIC KEYER, Sept. '63 EI.

PARTS LIST

Capacitors: 500 V or higher unless otherwise indicated
C1—.3 mf, 200 V or higher   C3—.001 mf
C2—.1 mf, 200 V or higher   C4—.005 mf
C5, C6—Dual 20 mf, 450 V electrolytic
C7—.01 mf (see text)   J1—3-circuit phone jack
NL1—NE2 neon lamp
PL1—Phone plug to match transmitter key jack
Resistors: ½ watt, 10% unless otherwise indicated
R1—1,500 ohms   R2—2,700 ohms
R3—25,000 ohm, linear-taper potentiometer
R4, R8—100,000 ohms
R5, R9—Dual 500,000-ohm linear-taper potentiometer with SPST switch
R6—22,000 ohms
R7—20,000-ohm, linear-taper potentiometer
R10—270 ohms   R11—27,000 ohms
R12, R13—1 megohm
R14, R15—1 megohm (see text)
R16—1,000 ohms
R17—100 ohms (see text)   R18—1,800 ohms
RY1—SPDT relay; 5,000-ohm coil (2.8 ma) Potter and Brumfield type PW5LS (Lafayette 30 G 8596)
S1—SPST switch (on R5, R9)
S2—SPST toggle switch
SPKR—1½-inch speaker, 10 ohms (Lafayette 99 G 6035)
SR1—Silicon rectifier; minimum ratings: 500 ma, 400 PIV
T1—Output transformer; 4,000-ohm primary, 3.5-ohm secondary (Stancor A3328)
T2—Power transformer; secondaries: 125 V @ 15 ma, 6.3 V @ 0.6 A (Lafayette 33 G 7502)
V1—6D10 compactron tube
Misc—5x7x2-inch aluminum chassis, terminal strips, 7-pin tube socket, compactron socket



Free-running multivibrator V1A, V1B produces string of pulses whose width is determined by resistance between V1A's cathode and ground. When R1 or R2 and R3 are grounded by key, multivibrator starts and energizes RY1. RY1 keys transmitter and allows signal from T1 to drive the speaker.

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Eddie Justice, WA4JJY, Nashville, Tenn.
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Rusty Kilgus, K4WJI, Maysville, Ky.
John A. Kizar, K8AJR, Youngstown, Ohio
D. Lamoreaux, K9UMH, Hinsdale, Ill.
Hugh Lines, VE7BJV, Ladner, B.C.
Richard Marchman, WA4KDL, New Port Richey, Fla.
Jean E. McDonnell, WB2ANU, Elmira, N.Y.
Harvey N. McDonnell, WA2YQR, Elmira, N.Y.
Fred Meiers, K0FZT, Springfield, Mo.
Ralph David Miller III, KP4BPH, San Juan, P.R.
Harvey L. Minars, WA2NZS, Woodmere, N.Y.
Jon Nagy, WB2GFY, Highland Park, N.J.
Don Nowak, K7EKX, Seattle, Wash.
Earnest Oney, EP2AO, New York, N.Y.
Irving Oppenheim, WA2WLJ, New York, N.Y.
Brian D. Pennycook, VE3CXC, Willowdale, Ont.
Edwin P. Petzolt, K1LNC, Gardner, Mass.
William Pike, K9FYZ, LaCrosse, Wis.
Richard Prester, WA2IFS, Garfield, N.J.
Randall W. Rhea, WA9FFO, Findlay, Ill.
Richard William Roberts, VE3NG, Willowdale, Ont.
Thomas E. Roof, KH6ENH, Kailua, Hawaii
Jeff Russell, WA9CNS, Madison, Wis.
Fred Schwab, K9HXX, Sterling, Ill.
Robert Martin Sechler, WA2PXI, Bellmore, N.Y.
Joseph P. Shinners, W7VIH, Seattle, Wash.
Charles Shively Jr., K7SJP, Beaverton, Ore.
Stanley Skawinski, K2YIO, Wallington, N.J.
Fred A. Slipsager, WA4GIX/3, Bryans Road, Md.
Edwin E. Spurr, W9VSR, East Moline, Ill.
William C. Stapleford, K1DII, Bristol, Conn.
Paul T. Steiner Jr., K3KIQ, Graperille, Pa.
Bob Stewart, WA2WIU, Bayshore, N.Y.
Jim Strayhorn, WA4PSA, Smyrna, Ga.
Gregory Surma, WA8GLY, Detroit, Mich.
Jack B. Thomas, K4UOD, Raleigh, N.C.
John Paul Tippetts, K7SAS, Salt Lake City, Utah
Robert Tornblom, WA2KEK, Ridgewood, N.Y.
Patricio Torres, KP4BQ, Merredita, P.R.
Louis Toth Jr., WB2JJK, Carteret, N.J.
George L. Tucker, W0QOA, Parsons, Kan.
William Utaszeski, WB2HLH, Bronx, N.Y.
George Wilson, WA8EWT, Columbus, Ohio
Nick Wislocki Jr., WA8AWH, Cleveland, Ohio
Samuel S. Yates, K4KAI, Buxton, N.C.
Arnold L. Young, K4VPN, Mobile, Ala.
Russell W. Young Jr., WA2VQV, Brooklyn, N.Y.
William Zandrew, K9VJS, Berwyn, Ill.

S W L

GENERAL CLASS

100 Countries • DX Century Awards

Carl Thomas Ashley, Nicholasville, Ky.
Bert Beyt, St. Martinville, La.
George R. Buchanan, Webster Groves, Mo.
Wendel Craighead, Kansas City, Kan.
Gerry L. Dexter, Waverly, Iowa
Franklin F. Flore, Bethlehem, Pa.
Fred Hamer, Waterloo, Ont.
J.K. Harvey, Bromsgrove, Worcs., England
Jonah F. Heffler, Bronx, N.Y.
Joseph L. Hueter, Philadelphia, Pa.
Donald N. Jensen, Racine, Wis.
Jeff Kadet Kimod, Needham, Mass.
Lavoyd Kinney, Detroit, Mich.
Dave Lisiort, Elmont, N.Y.
Michael Mandrick, Rochester, N.Y.
Joe Mauriello, Haskell, N.J.
Fred W. Noakes, Montreal, Que.
Giacomo Perolo, San Paulo, Brazil
Allan Roth, Bridgeport, Conn.
William S. Sparks, San Francisco, Calif.
Joseph A. Stauhs, Belleville, N.J.
Maarten Van Delft, Zeist, Holland
LeRoy Waite, Ballston Spa, N.Y.
Bill Wambach, Evansville, Ind.

50 Countries

Mr. Abramowitz, Port Elizabeth, S. Africa
Thomas Anderson, Union, N.J.

In the three years since EI's DX Club was created, more than 1,300 hams, DXers and SWL's have received awards and become members. The listing here shows the Club's membership roster at the close of the Third Award Period on April 30, 1964. The Fourth Award Period is open at present and will remain so until April 30, 1965.

Jack G. Babinger,
Syracuse, N.Y.
Fred K. Baines,
New Glasgow, N.S.
Sam Barto,
Naugatuck, Conn.
Eric Baumer,
Lansing, Mich.
Don W. Beebe,
Seattle, Wash.
Allan Belanger,
Baie D'urfe, Que.
David Bennett,
Richmond, B.C.
Joseph E. Billie Jr.,
Linden, N.J.
Hector Davilla Borero,
San Juan, P.R.
Edward D. Bowker,
Keene, N.H.
Michael Brumberger,
Brooklyn, N.Y.
Clarence A. Bugbee,
Manchester, N.H.
Charles Burton,
Cleveland, Ohio
Danny Caplan,
Atlanta, Ga.
Clifford Cardwell,
Fort Worth, Tex.
Michael Chabak,
Astoria, N.Y.
John L. Condrey,
Silver Springs, Fla.
Gary Marshall Cooper,
St. Catharines, Ont.
Richard E. Davis,
Denver Colo.
W.J. Dwyer,
Little Silver, N.J.
Bruce Eastwood,
Terang, Victoria, Australia
Robert Eddy,
Newport, Ohio
Lawrence J. Elkin,
Bronx, N.Y.
Norman C. Elser,
Evansport, Ohio
Richard England,
Colombus, Ohio
William A. Fast,
Colombus, Ohio
X. Franca,
Antwerp, Belgium
Ray Fronczak,
St. Louis, Mo.
Alex E. Garrison,
Richmond, Va.
Giovanni Gasparetto,
Rovigo, Italy
Paul Giuliani,
Worcester, Mass.
Robert Gobrick,
West Islip, N.Y.
Harry W. Gottshall,
Brooklyn, N.Y.
Walter T. Grubb,
Dubuque, Iowa
Leroy R. Gruber,
Deer Park, Ohio
Richard Gula,
Middletown, Conn.
John Hall,
San Francisco, Calif.
Edward Hamill,
Millbrae, Calif.
Dean Hanson,
Honolulu, Hawaii
Paul T. Harig,
Auburn, N.Y.
Richard Harris,
El Dorado, Ark.
Dan Henderson,
DeFuniak Springs, Fla.
Samuel Hevener,
Sharon, Pa.
Charles F. Howard Jr.,
Tampa, Fla.
James J. Howard,
Kansas City, Mo.
Michael Hromoko,
Newark, N.J.
Joseph L. Hueter,
Philadelphia, Pa.

