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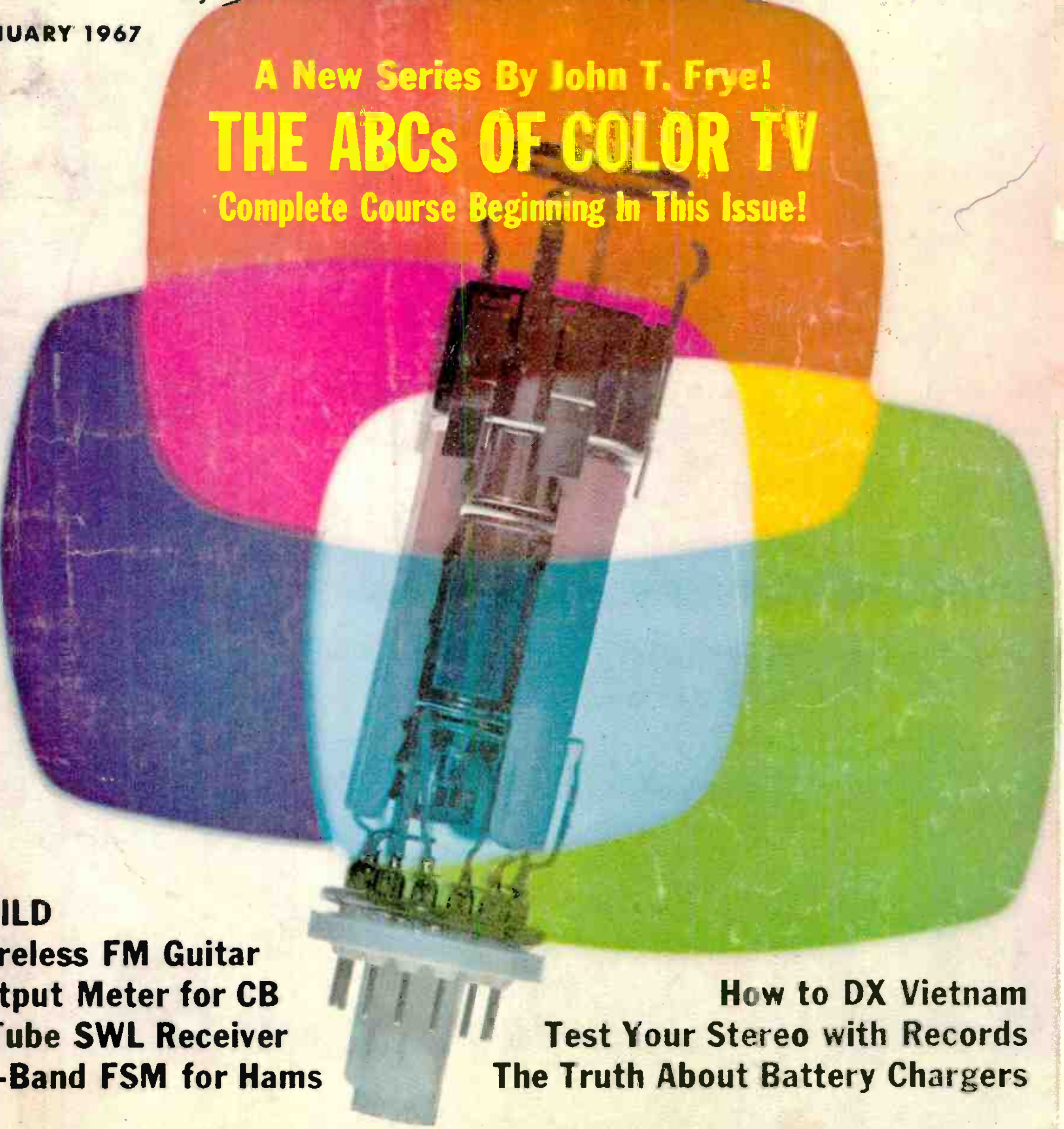

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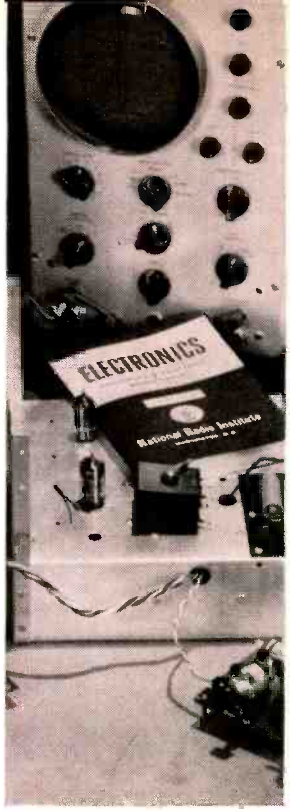

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JANUARY, 1967 A Fawcett Publication Vol. 10, No. 1

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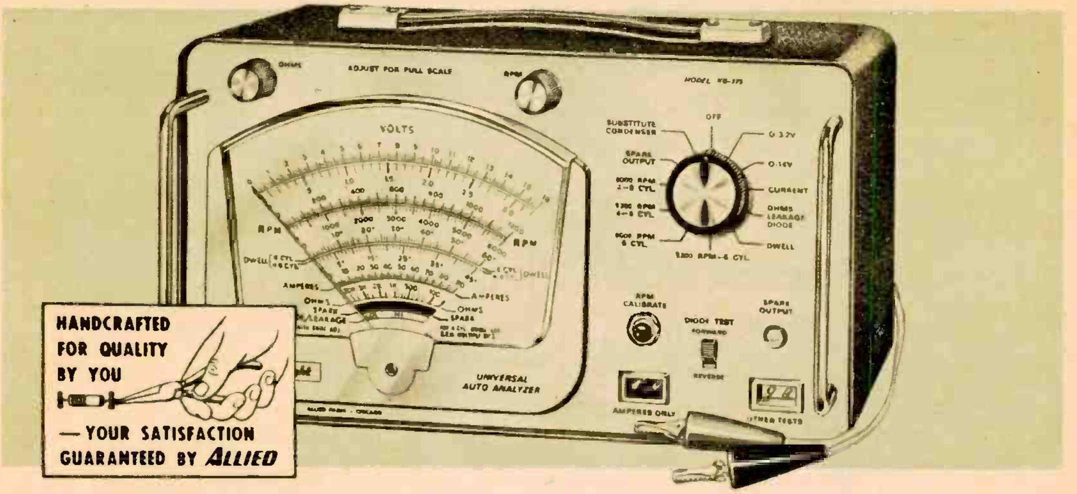

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CONTRIBUTING EDITORS

amateur radio	Robert Hertzberg, W2DJJ
citizens band	Len Buckwalter, KBA4480
swl-dx	C. M. Stanbury II
special projects	Herb Friedman, W2ZLF/KBI9457
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FEEDBACK
from our readers

Write to: Letters Editor, Electronics Illustrated, 67 West 44th Street, New York, N.Y. 10036

NEW HOPE

Until I read your article titled The Vanishing Battery, I couldn't understand why I was hearing music in my martini. Could you please tell me where I can get plans for retuning the olive? I prefer Lawrence Welk.

J.D.
New Hope, Pa.

Have you tried beer?

DEPT. OF CONFUSION

From a press release: "The TechRep Division of Ford Motor Company's Philco Subsidiary has been selected to operate and maintain the transmitting equipment of radio station WWV in Greenbelt, Md."

From a letter to Philco: "I am wondering whether WWV is pulling your leg or you are pulling ours. We have an article [Nov. '66 EI] about how WWV is moving Dec. 1 to Colorado, which is going to leave your people fairly unoccupied in Greenbelt."

From a letter from Philco: "Our best information is that WWV has no intentions of moving in December. Speculation concerning a possible move has been noted in the trade and technical press for two years and with each publication, the move was reported as imminent."

Will WWV make it to Colorado? Or is it doomed to a drab life in (gulp!) Greenbelt? Tune in (2.5, 5, 10, 15, 20, 25 mc) any tomorrow after Dec. 1 and see for yourself!

HOT LINE

Hey man, why is it that when I stick a steel file into one side of an electric outlet I get shocked but not on the other side?

Spence Tomb
Sewanee, Tenn.

Well, live (?) and learn.

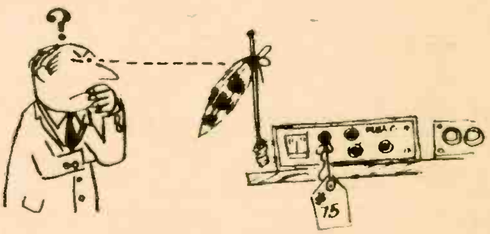
IN-CAPACITY

How can I build your computer [Nov. EI] without knowing values for C2 through C11?

Irving B. Morgenstern
Lexington, Ky.

You can't. They're all .01μf, 100-V and may be mylar-paper. Sorry about that, Irv.

SHERLOCK



About your article on The Truth About Used CB Equipment (Nov. '66 EI), how can I tell whether a rig has been modified?

J.J.D.
Long Beach, Calif.

Watch your mailbox—for an FCC citation.

ACHTUNG!

Your answer to S.S. in Sept. was not right; Germany also has a zip code. For example:

A letter to Frankfurt am Main has the prefix 6000 (or 6) in front of the city. The letter goes directly to Frankfurt. A letter to Mannheim has 6800 (or 68). The letter goes to Frankfurt am Main and is resorted for Mannheim. A letter for Saarbrucken has 6600 and goes to Saarbrucken via Frankfurt am Main. A letter for Zweibrucken has 6660 (or 666) and is routed via Frankfurt am Main, Saarbrucken and finally to Zweibrucken. A letter to a village near Zweibrucken would have the number 6661 or 6662 or 6663, etc.

Norman DeForest
Bagotville, Que.

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Visual . . . You can tell at a glance whether transmitter adjustments are needed from the pattern on the SB-610 Signal Monitor scope. The SB-610 is adaptable for transmitters operating

from 160 to 6 meters over a power range from 15 watts to 1 kw. For observing received signals, it can be used with receivers whose IFs are as high as 6 mc. Manual shows typical waveforms for SSB and RTTY. Kit, $69.95. Heath Co., Benton Harbor, Mich. 49022.

MARKETPLACE

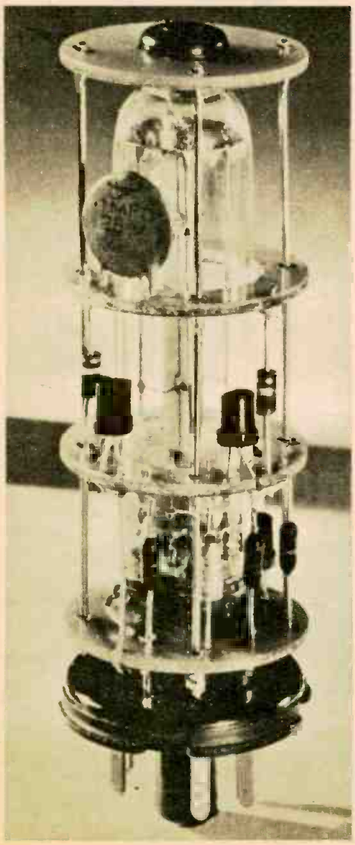
HELPer . . . Standard on the Companion 111 CB transceiver are channel 9 crystals, installed for operation on the HELP frequency. The transceiver will handle six CB channels, also is pro-

vided with a public-address-system jack, of value in police work for control of crowds and adaptable to a wide variety of situations. The electronic switching system changes channels at the tap of a push button. Other circuit features include automatic noise limiting, automatic output limiting for full modulation. The unit weighs 3 lbs., measures only 8½ in. wide x 2¼ in. high x 6⅜ in. deep and has a front-panel speaker. $139.90. Pearce-Simpson, Inc., Box 800, Biscayne Annex, Miami, Fla. 33152.

Monitoring . . . The aptly-named Listen-In is a crystal-controlled converter that will permit a standard AM radio to tune any frequency in the 25-175 mc range. Two 1½-volt penlight batteries supply power to the Listen-In, which is tuned with plug-in crystals to the channel it is to monitor. The unit converts the higher frequency to BCB RF so it can be monitored by the AM radio. Since the spectrum in which it can be tuned includes the FM band, it could be put to a variety of uses outside the more obvious communications and emergency applications. It might also be used to keep track of a ham frequency while you're listening to the ball game so you can take off for the shack when you hear some activity. The standard model will tune one channel; the deluxe model will accommodate two crystals. $19.95 ($24.95 for 2-channel model). Regency Electronics, Inc., 7900 Pendleton Pike, Indianapolis, Ind. 46226.

SELF-POPPING . . . The trial balloon at the left supports a fine-wire passive antenna for use in outer space. Although communications satellites aren't exactly red-hot news these days, there is something special about this test. At launch from Vandenberg AFB the whole antenna assembly was contained in a canister like the one held by man at lower left. Once helium had inflated balloon (and wire antenna) in space, ultraviolet radiation disintegrated the balloon's special plastic, leaving only the wire for minimum satellite disruption from space plasma, meteoroids or thermal changes.

...electronics in the news

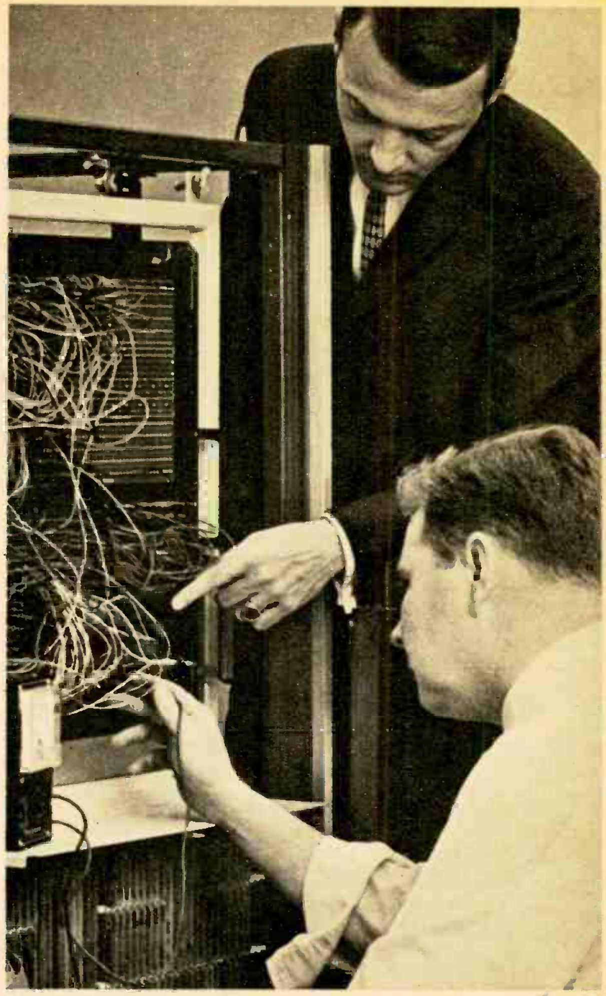


Curtain raiser . . . The pattern on the oscilloscope represents the shape of the opening between curtains of the brand-new Metropolitan Opera House in New York. It's part of elaborate stage machinery with electronic controls for exact, automatic reproduction of effects. Screen tells backstage technicians how curtains part, rise, drape. CRT deflection voltages are derived from pots that are coupled to the winch motors.

Oversize microelectronics? . . . The Marconi Co., Ltd. of England has announced a series of low-cost, medium-stability oscillator modules, crystal-tuned to frequencies ranging from 1 kc to 100 mc. Glass-enclosed quartz crystal and surrounding transistor circuit are enclosed in aluminum tube (here removed) on octal or (above 115 kc) miniature 7-pin base.

Why does one of these men earn so much more than the other?

More brains? More ambition?



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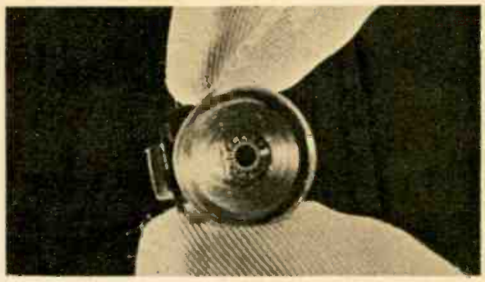
...electronics in the news

Quartz Filter . . . Most SSBers are familiar with filters of the crystal-lattice variety which often are used to suppress unwanted sidebands. Thing is, these filters typically contain as many as eight individual electronic components, which



fact tends to make them expensive and complicated. The gadget in our photo—a single wafer of quartz with two electrodes—well may succeed in simplifying this situation. Although crystal normally has but one resonant frequency, the quartz-wafer device—developed by Bell Telephone Laboratories—exhibits a dual resonance and thus will function as a filter. It can be fabricated for any frequency from 1 to 150 kc.

Pill-Size Oscillator . . . Though the semiconductor diode rarely is thought of as a microwave oscillator, the pill-size version in our photo is generating RF more effectively than many a soap-box-size cousin. Secret is a process called avalanching, which enables the unit to perform as an oscillator. Developed by members of the

Army Electronics Command at Fort Monmouth, N.J., the gallium arsenside diode already promises to be a major electronic advance. Reason: its miniscule size, miserly power requirements and low cost mean it well may prove capable of replacing klystrons and other tube-type devices in a variety of applications. Unusually stable and easy to tune, the diode is capable of operating at 40,000 mc though best performance has been in the 13,000-14,000 mc range.

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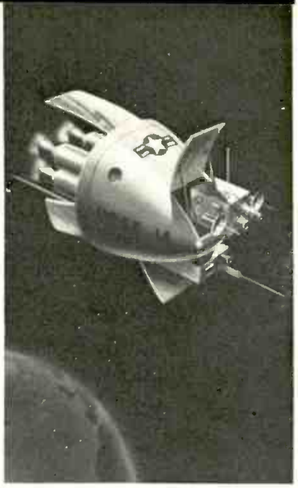

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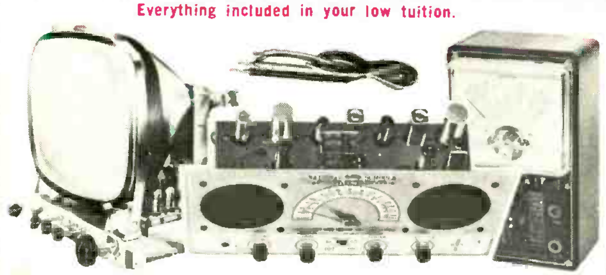

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ELECTRONIC
SWAP SHOP

El's Swap Shop provides a way for readers to obtain equipment they want in exchange for items they no longer need. Listings are limited to one item and must be from individuals; commercial concerns are referred to El's classified ad columns. Entries must include your name and address as well as a description of what you have and would like in exchange. Address: Swap Shop, ELECTRONICS ILLUSTRATED, 67 West 44th Street, New York, New York 10036.

HI-FI amplifier, other items. Will swap for ham equipment. Dick Bragg, 4634 N. 44th St., Phoenix, Ariz. 85018.

LAFAYETTE RK-142 Tape Recorder. Swap for CB transceiver. Wayne Del Medico, 3220 Oneida St., Sauquoit, N.Y. 13456.

LAFAYETTE HE-35A 6-meter transceiver. Will swap for 2-meter receiver or best offer. Israel Moskowitz, 1060 Sheridan Avenue, New York, N.Y. 10456.

HEATH VF-1 VFO. Swap for ham gear. Paul Baillie, Box 4, Bourne, Mass.

ASSORTED RADIO AND TV tubes, other items. Interested in Knight C-540 CB transceiver. Bruce Zuckerman, 3 Suburban Rd., Clark, N.J. 07066.

WEN 2-speed ⅜-in. drill and accessories. Make swap offer. Stephen Clifton, WA2TYF, 800 West End Ave., New York, N.Y. 10025.

ZENITH Model 12015, 4-band receiver, 550 kc to 50mc. Swap for RCA VTVM. Steve Milovich, 144 Dearborn St., Buffalo, N.Y. 14207.

KNIGHT KG-220 FM receiver. Interested in 155-175mc FM receiver or CB gear. Bill Stickney, 259 Pearl St., Middletown, Conn. 06457.

ZENITH portable stereo, other items. Swap for ham receiver. Gary Pritchard, 1450 N. Buckner, Dallas, Tex. 75218.

POLAROID 95B land camera with flash. Swap for SW receiver. Bill Wells, 1059 Christopher Cir., Rock Hill, S.C. 29730.

LAFAYETTE RK-142 Tape Recorder. Swap for CB transceiver or hi-fi equipment. David Revere, 1112 W. Chalet Dr., Mobile, Ala.

MAYFAIR tape recorder. Will trade for CB walkie-talkie or ham equipment. Randall Koper, 1107 Locksley S. W., Wyoming, Mich. 49509.

HI-FI speaker, 12-in. Will swap for CB transceiver or portable TV. John Sommese, 172-25 127th Ave., Jamaica, N.Y. 11434.

HEATH AC-11 FM multiplex adaptor. Make best offer. Gary M. Barclay, 5000 Spica Pk, Sacramento, Calif. 95823.

SHURE 545 mike. Swap for SWR meter or field-strength meter. K. R. Schreiber, 473 Wolfel Ave., St. Marys, Pa.

NORELCO cartridge tape recorder, or other items. Will swap for Hammarlund, Knight or National receiver. P. L. Thomas, 910 9th St., West Des Moines, Ia. 50265.

[Continued on page 20]

ELECTRONIC SWAP SHOP

Continued from page 19

RCA Mark VII CB transceiver. Swap for 2-meter transceiver. A. E. Zick, WA9OGI, 2180 S. 12th, Springfield, Ill. 62703.

GRAETZ MK-50 stereo tape recorders. Swap for Hammarlund or National receiver. James N. Orr, 5990 Fry Rd., Brookpark, Ohio 44142.

ASSORTED TUBES, other items. Need 80- and 40-meter receiver. Mike Brenner, 23 Cromwell Rd., Carle Pl., N.Y. 11514.

RCA 3-RG-31 receiver, other items. Will swap for Heath Sixer or other ham equipment. Mike Bratcher, Rte. 1, Maysville, Okla. 73057.

KNIGHT Span Master. Will swap for Conar Novice transmitter. Aldon Perkins, R.R.#1, Spencerville, Ind. 46788.

TV CAMERA with accessories. Swap for CB, ham or other communications equipment. Gregory E. Hyman, 19 Sicard Ave., New Rochelle, N.Y. 10804.

KNIGHT Star Roamer SW receiver. Want CB transceiver. Ronald A. Holliday, 6250 Barbanell St., Long Beach, Calif. 90815.

POWER TRANSFORMERS. Need Knight R-100A or RF signal generator. Lester Oliver, R.D.#4, Donation Rd., Greenville, Pa. 16125.

TAPE RECORDER, other items. Will swap for Hallicrafters S-118 or Heath GR-54. Bob Spencer, 114 Hilltop Rd., Lakewood, N.J. 08701.

CODE COURSE on tape. Make swap offer. Steve Holmberg, 5700 York Ave., So. Minneapolis, Minn. 55410.

FM TUNER, other items. Will swap for CB or ham equipment. Scott Stewart, 102 S. Grace St., Crockett, Tex. 75835.

KNIGHT C-100 walkie-talkies. Interested in components and tools. John Phipps, R.R.#2, Box 88, Chrisman, Ill. 61924.

MALLORY Recto Power Supply. Will swap for CB transceiver. Bruce Brandes, 6644 Akron St., Philadelphia, Pa.

SILVERTONE Mono tape recorder, other items. Will swap for stereo tape recorder or make offer. Marc A. Armstrong, WA5GZC, 5104 Gaston Ave., Dallas, Tex. 75214.

LAFAYETTE TE-15 Tube tester. Will swap for SW receiver. Ottis Haney, Rte. 7, Box 100, Greenville, Tenn. 37743.

KNIGHT wireless broadcaster, other items. Will swap for compressor preamp. Bill Steinfelt, Jr., R.D#2, Red Lion, Pa.

HALLICRAFTERS S-120 Amplifier. Swap for 12 V CB rig. C. Dwane Stevens, Rte. 3, Healdton, Okla. 73438.

MODERN DIAL TELEPHONES. Swap for test equipment. Kent C. Browser, Canal P.O. Box 252, New York, N.Y. 10013.

KNIGHT T-150. Will swap for 6-meter transmitter or transceiver. Jack Wilson, WA1CYM, Plum Brook Rd., Woodbury, Conn. 06798.

VHF CONVERTER. Want VTVM. Bob Ashcraft, 3542 N. Utah St., Arlington, Va. 22207.

HEATH GR-91. Will swap for mono hi-fi amplifier. Dick Feenberg, 7128 Kingsbury, St. Louis, Mo. 63130.

SONY Micro 5-in. TV. Will swap for CB or test equipment. Jerry Rathburn, 22 W. Main St., Alexandria, Ohio 43001.

HEATH AR-3 receiver. Will swap for CB transceiver or make swap offer. Dave Grenewetzki, 2865 San Benito Dr., Walnut Creek, Calif. 94596.

GLOBE V-10. Will swap for Heath HX-10 Marauder. Jim Sheffield, WA5NLF, 1150 East Dr., Beaumont, Tex. 77706.

B & K 400 C.R.T. checker. Swap for Polaroid camera or binoculars. D. L. Walker, Rte. 5, Box 117, Seneca, S.C.

KNIGHT Span Master with headphones and bullhorn loudspeaker. Will trade for CB transceiver. Michael Prodan, 1917 W. Marquette Rd., Chicago, Ill. 60636.

GLOBE V-10. Make swap offer. Lester Naylor, 808 W. 17th St., Hastings, Minn.

HEATH HR-10 with speaker. Want oscilloscope. Steve Osborne, Rte. 1, Union City, Tenn. 38261.

KNIGHT Star Roamer. Swap for VHF transceiver. Bill Bulchus, 64 Summer St., Hawthorne, N.J. 07506.

GEIGER COUNTER. Will swap for Lafayette HB-115A or other transceiver. Ronnie Greene, Box 67, Roan Mountain, Tenn. 37687.

WINEGARD U-730 UHF collinear antenna. Will swap for VHF TV booster or best offer. Morrie Goldman, WN9RAQ, 8046 S. Euclid Ave., Chicago, Ill. 60617.

PHILMORE TC-612 CB transceiver. Need test equipment or make offer. Roy Bales, 7823 Peppertree Rd., Dublin, Calif. 94566.

RECORDS, 45-rpm. Want Lafayette HA-60A walkie-talkie. Bruce Blechman, 2288 Mott Ave., Far Rockaway, N.Y. 11691.

EICO 360 TV-FM sweep generator. Will swap for EICO 377 sine- and square-wave generator. John Irwin, 10564 Lincoln, Huntington Woods, Mich. 48070.

HALLICRAFTERS S-120. Will swap for Lafayette HB-115A, HA-50A or HA-50. J. Ptacek, 3673 E. 53 St., Cleveland, Ohio 44105.

AM EQUIPMENT. Will swap for tape recorder. Mark Bell, 12567 Sugar Ave., Baron, Calif. 93516.

MOTOROLA TR12N ignition system. Make swap offer. Jim Hall, W4BLX, 8907 Tolman Rd., Richmond, Va. 23229.

NATIONAL NC-60. Will swap for tri-band beam antenna. Michael Gegan, WA6SNP, 311 Milagra Dr., Pacifica, Calif. 94044.

ZENITH 19-in. TV. Swap for CB equipment. Roy Lothringer, 3270 Rancho La Carlota, Covina, Calif. 91723.

TRANSISTOR RADIO, other items. Make swap offer. Wayne Miller, Rte. 1, Ford City, Pa.

CONAR VTVM, other items. Make swap offer. Ben L. Seeber, 1510 Rose St., Irving, Tex. 75060.

LAFAYETTE HE-30 receiver, matching speaker. Will swap for tape recorder or signal generator. James Glynn, 4863 W. Center St., Millington, Mich. 48746.

CONAR kit, other items. Want 2-meter transceiver. Bill LaJoy, Morrisonville Rd., Plattsburgh, N. Y. 12901.

HALLICRAFTERS S-53A Super Skyrider SW receiver. Want 2- and 6-meter ham equipment. Mike Bane, WB4DCO, 4483 Quince Rd., Memphis, Tenn. 38117.

GONSET Sidewinder 2-meter transceiver. Will swap for hi-fi or ham equipment. Carl Schentes, Box 222, Ellsworth, Me. 04605.

CODE-Practice oscillator with battery. Will swap for SW receiver. James Bowers, 517 Bryan Blvd., Goldsboron, N.C. 27530.

INVERTER, 24 VDC to 110 VAC. Will swap for Lafayette HB-115A CB transceiver. John Whitelam, 21160 Canyon View Dr., Saratoga, Calif. 95070.

HALLICRAFTERS SX-140. Swap for Lafayette HE-20C or other CB transceiver. M. S. Davidoff, 155 E. 168th St., New York, N.Y. 10452.

SCR 284/BC-654A receiver/transmitter (3.8-5.8 mc). Will swap for oscilloscope. R. J. Fleischer, 4240 Neosha Ave., Los Angeles, Calif. 90066.

KNIGHT radio broadcaster. Need Knight or Heath code-practice oscillator and key. Michael Jeffrey, R-1-A, Spencer, Ia. 51301.

CAPACITANCE bridge. Will swap for ham or test equipment. Nathan Gregory, 119 Crest Ave., Flemingsburg, Ky. 41041.

ELECTRO-VOICE-664 microphone. Swap for Sony or similar portable TV. J. S. Tillery, 912 Redstart Ave., W. Chesapeake, Va. 23506.

GLOBE HG-303 CW transmitter and power supply. Will swap for Knight T-60 and R-100A. Steven Brooks, 3513 Kayson St., Wheaton, Md. 20906.

LLOYD tape recorder. Swap for VTVM or signal generator. John Dilday, 806 Monticello Ave., Durham, N.C.

GARRARD RC-80 changer. Want Heath HR-10. Mike Fine, 6 Beechwood Tr., Poughkeepsie, N.Y. 12601.

DWELL angle meter and tachometer. Will swap for SW receiver. Linda Shole, 11112 La Cienega Blvd., Inglewood, Calif.

BELL 615 PA system, speakers, no microphone. Make swap offer. Michael Hemeon, 37 Avalon St., Revere, Mass. 02151.

RECORDS. Will swap for electronic equipment. Ervin Ramos, P.O. Box 8, San Antonio, P.R.

ANDREWS Deresnadyne antique radio, 1924. Make swap offer. Richard Seger, 23 Ellesboro Dr., Streetsville, Ont. Canada.

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ELECTRONIC SWAP SHOP

Continued from page 21

CHEMISTRY equipment. Want ham equipment. Glenn Little, WPE41YC, 2305 Camellia Ct., Savannah, Ga. 31404.

HEATH Twoer. Will swap for Heath HX-11, Knight T-60 or Heath DX-60A. Mike Barkart, 1906 Washington St., New Holstein, Wis.

3-IN. scope, tubes. Will swap for CB equipment. Ernest Rhodes, 1265 Mulvane St., Topeka, Kan. 66604.

LIONEL Super-O trains. Swap for CB transceiver. Jeff Kurman, 1729 S. Durango Ave., Los Angeles, Calif. 90035.

STAMPS. Will trade for record changer. A. Stancato, 230 E. 97th St., New York, N.Y. 10029.

ASSORTED tubes. Will swap for SCR-522 transceiver. John Harding, 24 Bertram St., Beverly, Mass. 01915.

GLOBE SW receiver. Swap for Knight Star Roamer. Charles Wiley, Rte. 1, Box 92, McIntosh, Ala. 36553.

ICS course for FCC license. Make swap offer. Bill Warner, 9460 S.W. 69th Ave., Miami, Fla. 33156.

EICO 950B resistance-capacitance-comparator bridge. Will trade for Lafayette 226 or Hallicrafters S-38B receiver. Bernard Shanahan, 705 W. Maple St., Centerville, Ia.

INDIAN handicrafts. Will swap for Heath VTVM. H. Machaveerchand Bhandari, 394 Mint St., Madras 1, India.

VARIABLE-voltage power supply. Will trade for Knight KG-625 VTVM. Bill Short, Rte. 1, Hamilton, Mo. 64644.

MAGAZINES. Want SW receiver. Les Merklin, Student's Apt. 21, College Pl., Wash. 99324.

HALLICRAFTERS S38-E. Will swap for electric guitar. Mike Papienuk, 100 Belknap St., Laconia, N.H.

WILCOX GAY tape recorder. Make swap offer. John Panelcak, 3714 Keyes, Flint, Mich. 48504.

TRANSMITTER (CW/AM/SSB, 125w). Will swap for National NCX-5 with power supply. Ronnie Carter, Box 67, Olivia, N.C.

ANSCO 8mm projector. Will swap for disc recorder. Everett Olin, 113A Gansevoort Rd., S. Glen Falls, N.Y.

MISCELLANEOUS electronic equipment. Make swap offer. Frank Kunik, 148 Burlington Rd., Riverside, Ill. 60546.

ARC-1 transceiver. Will swap for communications receiver. Steve Morrissey, 3910 Cassia, Boise, Ida. 83705.

MISCELLANEOUS electronic parts. Want back issues of QST. Frank Weissig, 3244 Oakes Dr., Hayward, Calif. 94541.

RCA C-11-1 receiver. Want ham equipment. Kenneth DeBush, 633 Ward Ave., Brookville, Fla. 33512.

CLARICON 15-110 walkie-talkie. Will swap for Knight Star Roamer or equivalent. Greg Larson, Box 112, Amery, Wis.

GONSET Communicator. Will trade for CB walkie-talkie. William J. Morris, 47 Main St., Danbury, Conn. 06810.

HO train set. Want ham equipment. Guy K. Sueoka, WH6FQW, 3328 Makini St., Honolulu, Hawaii 96815.

MISCELLANEOUS electronic equipment. Will swap for Hallicrafters SP-44 panoramic adapter. Charles Knapp, 6547 Virginia Hills Ave., Alexandria, Va. 22310.

LAFAYETTE HA-230 receiver. Swap for 2- or 6-meter transceiver. David Starobin, 711 Carlisle Rd., Jericho, N.Y. 11753.

EICO 753 transceiver. Will swap for Swan 240 transceiver. John Benson, 730 California St., El Segundo, Calif. 90245.

AMECO AC-1T transmitter. Want Heath Twoer. Rick Adams, 3006 Christmastree La., Bakersfield, Calif. 93300.

WESTINGHOUSE SW receiver. Trade for CB or ham gear. Fred Wally, Box 122, Davidson, N.C. 28036.

COYLE text books. Make swap offer. Richard Burgess, 17 Fifth St., Carnegie, Pa. 15106.

BROADSIDES

Pamphlets, booklets, flyers, application notes and bulletins available free or at low cost.

