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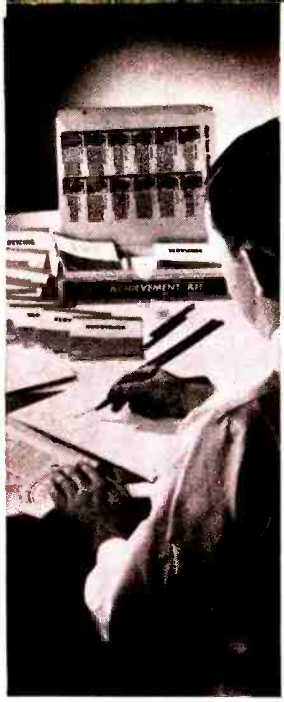

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NOVEMBER, 1965 A Fawcett Publication Vol. 8, No. 6

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Theory & Practice

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Glenn Horning, Local Equipment Supervisor, Western Reserve Telephone Company.

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FEEDBACK
from our readers

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● TANGOS FOR TWO

Momma always said a little is enough when we want to dance (music affects her so you see she does have a point). But now John and I dance all night and she doesn't know the diff. Our social life has increased 100% since he wired the den for phones (WIRELESS HEADPHONES, Sept. '65 EI). Johnny says dancing like we do is more intimate than candles and all that jazz because when you have the phones on you feel closer than with candles. We call them our frugging phones because that's what we do.

Susan M.
Philadelphia, Pa.

With a line like that this guy John doesn't need wireless headphones, Susie. And you'd better learn judo fast.

● INTERCHANGE

Why don't you people do a story about strange occurrences with radios and TVs? Like, for instance, the priest who was about to say mass over one of those new FM wireless microphones and all of a sudden, "Car 21, go to Spring Street," came over the loudspeakers. I read about this in the newspaper and they told how the priest's mike had picked up the police accidentally. But they said the police hadn't received any blessings over their radios yet.

Tyrone Young
New York, N.Y.

● SOLVED!

The TV antenna on your July cover looked nice and I'd like to buy one like it. Only you didn't identify it. Don't you usually?

Art Alexander
Richmond, Va.

Yes, A. A. (we goofed). The antenna was a Lafayette 18G0104WX and it sells for $11.88.

● BOILING QUESTION

Somebody told me that if you look at a glass of water and really really concentrate the electrical forces in your brain will make the water in the glass heat up. Is this true?

J. L.
Akron, Ohio

Didn't work for us, J. L., but it's nice of you to think we have that kind of talents. How about seeing through armor plate? Have you tried that lately? You never know unless you try.

● LEMON JUICE

Thirty years too late I discover the answer. As a boy of 7 I sold lemonade on the banks of the Wabash River. On those long, hot summer evenings I used to dream of becoming the Lemonade King of the country (28 flavors coast-to-coast and all that jazz). But, alas, for the want of a gimmick it all fell through. When I think of the power and scope your article explaining how to build a

[*Continued on page* 8]

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FEEDBACK

Continued from page 6

battery from a glass of lemonade (LEMONADE BATTERY, Sept. '65 EI) would have afforded me, I could cry. Just think—I could have been a millionaire by now if only you had printed the article on how to build a lemonade battery three decades ago.

B. Orbach
Indianapolis, Ind.

Stop blaming us, B.O. Where were you when the Lifebuoy people were looking for a new slogan?

● COLOR TAPER?

I read your report about building a home video tape recorder (Sept. '65 EI) and found it interesting. When do you think we'll have a recorder for color sets?

C. Miller
Brooklyn, N.Y.

Word is that Sony Corp. already has one in the works.

● TWEETER TRENDS

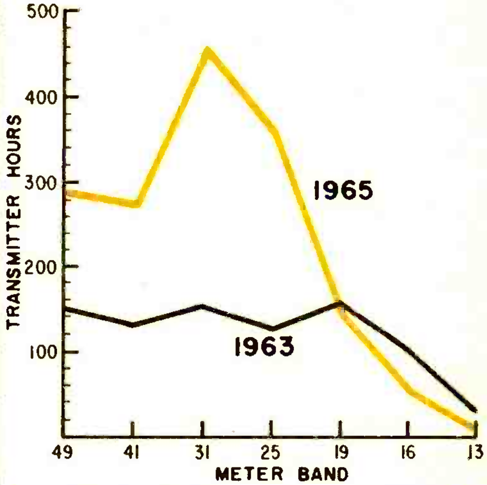
That letter in Feedback (Sept. '65 EI) about radio hats for the ladies went over big at our house. First I discover a couple of my speakers missing. Then my wife forces me to go to a fashion show sponsored by the PTA and, sure enough, right smack in the middle, during a section called Look-A-Likes (that's when the mothers and daughters dress alike), out parades my wife and my little girl with a woofer and tweeter perched on their heads. And you know something? They looked real pretty.

S. J. Werner
Los Angeles, Calif.

A STRANGE TURN FOR THE JAMMERS

MOUNTING evidence indicates the Russians have come up with yet another means of painting the SW broadcast bands hammer-and-sickle red. New Soviet transmitters have gone into service at an alarming rate, filling already overcrowded bands to the point of overflowing. Result has been further deterioration of SW broadcasting conditions, already severely disrupted by the current relatively low sunspot activity.

Much more importantly, it appears that many of these seemingly new transmitters actually represent those withdrawn from jamming operations. This leads to the conclusion that Russian jamming, which was thought to have been reduced significantly, really has



Soviet broadcasting-hour output increased 187% between 1963 and 1965, as chart reveals. Sunspot low accounts for fall-off in 13- and 16-meter bands.

not been cut back at all. Rather, it simply has taken another and more insidious form.

Before mid-1963, the Communists were jamming heavily all Western broadcasts with the exception of those in Albanian and Yugoslavian. But in June of that year, Russian policy took a sudden turn. Jamming of Voice of America and British Broadcasting Corporation broadcasts in Russian ended abruptly

[*Continued on page* 12]

A STRANGE TURN FOR THE JAMMERS

Continued from page 10

(see RADIO'S IRON CURTAIN, Jan. '65 EI).

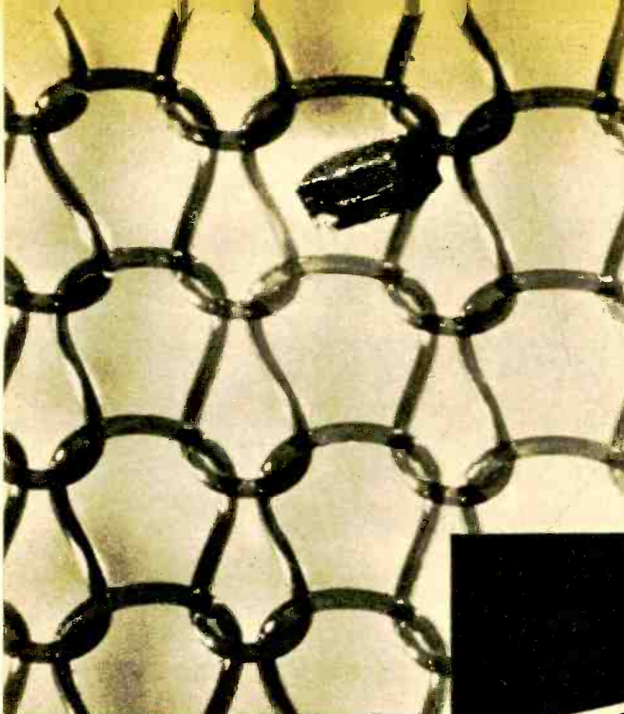
Since that time there has been a steady decrease in the jamming efforts of the Soviet Union and its satellites. At present, only V. America in Bulgarian, R. Liberty in Russian and R. Free Europe in Bulgarian, Czechoslovak and Polish are jammed by conventional means. Even Russian jamming of R. Peking, which began in mid '64, ended during the winter of '64-'65.

It has been estimated that as many as 2,500 transmitters were in use as jammers during the height of the jamming operation in early '62. And though roughly half these transmitters still are in operation as noise jammers against R. Liberty, R. Free Europe and V. America, there now is ample evidence to indicate that a good many of those remaining have been converted to broadcast transmitters. Such outlets now are on the air carrying conventional Soviet program material.

Our chart contrasts Russian broadcasting on the SW bands in the winter of '62-'63 (before the cutback in jamming) with Red operations on these same bands last winter (after the jamming trim-down). It can be seen that the Russians have increased use of the lower bands tremendously. In fact, in the two and one half years since the Russians supposedly cut back on jamming, the overall efforts in the SWBC bands have more than doubled.

In the all-important 6-11 mc regions, there has been a 249% increase in broadcast effort, marked by vastly expanded programming in domestic as well as international services (overall increase on all SWBC bands was 187%). And most frequencies selected for Russia's so-called new broadcasters are relatively worthless for reputable reasons, being already occupied by transmitters of one or more other nations. Since such operations serve only to degrade existing services, it must be concluded that for the most part the Russian maneuver is a negative one. Far from increasing the effectiveness of Soviet transmissions, the move would appear to be directed at degrading the effectiveness of other broadcasters. As such, it represents one of the strangest turns in the history of jamming.

—*George Haydon.*



MIGHTY MITE . . . What may appear in our photomicrograph to be a hunk of charcoal stuck on a chicken-wire fence in reality is a laser diode on a Nylon stocking. A mere 1/10 of a millimeter in length, this little jewel produces a light beam of the sort capable of carrying millions of simultaneous telephone conversations. Engineers employed by West Germany's Siemens & Halske, A.G., developers of the diode, hope light-style communications ultimately may ease the strain on already overtaxed radio frequencies.

Mysterious Miss . . . If the gal in our photo looks lost, it's only because she's checking a portion of a computer so complex it officially has been dubbed Myriad. Capable of storing 16,348 bits, Myriad merits her handle. The Marconi Company of Chelmsford, England, has entrusted Myriad with the task of solving air-traffic-control problems. And though Myriad has yet to make her mark, she someday may learn enough about airborne traffic snarls to unsnag the ground-based variety.

...electronics in the news

Fish Talk? . . . Dolphins rather than goldfish ordinarily are considered to be the communicators of the underwater world but James Richards, an electronic engineer at Washington's Naval Research Laboratories, would seem to have developed a means of communicating with his finny friend. Actually, the trace on the scope in our photo represents the signal produced by sound bouncing from Goldy's moving gills. The sound originates from an ultrasonic Doppler cardioscope, a device said to produce a trace free of extraneous background signals common to other types of heart-monitoring equipment.

Which end of this popular hand tool is the handle?

(Pass this test and you've qualified to build any of these handsome Electro-Voice Prefinished Kits!)

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Illustrated, left to right: Coronet 8" Speaker Systems $42.75 to $57. KD9A 12" Enclosure $63; KD10 Equipment Console $77; KD6A 12" Corner Enclosure $60; E-V TWO KD 12" Acoustic Suspension Speaker System $91.50

Electro-Voice
SETTING NEW STANDARDS IN SOUND

...electronics in the news

Plastic Nose . . . Stewing a witch's brew isn't quite what the Honeywell chemist in our photo is up to, though the gadgets he has at his disposal would cause a witch to twitch with delight. The brew in this chap's unusual beaker is being stirred by a Teflon-coated cylindrical magnet

turned by a second, motor-driven magnet in the beaker stand. And the device mounted atop the modern-day caldron is a plastic-covered electronic sensor designed to measure the strength of the chlorine solution inside. Though our photo shows a prototype version, the people at Honeywell hope eventually to market their super sniffer to owners of swimming pools, water-treatment plants and other interested in getting an electronic low-down on what's what in their H_2O.

Globe Girdler . . . Like the scuba diver in our photo, the aluminum spheres are having a brief respite from the briny deep. Alcoa made the balls to accommodate any kind of scientific gadget a

body'd want to send down to probe the mysteries below. They already have proven their worth in an experiment conducted by California U. Serving as bathyspheres for seismometers, the metal globes helped gather valuable data on the origin and propagation of earth tremors in the waters of the Central and South Pacific.

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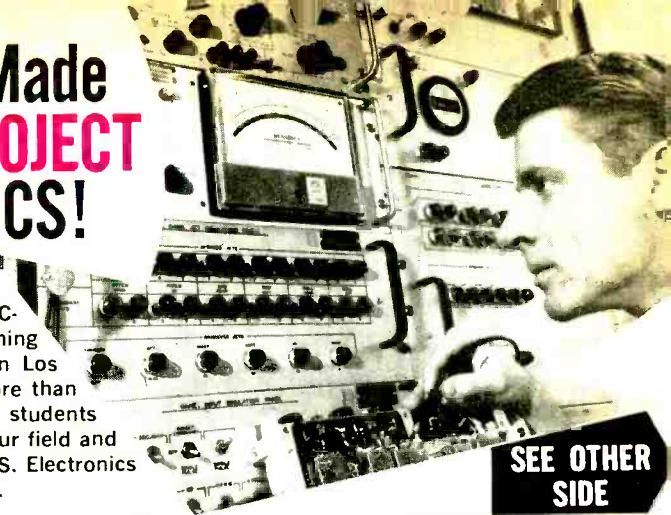

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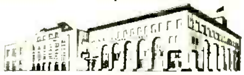

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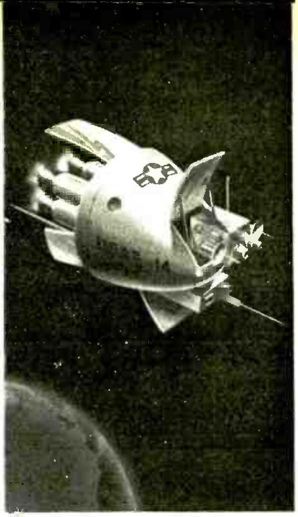

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...electronics in the news

Instant Emeralds . . . Under natural conditions emeralds take million of years to form. But Wayne Wilson (the man in our photo) and Hubert Hall of the Naval Ordnance Laboratory at White Oak, Md., have found a way to speed things up. With plenty of pressure and temperatures of 1,550°C, the process now takes just 2 minutes. The co-inventors expect their discovery to find ready acceptance in electronic circles because of the emerald's built-in maser properties.

ITEMS . . . Solid-state air conditioners soon may reach the marketplace if a unit RCA is testing manages to make mass production. Though a prototype has been built, production is expected to pose a tough problem. Parts of the solid-state modules will have to be joined by some extraordinary means to withstand the extremes of hot and cold the pairs are capable of producing. Should manufacturers decide that the gamble is worth the millions it is expected to cost, the public well may see units which both will heat and cool a room in a package roughly a third the size of current window air conditioners.

Results of a two-year study by Prof. Earl W. Barrett of Northwestern University have produced a unique method of keeping tabs on air pollutants. Prof. Barrett's scheme calls for a laser-like device to fire a short burst of light into the atmosphere. Light reflected by pollutants is detected and measured by a light-sensing instrument in much the same manner that targets are picked up by radar or sonar. Gimmick is that the amount of light returned is proportional to the amount of pollution. **Air-pollution radar** may see wide application as a watchdog, warning when pollution levels go above safe limits.

A microfilm edition of EI now is offered by University Microfilms, Inc., 313 N. First St., Ann Arbor, Mich. 48107. The edition is expected to be of special interest to public and technical libraries and to schools. Microfilms of all past issues also are available from University Microfilms in a licensing arrangement with EI.

BROADSIDES

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

With semiconductors finding their way into most every kind of gear these days, electronic hobbyists well may want to know how these little wonders are made. And background information on **semi-conductor manufacture** is precisely what a booklet called Reliability 65 contains. A copy can be yours for the asking if you write Fairchild Semiconductor, 313 Fairchild Dr., Mountain View, Calif. 94041.

Mixing unsealed switches with sea air ordinarily is a sure-fire recipe for circuit troubles. Way to get around this is by installing **hermetically-sealed switches,** which most any boating buff with a leaning toward electronics can select from the many listed in Catalog 100. Attractively illustrated, the brochure also includes sections on push-button switches, leaf and lever switches and indicator lights. Request your copy from Controls Co. of America, 1420 Delmar Dr., Folcroft, Pa. 19032.

You need a scorecard to tell one player from another, and so it goes with the thousands of **coils and associated components** on the market. The scorecard in this case well might take the form of a catalog such as Miller's No. 65, which lists more than 2,500 items. For your copy, write J. W. Miller Co., 5917 S. Main St., Los Angeles, Calif. 90003.

Current methods of cutting, grinding, cleaning, adjusting and mounting **quartz crystals** are detailed in a catalog titled Precision Frequency Regulation, which also includes descriptions of crystals and related products. Request your copy from Director of Marketing, McCoy Electronics Co., Mt. Holly Springs, Pa. 17065.

Finding room for pilot lamps, switches and fuse holders on a chassis or a panel can be a problem in these days of gnat-size components. A logical solution is to combine all three items in a fused, illuminated **push-button switch** of the sort Superior Electric describes in Bulletin FS365. A copy can be yours for the asking from Superior Electric Co., Bristol, Conn. 06012.

Glass capacitors in sizes from 0.5 to 10,000 $\mu\mu$f are pictured and described in bulletin CE-1.04. They are said to be all but indestructible. The capacitors have been subjected to tests in which they were boiled in salt water and immersed in saturated steam without adverse effect on performance. Request your copy from Corning Electronics, Corning Glass Works, 3900 Electronics Dr., Raleigh, N.C. 27604.

ELECTRONIC SWAP SHOP

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

HEATH GR-91 receiver. Want 100-kc/1-mc crystal calibrator, headphones, Hy-Gain SW-1 antenna or VHF converter. William L. Bound, 911 Beckley St., Kilgore, Tex. 75662.

HEATH GR-91 receiver. Will exchange for CB transceiver. Dan Wolfe, 2515 E. 24th St., Brooklyn, N.Y. 11235.

SHURE 404 hand mike. Want transistorized CB preamp. Donald Memberg, 687 W. Milton Ave., Rahway, N.J. 07065.

NATIONAL NC-33 receiver and Electro-Voice 950 mike. Will trade for tape recorder and EICO 955K capacitor checker. Bruce LaVoie, 26300 Marlene, Roseville, Mich. 48066.

RADIO SHACK communications receiver. Looking for 30- to 50-mc receiver. Gene L. Spratt, WN4VAK, 203 Bethany St., N. Charleston, S.C. 29406.

MOTOROLA H-11 walkie-talkie and BC-620 receiver. Want 30- or 152-mc receiver. Bill Lovejoy, 33 Standish Way, W. Yarmouth, Mass. 02673.

JOHNSON Viking 1 transmitter, Heath VF-1 VFO, Hammarlund HQ-100 receiver. Will exchange for Galaxy 300 transceiver. Mike Meyer, 404 E. 2nd St., Rugby, N.D.

TELELECTRO tape recorder, cameras, slide projectors. Want ham equipment. Roland Kulish, 5075 Heisig St., Beaumont, Tex. 77705.

HICKOK 610A TV/FM alignment generator, EICO 320 signal generator, 177B surplus tube tester, Heath AG-9 audio generator. Interested in all-band SW receiver. Stephen W. Kovacs, 4000 Carlock Dr., Boulder, Colo. 80302.

GE 2J5H1 selsyns. Want 1-in. CRT or vidicon. Stephen Fowler, 37 Hibiscus Ct., Weston, Ont.

PHILMORE CB transceiver. Need pair of CB transceivers. David Chmielewski, 6569 Horatio, Detroit, Mich. 48210.

VM 722 stereo tape recorder. Looking for Bell RT-360 stereo recorder. Aaron D. Parker, Box 646, Cullman, Ala. 35055.