Francis L. Jacobs,
Anson, Me.
Steve Jamour,
Philadelphia, Pa.
Jack L. Keene,
Houston, Tex.
Geoffrey Krauss,
Flushing, N.Y.
Gerry Klinck,
Buffalo, N.Y.
Robert Kunitsky,
Linden, N.J.
Ron Kusmack,
Winnipeg, Man.
Andrew Kwiatkowski,
Chicago, Ill.
Robert Lamkin,
Revere, Mass.
Leigh Lerner,
Highland Park, Ill.
Alan Robert Leith,
Sydney, N.S.
David Listort,
Elmont, N.Y.
Adolph A. Lugmayr,
Toronto, Ont.
William Lund,
Manhattan Beach, Calif.
Scott C. MacLeod,
Columbus, Ohio
Michael Mandrick,
Rochester, N.Y.
Anthony D. Manne,
Port Elizabeth, S. Africa
Michael Marx,
Birmingham, Ala.
Robin Martin,
Glen Head, N.Y.
Charles J. Matterer,
San Leandro, Calif.
Lowell E. McCown,
Lackey, Ky.
Gary A. McHugh,
El Paso, Tex.
Ted W. Midlam,
Fairborn, Ohio
Robert J. Miller,
Milwaukee, Wis.
Justin Mirkin,
Port Elizabeth, S. Africa
James R. Neff,
Springville, N.Y.
Mark Northup,
Philmont, N.Y.
George Oppegard,
New Castle, Del.
Chris Pinn,
Lockport, Ill.
David E. Pope,
Crescent Beach, S.C.
Donald Scott Pratt,
Hilton Park, W. Australia
Bernard Rachlin,
Ottawa, Ont.
Paul E. Rhodes, Goshen, Ind.
John J. Riley,
Glen Dale, W. Va.
Fred E. Rockman,
N. Burnaby, B.C.
John A. Rokita,
Sharon, Pa.
David I. Ruia,
Baltimore, Md.
Joseph Russo,
Toms River, N.J.
Richard P. Schreiber,
Wheatridge, Colo.
Stanley Schwartz,
Bridgeport, Conn.
Michael Sealfon,
Hillsdale, N.J.
John W. Shinn,
Bowsman, Man.
Steven Shook,
Lexington, Ky.
David Shores,
St. Louis, Mo.
David R. Siddall,
Hyannis, Mass.
Thomas W. Snow,
East Point, Ga.
William Stevens,
Jeannette, Pa.
Louie A. Stober, Tigard, Ore.
William G. Strait,
Lancaster, S.C.
Leo Thibaudeau,
St. Foy, Que.
Francis A. Thompson,
Otematata, N. Otago, New Zealand
David C. Truesdell,
Wilmington, Ohio
Alvin W. Turetasky,
Bridgeport, Conn.
Emil Vandevelde,
Oakland, N.J.
Nick N. Vrettos,
Fort Leonard Wood, Mo.
Bill Wambach,
Evansville, Ind.
David & Joel Weiner,
Montreal, Que.
Francis H. Welch Jr.,
Rochdale, Mass.
Tom White,
Hollywood, Calif.
Will White,
Lexington, Ky.
Jack Winther,
Moraga, Calif.
Wayne Wisniewski,
Philadelphia, Pa.
James W. Young,
Seattle, Wash.
James Zacher,
Chicago, Ill.
Robert Zulinski,
Berkley, Mich.

MEDIUM-FREQUENCY CLASS

25 Countries

Hank Holbrook,
Bethesda, Md.

BROADCAST-BAND CLASS

15 Countries

Michael Bugaj,
Middletown, Conn.
Jesse R. Bruner,
Lockbourne AFB, Ohio
Gregg A. Calkin,
Saint John, N.B.
Robert Eddy,
Newport, Ohio
Richard George,
Wichita, Kan.
Francis L. Jacobs,
Anson, Me.
Jack L. Keene,
Houston, Tex.
William E. Lipis,
El Cajon, Calif.
Earl MacKenzie,
Sydney, N.S.
Dallas A. McKenzie,
Wellington, New Zealand
David E. Pope,
Crescent Beach, S.C.

LOW-FREQUENCY CLASS

10 Countries

Maurice Ashby,
Wichita, Kan.
Desmond Reginald Frampton,
Invercargill, New Zealand

SPECIAL CLASS

10 Countries

Milton Abercrombie,
Bristol, Tenn.
Miles Abernathy,
San Marcos, Tex.
Leroy Porter Ackerman,
Phoenix, Ariz.
D.N. Adams,
Toronto, Ont.
Paul Adams,
Alvin, Tex.
Eugene Adkins,
Bassett, Va.
Joseph Martin Agrella,
Fort Lauderdale, Fla.
Alan D. Albert Jr.,
Chula Vista, Calif.
Eric Alchowiak,
Rochester, N.Y.
David P. Alessi,
Erie, Pa.
Norris L. Alford,
Winfield, W. Va.
David Algeo,
Dayton, Ohio
William Alisauskas Jr.,
Milford, Pa.
Don Allen,
Covington, Ind.
Hal Allen,
Ridgefield Park, N.J.
Richard H. Allen Jr.,
Quarry Heights, Canal Zone
Richard N. Allen,
Billings, Okla.
Roy Allen,
Louisville, Ky.
K. Alles,
Winnipeg, Man.
Kenneth Alyta Jr.,
Charlotte, N.C.
J.D. Amarnath,
Andhra Pradesh, S. India
Michael Amatucci,
Manchester, Mass.
Daniel F. Amoroso,
Philadelphia, Pa.
James R. Anderson,
St. Louis, Mo.
Robert D. Anderson,
Chicago, Ill.
Russ Anderson,
Muskegon, Mich.
Juanita Anderton,
St. Charles, Ill.
Craig Andrews,
Ridgewood, N.J.
Donald Antonelli,
Kearny, N.J.
Hugh L. Applewhite,
Mobile, Ala.
D.P. Aost,
Ashland, Ky.
Tom Arcand,
Springfield, Va.
Dennis Ardinger,
Canonsburg, Pa.
Michaud Armand,
Baie Cameau, Que.
Earnest A. Armstrong,
Perrin AFB, Tex.
Mel Arndt,
Toledo, Ohio
Roger Attwell,
Everett, Wash.
K. Austin,
Toronto, Ont.
Howard S. Axelrod,
Albany, N.Y.
Albert L. Aymer,
Bronx, N.Y.
John Babbitt
Houghton, N.Y.
Garry S. Bacon,
Cold Spring, N.Y.
Thomas Baedeker,
Lynwood, Calif.
Charles J. Baer,
Brooklyn, N.Y.
Albert Bagetta,
Agawam, Mass.
Ron Baier,
Detroit, Mich.
David Bailey,
Rushville, Ind.
Harold P. Balitski,
Saskatoon, Sask.
Kenneth G. Barbour,
Winnipeg, Man.