Panel instruments for measuring voltage, power and current are described in catalog D-66-I. A variety of sizes and shapes is illustrated, including a miniature panel meter that can fit into a space less than an inch wide. A free copy can be obtained by writing Triplett Electrical Instrument Co., Bluffton, Ohio 45817.

Hi-fi buffs always can use **audio accessories.** Catalog A-401B has plenty of variety to choose from, illustrating mixers, speaker parts, adaptors, connectors, cables and other gear. Free copy available by writing to Switchcraft, Inc., 5555 North Elston Ave., Chicago, Ill. 60630.

This year's cornucopia of equipment and parts is contained in **new electronics catalogs** available free from the following distributors: Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680; Walter Ashe Radio Co., 1125 Pine St., St. Louis, Mo., 63101; Burstein-Applebee Co., 1012-14 McGee St., Kansas City, Mo. 64100; Harrison Radio Corp., 225 Greenwich St., New York, N.Y. 10017; Harvey Radio Co., 2 W. 45th St., New York, N.Y. 10036; Heath Co., Benton Harbor, Mich. 49022; Lafayette Radio Electronics, 111 Jericho Tpke., Syosset, N.Y. 11791; Newark Electronics Corp., 224 W. Madison St., Chicago, Ill. 60606; Radio Shack Corp., 730 Commonwealth Ave., Boston, Mass. 02117; World Radio Lab., 3415 W. Broadway, Council Bluffs, Iowa 51501.

The buff who has ambitions of turning his hobby into a profitable livelihood will find interesting reading in three pamphlets outlining **careers in electronics,** published by The U.S. Department of Labor in its Occupational Outlook Report Series. One deals with television and radio technicians (5 cents), one with ten fields for engineers (10 cents) and one with engineering and science technicians and draftsmen (10 cents). Copies can be obtained by writing the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.

Have you ever had mobile gear lifted from your car? Thieves would have no clue that you were wired for sound if you used a **magnetically mounted antenna**—and took it down between uses. And that's only one application that suggests itself in reading over a new catalog of CB and ham whips for portable and temporary use. A free copy is available from Versa-Tronics, Rte. 1 Box 264, Marengo, Ill. 60152.

UNCLE TOM'S CORNER

Uncle Tom answers his most interesting letters in this column. Write him at Electronics Illustrated, 67 West 44th St., New York, N. Y. 10036.

By TOM KNEITEL, K2AES/KBG4303

★ *Say, what about those indoor TV antennas that somehow connect your TV set's antenna terminals into your household wiring? The ads say that they turn your wiring into a giant radar antenna.*

Brad Hilliard
Poteau, Okla.

That's just great—how'd you like to see radar blips all over the place while you're trying to watch Bullwinkle?

★ *I'm familiar with frequency abbreviations such as mc and kc but recently I've seen frequencies listed in something new known as mHz and kHz. Could you please bring me up to date on this?*

David L. Brown
Los Angeles, Calif.

The latest In bit is to call megacycles and kilocycles by their chic European names, megaHertz and kiloHertz. Only squares like myself (and apparently you) live in the past with the old fuddy-duddy terms, the ones everybody understands.

★ *A recent newspaper story described the making of a Hollywood film. In some of the photos I noticed the production people using two-way radios. How can I listen in on these conversations?*

Allan Burtin
Asbury Park, N.J.

Most of this communication is of the short-range VHF variety but a few longer-range units are in use, too. Our Hollywood spies tell us that Walt Disney Productions operates as KMK847 on 4637.5 kc. They share this channel with MGM's station, KA3916, which also uses 2292 kc. Paramount Pictures sports the call sign KMA886 on 1632 kc and Universal sometimes can be heard as KA5749 on 1628, 1652, 2292 and 4637.5 kc. Who'll be the first to get a QSL card signed by Donald Duck?

★ *In your March '66 column you gave the impression that station WTTT (where you used to work) is out of business. That's funny because on May 28, 1966, I picked up a station using these call letters. How does that grab you, fella?*

Robert K. Holland
East Longmeadow, Mass.

The current owner of the call WTTT is in Amherst, Mass. Fortunately for them, they have had better luck than *my* WTTT, which was in Coral Gables, Fla. As a point of interest, WTTT (Fla.) originally was known as WBAY, a call now used by a station in Green Bay, Wis. Where does that scratch you, chief?

★ *I just made a good deal on a Mark II military-surplus transmitter-receiver. Even though it seems to have been made in the 1940s, it's still unused. Although of American manufacture, the panel lettering is all in Russian. Since I'm a new Novice and this set covers both 80 and 2 meters, I hope to make it my rig. Can you help me out with conversion data?*

Owen Scharfer
Philadelphia, Pa.

The Mark II was made during the war for use in Russian tanks so if you happen to find a surplus Commy tank at your handy Army & Navy store this may be just the rig for you. I've seen some ham conversions of these units

[*Continued on page* 26]

UNCLE TOM'S CORNER

Continued from page 24

but it takes a superhuman effort to achieve even reasonable results with one. Save it. If you ever buy a boat it will make a dandy anchor.

★ *National Bureau of Standards radio station WWV has a male announcer with the time signals. What a drag! Why not go on a campaign for a female announcer?*

Wilbur Martin
Westmont, Ill.

Ever know a woman to be on time?

★ *Although I do quite a bit of electronic experimental work and kit building in my spare time, I've always wondered what resistors are made of.*

Alfred Vaina
Lawrence, Mass.

Resistance.

★ *People who write to you want honest answers to their questions. How do you write those smart-alec answers of yours?*

John Quigley
San Francisco, Calif.

On a Royal portable.

UHF Dept. Speaking of the lack of radio spectrum space for communications services, did you ever take a look at the amount of space reserved for TV broadcasting? UHF, for instance, occupies hundreds of megacycles and yet relatively few stations make use of the space—some channels being completely vacant. If UHF channels are a flop, then let's whittle them down and give the leavings to communications services. Or if they are as great as the FCC claims they are, let's shift all of the VHF-TV stations up to the UHF band. It's hard to justify TV's ownership of 600 mc based on the current activity and crop of entertainment gems issuing forth, especially when vital communications services are going begging for frequency space.

★ *I dug an old Philco portable out of the attic and am trying to restore it to past glory.*

Problem is that one of the broken tubes in the set is marked XXD. *Nobody around here has ever seen such a bird or even heard* *of it, and I'm stuck. The XXD is the only barrier between me and instant high fidelity. What did I do to deserve this?*

Billy Jarvis
Kissimmee, Fla.

The XXD was a loctal type made years ago. Loctals were an improvement over the old glass bottles but were made obsolete when miniatures came into vogue. My suggestion is to cheat on your restoration by replacing the XXD's socket with a noval type and using a 12AT7 instead. You'll have to change the connections on the 12AT7's socket so try to get a tube manual to see which connections go where. The XXD is listed in some manuals as 14AF7.

★ *What's the best device for detecting and/or obtaining drinking water from underground sources.*

Max Otto Siegert
Tomslake, B.C.

A pump.

★ *First it was Mechanix Illustrated with Uncle Tom McCahill, then EI came along with Uncle Tom Kneitel. Are you both the same guy?*

Arnold Dennison
Scottsboro, Ariz.

No. He gets paid in real money.

★ *Since when is CW allowed on the Citizens Band? Every time the band opens with skip I get pounded by code stations on channels 4 and 9. How does one get such a license?*

Cary Rodgers
Enid, Okla.

Not many people know it but dozens of commercial telegraph stations operate throughout the world on the 11-meter band. My guess is that your two stations are LQH5 in Argentina on channel 4 and XDA75 in Mexico. The Mexican actually is operating on 6765 kc but has a slight technical problem. Seems his fourth harmonic is so strong that it can be heard by many American CBers on channel 9.

★ *I'm 25 years old, single, attractive and an avid reader of Uncle Tom's Corner. What does a girl have to do to get a date with you?*

Lori Jean Andrews
Chillicothe, Ohio

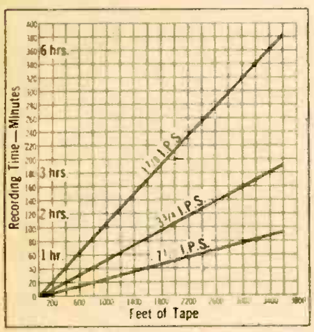
Do you have a landing place around there for a slightly stewed pilot?

Kodak

Some plain talk from Kodak about tape:

Uninterrupted listening pleasure... and the answer to a searching question

Recording a pop tune or even the whole top ten isn't much of a problem with standard sound tapes. But people always want more—like getting a whole Wagnerian opus on a single reel. Actually, the problem of long playing time involves two variables: how fast you run the tape, and how much tape length you get on a reel. The following chart will give you an idea of running times with different lengths of tape:



Some like it slow. Taking it slow is the obvious way to get longer playing time. This works very well up to a point. As a matter of fact, it is the historical trend—from 15 ips to 7½ ips to 3¾ ips and so on. But as you cut speed, you make the microscopic perfection in the tape more and more important. Furthermore, at slow speeds the increased dependence upon short wavelength information and the concurrently reduced flux-carrying capacity of the tape makes head design more difficult. But even though improved quality slow-play tape recordings are strongly dependent upon improved equipment, you are still ahead with the built-in quality of KODAK Tapes—high output tape Type 34A, with its output and noise advantages, or low-print tape Type 31A.

Some like it thin. The other avenue is to go to a thinner tape . . . one that packs more length on the reel. This too is an appealing idea—one that explains the proliferation of double and triple play tapes. So what's the catch? Well, for one thing, very thin tapes require careful habits on the part of the home recordist. Your recording/playback heads should be in good shape, as thin tape is more liable to physical distortion and breakage. Strive for smooth starts and stops. You can help by turning the reels away from one another (gently, please) so as to take up any slack in the tape which may have occurred during threading. Also, forget the fast-rewind knob—store tapes "as played." Fast rewind can set up a lot of tension and often cause erratic winding. All this can result in "stretched" or "fluted" tapes. In a nutshell, treat thin tapes with loving care.

When you record, be careful not to overload on input (if you have a VU meter, keep the needle slightly below the record level you would normally use for regular tape).

Last but not least, make sure you get your tape from a reliable maker—like Kodak. It takes a lot of extra care in winding, slitting and over-all handling to come up with a superior triple-play tape like Kodak's famed Type 12P. Because of its highly efficient oxide, Type 12P gives you a signal-to-noise ratio better by close to 6 db compared to the other leading triple-play tape. Add to this the advantage of back printing (so you always know what type of tape you're using—even when it's in the wrong box), and a dynamically balanced reel that reduces the stress and strain on a thin tape, and you can see why KODAK 12P Tape is becoming so popular.

KODAK Tapes—professional types and the long-playing variety—are available at most electronic, camera, and department stores. If you've had trouble finding them at your favorite store, Kodak would like to help. Simply tell us where you'd like to buy KODAK Tape, and we'll see what we can do about having these stores stock it. In the meantime, we'll rush you the names of nearby Kodak dealers where you'll be *sure* to find KODAK Tape; also, a very informative booklet "Some Plain Talk from Kodak about Sound Recording Tape." Just fill out the coupon.

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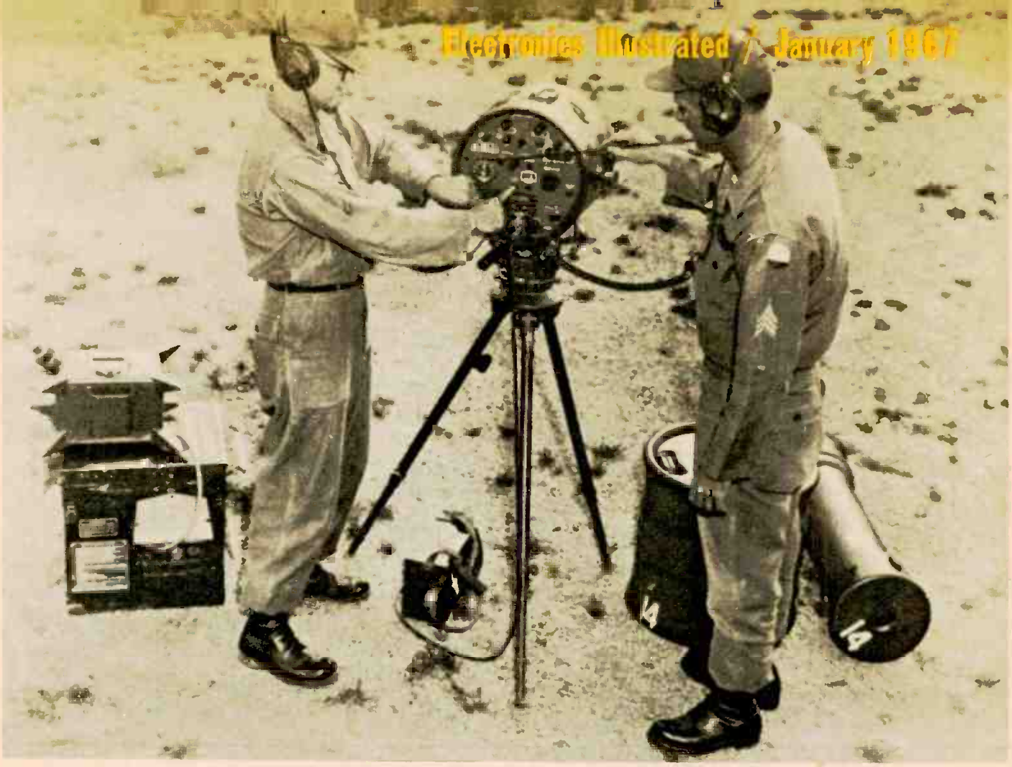


Pipsy-Four, already a veteran in South Vietnam, went through shakedown field testing at Ft. Huachuca.

THE AMAZING MARVELS FROM FT. HUACHUCA

Dazzling electronic gadgetry for Vietnam is tried out in Geronimo's desert.

By J. K. LOCKE

STAFF Sgt. R. J. Demaree shoved the headset in my direction. "Hear that sound?" he asked as I slipped the cans on my ears. We were standing behind a strange contraption that looked like a beer keg that had been sawed in two, painted a cheerful olive drab and mounted on a tripod. The flat end facing us was filled with dials, meters, knobs, switches.

The first time I had hung the cans on they made a steady crackling buzz, a sound with all the charm of fingernails scraping on glass. Now something new had been added—a sort of raspy whine, wavering rapidly in pitch and intensity.

"There he is," said Demaree, pointing off across the gently-rolling Arizona desert. About a half-mile away I saw the tiny figure of a man slogging toward us across the bare landscape. Demaree twirled a dial on the panel before us. "825 meters," he said.

The device next to us was an AN/PPS-4. Army men call it the Pipsy-Four. It's a versatile, transistorized, battery-powered radar set now being used all over Vietnam to spot infiltrators creeping through tall grass and heavy jungle foliage. Its performance is astonishing.

"A well-trained operator can tell from the sound whether he's watching a vehicle, one man or a half-dozen men," said Maj. Lee E. Anderson of the Army's Combat Surveil-

The Pipsy-Five (AN/PPS-5) still is undergoing tests at Ft. Huachuca. It produces a rough but useful TV-like picture of the area it surveys.

An AN/TPS-33 like this has foiled at least one recent Viet ambush. Pipsy-Four can also be Jeep-mounted but bouncing makes targets hard to spot.

To check accuracy, radar is pointed at this radar spoke. Operators know precise spacing of posts, easily can spot inaccuracies or distortion.

THE AMAZING MARVELS FROM FT. HUACHUCA

lance School, who was standing nearby. "And the range and azimuth are accurate enough to pull in direct fire on that target without ever having seen it."

The Pipsy-Four can do still more tricks. Demaree waved both arms above his head and the soldier approaching us (still close to a half-mile away) stopped. Listening in the cans again, I heard what sounded like a code—three quick whines, pause, another three whines. At the same time the soldier in the distance was waving his arms.

"Patrols coming back from enemy territory wave their helmets or canteens in a prearranged code," explained Anderson. "No more of that old password business where a guy says Brooklyn Dodgers and gets shot because he forgot the team moved to LA. Now he gives three swings—or whatever the code is for the day—and sentries know he's a friend."

The Pipsy-Four is just one of scores of remarkable devices in the modern Army's bag of electronic tricks. To take a look at some of these science-fiction weapons in use or under test for tomorrow's fighting forces, I recently went to Ft. Huachuca, the Army's bustling, $300 million electronic proving grounds in southern Arizona.

Everything about Huachuca is spectacular. The main section of the fort, established in 1877 to protect the region's white settlers from Apache bands led by Geronimo and other well-known hair-raisers of the day, huddles near the base of the black, threatening Huachuca Mountains. Looking out through the clear desert air across the saucer-shape San Pedro Valley, the mountains on the other side—50 mi. away—seem close enough to touch. A few scraggly tufts of grass, a stunted bush here and there or an occasional lonely cactus try unsuccessfully to hide the desert floor.

But Huachuca wasn't selected for its 20th Century role because of its colorful history or its weird and spectacular landscape. Tucson, 70 mi. away, is the only nearby city of any size. No large industries operate in the vicinity, no major air corridors cross the area. So little electromagnetic hash crowds the ether.

Such isolation, now hard to find, is perfect for checking out sensitive military electronic gear. Under the direction of Maj. Gen. Benjamin H. Pochyla, some 7,500 civilian and military technical experts spend $100 million a year to put a remarkable variety of devices through their paces.

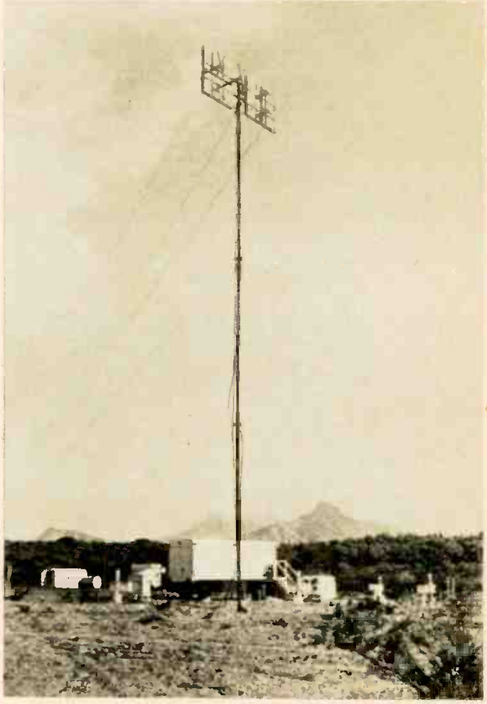
On one part of the range artillerymen playing the part of an enemy lob howitzer shells at a defending force. The shells, equipped with now-common electronically operated VT fuses approach, then explode harmlessly hundreds of feet in the air. Under test is an Army device that sends up signals to fool the shells' timing devices and pop them prematurely.

Elsewhere, men check out the latest in laser radar, voice scramblers and decoders to keep the enemy from understanding intercepted messages, devices to jam more signals into less bandwidth. They bounce radio signals from the ionized trails of meteors, experimenting with new ways to transmit data; test radio altimeters; try terrain-avoidance radar that allows planes to skim along just above the treetops, yet keep from bumping into hills, mountains and church steeples. They screen new ways to jam enemy radio signals and keep anybody else from jamming ours. And they constantly test new communications gear, from helmet radios that ultimately should put every soldier in the army in constant contact with his commander to huge, multi-trailer field control complexes designed to keep untangled the thousands of signals flying through the air.

"It's like putting the Bell System out in the field under combat conditions," said one observer.

Ft. Huachuca's job isn't limited entirely to testing. It's also the home of the Army's Combat Surveillance School where GI trainees learn how to apply the latest in electronic gear to one of the toughest problems the army has to face in Vietnam: finding and keeping track of the enemy.

At the school, I saw what may be the Army's champion enemy finder. It's a three-tail, underslung-jawed, twin-engine flying ma-



Control center (top) at the Field Test Facility has its roof at ground level to avoid interference with the signals it is testing. Some 4,000 mi. of cable connect it to 24 vans (center), each connected to several bird houses (bottom). Each contains some sort of transmitter. Any or all can be switched on simultaneously to test interference.

The Mohawk comes in two versions—in the foreground at left is infra-red-detecting model; plane sporting what looks like a piece of black telephone pole is equipped with side-looking radar. Together they constitute a champion team in finding the enemy in South Vietnam. Radar version (shown also in closeup below) takes pictures almost as clear as daytime photographs. The pod holds radar system's antenna. Infra-red unit senses heat to supplement the radar information.

THE AMAZING MARVELS FROM FT. HUACHUCA

chine with a pod the size and shape of a telephone pole lashed to its belly like an afterthought. In flight, it looks strangely like a dragonfly carrying a twig. It can loaf along at 100 mph or skim the treetops at 300. It's so quiet it can sneak up on a target without being heard.

"Sometimes in Vietnam we would be over the Viet Cong before they knew we were anywhere around," says one Army pilot, Capt. Marvin MacDonald.

This remarkable piece of flying hardware is called OV-1—the Mohawk. It comes in two versions. One sports the fabulous SLAR —Side-Looking Airborne Radar—that records the countryside in an image so clear it almost looks like a TV picture. With such a device, a plane can fly in relative safety behind its own lines, taking detailed pictures of enemy territory at night or in foggy or cloudy weather. The second version of the Mohawk is filled with IR—infra-red detection gear. What one can't find, the other can.

"With side-looking airborne radar, the plane can reach out on either side of its antenna (that long, thin pod hanging underneath) and pick up both stationary and moving targets," says Maj. Anderson. "On one side of a strip of film you record stationary targets—mountain ranges, rivers, roads, railroad tracks and so forth. Then on the other side you record just enough of this background to make your position recognizable, with big, black pips that represent moving targets. With an in-flight processor, the film is developed and the operator has a picture of any given spot just 2½ minutes after he has passed it."

The SLAR-equipped Mohawk now is used nightly in Vietnam in the widely reported Lightning Bug operations. Here's how it works:

Since roads and railroads are easy targets, North Vietnamese frequently move men, supplies and equipment by river at night—or did, until the Lightning Bugs came along. "There's a curfew. Anything that moves at night is fair game," explains Anderson. "So the aircraft flies along scanning rivers in the dark-

[*Continued on page* 116]

CB CORNER
BY LEN BUCKWALTER KBA4480

CONQUERING A PIKE'S PEAK

THE **131-mi.** toll road that spans the state of New Jersey may carry more vehicles per day than any other superhighway in the world. It's the New Jersey Turnpike, a route that swallows and spits out high-density traffic along the megalopolis route between New York City and Wilmington, Dela. What better lab for experimenting with HELP, the plan for aiding CB-equipped motorists in distress? (As you may recall, HELP means Highway Emergency Locating Plan.)

And turnpikes these days *need* help. Under normal conditions police patrol on Jersey's bustling highway is so intense that you can run out of gas and expect to greet a trooper ten, maybe 15 minutes from conkout. But the pattern changes for unusual conditions—an accident, say, that has skewered cars along the right-of-way. Normal patrol time is scrapped and shouldered motorists must wait much longer for aid.

So the turnpike's Communications Center took its first exploratory steps toward HELP. A trial monitoring point was installed at New Brunswick. There was no public hoopla since this simply was a listening test on CB Channel 9 (the informal HELP frequency). Personnel were assigned to listen and appraise conditions.

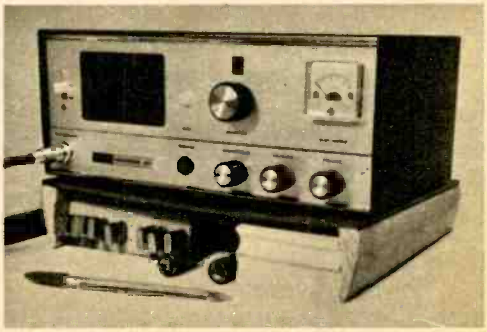
Anyone with an ear on Channel 9 can guess what the pike's people heard in the next four months of listening. The frequency was a continuous chorus of voices and heterodynes. Picked up, too, was carrier interference from a station outside the CB band, possibly a radio-paging service. Technicians found it nearly impossible to monitor and attend to regular duties as well.

Speculation by one turnpike official is that CB holds great potential for helping motorists but channels must be clear. One answer could be FCC action on a pending proposal to add special HELP-only frequencies to the band. At this time, however, the proposal languishes at Commission offices.

Despite the Jersey Turnpike's tentative, mostly negative, experience on Channel 9, they still have hope for HELP. They'll try again along a rural strip of the pike, far removed from raucous radio waves of the city.

How to Raise a Rig . . . If your shack's like some, the rig sits on a table surrounded by a debris of QSL cards, extra crystals, cables and the like. Trying to twist knobs or square your eye on the S-meter can be downright inconvenient. The simplest way to clear the clutter and make the rig a pleasure to operate is with a stand like the one shown in our photo. It yields handy storage space but also has a feature you've probably seen in the blockhouse at Cape Kennedy—it tilts the rig's front panel into your line of sight. Channel numbers and S-meter are far easier to view. And you won't scrape your knuckles when you reach for a knob that's close to the table surface.

It takes neither the skill of a Viking shipbuilder nor the cost of movie ticket to assemble the stand. It consists of a base and two side strips. Our base was cut from hardboard and measures 9 x 12 in. Vary the size to match your rig. The sides are pieces of wood molding 2 in. wide. If you taper the sides so the rear is about ½ in. narrower than the front, the base will sit at an angle. Just nail the pieces together and the unit is ready to receive the rig and the rest of your rigmarole.



Top piece of CB rig's stand is same size as unit and is supported by two side pieces, somewhat higher in front than in back, to tilt set back.

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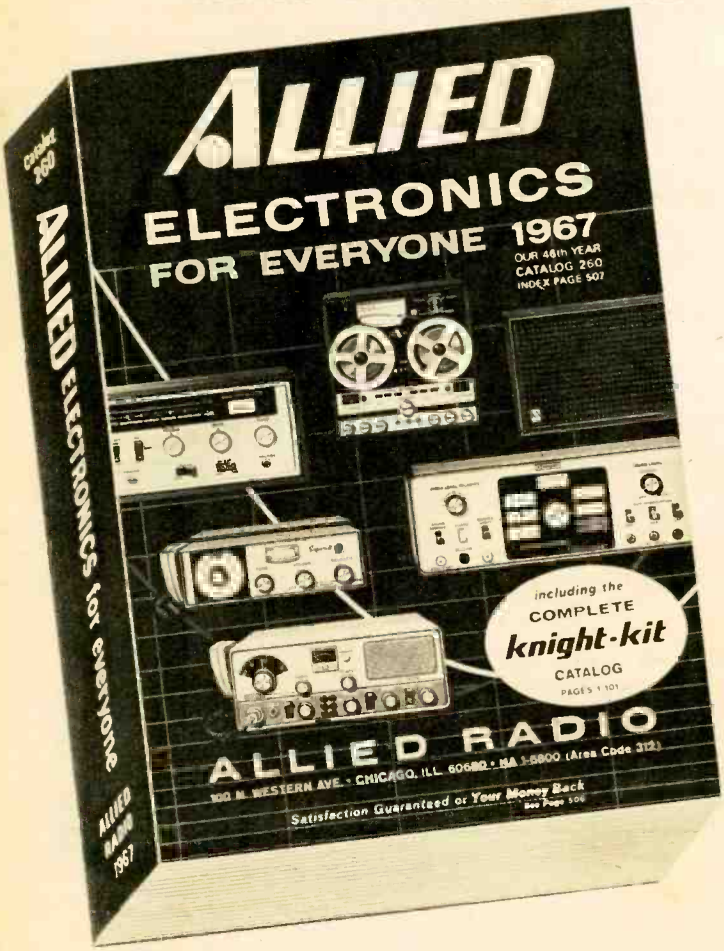

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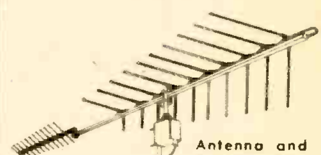

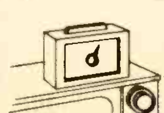

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FM Guitar Broadcaster

By **LAWRENCE GLENN** IMPORTANT thing swingers must have to really make the big scene these days is a guitar. Most everywhere you go—the beach, picnics, a ski resort, parties—you'll hear the instrument going all the time. The fad has grown tremendously.

Many guitar owners lay out quite a bit of extra cash for an amplifier to soup-up the instrument's volume. But EI's FM Guitar Broadcaster gives your guitar the big sound and saves you money to boot. The Broadcaster puts out a low-power signal in the FM broadcast band. This means you can use your stereo system (provided it includes an FM tuner or receiver) as the guitar's amplifier.

By operating your own popular-music broadcasting station (the Broadcaster has an input for a mike over which you can make announcements) you'll always be a step ahead of the other strummers in the crowd. About $10 worth of parts and an hour or two of easy work will put you on the air.

Other possibilities? You can serenade the girl next door even when it's raining. No need to stand under her window and get wet. Just sit in your favorite arm chair and strum. She'll be able to pick you up on her FM radio.

If you're really good at playing and singing, you might take the guitar to the beach or lake and serenade the crowd through their FM portables.

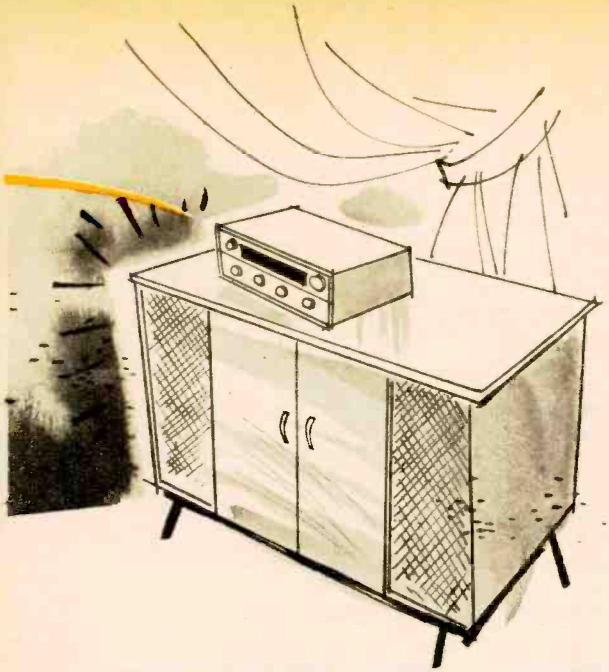
Heart of the Broadcaster is a low-power FM transmitter module. It's a prewired, encapsulated FM transmitter and modulator to which you simply connect a contact mike, battery and switching facility for a mike.

You mount the components on a piece of perforated phenolic board, or other plastic material, then install the board *inside* the guitar, as shown. Of course, we don't recommend you hack away at a $100 guitar. We suggest you install the transmitter in the $20 guitar you knock around at parties.

Construction

Our transmitter is built on a 2¼- x 3-in. piece of perforated board. Note that the board is only large enough to hold a single battery clamp for one penlight cell. One cell will produce a range of up to about 50 ft. For slightly more distance, connect two cells in series and use a larger board to accommodate a larger battery holder.

Before mounting any components drill four mounting holes—one at each corner of the board—for #6 screws. (The mounting screws should be self-tapping.) Then, on



top of the guitar, position the board and mark an outline of it with a pencil or scriber. Since hand capacity will detune the transmitter, position the board as far as possible from the normal playing position of your hand and arm.

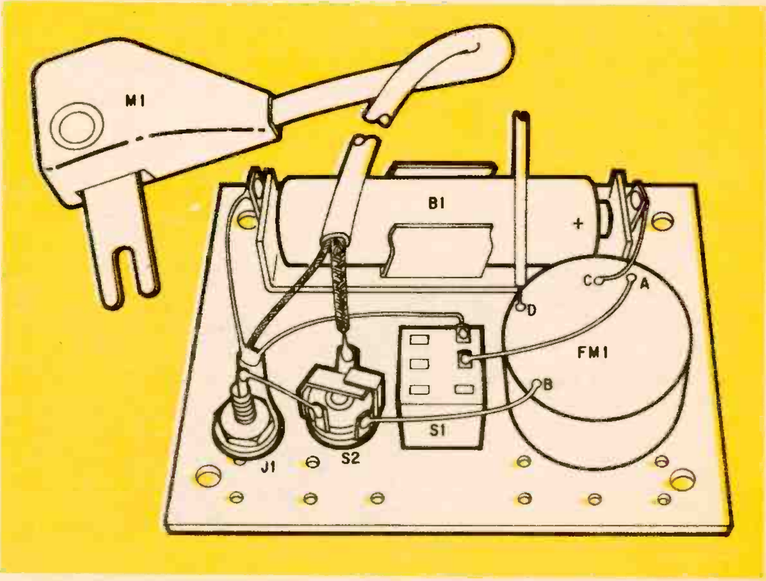
Drill a ½-in.-dia. hole ⅛ in. in from the scribed line at one corner. Using a fine-tooth-blade keyhole saw—preferably a sheet-metal blade—cut out the opening for the transmitter board. Note in the photo of the guitar that the corners are angled so there's support for each mounting screw.

Next, position the contact microphone (M1) on top of the guitar near the sound hole and drill a #28 hole for M1's mounting screw. When drilling the hole, keep in mind that the contact mike will be turned over when it is mounted inside the guitar. Mount M1 by passing it through the transmitter cutout. Keep M1 near the transmitter hole or you'll have to remove the strings in order to get your hand inside the guitar.

Now assemble the components on the perforated board. Remember that there will be ⅛ in. of wood under the board, so keep the components at least ⅛ in. in from the board's edges. First mount the single or double battery holder. Then mount mike jack J1, push-button switch S2 and power switch S1.

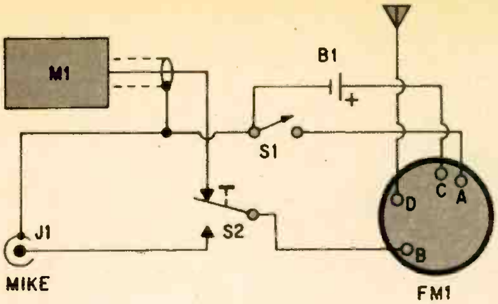
Switch S1 is a miniature DPDT type (use the one specified) whose unused lugs should be cut off. Using a thin layer of silicon rubber adhesive, such as GE's RTV or Silastic,

Broadcaster is built on 2¼- x 3-in. piece of perforated board. Model shown has one penlite cell, which will give a range of up to about 50 ft. For a slightly greater range, use larger board, two penlite cells and install a double battery holder. Note in pictorial, wire connected to D on module (FM1). It is an antenna and its length determines operating frequency. Be sure to get connections to S2 correct. M1 should normally be connected to module. When S2 is pressed, crystal mike plugged in J1 is connected to the module.