PILOT Mark IV FM tuner, Transvision 20-watt amplifier, electronic dwell meter, Knight C-100 transceiver. Want SW receiver or 152-mc converter or receiver. Onais Sellers, Box 611, Galveston, Tex.

HALLICRAFTERS S-53A communications receiver. Will trade for CB equipment. Dick Linde, 9934 S. Charles, Chicago, Ill. 60643.

SPRAGUE in-circuit capacitor checker, Victor 16-mm sound projector, other items. Want CB and ham gear. Diane MacKay, Drawer GGG, Wickenburg, Ariz.

TESLA coil with 12,000-V transformer. Will swap for VTVM. David Chamberlin, 1215 Stratford Ave., Nashville, Tenn. 37216.

HAMMARLUND SP-600 receiver. Need 9-in. transistorized TV or Fisher K-10 reverb and Winchester model 94 gun. M. D. Henke, 63 W. Emanual Dr., Brunswick, Me. 04011.

HEATHKIT HR-10 receiver, Lafayette HE-48 speaker and library for beginning ham. Want Knight KG-765 tuner. A. W. Gernhardt, 464 Lynwood Ave., Trenton, N.J. 08629.

KNIGHT G-30 grid-dip meter. Looking for signal generator. Stanley Piquet, Rte. 2, Tomah, Wis. 54660.

HAMMARLUND HQ-110 receiver. Will trade for other SW receiver or AM/FM/stereo-FM tuner. Joe Horner, 2901 Jackson, Amarillo, Tex. 79109.

GONSET-ELMAC 6- through 80-meter mobile station. Will swap for 2-meter gear. W. J. Davis, 4434 Josie Ave., Lakewood, Calif. 90713.

LAFAYETTE HE50A transceiver. Want HW-12 CB transceiver or communications receiver. Leo L. Boggan, WA5BYR, Rte. 2, Box 175, Lockhart, Tex. 78644.

KNIGHT C-27 CB transceiver and stamp collection. Will trade for ham station. Chuck Johnson, 9816 S. Greenwood Ave., Chicago, Ill. 60628.

NATIONAL NC-88 receiver with VHF converter. Will exchange for CB transceiver. Richard Smith, 46 164th Pl., Calumet City, Ill.

CURTIS-MATHES K-12 multiplex adaptor. Looking for oscilloscope or other test equipment. Jack E. Dole, 1823 Exeter St., Irving, Tex. 75060.

TRANSISTOR radio, BC radio, TV tubes. Interested in SW receiver. Raymond Tester, 117 Douglas St., Bristol, Va.

TUBES—CV 449s. Need R/C, ham, test or SWL equipment. Gene Hassell, Box 155, Manitou, Okla. 73555.

KNIGHT Span Master receiver. Want Knight Star Roamer. James Carroll, 1105 E. Schuylkill Rd., Pottstown, Pa.

EICO 420 oscilloscope with probes. Need multiplex AM/FM tuner. A. Stellerman, 1381 Linden Blvd., Brooklyn, N.Y. 11212.

KNIGHT Span Master receiver and Spacephone walkie-talkies. Will exchange for Star Roamer, model A-120 Star Lite or equivalent. Thomas Wind, Jamaica, Iowa.

STROMBERG-CARLSON record player. Will swap for ham gear. Orville Braaten, 406 E. 9th St., Morris, Minn. 56267.

HALLICRAFTERS S-120 receiver. Want 2-meter transceiver. Peter Berman, 442 Liberty Rd., Englewood, N.J.

TWO-METER transmitter, LW-50. Will exchange for R-55 receiver. Doug Robbins, Box 257, Turrell, Ark.

KNIGHT Span Master receiver. Will trade for CB transceiver. Virgil C. Clark, 122 Cumberland College. Williamsburg, Ky. 40769.

HEATH Twoer with halo antenna, Lafayette HE-35 and Philmore walkie-talkies. Want HQ-110 receiver or equivalent. Randy Dunham, WN4VZB, 110 Hartweg Ave., Fort Thomas, Ky.

MOTOROLA Airboy LF receiver, ATJ TV camera and 8DP4 TV picture tube. Will swap for CB equipment or transistor tape recorder. Gerry Stephens, Box 88, Sheldon, Ill. 60966.

MITY-AMP audio amplifiers. Want SW receiver. Eddie Gaffrey, Rte. 3, Huntsville, Ark. 72740

TUBES, SW receiver and BC receivers. Want hi-fi equipment. Jim Van Damme, 11921 Lansdowne, Detroit, Mich. 48224.

EICO 427 oscilloscope. Will exchange for Bonner Transimite servos. P. W. Barr, 9621 Angleridge, Dallas, Tex. 75238.

EICO 460 oscilloscope and signal generator. Want antique radios. James Doughty, 1½ Webber Pl., Texarkana, Ark.

RADIO CONTROL outfit. Interested in stereo tape recorder. David L. Nolt, Rte. 1, Box 197, New Holland, Pa. 17557.

KNIGHT Span Master receiver and radio broadcaster/audio amplifier. Will swap for test equipment or Novice transmitter. Darold Borree, 1915 Sherman Ave., Madison, Wis.

INTERCOM with six push-buttons. Will swap for stereo components or power tools. Leon Buddine, 1700 W. High St., Haddon Hts., N.J. 08035.

NATIONAL N-100A receiver and Magnavox AM/FM radio. Will swap for anything of equal value. R. D Lothringer, 3270 Rancho La Carlota, Covina, Calif. 91723.

GLOBE 100A transceiver. Will trade for 5- to 20-watt amplifier or electric guitar. Bob Jones, 405 Roe Ave., Elmira, N.Y. 14901.

HY-GAIN 18-V vertical antenna. Will exchange for VFO or other ham equipment. Steve H. Edwards, WA4UYK, 806 Lieber St., Henderson, Ky.

ARC-5/BC-454 command receiver with 12-V dynamotor. Will trade for grid dip meter of preselector. Manuel Lopez, 522 E. 138th St., Apt. 23, Bronx, N.Y. 10454.

LAFAYETTE Trutest stereo 15 amplifier. Want 12- or 15-in. hi-fi speakers. Stephen C. Keating, 2919 Colorado, Topeka, Kan. 66605.

ROSS 400 tape recorder. Will swap for anything of equal value. Robert Byrnes Jr., Rte. 3, Box 113, Jefferson, Iowa.

BUTTON TELEPHONE. Will swap for tape deck or record preamp. Chris Gundlach, 977 Ash St., Winnetka, Ill. 60093.

TURNER S95D mike with stand. Want B31-279 IF strip or chassis for 1954 Silvertone TV. Bob Solano. 4 Richard Ave., Oneonta, N.Y

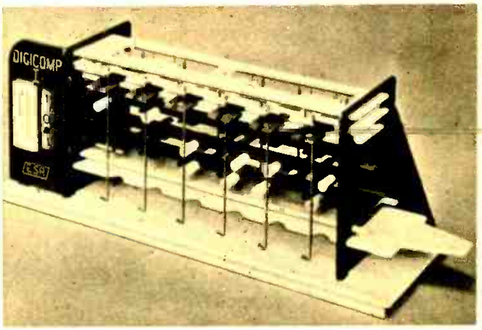
TESLA COIL transformer, 200,000 V. Will trade for CB rig. Denny Schmidt, 855 Hamilton, Freeport, Ill. 61032.

[*Continued on page* 112]

Half-Pint Computer

TOUTED as a table-top computer in kit form, the Digi-Comp 1 is likely to be of interest to the electronic hobbyist. To be sure, it's about as electronic as a Halloween pumpkin and is little more than a sophisticated toy. But the instrument does provide a means for the hobbyist to crawl toward the day when he can take those first tottering steps through the maze that is computer row.

The Digi-Comp 1 computer is made of plastic and weighs in as one of the cheapest and smallest puzzle-solvers yet to appear. It takes only an hour or so to put together and



Completed Digi-Comp 1 adds, subtracts, multiplies, carries, complements, compares, sequences and memorizes. It's supplied with 15 experiments.

diagrams are clear enough and instructions straightforward enough that even small fry should find the operation a no-sweat prospect.

Entirely mechanical in its operation, the plastic device relies on a system of sliding planes and movable rods instead of the on/off conditions of an electric circuit. And while its designer is to be complimented for his ingenuity, the ultimate result only is an instructive entertainment.

In other words, the device does suffice to demonstrate how logical alternatives can be translated into Boolean algebra and it is good for a game or three. Even so, adults who want to learn about the basic operations and technology of electronic computers still would have to gather such information from other sources.

Price of the Digi-Comp 1 kit is $5 postpaid. It's available from the Edmund Scientific Co., 105 E. Gloucester Pike, Barrington, N.J. 08007.—*Kurt Meisels*

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ELECTRONIC MARKETPLACE

TABLE-TOPPER . . . Sporting a vinyl-covered cabinet with a fake wood grain printed on it, the M660A Explorer is an all-band receiver at home in shack or living room. With separate

built-in antennas for the long- and short-wave bands, this versatile 5-tuber tunes 150 kc through 400 kc and 500 kc through 30 mc in five bands. Other features include a BFO, electrical band-spread and provision for operation on either 117 or 230 V at the flick of a switch. $99.95. Zenith Sales Corp., 1900 N. Austin Ave., Chicago, Ill. 60639.

Mitey . . . An easy and fairly inexpensive way for a ham to beef up his sideband signal is by tying onto the new HA-14 KW Kompact. Used

in conjunction with optional 12 VDC or 117/230 VAC power supplies, the HA-14 pumps out a gallon PEP from a paralleled pair of 572-Bs and can take the knocks, too. It squeezes out 10 watts for each 1 watt put in. Third-order harmonics are reduced a minimum of 30db throughout the linear's operating range, which covers the 80- through 10-meter ham bands. Measuring 3 1/16 x 12 3/16 x 10-in., the HA-14 is roughly the size of the sideband exciter required to drive it. $99.95. Heath Co., Benton Harbor, Mich. 49022.

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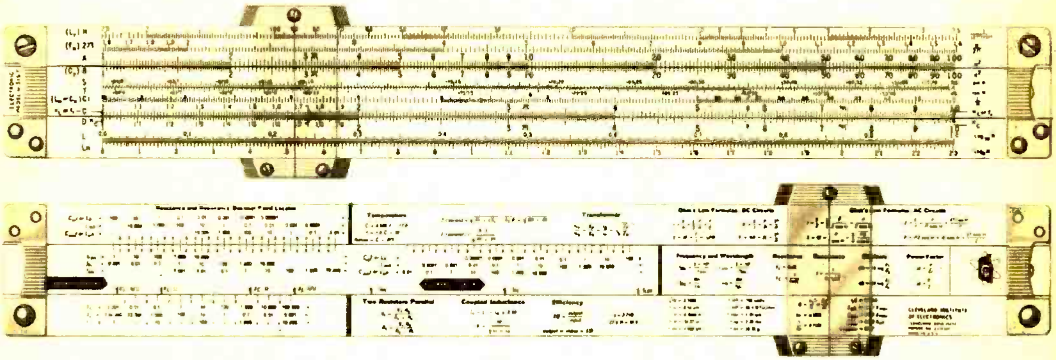

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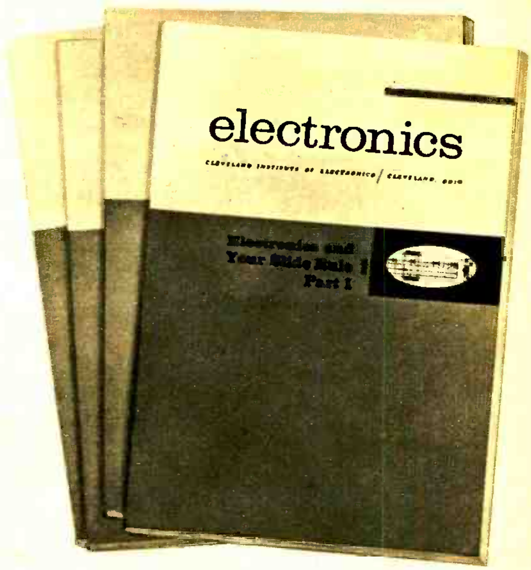

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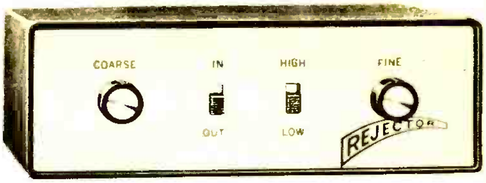

range from 300 to 5000 cps can be suppressed to the extent of —40db. Controls include an in/out switch, a high/low frequency switch and coarse and fine tuning. Measuring 7½ x 5⅜ x 2½-in., the Rejector is suitable for fixed or mobile operation. In addition, a unique reversible panel allows lettering to be right-side-up whether the Rejector is installed vertically or horizontally. $34.95. Galaxy Electronics, 10 S. 34th St., Council Bluffs, Iowa 51504.

Tape Minded . . . Many's the reel of tape that has been run through a battery-powered recorder without a sound to show for its trip. Reason is that trying to hold a mike on a subject while working switches on a battery-powered recorder can make a body busier than a circus juggler struggling to find a match. Designed specifically for use with personal tape portables, the M-203 crystal mike features a lockable PTT button that switches both mike and recorder motor, thus permitting convenient, economical and noise-free recording. Delivering a —50db output and having a frequency response from 40 to 6,000 cps, the M-203 makes for one-hand operation and also promises to save a bit of tape. A 5⅜ x 1½-in. case of modern design gives this useful recording accessory an eye-catching appearance. $2.95. Olson Electronics, 260 S. Forge St., Akron, Ohio 44308.

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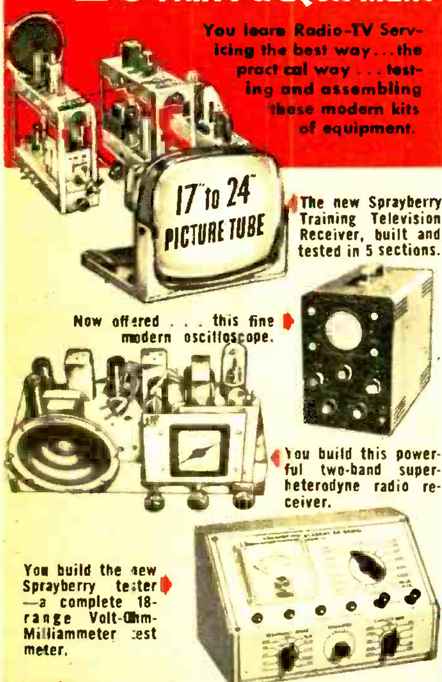

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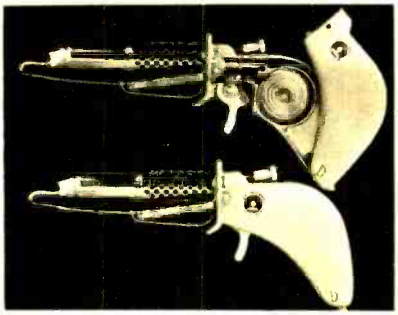
MARKETPLACE

Solder Totin' . . . The job of holding necessary tools and materials when soldering electronic circuits sometimes seems task enough for a man with as many arms as an octopus. One helpful



tool promising relief to the harried hobbyist is a gadget called a Blixt soldering iron. Reason is that the Blixt unwinds its own solder from a 16-ft.-long coil stowed in its handle. A squeeze of the trigger will continue to produce solder at the tip throughout even the longest project. $17.95. Roger-Crosbee Co., 1810 Rowland St., Riverton, N.J. 08077.

Low Drain . . . Leaving an old tube-type intercom on all day runs up electric bill enough to make you part owner of the power company. But the transistorized intercom shown here is such a power miser that it can stay on all week without consuming more than pennies worth of electricity. Transmitting its signals along the

power line, the wireless communicator sports two channels, thus permitting two pairs of intercoms to operate independently or in a net. A lockable press-to-talk bar permits hands-free talking; other controls include volume and channel selector. $21 each; $39.95 the pair. Lafayette Radio Electronics Corp., 111 Jericho Tpke., Syosset, N.Y., 11074

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- Combination "S" Meter and Relative RF Output Meter. "S" Meter indicates the relative strength of incoming signal in "S" units. RF Output Meter (EO) indicates relative strength of the signal being transmitted.
- Spotting Switch. Permits precise manual tuning of receiver without use of receiver crystals. Receiver can be tuned (or "spotted") quickly to any incoming channel for which you have a transmit crystal. This means, when you buy crystals for extra channels, you can (if you wish) omit the RECEIVE crystals and buy only TRANSMIT crystals. This feature alone pays the price difference if you use a number of channels.
- External Speaker Jack. Lets you connect an external speaker to the set, so incoming calls can be heard in remote locations.

*Optional distributor resale price.

GET THE FACTS. Write for free descriptive folder on either the Mark VIII or Mark Nine to: Commercial Engineering, Department K134R, RCA Electronic Components and Devices, Harrison, N. J.

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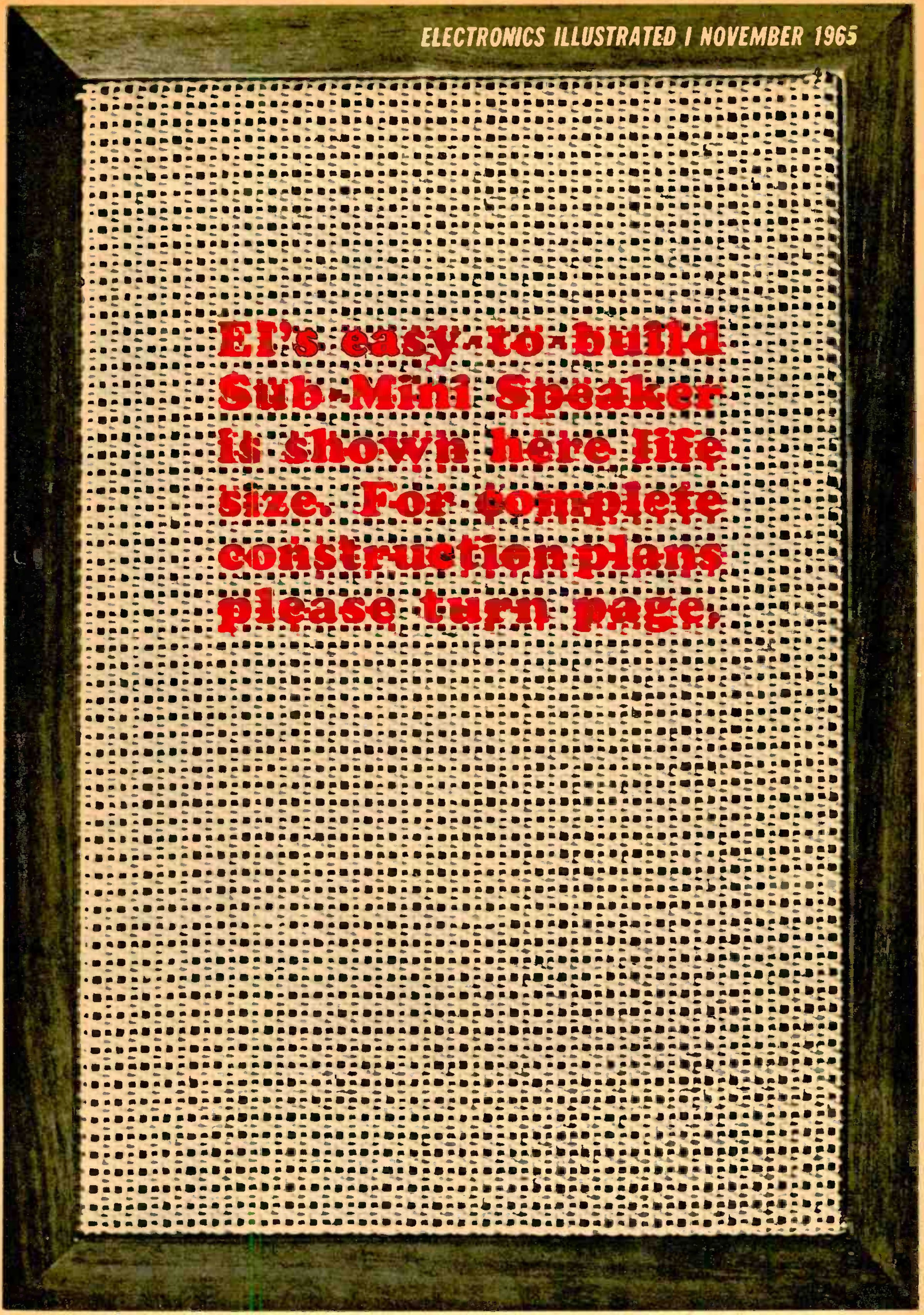

EI's easy-to-build Sub-Mini Speaker is shown here life size. For complete construction plans please turn page.