EIDXC MEMBERSHIP LIST

Robert Barden, Westbury, N.Y.
John Barrett, Morgan Hill, Calif.
William Barss Jr., Ypsilanti, Mich.
William N. Barthell, Norman, Okla.
Leonard G. Barwig, Mount Prospect, Ill.
Otto H. Barz, Flushing, N.Y.
Edward Bassett, Toledo, Ill.
Paul Bassiri, Morristown, N.J.
Neal D. Bates, Painesville, Ohio
John L. Bauer, Baltimore, Md.
William Bawdick, Hants Country, N.S.
Richard Beatie, Fort Lauderdale, Fla.
Gerard Beaudoin, Putnam, Conn.
Paul Beausoleil, Woonsocket, R.I.
Paul Becher, Wyatt, Ind.
David E. Becker, Pottstown, Pa.
Dick Becuar, Marshalltown, Iowa
Brian Michael Begg, Milltown, N.J.
Kenneth Bell, Indianapolis, Ind.
Thomas Bell, Winnipeg, Man.
G.A. Benadom, San Francisco, Calif.
Andrew L. Benson, Philadelphia, Pa.
John Benson, Port Arthur, Ont.
Dennis Bentson, Richmond Hill, N.Y.
David Berger, North Woodmere, N.Y.
Philip Berkeley Jr., Swampscott, Mass.
Donald Betz, Pittsburgh, Pa.
Mike Betz, Marion, Ohio
Richard Bianchino, Warren, R.I.
John J. Bien, Chicago, Ill.
Bob Bilkiss, Los Angeles, Calif.
Robert Binau, Williamsport, Md.
A.J. Birkinshaw, Blackburn, Lancs., England
Phillip E. Birlew, Dallas, Ore.
Earl B. Bitzel, Oella, Md.
Bill Black, Kansas City, Mo.
James E. Black III, Lexington, Ky.
Bill Blandford, Hammond, Ind.
Barry Bliem, Lakeland, Fla.
Elliott B. Block, Cincinnati, Ohio
Jon L. Bloomfield, Dallas, Tex.
Wally Bloss, Rochester, N.Y.
Dave Bock, Newfield, N.Y.
Alex M. Boles, Stoney Creek, Ont.
Edwin R. Bolton, Wayne, N.J.
Jay Bondell, North Bellmore, N.Y.
J. Boniakowski, Jersey City, N.J.
Arthur J. Bonito, Secaucus, N.J.
Robert G. Bonneville, Harrisburg, Pa.
Bill Booth, Woodbridge, Ont.
Richard Bororec, Berwyn, Ill.
Jerry L. Boss, Chicago, Ill.
Dick Bourcier, Montreal, Que.
Nick Boyce, Seneca Falls, N.Y.
Robert C. Boyer, Pottstown, Pa.
Douglas D. Bradham, Rocky Mount, N.C.
Jeffrey Bradley, Roslyn Heights, N.Y.
Walter Brady III, Conyngham, Pa.
Perry I. Brainin, Bronx, N.Y.
Frank Brandon, Schuylerville, N.Y.

Michael Brass, Framingham, Mass.
Edward Braytenbah, Kinsington, Md.
John Breen, Toccoa Falls, Ga.
James A. Brennan, Minersville, Pa.
Paul & Howard Brenner, Chicopee Falls, Mass.
George J. Breyer, Haddon Heights, N.J.
James L. Britton, Brockway, Pa.
Richard Brodeur, Chicopee Falls, Mass.
Terrance Brodie, Berwyn, Ill.
David Brodsky, Arlington, Va.
Danny Brodt, Gaithersburg, Md.
Bob Brook, Winter Haven, Fla.
Larry Brooks, Fort Worth, Tex.
Allen Brostowski, Wallington, N.J.
Barry C. Brown, Baltimore, Md.
Bruce Brown, Skokie, Ill.
Dave Brown, Woodland Hills, Calif.
Henry Brown Jr., Falmouth, Mass.
Joe A. Brown, Charlotte, N.C.
Richard S. Brown, Baltimore, Md.
Ronald Brown, Baltimore, Md.
Armand J. Brucato, Norfolk, Mass.
Ovide Brudo, Ware, Mass.
Lawrence W. Bruns, Linden, N.J.
Paul M. Bruns, Clovis, Calif.
John N. Brunst, Neptune Beach, Fla.
Robert O. Buckley, Charleston, S.C.
Allan Buckshon, Vancouver, B.C.
Boyd Bud, Buena Park, Calif.
Michael Bugaj, Middletown, Conn.
Ron Bulick, Hamilton, Ont.
Donald G. Burgin, Toronto, Ont.
Edward E. Burk, Lake Arrowhead, Calif.
George A. Burke, Crestwood, N.Y.
Mike Burney, Corpus Christi, Tex.
Arthur L. Burpee, Ottawa, Ont.
Jim Bush, Gibson City, Ill.
Kenneth Butler, Elkins, W. Va.
Joseph Byrns, Jamaica, N.Y.
Howard Cahn, Yonkers, N.Y.
Amedeo A. Calviello, Brooklyn, N.Y.
Allan Cameron, Los Angeles, Calif.
Thomas Camm, Columbus, Ohio
Bill Campbell, Canandaigua, N.Y.
John Canfield, Miami, Fla.
Pierce Cantrell, Houston, Tex.
Antony Capel, Clarkson, Ont.
Robert Cardish, Toronto, Ont.
John Carpenter, Fremont, Ohio
James L. Carr, Lincoln, Neb.
Edward P. Castorina, Schenectady, N.Y.
William G. Cave, Yonkers, N.Y.
Joseph Cecchi, Chicago, Ill.
Arne Chandler, Alhambra, Calif.
Bruce Chapman, Vanderhoof, B.C.
Barry Chase, Worcester, Mass.
Alan E. Chate, Sydney, Australia
Anthony Chesler, Newlands Cape, S. Africa
Patrick J. Chick, Mayfield Heights, Ohio
Ronald L. Chrisley, Topeka, Kan.
David Christensen, St. Ansgar, Iowa

John V. Ciesielski, Niagara Falls, N.Y.
Frank Cingilia, Harrison, N.Y.
Thomas Clancy, Quincy, Mass.
Gary Clark, Flushing, N.Y.
Gary Clark, Hazleton, Pa.
Stephen Clark, Cornwall, N.Y.
Howard Dennis Clarke, Kenmore, N.Y.
John Clarke, Etobicoke, Ont.
John F. Clarke, Ashland, Pa.
Jerry L. Clayton, Ft. Wayne, Ind.
Joseph R. Claus, Anaheim, Calif.
Wayne J. Cline, Catersville, Ga.
Samuel Clopper Jr., Catonsville, Md.
Stanley Cohen, Philadelphia, Pa.
Stuart Cohen, Cranston, R.I.
Stephen Colburn, Niles, Ohio
Robert Coleman, Atlanta, Ga.
Terrance Colgan, Atchinson, Kan.
Lloyd Compton, Chattanooga, Tenn.
Gary Robert Cook, Lansing, Mich.
Larry L. Cook, Gainesville, Fla.
Mike Corkle, Harrisburg, Pa.
Craig Cornell, St. Paul, Minn.
Michel Couture, Capricieuse, Que.
Charles Craft, Lansdale, Pa.
David W. Crawford, San Francisco, Calif.
David B. Crowe, Pittsburgh, Pa.
J.R. Crum, Bloomingdale, N.J.
Richard V. Crume, Ferguson, Mo.
Charles Crepas, Melrose Park, Ill.
Bill Crook, Campbell, Calif.
Ken E. Culbert, Cold Spring, N.Y.
John J. Cull, N. Abington, Mass.
Don Cunningham, Woodward, Okla.
Alan Curry, Freeport, Me.
Tom Czerniak, South Bend, Ind.
John A. Czupowski, Cicero, Ill.
Louis Daigle, Laval sur le lac, Que.
Sheldon Daitch, Louisville, Ga.
Gerald R. Dalum, Aurora, Colo.
James E. Damron, Charleston, W. Va.
Byron Daniel, Hazard, Ky.
Richard M. Daniel Jr., Swarthmore, Pa.
Richard Daniels, Philadelphia, Pa.
Donald Daso, Lodi, Ohio
Charles Dauwalder, Iona, N.J.
Wendell E. Davis, Indianapolis, Ind.
Don Dawson, Penny, B.C.
Barry Thomas Day, Cincinnati, Ohio
Junior Dean, Amory, Miss.
Tracy Deane, Miami, Fla.
Kenneth W. Deans, Secane, Pa.
David J. Decker, Philmont, N.Y.
Loren E. Decker Jr., Waco, Tex.
Michael Deckmand, Lancaster, Pa.
Sam DeDonatis, Philadelphia, Pa.
Louis Del Valle, Santiago, Chile
Robert DeMarco, Haverhill, Mass.
Michael Denis, Westbrook, Me.
Dale Denisten Jr., New York, N.Y.
Jack L. Dennis, Washington, D.C.
George Derringer, Newburgh, N.Y.
Brian C. Derx, Hastings-on-Hudson, N.Y.
Richard Desharnais, Dracut, Mass.