PARTS LIST

B1—1.5 V penlite cell (see text)
FM1—FM transmitter module: Cordover Type FMG-1. Carl Cordover & Co., 104 Liberty Ave., Mineola, N.Y. $3.50 plus postage
J1—Phono jack
M1—Crystal contact microphone (Lafayette 99 R 4516)
S1—DPDT subminiature toggle switch (Lafayette 99 R 6162); Modified, see text
S2—Miniature SPDT pushbutton switch (Lafayette 99 R 6218 or equiv.)
Misc.—Perforated board, battery holder, guitar, crystal microphone.



Schematic of Broadcaster. S1 turns on power. S2 is shown connecting contact mike to module. When S2 is pressed, it connects external mike to module.

FM Guitar Broadcaster

cement the FM module to the board, positioning it up against S1 and the battery holder. If you don't cement the FM module against the switch and holder you'll have to add wire to the module's leads.

Cut off the excess shielded cable from the contact mike (M1), leaving about 3 in. protruding from the hole. Connect the mike to the circuit and install the assembly in the guitar. If you don't like the color of the board, paint it with quick-drying model paint.

Tune Up

The Broadcaster's output frequency is around 100 mc. Place an FM radio near the guitar, or place the guitar near your stereo system's FM receiver. Turn on power with S1 and tune the FM receiver for the dead carrier being transmitted. Flick S1 on and off a few times to make certain you've tuned in the right signal.

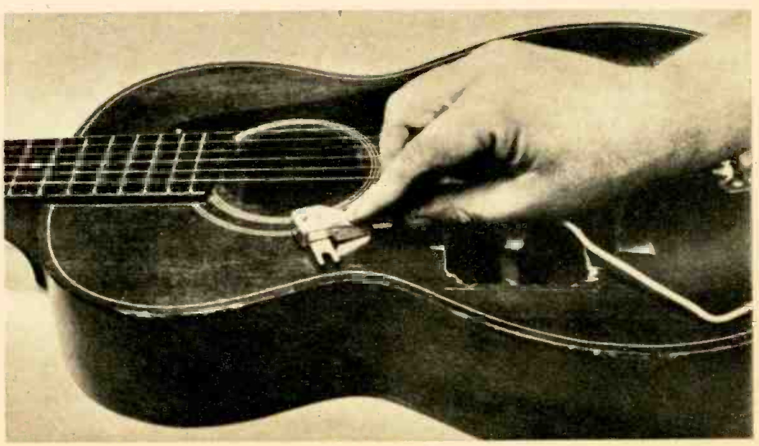
If the Broadcaster's signal interferes with an FM station, change its frequency by adding a small length of wire—about ½ in. at a time—to the module's antenna (wire D). Increasing D's length will *raise* the frequency.

Now play a tune. You should hear the guitar in the receiver. Plug a mike into J1, press S2, and speak into the mike. You should hear yourself, or a horrible squeal (feedback) if the receiver's volume is too high. If the Broadcaster fails to operate, check S2's wiring. If the connections are reversed the mike will normally be connected while the contact mike will be switched on when you press S2.

For convenience, especially if you plan to announce all your numbers, the announce mike may be taped to the neck or frame of the guitar enabling you to keep both hands free at all times. To operate the mike you simply press S2. When S2 is released, you're all ready to play.

Okay, standby; 10 seconds. You're on-the-air!

Use a fine-tooth-blade keyhole saw to cut out a section (under hand) of the guitar for the transmitter board. Position the contact mike close to the cutout and mount it inside the guitar with its shielded cable passing through the transmitter hole. A single screw holds the contact mike in place.



Beginning a Great New Series from the Author of Our Successful Series on the ABCs of Radio:

the ABCs of COLOR TV

By JOHN T. FRYE, W9EGV

TEN million color TV sets were in use in this country at the end of 1966. It is estimated that by 1970 there will be thirty-nine million color sets playing in about two thirds of American homes. Obviously color is here to stay, and anyone pretending to have any scientific savvy should know how this mushrooming modern miracle works. That's the aim of this series: to explain in layman's language how an animated color scene is televised, transmitted and recreated on the receiver screen.

Do not be mislead by the title. While the series proposes to explain a color system from A to Z, complex color TV theory does not belong in an electronics primer. However, we intend to prove the operation of a color TV system can be successfully explained to anyone who has a smattering of electronics, can understand what he reads, and is willing to *think*.

PART 1: REVIEW OF FUNDAMENTALS

IT may seem strange to start a color TV series with a discussion of black-and-white TV, but sound reasons dictate this oblique approach. B&W TV was here first, and color TV has been made to fit the B&W framework the way colored lights are added to a Christmas tree. Many circuit functions are the same in both types of receivers since the color system is required to be fully *compatible* with the B&W system. B&W sets must receive color telecasts as though no color information were present, and color sets must reproduce B&W telecasts in black and white. Once you understand B&W TV, you're halfway home to understanding color.

Let's start our discussion of monochrome TV with the picture tube shown in Figure 1-1. The structure in the neck of the tube is called the *electron gun,*

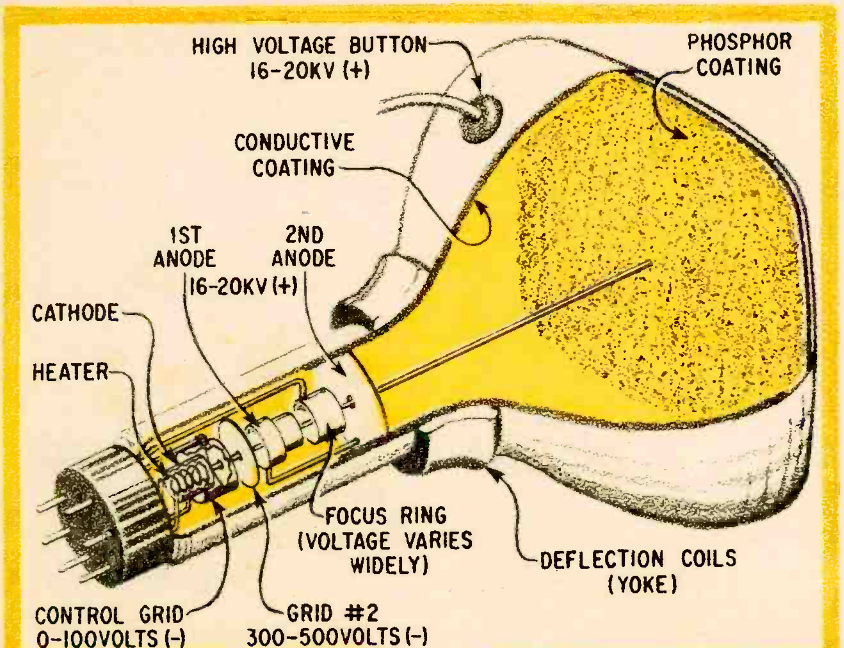


Fig. 1-1

and its function is to produce a controlled-intensity, small-diameter, high-velocity stream of electrons aimed at the phosphor coating on the inside of the face plate. Electrons emitted from the heated cathode escape through a hole in the front of the metal cup enclosing the cathode. How many escape at a given moment depen› on the instantaneous negative voltage on this cup, or *control grid*. Increasing negative voltage repels the negative electrons more strongly and cuts down on the number of escapees.

The remaining gun structure is designed to accelerate the escaped electrons and compress them into a small-diameter beam. This is done in much the same way that a copper wire is made smaller by pulling it through a compressing die. The pulling action in this case results from the attraction of the electrons in the stream by positive voltages on *grid 2* and the *first* and *second anodes*. These disk- and funnel-shaped electrodes all have holes in their centers through which the electrons pass, for the pulling action of the electrodes is like that of a clothes-wringer. A negative charge on the walls of the cylindrical focusing electrode pushes from all sides on the beam passing through its center and crowds the

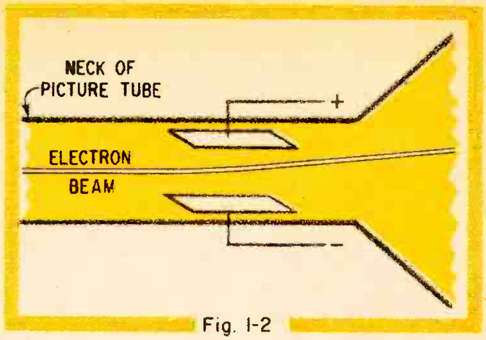


Fig. I-2

electrons together into an intense, wire-thin beam traveling at high velocity toward the center of the phosphor screen coating.

Where the beam strikes the coating, the phosphor fluoresces in a small round dot of light. Color of the light depends on the phosphor used. B&W TV tubes usually give off white light, but other phosphors can yield such colors as red, blue, green, and yellow. The brilliance (and to some extent the diameter) of the dot depends on the number of electrons in the beam, which we have seen is regulated by the voltage of the control grid. If high voltage cuts off the beam or if the beam is moved abruptly, the spot of light where the beam had been is not extinguished instantly but continues to glow for a few microseconds. This characteristic, which can be controlled in manufacture, is called the *persistence* of the screen.

To draw a picture on the screen with a variable-intensity pencil of electrons we must be able to move our pencil-point of light to any portion of the screen. This is done by deflecting the electron beam. Keeping in mind that the beam consists of negative particles of electricity, imagine placing a voltage drop across a pair of beam-straddling plates inside the tube at the point where the beam leaves the gun (Fig. I-2). This will cause the negatively-charged plate to push on the beam while the opposite, positive plate pulls on it. The more voltage differential across the plates the greater is the deflection of the beam's path. One set of plates may be used to deflect the beam horizontally while the other set deflects it vertically. The resultant of two independent sets of voltages applied simultaneously to the two sets of plates can move the spot of light to any portion of the screen. This *electrostatic deflection* is used in most scopes and in some small-screen TV sets.

Larger TV tubes use high accelerating voltages to produce sufficient brilliance. The fast-moving beam requires very high deflecting voltages, which are expensive to produce in the proper waveform. Fortunately the beam's moving electrons constitute an electric current, so the beam is surrounded by a magnetic field. That means it can be deflected by a magnetic as well as an electrostatic force. Two fluctuating magnetic fields are produced through the forward neck of the tube by pulses of current through four *deflection coils* in the yoke (see Fig. I-1), working in opposite pairs, mounted outside the tube. Interaction between the magnetic field produced by a pair of yoke coils and the field surrounding the beam causes the beam to move in a direction at right angles to the yoke field (Fig. I-3). Reversing current through the yoke coils reverses the direction of the *magnetic deflection*, and the amount of the deflection is proportionate to the amount of current. Heavy deflecting currents of the proper wave-

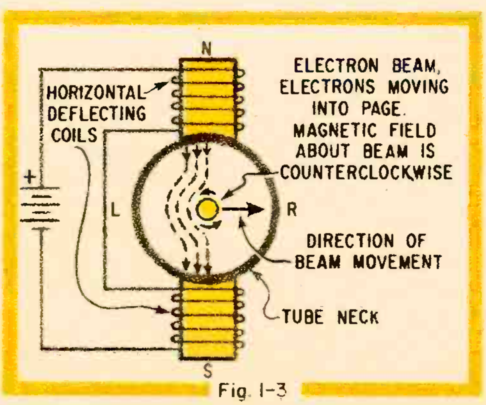


Fig. I-3

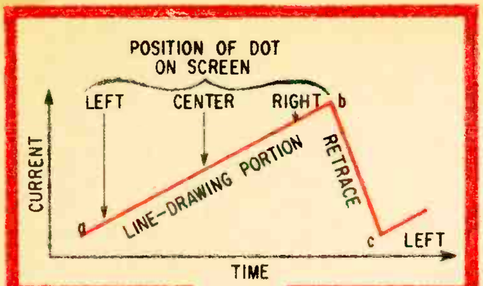


Fig. I-4

form are less expensive to produce than high deflecting voltages.

The next step is to paint the screen white by drawing 525 closely-spaced horizontal lines, one beneath the other, clear across the screen with our moving dot of light. Each line is produced by the effect of a sawtooth of current through the horizontal yoke coils, as shown in Fig. I-4. As the current gradually increases from *a* to *b*, the dot moves with uniform speed from extreme left to the extreme right of the screen. Then reversing current, plunging down to *c*, snaps it back to the left side, ready to start drawing another line.

A lower-frequency sawtooth of current through the vertical yoke coils keeps the electron beam moving steadily downward at the same time so each line is drawn below the preceding one until the bottom of the screen is reached. Then the dot is quickly moved back to the top of the screen by the short, steep part of the vertical sawtooth to start another group of lines.

During *retrace* periods, when the electron beam is being snapped back to the left side of the screen or is being moved quickly from the bottom back to the top, the beam is entirely cut off by a high negative *blanking* voltage on the control grid so retrace paths are not visible.

Actually all 525 lines are not drawn in sequence. Instead, 262½ lines are drawn (represented by the odd-numbered lines in Fig. I-5). Then another 262½ lines are added in the spaces between the original group (the even-numbered lines in Fig. I-5). This *interlaced scanning* reduces flicker. Thirty 525-line *frames* are produced each second. Each frame is made up of 262½-line *fields* so the screen is illuminated 60 times a second, far above the frequency at which the eye can detect flickering. The screen persistence and the eye's persistence combine to make the first line still seem visible when the last line of the frame is drawn, but the lines quickly fade after that so the next frame can make its impression.

Now for a little painless math. To display 30 times per second frames of 525 lines each, our line-drawing horizontal sweep generator must put out 30 x 525 or 15,750 sawteeth of current per second. In other words, it has a frequency of 15,750 cps. The vertical sweep generator must sweep the beam down and up twice for each frame, so its frequency will be 2 x 30 or 60 cps.

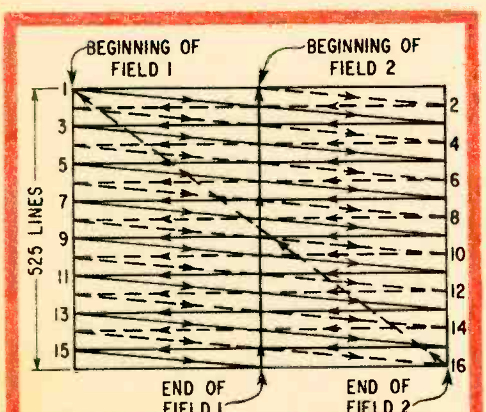


Fig. I-5

This display of evenly-illuminated lines, called a *raster*, is what you see when a signal is not being received. To change a raster to a picture, we need to modulate the intensity of the line-drawing beam by means of the control grid voltage so selected portions of the lines are made dimmer or even extinguished. By progressive dimming of the lines in succeeding frames in a certain area of the screen, we can make that area go from white through darkening shades of gray to black. If we can do this for one area of the screen, we can do it for all areas, large or small. And that means we can reproduce any scene in shades of gray (Fig. I-6).

The quality of the TV picture depends on how much detail we can reproduce on the screen. This depends on the smallest area we can, at will, make black or white. Suppose we want to reproduce a checkerboard pattern, like that of Fig. I-7, with the smallest possible squares. Obviously the squares cannot be smaller than the line that draws them. If there are 525 lines from the top of the screen to the bottom, that is the greatest number of squares we can have in that dimension of our checkerboard. Since the width vs. height, or *aspect ratio* of a TV picture is 4:3, we can fit 4/3 x 525 or 700 of our minimum-size squares in the horizontal dimension of our checkerboard. As the beam moves along a horizontal line from a black square to a white one and back again, the beam intensity must jump from off to on and back again through 350 cycles in each line. With 525 lines in the frame at 30 frames per second, that makes 350 x 525 x 30 or approximately 5,500,000 cps as the number of voltage cycles the control grid must undergo to produce the maximum number of squares (or picture elements) possible. This is not quite achieved in practice. On small TV tubes the spot size cannot be reduced to the width of a line, and limitations on channel width prevents transmitting a video signal of more than 4 mc.

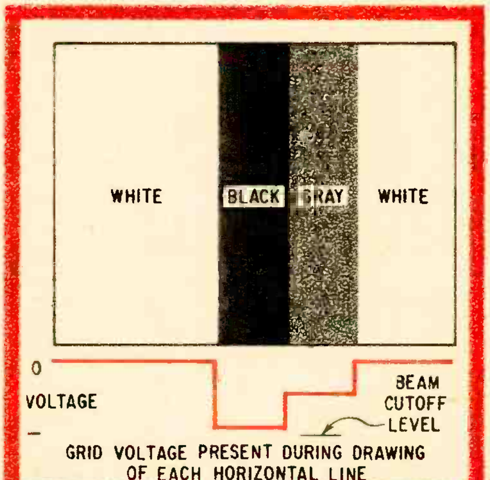


Fig. I-6

Now let's examine very briefly the way in which a scene is televised and transmitted in B&W. Fig. I-8 shows the essentials of a TV camera using an iconoscope tube, which most clearly illustrates the basic principle although it has been supplanted in practice by more sensitive tube types. The heart of the tube is the thin sheet of mica covered on the front with a mosaic of millions of tiny, insulated, silver-backed globules of photosensitive material. The back of the mica carries a uniform silver coating. Each photosensitive globule forms a tiny capacitor with the silver coating, using the intervening mica as a dielectric. The scene to be televised is focused by the lens system on the mosaic, and individual globules emit electrons in proportion to the amount of light falling on them. The more light a globule receives the more electrons it loses and the more electrons its resulting positive charge attracts to the portion of the silver coating directly behind it.

An electron gun and deflection system in the offset neck of the tube scans the mosaic exactly as the picture tube beam scans its screen. When this beam of negative electrons sprays across a globule, it neutralizes whatever positive charge light from the televised scene has imparted to the globule. This, in turn, releases electrons held captive on the backing-plate by the globule's positive charge, and they flow to ground through resistor R, causing a voltage to appear across the resistor. The scanning spot is about ten times wider than a globule so its passage releases the light-generated charges of several globules simultaneously.

Once you get this picture clearly in mind you will see that the instantaneous output voltage of the iconoscope is always a function of the illumination falling on the portion of the mosaic the electron beam is scanning at that particular instant. When a bright area is being scanned the output will be high. As illumination is reduced the output of the iconoscope will drop proportionately.

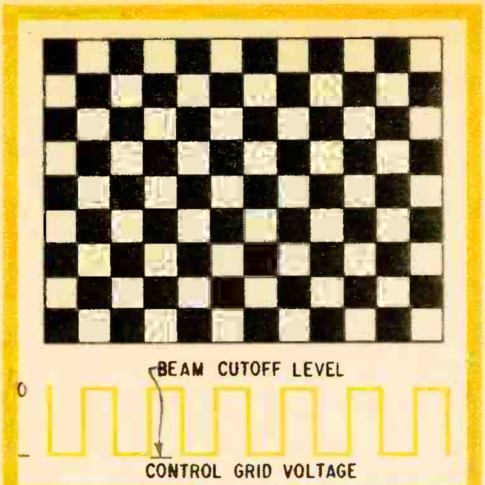


Fig. 1-7

Suppose we amplify the signal appearing across R, reverse its polarity so bright areas make the amplified output *less* negative, and connect that output to the control grid of our picture tube, as shown in Fig. 1-9. At the same time let's connect the picture tube yoke to the same sawtooth generators deflecting the iconoscope beam. This will keep the spot on the face of the picture tube always in the same relative position as the spot where the iconoscope beam is striking the mosaic. Both will start in the upper left corner and scan line for line down their respective target areas. When the iconoscope beam is scanning a light area, the amplifier output and the control grid are low—and the spot on the TV screen will glow brightly. When the camera beam scans a dark area, the amplifier's negative output increases and it cuts down the picture tube beam, darkening the spot. Thus the TV screen will reproduce faithfully the scene focused on the mosaic, white for white, black for black, gray for gray. And, as the scene on the mosaic changes, the picture on the receiver screen will change with it.

Picture or *video* information and beam-blanking signals primarily are voltage changes involving little power; so they can modulate a carrier, be transmitted through the air, and be recovered for use in the receiver. Heavy deflection currents, however, represent considerable actual power and cannot be transmitted without wires. The problem is solved by building sawtooth generators into the receiver and keeping them in precise step with the horizontal and vertical sweep generators of the camera by means of telecast *synchronizing pulses* sent during retrace periods when the picture tube beam current is cut off.

When a group of frequencies modulate a carrier, sidebands extend out on either side of that carrier for a distance representing the highest modulating frequency. For example, if up to 4 mc modulates a 100-mc carrier, sidebands occupy the spectrum from 96 to 104 mc, a total of 8 mc. Since each TV channel is allotted only 6 mc some way must be devised to fit the video, blanking, synchronizing and audio information

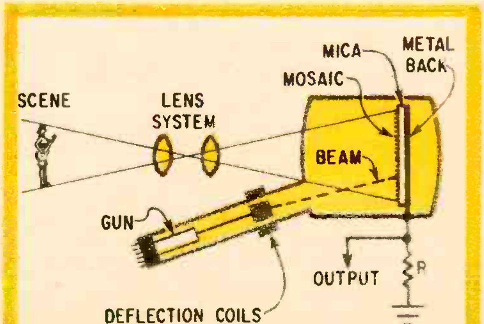


Fig. 1-8

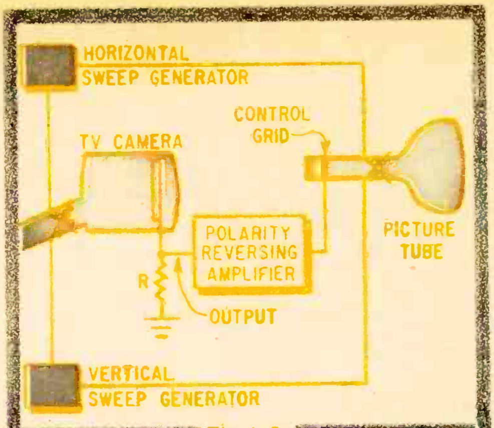


Fig. I-9

into this space. It is accomplished by using vestigial sideband modulation of the video carrier and arranging the various signal components as shown in Fig. I-10.

The two sidebands contain identical information so only one need be transmitted. With practical filters, however, it is impossible to transmit only a single sideband without losing essential low-frequency information near the carrier. The solution is to transmit all 4 mc of the upper sideband and only 1.25 mc, or a vestige, of the lower sideband. This still leaves room for the FM audio signal—whose deviation is restricted to ± 25 kc to save space—and for a small guard band between the two signals to avoid mutual interference.

It is time to tie all this information together by studying a block diagram of a typical modern TV receiver, such as shown in Fig. I-11. Let's trace the signal, a step at a time, through this receiver:

1. The *RF amplifier* selects a channel, amplifies uniformly all 6 mc of its signal and feeds it into the *mixer*.

2. Heterodyning there with the proper signal from the *oscillator* converts the TV signal to an IF usually centered around 43 mc.

3. Video and audio signals amplified as IF are fed to a *video detector,* where video, blanking, and synchronizing signals are recovered.

4. Video and blanking signals are fed to the *picture tube* control grid.

5. The sound and video carriers of any channel are 4.5 mc apart, so their *beat* or *difference* signal of 4.5 mc is picked off the output of the video detector and fed through a 4.5 mc Audio IF Amplifier to the FM Detector.

6. The detected audio signal is fed through the *audio amplifier* to drive the *speaker*.

7. Vertical and horizontal synchronizing signals picked off the *video amplifier* are fed to a *sync separator* for separation.

8. Horizontal sync pulses keep the *horizontal sweep circuit* operating exactly in step with the horizontal sweep circuit of the transmitter, and vertical sync pulses do the same thing for the *vertical sweep circuit.*

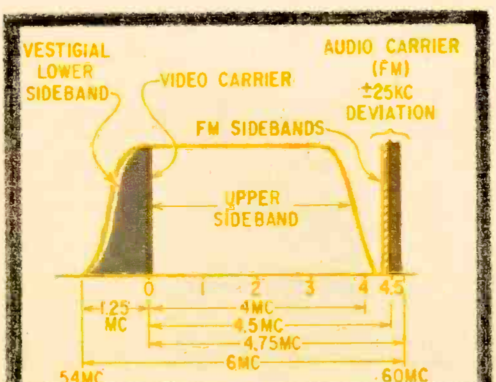


Fig. I-10

9. The sweep circuits send properly-shaped pulses through the yoke (consisting of horizontal and vertical deflection coils) to create a raster in the *picture tube.*

10. A winding on the horizontal output transformer, which delivers horizontal sweep pulses to the yoke, develops a very high voltage that

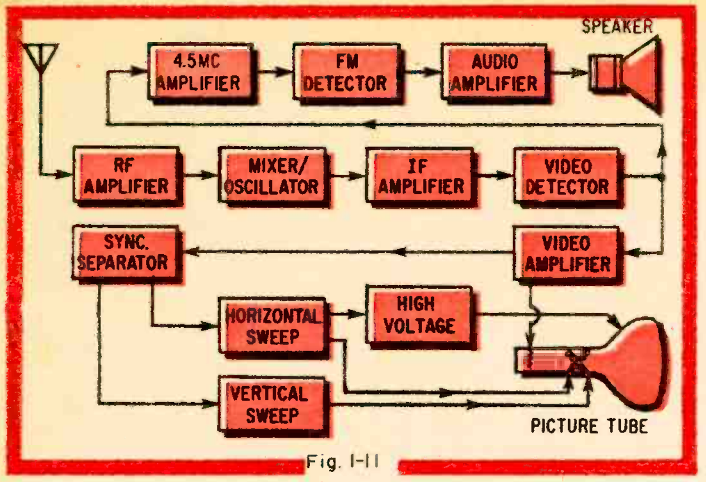


Fig. I-11

is rectified and fed to the picture tube anodes.

There you have the bare essentials of a B&W TV system. Fat books have been written about every function shown in that block diagram but we have tried to supply enough information to enable you to grasp the basic principles without elaborate explanations of each step.

Now let's conclude this chapter by pondering the changes that must be introduced before our monochrome picture can take on all the colors of the rainbow.

First, we obviously must have a new kind of picture tube—one whose screen will glow with more than one color. Since we can't use a different phosphor for each of the infinite variety of colors we will need, we must find a way to use a few phosphors to produce different colors by combining the fluorescence of one phosphor with that of another.

What is the least number of phosphors we can use to obtain full color and how can we excite the phosphors we need without exciting others? And how can we make a certain portion of the screen glow with one color for one scene and with another color for other scenes?

In order to answer these questions we will need to know exactly what we mean by color to decide which of its characteristics must be transmitted, recovered and reproduced. What is the difference, for example, between the many shades of red? Are there perhaps any peculiarities about the way in which the eye sees color—peculiarities that we must take into account or may even take advantage of in color television?

Finally, how can we fit all this extra color information into our already crowded 6-mc channel width? How can we make a B&W receiver reproduce a color telecast in suitable shades of gray? Having put color in the set, how can we keep it from introducing unwanted color into a B&W telecast?

NEXT ISSUE: COLORIMETRY

Output Meter for Solid-State CB Rigs

Check relative output power, modulation and your antenna at a glance.

By BERT MANN

IN the early days, CB transceivers started off small and simple. Then as time passed, they grew in complexity and got bigger—and bigger—and bigger. It took a lot of space to cram in super sensitivity, selectivity and talk power. And the rigs got heavier and heavier, too.

All of a sudden—zap—CB transceivers went solid-state. On the new scene there appeared two-pound handfuls that contained more features and boasted equal or better performance than the best of the old tube rigs.

But after you struggle out from under the long lists of features of solid-state CB rigs, you realize something is missing—an RF output meter. Very few of the tiny transistor rigs have one. And if you remember the days when tube transceivers didn't have an output meter, you know what it was like when someone didn't answer your shout.

You wondered whether or not the transmitter had pooped out, if the modulation was just hash, or if the signal even got to the antenna. In short, without an output meter you never knew for certain if your signal was getting out. Although the new breed of solid-state rigs have just about every feature, they lack the old output meter. Again, you can't know for sure whether pressing the PTT button is putting anything into sky-hook or just exercising your finger.

But for less than a ten spot, perhaps even less than five, you can add an output meter to any solid-state rig. It will indicate relative output power, modulation, and changes in the antenna-system's SWR.

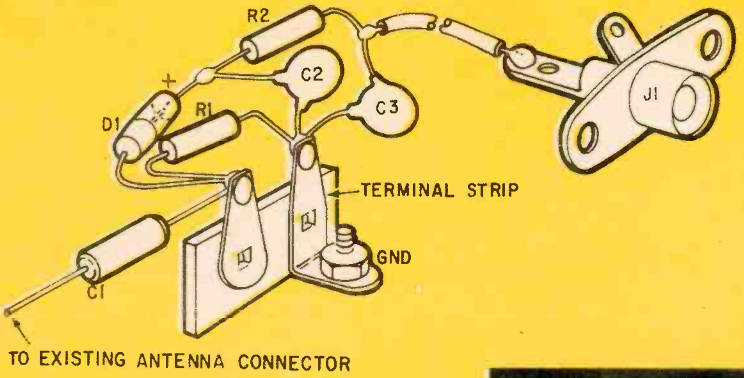
Squeezing It In

Because solid-state rigs are so compact there is virtually no extra space in them for even a miniature meter. In fact, the height of some rigs is less than the height of a conventional panel meter. As a result, the meter must be added outboard. However, the power-detector circuit (Fig. 1) *can* be built into the transceiver. There's always room for a few extra components providing they're small.

The power detector's output—DC proportional to the transceiver's RF output—is fed to a small phono jack (J1) mounted on the rig's rear apron. The meter (M1) and the calibrating potentiometer (R3) are mounted in a very tiny Minibox which is plugged into J1. The meter can be connected only during tests or it can be left permanently connected as it causes no measurable loss of output power.

Construction

The power-detector circuit, which consists of C1, C2, C3, R1, R2 and D1, must be mounted close to the transceiver's output connector. To con-



Output Meter for Solid-State CB Rigs

serve space, all components must be the miniature size we specify in the Parts List. The resistors are rated at 1/10 watt, the capacitors are low-voltage ceramic discs and the diode is a 1N34A.

Leads should be kept very short—about ¼-in. Since the components are sensitive to heat, a heat sink such as an alligator clip must be used on each lead when soldering. We suggest you use a low wattage iron—less than 50 watts. The connecting cable to the meter box, can be shielded microphone cable or small-diameter coax.

Checkout and Calibration

Connect the indicator to J1 and connect your antenna to the transceiver. Turn on power and press your PTT button. M1 will indicate something—the exact value is not important. Turn R3 to see if M1's pointer can be adjusted above and below the center of the meter's scale.

Now talk into the mike. M1's pointer should wiggle, indicating modulation. Depending on the type of rig and the power detector's installation, the meter may wiggle up or down with modulation. If it wiggles down do not assume something is wrong. The direction of our meter's needle movement bears no relationship to the usual upward movement of a power-output meter. In fact, if you connect a power meter to the transceiver it will most likely show an increase in power during modulation even if the needle wiggles downward. The only

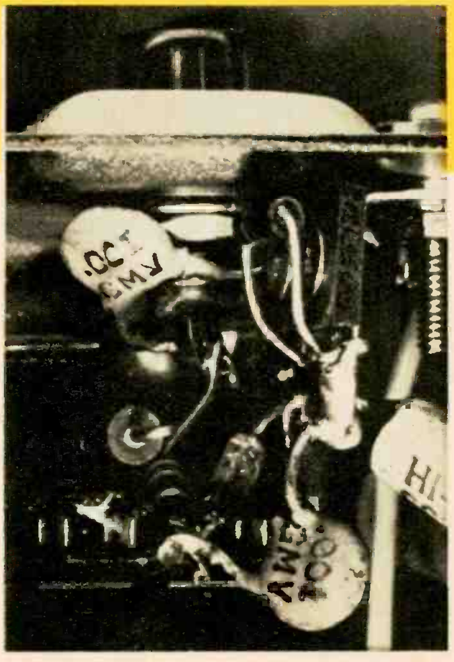


Fig. 1—Although solid-state CB rigs have next to nothing in the way of extra space, there's always a little near the output jack. Circuit at top is shown installed in the photo above.

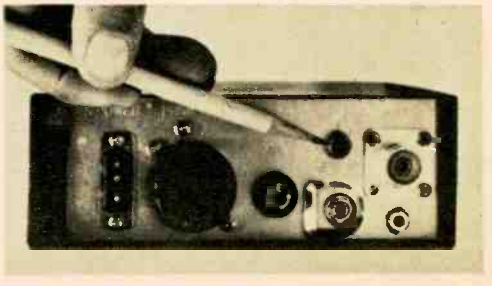


Fig. 2—Pencil points to the added phono jack which feeds the output of the power detector to the remote indicator. Rig is a Lafayette HB-555.

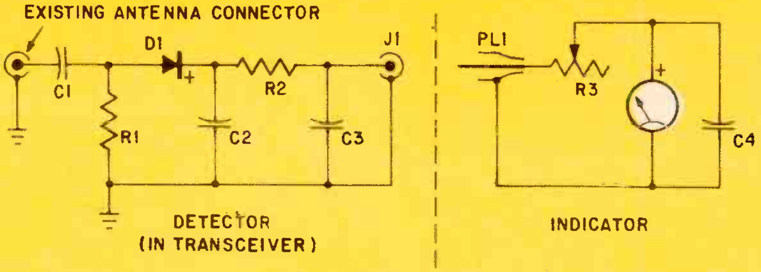


Fig. 3—Complete circuit. Detector, left of dashed line, is installed in transceiver near output connector. Remote indicator at right of line is connected with shielded wire.

PARTS LIST

C1—5 $\mu\mu$f, 600 V tubular ceramic capacitor (Centralab D6-050. Lafayette 33 R 2061 or equiv.)
C2,C3—.01 μf, 75 V subminiature ceramic capacitor (Lafayette 33 R 6902)
C4—.01 μf, 1,000 V ceramic disc capacitor
D1—1N34A diode
J1—Phone jack
M1—0-1 ma DC milliammeter (Lafayette 99 R 2513 miniature S-meter or equiv.)
PL1—Phono plug
R1—1,000 ohm, 1/10 watt, 10% resistor
R2—3,300 ohm, 1/10 watt, 10% resistor
R3—10,000 ohm, linear taper potentiometer
Misc.—3¼ x 2⅛ x 1⅝-in. Minibox, miniature terminal strip, shielded cable

thing to be concerned with is that the needle moves. If it doesn't, you have no modulation.

Adjustment

We suggest you use the output meter in the following manner: First, check your rig with a power output meter to be certain the antenna system is up to its rated performance. Then connect the antenna to the transceiver, connect our indicator and press the PTT button. Adjust R3 so M1's pointer is at exactly the mid-scale.