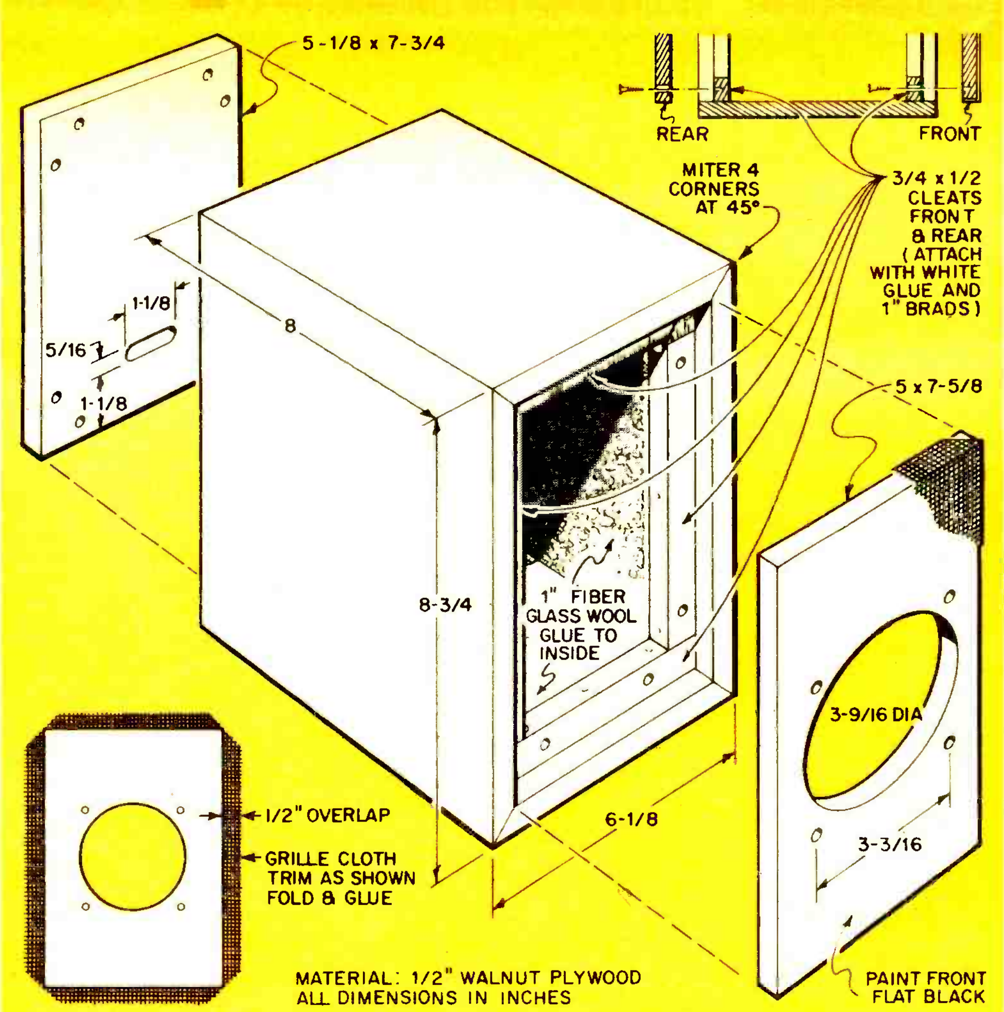


Fig. 1—Joints of our cabinet are mitered 45° but they could be butted together. For tight fit, rear panel's dimensions are same as inside of cabinet. Length and width of front panel is ⅛ in. less to allow for grille cloth. If necessary, use putty between panels and cleats for an air-tight fit.

By F. DAVID HERMAN Speakers are taking a page out of Wonderland and, as Alice would say, they're getting smaller and smaller. The cabinets are beginning to look as if they are made to be carried through a teeny-tiny door by a gnat.

EI herewith joins the parade toward the point of disappearance with a Sub-Mini speaker that is smaller than anything now on the market. Fact is, the Sub-Mini speaker is smaller than this page. But don't judge it on size alone. The Sub-Mini's sound will surprise you.

Since a pair will set you back only about $25, they're ideal for a budget stereo system or for extension speakers for your present system. And if it's space you're worrying about, two Sub-Minis won't even be noticed in a paperback-height bookshelf.

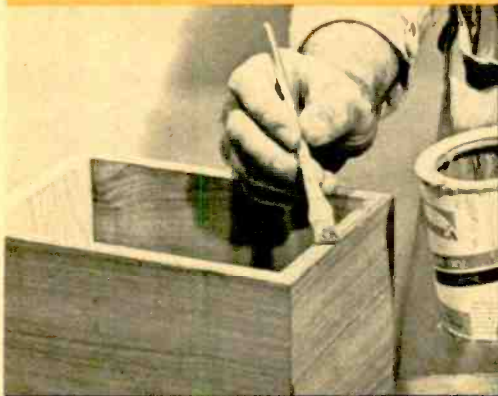
Or maybe you need a pair of speakers for better-than-average sound at a discothèque party. You can tuck two Sub-Minis under your arm and still have room for a stack of records—and maybe a partner or two to boot.

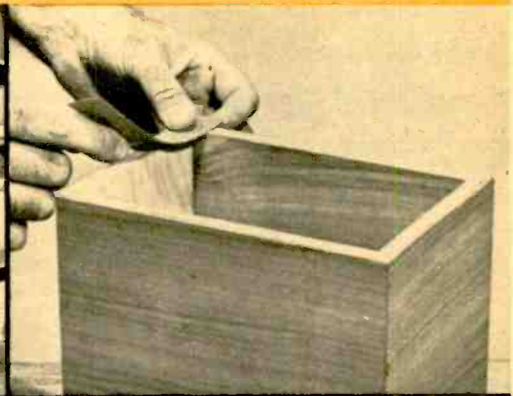
Why not build a pair if you're tired of the tinny sound from $2 speakers connected to a $500 tape recorder? You might even install a transistor amplifier in a Sub-Mini to carry along with the guitar at parties or picnics. The Sub-Mini is the answer to literally dozens of speaker problems.

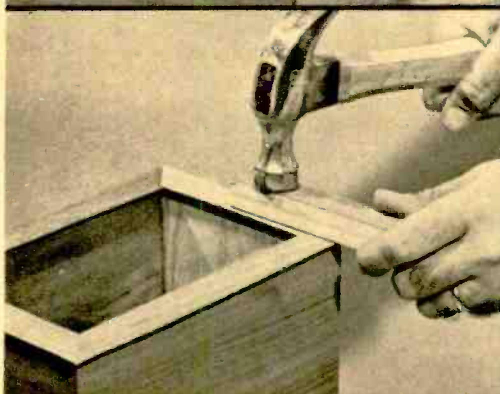
Come on, dig out those old woodworking tools you stuffed in the closet the day you took up electronics. A few square feet of walnut plywood and an evening's time are

Fig. 2—Mitering the cabinet's corners makes for a professional-looking job but the front must be taken care of. After assembly, apply a coat of contact cement to the front edges.

Fig. 3—After the contact cement dries, place pre-cut strips of walnut-finish wood tape on the edges. You can wind the contour-network coil while you're waiting for the cement to dry.







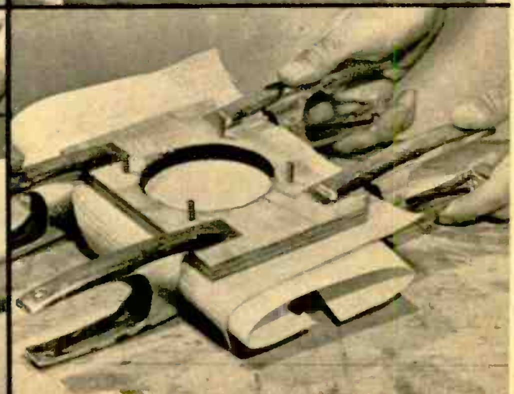


Fig. 4—To be sure of adequate contact, it's a good idea to pound the strip all around with a hammer, using a block of wood to protect the finish. Trim strips to thickness of the edges.

Fig. 5—After the speaker mounting screws are inserted and panel is painted flat black, put on stretched grille cloth and use a piece of scrap wood and clamps to apply pressure.

all it will take to build a pair of them.

The Design

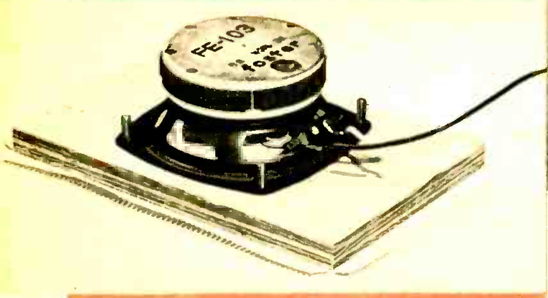
EI's Sub-Mini was designed specifically for applications that require an ultra-small speaker with what could be called medium-fi sound. (See A REASONABLE GUIDE TO MEDIUM-FI, Sept., '65 EI.) In terms of performance, there'll naturally be less bass than you'd get from a larger speaker.

How can the Sub-Mini sound much better than, say, a PA speaker in a wall baffle if it's so small and inexpensive? That is, how can you possibly expect to get decent sound out of a 280-cu. in. enclosure when the volume of most other speakers is measured in cubic feet?

For one thing, the Sub-Mini's 4-in. speaker, which is an acoustic-suspension design, has a very compliant, or loose, cone suspension. (See Fig. 7.) This goes a long way in keeping distortion down.

Another thing is the speaker's large magnet (see Fig. 6). This means a strong magnetic field surrounding the voice coil and greater back-and-forth cone movement. Large cone movement means a lot of air can be moved. Result is better low-frequency response than could be obtained from an ordinary replacement speaker of the same size.

The cabinet is completely sealed to permit the enclosed air to work as the cone's restoring force. This is the reason the Sub-Mini's cabinet is not a bass-reflex or ducted-port design.



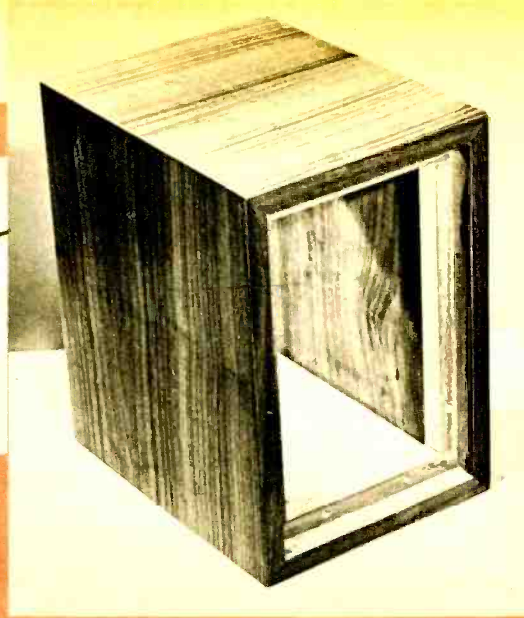


Fig. 6—When the grille-cloth glue dries, trim the excess material to ½ in., then fold it and glue or staple to the panel edge. Note the large size of the speaker's magnet. At right is completed cabinet ready for installation of the fiberglass wool and the panels.

It's all of these characteristics (which are found in many higher-price, large book-shelf speakers) that go toward producing the Sub-Mini's big little-speaker sound.

But this wasn't enough for us. In order to smooth out the response across most of the audio spectrum, we put a contour network (a resistor, capacitor and inductor in parallel) in series with one speaker lead. The purpose of the contour network is to match, or integrate, the speaker and the cabinet. The result makes the Sub-Mini's response flat, within 2db, from around 120 cps to 14 kc. And there's no prominent mid-range or upper end.

As we said, you won't get knee-bending bass. This is virtually impossible with a 4-in. speaker in *any* enclosure. But for enjoyable listening from a small cabinet, the Sub-Mini has few peers when compared to commercially-made speakers of equal size and the same, or greater, cost.

The Cabinet

You'll need a ½-in.-thick piece of walnut plywood about 40 in. long and 8 in. wide for the top, bottom, sides and front and rear panels.

Cut two 8 x 8¾-in. pieces for the sides and two 6⅛ x 8-in. pieces for the top and bottom. Next, miter the edges 45° as shown in Fig. 1. Nails are not used to fasten the top, bottom and sides together. Instead, use white glue and, after the pieces are put together, make certain they're absolutely square. If necessary, put the back and front panels in place temporarily. Tie rope around the frame to hold it together firmly until the

Fig. 7—Heart of the Sub-Mini is a 4-in. dia. long-throw speaker. Pencil tip points to edge of stiff cone, the remaining surround is a very flexible fabric. Note the large magnet. Power rating of speaker is 3 watts nominal, 15 watts music power.

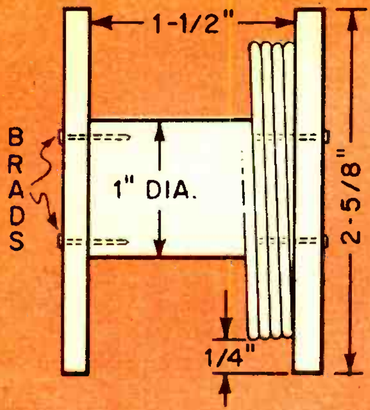
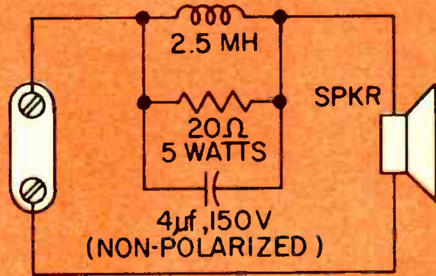


Fig. 8—Make a jig on which to wind the contour-network choke with a 1-in. dia. x 1½-in.-long dowel. Nail pieces of scrap wood on the ends and evenly wind wire until coil dia. is 2⅛ in.

Fig. 9—Note size of blocks of fiberglass wool above. We used two 2 µf capacitors in parallel in our contour network, the schematic of which is shown below.



glue dries.

After the glue has dried install the ¾ x ½-in. cleats, with 1-in. brads and white glue, at the front and rear of the cabinet as shown in Figs. 1 and 6. Drill holes in front cleats for the screws that hold the front panel in place.

Use a circle cutter to cut a 3-9/16-in.-dia. hole in the front panel for the speaker, then drill the four speaker-mounting holes. In the rear panel, cut a hole for the terminal strip and drill holes around the edges for the panel mounting screws.

Give the front panel a coat of flat black paint. After the paint dries apply a light coat of glue and insert flat-head screws for mounting the speaker. Stretch the grille cloth tight and put it on the panel. Fold the edges around the sides of the panel and glue or staple them in place. Be sure there are no bulges in the cloth and that the weave is straight. Mount the speaker on the front panel and set the panel aside.

The Contour Network

To wind the choke for the contour network, get hold of a 1-in.-dia. x 1½-in.-long dowel and nail two 2⅝-in.-square pieces of scrap wood or Masonite on each end. Wind in layers about 1 lb. of No. 18 enameled wire until the diameter of the coil is 2⅛ in. Disassemble the form and wrap the coil with electrical tape to hold it together.

Then mount the coil, the 4 µf (non-polarized) capacitor and the resistor on the inside of the back panel and connect them in parallel. Make sure the components are held down tightly so they won't rattle.

Put the front panel in place and fasten it with wood screws through the cleats. If the fit isn't air tight, put strip putty between the panel and cleats. Connect one speaker lead to the terminal strip and the other to the contour network. Line all sides of the inside of the cabinet with 1 in. fiberglass wool, then stuff the cabinet with 32 2-in. square blocks of fiberglass wool, as shown in Fig. 9. Mount the rear panel, making sure you have an air-tight fit. If the fit is loose, apply some strip putty where needed.

Hook up the Sub-Mini, sit back and listen. We're sure you'll be delighted.

PARTS LIST

- ½-in. walnut plywood: one piece 8x40 in. (approx. 2½ sq. feet)
- ½-in. walnut-veneer strip (approx. 30 in.)
- ¾x½-in. strip for cleats (approx. 50 in.)
- Grille Cloth
- 1-in. thick fiberglass wool
- ¾-in. round-head wood screws (20)
- #8x1-in. long flat-head machine screws and nuts (4)
- 4 µf, 150 V non-polarized capacitor (Lafayette 99 G 6041 or equiv.)
- 20 ohm, 5 watt wirewound resistor
- 1 lb. No. 18 enameled wire
- Speaker: Olson No. S-732. $8.98 plus postage (Not listed in catalog.) Olson Electronics Corp., 260 S. Forge St., Akron, Ohio 44308.

A NEW LOOK FOR

RESIDENTS of Tyrone, Pa., and Farmington, N.M., regularly are watching television from independent stations located 200 miles and more away. Inhabitants of little Honesdale, Pa. (pop. 5,569), have a wider selection of stereo-FM stations than listeners in New York City. Viewers in Chambersburg or Harrisburg, Pa., soon may have a choice of as many as 12 television programs at any given time (though there are only a quarter that many networks in the nation). And idiot-tube watchers in any of hundreds of small towns scattered across the country have a constant TV time-and-weather service unavailable in the big cities.

Perpetrator of this TV and FM bonanza is none other than community antenna television, a setup usually referred to as CATV. Cinderella of the television industry, CATV began life 15 years ago by relaying TV signals to viewers in Lansford, Pa., who, because of the Appalachians, previously could pick up nothing but snow on their screens. It was CATV or nothing. CATV grew up in mountainous or remote communities like Lansford. And, having come of age, it now is flexing its muscles in Philadelphia, New York, Washington, San Francisco, Los Angeles and other major population centers.

The new CATV basically is an extension of home receiving apparatus. And still it's true that communities where TV reception is less than excellent because of natural terrain, distance from stations or tall buildings stand to gain most from it. A CATV firm used to find a good reception location, build an array of antennas and connect them to homes in the community with a cable strung on telephone or power poles. Viewers could lease the service for $4 or $5 a month, once they had paid a nominal installation fee.

Until recently, CATV operators were content to provide the three networks to localities which had less than three TV stations. Then Jerrold Electronics developed the 12-channel reception and distribution system. About the same time, CATV operators began using microwave relay to import programs from independent and network stations outside the range of the system's own antennas. Result soon was a new look for CATV.