Henry J. Desjardin Jr., Pittsburg, Calif.
John N. Desko, Sharon Hill, Pa.
William P. Desmond, Elmhurst, N.Y.
Richard Devlin, Boston, Mass.
Jack L. Dickinson, Marietta, Ohio
Frank A. Diehl, Buffalo, N.Y.
Michael Diers, Brooklyn, N.Y.
Stephen Dildine, Los Alamos, N.M.
Gregory Dill, Dartmouth, N.S.
Albert Dinsmore, New York, N.Y.
Sidney J. Dize, Bangor, Me.
John L. Dlugopolski, Russellton, Pa.
Charles A. Dobbins Jr., Seattle, Wash.
Robert Dockery, Asheville, N.C.
David Doernberg, Atlanta, Ga.
Robert Doucet, Sacramento, Calif.
Charles Douglas, Alma, Ga.
Tom Doyle, Madison, Wis.
Carle Dow, S. Burlington, Vt.
Karl J. Drake, Palo Alto, Calif.
John Edward Paul Draut, Bronx, N.Y.
Bruce Drewett, Miami, Fla.
Peter Drexel, Bronx, N.Y.
James Drisko, Concord, Calif.
Bandani Driss, Mostaganem, Algeria
Lyman Duggan, Summerside, P.E.I.
Raymond Duncan, Corona, Calif.
Stephen Carson Dunning, Rocky Mount, N.C.
Dennis F.X. Dyroff, Norristown, Pa.
James Earl, Bend, Ore.
Paul Eaton, New York, N.Y.
John Eckert, Evanston, Ill.
Irving Eichler, Whitestone, N.Y.
Dennie Eisele, Peoria, Ill.
Jack Ekstrom, North Aurora, Ill.
Jon Elliott, Astoria, N.Y.
Malcolm Epperson, Anderson, Ind.
Warren D. Erdman, Lansdale, Pa.
Charles Errickson, Avenel, N.J.
Jose Antonio Escarre, Los Angeles, Calif.
Fred Essenwein, Mineola, N.Y.
Luke E. Evans, Troy, N.Y.
William R. Evinger, Arlington, Va.
Gary Ezell, Vallejo, Calif.
Robert P. Faerber, River Forest, Ill.
F.K. Fager, Worthington, Minn.
Mrs. Margaret A. Fafrless, Scotch Plains, N.J.
Richard Farage, Brooklyn, N.Y.
Robert E. Fariss Jr., Phoenixville, Pa.
Richard L. Farrell, Clearwater, Fla.
Roger D. Farrier, Westfir, Ore.
Arno Feltner, New Braunfels, Tex.
Neal Felton, Wilmington, Del.
Russell Feran, New Orleans, La.
Mike Ferguson, St. Joseph, Mich.
Russell Ferland, Pawtucket, R.I.
Ed Fielding, Lynchburg, Va.
Robert Fierstein, Passaic, N.J.
Jan Filip, West Unity, Ohio
Hal Finkelstein, Brooklyn, N.Y.
David G. Finley, Sebring, Fla.
Avery M. Finn, St. Louis Park, Minn.
Richard Finnie, Kamsack, Sask.
Albert W. First Jr., Harrisburg, Pa.

Gordon E. Fish, Salem, Va.
Jerry Fisher, Westover AFB, Mass.
Robert H. Fiske Jr., W. Acton, Mass.
John Fitzpatrick, Albany, N.Y.
Joe Fleming, Opa-Locka, Fla.
Michael R. Fletcher, Waco, Tex.
Philip E. Flickinger, Rockwood, Pa.
Robert W. Floyd, San Diego, Calif.
Charles Flynn, Huntington Station, N.Y.
Barry Forbes, Regina, Sask.
Ian H. Forrester, Auckland, New Zealand
Kenneth Forsyth, Mobile, Ala.
Michael Fortuna, Franklin, Mich.
Ronnie Foss, St. Albans, W. Va.
Gary Frankeberger, Normal, Ill.
Martin D. Franks, Michigan City, Ind.
Earl B. Frederick, Lancaster, Pa.
Moril Frederickson, Wildwood, Ill.
Roy Frederiksen, Hamden, Conn.
Joel E. Freeland, Detroit, Mich.
Dennis Freeman, Mt. Shasta, Calif.
John Freiman, Akron, Ohio
Robert H. French, Bellaire, Ohio
Peter W. Frentz, Hagerstown, Md.
Edward S. Frohling Jr., Westchester, Pa.
Ray Fronczak, St. Louis, Mo.
Pat Fuller, Lombard, Ill.
Mike Fusick, Chicago, Ill.
Peter Gabrielli, Rochester, N.Y.
Frederick Galdo, Riverside, N.J.
Paul B. Gallant Jr., Bedford, Mass.
Ronald Gang, Toronto, Ont.
Gregory Ganz, Riverdale, Ill.
Leonard R. Gardner, Boulder, Colo.
Daryl Garrett, Hickory, N.C.
Ron Gavala, Fishkill, N.Y.
Richard George, Wichita, Kan.
Gerald Georgopolis, Lawrence, Mass.
Glenn Gerber, Bayside, N.Y.
Jerry Gers, University City, Mo.
Tom Giacopelli, Tuckahoe, N.Y.
Alfred W. Gilmore, Lyndhurst, N.J.
Woodrow P. Gimbel Jr., Culpeper, Va.
Al Girard, Edmonton, Alta.
Wallace Glavich, Eureka, Calif.
Anthony J. Gocellak Jr., Jersey City, N.J.
Dan Goelzer, Wauwatosa, Wis.
Kenneth Goetz, Floral Park, N.Y.
Philip D. Goff, Pawtucket, R.I.
Harvey Goldberg, Whitestone, N.Y.
Robert S. Golder, Broad Channel, N.Y.
Boyd F. Goldsmith, Oklahoma City, Okla.
Alfred Gonzalez, Bronx, N.Y.
Paul Goodman, Oneonta, N.Y.
John Goodwin, Moncton, N.B.
Willy Goovaerts, Edegem by Antwerp, Belgium
Russell Gorchov, Miami, Fla.
Mark Gorden, Providence, R.I.
Douglas J. Gorga, Schenectady, N.Y.
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James Jordan, Laurel, Miss.
Julian Jorstad, Seaside, Calif.
Michael R. Joye, Springfield, Va.
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Tim Kerfoot, Toronto, Ont.
Mark Ketola, Madison Heights, Mich.
Reed Khan, Seoul, Korea
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Craig Kirkwood, Honeoye Falls, N.Y.
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Ernest Kleinman, Montreal, Que.
Jim Kline, Genoa, Ill.
Ziba B. Knapp, S. San Gabriel, Calif.
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Luther Knight, Baltimore, Md.
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Drew Knowland, Williamstown, Mass.
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John Long, Lebanon, Pa.
Michael J. Loucks, Wrentham, Mass.

[*Continued on page* 111]

HI-FI TODAY

By John Milder

✓ *Two ways to lick the multipath problem*

✓ *Dressing up dynamics with two-track tape*

✓ *Speaker cables the missus should go for*

WHETHER you live in a big town or the hills, chances are you've stumbled across a little problem known as multipath distortion. This bugaboo appears whenever an antenna picks up not only an FM station's primary signal but also a healthy dose of signals bounced back from surrounding hills, buildings, living-room walls or what have you.

Since these reflections may arrive at the antenna out of step with the main signal, the result frequently is the audible equivalent of ghosts on a TV screen. In other words, the sound you hear may range from slightly fuzzy to downright distorted. And multipath becomes a really sticky problem in stereo reception, since it can play hob with separation and that all-important signal-to-noise ratio.

Best solution for multipath, of course, is a directional outdoor antenna that responds almost exclusively to a station's primary signal. Lots of people, though, can't stick a yagi on the roof, particularly if they live in an apartment under the rule of a tyrannical landlord. What then?

Well, there's always our old friend, the folded dipole. Maneuver it into position where it's broadside to an incoming signal and it will cancel some of the reflections arriving from the side. To be sure, it can't do the kind of job a good outdoor antenna can. But it's a lot better than nothing when used correctly.

Problem here, of course, is that maneuvering a folded dipole isn't easy. Matter of fact, you even might argue that what this country needs is a good, highly directional indoor FM antenna. Most of those expensive black-box indoor jobs touted so loudly aren't worth the proverbial powder. And even those with a bit of gain aren't directional.

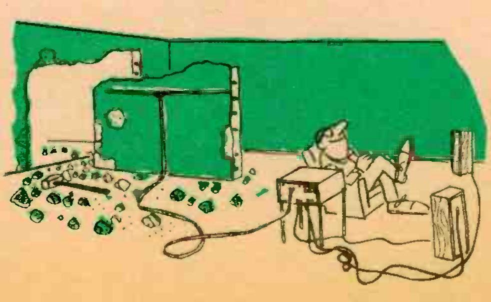
But some of the R&D boys I've talked with lately say it *can* be done. *They* don't want to do it but they believe a compact directional antenna is a possibility—for a price. Anyone willing to pay it?

Speaking of price, the 3M Company has a new master tape machine that—at $5,500 to $8,500—is unlikely to wind up in anybody's living room. But that's not what it's for, anyway. The new recorder is strictly for the recording studio, and what it has to offer is the promise of a whopping 15db gain in signal-to-noise ratio.

Here's how it's done. Each channel of a stereo recording is piped automatically onto two different tracks. One track operates quite normally and can handle peak recording levels without overloading. The other, however, is specially designed so it can pick up the low-level material that's usually lost in the soup. During playback (onto a disc-cutting lathe), the machine samples both tracks and reproduces the one that's best at any given moment.