If the transmitter performs properly, the meter will always rise to mid-scale when the transmitter is keyed and will wiggle during modulation. Should the transmitter's output start to fall the meter will no longer rise to mid-scale and you'll know something's wrong. Similarly, if the meter fails to wiggle under modulation you know you're talking only to yourself.

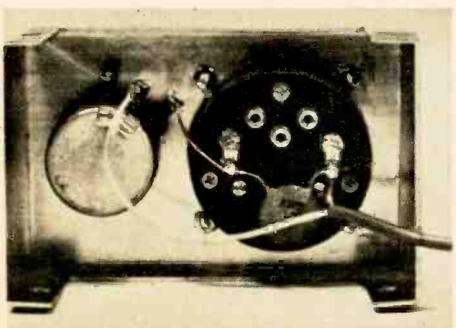


Fig. 4—Cabinet for the remote indicator is a 3¼ x 2⅛ x 1⅝-in. Minibox. The hole for the meter can be cut with a standard 1½-in.-dia. socket punch.

Should something happen to the antenna system, SWR will increase. This generally results in a sharp increase or decrease in voltage at points along the transmission line. Since the transceiver's output jack is part of the transmission line the voltage sensed by the power detector will show a sharp increase or decrease. Therefore, if M1's indication changes sharply from mid-scale, you can be certain you've got antenna trouble.

Note that the meter we specify—an S-meter—has an 0-5 scale. This is not a power-output scale and no adjustment of R3 will turn M1 into a direct-power meter. We selected the meter specified for M1 only because it is inexpensive. Any 0-1 ma meter can be used. The scales have no relationship to RF output power.

If desired, the output meter can be calibrated to indicate the transceiver's relative output power at several levels. Borrow a calibrated output-power meter and connect it to the transceiver's output jack. Operate the transmitter and note the output power on the calibrated meter. Adjust our meter's calibration control (R3) for a convenient reference and then mark the meter's scale to correspond with the indication on the calibrated output-power meter. Then reduce the transceiver's output power by detuning the final RF amplifier, and mark the meter's scale at each of several different power levels.

The LISTENER

C. M. STANBURY II

THE NEW BREED . . . Space DX is now some nine years old. During that time more and more satellite activity has switched from short wave to VHF and UHF. The result is a new approach to the challenge. When a manned Gemini space vehicle is launched, the new breed space DXer does not concentrate all his attention on 15016 kc (where the men in space will test at least once during each mission). The emphasis now is on ground stations connected with space operations. A pair of favorite frequencies are 15088 and 15022 kc, which are used by the recovery and rescue networks. Here you'll hear such IDs as Wasp Radio, Atlantic Chief Radio, Pacific Chief Radio, Samoa Radio, Eniwetok Rescue, and Guam Rescue. The latter three would be excellent DX even without a space angle. All of these transmitters use single sideband.

Another facet of this inner-earth approach is watching for broadcast stations that, contrary to international agreement, QRM these vital channels. The most startling case is R. Hanoi's sudden reappearance (after several years) on 15016 kc, the man-in-space frequency itself. While we cannot be absolutely certain that this was intentional, it is hard not to draw the obvious conclusion.

A second offender is R. Euskadi, which often appears within a couple kc of 15088. R. Euskadi (as noted in A DX Guide to Europe in last September's EI) is a clandestine transmission for the Basque provinces of Spain. It is on the air for half-hour transmissions at 1530, 1630 and 1730 EST. Equally serious is the Spanish jamming that accompanies Euskadi. Ironically, one of the jammers, a converted radioteletype transmitter, bears a striking resemblance to the first Sputniks.

The Radio Americas Controversy . . . As a result of the column we did on this subject last May (The 212 Mystery) we received a good deal of mail. One DXer wrote, "It seems to me, they should at least supply you with a one way ticket to Yucatan . . . If you get the trip, give my regards to the peasants." It turned out this fellow had a friend on RA's staff. Another sport, a Ph.D. no less, wrote "further *unsupported* speculation on your part can only further damage your credibility." Also, partially as a result of that same column, R. Americas (which is generally assumed to be CIA operated) wrote a multitude of letters to a number of DXers and subsequently corresponded with the American SWL Club, of which your scribe happens to be an officer. The ASWLC, in turn, challenged R. Americas as follows: "Will you allow us to send a witness of *our choice* to Swan Island to confirm your station's location, said witness to carry monitoring equipment of limited weight and size and to ride on your aircraft so that he may also inspect your stopover at Cozumel Island?" But ASWLC's challenge has not been taken up.

As it happens, we have a signed statement from an unimpeachable eye witness, a well known radio man. His statement was made to another DXpert who was good enough to provide us with a photostatic copy. This document has been kicking around for some time but until recently no one realized exactly when its author was on Swan. Now the EIDXC has established that it was for eight days during the last half of February 1960.

The idea for R. Americas (originally known as R. Swan) was conceived very late in 1959. By mid-May 1960 the potent station was completely operational on 1160 (now 1157) and 6000 kc. During those five months—if we are to believe that Swan is the real location—it would have been necessary to

[*Continued on page* 115]

Bob LaRose, Associate SWBC Editor of the American SWL Club and one of the very top New-Breed space DXers as well as a star member of EIDXC.

THE FARM OF THE SHY GIANT

Or how to escape notice while filling 500 acres with antennas and hot news

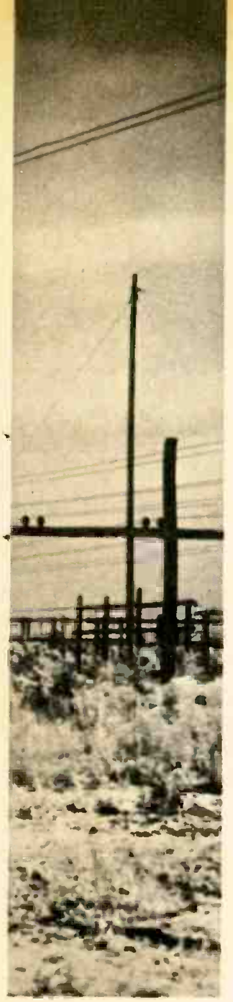
By LEN BUCKWALTER, K1ODH

IF a man bites a dog in Zanzibar or Kosygin sneezes in the Kremlin you probably will hear about it via PREWI. That's cable shorthand for Press Wireless, an ocean-hopping radio carrier that daily moves a mass of news and pictures to newspapers, radio and TV. What the barge is to coal, PREWI is to information. Both can move mountains at ridiculously low cost. Except Press Wireless snakes into 65 countries and hustles traffic out of its antenna farms at 186,000 miles per second.

But ironically, while it dispenses news and publicity throughout the world, Press Wireless itself is about as well known as the King of Western Samoa (His Highness, Malietoa Tanumafili II, in case you had forgotten).

The light under this bushel originally was generated by a mixture of Yankee ingenuity and World War I. At that time, the only reliable link across the ocean was undersea cable. And when reporters tried to use it to file stories, cable operators (with an eye to maximum revenue) said commercial messages go first—press travels last. So several U.S. newspapers cooked up a scheme to skip the cable. They built a receiving station in Canada to pick up radio signals from a transmitter in Britain.

News flowed smoothly until the regular carriers, who linked the Canadian



Master control room of the Press Wireless transmitting facility at Centereach, Long Island, is circular hub of the operation. Schedule board is at left in photo. Patch panels connect customer feeds to transmitters. A teletype feed here is being monitored on the printer in left foreground.

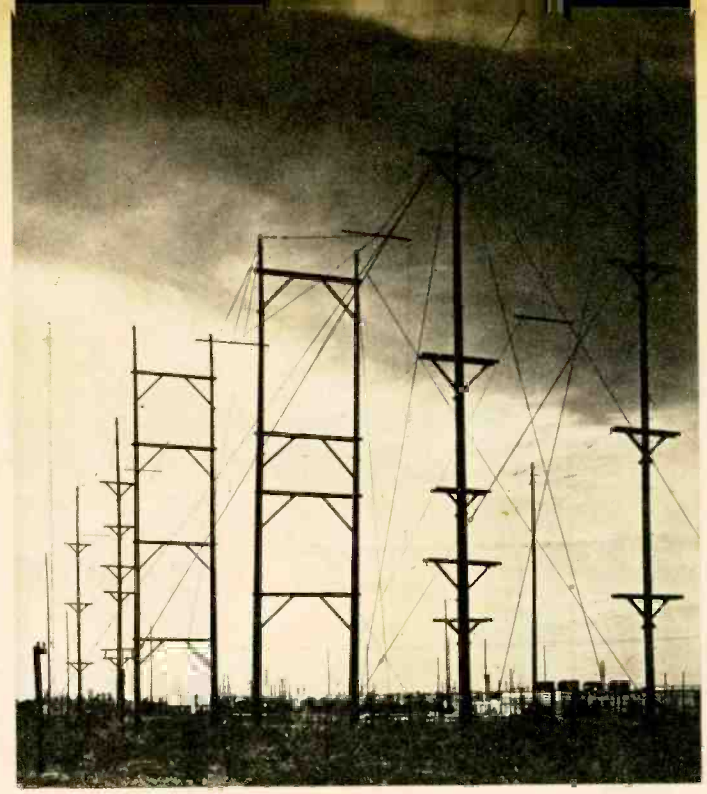
Monitoring facilities in the master control room enable technicians to keep tabs on quality of transmissions. In this photo a multiplex transmission to Europe is being checked out. None of the program material carried originates here. It is supplied by subscribers via phone lines.

receiver with the news media it served, tripled their rates. This kind of wrangling dragged on until 1929. Then the Federal Radio Commission (FCC's predecessor) finally recognized the communications needs of the press and set aside for its exclusive use frequencies in the more dependable short-wave band that was just beginning to replace long wave. Today, Press Wireless (now owned by ITT World Communications, Inc.) operates two major installations in the U.S.—one near San Francisco, the other in the New York area. Its bridge to the world is HF—high-frequency radio—from 3 to 30 mc. With some 200 assigned frequencies, Press Wireless can roam the band and select choice skip frequencies to saturate any region of the world.

Most transmissions are what is termed multiple address—with many receivers picking up the same signal. Using this system, a news service like UPI, for example, can cover South America, bringing its service simultaneously to many countries. A small newspaper office simply needs a receiver and a teletype printer to copy the UPI signal. Though news constitutes the bulk of daily traffic, Press Wireless also transmits overseas voice broadcasts for the U.S. Information Agency and special sports events like World Series baseball. Other customers include everybody from the New York Times to the Geneva Tribune, from Radio Free Europe to the Bulgarian Telegraph Agency. Airlines even use the service for long-haul overseas flight communications.

Press Wireless does not handle the content of the transmission directly—it is only the carrier. The customer provides the signals (voice, teletype, photofax)

THE FARM OF THE SHY GIANT



The antenna array of Press Wireless covers almost all of the 500-acre site. Transmitters are in building at the lower right. Forest of poles just in front of it carry feeder lines out to antennas. Tall steel tower at extreme left is one tackled by two teenagers.

via telephone line to Press Wireless, which uses it to modulate PREWI transmitters.

If you tuned in their transmission with a short-wave receiver you probably could make little sense of it. Picture signals on the air sound like snarling wildcats. Radio-teletype, the bulk of PREWI's traffic, sounds like high-speed Morse (and since it is transmitted at approximately 66 wpm, it can't be copied by RTTY machines at 60 wpm). Signals often are multiplexed to increase circuit capacity, which further reduces intelligibility. So there are slim pickings for the SWL.

Since the international flow of information is a two-way street Press Wireless operations have separate transmitting and receiving locations about 40 mi. from each other to prevent transmitters from overloading receivers when they are operating on nearby frequencies. In California the 161-acre receiving station, with ten rhombics, is at Napa; the 114-acre transmitting station, with 14 rhombics, is at Belmont. On the opposite coast, the receiving station is at Northville, Long Island, with 19 rhombics on 335 acres. The Long Island transmitting station is at Centereach, about 60 mi. east of New York City.

That is where I went to see Press Wireless in action. There, in a 500-acre tract, are hundreds of wooden poles stabbing about 100 ft. above the ground. A pattern of copper wire extends between poles, which are guyed against the wind by long nylon ropes. Lower poles carry ladder-like feeder lines from transmitters as much as 1,800 ft. away.

Ed Fee, who supervises the giant antenna farm, made sense of the maze of poles and wires. He traced the diamond-shape pattern of a huge rhombic some 600 ft. long and 200 ft. wide. It's the favored antenna type at Press Wireless. Not only does it have a low radiation angle for long skip but it also handles a wide portion of the spectrum without retuning. And the gain is a blistering 15db. Those 500 acres of real estate contain more rhombics than one is apt to see in a lifetime. They account for nearly half the site's 66 antennas.

By coincidence, a new rhombic was being proved out as we toured the farm. Below the antenna an engineer adjusted a tuning stub (a length of feeder line that behaves like a transformer). He attempted to bring the antenna's standing-wave ratio down to a low value and had reached a reading of about 1.3 to 1. Even without final matching, a receiving station reported that signals were booming in. It was in Montevideo, more

[*Continued on page* 113]

GOOD READING

By Tim Cartwright

RADIO CONTROL FOR MODELS *By F. C. Judd. Data Publications, London. Distributed in U.S.A. by Leader Enterprises, Box 44718, Los Angeles, Calif. 90004. 191 pages. $3.75*

This is the most thorough book on the subject I've ever come across and though it may tell you more than you ever wanted to know it should be a very valuable addition to many a hobbyist's library. Beginning with the basic methods for coding and decoding control commands, it goes on to cover basic components, transmitter design, and servomechanisms. It winds up with practical suggestions about antennas and layout in model ships and aircraft. Tubes are called valves, of course, in this very British treatise but there *is* an occasional bit of humor—particularly in the illustrations which are profuse, if pretty variable in quality. Worth looking into.

ELECTRONIC TROUBLESHOOTING, *A Self-Instructional Programmed Manual. Prepared by Philco Technical Institute. Prentice-Hall, Englewood Cliffs, N.J. 274 pages. $12.50*

Could be of great value to the man who would probably be the last to pick it up—the not-with-it radio serviceman who has never taken time to learn his real ABCs. The chief difference between this and other programmed instruction books I've seen is that it contains considerable amounts of unembarrassed instruction. Some real effort is required of the reader, but the troubleshooting course it offers is extremely good by any standards. I'd recommend it to anyone who wants to fill in gaps in his technical capabilities.

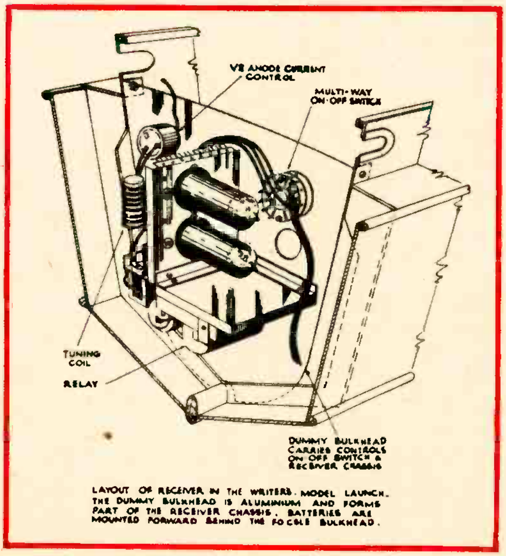


Illustration from Radio Control for Models shows cutaway detail of receiver installed in a model boat.

DETECTING AND ELIMINATING TV INTERFERENCE, POWER LINE INTERFERENCE, AND MOBILE NOISE. *Edited by Tom Kneitel. Cowan Publications, Port Washington, N.Y. 15 pages, $1.00*

A skimpy little booklet to carry a dollar price tag. But since interference is the bane of just about everybody in amateur communications, I recommend it for quick and easy reference. (How come the section on alternators deals only with airplanes, not automobiles?)

IONOSPHERIC RADIO PROPAGATION. *By Kenneth Davies. Dover Publications, New York. 470 pages. $2.25*

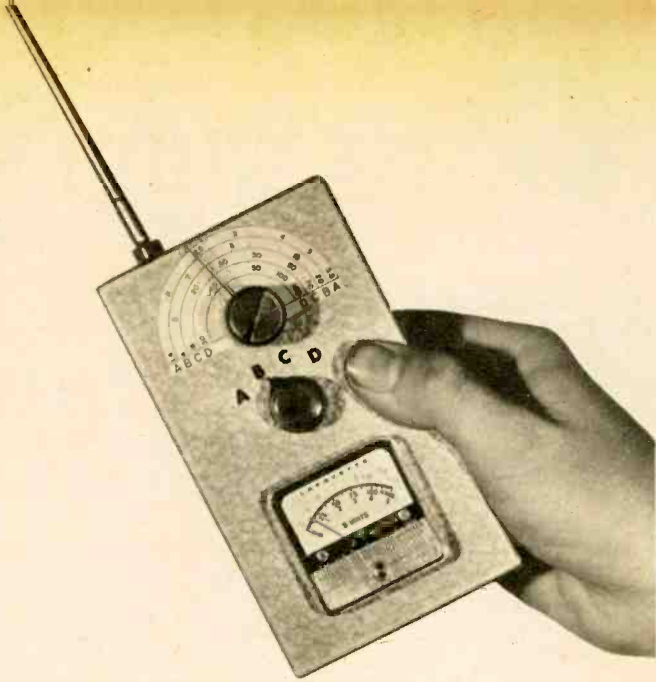
This highly esoteric but information-packed book is a good long way beyond the kind of handy-dandy guide that a ham might want to keep around, but it does offer a wealth of information about reception conditions, magnetic variations, and other matters gleaned from recent international research. The amount of graphic data is almost staggering. Any difficulty of access is balanced by information almost certainly unavailable from any other single source.

And make note of . . .

RCA TRANSISTOR MANUAL. RCA, Harrison, N.J. 480 pages. $1.50

AUDEL'S PROGRAMMED BASIC ELECTRICITY COURSE. Howard Sams, Indianapolis. 263 pages. $4.00

SUPER SENSITIVE FIELD STRENGTH METER



By F. DAVID HERMAN

GIVEN the choice of but one test instrument for your ham shack, what would you take? You know your onions if the answer is a field-strength meter (FSM). It is regarded by most hams as the best all-round instrument. True, it can't measure standing-wave ratio (SWR) but, being a relative-power indicator, it *can* tell you when your rig and your antenna are tuned to a razor's edge.

It also can sniff out harmonics and parasitics that have been bugging both you and the FCC. And an FSM probably is the only instrument commonly used by hams that will tell whether a flea-power rig is putting any soup into the line.

But to do all the jobs right you need something more than a ham-band-only FSM. Reason is, parasitics sometimes fall outside the bands. And to find the stage in which harmonics are being developed or to even tune a flea-power rig, you need top sensitivity. In short, you need an FSM which is super sensitive, one that tunes all the commonly-used ham bands from 160 to 2 meters—and then all the frequencies in between. Now add up all these features, figure ten bucks for parts an an evening's work and you've got EI's Super-Sensitive (amplified) FSM.

Construction

Our FSM is built on the main section of a 5¼ x 3 x 2⅛-in. Minibox. To avoid creating a parts jam or spreading the components too far apart, we suggest you use the front-panel template shown in Fig. 5 as a drilling guide. The specified meter mounts in a hole cut with a 1½-in. socket punch. Do not substitute any other variable capacitor for C1.

Mount all cabinet components, including the battery holder and antenna jack J1, before you start wiring. J1 is a standard insulated banana jack. It should be used instead of the jack supplied with the telescoping antenna because the latter is not strong enough to support the antenna. Mount the antenna in a hollow-type banana plug. Fill the hollow with molten solder and fit the antenna's threaded base into it. While the antenna does not accept solder, the solder will harden around the threads forming a rigid connection. Complete all wiring before you install the coils.

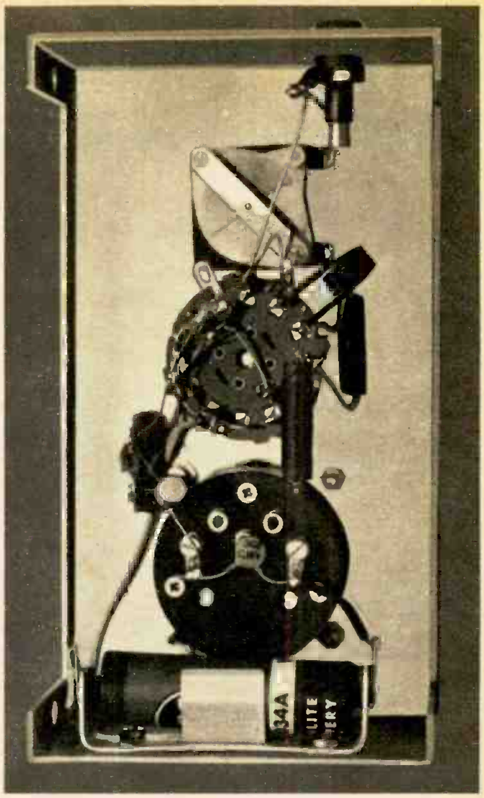
To keep cost down, Q1 can be any general-purpose transistor such as a 2N217. Naturally, the sensitivity of the FSM will depend on the gain of Q1. Also, Q1's leakage current will result in a slight residual meter reading. For maximum gain (sensitivity) and lowest residual reading (almost non-existent) use an RCA 2N2613 transistor for Q1.

Similarly, to keep costs down, D1 can be any diode such as a 1N34A. However, a 1N34A will reduce sensitivity from about 50 to 150 mc. For maximum sensitivity on the high band, use a 1N48 diode.

Coils L1 and L2 are homebrew; L3 and L4 are standard stock. L1 must be made with extra care if you want coverage to the top of the 2-meter band. If L1 is not wound carefully the FSM's top frequency will be around 120 mc. First, remove the insulation from a 6-in. piece of No. 20 solid hookup wire. Then tensilize the wire by clamping one end in a vise and pulling the other end until the wire goes dead slack.

Using the shank of a ¼-in. drill as a form, wind a single-turn coil. Note from the photograph and pictorial (Figs. 2 and 3) that L1 is not a hairpin coil. That is, the winding is a full 360°. Finally, pull the coil leads apart (along the axis perpendicular to the plane of the coil) so the leads are spaced exactly 5/16-in. When L1 is installed on S1 make certain the leads are exactly ¼-in. long—no more, no less. Also, position L1 so it sticks straight up from S1 toward the cabinet back.

Coil L2 consists of 5 closewound turns of



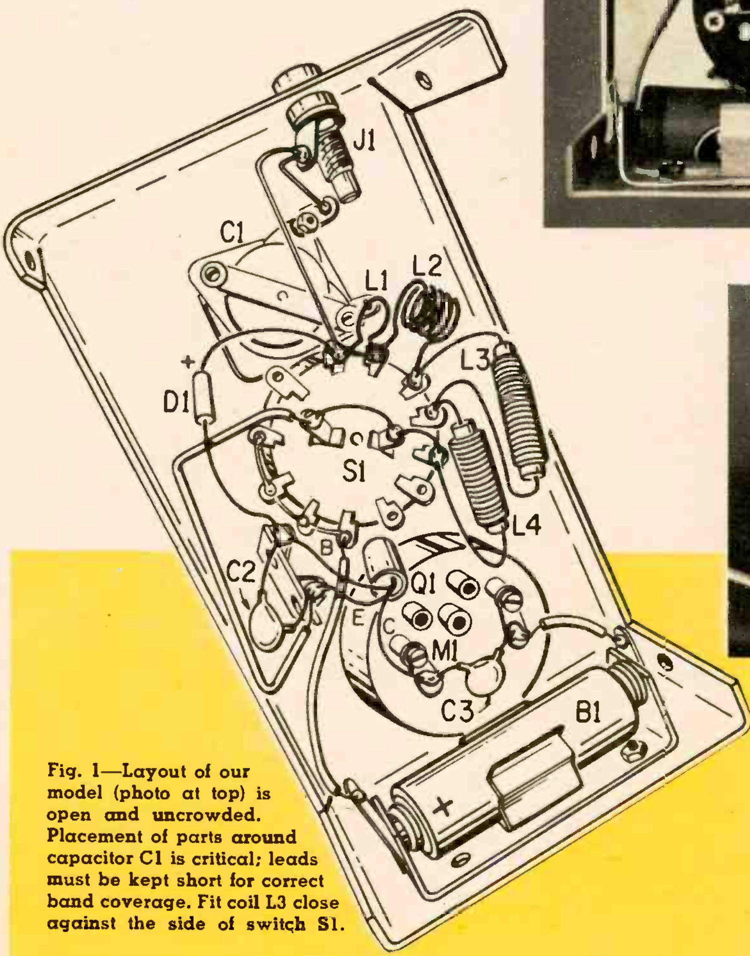


Fig. 1—Layout of our model (photo at top) is open and uncrowded. Placement of parts around capacitor C1 is critical; leads must be kept short for correct band coverage. Fit coil L3 close against the side of switch S1.

Fig. 2—Closeup of homebrew coils. L1 is at left. After making single turn, spread loop 5/16 in. Length of leads to switch lugs must be exactly ¼ in. Coil L2, 5 closewound turns, also must be mounted no more or less than ¼ in. from lugs on switch.

SUPER-SENSITIVE FIELD-STRENGTH METER

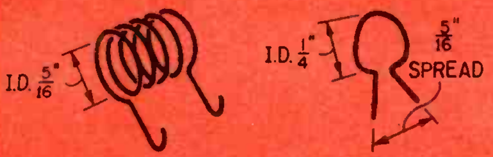
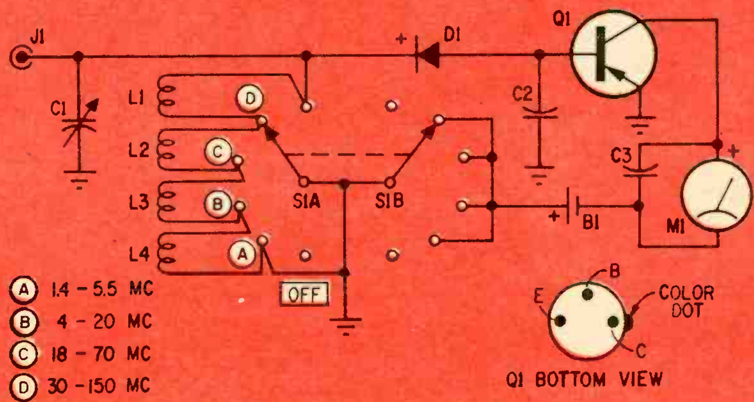


Fig. 3—Coil dimensions. At left is L2. Its turns must be closewound. Coil L1 is at right. Wind both coils on drill shanks and cut leads to 5/16-in. so coils will be ¼-in. from the switch lugs.

PARTS LIST

B1—1.5 V penlite cell
C1—10-365 μμf miniature variable capacitor (Lafayette 99 R 6217)
C2—.005 μf, 1,000 V ceramic disc capacitor
C3—.001 μf, 1,000 V ceramic disc capacitor
D1—1N34A or 1N48 diode (see text)
J1—Banana jack
L1—Coil wound with No. 20 solid hookup wire (see text)
L2—Coil wound with No. 18 enameled wire (see text)
L3—2.4 μh RF choke. J. W. Miller 4606 (Allied 63 U 830)
L4—24 μh RF choke. J. W. Miller 4626 (Allied 63 U 839)
M1—0-1 ma DC milliammeter (Lafayette S-meter; 99 R 2507)
Q1—2N217 or 2N2613 transistor (see text)
S1—2 pole, 6 position rotary switch (Mallory 3226J)
Misc.—Telescoping antenna (Lafayette 99 G 4001), banana plug, 5¼ x 3 x 2⅛-in. Minibox, battery holder

Fig. 4—Schematic of FSM. Signals picked up by antenna plugged into J1 are tuned by C1 and coil selected by S1. (Inductances of coils are added as S1 is moved from position D to A.) Tuned signal is detected by D1 and applied to base of Q1. Q1 amplifies signal to drive meter M1. Band covered by each coil is at lower left of schematic.



No. 18 enameled wire. Use the shank of a 5/16-in. drill for the form. Again, tensilize the wire before winding the coil. L2 is installed with ¼-in. leads. Use the exact coils we specify for L3 and L4.

When the unit is completed you'll find that a standard knob will not fit on C1's shaft and the supplied knob is useless. Cut off a ¼-in. length of a *round* volume-control shaft and, using epoxy, cement the piece of shaft to C1's shaft stub. Let the joint dry 24 hours.

Calibration

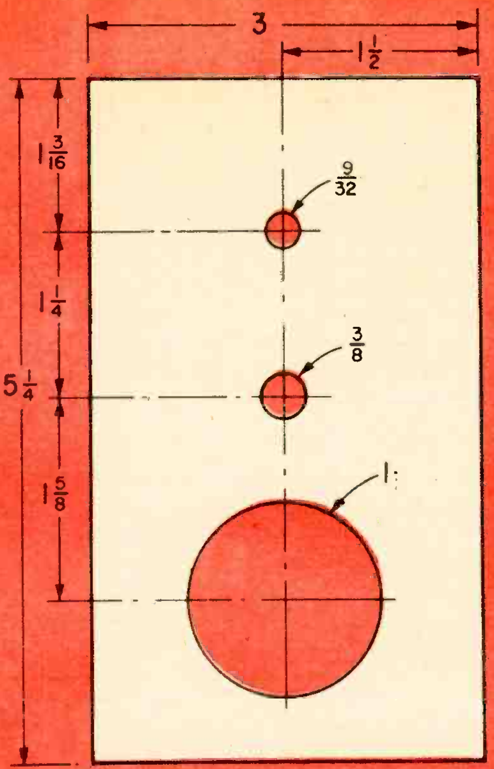
The FSM's approximate frequency ranges are shown in Fig. 4. The exact coverage is determined by L1's and L2's construction and the layout. However, if carefully built, coverage will be close to that shown in the chart.

Paste a semicircle of paper (with four bands inscribed) on the cabinet over C1's shaft with rubber cement. Mark the four bands—A, B, C, D—starting at the outer edge. Set C1 to maximum capacity (plates fully meshed) and set S1 to band *A*.

Either a grid-dip oscillator (GDO) or a signal generator can be used as the calibrating signal source, though it will be easier with a GDO.

Hold the GDO about 2 in. from the fully extended antenna and sweep the GDO down from 1.4 mc. When M1 peaks, mark the dial with the GDO's frequency. Then set the GDO to each of the desired calibration frequencies and adjust C1 for peak indication. Mark the panel as you go along. For the top of the band set C1 to *minimum* capacity and sweep the GDO frequency. Perform the B-, C- and D-band calibrations the same way.

If you can't borrow a GDO you can use a signal generator. But you must take extra



ALL DIMENSIONS IN INCHES

Fig. 5—Because parts placement is critical, use dimensions shown above for drilling main section of Minibox. The 1½-in.-dia. hole at bottom for meter can be made with a socket punch.

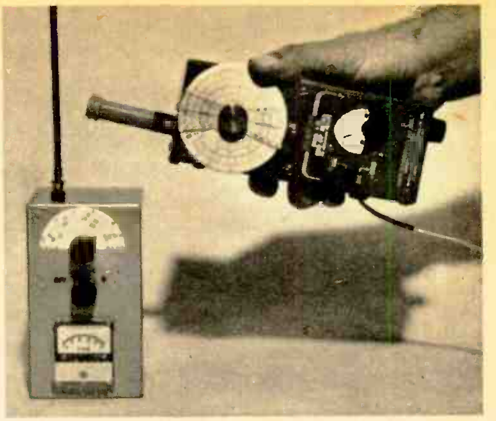


Fig. 6—Easiest way to calibrate the FSM is with a GDO. But be careful you don't overload the FSM. If the FSM's meter pins, move GDO farther away.

care not to pin M1. The generator's output level must be kept low. First, try connecting the generator's ground lead to the FSM cabinet and just *wrap* the hot lead around the antenna. If M1 pins with the generator's output control at off (remember, this is a *sensitive* FSM), try placing the generator's output lead about a foot from the antenna.

When using a generator whose high-frequency output is a harmonic of a lower frequency, make certain you are calibrating the FSM to the correct frequency. For example, if you are calibrating at 100 mc, make certain the FSM is not tuned to the generator's 50-mc output.

Using the FSM

Keep in mind at all times that our FSM is extremely sensitive and must be used carefully. Do not stick the FSM close to an antenna or oscillator when the equipment is on. Rather, keep the FSM as far as possible from the equipment for an easily readable meter indication. Only if the meter reading is so low it becomes inconvenient or difficult to observe should the FSM be moved closer to the signal source.

Generally speaking, low-power oscillators, such as are in 5- to 10-watt transmitters or solid-state transceivers, will require that the FSM's antenna be placed in close proximity to the oscillator tank circuit. However, the FSM's antenna should be far away from the tank circuit (or any resonant circuit, for that matter) when power is on and you're tuning up. If the antenna is placed close to a tuned circuit the inductive-capacity effects of the antenna may detune the FSM.

When using an FSM to tune an antenna, such as the multi-element type where the element spacing and length is adjusted for optimum forward gain or high front-to-back ratio, keep the FSM about five wavelengths from the antenna.

When using the FSM to track down harmonic TVI, make certain the instrument is tuned to the correct harmonic. First, tune to the lowest frequency that causes the meter to indicate. This is the transmitter's fundamental frequency. (But make certain you are not reading signal leak-through from one of the lower-frequency multiplier stages.) Then tune for the next higher frequency that causes a meter indication. If the frequency is twice the fundamental frequency it is the second harmonic. Then check for an indication at three and four times the fundamental.

Notes from EI's DX CLUB

MOST, if not all, of the current crop of KS4s claiming to operate from Swan Island can be reached via P.O. Box 1148, Miami, Florida 33148, which happens to be one of the addresses belonging to that controversial R. Americas. Might be interesting to see if these hams are mysteriously silent every couple weeks. Incidentally, we credit R. Americas as International Waters.

If you still haven't bagged Cyprus yet, try the BBC relay on 11905 kc at 0100 EST (2200 PST). At last report there was strong QRM from the Deutsche Welle (Voice of Germany) Ruanda relay so you might be able to log them both at once.

Speaking of BBC relays, the first of their new Ascension Island transmitters is now operating regularly. Fair signals on 15350 kc at 1745 EST (1445 PST) sign-off. This from California members H. L. Chadbourne and William Sparks.

Wonder how many of our ham members appreciate the subtleties of 75-meter DX? For example, EIDXCer Everett C. Bollin, WA3DVO, worked YN4SB, Nicaragua down here. On 75 meters this is a fine catch. Up on 20 meters it's just another QSL.

After an expose which appeared in The Listener, R. Portgual has begun issuing QSL cards without insisting that one join their DX Club. Chalk up one for our side!