Early as 1963, viewers in Pennsylvania's Susquehanna Valley were tuning in the shows of independent stations in New York. Now there's talk within the industry of continuing the microwave relay from Pennsylvania to link up with a similar relay snaking eastward across Indiana from Chicago. Some industry spokesmen believe it eventually will be possible for Chicago viewers to catch the Million Dollar Movie from WOR-TV in New York while Gothamites tune their sets to Chicago's educational station, WTTW. Viewers in between, of course, could have both.

As CATV moves into bigger and bigger towns, the drive is on to find extras which will attract customers. An obvious one has been stereo-FM. As an official for a Florida CATV system said recently, "The same antennas that are up there pulling in TV signals also can pick up FM. All we do is to collect as many strong FM signals as we can, then feed them through the same cable with the TV signals.

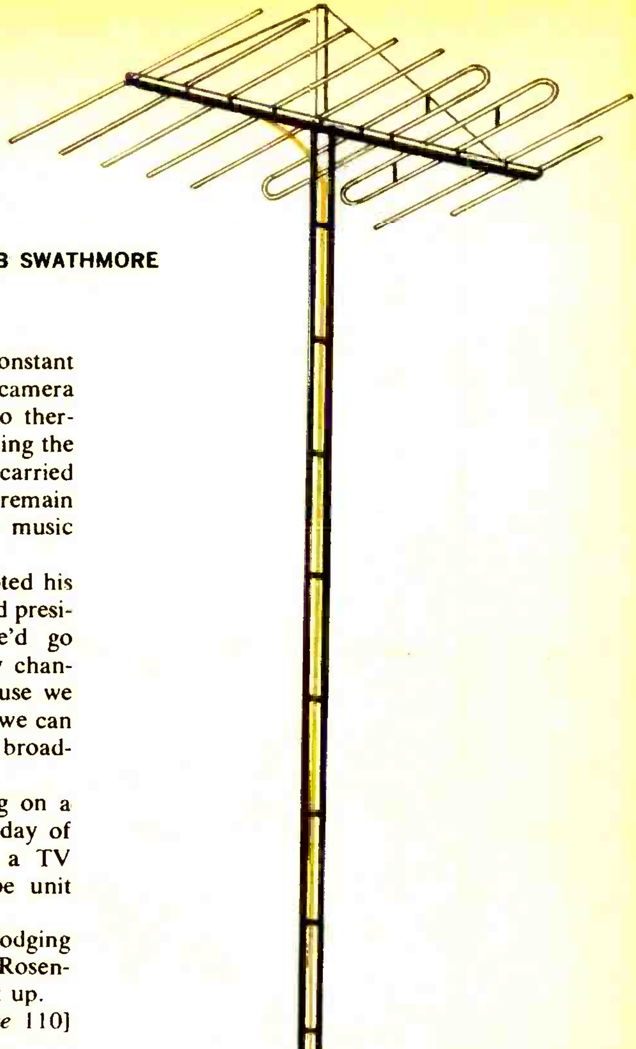
"At the home there's a divider tap—one for TV, one for FM. Whereas we have to convert the TV signal to another channel to feed it through the cable [channel 9 in New York City may be viewed on channel 5 in Danville, Pa., or on channel 6 in the Mohawk Valley of upstate New York], the FM stations appear at their normal places on the dial. If the station broadcasts in stereo, we carry it in stereo."

At the moment, FM fanciers in South Laguna, Calif., can receive as many as 40 stations on a regular basis. Those in Honesdale, Pa., get 49 from as far as 100 miles away. Unlike TV, FM hasn't been carried over long distances via multiplex relay. But it could be.

So far, CATV has been cautious about originating programs of its own—though some large systems are equipped to do so. Instead, program origination over much of

CATV

BY BOB SWATHMORE



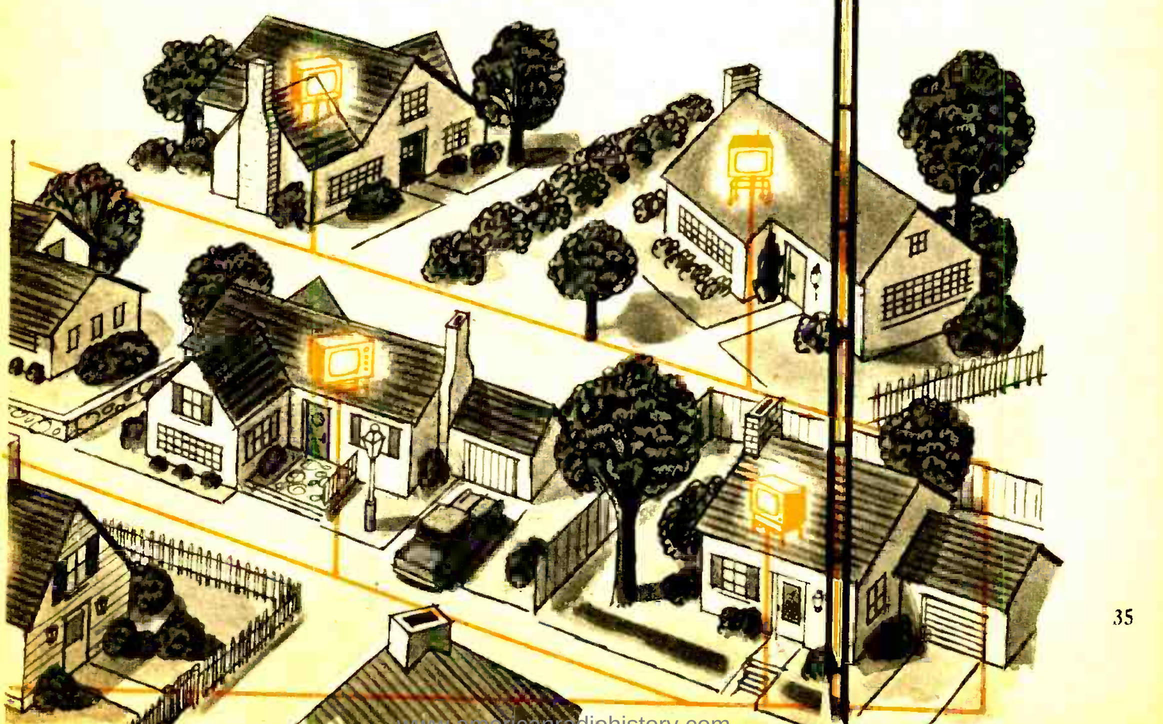
the country has been limited to a constant time-and-weather service (a TV camera swivels back and forth from clock to thermometer to barometer to a card carrying the local forecast). The service usually is carried on a channel which otherwise would remain dark—occasionally with background music provided by an FM station.

"If a commercial broadcaster devoted his only channel to such a service," Jerrold president Milton Shapp comments, "he'd go broke. But CATV can offer as many channels as people can absorb. And because we have so many channels to work with, we can cater to minority needs in a way no broadcaster can."

Shapp, whose firm now is working on a 20-channel system, predicts that the day of the continuous newscast—in which a TV camera is mounted facing a teletype unit—isn't far off.

And while the industry has been dodging the issue of program origination, Joel Rosenbloom of the FCC has been talking it up.

[*Continued on page* 110]



HI-FI TODAY

By John Milder

✔ *A record for better listening*

✔ *Zingless transistor sound*

EVERY once in a while I get a call from a friend or acquaintance asking me to drop over and check out some speakers. Seems they're buzzing or screeching or sizzling or making some equally unpleasant noise. Doesn't happen all the time—just on loud wham-bang finales, soprano screams, things like that.

Before the scene goes further I usually get in one question: "Does it happen on FM and tape, or just on records?" There's a minute of silence, and then the voice at the other end recalls that it seems to happen only on records. "I guess," he says, "it's not the speakers."

What is it? Well, about 99 44/100% of the time, it's a disease called too-light-tracking-force-itis. Story goes that most everybody has absorbed the information that light tracking forces can help records live longer. And somewhere along the line many people have picked up the notion that the lighter the tracking force the better. Thinking is that all you have to do is find the lightest force at which the needle will stay in the groove and you're in business. But I'm afraid that one just doesn't make sense.

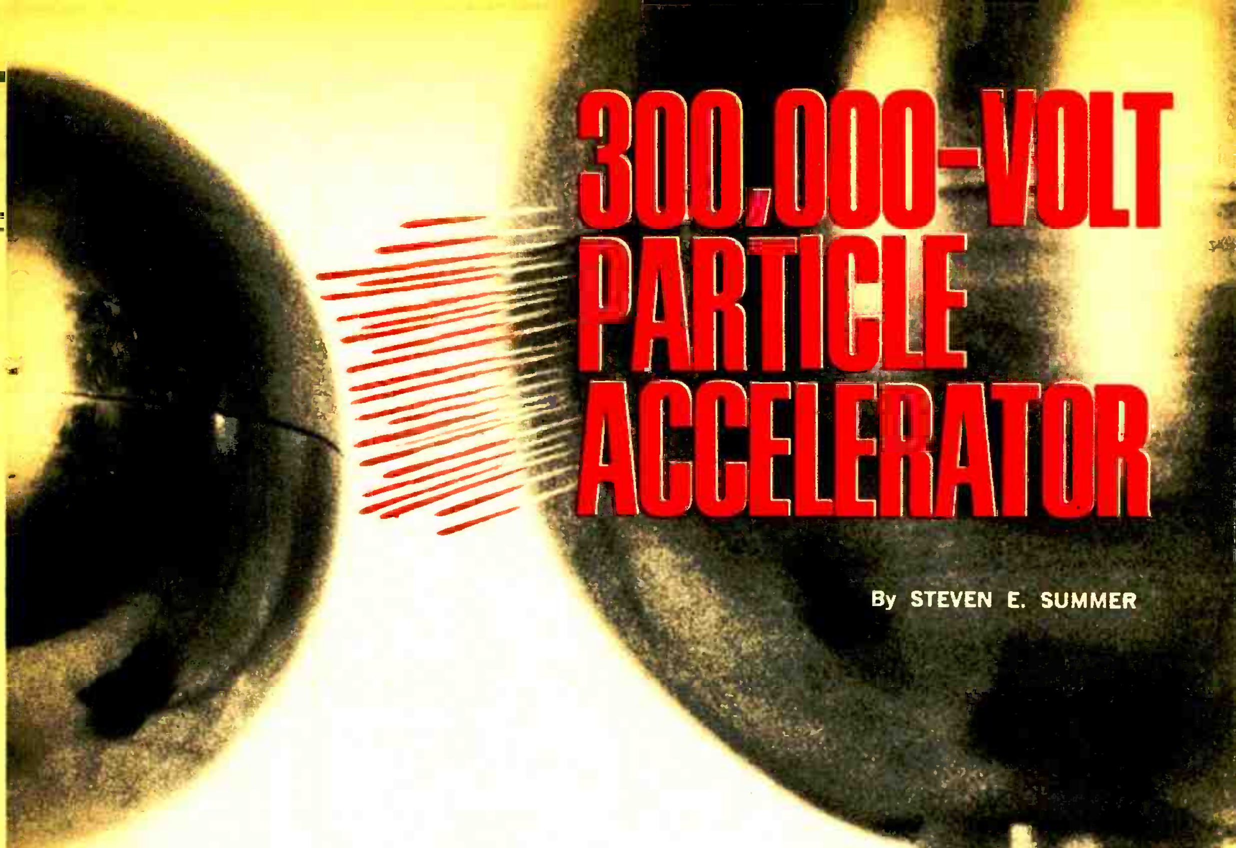
Why? For one thing, any stylus of the modern compliant variety will stay in the groove (in the sense that it doesn't skip from one groove to the next) at a force quite a bit lighter than the correct one. What's actually happening, though, is that the tip is losing contact intermittently with the groove walls and rattling around more than a little. This not only results in that deceptive speaker buzz on loud or otherwise demanding material but it also causes the stylus to chip away at the groove walls. Super-high frequencies disappear in two or three playings and records quickly are robbed of all fresh-out-of-the-jacket sparkle.

What *is* the right tracking force? Well, it is a function of the particular cartridge you use and is decided by such esoteric factors as the dynamic mass of the stylus assembly. You can translate this to say that the right force is the lowest one at which the stylus will maintain perfect contact with the groove on even the toughest recorded material.

And how do you find that point? One way is to pick a demanding record, set the force at its lowest point and keep edging it upward until you no longer hear a trace of distortion. But a better way is to use a disc specifically designed for the purpose. My top recommendation would be the new CBS test record, Seven Steps to Better Listening, which supplies, along with a great deal of other valuable test data, a foolproof method of setting the right force by ear. The record number is STR-101 and it goes for $5. If you

[*Continued on page* 112]

Seven Steps To Better Listening, a special test record designed to check a stereo system's channel separation, frequency response and the like, also enables you to determine the correct tracking force for your particular tone arm and cartridge. See text for details.



300,000-VOLT PARTICLE ACCELERATOR

By STEVEN E. SUMMER

THERE'S a touch of the mad scientist in all of us. At least we felt that way the other evening when we generated lightning bolts in the living room. And when that didn't startle all the guests we made one gent's hair stand on end and lighted fluorescent lamps from a distance.

Witchcraft or black magic? Not on your life! We did it scientifically with a particle accelerator—otherwise known as a Van de Graaff generator. The *particle-accelerator* term comes from the fact that the device excites (or accelerates) electrons to an extremely high energy level.

Besides being exciting entertainment, the generator is an excellent Science Fair project for static-electricity experiments. Its output is a third of a million volts but it's almost harmless because the current is very small.

The operating principle of the Van de Graaff generator is simple: static electricity is produced by friction between two different materials (such as wool and Lucite) when they are rubbed together. A good example of this is the crackle you hear when pulling a sweater off. Another example is the shock you get when you touch a doorknob after walking across a carpeted room.

Static electricity from everyday things cannot build up to high levels because it leaks away. But by charging a low-leakage, high-voltage capacitor with static electricity, the voltage goes sky high. In our generator, a 10-in.-dia. aluminum sphere and another sphere a few inches away form the capacitor.

A gum-rubber belt running from the bottom to the top of a 23-in. Lucite column has a charge put on it as it rubs against, or is turned by, a plastic pulley on the motor shaft. The belt carries the charge

300,000-VOLT

BILL OF MATERIALS

Lucite tubing and rod: dimensions in inches

Quantity	Length	O.D.	I.D.
1	23	2¼	2
4	1	2½	2¼
1	4	¾	⅝
1	4	⅝	½
1	4	½	⅜
1	4	⅜	¼
1	4	¼	rod

$12, postage included, for the lot from Industrial Plastics Supply Co., 324 Canal St., New York 13, N.Y.

10-in. dia. sphere: Available for $9 plus postage from Russco Metal Spinning Co., 123-07 101 Ave., Richmond Hill, N.Y. Specify 10-in. dia. Van de Graaff sphere with 2¼-in. dia. hole.

Ball bearings: Fafnir type S1K7. Order two from Jamaica Bearings Co., 138-72 Queens Blvd., Jamaica 35, N.Y. $1.32 ea. plus postage.

Rubber: Order 3 ft. of 1⅝-in. wide gum-rubber strip plus six gum-rubber grommets from Canal Rubber Supply Co., 329 Canal St., New York 13, N.Y. 75¢ postage included.

Motor: 1/15 hp., 12 oz.-in. torque AC/DC motor (Lafayette 19 G 2410)

10-in. insulated sphere on stand. Welch No. 1911. Welch Scientific Co., 7300 N. Linder Ave., Skokie, Ill. $10 plus postage.

Misc.—Wood and machine screws, flashing aluminum, copper screen, binding post, aluminum plate, .005 µf, 1,000 V ceramic disc capacitor, line cord, aluminum foil, electrical tape.

to the top pulley where it is transferred to the sphere and accumulates. After a few seconds of operation, the charge becomes great enough to jump the gap from the generator sphere to the other sphere (connected to the ground lug).

The charge, and consequently the size of the spark, will be reduced by humidity, moisture and dirt on the column and dust and burrs on the sphere. Always keep everything clean. The intensity or fatness of the spark increases if the belt is made wider or if it turns faster. The maximum voltage (read in kilovolts) is about 30 times the sphere's diameter (read in inches).

Construction. To insulate the sphere properly from the base, the column's height should be at least twice the sphere's diameter. And the column must be made of Lucite. A cardboard mailing tube will not work. The base can be made from any kind of wood

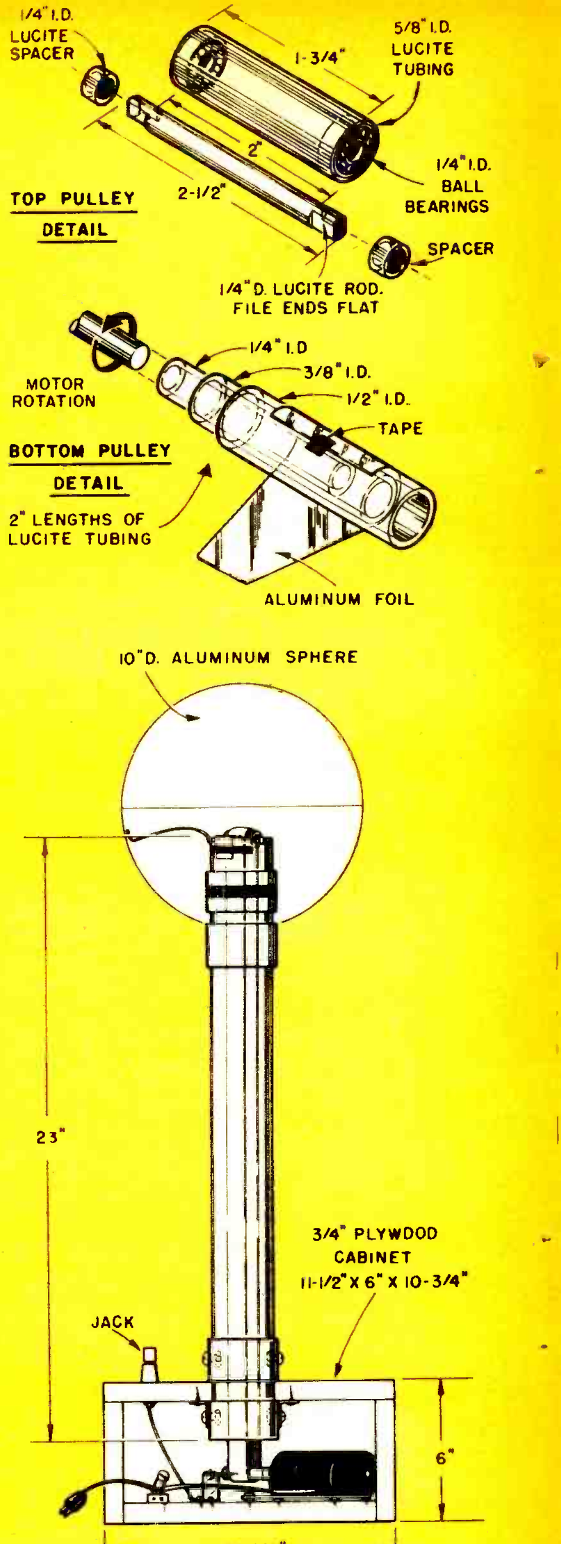


Fig. 1—Upper and lower pulley details, top. Note in bottom diagram how Lucite rings are used to clamp sphere and cabinet to column.