If 3M's new recorder isn't for the average living room, another new 3M offering definitely is. It's the Scotch-flex speaker cable, a flat, adhesive-backed strip of vinyl tape with four conductors imbedded therein.

Needless to say, this looks like just the ticket for invisible wiring of audio installations. And it ought to be a real boon for anyone whose gear sits out on an open-shelf arrangement. The cable currently is available with accessories for splicing and terminal connections, and for long runs it will convert to a two-conductor arrangement. ◆



Notes from EI's DX CLUB

ANGOLA, long a center of controversy, suddenly is providing North American DXers with a first-class catch. R. Diamang, operated by the Angolan Diamond Co. at Dundo, now is appearing Monday through Saturday on 11685 kc between 1300 and 1430 EST. Signals are fair to good but you'd best nab this one while it's still on this choice channel.

John Brunst, down Florida way, reports a new Nicaraguan on 5965 kc. Station proves to be an SW relay of R. Quinientosnoventa (Managua) and therefore worth noting. The parent station formerly was BCB only (590 kc).

Those who like their DX to speak English should try R. Yaounde's 0005 English newscast on 4972.5 kc. The broadcast originates in Cameroon.

From H.L. Chadbourne in California comes word of a new R. Nacional de Espana transmitter in the Canary Islands. Frequency, strangely enough, is 11800 kc and time is 1900 to 2200.

R. Malagasy (formerly Madagascar) has been testing a new transmitter on 19 meters between 1100 and 1300 EST. Frequency usually is 15270 kc but 15255 has been sampled, too.

Latest prize catch by Gerry Klinck of Buffalo, N.Y., is TFJ, Iceland. (Gerry is Executive Editor of the ASWLC.) And as for that station, you'll find it on 9640 kc at 1530-1700.

Why all the sudden ham activity in Rwanda? The big reason turns out to be that Deutsche Welle (Voice of Germany) relay station. When DW's 600-watt pilot transmitter at Kigali isn't in service, the amateurs on DW's staff throw it on 40-meter fone for their own fun.

William Sparks, California, finally got his QSL Radiodifusao de Timor. But it took a little while—like 13 months! Patient West Coast DXers should try for this one on 3268 kc before 0600 PST.

Everyone seems to be hearing those new high-powered transmitters used by R. Berlin International. But are they really in East Germany? Or could some of the other East European broadcasting organizations which already had the muscle (like R. Prague) simply be relaying RBI?

Latest frequency for R. Republik Indonesia's 1830 English newscast is 9585. Watch for this one on the East Coast, through the QRM, when Peking is particularly strong on 9480.

Though many Latin American stations don't have much history behind them, YVKB at Caracas turns out to be one that does. Known as Radiodifusora Venezuela, the station still is using a home-brew transmitter built way back in 1932 when short-wave was in a pioneer state. Present frequency is 4890 kc.

A country which most any BCB DXer can log without too much difficulty these days is the Leeward Is. Though signal strength isn't spectacular, R. Montserrat often is received on 885 kc before 2100 sign-off. Incidentally, it's rumored that this island group might merge with the Windwards to form a new independent state.

Those CW markers using the prefix 6YR are Cable & Wireless at Kingston, Jamaica. Similarly, Kingston Aeradio (and beacon—360 kc) now is 6YK instead of the former ZET. Frequencies for 6YK include 2952, 2966 and 5566.5.

Propagation: As days begin to lengthen [*Continued on page* 119]

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HOW TO LOG 100 COUNTRIES

READERS familiar with EI's DX Club well know that all but one of its Awards are issued on the basis of the number of countries QSL'ed. In the case of SWL's, the Club will award certificates to listeners who can prove reception of stations in 10, 50 or 100 different countries.

Knowing when and where to look is half the DX'ing battle, of course, and the following listing provides the when and where for 100 different countries. Bring enough patience and persistence to bear, and 100 countries eventually can be yours. Good listening!

NO.	COUNTRY	STATION AND LOCATION	KC.	TIME (EST)
THE FIRST TEN				
1	AUSTRALIA	R. Australia, Melbourne	15220	1714-2300
2	CANADA	R. Canada, Montreal	11720	1300-1700
3	CONGO REP.	R. Brazzaville	11710	1200-2400
4	COSTA RICA	TIFC, Faro del Caribe, San Jose	9645	1800-2400 (Apartado 2710)
5	ECUADOR	HCJB, Quito	9745	1800-2300 (Cas. 691)
6	JAPAN	R. Japan, Tokyo	11780	1800-2000
7	NEW ZEALAND	R. New Zealand	9540	0100-0645
8	SWEDEN	R. Sweden, Stockholm	6065	2000-2245
9	SWITZERLAND	S.B.C., Berne	6165	2100-0100 (DX Editor)
10	WEST GERMANY	Deutsche Welle, Cologne	6160	2030-0130
THE NEXT FORTY				
11	ALBANIA	R. Tirana	9390	1400-1600
12	ALGERIA	R. Algerie	11835	1230-1800
13	ANGOLA	R. Angola, Luanda	6025	0100-0200
14	ARGENTINA	R.A.E., Buenos Aires	9690	2000-0200 (Sarmiento 151)
15	AUSTRIA	Osterreich. Rundfunk, Vienna	6155	1700-0200
16	BELGIUM	R.T.B., Brussels	9705	1815-2000
17	BRAZIL	R. Bandeirantes, Sao Paulo	11925	1800-2200 (Paula Souza 181)
18	BRITISH GUIANA	R. Demerara, Georgetown	3255	1800-2215
19	BR. HONDURAS	R. Belize	3300	1900-2230
20	BRUNEI	R. Brunei	4865	1700-0930
21	BULGARIA	R. Sofia	6070	1500-2300
22	CHILE	R. Nuevo Mundo, Santiago	9700	1800-2300 (Cas. 1627)
23	CHINA	R. Peking	9480	2000-2200
24	COLOMBIA	R. Nacional, Bogota	4955	1900-2400
25	CONGO, REP. OF	R. Leopoldville	9625	2300-0200
26	CZECHO-SLOVAKIA	R. Prague	7345	2000-0030
27	DENMARK	V. Denmark, Copenhagen	15165	1230-1545
28	EAST GERMANY	R. Berlin International	6230	1830-2200
29	EGYPT	U.A.R.B.S., Cairo	11910	1000-1730 (Monitoring Dept.)
30	EL SALVADOR	R. Nacional, San Salvador	6010	1900-2400
31	ENGLAND	B.B.C., London	6195	1815-0100
32	ETHIOPIA	R. V. Gospel, Addis Ababa	11755	1300-1475
33	FORMOSA (Taiwan)	V. Free China, Taipei	11825	2150-2330
34	GHANA	R. Ghana, Accra	11800	1500-1720
35	GUATEMALA	R. Cultural, Guatemala	9667	1900-2400 (Apartado 601)
36	HAITI	4VEH, Cap Haitien	9770	1900-2200 (Box 1)
37	HUNGARY	R. Budapest	9833	1200-0100
38	IRAN	R. Teheran	11705	1200-1730
39	ISRAEL	Kol Israel, Jerusalem	9009	1200-1600
40	ITALY	R.A.I., Rome	5960	1730-1900
41	LEBANON	R. Beirut	9750	2000-2200