If your only Costa Rican SW QSL is TIFC, which hardly can be considered rare, you might try for telephone station Telegraphica Costaricense at San Jose around 8200 kc. Member Paul R. Goodman (N.Y.) found this one to be a good verifier so listen for their test tape.

Another one to watch for is the R. Ulan Bator (Outer Mongolia) home service on 10885 kc any time between 1800 and 0700 EST. Even though all programs will be Mongolian, this should be the easiest way to log Ulan Bator. Our thanks to EIDXCer Robert Hejl who came up with their schedule.

R. Luxembourg is suddenly being heard quite consistently in North America up on 19 meters. Frequency is 15350 kc (a real hot spot these days) and member Bob LaRose (N.Y.) reports best reception around 2000 EST.

Here are some more frequencies for All India Radio's general overseas service: 9915 kc at 1445-1730 EST, 9815 and 11905 at 1545-1730 EST. None are beamed our way and reception will probably be best just before sign-off.

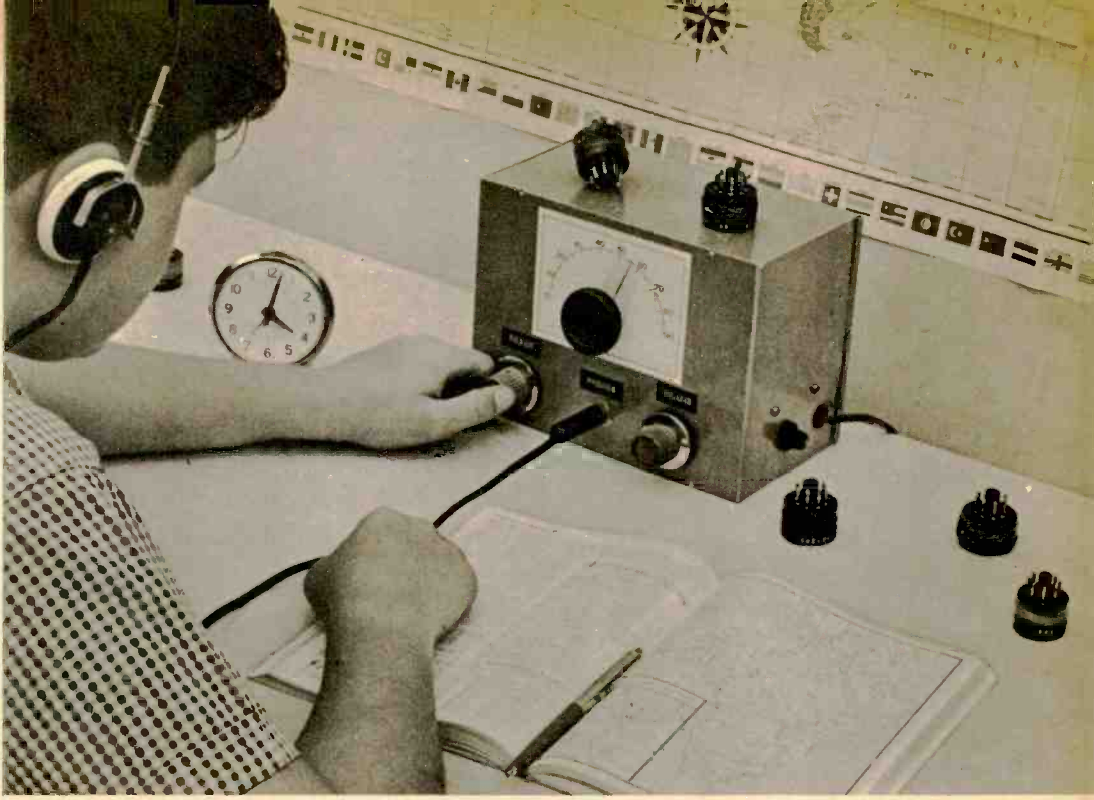
R. Berlin International, East Germany, has been noted on the offbeat frequency of 17700 kc, which has also been used by the Communist clandestine Radio Espana Independiente. Could it be that both use the same transmitter?

Propagation: Although there will be some change toward the end of the period, winter propagation conditions will be in evidence at least until mid-February with 21, 17, and 15 mc good for DX during the relatively short daylight hours, while 6 and 9 mc continue best at night.

The 26-mc band will open briefly during the early morning hours. The best bet for early-bird DXers is the BBC on 25750 kc during the period 0900-1100 GMT (0400-0600 EST).

With sunspots still climbing, the amateur 10-meter band and the Citizens Band will both open during the daylight hours on some days of January, and possibly early February.

Static levels will remain relatively low in January making BCB DX possible every night, trans-Atlantic openings likely.



1-Tube All-Bander

A low-cost, high-performance receiver for the listener on a budget.

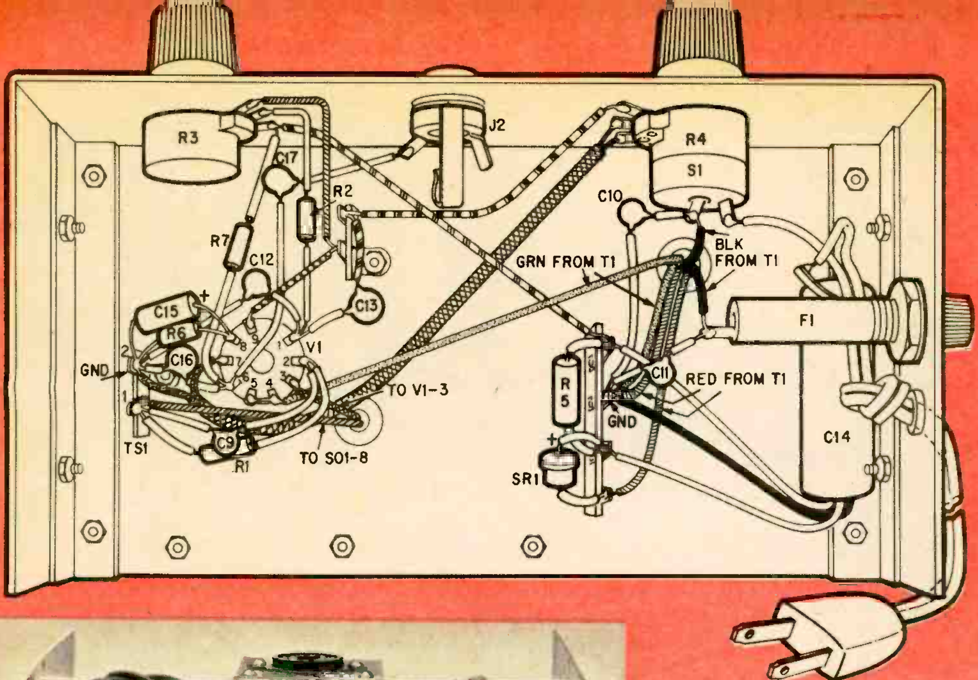
By DAVID J. GREEN, K3KNY

IT'S not just young folk that must crawl before they can walk. Hams-to-be and short-wave listeners must, too. And a good way to get started in either of these activities is with a receiver that is simple, doesn't put a strain on your wallet yet performs well.

If you really get hooked, you'll have a receiver which will hold you in good stead until the time comes when more cash is available for a larger rig.

On the other hand, if after monitoring the bands your interest wanes, you won't kick yourself for having tied up a lot of money in a receiver that ends up sitting on the shelf.

Our receiver is just what you need to start. It uses a dual triode for the detector and the audio-amplifier stage. Operating frequency is changed by simply plugging in a coil for each of the following bands: 15 meters, 20 meters, 31 meters, 40 meters, 80 meters, 160 meters and the broadcast band.



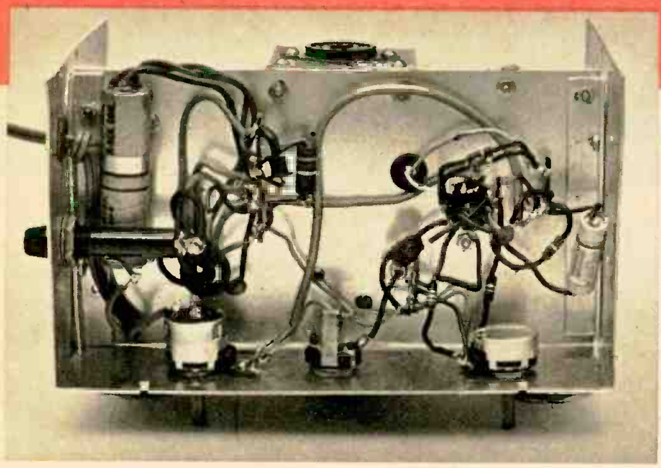


Fig. 1—There is very little under the chassis; therefore, you should have no problems fitting everything in place. Keep all leads to and around V1 short and direct. Note how the chassis is installed in the main section of the Minibox with home-brew brackets. Our chassis was installed 2¼ in. above the bottom of the cabinet. Heavy wire from volume control R4 to pin 7 on V1 is shielded.

1-Tube All-Bander

The Circuit

Signals to antenna jack J1 are coupled via antenna trimmer capacitor C1 to the tuned circuit consisting of coil L1 (or L2 through L7) and tuning capacitor C8. Bias for the detector stage (V1A) is developed by R1 and C9. To provide regenerative feedback, the cathode of V1A is connected to a tap on each coil. Regeneration is controlled by varying V1A's plate voltage with *regen* control R3.

The detected signal across R2 is coupled by C13 to *volume* control R4. The signal is then fed to the grid of audio amplifier V1B. Bias for V1B is provided by R6 and C15. The amplified signal which appears across R7 is coupled by C17 to phone-jack J2. The impedance of your phones should be at least 3,000 ohms, or higher. Operating power is furnished by power transformer T1, rectifier SR1 and the R/C filter circuit consisting of C14A, C14B and R5.

Construction

Mount a 7¾ x 3¼-in. piece of aluminum in main section of a 8 x 6 x 3½-in. Minibox. Support the plate approximately 2 in. from the bottom of the cabinet with brackets mounted on the side of the cabinet. Duplicate our parts layout to insure correct operation.

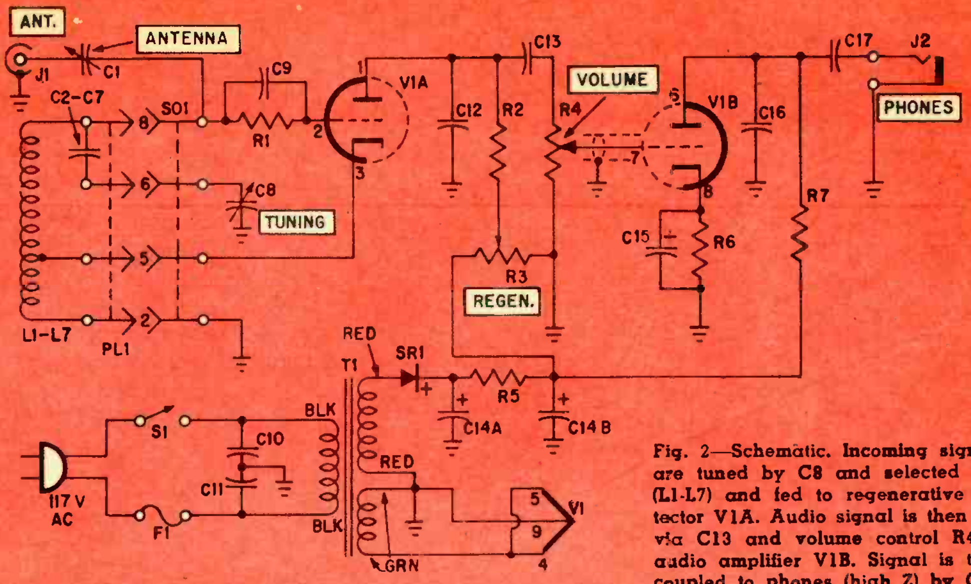


Fig. 2—Schematic. Incoming signals are tuned by C8 and selected coil (L1-L7) and fed to regenerative detector V1A. Audio signal is then fed via C13 and volume control R4 to audio amplifier V1B. Signal is then coupled to phones (high Z) by C17.

PARTS LIST

Capacitors: 1,000 V ceramic disc unless otherwise indicated
C1—4-30 $\mu\mu$f trimmer (Allied 11 U 651 or equiv.)
C2-C7—See coil chart
C8—10-365 $\mu\mu$f variable (Lafayette 32 R 1103)
C9—100 $\mu\mu$f
C10,C11—.005 μf
C12—470 $\mu\mu$f
C13;C17—.01 μf
C14A,C14B—20/20 μf, 150 V electrolytic
C15—10 μf, 25 V electrolytic
C16—.001 μf
F1—½ A fuse and holder
J1—Phono jack
J2—Phone Jack
L1-L7—Coils (see coil chart) wound on octal tube bases
PL1—Octal tube base (7 reqd.)
Resistors: ½ watt, 10% unless otherwise indicated
R1—2.2 megohms
R2—270,000 ohms
R3—50,000 ohm liner-taper potentiometer
R4—1 megohm, audio-taper potentiometer
R5—1,800 ohms, 1 watt
R6—1,000 ohms
R7—100,000 ohms
S1—SPST switch on R4
SO1—Octal tube socket (Amphenol 77MIP8 or equiv.)
SR1—Silicon rectifier: 750 ma, 400 PIV (Lafayette 19 R 5001)
T1—Power transformer; Secondaries: 125 V @ 15 ma, 6.3 V @ 0.6 A (Allied 61 U 410 or equiv.)
V1—12AT7 tube
Misc.—8 x 6 x 3½-in. Minibox, plastic tape kit (Lafayette 99 R 8029), No. 28 enameled wire, 9-pin tube socket, terminal strips, knobs, AC line cord and plug

The octal tube socket (SO1) for the coils should be mounted on a 2½ x 2-in. aluminum bracket. Install the bracket 2¾ in. from the left, and 3 in. from the right sides of the cabinet. The back of the cabinet should have a 1¼-in. hole cut in it in front of SO1. At the top of the coil-socket bracket drill a small hole for a sheet metal screw which should be used to hold the back of the cabinet to the bracket.

Trimmer capacitor C1 should be mounted

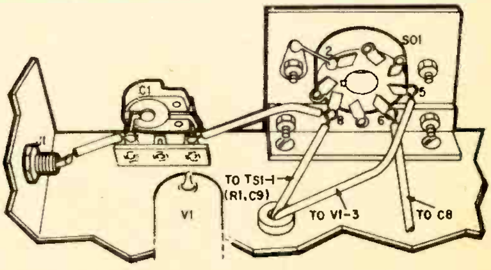
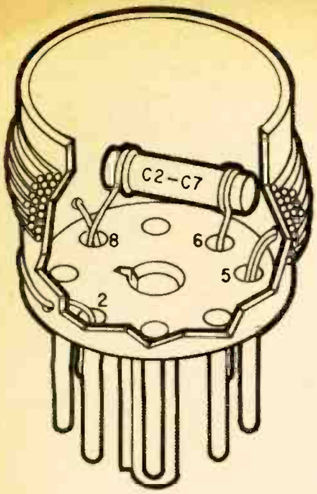
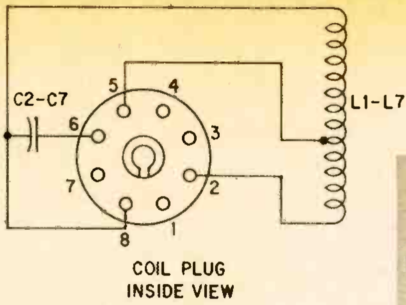


Fig. 3—View of top rear of chassis shows how trimmer capacitor C1 and socket for coils are mounted. Cut holes in back of cabinet for access.





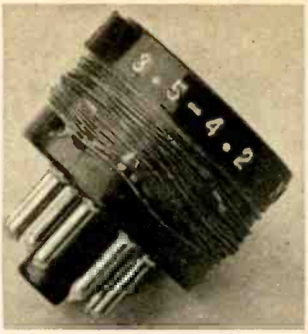


Fig. 4—Coil details. First, drill holes just above pins 2, 5 and 8. Start winding at pin 2, tap goes to pin 5, finish at pin 8. Install capacitor or jumper (see table) before soldering pin 8. An example of scramble winding can be seen in the photo of L3 at the right.

1-Tube All-Bander

by soldering its lugs to a three-lug terminal strip as shown in Fig. 3. C1 should be positioned to line with a hole in the back of the cabinet 1½-in. from the right side.

The Coils

The coils are wound on octal-tube bases. Before winding them, drill holes at the bottom of each base right above pins 2, 5 and 8. Start winding the coil from pin 2, as shown in the coil table. When you reach the number of turns at which you make the tap, break the wire, remove the enamel insulation, push both ends of the wire into pin 5 and solder. Then keep winding the coil the same direction and connect the last turn to pin 8.

Install the capacitor, or a jumper wire in the case of the broadcast-band coil, from pin 8 to pin 6. Keep the wire tight and the capacitor's leads short. After finishing, wrap plastic tape around the coil wire. We used different-colored plastic tape for quick identification of each coil.

Operation

Plug in the broadcast-band coil first. Turn the set on and give it a few moments to warm up. Turn the *volume* control all the way up and adjust the *regen* control until the receiver is just below the point of whistling. Tune for a loud station and then adjust the *regen* control until the station comes in loud and clear. Then adjust the antenna trimmer capacitor for maximum volume.

COIL CHART

Coil	Freq. (mc)	Turns	Capacitor (C2-C7)
L1	.55-1.5 (bdcst.)	80, tap at 20 from gnd.	Jumper
L2	1.65-2 (160 M)	75, tap at 20 from gnd.	47 $\mu\mu f$
L3	3.5-4.2 (80 M)	29, tap at 8 from gnd.	47 $\mu\mu f$
L4	6.5-8.5 (40 M)	13, tap at 3 from gnd.	47 $\mu\mu f$
L5	9.5-9.7 (31 M)	12, tap at 3 from gnd.	27 $\mu\mu f$
L6	14-14.5 (20 M)	8 tap at 4 from gnd.	10 $\mu\mu f$
L7	21-22 (15 M)	5, tap at 2 from gnd.	10 $\mu\mu f$

All capacitors ceramic disc or mica. All coils are scatter wound with No. 28 enameled wire.

Fig. 5—Chart above contains details for all seven coils. Frequency coverage is approximate and depends to a large extent on how coils are wound.

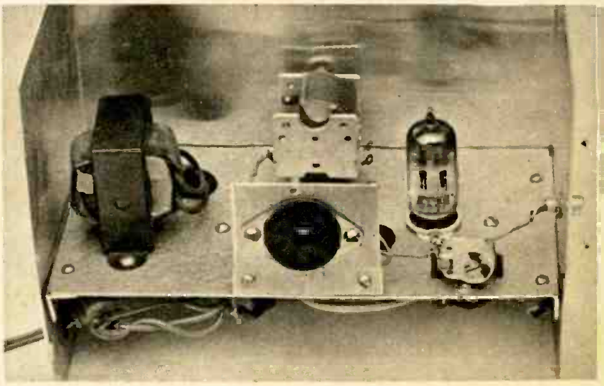


Fig. 6—Note location of antenna jack and trimmer capacitor. Hole above the coil socket is for self-tapping screw installed through back of cabinet.

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Double-cutaway for easy fingering of 16 frets; ultra-slim fingerboard — 24½" scale; ultra-slim "uniform feel" neck with adjustable Torque-Lok reinforcing rod; 3 pickups with individually adjustable pole-pieces under each string for emphasis and balance; 3 silent switches select 7 pickup combinations; 6 controls for pickup tone and volume; professional Bigsby vibrato tail-piece; curly maple arched body — 2" rim — shaded cherry red. 17 lbs.

C Silhouette Solid-Body Guitar . . . 2 Pickups
Modified double cutaway leaves 15 frets clear of body; ultra-slim fingerboard — 24½" scale; ultra-slim neck for "uniform feel"; Torque-Lok adjustable reinforcing rod; 2 pickups with individually adjustable pole-pieces under each string; 4 controls for tone and volume; Harmony type 'W' vibrato tailpiece; hardwood solid body, 1½" rim, shaded cherry red. 13 lbs.

D "Rocket" Guitar . . . 2 Pickups . . . Hollow Body
Single cutaway style; ultra-slim fingerboard; ultra-slim neck, steel rod reinforced; 2 pickups with individually adjustable pole-pieces for each string; silent switch selects 3 combinations of pickups; 4 controls for tone and volume; Harmony type 'W' vibrato tailpiece; laminated maple arched body, 2" rim; shaded cherry red. 17 lbs.

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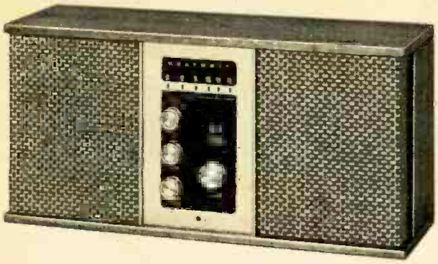

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NEW Deluxe SB-401 Amateur Transmitter Kit

Kit SB-301
$260.00
(less speaker)

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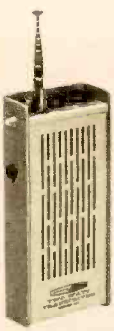

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By HERB FRIEDMAN, W2ZLF

THE LOW-DOWN ON THOSE LOW-COST CHARGERS

How good are those gadgets for putting new juice in dry cells?

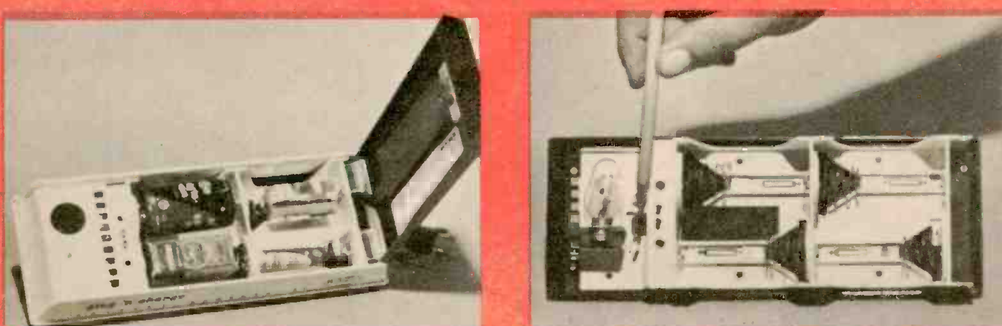
YEARS ago there were rumors that the battery industry was suppressing news about a way of putting new life into old dry cells. But today radio parts catalogs list low-cost chargers that allow you to use a battery over and over and over.

Think of it: buy only one set of lifetime batteries for your flashlight. Just forty cents' worth of batteries to keep life in those toys that used to burn up batteries by the dozen. We could go on and on about how much money you'll save—just like they do in the advertisements—but the big question remains: Do battery chargers really work—will they really deliver the performance implied by weasel-worded descriptions or are they just another useless gadget?

In search of answers we selected four popular chargers out of the seemingly endless list now on the market and put them through their paces. While our results give a picture that is somewhat black there are still a few rays of sunshine.

Plug-N-Charge

The Plug-N-Charge heads our list because it has been advertised in newspapers from coast to coast, is available from parts distribu-



Plug-N-Charge (also shown at top of page) is nationally advertised, handles D, C, AA, Z and miniature 9-V batteries, is supplied with so-called battery test lamp, adaptor for 9-volters. Battery holders are particularly versatile. Circuit consists of a 10-watt, current-limiting lamp in series with a diode.

tors and is even stocked by department stores.

The Plug-N-Charge is a rather fancy charger and, we must admit, rather well made. It will accommodate up to four batteries at one time automatically. If you insert only one battery, spring loaded switches establish a series circuit so the charger will still work. Switching is not necessary as the charger delivers a constant 40 ma charging current whether you plug in one D cell or a 9-volter.

The actual charging circuit is rather simple: As shown in Schematic 1 it consists of just a 10-watt lamp and rectifier in series with the AC line. When the battery is connected, the circuit is completed. The lamp limits the current to about 40 ma.

Any round battery such as the D, C, AA, Z and round 9-volters can be plugged in directly. A special adaptor is supplied for the common 9-volter such as the Burgess 2U6. Larger 9-volters cannot be charged as there are no adaptor cables. The charger is supplied with what is supposed to be a test lamp—next to useless in our check.

Did the Plug-N-Charge work? Yes it did. By following the charging times indicated on the back panel we were successful in charging many different batteries. But there were several snags, which also applied to the other battery chargers.

If the cell voltage *under load* had fallen below 1.0 to 1.1 V it was almost impossible to rejuvenate the battery. It could only be brought back to about 4 V for the Z cell and 6 V for the 9-volters.

Another difficulty was shelf life. Once the batteries had been recharged they had to be used almost immediately—then they delivered about one third the when-new service period. For example, if a new 9-volter would power a transistor radio for 30 hours, after charging it would only deliver service of about 10 hours.

The number of times a cell could be recharged ranged from twice to twelve times, though it must be noted that they were not run-down tested. The batteries were placed in normal service and were recharged when intuition deemed the time appropriate—just as the average user would do.

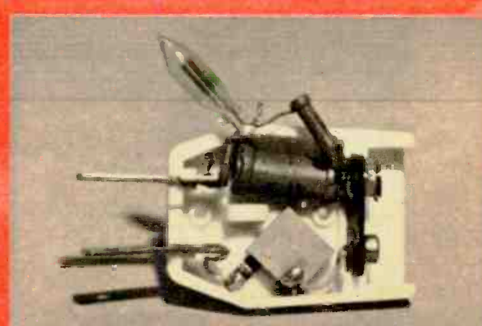
One difficulty must be avoided—that of placing different types of batteries in the charger at the same time. Since the charge rate is constant, each battery requires a different charging period. Leaving a 9-volter in for the extended time needed to recharge a D cell resulted in excessive heating and destruction of the 9-volter.

We'd like to point out that we successfully recharged several D cells that were specifically marked *Not Rechargeable*.

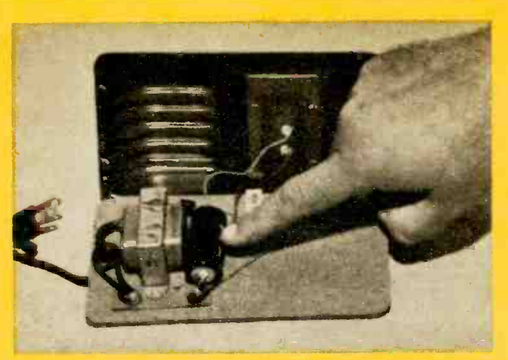
Battery-Charger Combo

Our second battery charger is one sold by major mail-order distributors as a combination *rechargeable battery—plug-in charger*. The basic charger circuit is shown in Schematic 2. While no one seemed to know (or would tell) precisely what was different about this 9-V battery, it did turn out to be quite successful. Alternating three batteries in a transistor radio we obtained an average of 31 cycles before the batteries failed to deliver a reasonable service period.

Each service period from the first charge became progressively smaller. And while the



Combination rechargeable battery and plug-in charger, available from several mail-order houses, gave good results, can also be used with standard batteries. Charging circuit consists of series-connected resistor and selenium rectifier. Small resistor and neon lamp are only for ON indicator in this case.



Rogers 880, available through parts distributors in blister pack, provided charging currents ranging from 500 ma for D cell to less than 1 ma per AA cell in Z battery. Circuit uses isolation transformer, silicon diode. Finger points to filter capacitor needed to control line hum for battery eliminator use.

CHARGERS

service period at no time was equal to an American-made 9-volter it was convenient to have a fresh battery always sitting in the charger.

An example of how the service periods compared was determined by using both rechargeable and standard batteries in a transistor radio used heavily by children. While a standard battery delivered an average of 8 days of service, the rechargeable battery gave about 5 days until the fifth cycle, then 2 to 3 days until the tenth cycle. Then it had to be recharged every day. In terms of cost the rechargeable battery has the advantage.

Rogers 880

Our third charger is the Rogers 880 Battery Charger and eliminator. This model is supposed to recharge D, C and Z cells. On D and C sizes it works well, with a charging current of about 500 ma when one battery is in the charger—a maximum of two cells can be charged at the same time.

It's a temptation to try AA cells too, although it's not recommended. Don't do it. The 500-ma charge rate overheats the AA cells and they are ruined.

Performance was definitely down on Z batteries. A Z battery is a 6-V pack made up of four series-connected AA cells. A single Z battery dropped the charge current to less than 1 ma, requiring days for a recharge.

The charger utilizes a step-down isolation transformer, a rectifier and a filter capacitor. This arrangement is used because the charger is also supposed to be a battery eliminator. Unfortunately, the filtering is rather light and we got severe hum when we tried to use the device as an eliminator. But the unit makes a fine D and C cell charger. Use it for that only.

Lafayette Charger-Eliminator

Our fourth money saver was the Lafayette 9-V transistor-radio battery charger and eliminator. This one is designed to be used with the 2U6 and the round P6 types.

As a charger it does well, delivering about 7 ma charging current. A switch allows you to use the device simultaneously as an eliminator and charger. Very heavy filtering is provided and there was no discernable hum in the radio.

How Good Are They?

If the user doesn't expect too much out of a charger the picture is reasonably bright. All chargers will recharge some batteries. Disappointment only comes about when the user believes all the claims made for chargers.

First, as you've seen, any particular charger cannot handle all sizes and types of batteries *efficiently*. Each charger gives optimum results with a few specific batteries. For example the charger that rejuvenated D cells with a 500 ma charge in a few hours took days to charge Z batteries. On the other hand, the almost universal Plug-N-Charge, which rejuvenated 9-V batteries in a few hours, takes about a day for its 40-ma charge current to build up sufficient voltage in D cells.

Then, one must keep in mind that the

Lafayette Radio 9-V transistor-radio battery charger and eliminator can deliver DC to radio while it is recharging battery. It is the most sophisticated of the units tested, having isolation transformer and relatively heavy filtering to reduce hum when the charger is used in the battery-eliminator mode.

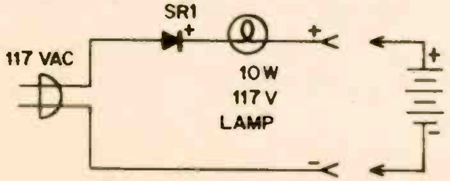
chargers are most successful with the standard flashlight batteries—the carbon-zinc and alkaline types. Mercury cells are apt to rupture or may even explode unless they can vent the internal gas pressure generated during recharging. Nickel-cadmium (Nicad) batteries also cannot be recharged as they require a specific charge rate which is generally printed on the battery. Exceeding the recommended charge rate can easily result in expensive permanent damage, while too low a charge rate will not put in enough energy for reasonable service periods. A nickel-cadmium battery requires a special charger.

Finally, the user must keep in mind that not all rechargeable batteries *can* be recharged. If the battery is used until it's almost exhausted it cannot be recharged. Or if the battery is recharged when it is still too fresh its demise will be accelerated. Optimum results are obtained only if you catch the battery at just the right point in the discharge cycle. If you find a means of keeping track of how much energy is removed from the battery you can utilize the charger to best advantage.

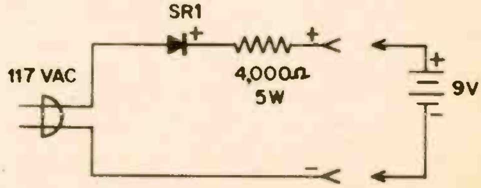
Optimum recharging is obtained with the commercial chargers when the recharging energy equals 120 to 150 per cent of the expended energy. As an example, if a C cell is used 5 hours in a project requiring 50 ma the expended energy is the current in amperes multiplied by the time in hours (.05 x 5) or .25 ampere-hours (A-H). The battery should then be charged with an input energy of at least 120 per cent of .25 A-H—or .31 A-H.

The battery should be charged for a time equal to the desired charging rate in A-H divided by the current the charger delivers. If the C cell was rejuvenated in a charger delivering 40 ma the charging time is .31 A-H ÷ .04 A—or 7.7 hours. If you leave it in the charger for a longer period, though, no damage is done. If the charge time is reduced while the current remains at 40 ma the rejuvenated battery will simply deliver a shorter service period.

The degree to which you will be satisfied with one of these chargers, then, depends to a large extent on how much you expect of it. If you don't expect too much, and if you get a unit well adapted to the kind of batteries you regularly use, you will run minimum risk of ending up with just another closet-filler.



Schematic 1—This 40-ma charger can be used with 1½- to 22½-V batteries. SR1 can be any 200-PIV silicon or selenium rectifier. Lamp is standard.



Schematic 2—This 17-ma charger is recommended for miniature 9-V transistor radio batteries of the 2U6 type. SR1 is same as in Fig. 1.

HI-FI TODAY

By John Milder

✓ *Good news for record buyers*

✓ *Sony takes a new tack*

MOST of the emphasis in this column each issue is on hi-fi hardware, but every so often it's time to remember that records are the all-important raw material for most hi-fi rigs. The reminder this time is a whole spate of new low-priced labels that will soon be appearing in record stores across the country. Joining the pioneer budget labels that I mentioned a while back (Nonesuch, Turnabout, Everyman, etc.) are some of the biggest names in the record business. Columbia's big subsidiary, Epic, is offering the new Crossroads label. Angel has Seraphim (did you expect Lucifer?). Mercury/Philips now presents their World Series (no reference to baseball). And in early '67 Columbia itself will have a low-priced series called Odyssey.

Traditionally, low-priced records have implied either reissues or new American releases of old European master tapes bought at cut rates. But with all of the big guns now aiming at the budget market, things won't be that pat. Sure, there will be older records brought back into circulation, but some of them (particularly Angel's Seraphim releases) will be of ultra-valuable collector's items, many of which previously might have wound up as premium-priced Great Recordings of The Century material. And Epic's releases will feature recordings from the highly-reputed Czech Supraphon label. It may get pretty difficult to tell the difference between the cheap and expensive releases (and for record companies to maintain the identities of their premium-priced labels). All of the new labels, by the way, are in the $1.98-$2.50 range. Good shopping!

Speaking of records, a new demonstration disc from KLH unsurprisingly titled Music To Listen to KLH By, uses musical material to show what to listen for in a stereo rig. Since I had a part in the production of the record, I can't pretend to complete objectivity about it. But it does do what it promises to. It's available *only* from KLH dealers or directly from KLH, 30 Cross St., Cambridge, Mass. 02139, for $2.98.

To my mind one of the most surprising entries into the audio business has been the recent component line from Sony. Far from being comparable to the Tummy TV or the pocket radio, these are imposing and expensive units. There's a $150 transcription turntable (TTS-3000), to which you can add an $85 tone arm (PUA-237) and a $65 moving-coil cartridge (VC-8E). As for electronics, Sony's new amplifier (TA-1120) is an integrated 120-watt (IHF stereo music power) job that sells for $400. Now all Sony needs is a nice $1,500 speaker system and its ad agency will go crazy trying to keep the old image straight.