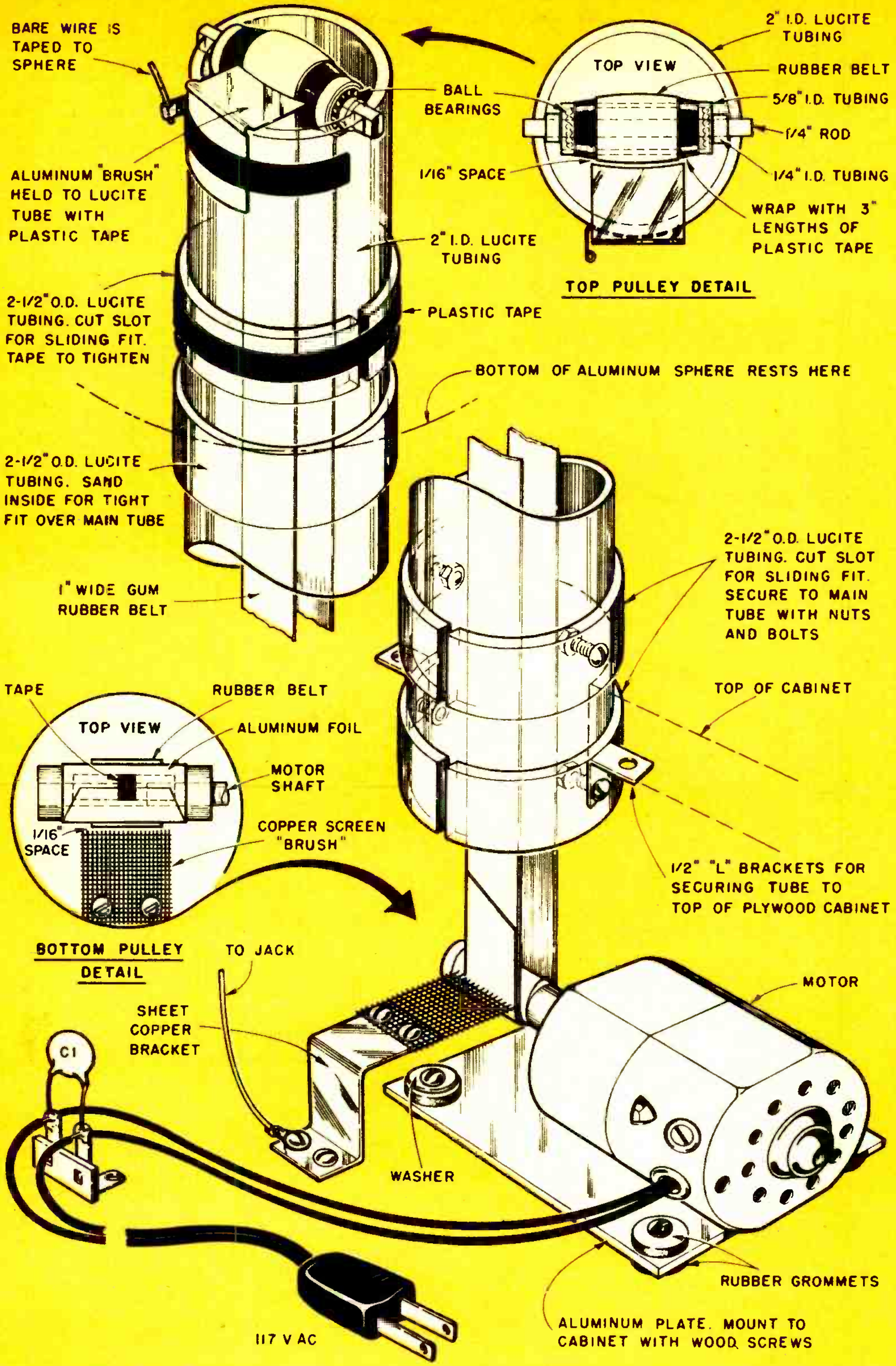


Fig. 2—Aluminum and copper brushes at top and bottom pulleys must be positioned so the edges are about 1/16 in. away from belt at point where belt is tangent to pulley. The ¼-in. I.D. spacers on top pulley prevent horizontal movement. The axes of rotation of pulleys must be parallel or belt will slip off.

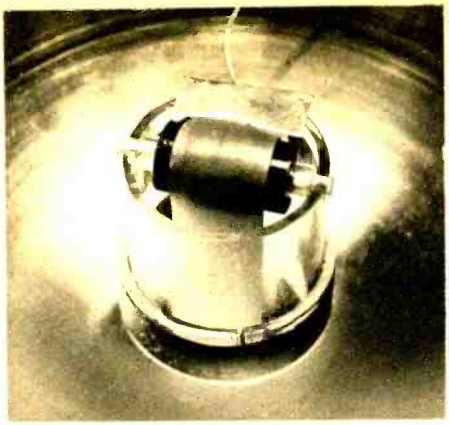
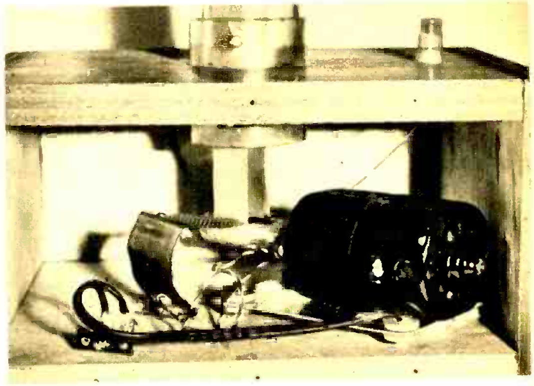


Fig. 3—Top pulley, left. If the belt moves toward one side of pulley, file the notch deeper on the other side of the column. Motor mounting, below. If the belt slips off the bottom pulley, tighten up on the front or rear screws in the mounting plate. The ground binding post above the motor gets connected to the lower brush.



300,000-VOLT

that is at least ¾-in. thick (see Fig. 2).

Use a ½-in. drill or chassis punch to make four mounting holes in the 3 x 5-in. aluminum motor plate, then drill two ¼-in. holes in the plate for the 10-32 motor-mounting screws. Install the motor on the plate and put a gum-rubber grommet in all mounting holes.

The lower pulley is made of three pieces of Lucite tubing which telescope (after light sanding) into one another. When the three pieces fit together snugly, push the pulley on the motor shaft.

Wrap heavy aluminum foil (fastened with tape) around the lower pulley *opposite* to the direction of the shaft's rotation. Position the motor-mounting plate so the pulley is centered squarely below the Lucite column.

Make a cut with a fine-tooth coping saw down the side of three 2¼-in. I.D. x 1-in.-long rings of tubing. Drill two 3/16-in.-dia. holes on the diameter line of each of the two rings. Install the column in the base and fasten one ring on the bottom, using the screws that hold two L-brackets. Slide the other ring down the column to the top of the base and attach it also with the L-bracket screws. The column must neither rotate nor move up and down.

Saw two 3/16-in. wide and deep notches in the top of the column directly over the lower pulley (see top-pulley detail in Fig. 3). Sand the inside of the uncut piece of 2¼-in. I.D. tubing until it can be force-fitted on the column. Push it down 5 in. from the top. Put the bottom half of the sphere on the column and secure it with the remaining piece of 2¼-in.-I.D. tubing. *Don't* attach the top rings with screws. Tighten the upper ring with tape.

To make the top pulley, force the two ball bearings into a 1¾-in.-wide piece of ⅝-in. tubing. Tightly wrap 3-in. lengths of electrical tape on the tubing so that a crown is built up in the center. Sand a piece of ¼-in. Lucite rod until it slips freely into the ball bearings. Then cut it to length and file the ends flat. Put a piece of ¼-in. I.D. tubing on each side of the ¼-in. rod to act as side spacers.

Experiments. To get a bright spark you'll need another metal sphere connected to the ground terminal. We specify a sphere and stand in the Parts List, but you could use the back of a round soup ladle. A pointed electrode will produce only thin streamers.

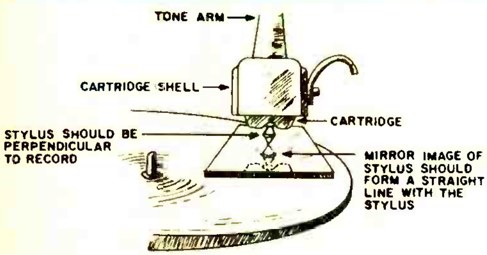
To stand your hair on end, make an insulated platform by putting a piece of plywood on top of glass jars. Step on the platform and grasp the sphere. Then have a friend turn on the power. Before you take your hands off the sphere your friend must shut off the generator and discharge it (and you). After lighting up fluorescent bulbs, short both ends to discharge them before putting them away. Remember: *don't* permit yourself to come between the charged ball and ground, especially if the charge can pass through the heart. Such high voltage, if going to ground, can be dangerous and might even stop your heart.

GOOD READING

By Tim Cartwright

***HI-FI TROUBLES . . . How You Can Avoid Them . . . How You Can Cure Them.** By Herman Burstein. Gernsback Library, New York. 159 pages. $3.95*

Trouble with most books like this one is that the author is an electronics buff with only casual interest in hi-fi. But this isn't the case with Herman Burstein. He's been handling technical topics (particularly tape recording) from an audiophile's point of view for years. And for all the things one might say about this book, its biggest asset is the sense it gives that the author himself has traveled the route he describes.



The troubles, by the way, are not just specific illnesses in hi-fi gear but anything that may stand in the way of getting the most out of your equipment. (Our illustration, taken from the book, shows how to determine whether a stylus is aligned properly with respect to record grooves.) And if the book has a weakness, it's only that one of the biggest audio villains, the tube, definitely (if grudgingly) is on the way out, and that manufacturers accordingly have been getting more conscientious about ironing out problems they used to leave to the audiophile.

But that's not to say that we now can do without a book like this one. It's recommended without reservation and with special note of a new and readable format from Gernsback.

***ELECTRONICS PROJECTS FOR STUDENTS, BEGINNERS & HOBBYISTS.** Semitronics Corp., New York. 96 pages. $1.95*

Here's another pump-priming little book designed, among other things, to sell some transistors. The virtue of this one is that it promises to be fun for a lot of hobbyists. The projects range from a crystal set in modern dress through a miniature electronic organ to an applause meter. And if there's no pretense of teaching electronic theory, there is the assurance of some useful as well as entertaining gadgets.

***SOLAR CELL & PHOTOCELL EXPERIMENTERS GUIDE.** By Stu Hoberman. Howard W. Sams & Bobbs-Merrill, New York & Indianapolis. 128 pages. $2.95*

Though this one also offers construction projects, emphasis here is a bit different. There is much more concentration on supplying basic information for the curious tinkerer to work with. The projects themselves take up roughly half the text and include such useful gadgets as a photographic slave flash unit and an automatic tape-recorder stop.

***FUNDAMENTALS OF RADIO.** By Murray P. Rosenthal. John F. Rider, New York. 318 pages. $8.95*

There is nothing unusual about the approach or general format of this book but it is a well-organized, thorough and up-to-date treatment of the subject. Emphasis primarily is on vacuum-tube circuitry but there is concise and accurate coverage of transistors as well. A good all-around basic text.

***ELEMENTS OF COMPUTER PROGRAMMING.** By Kenneth P. Swallow and Wilson T. Price. Holt, Rinehart and Winston, New York. 353 pages. $6.95*

This unusually concise and thorough approach to computer programming is organized around the IBM 141 Data Processing System. Everything is geared to practicality and immediate usefulness to a student and those seeking a leisurely introduction to computer theory best had look elsewhere. But for those who assimilate new material quickly, here is a crash course like few others.

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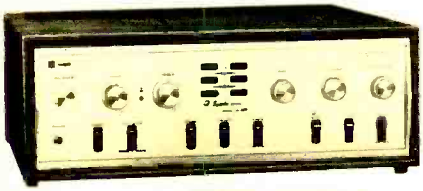

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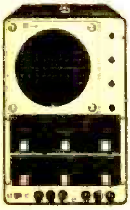

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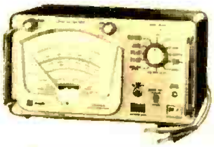

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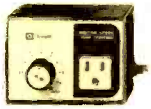

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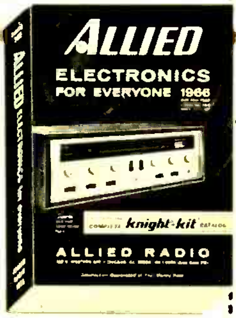

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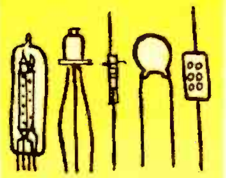


BEGINNER'S CORNER

THE DOPE

Fig. 1—Coils in boxes are standard off-the-shelf items. At left is Air Dux made by Illumitronic Engineering. Coil in box at right is Barker and Williamson Miniductor. Coil standing at upper left is wound on cardboard tube from roll of bathroom tissue. Other forms are all catalog items.

MOST parts used in experimental projects can be bought ready-made. You'd never think of making your own tubes, transistors, resistors or capacitors. But often an RF circuit calls for a coil of a special value that can't be found in any catalog. So it has to be custom designed and wound.

To show you how easy coil design can be, we're going to make a coil for a field-strength meter (Fig. 4). It's a handy accessory for measuring the relative output power of a ham or CB transmitter. Though our coil is for the 40-meter (7-7.3 mc) ham band, you'll be able to make a coil for most any other band by repeating this step-by-step procedure.

Rather than spend hours wrestling with mathematical equations, we'll use an inexpensive coil calculator. Two are available. One is the $1.50 Lightning Calculator (Type A) sold by the American Radio Relay League. The other, which we will use, is Allied Radio's 50¢ RF Resonance and Coil-Winding Calculator (Stock No. 37 K 955).

Okay, we want to tune 7 to 7.3 mc. What next? Remember the formula for resonant frequency? It is:

$$fr = 1/2\pi\sqrt{LC}.$$

(We won't have to use the formula since the calculator solves the equation.) *fr* is frequency in cycles per second, L is inductance in henries and C is capacitance in farads. So far we know that fr is 7 mc (7,000,000 cycles), which is the low end of the 40-meter band. The big problem is determining L and C. It's simple enough to solve for L or C ($L = 1/4C\pi^2fr^2$) and ($C = 1/4L\pi^2fr^2$). But the formula can't be used to determine *two* unknowns. We must know either L or C to get the other. It's a fundamental rule of algebra: two unknowns mean two equations.

When we set up the calculator for 7 mc, we find two extreme combinations of L and C on the scales. One is a 1,000 $\mu\mu$f capacitor and a 0.5 μhy coil. The other is a 3 $\mu\mu$f capacitor and a 170 μhy coil. Between these two (and beyond) there are as many other combinations of L and C as you can read off the scales.

Which is better? In pure theory, it's the first. Why? Because in our circuit, we want sharp tuning, which can be achieved best with a large capacitance. And a high value for C will reduce the number of coil turns, which will lower the resistance and raise the Q of the circuit.

But a 1,000 $\mu\mu$f variable capacitor simply isn't available. Also, it probably would have

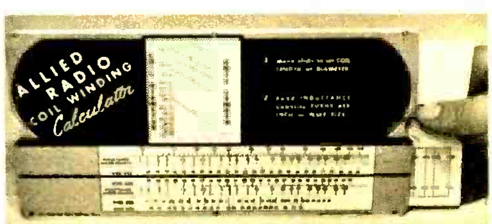


Fig. 2—A calculator is invaluable for relating capacitance, inductance, frequency, coil diameter and length. Shown above is Allied Radio's.

ON COILS

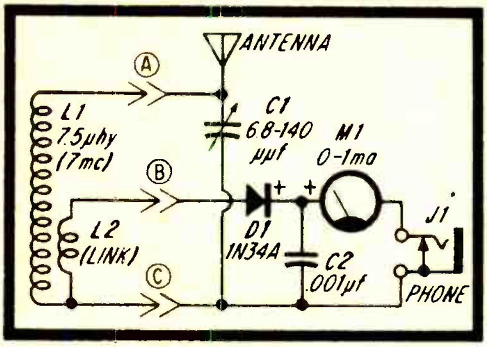


Fig. 3—Schematic of 40-meter field-strength meter. For other bands, use plug-in coils, which connect at A, B, C. Two-turn link of hook-up wire matches impedance of coil to that of rectifier circuit.

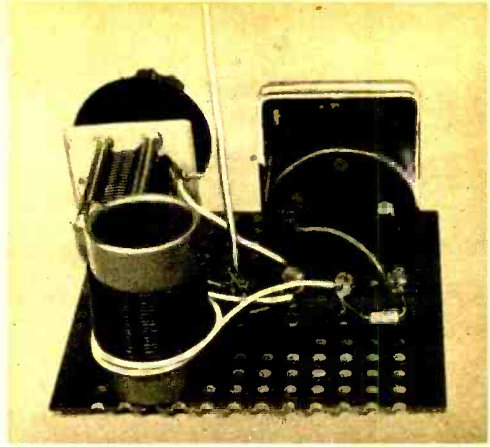


Fig. 4—Rear view of field-strength meter. Variable capacitor used in our model is Hammarlund APC-140B. Two-turn link at bottom of coil is for 7 mc. For higher frequencies, wind only one turn.

a lot of inductance, like a coil, which would cause problems.

Generally, variable capacitors are available up to about 400 μμf. To choose one, keep the following rule-of-thumb in mind: to tune frequencies up to 2 mc, use a standard broadcast-band variable capacitor which has a maximum capacitance of about 400 μμf. For frequencies from 2 mc to around 80 mc, the variable should have a maximum capacitance of about 150 μμf. Higher frequencies don't need as much capacitance.

With these points in mind, we selected a variable capacitor with a maximum capacity of 140 μμf. To find the inductance to go with this, we simply set up the coil calculator for 140 μμf and 7 mc. We find we need a 3.6 μhy coil.

Next, check the *highest* frequency the capacitor will tune at its *minimum* capacitance with a 3.6 μhy coil. The capacitor we selected has a minimum capacitance of 6.7 μμf. (Variable capacitors have both maximum and minimum capacitance listed in catalogs.) Again we call on the coil calculator. This time we set it up for 6.7 μμf and 3.6 μhy. The calculator tells us the highest frequency we can tune will be about 30 mc.

We now know the field-strength meter will tune from 7 to 30 mc. (All we need is 7 to 7.3 mc.) This looks good on paper but will vary in practice. Reason: incidental circuit capacitance tends to give us a different range. But there are ways to counteract this.

The lowest frequency that can be tuned at maximum capacitance of the variable capacitor should be *below* the desired frequency —in this case 7 mc. Since we have a wider tuning range than we need, it is better to select a coil that will shift the bottom end of the tuning range down to 5 mc. The calculator tells us 140 μμf and 5 mc require a 7.5 μhy coil. When the capacitor is set at its minimum capacitance of 6.7 μμf the highest frequency that can be tuned is 24 mc. Thus with a 6.7 μμf to 140 μμf variable capacitor and a 7.5 μhy coil, our tuning range will be 5-24 mc.

But why not select an inductance that places 7 mc precisely in the center of the variable capacitor's tuning range? Because the more capacitance in a tuned circuit, the higher its efficiency. For this reason, 7 mc was put near the high end of the capacitor's range where plates are nearly closed.

What's more, our 5-24 mc tuned circuit performs poorly from about 12-24 mc because little capacitance is in the circuit at the high-frequency end of the tuning range. This factor is important if you're thinking about tuning the 20-meter (14-14.35 mc) ham band. The 7.5 μhy coil would tune it but results would be better if you designed another coil that with 140 μμf would tune from 12 mc up.

Now that we know a 7.5 μhy coil is required, let's wind it. Again, there will be juggling of coil length and diameter. In general, inductance will be greatest when coil length

[*Continued on page* 113]

KIT EI REPORT

J.W. Miller 565

Fancy Crystal Tuner

THE J.W. Miller Co. is a big name in coils but perhaps it also should be renowned for crystal sets. As suggested by its name, Miller's No. 565 High Fidelity Broadcast Band AM Tuner Kit is about the fanciest crystal rig ever found on these shores.