NO.	COUNTRY	STATION AND LOCATION	KC.	TIME (EST)
42	LIBERIA	V. America, Monrovia	15315	0800-1615 (Washington, D.C.)
43	LUXEMBOURG	R. Luxembourg, Vill Louvigny	6090	0000-0200
44	MEXICO	V. America Latina, Mexico, D.F.	9515	0700-0100 (Ayuntamiento 54)
45	NETHERLANDS	R. Nederland, Hilversum	6085	2300-2350
46	PHILIPPINES	F.E.B.C., Manila	11850	0130-1200 (Box 2041)
47	ROMANIA	R. Bucarest	7195	2000-2400
48	SENEGAL	R. Senegal, Dakar	9720	1230-1800
49	SOUTH AFRICA	Springbok R. Johannesburg	7270	2200-2300
50	SOUTH KOREA	K.B.S., Seoul	9640	0430-0600
THE FINAL FIFTY				
51	ANDORRA	R. Andorra	5995	1600-1900
52	AZORES IS.	Emisora Regional, Ponta Delgada	4865	1700-1810
53	BOLIVIA	R. Amauta, La Paz	6270	1900-2300 (Commercio 386)
54	BR. SOLOMON IS.	S.I.B.S., Honiara	3995	0230-0500 (Box 115)
55	BURMA	B.B.S., Rangoon	5040	0700-1030
56	CAMBODIA	R. Cambodge, Phnom Penh	9695	0800-1000
57	CAMEROON	R. Yaounde	4972	0000-0100
58	CEYLON	V. America, Colombo	11835	0700-1300 (Washington, D.C.)
59	CENT. AFR. REP.	R. Bangui	5035	2330-0030
60	CHAD	R. Tchad, Fort Lamy	6165	0100-0300
61	COOK IS.	R. Roratonga	5045	0100-0200
62	CUBA	R. Habana Cuba	6135	1900-0100
63	DAHOMEY	R. Dahomey, Cotonou	4875	0000-0200
64	DOMINICAN REP.	R. Santo Domingo-Televison	9505	1900-0100
65	FIJI IS.	F.B.C., Suva	3255	0300-0530
66	FINLAND	F.B.C., Helsinki	15185	1530-1730
67	FRANCE	R.T.F., Paris	11920	1700-2300
68	FRENCH GUIANA	R. Cayenne	6175	0515-0615
69	HAWAIIAN IS.	V.America, Honolulu	9650	0400-0700 (Washington, D.C.)
70	HONDURAS	La Voz de Honduras, Tegucigalpa	5870	1900-0100 (Av. Lempira)
71	INDIA	A.I.R., Delhi	11810	0830-0930
72	INDONESIA	R.R.I., Djakarta	9585	1830-2000
73	IRAQ	R. Baghdad	6095	2300-0200
74	IVORY COAST	R. Abidjan	11820	1130-1730
75	JORDAN	R. Amman	9560	2015-2100
76	MALAWI	R. Zomba	3955	2300-2400
77	MALAYSIA	V. Malaysia, Kuala Lumpur	11900	0400-1030
78	MALI	R. Mali, Bamako	9745	1600-1800
79	MARTINIQUE IS.	R. Martinique, Fort de France	3315	1800-2115
80	MAURITANIA	R. Mauritania, Nouakchott	4855	0130-0800
81	MONACO	Trans World R., Monte Carlo	7260	0230-0330 (Box 141)
82	MOROCCO	R.T.M., Rabat	15185	1300-1830
83	MOZAMBIQUE	R. Clube de M., Lourenco Marques	4925	2230-0100
84	N. CALEDONIA IS.	R.T.F., Noumea	7170	0200-0530
85	PANAMA	R.P.C., Panama	9685	1800-2400 (Apartado 1795)
86	PAPUA TERR.	A.B.C., Port Moresby	9520	2300-0145
87	PARAGUAY	R. Encarnacion	11940	1900-2100
88	PERU	R. America, Lima	9450	1900-2400
89	POLAND	R. Warsaw	7295	1800-2100
90	PORTUGAL	V. West, Lisbon	6785	1900-2300
91	SIERRE LEONE	S.L.B.S., Freetown	3316	0100-0200
92	S. RHODESIA	S.R.B.C., Salisbury	4828	2300-0100
93	SPAIN	R.N.E., Madrid	6130	2000-2245
94	SUDAN	R. Omdurman	9480	2300-0100
95	TAHITI (Fr. Polynesia)	R. Tahiti, Papeete	11825	2300-0200
96	THAILAND	T.N.B.S., Bangkok	11910	0500-0900
97	TUNISIA	R.T.T., Tunis	6125	2330-0100
98	TURKEY	R. Ankara	7285	1500-1700
99	UGANDA	R. Uganda, Kampala	3340	0100-0200
100	VENEZUELA	R. Rumbos, Caracas	4970	1800-2330 (Apartado 2618)

Location is that of the studio. Most stations can be addressed simply by name and studio location; additional address, where required, is shown in brackets.

℞ FOR TAPE

How to diagnose and treat the handful of

By LAWRENCE GLENN

Any hobbyist who has chalked up more than 100 hours on a tape recorder ought to take a few minutes out for maintenance. And anyone whose tape recorder has whirled away for 200 or 300 hours can bet there's room for plenty of improvement.

Though tape heads appear to be quite rugged, they are fouled easily by particles of grime and oxide flake-off. In a way, tape heads are just as temperamental as phonograph styli. Thing is, heads rarely konk out suddenly. Instead, they undergo a slow deterioration which is about as apparent as the droop rate of Pisa's tilting tower.

Slowly but surely, though, highs fall off, noise is added to recordings and tapes begin to skew in and out of alignment. And so gradual is this descent that it's only when the tape heads and guide path are overhauled—and brilliance magically is restored to the sound—that one realizes how much fidelity got lost.

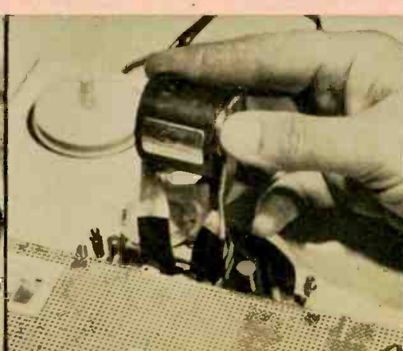
First aid for tape heads begins with routine cleaning. Things being what they are, this should be done after each eight hours of operation, at least.

As the tape passes over the heads, they naturally are worn. Worse yet, some oxide flakes off the tape's base (even if it's Mylar) and accumulates on the trailing edges of the heads—the part the tape travels over last. In time, it's not unusual for a heavy accumulation to lift the tape enough to destroy the all-important intimate contact between head and tape. Result is loss of high-frequency response and poor erasure.

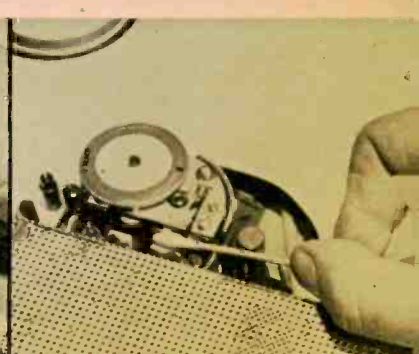
Though most recorder instruction manuals warn against allowing flake-off to accumulate, they also recommend Q-tips dipped in head cleaner for cleaning. What they don't tell you is how to maneuver a Q-tip in a tape slot that just is not wide enough. Sure, you can get the Q-tip into the slot, all right, but it also will contact the pressure pads (if your recorder has them). And the best instantaneous solvent for the cement which retains pressure pads is head-cleaning fluid.

If yours is a narrow-slot recorder, use the Q-tip for cleaning the capstan, pinch roller

Cover must be removed to permit access to most heads. Step usually requires removal of a few screws.

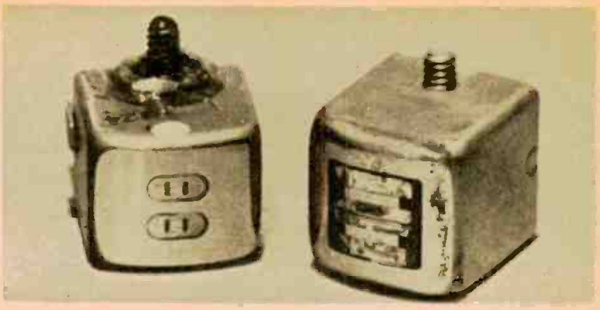


Demagnetizer is a must for head maintenance. Heads should be demagnetized after eight hours of use.



Heads should be cleaned at same time they are demagnetized. A Q-tip often will turn the trick.

HEADS



pains that every head is heir to

and tape guides (all of these also are subject to flake-off accumulation and should be cleaned at the same time the heads are). Use Kleen-Tape or its equivalent for the heads.

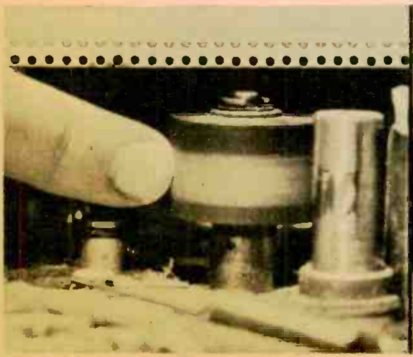
By way of explanation, Kleen-Tape is a fabric ribbon supplied on a standard tape reel. It is moistened lightly with cleaner and then run through like a tape, cleaning the heads as it passes over them. While it does moisten the pressure pads with head cleaner, there isn't enough cleaner present to dissolve the cement. Kleen-Tape also is useful on recorders that require tools to dismantle the head cover; you just run it through and the job is done.

Make it a practice to demagnetize the heads whenever they are cleaned. A magnetized head usually stems from excess record signal levels or perhaps contact with a magnetized tool. Bad thing about it is the fact that it adds noise to recordings every time the tape is played. Take a few seconds with a head demagnetizer, however, and this trouble can be avoided.