New Sony Integrated Amplifier is an exceptionally clean-looking unit, suggesting quality in line with its $400 price tag. Switch allows tone controls (and the phase shift they introduce) to be cut out of the circuit. Similar power amp is available separately.

ELECTRONICS ILLUSTRATED DX CLUB

NOW! A UNITED NATIONS-25 AWARD FOR HAMS & SWLs!

EVERY year since 1962 EI has announced the addition of a new award to its prized series of DX certificates for hams and SWLs.

In this Sixth Award Period, now open, EI moves from radio's many official-countries lists, which include dots of land that are not important either politically or commercially, to the official Membership List of the United Nations and creates a United Nations-25 Award.

To win a U.N.-25 from EI's DX Club, you must log any 25 of the 117 countries which appear on the United Nations Membership List, a roll that hardly could be of more import since on it depend both the peace and the future of the world as we know it.

Note: DX credit will be given for all countries on our list that were United Nations members at the opening of the 21st General Assembly—but not for members admitted after the opening. Therefore no credit will be given for Indonesia, Guyana (formerly British Guiana), Botswana (formerly Bechuanaland) or Lesotho (formerly Basutoland).

EI's other DX awards also are available during the new Awards Period, of course.

To apply for any of the certificates, use the DX Log on the following pages (or a duplicate). You must, of course, be able to substantiate every entry with a QSL card or letter. All entries must be mailed by April 30, 1967. Entries postmarked later than midnight of that date will be disqualified for awards during this Award Period and returned to the sender. The table at bottom shows all the awards now available, as well as the requirements for each.

For the DX Century, based on 100 entries, an additional copy of the Log form will be required to give you the necessary space. You may get it from another copy of this issue or you may have a photostatic copy made. It is

HANDY GUIDE TO EI'S DX AWARDS

CLASS OF AWARD	TYPE OF SWL	AWARD HAM	FREQ. LIMITS	REQUIREMENTS
General 100 (DX Century)	X	X	None	Reception of or two-way communications with stations in at least 100 different countries.
General 50	X	X	None	Reception of or two-way communications with stations in at least 50 different countries.
Special	X	X	None	Reception of or two-way communications with stations in at least 10 different countries.
BCB Stateside Special	X		535-1605 kc	Reception of stations in at least 25 different states or provinces.
Broadcast Band	X		535-1605 kc	Reception of stations in at least 15 different countries.
All-Continents	X	X	None	Reception of or two-way communications with stations on all six continents.
United Nations-25	X	X	None	Reception of or two-way communications with stations in at least 25 different UN member countries.

UNITED NATIONS-25 AWARD

important to note that copies of the form will be accepted only if they are identical, even to size, to the form printed in this issue.

If you are trying for one of the several awards that require logging a number of different countries (instead of states, as required by the broadcast certificate), you will need to refer to a copy of EI's DX Club Official Countries List. It originally was published in the March 1965 issue but since has been updated to reflect subsequent name changes. You may have a copy of the list free by sending a stamped, self-addressed business (No. 10) envelope to: Countries List, EI's DX Club, 67 West 44th, New York, N.Y. 10036.

In filling out the DX Log, use a typewriter or ball-point pen. And be sure that *all* the information required is filled in—and filled in accurately. Date, time, frequency, location and type of QSL for each entry must stand up to careful scrutiny if an application is to win an award.

Be sure, above all, to specify whether the QSL for each entry is by card or by letter. *But do not include QSL cards or letters with your log.* Keep them on hand so that you can submit any or all for inspection, should we request it.

Then, before you send your application, double-check all the information on it. When you are sure that you are giving us everything we will need, put the application in an envelope and mail it to:

EI's DX Club
67 West 44th St.
New York, N.Y. 10036

If your application is accepted after the necessary checking and processing, a DX Award, similar to the ones shown on the previous page will be made out in your name and mailed to you. The Award is handsomely printed on 8½ x 5½-in. stock suitable for framing.

OFFICIAL UNITED NATIONS MEMBERSHIP LIST

Afghanistan	Greece	Nigeria
Albania	Guatemala	Norway
Algeria	Guinea	Pakistan
Argentina	Haiti	Panama
Australia	Honduras	Paraguay
Austria	Hungary	Peru
Belgium	Iceland	Philippines
Bolivia	India	Poland
Brazil	Iran	Portugal
Bulgaria	Iraq	Romania
Burma	Ireland	Rwanda
Burundi	Israel	Saudi Arabia
Byelorussia	Italy	Senegal
Cambodia	Ivory Coast	Sierra Leone
Cameroon	Jamaica	Singapore
Canada	Japan	Somalia
Central African Republic	Jordan	South Africa
Ceylon	Kenya	Spain
Chad	Kuwait	Sudan
Chile	Laos	Sweden
China	Lebanon	Syria
Colombia	Liberia	Thailand
Congo (Brazzaville)	Libya	Togo
Congo (Democratic Republic of)	Luxembourg	Trinidad & Tobago
Costa Rica	Madagascar	Tunisia
Cuba	Malawi	Turkey
Cyprus	Malaysia	Uganda
Czechoslovakia	Maldive Islands	Ukraine
Dahomey	Mali	U.S.S.R.
Denmark	Malta	United Arab Republic
Dominican Republic	Mauritania	United Kingdom
Ecuador	Mexico	United Republic of Tanzania
El Salvador	Mongolia	United States
Ethiopia	Morocco	Upper Volta
Finland	Nepal	Uruguay
France	Netherlands	Venezuela
Gabon	New Zealand	Yemen
Gambia	Nicaragua	Yugoslavia
Ghana	Niger	Zambia

ELECTRONICS ILLUSTRATED
DX CLUB

OFFICIAL DX LOG

INSTRUCTIONS: PRINT neatly or use typewriter—DO NOT WRITE! Under *Type of Award*, check SWL or HAM to designate type of Award you are applying for. Under *Class of Award* print class of Award you are applying for (see our chart on opposite page). In tabular listing below, be certain to complete all blanks for each entry. Under *Date*, use figures (such as 10-1-64); all log entries must be dated January 1, 1950 or later. Under *Time*, use local standard time and 24-hour clock (0000 to 2359 hours). Make up identical copy of this log for second 50 countries. Sixth Award Period ends April 30, 1967.

NAME .... HAM CALL ....
(last name) (first name and initial)

ADDRESS ....

CITY .... STATE AND ZIP ....
(or country)

TYPE OF AWARD ☐ SWL ☐ HAM CLASS OF AWARD .... DATE ....

	DATE (local)	TIME (local)	FREQ. (kc)	STATION CALL	LOCATION (city & country)	QSL
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2						card ☐ letter ☐
3						card ☐ letter ☐
4						card ☐ letter ☐
5						card ☐ letter ☐
6						card ☐ letter ☐
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18						card ☐ letter ☐
19						card ☐ letter ☐
20						card ☐ letter ☐
21						card ☐ letter ☐

	DATE (local)	TIME (local)	FREQ. (kc)	STATION CALL	LOCATION (city & country)	QSL
22						card ☐ letter ☐
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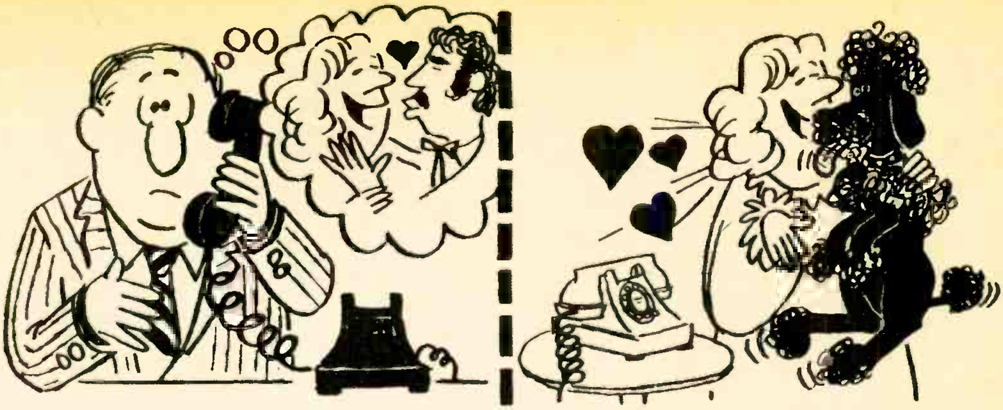


008 Tele-Spy

Would You Believe 004?

By AL TOLER

WHEN the cat's away the mice just may play. Like, does the baby-sitter throw a blast for every teen-ager on the block? Is there hanky-panky between your wife and the poodle? Maybe the kids get up after you go over to the neighbors for a night of bridge. Or when you start on vacation, does it suddenly occur to you that you may have left the water running? Banish all doubts forever with our 008 Tele-Spy!

What is it? A device that turns your telephone into a private eye . . . err, ear, we mean. Here's how it works: you connect the Tele-Spy to your telephone line. Whenever you call your number the phone will be answered electrically by the Tele-Spy *before* the bell rings! You'll then hear every sound in the room for 30 seconds, a minute or whatever time you want.

At the end of the snooping period the Tele-Spy disconnects itself from the phone line (hangs the phone up electrically) and is ready for another call. Should you want to make an outgoing call, the Tele-Spy won't interfere. However, it must be turned off to let an incoming call get through.

Construction. Our Tele-Spy is built in a 7 x 5 x 3-in. Minibox. We suggest you build it exactly as shown and make no parts substitions or layout changes.

The circuit is made in two parts then wired together. First, mount all mechanical components, relays, switch etc., in the main-section of the Minibox. Capacitor C11 must be a non-polarized type, not an electrolytic.

While S1 need only be DPST switch, we used a DPDT type to provide an extra terminal for the line cord and circuit breaker. (A 1-A fuse can be substituted for CB1.)

Delay relay RY3 is mounted on a small bracket made from scrap aluminum. Mount the bracket as shown, so that RY3 is upright when the cabinet is in the operating position. mount J1 far from RY3's socket.

The amplifier is assembled on a 4⅜-in. square piece of perforated Vectorboard. Vector No. T28 push-in terminals are used for

Fig. 1—Tele-Spy control box doesn't have to be near phone; it can be connected to line anywhere. Mike can be hidden as amplifier's gain is high.

008 TeLe-sPY

tie points. To avoid a parts jam in tight corners, some resistors and capacitors should be mounted on end.

Double check the installation of the bridge rectifier consisting of diodes SR1-SR4. If a single diode is reversed either CB1 will open or T2 will be damaged. Also, double check capacitor polarities. With the exception of C1 and C11, all capacitors are polarized; note their connections carefully.

Mount the amplifier board in the bottom of the main section of the Minibox. If RY3's bracket interferes with T2, making it difficult to mount the amplifier, trim the excess metal from the bracket with tin snips. To prevent the push-in terminals (which protrude, through the board) from shorting to the chassis, slip a standoff insulator—two ¼-in. grommets—on each mounting screw between the board and the cabinet.

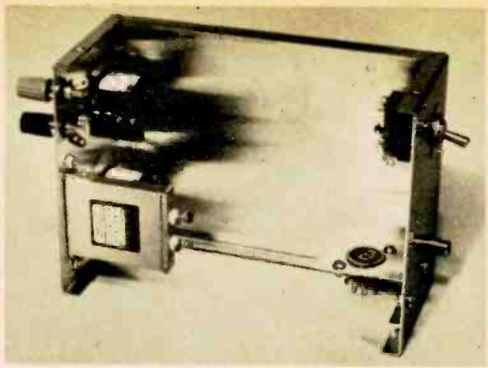
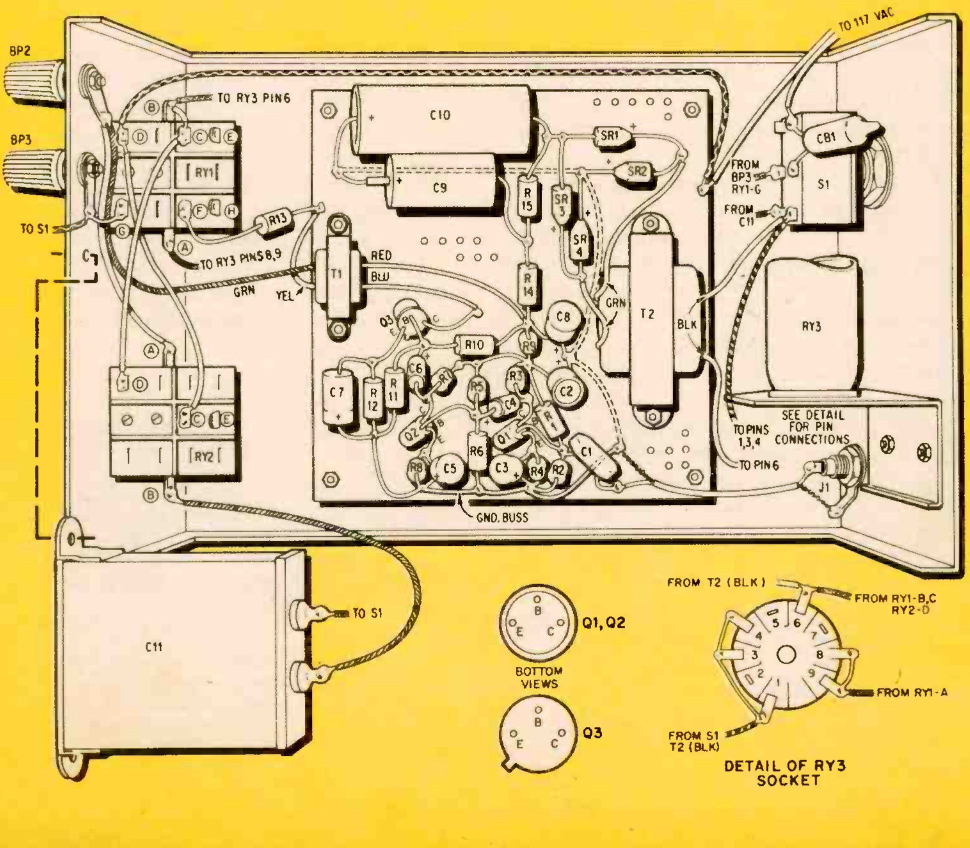


Fig. 2—Start construction by mounting all the cabinet components. L-bracket at the lower right supports 9-pin tube socket for delay relay RY3.

Complete the wiring in this order: S1 to C11 and BP3; C11 to RY2; RY3's socket (all connections); T2 and line cord to S1; all connections to RY1 with R13 last; T1's green lead to BP2 (cut off T1's black lead and use the full length of the green lead routing it

Fig. 3—Amplifier is assembled on a 4⅜-in.-square piece of perforated board. Push-in terminals are used for all tie points. All wiring except the ground buss (broken lines) is on top of the board. Notice the way several resistors and capacitors are mounted standing up to prevent a parts jam.



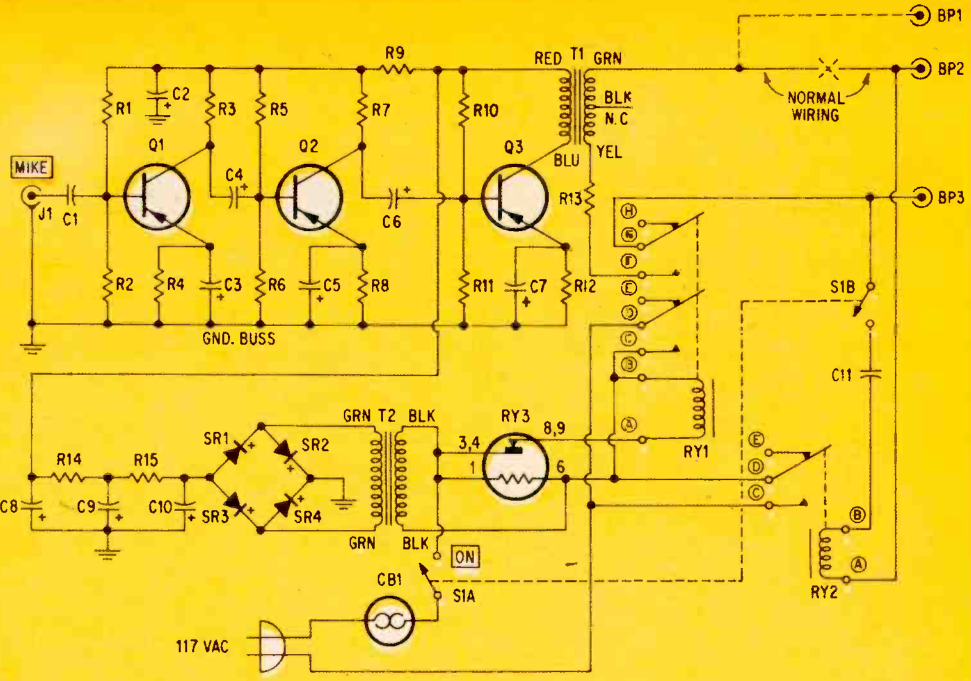


Fig. 4—Ring current energizes RY2: contacts C,D close and energize RY1. RY1's C,D contacts hold it closed, apply line voltage to T2. RY1's F,G contacts feed amp output to line at BP2,BP3. Voltage to RY1 goes to RY3's heater. After delay, RY3's contacts open and disconnect Tele-Spy.

PARTS LIST

BP1-BP3—5-way binding post
Capacitors: 12 V or higher unless otherwise indicated
C1—.25 μf ceramic disc
C2,C8—30 μf, electrolytic
C3,C5—50 μf, 6 V electrolytic
C4,C6—3 μf electrolytic
C7—30 μf, 6 μf electrolytic
C9—100 μf electrolytic
C10—500 μf, electrolytic
C11—4 μf, 200 V metallized paper (Lafayette 34 R 7316 or equiv.) see text
CB1—1-A circuit breaker (Sylvania MB-315 Mite-T-Breaker. Allied 34 U 075) see text
J1—Phono jack
Q1,Q2—2N2613 transistor (RCA)
Q3—GE-transistor (GE)
Resistors: ½ watt, 10%
R1—82,000 ohms
R2,R6—10,000 ohms
R3,R7—4,700 ohms
R4—690 ohms
R5—47,000 ohms
R8—1,500 ohms
R9,R13,R15—470 ohms
R10—33,000 ohms
R11—22,000 ohms
R12—820 ohms
R14—100 ohms
RY1—DPDT relay, 115 VAC coil (Allied 74 U 657)
RY2—SPDT relay, 115 VAC coil (Allied 74 U 652)
RY3—Amperite delay relay (see table)
S1—DPDT toggle switch (see text)
SR1-SR4—Silicon rectifier; minimum ratings: 50 ma, 25 PIV (Allied 39 U 692 M or equiv.)
T1—Transistor driver transformer; primary: 1,500 ohms; secondary: 500 ohms, center tapped (Lafayette 33 R 8548)
T2—Filament transformer; secondary: 6.3 V @ 0.5 A
Misc.—7 x 5 x 3-in. Minibox, 9-pin tube socket, Vector Pattern B prepunched terminal board Type 45B30 (Allied 46 U 005), Vector push-in terminals Type T28 (Allied 40 U 879), crystal or ceramic microphone

clear of RY1's coil. J1 to board (even though it's a very short lead, use shielded wire).

The Tele-Spy's time delay is established by RY3. The chart at the end of this article lists several other relays and their delay time. Additional types may be selected from Amperite's listing of 115-V normally-closed relays in most parts catalogs.

Checkout. Connect a pair of magnetic headphones—500 ohms or higher—to binding posts BP2 and BP3. Turn on power with S1. Using an insulated screwdriver, press RY2's armature (the wiper contacts) and quickly remove the screwdriver. As soon as

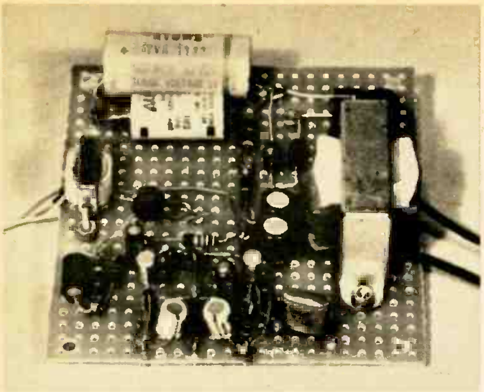


Fig. 5—Completed amplifier board ready to be installed in cabinet. Wiring is tight in spots making it necessary to mount several parts on end.

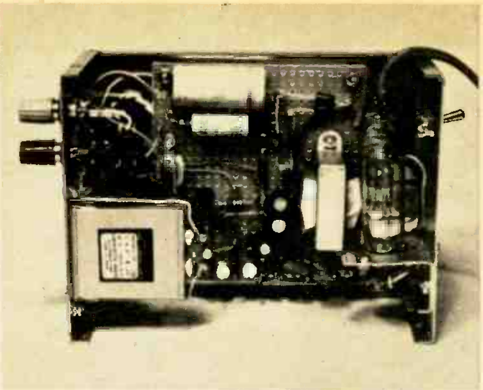


Fig. 6—Completed Tele-Spy. Final assembly results in tight quarters. To avoid burning wires when soldering, follow assembly steps in the text.

008 Tele-SPY

you've closed RY2, RY1 should close and RY2 should open. RY1 should remain closed. If RY1 doesn't close check the wiring to RY2's contacts and RY1's coil. Also check that RY3 has normally-*closed* contacts (just look, you'll see them).

As soon as RY1 closes you should hear a hiss or very slight hum in the phones indicating the amplifier is on. If you fail to hear this, check that power is applied to T2 by measuring the voltage across the black primary leads. If you measure the correct voltage (117 V) check for about 12 VDC at the diode-bridge output terminals (from junction of SR1 and SR3 to ground). If you get voltage there, check to make sure that R13 is not connected to the wrong contacts on RY1. If the amplifier breaks into oscillation look for a wiring error at the input end of C1.

The frequency-response of the amplifier will produce a *crisp* sound from a ceramic or crystal mike. The bass has been attenuated deliberately by the low input impedance of the transistor amplifier. Do not substitute a low- or medium-impedance dynamic mike as the sound at the receiving telephone will be muddy and difficult to understand.

Connecting to the Phone Lines. Our model is designed for operation with a two-wire telephone circuit where the talk and ring current is on the same pair of wires. Simply connect BP2 and BP3 to the two phone wires at a telephone jack. Direct connection to the phone wires is not recommended as it makes it difficult to move the Tele-Spy.

If you have a party line (two parties on the same talking line but with separate ringers) the Tele-Spy must be modified as shown on the schematic by the dashed line. Remove T1's green lead from BP2, add a third binding post (BP1) and put the green lead on it.

Next, determine which two of the three incoming telephone wires are the talking pair—they are usually the pair connected inside the telephone to terminals marked L1 and L2. The third wire is the common ringer wire. Connect the common ringer wire to BP3 and either of the talking pair to BP2. Have a friend call you, and let the phone ring. Notice if RY2 closes. If it fails to close connect the other talking wire to BP3—this should give you the ringing pair. Then connect the remaining wire to BP1.

Operation. Relay RY1 should operate as soon as the ring signal comes in on the telephone line. When RY2 closes the ring signal should stop before the bell rings. It *is* possible for the bell to give a slight, sharp ring before RY2's closing silences the bell. (The bell signal stops as soon as T1 and R13 are connected across the line.) If the bell rings slightly, simply adjust its volume on the phone.

AMPERITE DELAY RELAYS	
Delay (seconds)	Type
15	115C15
30	115C30
60	115C60
90	115C90
120	115C120
180	115C180

what do those TEST RECORDS REALLY TEST?

Want to find out how high your fi is? Test discs can help out but . . .

By ROBERT ANGUS

EVERYBODY who owns a car knows that the only way you really can evaluate one is to drive it. Like the world of cars, high-fidelity componentry is spotted with test readings, specifications, reports and graphs. And, as with automobiles, all these can tell you less about the equipment than one week of use.

Is it really possible to road-test hi-fi equipment without a lot of expensive gear? Can your ear and a good record help you evaluate the worth of a system or detect a flaw? The answer is a qualified yes—if you have access to a good stereo test record and if you know how to use it.

Once you get into the world of test records, there are some new terms and new sounds you'll encounter. One of the first is a swishing noise similar to what you hear between stations on an FM tuner. This is white noise, a mixture at equal-energy levels of all frequencies in the audio spectrum. Pink noise—random tones one third of an octave wide—contains elements both of musical sound and of white noise. So-called gray noise is an intermediate sampling of the spectrum, usually covering a portion of the bass, midrange or upper frequencies. You'll also come across tone bursts—a frequency which starts and stops quickly and usually is used to test your speakers.

Testing Speakers

There are on the market at least half a dozen records that, for starters, can identify left and right channels. Most of the same records also can tell you whether your speakers are in phase. In records manufactured by Audio Fidelity (FCS-50000), CBS Laboratories (STR-100 and 101), Command (CSC-100), Hi-Fi/Stereo Review (Model 211) and Vanguard (VSD-100), a series of test tones is recorded separately for the left and right speakers. To simplify channel identification, the HF/SR disc begins with a voice proclaiming, "This is the left channel." If the voice comes out of the right speaker, though, the record won't help you locate the trouble. You'll have to check each set of connections in the system, beginning with the speakers and going

HERE'S WHAT YOU'LL FIND ON SOME OF TODAY'S MOST POPULAR TEST RECORDS

AUDIO FIDELITY (through dealers)
FCS 50000—Stereo metronome; 1,000 cps tone; 25-sec. silence; High-freq. in-phase tones; low-freq. tones; 70-15,000 cps sweep; white-noise phasing bursts; 440 cps tone; 3,000 cps and 800 cps channel sep. Side 2 is music. ($4.79)

CBS LABORATORIES INC., 227 High Ridge Rd., Stamford, Conn. (special order through dealers or direct.)
STR 100—40-20,000 cps sweep; 20-20,000 cps spot freq. with announcements; 1,000 cps & sweep freq. left & right; lat. & vert. tracking. ($8.50)
STR 101—Left-right ident.; speaker phasing; 1,000-cps balance tone; 30-16,000 cps spot freq. with 1,000-cps ref., 15,000-50-cps sweep; lat. & vert. tracking. ($4.98)

COMMAND RECORDS (special order through dealers)
CSC100—Left-right channel ident.; speaker balancing & phasing; silent passage (rumble test); wow & flutter; room acoustics balance. Side 2 is music ($5.98)

COOK LABORATORIES, INC., 101 S. 2nd St., Stamford, Conn.
Series 60—Mono, using musical tones: Chromatic scale; tone bursts (bass & treble), both flat & to Fletcher-Munson curve. ($4.98)
Other specialized Cook test records include Series 10, 12, 40, 50, 300, 301, 302.

FOLKWAYS RECORDS (through dealers)
FX 6100—Sweep from 15.6-22,500 cps, recorded at 78 & 33⅓ rpm; musical selections recorded with LP, RIAA, NAB curves.

HI-FI/STEREO REVIEW, 1 Park Ave., New York, N.Y. 10016
211—Spoken channel ident.; speaker phasing; white-noise channel balancing; 20-20,000 cps freq. resp. with 1,000-cps ref.; stereo separation & spread; musical selections (cartridge eval.); silent tracks (hum & rumble); piano chords (flutter). Side 2 is music. ($4.98)

VANGUARD RECORDING SOCIETY (special order through dealers)
VSD 100—50-15,000 cps sweep & test tones; strobe label; separate freq. check for each channel; speaker balancing & phasing; tracking error & distortion; sustained tones (wow & flutter). ($5.79)

TEST RECORDS

right back to the phono cartridge.

The Vanguard check for phasing of stereo speaker systems asks you to place the two speakers together, preferably facing each other. The record contains a 150-cps test tone, recorded in phase and out of phase. If there is not a sharp drop in volume as the tone switches from in to out, the speakers are out of phase.

A variation on this theme is Command's metronome, which should tick exactly midway between and slightly forward of your speakers. Audio Fidelity's tone bursts are perhaps the easiest to use. At first, they appear to come from points on either side beyond the speakers, then from a single point between the speakers.

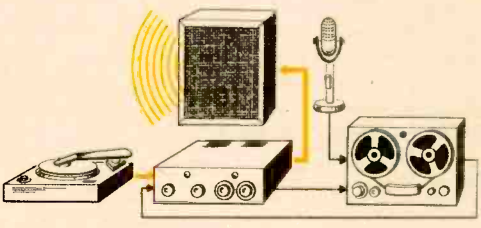
Frequency Response

A number of test records give frequency-response checks, including CBS Labs STR-100, Cook 302, Folkways FX6100, HF/SR and Vanguard VSD 100. In some cases, the records contain both a series of steady tones and a continuous sweep.

Cook 60 has taken into account the frequency-selective sensitivity of the human ear by providing a compensated recording of the frequency spectrum as well as one recorded flat. Some records provide separate frequency checks for each channel. While the human ear can check overall results, only electronic test equipment can tell you which component is the limiting factor.

For the man with a perfect ear and a near-perfect system there is Folkways Sound of Frequency (FX-6100), which covers the range from 15.6 cps to 22,500 cps. Next, covering the 20-20,000 cps range are the CBS Labs STR-100, HF/SR and Cook 12. Others cover only the 50-15,000 cps range.

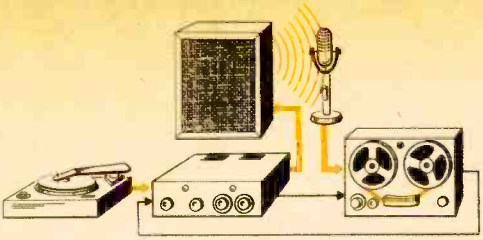
If your system is nagged by buzzes or rattles due to resonant frequencies, tonal sweeps can identify the offending frequency and help you locate the trouble. A record with plenty of bass (Audio Fidelity FCS-50000, CBS Labs STR-100 and 101, Cook 60, for instance) generally work best here.



Most tests are carried out with test record played through amplifier and speaker. Stereo requires two speakers plus a whole barrage of extra tests.

Balance and Separation

Some records, such as Cook 302, feature the same signal cut in both channels. When you stand at a point midway between properly balanced speakers, the sound from each should be equal in volume. HF/SR uses two



Testing with loudspeaker is recommended only for rough comparison between microphones because of distortion introduced by speaker, listening room.

independent white-noise signals, one for each speaker. The questionable assumption with these tests is that cartridge output is equal on both channels.

Some of these tests also tell you just how much separation there is between stereo channels. (Again, however, they don't locate what, if anything, is wrong.) Test tones should be heard on one speaker only, while the other exudes blissful silence. But no cartridge, no amplifier, no test record is that perfect. By substituting cartridges (the usual source of trouble), you can find one that holds channel crosstalk to a minimum.

Checking Record Players

Audio Fidelity, Cook, HF/SR and Vanguard provide a strobe disc as part of their label design. Under a 60-cps light—preferably fluorescent or neon—the design appears to stand still when turntable speed is on the nose. Other manufacturers assume (unwisely) that it already is.

Audio Fidelity asks you to play a silent band on the record and then look at it. If the test band has a grayish appearance (compared with an unplayed band) it means worn stylus, improper angle or bad tracking. CBS Labs STR-100 seems more accurate. It contains test tones for each side of the stylus. As you play them, you listen for the highest frequency in each channel. The two should match in volume and clarity. To test compliance and tracking, two records contain bands with low frequencies that tend to throw stiff cartridges and styli out of the groove.

To test for hum and for turntable rumble, Audio Fidelity, Command and HF/SR have provided a few bands of silence. (Having exposed the presence of hum the record can't help you locate its source but you might check your charger's grounding.

Another turntable fault—wow & flutter—is tested in three ways by Vanguard, Command and HF/SR. The first two tell you *whether* it is present. Only HF/SR tells you how much.

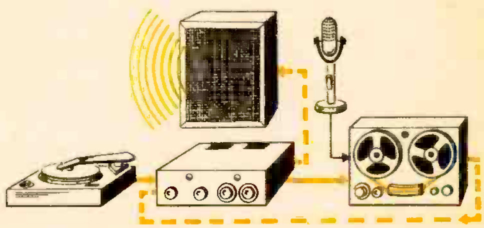
Matching Room Acoustics

The tone control test on CBS Labs STR-101 is designed to help you achieve proper tonal balance in your listening room with your equipment by matching various tones to a 1-kc pilot. It thus is a test of your room acoustics rather than your equipment. Cook 60 and Command accomplish somewhat the same thing with pianos.

Recording Equipment Tests

While your ear can't give you accurate measurements, it can help you judge the relative merits of two or more similar products with the aid of the frequency-response tests. To test a recorder or tape, connect the recorder to your amplifier and record a signal fed through the system. Then play back the finished result and compare it with the disc.

A highly unscientific way of testing a microphone—but one that can be helpful—is to play the record through your component system or phonograph, holding the microphone a foot or so in front of the loudspeaker. When compared with similar recordings made by other mikes, it gives some indication of frequency response. By placing the mike six or eight feet away from the speaker and noting the volume necessary to record the test disc at peak, you can get an idea of mike sensitivity. And by moving the microphone about in



Tape recorder can be checked by recording from test record, then playing back. Fancier setups allow both simultaneously for direct comparison.

front of the speaker, you can get a pretty good picture of its pickup pattern—again relative to other microphones and with everything else kept identical.

Above all you should not forget, however, that all judgments made with the ear alone are approximate and subject to individual judgment and taste.

KIT EI REPORT

Heathkit AR-14

Stereo FM at Bargain Prices

WITH money as tight as it is these days, budgets are being stretched to the limit. There never seems to be enough of the green stuff to go around—especially for luxuries like a stereo system.

But there *is* a way to stereo that won't require you to get a second mortgage on the house. It's the Heathkit AR-14 stereo FM receiver.

For $99.95 it is one of the best buys going. Compact, light weight, easy-to-put-together and outstanding performance describe it in a nutshell. A walnut-veneer cabinet is extra at $9.95 and a metal cabinet costs $3.95.

The AR-14 is ideal for a small music system. Reasons we say this are its 3⅞ x 15¼ x 12-in. dimensions and because its maximum output power (sine wave) is 11.2 watts per channel. Used with high or medium-efficiency speakers, this is sufficient power for an average-size room. However, it's not enough for a low-efficiency acoustic-suspension speaker in a big room.

These are some of the AR-14's features: Both channels can deliver up to 11.2 watts of sine-wave power simultaneously into 8-ohm speakers. Bass and treble controls are ganged, meaning there is only one adjustment for both channels. There are separate volume controls for each channel — the knobs are concentric and friction-held together. There is no balance control and no tuning indicator.