The little tuner (see photo above) is a true crystal set devoid of a power supply. Its only power is supplied by the same source that brings in the program material—an AM radio signal.

Miller suggests in its literature that the 565 should, as an AM tuner, be a companion set to the FM tuner in a hi-fi system. Wild as the suggestion may sound, it actually makes pretty good sense for a hi-fi fan who has nothing but an FM-only tuner. The set also should be of interest to experimenters, tinkerers and youngsters.

The kit costs $17.70 (or $21.75 wired). A $2.25 adaptor is necessary if you want to listen via headphones. Otherwise, the 565's output must be fed into a preamp.

Our builder put the receiver, with its dozen components, together in about two and a half hours. The parts are assembled on a small board which has brass eyelets for connective points. Assembly is simple.

Unfortunately, cellophane tape is used in packing the parts and when it comes into contact with the knobs there is a chemical reaction that mars the finish permanently.

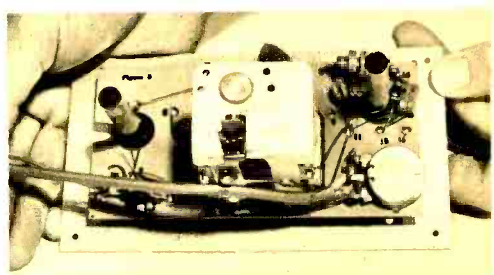
For reasonable performance, the Miller crystal set requires a good ground and a sizable antenna (the company suggests a 75-footer). The 565 shows good sensitivity and should pick up all local stations. Selectivity is excellent for a crystal set.

The instructions tell you to feed the output into the mike or phono input of a preamp. Since most preamps no longer have mike inputs, this leaves you with an equalized (RIAA) phono input, which means that all high frequencies are chopped off and there is a big bass boost. But distortion is low (around 1 per cent) and the 565 does give you quite listenable sound. No power supply means no hum.

The circuit amounts to a sophisticated filter. Two tuned circuits with high-Q coils are coupled by mutual inductance. A germanium diode serves as crystal detector. A wide passband gives excellent frequency response so the High Fidelity in the name is warranted.

Output is proportional to received signal strength and can range from a few millivolts to well over a volt. When tuning, it is necessary to turn down the amplifier's gain control or, in passing from a weak station to a strong one, you can blow a speaker quite easily.

Summing up, in its field, the Miller 565 has no peers—and no competitors, either.



Assembly board of tuner is shown mounted on front panel. Variable capacitor is in center, two coils are at upper right, third coil is at the left.

the ABCs of RADIO

By JOHN T. FRYE, W9EGV

PART 2: THE CARRIER

BEFORE any radio signal can radiate out into space it somehow must be persuaded to leave its nest—in other words, the antenna. Part of this persuading can be done if we set our frequency at hundreds of thousands of cycles per second and make the length of our transmitting antenna an appreciable part of the carrier's wavelength.

From physics you know that AC flowing through a wire surrounds that wire with a *magnetic field* composed of concentric lines of force spreading out from around the wire as current increases and collapsing back toward the wire as current decreases. These lines move with the speed of light but the expansion-contraction bit still takes *some* time. At 60 cycles per second there is plenty of time for the magnetic field to get safe home in the wire while the current is stopping and reversing direction. But raise the frequency to a half-million cycles and a new reversed magnetic field is starting to push out before the old one can collapse into the wire. The old one takes the hint and keeps going right on out into space. So do the next and the next and the next.

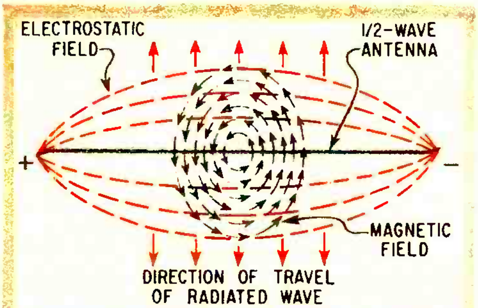


Fig. 2-1

Our magnetic field has a traveling companion. Think about an antenna a half-wavelength long, as shown in Fig. 2-1. RF current surging back and forth through the wire—the same current that produces our pulsing magnetic field—causes electrons to pile up first on one end of the wire and then the other. Potential differences between alternating electron-rich and electron-poor ends of the antenna create a pulsing, reversing *electrostatic field*. The electrostatic lines of force are at right angles to magnetic lines of force and the direction of wave travel is at right angles to both. A wave is said to be *horizontally* or *vertically polarized*, depending on whether the electrostatic lines of force are parallel or perpendicular to the earth's surface.

Keep in mind there are two different fields: the induced field close to the wire is an in-and-out-proposition, while the radiated field moves out and keeps right on going. In the immediate vicinity of the antenna the two fields interact and cause differences in phase and relative amplitude. However, as soon as the radiated wave is a few wavelengths away from the antenna the two fields settle down to a fixed relationship which they maintain.

Radiation spreads out in all directions from the transmitting antenna as shown in Fig. 2-2. Notice one part, called the *ground wave*, skims the earth. Another part goes directly from one elevated antenna to another. This is called the line-of-sight or *direct wave*. Under some favorable conditions this wave may be bent downward in a portion of the atmosphere called the *troposphere* so that it reaches an antenna otherwise hidden by the curvature of the earth. Still another part, the *sky wave*, goes up into another part of the atmosphere called the *ionosphere* where it is refracted back to earth in some instances and keeps on going out into space in others.

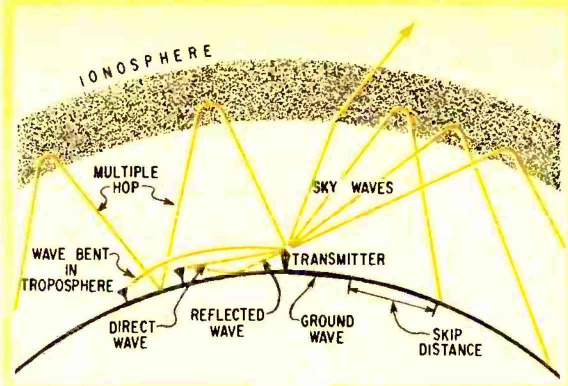


Fig. 2-2

The ground wave must be polarized vertically if the conductive earth is to be prevented from short-circuiting the electrostatic field. And even then the wave sets up currents in the earth that absorb energy and weaken it (the wave). This happens to a greater extent as the frequency of the wave increases. Broadcast stations, however, operate on comparatively low radio frequencies and their vertical transmitting antennas radiate vertically polarized waves. The ground wave accounts for practically all daytime broadcast reception. With sufficient transmitting power, a ground wave can be sent a couple of hundred miles on the low end of the broadcast band. With the same power at 30 mc, the ground wave will die out in a fraction of this distance.

Both VHF and UHF TV and FM signals depend chiefly on line-of-sight waves for reception. As shown in Fig. 2-3, these direct waves are supplemented somewhat by waves reflected upward from the ground or bent downward in the troposphere. Television transmitting antennas are placed quite high so their direct waves will graze the earth as far away as possible. Such an antenna atop a 1,000-ft. tower will send line-of-sight signals about 45 miles to the horizon. Raising the receiving antenna extends the reception distance.

Most short-wave and long-distance night-time broadcast-band reception is by means of sky waves reflected or refracted back to earth by the ionosphere, a portion of the atmosphere located between roughly 30 and 300 miles above the earth's surface (see Fig. 2-4). The ionosphere is composed of varying densities of ions and free electrons produced when gas molecules are split up by ultraviolet radiation from the sun. Stratified areas of increased ionization are called *layers* and bear such identifying letters as D, E, F1 and F2. Since these layers depend on the sun for their generation, it is not surprising that heights and densities vary with daylight and darkness, with the proximity of the sun, with the season of the year and with the waxing and waning 11-year sunspot cycle.

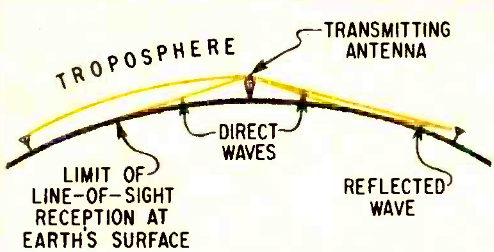


Fig. 2-3

A wave entering an ionized layer is refracted or bent away from the more heavily ionized center of the layer, as shown in Fig. 2-5. The amount of bending increases with ionization and decreases as the frequency of the wave goes up. Whether the wave is refracted sufficiently to return to earth depends on 1) the amount of ionization of the layers, 2) the frequency of the wave and 3) the angle at which the wave strikes the layer. In some instances the ionization is low enough, the frequency of the wave high enough and the angle of incidence great enough that the signal goes right on through the layer. In the event one of these conditions is not quite met, the signal may be refracted but still miss the earth.

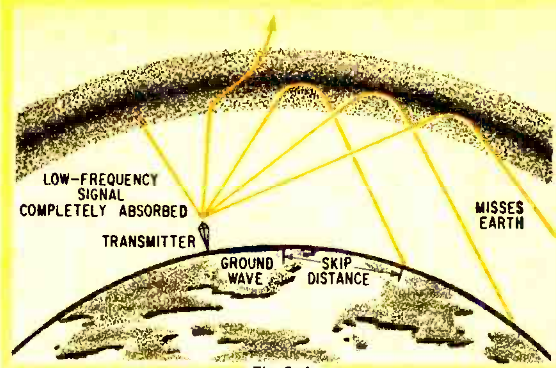


Fig. 2-4

In many cases, especially on the short-wave bands, the sky wave only returns to earth at some distance from the transmitter. There is a space between where the ground wave dies out and the sky wave is returned to earth and here the signal cannot be heard. This no-signal area is called a *skip zone.* In other instances a signal may reach a point even on the other side of the earth from the transmitter by making two or more hops as the signal is refracted in the ionosphere.

The ionosphere does more to a radio wave than reflect and refract it. Ionization also extracts a toll in the form of energy absorbed from the wave. This absorption goes up with ionization and with the decreasing frequency of the wave. In fact, broadcast frequencies are absorbed entirely during heavy daytime ionization. Only when darkness lowers the ionization and reduces absorption are broadcast sky waves able to return to earth and provide long-distance reception.

At night a broadcast signal may reach a receiver by both the ground wave and the sky wave. The distance traveled by the latter is not only much longer but also shifts from minute to minute with changes in the ionosphere (see Fig. 2-6). Remember the fields of the wave are alternating fields, constantly zigzagging as the wave travels. It seems reasonable, therefore, to assume the two portions of the wave may or may not be zigzagging precisely together when both reach the receiving antenna by separate paths. If the alternations are in step, or *phase,* they reinforce each other and the signal is louder than would be the case if either portion were absent. But a little later a shift in the ionosphere may lengthen or shorten the path of the sky wave so that it is zigging at the receiving antenna when the ground wave is zagging. In this case the two parts of the signal buck each other and produce weaker reception. In fact, if the amplitude of the sky wave and the ground wave are equal and opposite in phase the signal will be cancelled entirely.

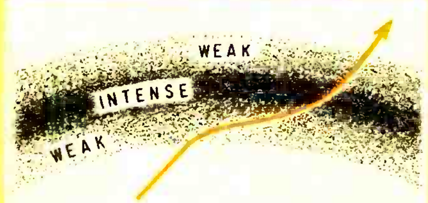


Fig. 2-5

This *fading* effect is particularly bad on the broadcast band at night at the outer edges of the ground-wave area where the ground-wave signal and the sky-wave signal are likely to be about equal in strength. Any time you have a signal reaching the receiving antenna by two different paths, at least one of which is subject to variation in length, you have conditions favorable for fading. Slightly different frequencies often travel somewhat different paths through the ionosphere. When this happens to the two sidebands of a signal, the modulation components frequently will get out of step and produce a garbling type of distortion called *selective fading*.

The chart below presents some basic facts on the ionosphere and its effect on waves trying to pass through it. Studying this and Fig. 2-2 should clear up many puzzling things about radio reception. To spark you off, here are some questions and answers you should be able to handle.

Q. Why do I hear farther on short waves than the broadcast band?

A. Short waves are not absorbed to as great an extent. Neither are they refracted as much. Consequently they are returned to earth at great distances from the transmitter with less attenuation.

Q. Why does the 28-mc band go dead during the minimum sunspot cycle but DX conditions on the 4-mc band improve?

A. During the weak ionization conditions that accompany the minimum sunspot cycle, the high-frequency 28-mc waves are not refracted to earth. At the same time absorption of the relatively lower frequency 4-mc signal decreases and the lessened refraction permits sky waves to be returned to earth at greater distances from the transmitter than was the case with the heavier ionization.

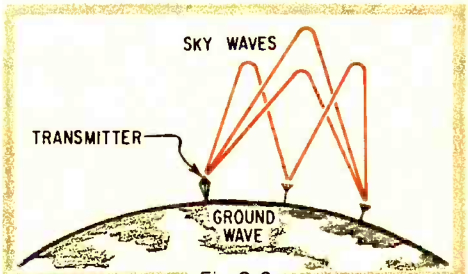


Fig. 2-6

See how easy it is? Now you try it. Study the chart, look at the figures and *think!*

So here we have radio signals skimming the ground, shooting straight as an arrow from transmitting to receiving antenna or arching up into the sky and back down. Out of this welter of darting waves we want to sort out a particular signal and start recovering the modulation from it. And this, as you already may have guessed, will be the subject of our subsequent installment.

EFFECTS OF IONIZATION ON THE RADIO SPECTRUM

	FREQUENCY BAND			
Degree of Ionization	Low Frequency (30 to 300 kc)	Medium Frequency (300 to 3000 kc)	High Frequency (3 to 30 mc)	Very High Frequency (30 to 300 mc)
Strong	Absorbed	Reflected to earth very near transmitter	Reflected to earth farther away	Reflected to earth at a distant point
Medium	Reflected to earth very near transmitter	Reflected to earth farther away	Reflected to earth at a distant point	Not reflected
Weak	Reflected to earth farther away	Reflected to earth at a distant point	Not reflected	Not reflected

NEXT ISSUE: TRAPPING THE SIGNAL

The Attaché 80

By CHARLES GREEN, W3IKH

IS that 007 checking in on a special assignment? A financial bigwig about to conclude a million-dollar deal? Or maybe he's a diplomatic courier delivering top-secret plans for a new missile defense system.

Our nattily dressed gentleman is none of these—he's just a ham on a trip. But in that attaché case is a compact 40-watt, 80-meter transceiver that he always takes along when he travels. No wild nights on the town for this chap when he's away from home. Instead, he's on the air all evening. The Attaché 80 measures 10 x 11 x 2¼-in. and weighs in at about 10 lbs. The whole station is in that one case and it does not need an elaborate antenna installation.

The transmitter uses a 6GJ5 beam-power amplifier tube as a combined crystal oscillator and power amplifier. The receiver consists of two 6U8A's in a superhet-regen circuit that has a built-in speaker. The power supply contains a husky transformer, four silicon rectifiers (in a modified bridge circuit) and an OA2 voltage-regulator.

Unlike many EI projects built on a conventional chassis or in a Minibox, the Attaché 80 is built with ½x½-in. aluminum angle and ½-in. aluminum strips. Such material is available from metal suppliers whose names you'll find in the classified telephone directory (Yellow Pages). It will take a bit more work than the usual project, but it will be well worth the effort. The transmitter, receiver and power supply are built separately on aluminum-angle shelves, or chassis, and are then mounted in rack fashion in the main frame (see Figs. 1 and 3).

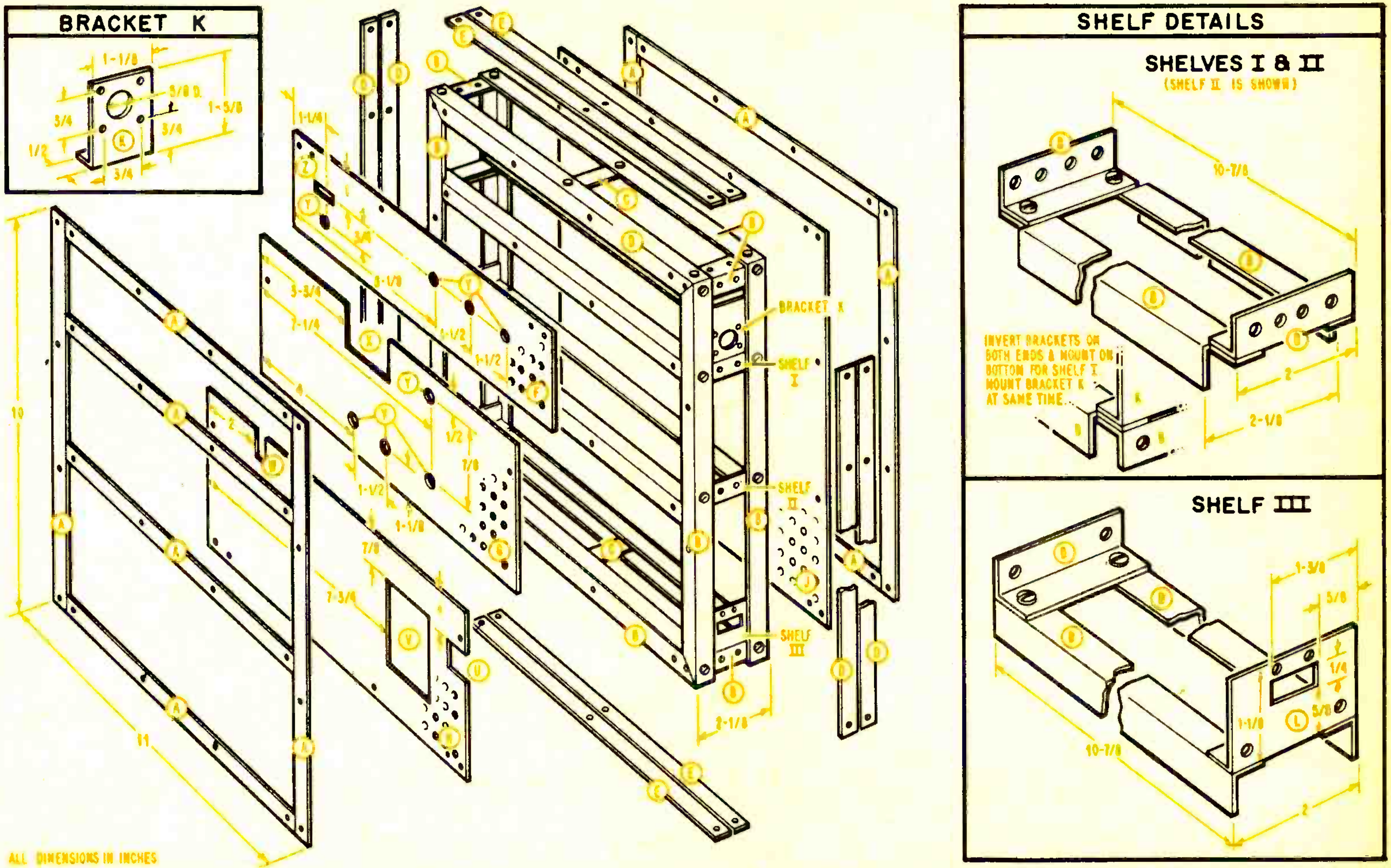


Fig. 1—The main frame is built entirely of ½x½x1/16 in. aluminum angle and ½x1/16 in. aluminum strip. Cut the angle to the lengths specified for all horizontal and vertical members then cut the crosspieces (B). Assemble frame with two bottom crosspieces only using flat-head screws, lockwashers and nuts.