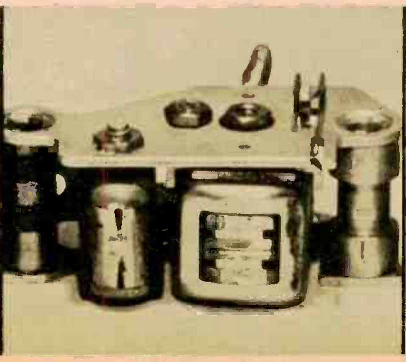
Something else that must be checked periodically is head alignment. Thing to do is play back a tape you made when the machine was new or put on a commercial alignment tape. Using light finger pressure or a Q-tip, skew the tape up and down at the playback (or record/play) head. If motion in either direction causes the highs to *increase*, the head is out of alignment. Naturally, the greater the amount of skewing needed to increase the highs the greater the misalignment. If skewing causes the highs to *decrease*, the head is in alignment.

Though you might think this puts the cart before the horse, aligning tape heads starts with demagnetizing the screwdriver and any other tools you'll need for the job. Place the tools on a bulk tape eraser, wiggle them around, then slowly remove them. Do not leave them on the eraser and shut off the power because this will cause tools to remain in a magnetized state.

Locate the alignment screw (or whatever adjustment is provided) and rotate the head slowly from side to side as the alignment tape is feeding through. At some adjustment,



Oxide flake-off on capstan pinch roller shows cleaning is called for. A Q-tip again is required.



Head assembly reveals heavy wear; photo at top of page contrasts appearance of old and new heads.

Tools always should be demagnetized with a bulk tape eraser before bringing them near tape heads.

maximum high-frequency response will be obtained. This is the *exact* alignment adjustment and the alignment screw should be locked at this setting.

In the case of three-head machines, first adjust the playback head as described. Then feed in a signal with plenty of highs, set the machine to record and adjust the *record* head for maximum high-frequency response while listening to the simultaneous playback. Better yet, feed the output of an AF signal generator into your recorder with the generator set at 7,500 or 10,000 cycles (the higher the better). Maintain the proper record level, then adjust the record head for maximum output on simultaneous playback.

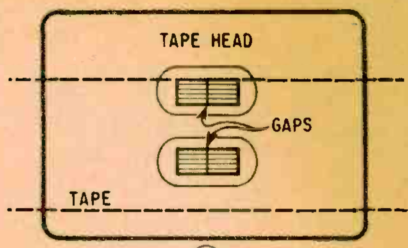
Given time enough, of course, all heads wear out. Fact is, many heads will show signs of wear after about 100 hours of operation. (Actually, the better the recorder the better the head quality, and you might get by with up to 500 hours before severe head wear starts to show.) As the heads wear, several factors work toward ruining your enjoyment.

First, excess wear by a combination of factors can—and usually does—reduce the recorder's high-frequency response. Second, small pits are developed on the head surfaces which fill with flake-off. The flake-off fill attracts more flake-off until there are hard little hills on the head surfaces. These hills in turn cut into the oxide as the tape passes over and loosen even more oxide in a never-ending process.

A third problem is the knife-edges worn into the heads at the top and bottom of the normal tape path. If the tape skews in passage or if the tape is warped, it passes over these edges, which cut into the oxide. Both pits and knife-cuts evidence themselves as tracks cut into the tape coating.

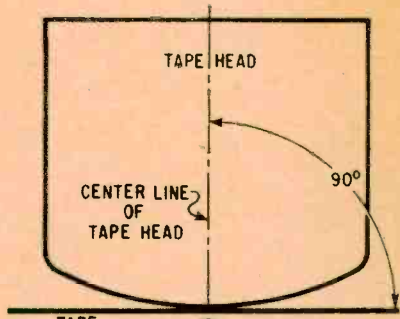
Since head replacement isn't a difficult job, there's no need to put up with inferior performance. Nevertheless, you've got to go about it the right way. Sure, you always can get a replacement head from one source or another, but if yours is a budget recorder why put in another fast-wear head? For a few dollars more you can obtain a professional-quality head, one less prone to wear and pos-

[*Continued on page* 119]



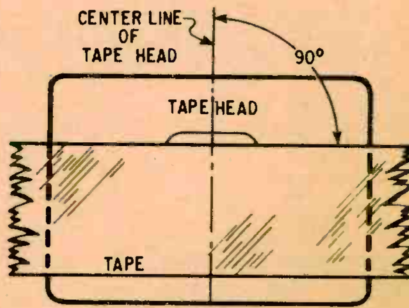
①

Gaps must span proper portion of tape; drawing shows position for 4-track head.



②

Optimum performance results when center line of head forms a 90° angle with tape.



③

Gap on head must form 90° angle with the edge of tape; this is azimuth adjustment.

Replacing tape heads can be a relatively straightforward operation if three things are kept in mind. As our diagrams show, 1) head must be positioned properly against tape, 2) face of head must be at right angles to tape, 3) gaps in head must form right angles with edges of tape.

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About Phone Patches

Continued from page 54

in the final version, the Commission stating that other laws amply spell it out.

Despite the law and the warnings in the phone books, there is a significant amount of phone-patch activity in ham radio. And it's a matter of record that the phone company traditionally has looked the other way. Several reasons are put forth. Hams use patches almost exclusively to handle phone calls from overseas servicemen. Since the radio link is free, the serviceman doesn't spend a half-month's pay to call home; instead, he pays only the toll charge for an ordinary long-distance call inside the U.S.

Attacking this practice would be about as as popular a move as calling Paul Revere a coward for riding out of Boston. It's been estimated, too, that the phone company has enjoyed higher toll traffic in the U.S. due to the patch. Reason is that most servicemen simply wouldn't have placed a costly overseas call without an assist from the ham.

CB and phone-patching also could form a working partnership, especially for public service. The CBer involved in an emergency situation, for example, could permit officials —Civil Defense, Red Cross, police—to speak directly to others via phone line.

Thing is, any phone patch must be used only for good, legitimate reasons and then only with the greatest discretion. You won't find it in any lawbook, but an unwritten code on phone patches might read something like this:

1. Use a patch only when no other facility is practical for the communications job at hand. The patch never should be used to lower your monthly telephone bill.
2. Patches must be well-designed so as not to disturb the phone line. They are available in kit or wired form, but make certain the one you get is a good one. (If you want to build your own, see our Phone Patch project elsewhere in this issue.)
3. Never put a telephone operator's voice over the air and never allow dialing tones or clicks to be transmitted.
4. Always explain to the party on the other end of the phone line that hundreds of eavesdroppers may be listening in.
5. Finally, use a patch sparingly.

—Len Buckwalter, KBA4480

Part 15 Powerhouse

Continued from page 58

If the Powerhouse's signal has some distortion (caused by overmodulation) move diode D1 from the top of R1 to the junction of R1 and R2. If this doesn't do it, move D1 to the junction of R2 and R3.

Operation. When using the Powerhouse, set the CB transceiver on a transmit frequency several channels away from the Powerhouse's crystal frequency. This is necessary because some RF from the CB set could leak through and interact with the Powerhouse's transmitter.

To transmit, press your CB rig's push-to-talk switch and flip S1 to transmit at the same time. Release the PTT switch, flip S1 to receive and the CB receiver will pick up the incoming signal.

To operate your 5-watt setup normally, you may simply set S1 to *receive*. However, it is better to disconnect the Powerhouse to minimize losses that might be introduced by S1.

What's Ahead For CB

Continued from page 42

watt rigs stepped up power ten times to 1 watt. Today there is a doubling to 2 watts. Physical size remains within the convenient walkie-talkie package.

The Webster unit, out for some months now, recently was joined by the new Lafayette HA-300. It'll fit in a palm and it offers a possible ten-mile range over favorable terrain. Another upcoming contender in the teenie-tiny high-power class is Maxwell Electronics' Radiocom. It boasts a full 5-watt transmitter but still is hand-held, weighing in at 2½ lb.

The bi-power set is a brand-new category to add to the list of regular rigs, walkie-talkies and monster midgets. Just introduced by E.C.I., the Courier 12 is a conventional 5-watt transmitter—until you take a look in back, that is. There you'll find a switch which, when flipped, converts the rig automatically to a certified Part 15 transceiver of the 100-milliwatt type.

Install a rock on 27.995, and you can forget about regular CB rules while working other stations under Part 15. Long-winded chatting, working skip, calling CQ, even pounding a code key become legal. To complement the Courier 12 when it's on Part 15 operation, E.C.I. also has announced a line of special 5-foot antennas and a mast-mounted preamp.

Selective call is still another area where things just aren't what they used to be. After the dam broke, filling the marketplace with numerous one- and two-tone signaling systems, designers took a second look. What they saw prompted newer, more-sophisticated gadgetry. Topping the list is Cadre's new triple-threat 524. It employs a three-tone combination to offer more code possibilities and increased resistance to false responses. Operating the 524 is like winding up a three-minute egg timer—and the unit has nearly the same action.

Unlike other callers which transmit tones all at once (simultaneously), this one sounds them one after another (sequentially). Stringing out tones is done by a spring mechanism; press down the call lever and it take several seconds to return, keying the transmitter as it goes. The think circuits in the distant receiver shrewdly accept only the correct tone combination and order.