There is a *source* switch, which selects the program source, as well as tuning and phase controls. The *phase* control establishes the correct phase between the received 19-kc multiplex pilot signal and the 38-kc subcarrier generated in the receiver. The correct setting is determined merely by listening for maximum volume. A front-panel light comes on automatically when a stereo program is tuned in.

The AR-14 has *phono* inputs for a magnetic cartridge and *aux* inputs for such high-level program sources as a tape deck, TV, or crystal or ceramic phono cartridge. Output connectors are provided for a tape recorder. There is but one pair of connections for each speaker as the AR-14's impedance covers 4- *to* 16-ohm speakers.

Another important feature of the AR-14 is no transformers, except, of course, the power transformer. The two-transistor complementary-symmetry output stage (a PNP and an NPN transistor) makes a driver transformer

THE AR-14 AT A GLANCE

TUNER		Builder Aligned	Instrument Aligned
IHF usable sensitivity	106 mc	8.5 μv	4.5 μv
	90 mc	9.0 μv	4.7 μv
Total harmonic distortion (mono)		1.2%	0.34%
Total harmonic distortion (stereo, left or right channel)		3.4%	0.46%
Signal-to-noise ratio (mono)		55db	55db
Frequency response ± 1db, 50 cps-10 kc. down 1.5db @ 15 kc			
Stereo separation	50 cps	21db	25db
	1,000 cps	25db	32db
	10,000 cps	9db	16db
AMPLIFIERS			
Maximum sine-wave output power per channel for 1% total harmonic distortion (both channels working, 1,000 cps)		11.2 watts	
IM distortion	1 watt	0.35%	
	10 watts	0.52%	
Frequency response	1 watt	± 1db, 15 cps-62 kc	
	10 watts	± 1db, 15 cps-51 kc	
Total harmonic distortion	10 watts	0.56%	
Construction time		About 25 hours	

unnecessary and eliminates the usual phase-inverter stage.

According to Heath, the speaker terminals can be shorted for up to 30 seconds before there will be any damage to the output transistors. Reason for this is conservative voltage and current in the output stage.

Putting It Together. In the Heath tradition, the construction manual left little to be desired. However, our manual, an early edition, had six pages of corrections which included four new pictorials. Before we started construction, we transposed all corrections.

The builder with limited kit experience need have no fear of the AR-14. Our man, who was slow and careful, found the major snag was sorting out the parts which came randomly packed in bags.

The majority of parts are mounted on two circuit boards. One contains the RF circuitry and the other the audio circuitry. No problems here; there was plenty of space and boards were clearly marked with each part's value and position. After the boards are assembled, the frame is put together and the boards and remaining parts are installed.

We found an electrolytic capacitor was missing. Mounting this electrolytic presented a problem. According to the manual, a mounting strap should first be attached to the chassis. This completed, the capacitor, we read, should easily slide in the strap. But it didn't. It was necessary for us to devise our own method of getting it in.

After stringing the dial cord we found tension was insufficient. This caused slipping when we tuned the receiver and meant a little extra time restringing the cord.

Alignment, or adjustment as Heath calls it, went without difficulty. As all coils are prealigned—only touch-up is required. The figures in the chart show the difference between builder and instrument alignment.

Performance. How did the AR-14 check out and sound? Top drawer! In practically every test we found its specs equaled or exceeded those claimed by Heath.

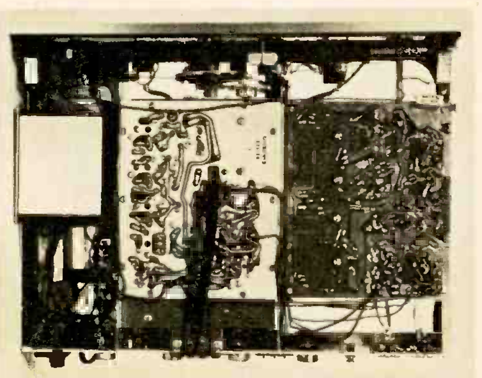
The one thing that bothered us was the fact that the AFC could not be defeated with a front-panel control. This can create a problem when you try to tune in a weak station near a strong one on the dial. The AFC causes the receiver to hang on to the stronger station making it difficult, if not impossible, to tune in the weak one.

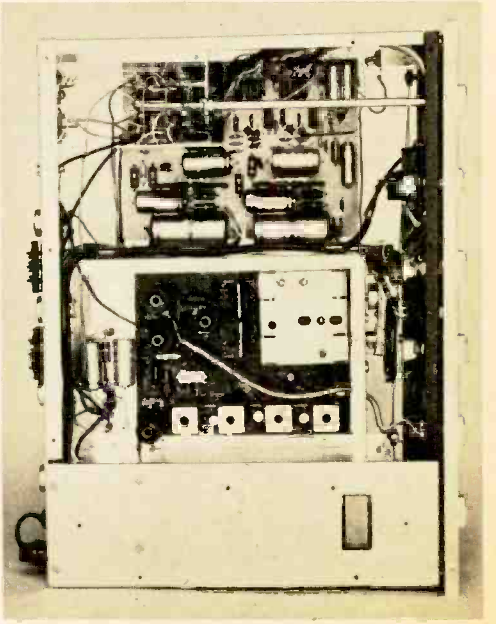
However, you can permanently defeat AFC action by grounding a point marked *X* on the RF circuit board. We found there was no significant drift without AFC.

Crossmodulation, caused by a strong local signal and often thought to be a problem with transistor FM receivers, did not exist in the AR-14. All in all, we'd say the AR-14 is one of the most attractive rigs around.

Bottom view of receiver, right. Audio board is at top. RF and multiplex circuit board, with front-end in upper right corner, is in center. Output power transistors are on rear panel at the left.

Top of receiver, below. Shield at extreme left is around power transformer. RF and multiplex board is at center, audio board is at right. Dial cord stringing is tricky as space is tight.





DXing Vietnam and its Neighbors

By ALEX BOWER

FOR most short-wave listeners, Southeast Asian stations operated by the U.S. or her allies have a special significance these days. The intricate involvement of the West with the powers that flank the South China Sea has drawn a great many Americans into the area—in the military forces or with other agencies of government.

Reception from Southeast Asia will, needless to say, be considerably easier in the western United States than in the EST and CST time zones. Cinch station like the Voice of Free China, Taiwan, should be fair game anywhere, though. Its English transmission is beamed to North America at 2150-2250 EST (1850-1950 PST) on 15345 kc. Peak Asian reception, however, occurs between dawn (groan) and 0900 local time. While DXing is possible at any time except 1200-1500 EST, the wakening hours are best.

Most important of all to U.S. listeners, naturally, is South Vietnam. R. Saigon, the government station, has English at 0730-0800 EST on 9755 kc. With fair to poor signals, it probably will require a little patience.

Another area of intense American activity is neighboring Laos. Radiodiffusion Nationale Lao at the capital city of Vientiane is the nation's only legal broadcast station and this comparatively low-power rig seldom is heard in North America. Last reported frequency was 6113 kc and your best bet is around dawn. Programs are in French and Laotian. It's a real DX challenge.

Bangkok, Thailand, is headquarters for the South East Asia Treaty Organization and Thailand itself is our most stable ally in that corner of the continent. Early risers shouldn't have too much trouble hearing R. Thailand's English on 11945 kc at 0530 EST (0230 PST). A more interesting DX challenge is strategic Bangkok Aeradio on 6529 kc with weather broadcasts at 10 and 40 minutes past

DX GUIDE TO SOUTHEAST ASIA				
FREQ. (kc)	STATION	LOCATION	TIME (local)	REMARKS
5506.5, 8862.5	Taipei Aeradio	Taiwan	Dawn to 0900	
6113	R. Nationale Lao	Vientane, Laos	Around dawn	Broadcasts in French and Laotian
6529	Bangkok Aeradio	Thailand	Dawn to 0900	English weather half-hourly at —10 and —40
7215	A.F.R.T.S.	Taiwan	Early AM	
8905	Hong Kong Aeradio	Hong Kong	Dawn to 0900	English weather half-hourly at —15 and —45
9755	R. Saigon	S. Vietnam	0730-0800 EST	Broadcasts in English
9760, 9840, 11760, 11840	R. Hanoi*	N. Vietnam	From 2400, 0800, 1000, 1800 EST	Also broadcasts as V. of Vietnam, R. Liberation, R. Stateside*
11945	R. Thailand	Bangkok, Thailand	From 0530 EST	Broadcasts in English
15345	V. Free China	Taiwan	2150-2250 EST	Broadcasts in English

* See November 1966 EI: Tuning in The Turncoats

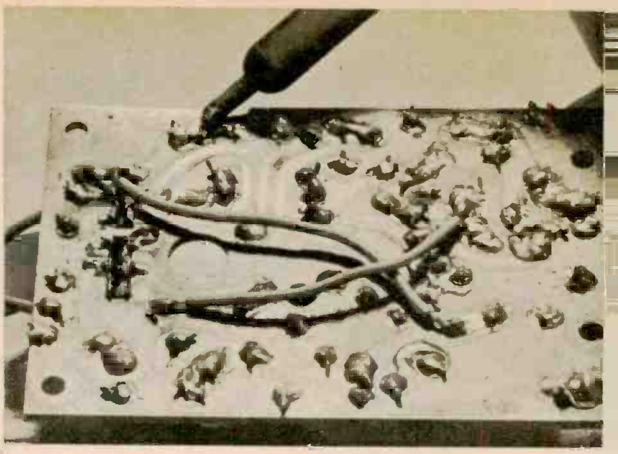
each hour. These also are in English—and you *may* quote details from weather forecasts when verifying a utility station. Send your reports to the Chief Radio Technician.

Meanwhile, Hong Kong Aeradio can be heard on 8905 kc with weather broadcasts at 15 and 45 minutes past each hour. Hong Kong, though not actively involved in the Vietnam war, is a particularly sensitive Western spot on the Chinese coastal underbelly.

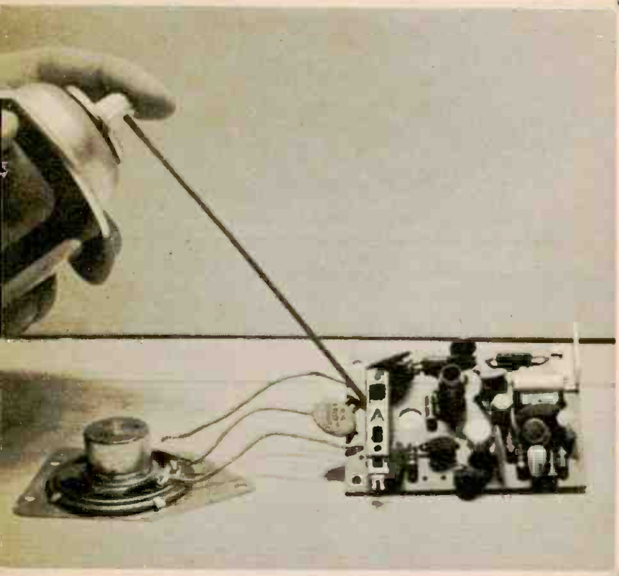
The U.S. Armed Forces Radio & Television Service also maintains a station on Taiwan. Look for it on 7215 kc during the early hours. That frequency is amateur territory over here and in the event ham QRM is too much, you also might try Taipei Aeradio working aircraft on 5506.5 and 8862.5 kc.

Easy REPAIRS FOR WALKIE-TALKIES

By HOMER L. DAVIDSON

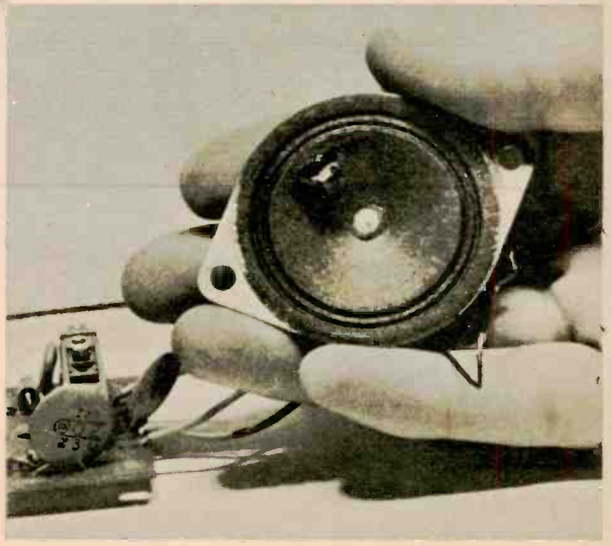


Was the walkie-talkie dropped? First, look to see if any parts are damaged. If it works when the board is bent or pushed, remove the board and examine the foil for a break. If you find one, bridge it with wire—not a drop of solder.



Putting out a signal only occasionally when you hit the push-to-talk switch? Trouble could be dirty switch contacts. A blast of contact cleaner and the switch is new again. And while you have the cover off, get the volume control, too.

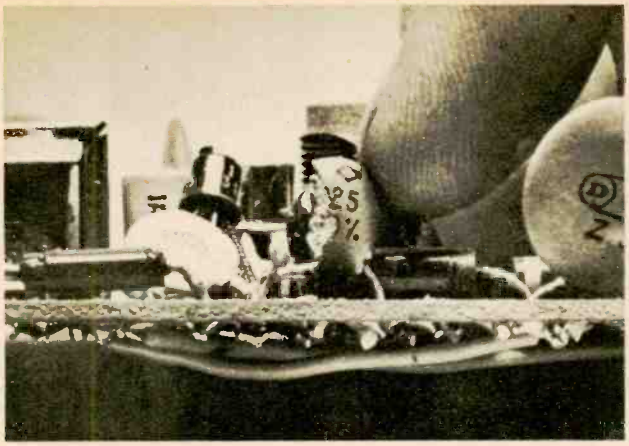
It's a safe bet the speaker's the cause of raspy or mushy sound. Take a close look for dust and dirt. Gently push the cone at the center. If it is rubbing, replace the speaker. Small holes and tears can be fixed with speaker cement.

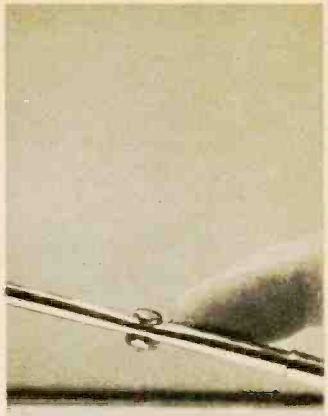


HOLD it! Don't be in such a hurry to cart that sick walkie-talkie off to a serviceman or to consign it to the spare-parts box.

You can repair it yourself—and you don't have to be a CB expert either. Most troubles are minor—many are obvious, but some are slightly hidden. As is the case when servicing any electronic device, the most important tools are patience and knowing where to look.

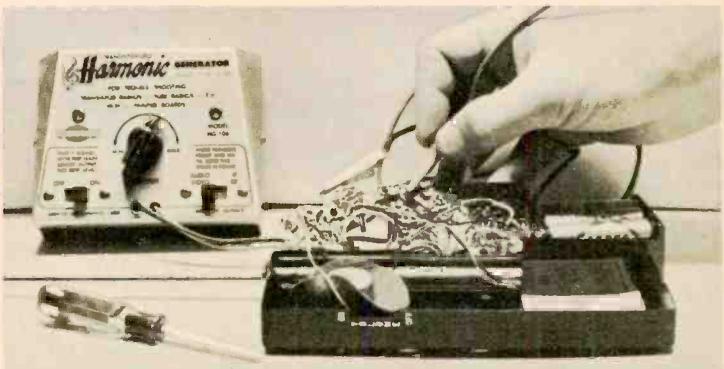
If the rig doesn't work after you replace the battery, try our seven hints. Chances are quite good one of them will get you back on the air.





There could be a broken part, such as this disc capacitor. Only thing to do here is replace the part. While the circuit board is out of the case, check to make sure there are no cold or broken solder connections on the foil. If you have to replace a transistor or diode, heat sink the leads when unsoldering and soldering.

Sometimes the antenna gets bent or broken off. If it breaks close to the case, cut off the bent ends and insert the antenna into the broken piece, drill a small hole and bolt the pieces together. It may be shorter, but it will still do the job. Do the same thing if it breaks in the middle. Solder joints just won't hold.



You can check the receiver for a defective component with a signal generator such as the Sencore HG 104 Harmonic Generator. It puts out audio, IF, RF signals. Start at output transistor and proceed from base to collector of each transistor back to the antenna. When the signal disappears, you've found most likely defective stage.

If the walkie-talkie still isn't working after you've tried all the things we've suggested, you'd better make some voltage and resistance measurements. Get hold of a schematic of the unit and, if possible, a voltage and resistance chart. Check all the voltages and resistances and you'll find the trouble. Your VOM must have a very low voltage range for making measurements in transistor circuits.

THE HAM SHACK

BY
WAYNE GREEN
W2NSD/1

NAIROBI, KENYA

DARK PROSPECTS . . . Some part of Africa manages to make headlines every few days. And if this continent is a trouble spot for world peace it also threatens to be a trouble spot for amateur radio.

A few years back, the European countries held the balance of power in the International Telecommunications Union, the organization established 100 years ago to regulate international communications. Now we find that the one-vote-per-country arrangement has put the Afro-Asian countries in a position to call the tune. So if amateur radio is to continue through the next frequency-allocation conference (only a couple years off) with enough amateur allocations to permit our growth—or even continued existence—we must have African support.

What are our chances? Well, right now they seem pretty poor, to be honest.

Of all the countries in East Africa, Kenya is by far the most stable and progressive. In December 1963 the Africans took over the government. Since then no further amateur licenses have been issued. Why? Well, it seems that the new authorities weren't up on amateur radio and didn't know what to do about licensing. And if familiarity breeds contempt, lack of it breeds mistrust and fear.

We must find a way to bring news of amateur radio and its benefits to the governments of these new countries. This obviously means that we must work to attract black Africans. Here in Kenya there is only one licensed so far—out of 30-odd amateurs. I might mention that this chap, 5Z4JY, is extremely well thought of by other amateurs. There are, at a rough estimate, probably another 50 Negroes in Kenya with a suitable education for amateur radio. And with Kenya being the most advanced of these countries, we can expect much less cooperation from the others.

Amateur radio would be a wonderful asset to Africans if we could get them interested in supporting it. I see a tremendous challenge here. This would be a fine opportunity for amateurs interested in doing good work through an organization like the Peace Corps.

Faraway Friends . . . It is always encouraging to me to find out how much DX amateurs are willing to put themselves out to entertain and help visiting hams. For instance, while I've been in Nairobi I've been put up by Robby, 5Z4ERR. If I am to draw any conclusions from other amateurs I've met, Robby must have his guest rooms full a good deal of the time.

The Kenya amateurs kindly held a special dinner in my honor with members of the East African Amateur Radio Group coming in all the way from Kitals, a couple of hundred miles away. After driving over some of these roads myself, I appreciate their effort. Ian Cable, MP4BBW, and his new bride were luckily in town, too.

The other night I had an opportunity to get on the air from 5Z4ERR and have a go at DXing from the medium-rare end. There were a number of chaps that were new to me and many an old friend calling in. Gay, W4NJF, first winner of the Worked The World Certificate, was on there with his fine signal. Doc, WA2RAU, driving to Florida, called me from Virginia. Charley, W1FH, one of the world's top DXers, called in. Larry, DJØLB, whose new baby arrived just in time to prevent him from showing up at a Frankfurt club meeting I attended last May, broke in to find out how I was making out. One of the nicest things about amateur radio is the friends you make all over the world.

Robby, 5Z4ERR, of Nairobi, Kenya, is one of the world's top DX operators. He played host to Wayne Green during a recent, extensive tour.

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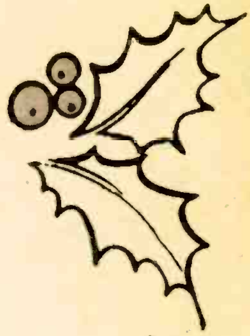

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Transceiver, 3-Band 3-Mode (EICO 753)	Nov.	92
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VHF Receiver (Knight-Kit KG-221)	Sept.	82

SLOPING-ROOF TOWER MOUNT

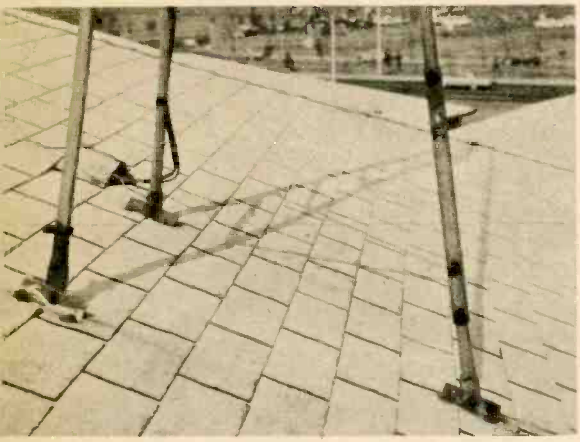
IT'S a big day when that tower finally is delivered and unpacked. But the excitement fades when your neighbor appears in the yard just as you start to mount the tower astride the ridge pole.

Unfortunately, he's there to complain, not help. He may say one of several things, all having to do with the fact that the elements of your antenna extend over his property line. Maybe it's a two-family house. Perhaps a narrow lot. Or maybe his line is just close to your hacienda.

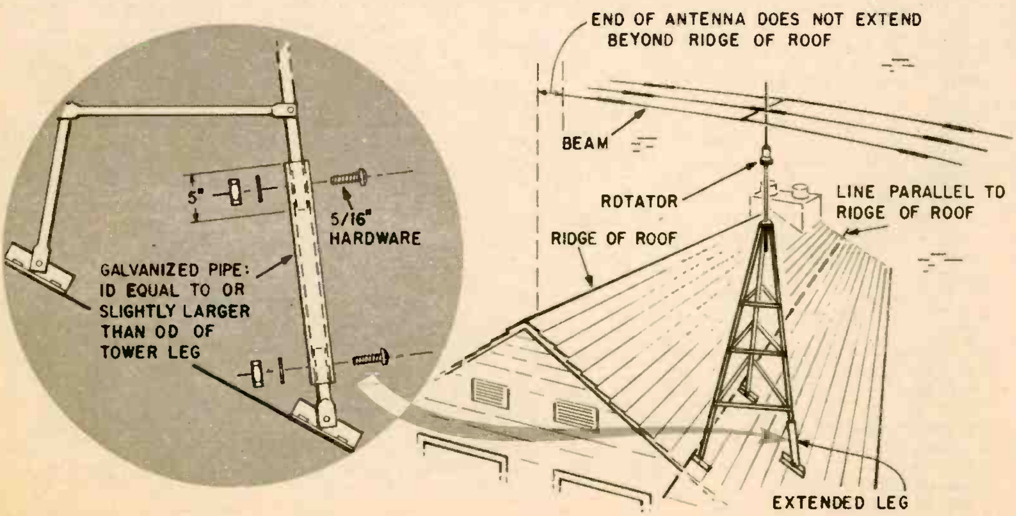
There really is no need to sell the house or worry about having a Tower of Pisa on your hands. First thing to do is determine how wide your beam really is. Take half this dimension and use it as a starting point to determine how far back you must mount the tower to keep the beam ends from passing over your neighbor's property line.

Next, mark off a line on your roof parallel to the ridge (as shown below in a two-family-house situation) far enough down so the beam will stay over your property. Then bolt two of the tower's feet to the roof on this line. The third leg should face the side of the house. About 6 in. from the foot, cut the leg. Lift up the tower so it is vertical to determine the length of galvanized pipe required to extend the leg and join it to the foot.

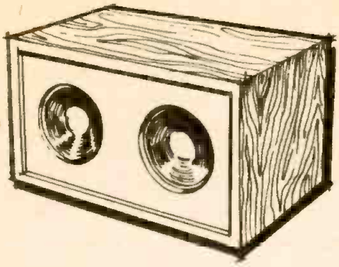
—Paul Hertzberg, K2DUX



The piece of pipe used to extend our tower's leg was about 2 ft. long. The pipe's inside diameter was slightly larger than the outside diameter of the tower's leg. When cutting the leg, leave about 6 in. attached to the foot for support.



For Super Sound, Try The TWIN FIN!



By HARRY KOLBE

BACK in hi-fi's salad days the word *woofer* always meant a big speaker—husky, heavy and at least 12 in. in diameter.

Fifteen-in. woofers were common, too. And for the really well-heeled audiophile who wasn't afraid of a little conspicuous (though hidden by a grille cloth) consumption, there was even a 30-in. woofer.

Would you believe that 3- to 6-in. speakers are being called woofers today? By George, it's true! Big thing about this new breed of small woofers is that the resonant frequency is not in the 100- to 200-cps range where you'd expect to find it in a conventional speaker of the same size.

The resonance of the new small speakers is between 35 and 60 cps! What does this mean in terms of performance? More bass than from a conventional small speaker. Here's why: the output of a speaker falls off rapidly below resonant frequency. Other things being equal, if you lower the resonant frequency the low-end response improves.

How is the resonant frequency of a speaker lowered? One way is to make the cone and voice-coil suspension extremely compliant. Touch a high-compliance speaker's cone and you'll notice it moves in and out freely and also moves a greater distance than it would in a conventional speaker.

And this greater movement means more bass (for a speaker this size, compared to a conventional speaker of the same size) because more air is being moved. Compared to a 10- or 12-in. speaker, whose cone has a large area, a small-diameter speaker's cone must move a greater distance to move the same amount of air.

These small high-compliance speakers also have large magnets and long magnetic gaps to keep the voice coil always surrounded by lines of magnetic flux. This is necessary to prevent distortion on long voice-coil excursions.

The development and availability of these high-compliance small speakers make possible the Twin Fin—a distributed-port bass-reflex system that has excellent response characteristics, considering its small size.

The Twin Fin measures 14 x 8 x 8¼-in. It has a 5-in. woofer and a 5-in. tweeter—the two fives giving the system its name, a fin being five in slang. The woofer has a resonant frequency of around 40 cps—mighty low considering its diameter.

Outstanding as the sound is from the Twin

Fig. 1—Smart-looking . . . and clean-sounding, too! The dimensions of the Twin Fin are 14 x 8 x 8½ in. System consists of a 5-in. woofer and 5-in. tweeter.

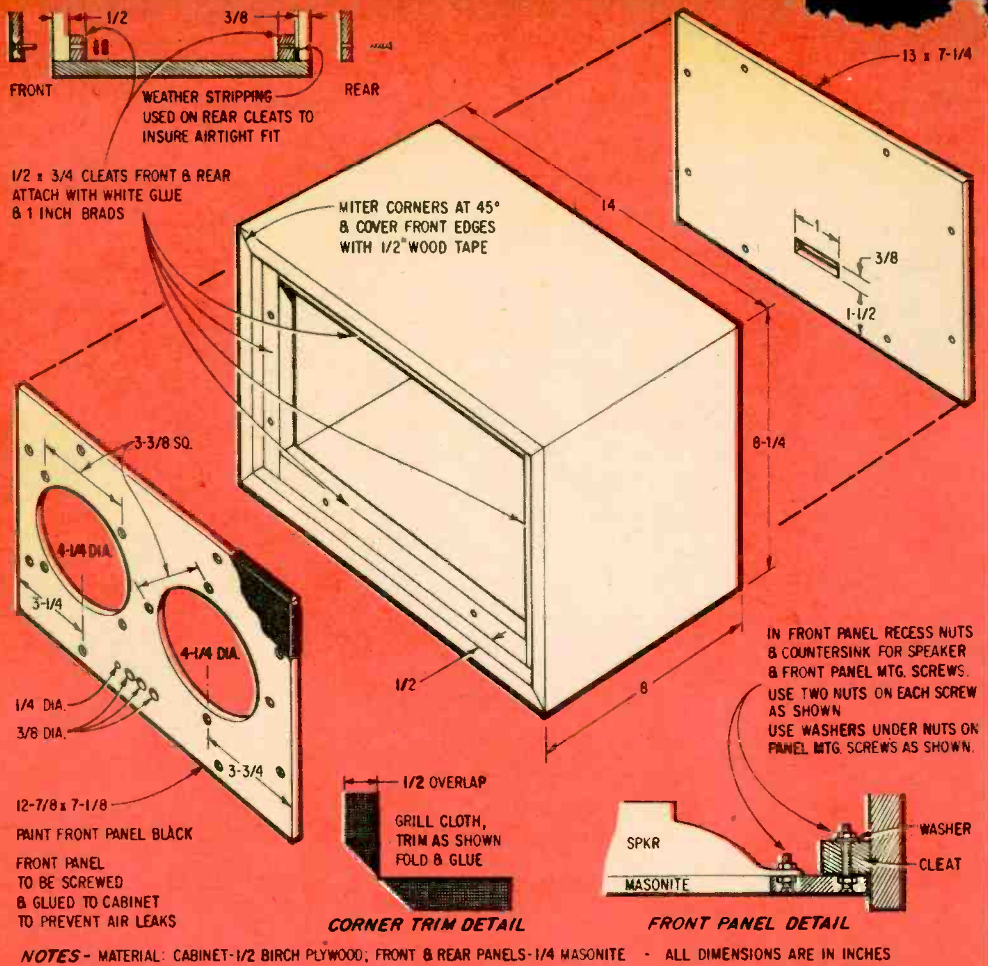


Fig. 2—Our cabinet's corners are mitered 45° but they could be butted as edges are covered with wood tape. Note in lower right corner how speaker and front panel are mounted.

TWIN FIN!

PARTS LIST

C1, C2—8 µf, 150 V electrolytic capacitor
L1—Choke: 270 turns # 18 enameled wire wound on 1-in.-dia. x 1½-in.-long form. (see text)
SPKR 1—5-in. woofer speaker. Fane E/W750
SPKR 2—5-in. tweeter speaker. Fane L/C-STW
Both speakers are available for $15.50 plus 75¢ postage from Electronic Workshop, Inc., 26 W. 8th St., New York, N.Y. 10011.
½-in. thick birch plywood
¼-in. thick masonite
1-in. thick fiberglass wool
Terminal strip
White glue
18 enameled wire
Grille cloth
½-in. wood tape

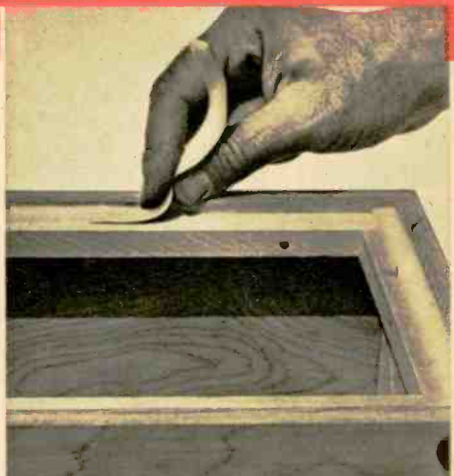


Fig. 3—Rear of cabinet. To be sure of getting an airtight seal, glue weather stripping on cleats. Attach panel with eight flat-head wood screws.

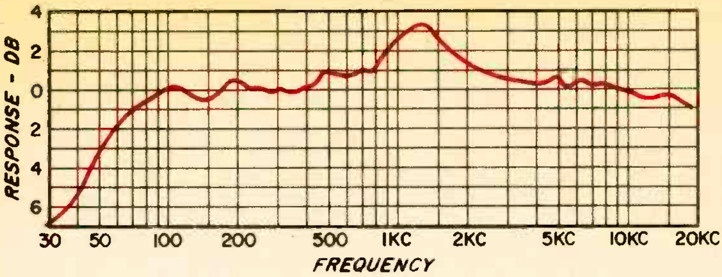


Fig. 5—Twin Fin speaker-system frequency response. Except for slight rise at about 1,500 cps, response is flat within 2db from 60 cps to 15 kc. The mike used to measure response was a PML type EC-61A calibrated condenser microphone.

Fin, you must remember that it's a medium-fi speaker. Don't expect it to produce knee-bending bass as you would from a larger speaker system that includes a 10- or 12-in. woofer.

The Twin Fin's response is flat within 2db from 60 cps to 15 kc. There is a slight rise in response around 1,500 cps, as shown in our curve in Fig. 5.

The Fane speakers used in the Twin Fin are made in England and are not generally available in this country. However, we have made arrangements with Electronic Workshop, Inc., to supply the speakers to EI readers. The price for both is $15.50 plus 75¢ postage. Ordering information appears in our Parts List. Do not substitute other speakers because the enclosure was designed and tuned around the Fane speakers.

The Cabinet

For the top, bottom and sides of the cabinet you'll need an 8-in.-wide by 45-in.-long piece of ½-in. birch plywood. Of course, you could use pine. The choice is yours.

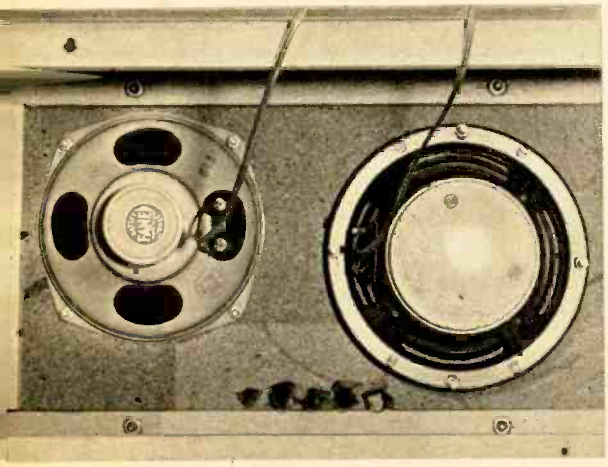


Fig. 4—Rear of front panel after being attached to cabinet. Tweeter is at the left, woofer is at right. Port holes were plugged during tuning.

Cut two 8 x 14-in. pieces for the top and bottom and two 8 x 8¼-in. pieces for the sides. Next thing to do is miter the edges (8-in. dimensions) 45° as shown in Fig. 2.

Of course, if you don't want to miter the edges, you can butt them together. The front edges of the cabinet are covered with ½-in. wood tape, which will hide the butted corners. But you must miter the wood tape at the corners. If you choose this type of construction, the dimensions of the sides will be somewhat different. The important thing is that the overall dimensions of the cabinet remain the same.

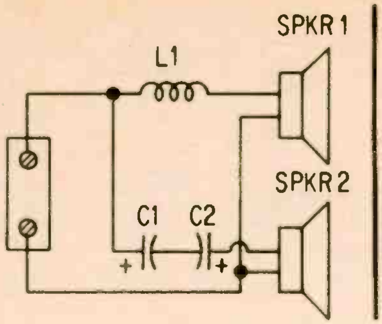
To make sure the cabinet is absolutely square, cut two 13 x 7¼-in. panels out of ¼-in. Masonite. (One will be used as is for the back panel. The other one will be trimmed to 12⅞ x 7⅛-in. later for the front panel.) Install the panels temporarily in the front and back and tie cord around the cabinet to hold it together firmly until the white glue, applied to all corners, dries.