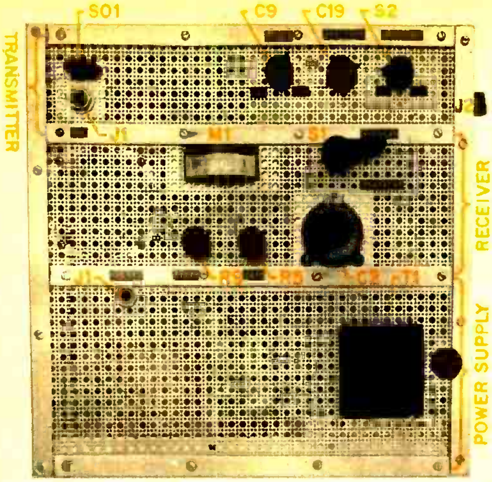


Fig. 2—Front of Attaché 80. Perforated aluminum is used for ventilation. Meter M1 and speaker (left of M1) are mounted on perforated aluminum.

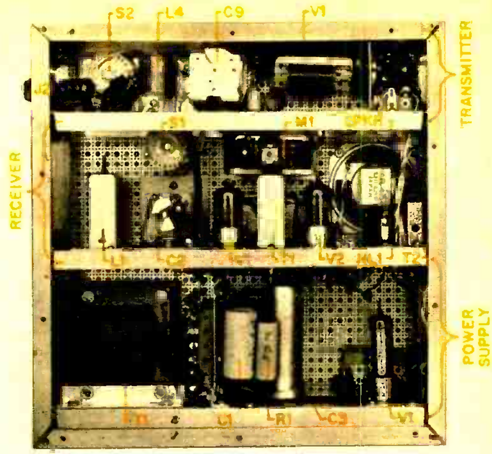


Fig. 3—Rear view of Attaché 80. Power supply is lowered in frame first. Receiver is then mounted above it and transmitter is installed at the top.

Let's Build It

Construction of the Attaché 80 is broken down into four major steps consisting of assembly of the main frame, followed by mechanical assembly and wiring of the power supply, transmitter and receiver chassis.

Begin by building the frame shown in Fig. 1. The aluminum angle and strips can be fastened together in several ways. You can use sheet-metal screws, countersunk flat-head machine screws and nuts, machine screws and threaded holes in the aluminum angle or a combination of these methods. After the frame is built, cut the front and rear panels out of perforated aluminum sheet and set them aside until later. Now to the individual chassis.

BILL OF METAL MATERIALS

Key	Description	Quantity
A	Aluminum strip: 1/2 X 1/16 X 10	10
B	Aluminum angle: 1/2 X 1/2 X various lengths	12 feet
C	Aluminum strip: 1/2 X 1/16 X 2	2
D	Aluminum strip: 1/2 X 1/16 X 6 1/2 and 10	2 ea.
E	Aluminum strip: 1/2 X 1/16 X 10 7/8	4
F	Perforated aluminum: 10 3/4 X 2 3/8	1
G	Perforated aluminum: 10 3/4 X 3 3/8	1
H	Perforated aluminum: 10 3/4 X 4	1
J	Perforated aluminum: 10 3/4 X 9 3/8	1
K	Aluminum sheet: 1 1/8 X 2 1/8 X 1/16	1
L	Aluminum sheet: 2 X 1 5/8 X 1/16	1

Key	Hole Sizes	Quantity
U	3/4 wide X 3/4 high	1
V	1 7/8 wide X 2 5/16 high	1
W	1/2 wide X 3/4 high	1
X	2 wide X 1 high	1
Y	3/8 dia.	8
Z	7/8 wide X 3/8 high	1

Note: All dimensions in inches

● **The Power Supply** is built on shelf III which is shown in the lower right of Fig 1. After the shelf is assembled slip it into the bottom of the main frame to make sure it fits.

Carefully remove the lower shell (the side from which the leads emerge) of the power-supply transformer (T1) then mount T1 with two pieces of aluminum angle on the shelf as shown in Fig. 5.

Make sure that the diode-rectifier mounting plate (to the right of T1 in Fig. 5) is not too close to T1. The fuse holder should not be mounted until final assembly. Install and connect all power-supply components following the schematic in Fig. 4 and the layout in Fig. 5. Be sure that the leads that go from the power supply to other chassis are long enough. Set the power supply aside.

● **Transmitter Assembly.** The transmitter is built on shelf I, which is shown in the upper right corner of Fig. 1. Note that the end brackets are mounted so they point in a *downward* direction. Also note that bracket K is used at one end of the shelf for the antenna connector. Mount the transmitter components on the chassis as shown in Figs. 3 and 6.

Mount coil L4 by removing 1/2-in. of turns from one end (30 turns must remain) and by drilling a hole in the plastic support. A bracket on the chassis holds the coil upright as

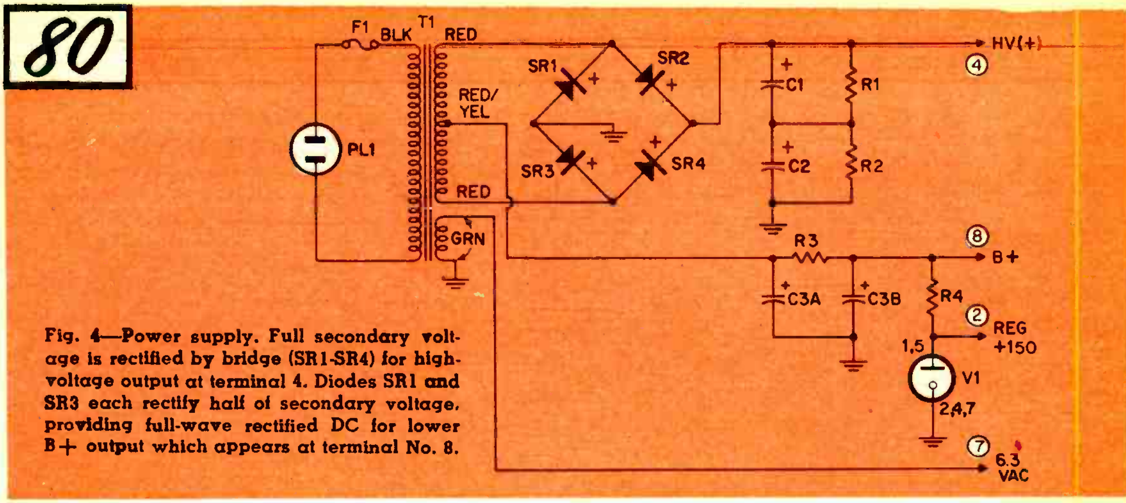


Fig. 4—Power supply. Full secondary voltage is rectified by bridge (SR1-SR4) for high-voltage output at terminal 4. Diodes SR1 and SR3 each rectify half of secondary voltage, providing full-wave rectified DC for lower B+ output which appears at terminal No. 8.

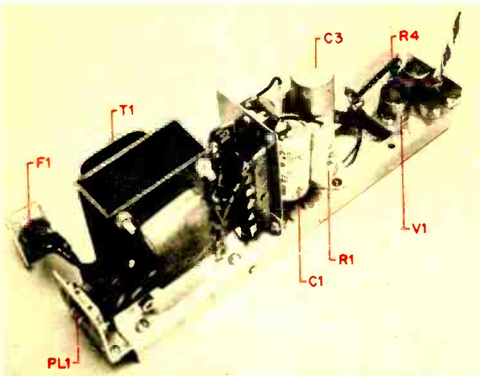


Fig. 5—Power supply. Transformer T1 is mounted at left with angle brackets. Rectifier diodes are on terminal strip on bracket at the right of T1.

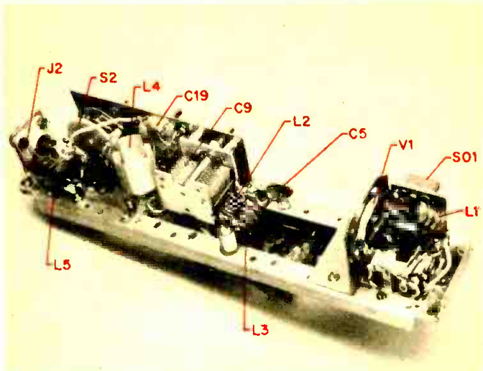


Fig. 6—Transmitter. Make a bracket 5-in. wide and install it on front of chassis to support S2, C9 and C19. Coil L4 is mounted with small bracket.

shown in Fig. 6. Plate-tuning capacitor C9 is mounted with three ⅜-in. spacers and countersunk flat-head machine screws.

● **Receiver Assembly.** The receiver is built on shelf II, which is shown in the upper right corner of Fig. 1. After the shelf has been assembled, mount the parts on it as shown in Figs. 3 and 9. Major components are installed on small pieces of aluminum mounted across the shelf. Tuning capacitor C2 is mounted behind a bracket with a machine screw and stack of lock washers.

The gimmick capacitor is made by connecting two lengths of hookup wire to pins 2 and 9 on V1's socket. Tightly twist the wire four turns. Cut off the extra wire and position the gimmick so it is perpendicular to the chassis surface. Now set the receiver chassis aside; it will be installed later on.

● **Final Assembly.** Install the power-supply chassis in the main frame by easing it down to the bottom. Then bolt it to the frame and install the fuseholder and bracket for PL1 near T1.

Install the receiver chassis about 3½ in. above the power supply chassis, making sure the components under the chassis don't touch the power-supply components.

Mount the transmitter chassis about 3¼ in. above the receiver, making sure that there is clearance between meter M1 (installed in the front panel in the receiver section) and the top of T1. Put on the top of the main frame and install the three front panel sections holding them in place with aluminum strips. Mount the vernier dial, the

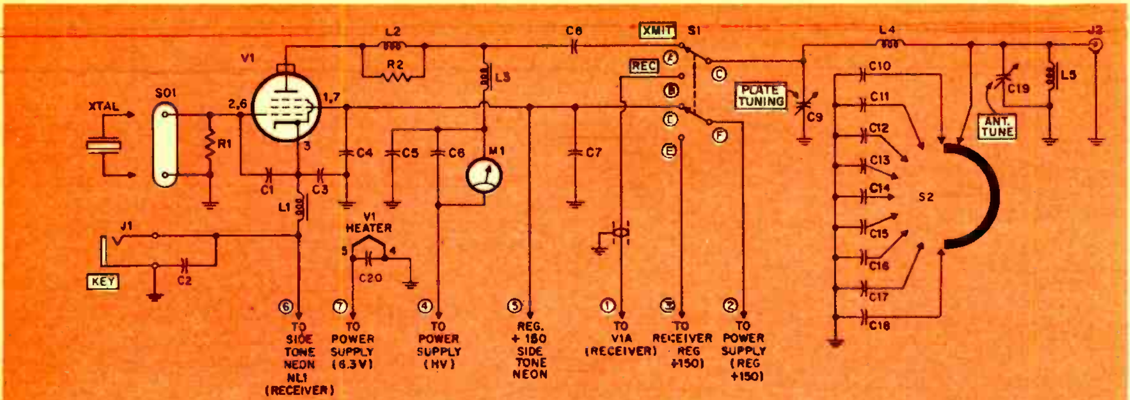


Fig. 7—Transmitter. Numbers on leads at bottom indicate connections to other chassis. S2 adds or removes capacitance for coarse antenna loading; C19 is antenna fine-tuning control. S1 supplies regulated + 150 V power to transmitter or receiver and switches antenna from transmitter to receiver.

PARTS LISTS

POWER SUPPLY
C1, C2—16 μf, 450 V electrolytic capacitor
C3A, C3B—20/20 μf, 450 V can-type electrolytic capacitor
F1—3 A fuse and panel-mount holder
PL1—Chassis-mount AC plug (Lafayette 18 G 2712)
R1, R2—50,000 ohm, 10 watt wirewound resistor
R3—1,800 ohm, 2 watt, 10% resistor
R4—5,000 ohm, 10 watt wirewound resistor
SR1-SR4—Silicon rectifier; minimum ratings: 600 ma, 500 PIV (1N1696, or Lafayette 19 G 4203 or equiv.)
T1—Power transformer; secondaries: 480 V c.t. @ 70 ma, 6.3 V @ 3 A. (Stancor PM-8419 or equiv.)
V1—OA2 tube
Misc.—Terminal strips, 7-pin tube socket

TRANSMITTER
C1—22 μμf, 500 V mica capacitor
C2, C4, C6, C7, C20—.005 μf, 1,000 V ceramic disc capacitor
C5, C8—1,000 μμf, 1,500 V ceramic disc capacitor
C9—10-365 μμf variable capacitor (Lafayette 32 G 1103)
C3, C10 through C18—220 μμf, 500 V mica capacitor
C19—10-365 μμf miniature variable capacitor (Lafayette 99 G 6217)
J1—Phone Jack
J2—Chassis-mount coax connector (Amphenol 83-1R or equiv.)
L1, L3, L5—2.5 mh RF choke (National R25-2.5 or equiv.)
L2—Coil: 6 turns No. 18 wire wound on R2
L4—30 turns of Barker & Williamson No. 3016 Miniductor (Lafayette 40 G 1625)
M1—0-150 ma DC milliammeter (Emico Model 13, Allied 66 F 030)
R1—47,000 ohm, 1 watt, 10% resistor
R2—100 ohm, 1 watt, 10% resistor
S1—2 pole, 2 position (non-shorting) ceramic rotary switch (author used a Centralab PA-2019 6 pole, 2 position switch)
S2—1 pole, 10 position progressively shorting rotary switch (Centralab PA-2042. Allied 35 B 095, $2.16 plus postage; not listed in catalog.)
SO1—Panel-mount crystal socket (Millen 33102 or equiv.)
V1—6GJ5 tube
XTAL—80-meter crystal
Misc.—Novar tube socket (Allied 41 H 390), terminal strips, ½-in. long ceramic standoffs

RECEIVER
C1, C4, C12—330 μμf, 500 V ceramic disc capacitor
C2—3.7-52 μμf variable capacitor (Hammarlund HF-50)
C3—150 μμf, 500 V silver mica capacitor
C5, C6, C7, C8, C14, C20—.005 μf, 500 V ceramic disc capacitor
C9—10 μμf, 500 V silver mica capacitor
C10, C13, C18—1,000 μμf, 500 V ceramic disc capacitor
C11—100 μμf, 500 V ceramic disc capacitor
C15—5 μμf, 500 V ceramic disc capacitor (see text)
C16—4,700 μμf, 600 V mica or mylar capacitor (see text)
C17—10 μf, 15 V electrolytic capacitor
C19—.1 μf, 600 V mylar capacitor
Gimmick capacitor—see text
J1—Closed-circuit phone jack
L1—RF coil, J. W. Miller B-121-C (Allied 39 A 327 $1.50 plus postage; not listed in catalog.)
L2—.55 mh RF choke (J. W. Miller No. 4649, Allied 63 G 853)
NL1—NE-51 neon lamp
Resistors: ½ watt, 10% unless otherwise indicated
R1, R10, R14—1 megohm, R2, R11—68 ohms
R3—15,000 ohms, R4, R12—47,000 ohms
R5, R9—250,000 ohm linear-taper potentiometer
R6—4,700 ohms, R7—2.2 megohms,
R8—100,000 ohms
R13—1 megohm (see text)
Spkr.—3.2 ohm, 2½-in. speaker
T1—455 kc input IF transformer (J. W. Miller 12-C30, Allied 61 G 318)
T2—Output transformer; primary: 8,000 ohms, secondary: 3.2 ohms (Stancor A-3329 or equiv.)
V1, V2—6U8A tube
Misc.—1½ in. dia. vernier dial (Lafayette 99 G 6031), 9-pin tube sockets, terminal strips, insulated bayonet socket for NL1, RG58/U coax.

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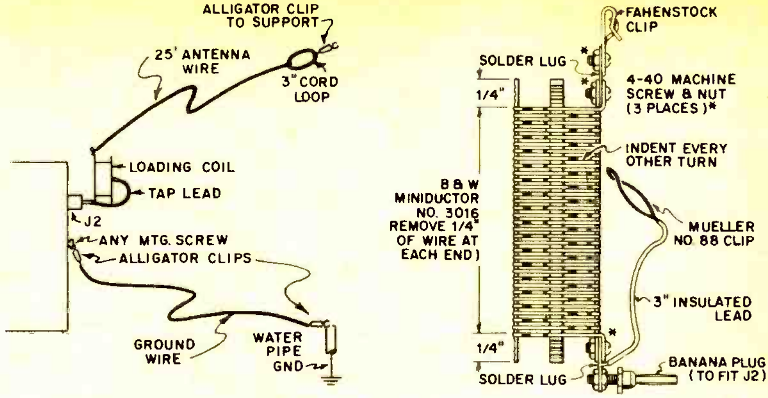


Fig. 8—For portable operation, build the loading coil at the right. A 25-ft. length of antenna wire connected to the loading coil and a good ground connection will put you on the air. The ground lead should be as short as possible.

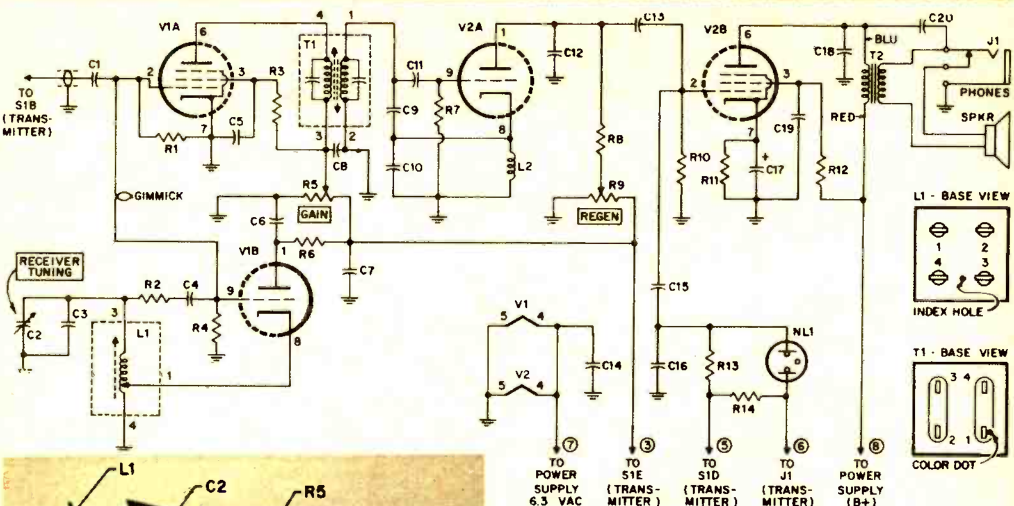
speaker and the control mounting nuts as you install each section of the front panel. Do not install the side aluminum strips until the chassis interconnecting wiring is taken care of.

The interconnecting cables should be tied together with plastic tape. The coax cable from V1A in the receiver to S1 on the transmitter should be kept away from tuning capacitor C2. Make sure that V1's (transmitter) plate lead, R2 and L2 don't touch the frame.