A novel bit of automation appears in Utica's selective device, the Uti-Call. As the CBer lifts the mike off its hook, the receiver comes alive automatically so the channel can be monitored before transmitting. If it's clear, the act of pressing the mike button transmits the tone code. Another feature: if the operator is out of his car during the incoming call (from a station transmitting the correct code), the car horn is sounded for one second.

Finally, don't think your neighbor's gone wooly if you catch him trying to feed transmitter power into his car's luggage rack. Chances are the rack is one of the new square antennas sitting flat atop the car roof. Called the Squalo, it's made by Cush Craft.

To sum up the long and the short of it, 1965 isn't going to be the year of CB equipment's great leap forward. But it does seem to reflect a progressive, sure-footed pace. After all, CB's come a long way since the time a communications engineer was asked, "What do you think of CB circuits?" In reply, he didn't say a word, just leaned back and guffawed. But that, as we said, was several years ago. Today, he's apt to take a second look.

Those Totable Transceivers

Continued from page 78

of course, is that of any 5-watt transceiver, being limited only by the choice of antenna. Connected to a portable-type loaded antenna, these units easily can deliver a signal over 5 to 10 miles of flat terrain or 20 miles of water. Connect the 5-watt unit to a standard antenna mounted high in a tree and the range goes to 15 or 20 miles in open country.

The 5-watt portables can be purchased for operation on 12VDC only or for 12VDC/117VAC use. Then, too, an accessory 117VAC supply can be used with all DC models.

When it comes to buying any totable transceiver, big rule is never to overbuy—unless, of course, you just don't care how you spend your money. If you need a walkie-talkie on a construction job where the working range is 50 or 100 ft., any inexpensive unit will do. In fact, using a high-power walkie-talkie over a short range may result in a signal so strong that it overloads the receiving unit.

But for communicating primarily over relatively long distances where maximum reliability is a prerequisite, something a mite better will be required. Should you need a one-mile range, one of the true 100-mw units just might squeeze through. But it's best to keep on the plus side and get a rig with a little more sock—a 1-watt unit, say. This way you're certain to get the range even when the batteries weaken.

Something else to keep in mind is battery requirements. If you can get to a 117VAC source conveniently, nickel-cads might be a good investment. This way you never have to worry about replacing batteries; you simply recharge them. Comes the day when you go on a camping trip, though, and you just may not be able to find an AC source for love nor money. A sack full of flashlight batteries in this instance certainly would be more convenient.

Though our directory includes all models currently in production, bear in mind that new models come out almost weekly. Sometimes these are old units in new cases, though they well may be new all the way through. In any event, prices ordinarily change when cases or model numbers are changed. And, as a general rule, the latest models offer the most value per dollar.

Phone Patch

Continued from page 53

signal, simply depress the PTT switch and, using a modulation meter, adjust R5 for optimum modulation. When the PTT is released the received signal will be fed to the telephone circuit.

The transceiver's volume control is used to set the level of the signal fed into the telephone lines. Adjust the volume control so M1 indicates about −4 VU on speech peaks. Under no circumstances try to feed in a higher-level signal. It will only overload the telephone circuits—and this again makes telephone companies unhappy. M1 does not indicate when feeding from the telephone to the transmitter. When the call is completed, set S1 to *off* to restore normal transceiver operation.

There are many more applications for phone patches than we discussed at the beginning of this article. Once you become familiar with patch operation, a little bit of imagination will help you find other interesting and important uses for the device.

"So much for your QSL cards. Now we can have the regular deck?"

Build Your Own Electronic Organ

Continued from page 33

and produce a wide range of interesting sounds such as that of the mandolin, marimba and xylophone.

The vibrato works well even though its intensity cannot be varied and its speed can be changed only on the amplifier and not near the manuals. The two-speed Leslie speaker makes the GD-983 sound like a big theater organ and imparts an authentic quality to liturgical music.

The location of the percussion and speaker tabs on the right of the lower manual takes a while to get used to. Reason is that the location requires you to swing your left arm over to the right to make registration changes while you're playing. The chimes aren't quite what they might be but with only the quint tab depressed their sound is fairly good.

In spite of these small shortcomings we consider the GD-983 an excellent value and a fine musical instrument in its price class. It's a big assembly job, but you'll get years of pleasure from the infinite variety of its musical voices.

5-Watter Portable

Continued from page 67

In the Field. If your transceiver's 12-volt power cable does not have a connector on the end, install a cigarette-lighter type plug on it. This can be obtained from most auto-supply stores. If your transceiver has a transistor power supply instead of a vibrator, be sure the positive lead is connected to B1's positive terminal or the transistors will be destroyed.

The best antenna to use is a collapsible portable type. In the photo on the first page of this article we show a base-loaded telescopic antenna (Lafayette 99 G 3015) plugged into a Lafayette HB-500 transceiver. (If your transceiver has an antenna connector other than a PL-259 you'll need an adaptor.)

This antenna puts out a solid signal over a 5-mile range, providing there are no skyscrapers or mountains in the way. In hilly country it performs about as well as any mobile whip.

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Notes From EI's DX Club

Continued from page 101

the ionosphere warms and expands. These changes affect the way in which radio signals are reflected by the ionosphere

The tendency toward higher nighttime frequencies, for example, will result in a tapering off in BCB DX. The relatively nearby Canadians and Latins still will be coming in, as will many distant U.S. medium-wave stations. But Europeans in general won't be heard well. Further, since thunderstorm activity in the Northern Hemisphere will increase during the warmer months, more noise will be generated in the BCB and SW bands. This, too, will affect reception adversely.

On the credit side, seasonal increases in TV and FM DX will start being observed.

Of the SW bands, 21 mc will continue to be the highest daytime DX band. The 17-mc band will be better for DX, and 15 mc will be best and most-used by international broadcasters.

At night, 6,7,9 and 11 mc will be useful, with 6 and 9 mc generally best.

Rx For Tape Heads

Continued from page 110

sibly offering better overall response.

For the non-serviceman do-it-yourselfer, a Nortronics replacement head is a good choice. Part of a replacement kit, the head is supplied with new pressure-pad material (a year's supply), solder lugs (if they're needed), soldering aids and instructions specifically for your model tape recorder.

When replacing heads always take extreme care. Make certain *all* tools used to remove the head and its assembly are demagnetized. It's also a good idea to demagnetize the new heads and all fittings removed from the recorder. Under no circumstances allow any metal tool to come in contact with the front of the heads; after all, there's no sense adding pits before you run the first tape through.

If possible, don't disturb the original alignment and head-height adjustment screws. Most often, the replacement heads will be in fair alignment as installed. At worst, the new heads will require only a slight trimming of the adjustment screws.

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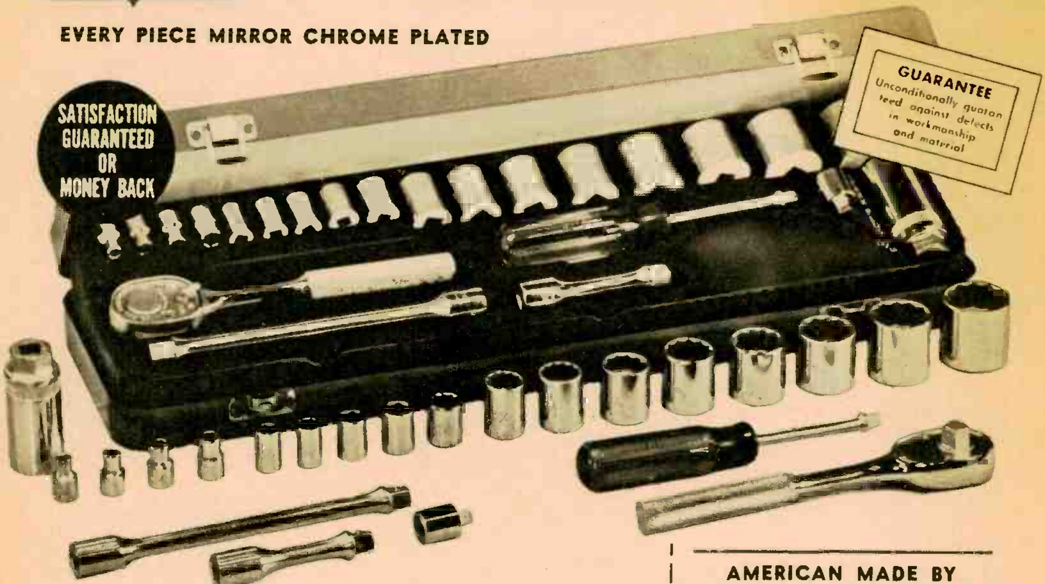


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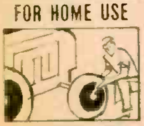
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