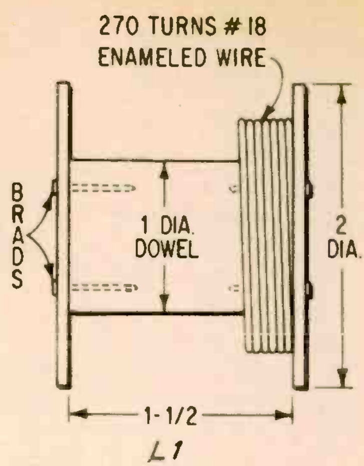
After the glue has dried, remove the panels and install the ½ x ¾-in. cleats, using white glue and 1-in. finishing nails. Details showing the installation of the cleats appear in the upper left corner of the pictorial in Fig. 2.

Next thing to tackle is the front panel. Trim one 13 x 7¼-in. piece of Masonite to 12⅞ x 7⅛-in. Using a hole cutter, cut two 4¼-in.-dia. holes in the front panel for the speakers. If you don't have a hole cutter, draw two 4¼-in.-dia. circles with a compass on the front panel. Back up the panel with a piece of scrap wood and drill a ½-in.-dia. hole inside and tangent to the circle. Then use a keyhole saw to cut out the 4½-in.-dia. hole.

The hole center for the woofer should be

Fig. 6—In crossover schematic, SPKR 1 is woofer, SPKR 2 is tweeter. Note that electrolytics are connected in series and that like-polarity terminals are tied together. Choke is 270 turns of #18 enameled wire wound on 1-in.-dia. x 1¼-in.-long form. Wind wire evenly, tightly and in layers, then apply tape. The brads should be brass.





TWIN FIN!

3¼-in. in from the left side. The center of the hole for the tweeter should be 3¾-in. in from the right side. The speaker mounting holes should be drilled on a 3⅜-in. square, centered about the speaker holes.

Centered between the speaker holes and 1-in. above the bottom of the panel drill one ¼-in.-dia. port hole and three ⅜-in.-dia. port holes. The space between the holes is ⅝-in.

After all holes have been drilled in the front panel, install the mounting screws for the speaker and panel as shown in the lower right corner of Fig. 2. Don't install the speakers yet.

Next, paint the front panel black. After the paint has dried, apply a light coat of glue, stretch the grille cloth tight on the panel and put the panel under a pile of heavy books until the glue dries. Make sure there are no bulges in the cloth and that the weave is straight.

Now install the speakers on the panel. Apply a coat of glue to the front-panel cleats, install the panel and tighten the nuts on the front-panel machine screws. It is important that the nuts be tight so there are no air leaks.

The Crossover Network

The crossover network for the Twin Fin was designed for a crossover frequency of 1,600 cps. The choke is made by winding 270 turns of enameled wire on a 1-in.-dia.

[*Continued on page* 113]

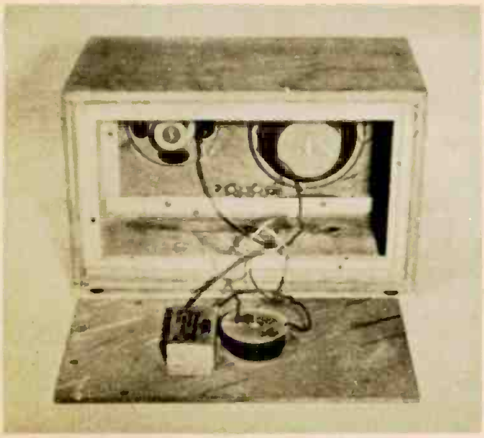


Fig. 7—Completed cabinet ready for stuffing with fiberglass blocks. Mount choke with 2½-in.-long machine screw. Cement electrolytics with epoxy.

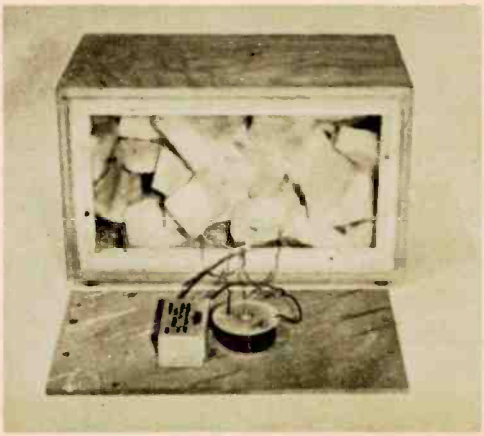


Fig. 8—After you've connected the speakers and the crossover network, stuff the cabinet with 52 2-in.-sq. x 1-in.-thick blocks of fiberglass wool.

BEGINNER'S CORNER

THE THERMISTOR

MENTION the word thermometer and most people think of a fragile stem of glass filled with mercury or colored alcohol.

But like so many other things these days, thermometers can be replaced by semiconductors—in this case a thermistor. The name is derived from the words *thermal* and *resistor* because the device behaves like a temperature-sensitive resistor.

The thermistor is not a particularly new product, nor is it a device anything like a simple carbon resistor. It contains combinations of manganese, nickel, cobalt and copper—all of which are related to operating range and power-handling needs.

Unlike wire, whose resistance increases with temperature, the thermistor's resistance *decreases* as temperature increases. For this reason it is said to have a negative temperature coefficient of resistance.

Why does it behave this way? Because the metal oxides mentioned above form a molecular lattice. Apply heat and conducting paths are formed which enable current to flow. The higher the temperature, the more conducting paths and the greater the current. Connect a thermistor in a circuit with a battery and a meter, then heat the thermistor and you'll notice the current *increases* because of the decrease in resistance.

In conjunction with a power source, a thermistor controls current flow. The current can be indicated as degrees of temperature or used to control a heat source in the manner of a thermostat.

Thermistors also are used in circuits to offset the effect of components which have a positive temperature coefficient of resistance. In our experiment, we'll make a thermistor electronic thermometer.

Thermistors are classified according to physical shape, which also is a clue to electrical ratings. There are *beads*—pinhead size units known for fast response time and accuracy. Next are *probes*, which are beads installed in thin glass tubes to give them physical ruggedness and mounting simplicity. *Discs* are thicker and capable of handling greater power. *Rods* and *washers* usually are for higher-wattage applications.

In general, you may find the probe type most useful. It's inexpensive and easy to use in temperature-measuring or heat-detecting circuits. The beads are small components with hair-like leads. Larger thermistors usually require heat sinks and sophisticated circuits.

Figure 1 shows how the resistance of a typical thermistor is related to temperature change. The curve begins at the freezing point of water (0° C), at which point resistance is 5,800 ohms. When the thermistor is heated to its maximum safe temperature (300° C), resistance drops to 6 ohms.

An important characteristic of the thermistor is revealed by the shape of the curve. Notice that temperature and resistance do not vary linearly. For example, if you double temperature, say, from 25° to 50° there is a 1,200-ohm drop in resistance. But double temperature again from 50° to 100° and resistance drops only about 600 ohms.

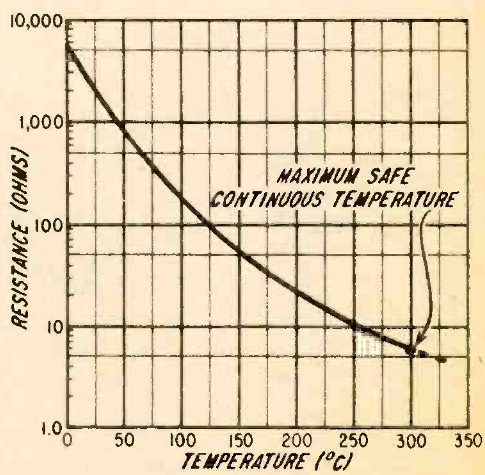


Fig. 1—Curve shows how the resistance of a Fenwal GB32J2 thermistor decreases as the temperature increases from 0° C (32° F) to 300° C (572° F).

THE THERMISTOR

In other words, the thermistor behaves in logarithmic fashion. This creates a problem in a practical application: Let's say you want to use a thermistor with a meter whose linear scale is to be calibrated in degrees of temperature. If the meter is used to indicate a large portion of the thermistor's characteristic curve, the dial markings become crowded and hard to read at each end of the scale. That is, the distance between each degree near freezing or boiling is not the same. This problem can be solved by using only a portion of the thermistor's curve. As our project will show, different meter sensitivities can compensate for this.

An electronic-thermometer is shown in Figs. 3 and 4. The thermistor responds to heat and controls current from the battery to the meter. One valuable feature of this circuit is that the thermistor can be mounted a great distance from the meter and battery.

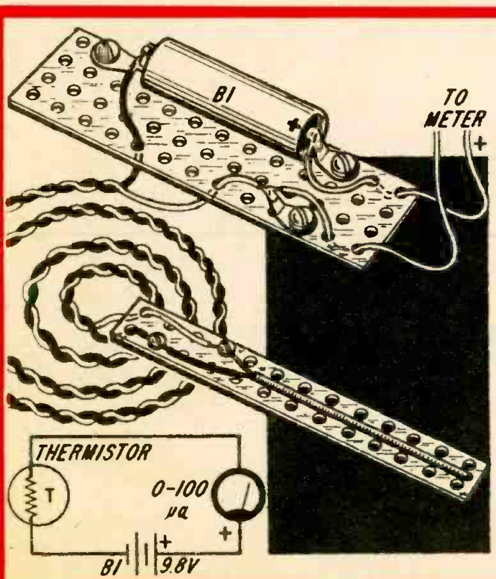
Resistance of the long connecting wire is negligible compared to that of the thermistor; therefore, accuracy will not be affected. Thus, thermistors can be used for temperature sensing at remote locations, such as the inside of a freezer or an oven or on the outside of a space vehicle.

The important temperature rating you'll see in the thermistor specs is resistance at 25° C. This corresponds to a room temperature of 77° F. When measuring thermistor resistance you must observe a precaution: use a high-resistance scale on the VTVM. If you don't the meter might cause a heavy current to flow through the thermistor and cause it to heat up. This heat will lower the resistance further and produce an error.

The self-heating effect, incidentally, is important in some special applications. It permits the device to become an electrical regulator. Rather than respond to outside temperature, the thermistor develops internal heat from large current flow. Resulting changes in resistance then operate current-regulating circuits.

In our thermometer, we must avoid self-heating because this will introduce an error in temperature indications. In a small thermistor, each milliwatt of power developed within the device will raise the internal temperature by 1° C. This will change resistance by about 4 or 5 per cent.

Designing a circuit with thermistors is not simple. As one manufacturer puts it, "Trial and error may be the easiest way!" There is, however, an excellent aid for anyone who wants to begin experimenting with thermistors. It is the *Thermistor Data and Curve Computer* (Fig. 5). Price is $1.50, but it is included in a $4.95 kit (G-700) made by Fenwal Electronics, Inc. The kit (Allied Stock No. 8 U 658) includes the



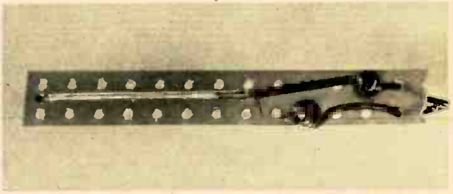


Fig. 2—Probe for our thermometer is made by mounting probe-type thermistor on a ½ x 3½-in. piece of perforated board. Actual thermistor is the black dot on probe tip at the extreme left.

Fig. 3—Complete thermometer (less meter) is at left. Battery is mounted on 1⅛ x 3½-in. piece of perforated board. Schematic shows circuit as a thermistor, battery and meter connected in series.

curve computer, a thermistor-specification manual and four thermistors. The thermistor used in our project is the one marked 135,000 ohms (at 25° C). If you don't wish to purchase the kit, the equivalent thermistor is the Fenwal GA51P8 (Allied 9 U 967) priced at $2.35 plus postage.

Here's how we developed the practical circuit. First consideration was to keep power dissipation low to avoid self-heating. We did this by using a 100-microampere meter. (You can also use the equivalent range on a VOM.) Our voltage source is a standard 9.8-V mercury battery. This combination of voltage and current (9.8V × .0001A) produces a power dissipation in the thermistor of 0.98 milliwatts. Next, we checked the resistance range of the thermistor. You can look this up in a thermistor manual but the curve computer just mentioned will give the information and other pertinent data in seconds. Our thermistor is rated at 135,000 ohms at 25° C (77° F). The specs show that at freezing (32° F) resistance is about 500,000 ohms. At 95° F it is about 80,000 ohms. Since we know the battery voltage is 9.8 it is possible to determine where each current, or temperature, point would fall on the meter scale (dividing voltage by resistance yields current).

Thus, it is possible to make a chart like the one in Fig. 6, which shows temperature at key points on the meter's dial. Calibration also can be made by comparing meter indications with a household thermometer. You can obtain a cold point by placing a thermometer and the thermistor probe in a refrigerator or freezer. A good reference for water's freezing point (32° F) is a glass of water with ice cubes and salt added.

By following these procedures you can derive other temperature scales. Two variables which affect range are battery voltage and meter sensitivity. A simple way to raise the range for higher temperature would be to switch to a higher current range on the meter. You also could add a shunt to reduce meter sensitivity. —*H. B. Morris*

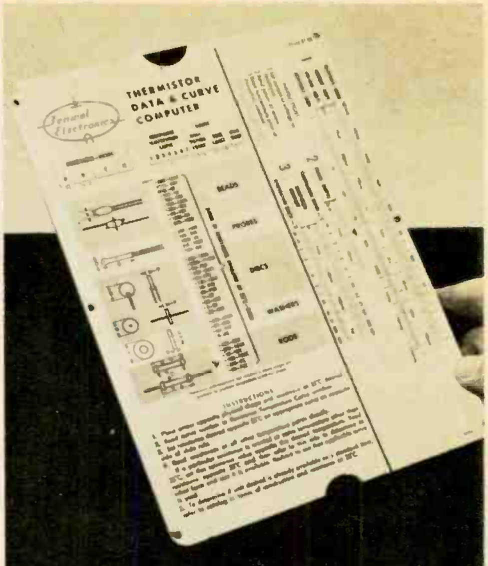


Fig. 5—Cardboard computer by Fenwal quickly solves thermistor problems involving resistance-versus-temperature and power.

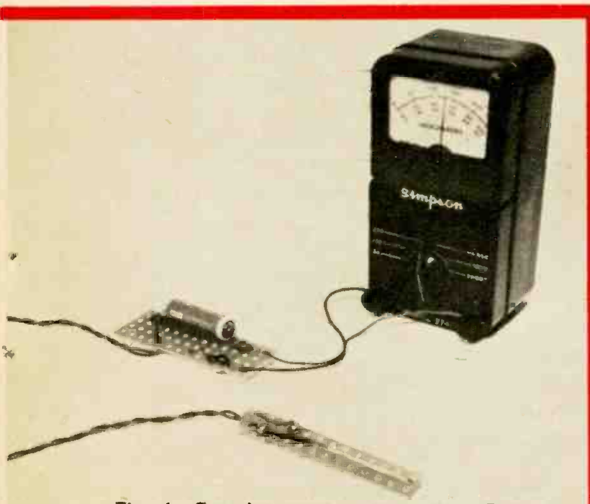


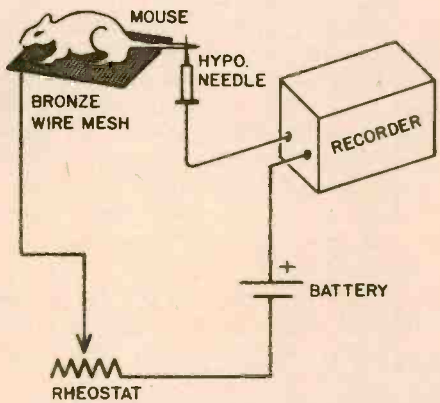
Fig. 4—Complete project. Meter is a Simpson Model 374 DC microammeter. Its full-scale ranges are 50, 100, 250, 500, 1,000 microamps.

THERMISTOR CALIBRATION CHART

Current (ua)	Temperature (F)
0	—
17	20
22	32
38	50
67	70
100	87
180	110

Fig. 6—To make calibration chart, dip thermistor in glass of water. Freezing point can be obtained by measuring temperature of melting ice in water. Use hot water for temperatures over 70°.

the curious case of the



MOSQUITO-POWERED BITEMETER

VAMPIRES and other ghouls of the spook world supposedly are at their charming and chilling best during the blackest of witching hours, which just might explain why the lowly mosquito comes round in the cool of the evening. For, small though it may be, the mosquito rightly can be considered a vampire in the sense that it delights to dine on blood. And the mosquito often squares with its host, paying for the blood it has taken. Payment, in this instance, may come in the form of a fatal disease—malaria, say. But precisely how does the mosquito dole out its death-dealing germs?

To find out, a biochemist at Chicago's IIT Research Institute constructed the mosquito-powered bitemeter shown in our photos and drawing (that's the biochemist, Philip Kashin, in the photos). A mouse, anesthetized so he wouldn't mind the needle in his tail and the mosquito bites in his tummy, made like the guinea pig. Resting on top of a wire screen, the mouse actually formed part of an electric circuit, though no current could flow because his fur acted as an insulator. But let a mosquito stand on its legs on the screen and probe through the mouse's hair into his skin and—presto! The mosquito-powered bitemeter swung into action.

A recording instrument connected into the circuit revealed each probe the mosquito made in the mouse's skin. And it also indicated whether the mosquito was probing, salivating or actually engorging on the host's blood (each caused progressively more current to flow).

Since a mosquito transmits diseases primarily when it is probing and salivating rather than engorging, Mr. Kashin hopes his experiments ultimately will lead to more effective mosquito repellents. Reason is that previous studies were chiefly visual and could not distinguish probing and salivation from actual engorgement.—*Robert Levine*

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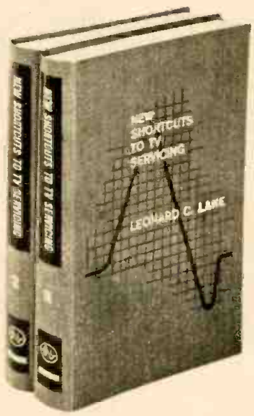

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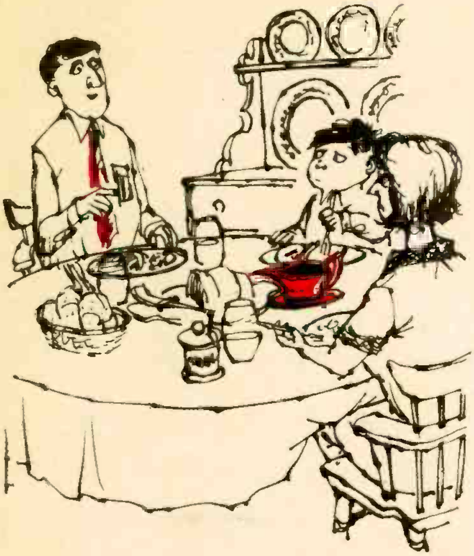
OVER AND OUT

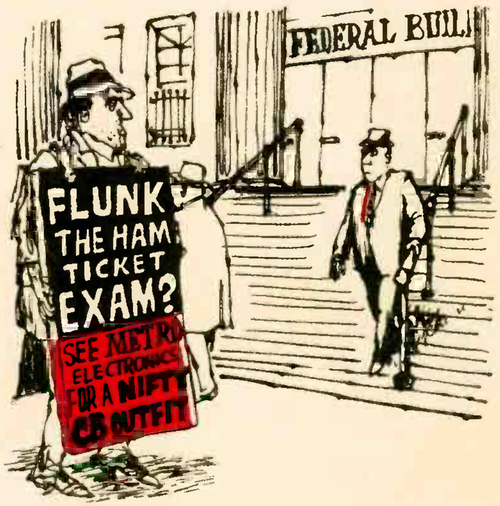
By Rodrigues



"Pass—pass is didahdahdit, didah, dididit, did-idit. The—the is dah, didididit, dit. Gravy—gravy is. . . ."

"I've gotta pass the General test. My kid's only 11 and he's got an Extra Class ticket."

"I got mixed up on the room number and took the wrong test. So I start next week on the Buffalo to Chicago run as a Railway Postal Clerk."



"I had the shortest ham career on record. My first QSO was with WWV."

Twin Fin

Continued from page 106

x 1½-in.-long form as shown in Fig. 6. Wind the wire as evenly as possible, distributing it over the entire length of the form.

Connect the capacitors in series but make sure you connect either the negative or positive leads together. *Do not* connect a negative lead to a positive end.

Install the crossover network on the back panel, making sure the coil and the capacitors aren't loose. (Loose parts will mean disturbing rattles later on.)

On the back panel, install a two-screw terminal strip. Don't simply drill a hole through for a wire. Such a hole will admit air which will affect the speaker's performance.

Before closing the cabinet, fill it with 52 blocks of 2-in.-square x 1-in.-thick pieces of acoustic fiberglass. Attach the back panel with flat-head wood screws.

Don't be surprised if you have to turn your amplifier's volume up a little higher than usual. The Twin Fin is a bit inefficient and needs an extra push. But this in no way means its performance will suffer.

Good listening!

The Farm Of The Shy Giant

Continued from page 58

than halfway down the South American continent.

Those outsize rhombics cannot be rotated like a beam antenna, of course. But with several dozen to choose from, there's broad coverage. Certain rhombics have a reversing feature. Since direction is determined by the end that has a terminating resistor, resistors are placed at each end. By choosing the right one a single antenna can be aimed, for example, at Europe or Mexico.

In what you might call the shack feeding those antennas are 39 transmitters. Many are capable of power ranging to 50,000 watts but the average transmission uses about 15,000. Power is held to the minimum required for communication. Just below the ceiling is a novel system that enables any transmitter to power any antenna on the farm. Feeder lines (600-ohm open wire) from each antenna are brought across the top of the room, where they form a grid, or checkerboard pattern, with lines from the transmitters. The engi-

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neer can create a continuous path between them by strategic jumper placement.

Press Wireless fights capricious propagation conditions with high power, superb antennas and an ability to select frequencies nearly anywhere in the short-wave spectrum. But the neatest resource is the one Ed Fee pulled out when I asked him how he picks frequencies. I happen to work skip on ham radio by listening and tuning around.

"That won't work for us," he explained, and pulled out a volume prepared monthly for Press Wireless by the National Bureau of Standards. In it are graphs prepared by computer, using all available data, to supply highly accurate propagation predictions. With the book, it takes only seconds to find the FOT—optimum traffic frequency—for any day and hour for any broadcast target.

In addition, of course, an occasional, unpredictable solar flare can cause a communications blackout. In his 30-year career in short wave, Ed Fee's worst radio blackout from solar storms lasted three hours. All frequencies were useless.

That's not the only hazard in tending an antenna farm. The neighbors seem to look on the towering masts as something of a challenge. When they get a chance they take pot shots at those hundreds of insulators. But that's nothing. One night shouts and screams were heard from the station's 400-ft. steel tower (which supports a microwave dish). Two teen-agers had climbed to the top of that high, slim tower, then apparently chickened out on the descent. Police had to make the rescue.

Press Wireless, after more than 30 years, may have reached its zenith. The recent addition of a sixth submarine cable across the Atlantic, together with new techniques that increase significantly the cable's traffic-handling capacity (with no outages due to atmospheric conditions) make wire communications newly attractive. Also threatening short wave are new communications satellites, which can also operate without regard to ionospheric conditions. Both already have snared much of the higher-priced commercial traffic once enjoyed by short-wave.

But there is one job that Press Wireless can continue to do well—dispensing vast amounts of information at low cost. It will take much sophistication and time before any other medium can transmit 4,000 words almost anywhere for less than $4.

The Listener

Continued from page 52

make engineering field surveys, set up a camp for the construction crew, ship in or fly in heavy equipment and build the station itself. We can assume that, to get the facility on the air as soon as possible, this mammoth task would have been begun immediately. Yet our witness tells us flatly: "Our visit down there to operate from KS4 — — came before any broadcasting station had been established down there . . . I heard about R. Swan a year or so after the trip."

In short, halfway through the construction period our observer saw absolutely nothing happening on the controversial isle. The impending arrival of such a large operation on the isolated island would have been a major topic of conversation with the lonely American weather bureau technicians (our man says only about 20 people including a mere six Americans—barely enough technicians to run the WX station there—were on Swan at the time) yet he heard not one word about it. So it would certainly appear that when R. Americas first came on the air some six years ago it was transmitting from a location other than Swan Island.

One possibility is a boat working considerably nearer Cozumel than Swan but *serviced from* Swan Island. Of course a DXtremist could always argue that the station had been moved onto dry land during the last couple years. That seems most unlikely to us *but the ASWLC's challenge is still on the table.*

Somehow . . . By the time it reached print, a reference to R. City in November (A Case of Murder) didn't quite match the facts. R. 390 (formerly R. Invictus) has no connection with R. City (formerly R. Such and now supposedly R. UKGM).

Briefly . . . For those who want to join the intrepid American SWL Club, simply send your name, address and $4.00 dues to it at 16182 Ballad Lane, Huntington Beach, Calif. 92647. But the ASWLC is not the only hot club. Running neck and neck with it is the greatly improved North American SW Association, Apt. 2, 1503 Fifth Ave., Altoona, Pa. 16602, also with dues of $4.00. NASWA has larger bulletins, the ASWLC's are mailed first class. Take your pick—or join both.

Fort Huachuca

Continued from page 32

ness. Now if there's anything moving, the operator sees it and radios the helicopter team or some other attack unit in the area.

"One chopper—the Lightning Bug—is loaded with floodlights. It flies over the reported target and turns on its lights. The armed helicopter or plane comes in over the enemy and they're zapped. It's effective."

If the SLAR-equipped Mohawk spots a suspicious area—say in the jungle—but can't tell what it is, it calls for its IR twin. An infrared detector essentially is nothing but a heat-sensing device. In this airborne version a detector tube scans back and forth rapidly across the plane's flight path. At the same time and in perfect synchronization a beam swings across a cathode ray tube in the plane. When the IR scanner detects a hot spot on the ground it modulates the spot on the CR tube and a blip shows up at that point. The hotter the area, the more intense the blip. As the plane moves forward, then, the successive lines on the tube form a picture in much the same way that adjacent sweeps on a TV tube do. In effect, the moving beam draws a heat map of the area being searched.

So sensitive is the scanner that even a carefully hidden campfire or cookstove, invisible to the eye, stands out like a beacon. Trucks or tanks parked under heavy foliage frequently can be found by sensing the heat of the engines. Even hours after the engines have been turned off residual heat stands out as clearly as an elephant on a dance floor.

Engineers and technicians elsewhere at the proving grounds are working to solve current electronics problems. One of the biggest is the morass of RF that the military has to cope with. Troops are up to their carbines in walkie-talkies, vehicle transmitters, airborne gear, radio-relay stations, command and control systems, radio teletypes, surveillance and fire-control radar systems.

The interference problem is approaching the crisis stage. A modern Army corps has more than 15,000 pieces of communications and electronic equipment in an area 40 by 60 mi. A field army would have more than 105,000—and the number is increasing.

Since the army can't reduce the number of devices and there just isn't any more spectrum to put them in, some method must be found to let them all operate simultaneously.

And finding out how to do that is the job of Huachuca's Electro-Magnetic Environmental Test Facility, a 2,400-square-mi. stretch of desert near Gila Bend, Ariz., studded with sites for hundreds of transmitters, linked together with some 4,000 mi. of control and power cables.

From a central control point, transmitters of all types can be switched on and off and all of their effects on each other recorded on punched cards. Then the results are sent through an IBM 7090 computer. It analyzes which units can be operated with which, under what conditions, and how much each will be affected. On the basis of these tests, army planners try to figure out how to outfit units with equipment that will keep the mutual interference down as much as possible.

Electronic wonders being checked out and scheduled for testing seem endless. One fantastic gadget, for example, is an image tube similar to the tube in a TV camera but so sensitive that it produces clear, bright pictures without lights on a moonless night. The dim light filtering down from the stars furnishes all the illumination it needs. Built into an airborne TV system, such a tube could fly above enemy-held territory at night— possibly in a pilotless drone—sending back pictures as clear as though they had been shot under the mid-day sun.

Not all of Huachuca's projects can be talked about, of course. Some, in fact, are so hush-hush that not even base officials know about them. Not far from the crumbling adobe huts that once housed Indian Scouts (and now are used for Boy Scout meetings) is a heavily guarded building. I asked my guide what it was. "That's the 52nd U.S. Army Security Agency, Special Operations Command," he rattled off glibly.

"What do they do there?" I asked.

"Beats hell out of me," he said cheerfully, suddenly dropping the officialese he had been talking. "You couldn't get in there if you walked on water."

Among the vast array of impressive equipment I saw at Ft. Huachuca, there was only one thing I missed: a device reported to be the army's newest super-sensitive detection gadget. I had read about it shortly before visiting the fort.

Scientists at the army's Limited War Laboratory at Aberdeen, Md., have come up with

[*Continued on page* 119]

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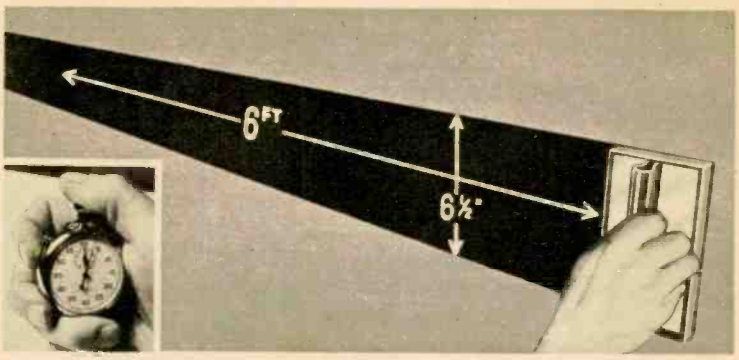

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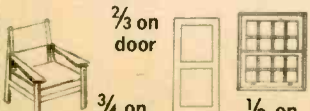

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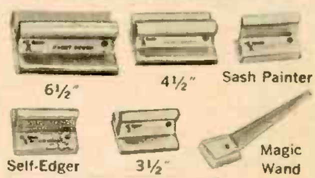

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Continued from page 117

a great new idea on how to catch infiltrators. It seems that the combat bedbug, a character about the size of a thumbnail, becomes so enraptured at the smell of human flesh that he lets out a loud whoop of excitement—loud for a bedbug, anyway. The scientists are building a capsule that will allow the bedbug to smell forward (to detect people the Army may be beating the bushes for) but not backward (to detect the man carrying him). The capsule would be fitted out with a tiny microphone and amplifier because the bedbug's howl, while lusty by insect standards, might be lost by a soldier crunching through the underbrush.

If the device works—and if the Army decides it has combat possibilities—and if someone builds a prototype, no doubt Ft. Huachuca will get the testing assignment. If so, the Arizona desert may see one of the strangest sights in military history: soldiers marching resolutely forward, bedbugs at the ready, listening intently through headphones for screams of delight from ecstatic insects as they sniff human flesh.

A Statement

THIS concerns your article, The Truth About That UL Label, which appeared in the May EI. I call your attention to the statement in your article to the effect that one of our field inspectors was receiving a salary from a manufacturer whose production he regularly inspected to determine its eligibility for UL listing. . .

The Laboratories has found absolutely no evidence to substantiate the charge made in your article . . .

I now ask that you publish a retraction in the next issue of EI. I am sure that you understand that we consider this a very serious matter since the integrity of the entire basis of our operation has been challenged.

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NOT SATISFIED with your present income? The most practical thing you can do about it is "bone up" on your electronics and get your Government license.

The demand for licensed men is enormous. Ten years ago there were about 100,000 licensed communications stations, including those for police and fire departments, airlines, pipelines, telephone companies, taxicabs, railroads, trucking firms, delivery services, etc.

Today there are over a million such stations on the air, and the number is growing constantly. And according to Federal law, no one is permitted to operate or service such equipment without a Commercial FCC License or without being under the direct supervision of a licensed operator.

This has resulted in a gold mine of new business for licensed service technicians. A typical mobile radio service contract pays an average of about $100 a month. It's possible for one trained technician to maintain eight to ten mobile systems. Some men cover up to fifteen systems, each with perhaps a dozen units.

Countless Other Opportunities

The UHF boom may soon double or triple the number of TV stations on the air—and the number of licensed men needed to man them. And even in industries that do not require FCC Licenses, the licensed technician is considered first for promotion and in-plant training programs. Why? Because passing the Government FCC exam is considered proof that you know the fundamentals of electronics.

So why doesn't everybody who "tinkers" with electronic components get an FCC License and start cleaning up?

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"There's no doubt about it. I owe my 2nd Class FCC License to Cleveland Institute. Their FCC License Course really teaches you theory and fundamentals and is particularly strong on transistors, mobile radio, troubleshooting and math. Do I use this knowledge? You bet. We're installing more sophisticated electronic gear all the time and what I learned from CIE sure helps."

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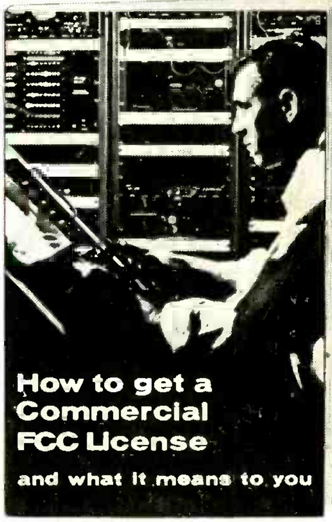

THERE'S A BIG BOOM in Electronics. And YOU can be part of it. You don't need a college education or any previous experience in electronics. The free book shown here tells you how.

In the last 15 years, the electronics manufacturing industry alone has grown from $2.7 billion to $17 billion, and is expected to hit $24 billion by 1970.

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Regardless of which you choose, the secret of "getting your foot in the door" is getting a Government FCC License. It's certified proof, respected by employers everywhere, that you have passed a standard Federal exam on the fundamentals of electronics—that you're not just an electronics handyman, but a real "pro." Many jobs legally require it.

Now, because of the importance of getting your FCC Commercial License, the Cleveland Institute of Electronics has prepared a valuable 24-page book telling you how to go about it.

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With this book, you will receive a second free book, "How To Succeed In Electronics." It's the catalog of CIE...first to offer an FCC License Warranty. You will learn why better than 9 out of 10 men with CIE training get their FCC Licenses even though 2 out of 3 without this training fail.

To receive both books without cost or obligation, clip and mail the postage-free card at the left. Or write to Cleveland Institute of Electronics, Dept. EI-67, 1776 E. 17th St., Cleveland, Ohio 44114. Do it right now—it may change your whole life.

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