Testing and Calibration

● **Transmitter.** Do not operate the transmitter without an 80-meter crystal in SO1 or V1 will be damaged. Connect a 100-watt light bulb to antenna jack J2 and plug a key in J1. Set the transmit-receive switch S1 to

[*Continued on page* 110]



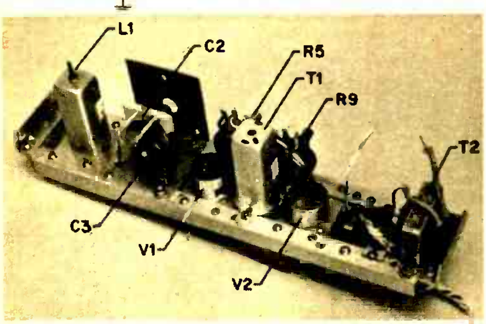


Fig. 9—Receiver schematic above, chassis left. Superhet portion of circuit consists of oscillator V1B and mixer V1A. IF signal from V1A is fed to regenerative detector V2A whose output is coupled by C13 to audio output V2B. NL1 is a relaxation oscillator whose output goes to audio stage when transmitter is keyed. Numbers on leads at bottom of schematic show connections to other two chassis. Parts are mounted on chassis on small pieces of aluminum. Dial mounts on bracket in front of C2.

TAPES FOR TOURING

By BOB ANGUS Every couple of years somebody comes up with a tape-cartridge system, an automated way of playing tapes that long has threatened to banish records forever. First of these, designed by audio engineer George Eash, came out in the mid-'50s and made music anywhere there was a matching deck—including the under-the-dash area of most any car. Promising motorists entertainment free of noise and insistent commercials, the Eash system promptly won a small following—but the tape and record industries continued on their merry way.

In the years that followed, RCA Victor and Minnesota Mining both introduced cartridge systems for the living room. Like the Eash, the RCA and 3M versions require no manual threading. All the user need do is insert the cartridge in the player, throw a switch and relax to the strains of a Strauss waltz or the beat of the Beatles. Last spring yet another cartridge player was announced. Like George Eash's, it is intended for use in automobiles. But unlike the older Eash unit, it has the blessing of RCA Victor, which announced that the Victor library would be made available in the new cartridge.

In keeping with its predecessors, the new setup—called the Lear Jet system because of development work by the maker of the business aircraft of the same name—proved to be incompatible with everything that had gone before (its player utilizes a special eight-track stereo head). Nonetheless, it's the Lear unit which is appearing this fall in new Thunderbirds and Mustangs (and other cars) as an optional extra. The cartridge players, which contain an AM radio as well, are manufactured by Motorola under license from Lear Jet and add from $100 to $150 to the price of the car.

As it happens, the Eash cartridge isn't totally dormant. Viking of Minneapolis had

Porta-Tape player by Telepro lists for $70, uses Fidelipac cartridge, reproduces tapes monaurally.

TAPES FOR TOURING

experimented with a somewhat revised version known as the Fidelipac. And Earl (Mad Man) Muntz, hoping that car-cartridge players could be to the '60s what television had been to the '50s, asked Viking to build him some players (STEREO ON WHEELS, Sept. '64 EI.) Sometime later, Muntz turned to Japan for players and Viking began doing its own marketing as well as producing players for other manufacturers to sell under various brand names.

As 1965 opened, there were only half a dozen manufacturers marketing tape players for cars. But as of this writing the total stands at 15 and the number is growing. Of these, all but two have standardized on the Fidelipac cartridge, a rectangular plastic box containing an endless loop of tape wound around a single hub. As the tape plays it feeds out from the hub, past a head on the player and then back on the outside of the tape packed around the hub. When the player is push-buttoned into operation, a pinch roller pops up through a hole in the cartridge. The roller and capstan pull the tape past the playback head.

Big exception to the Fidelipac system is the Lear Jet unit, which makes the pinch roller part of the tape cartridge. Like Fidelipac's, Lear Jet's ¼-in. tape is wound around a single hub. Heads for the system, developed by Nortronics, Inc., utilize eight tracks, each

AutoMate player by Orrtronics uses Orrtronics cartridge, is available in mono and stereo versions.

slightly less than half the width of Fidelipac's four. A triggering device at the end of each pair of tracks causes the heads automatically to switch to the next pair.

Systems aside, the prospective owner of a car-cartridge system now is offered a wealth of sounds he couldn't touch before. In the car cartridge's early days, users had to make do with prerecorded tapes by such no-name artists as the Graz Philharmonic, Lenny Herman, Hack Swain and others. No such problem exists now for the car-cartridge buyer. He can choose from music recorded by major artists on Dot, Westminster, United Artists, Mercury, Command, ABC-Paramount, Warner Brothers, Reprise and other big labels. Largest single supplier perhaps

[*Continued on page* 114]

EI'S READY REFERENCE GUIDE TO CAR CARTRIDGE PLAYERS

Manufacturer & Model	Price	Includes Installation	Includes Speakers	Tape Speed	Mono	Stereo	Cartridge Type
Audio Spectrum	$ 69.95	yes	yes		x		Fidelipac
Auto Phonic		yes	yes	3¾		x	Fidelipac
Auto-Sonic		yes	yes	3¾		x	Fidelipac
Auto Stereo MP 6	$ 98.95	yes	no	3¾		x	Fidelipac
Auto Stereo MP 8	$139.50	yes	yes	3¾		x	Fidelipac
Auto Stereo MC 8	$159.50	yes	yes	3¾		x	Fidelipac
Craig Panorama C501	$ 99.50	yes	yes	3¾		x	Fidelipac
Craig Panorama C502	$119	yes	yes	3¾		x	Fidelipac
Lear Jet ASR830P	$150*	yes	yes	3¾		x	Lear Jet
Lear Jet ASR830H		no	yes	3¾		x	Lear Jet
Metra Electronics MTP5	$149.95	yes	no	3¾		x	Fidelipac
Metra Electronics MTPC	$169.95	yes	no	3¾		x	Fidelipac
Muntz Stereo-Pak CI	$ 99.95	yes	yes	3¾		x	Fidelipac
Olson Radio RA-776	$ 79.98	no	no	3¾		x	Fidelipac
Orrtronics	$ 89.95	yes	no		x		Orrtronics
Orrtronics	$150	yes	yes			x	Orrtronics
Quality Audionics	$129.95					x	Fidelipac
SJB, Inc. ST 400	$139	yes	yes	3¾		x	Fidelipac
Telepro	$ 69.95	yes	no	3¾	x		Fidelipac
Trans-World	$119.50	no	yes	3¾		x	Fidelipac
Viking Autotape 500	$150-160	no	yes	3¾		x	Fidelipac

** Price when purchased with new Ford Thunderbird or Mustang (unit includes AM car radio). Player purchased separately is expected to cost about the same.*

CB CORNER

BY LEN BUCKWALTER KBA4480

The Infallible Filter

MENTION mechanics to an electrical engineer and you just may raise a sneer. His job, after all, is to make mechanical things electronic—like replacing rusty relays in old-time computers with ever-so-efficient flip-flops. But your next CB rig well may have come full circle in the sense that a mechanical component will have replaced an electronic one. It'll be a filter, buried between stages of the receiver. This little piece of hardware can do a more sophisticated job of slicing interference than a handful of pure electronics.

Blossoming throughout the CB scene, the mechanical filter now appears in Lafayette's all-transistor transceiver, in the Contact 23 by United Scientific Labs and in a rig by Polytronics. (Our photo shows one made by Collins Radio, the company which pioneered mechanical filters years ago.) Reason for the bloom isn't hard to find: the mechanical filter does an amazingly fine job of improving receiver selectivity. When the rig is tuned to channel 2, for example, you plain can't hear 1 or 3. Response literally is razor-sharp.

Razor-sharp and whistle-clean, mechanical filters beat their electronic counterparts hands down. This one is made by Collins.

Secret of the mechanical filter is in a special metal alloy cut to vibrate like a tuning fork. (Frequency usually is 455 kc, for operation in the receiver's IF amplifier.) Incoming signals are made to ride tightrope fashion through the vibrating section. Unless signal and filter frequencies agree, signals can't get through. What's more, these filters are famous for their skirt selectivity, another way of saying that desired signals slip through without being stripped of their important audio sidebands.

It's a novel feeling when you first tune a filter-equipped receiver across the band. Stations just don't slide in, peak up, then fall away. It's more of a pop-in effect. Now you hear it, now you don't.

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5 by 5. Some CBers thought they fell into it. Hidden in the new regulations was what looked like a loophole in the five-minute rule, the one that says you can't talk more than five minutes without observing a five-minute silent period. The armchair barristers had it figured this way: if *one* station can talk for five minutes, *two* stations might talk for ten. And, of course, a chatty three-way contact could drag on 15 minutes. Simple reasoning? You bet.

But one cerebral CBer in that group liked to fink for himself. So he wrote to the Commission for clarification. The reply from FCC Secretary Ben Waple neatly knitted up the loophole. His key phrase for applying the five-minute rule: ". . . communications *between* or *among* Class D stations."

This means that even if the King Family got on and had a rousing round-robin, they'd have to sing five, rest five—at least so long as they operated under different licenses. (There's still no time limit for stations under one call sign.)

Cat Chat. Five minutes notwithstanding, who talks more on the air—guys or gals? If one recent FCC docket is any indication, it may be the women, after all. For this docket, detailing a flagrant violation of the five-minute rule, was addressed to a lady. And here was no slip of the tongue. No ma'am. Here was a real gasser. Seems this lady had

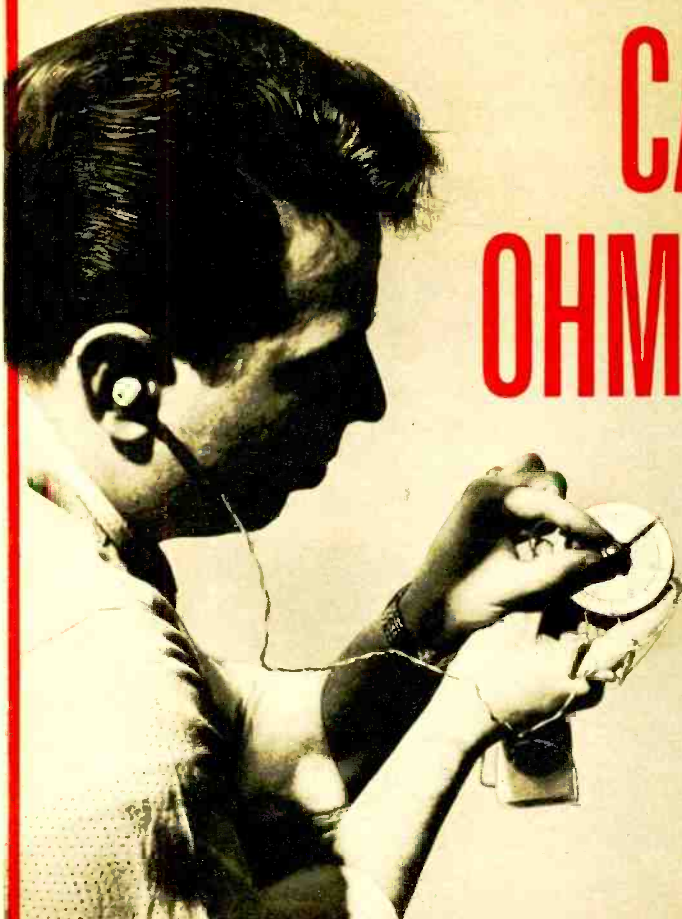
[*Continued on page* 115]

LONG before VOMs or VTVMs came along to measure resistance, a bridge that never crossed a river was used to do the job. Called a Wheatstone Bridge, it determined resistance by comparing an unknown-value resistance with a known-value resistance.

Using about $2 worth of parts and your transistor radio (or any audio-signal source) you can build a Wheatstone Bridge ohmmeter that will measure resistance from less than an ohm to 1 megohm. Most any small container can be used as a case. A handy one from the size standpoint is a cleaned-out shoe-polish can which ours was built in. If calibrated with care its accuracy will be as good as the tolerance of resistors R2-R8.

To measure resistance you simply plug the ohmmeter via PL1 into the earphone jack of a transistor radio and put the Canned Ohmmeter's earphone in your ear. Turn the ohmmeter's knob (R1) until the volume is at a minimum, or until you don't hear anything, then read the value of the resistor from the ohmmeter's dial. Construction details are covered in the pictorial's caption.

To calibrate the dial, turn R1 full counterclockwise and mark this point on the dial. Turn R1 full clockwise and also mark this point on the dial. Having found R1's rotation extremes, use a compass and a ruler to determine the exact midpoint of rotation. This point represents half of R1's resistance and should be



CANNED OHMMETER

BY MARTIN H. PATRICK

CANNED OHMMETER

marked 10 on the dial.

Plug PL1 into the earphone jack of a radio tuned to a strong station. Put the earphone in your ear and put PL2 in the hole in SO1 marked ×100. You should be able to hear the station. Now, connect a 5,000-ohm potentiometer (which we'll call *pot A*) to the alligator clips, set R1 to number 10, and adjust pot A until you either hear nothing or the volume is at minimum (null). Pot A is now set at 1,000 ohms. In conjunction with a 10,000-ohm potentiometer (which we'll call *pot B*) connected in series with pot A, we are now going to calibrate the ohmmeter's dial from 1 to 10.

With pot A (which is set at 1,000 ohms) connected to the alligator clips, move PL2 from the ×100 to the ×1,000 hole in SO1 Turn R1 counterclockwise for another null. Mark this as point 1.

Set R1 at 10 again, put PL2 in the ×100 hole and connect pot B to the alligator clips. Adjust pot B for null. Pot B is now set at 1,000 ohms. Connect pots A and B in series (1,000 plus 1,000 equals 2,000 ohms) to the alligator clips. Plug PL2 in the ×1,000 hole and adjust R1 for null. Mark this as point 2.

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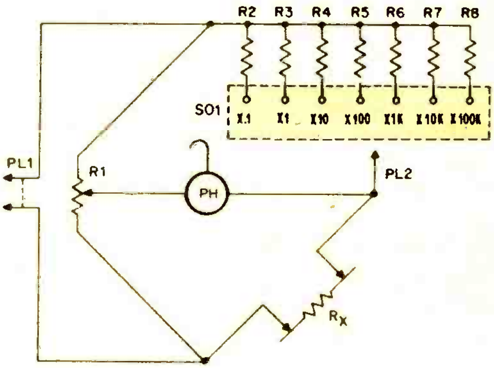
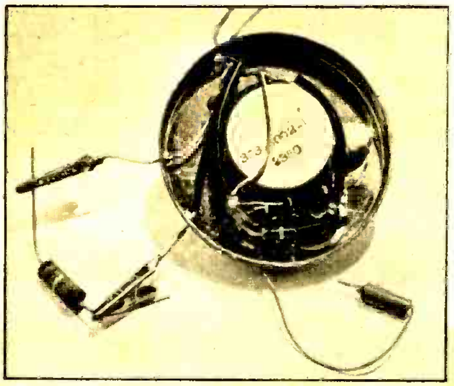


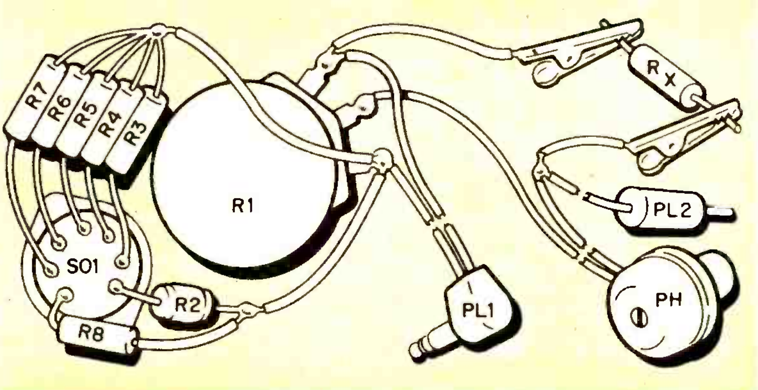
Ohmmeter is a bridge to which audio is fed at PL1. When R1 is set so voltage drops across Rx and part of R1 are equal, signal will be weak or inaudible.

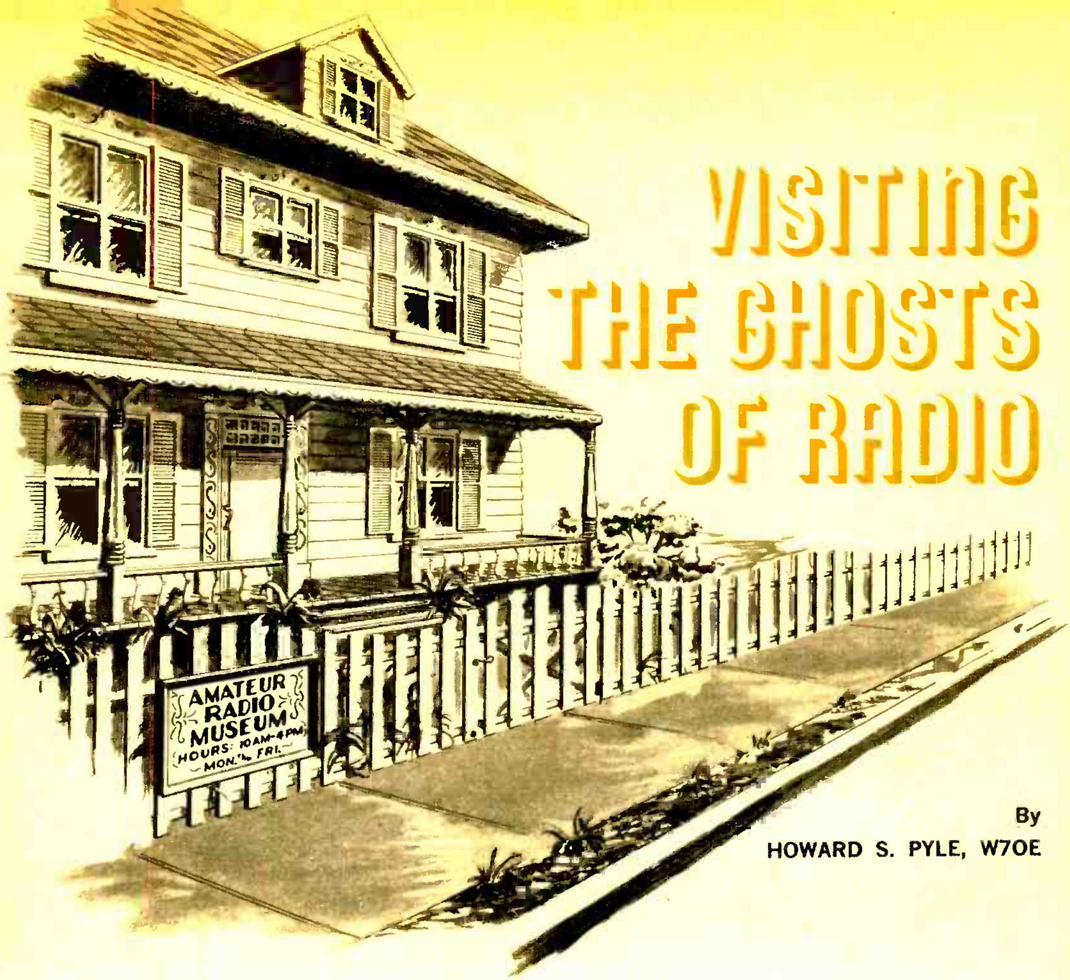


PARTS LIST

PL1—Miniature phone plug to match phone jack on radio
PL2—Tip plug   PH—8 ohm earphone
Resistors: ½ watt, 5% or 10% unless otherwise indicated
R1—5,000 ohm, wirewound linear taper potentiometer
R2—1 ohm, wirewound resistor (6 feet No. 32 enameled wire wound on 3/16 in. dia. X ½ in. long piece of wood.)
R3—10 ohms   R4—100 ohms
R5—1,000 ohms   R6—10,000 ohms
R7—100,000 ohms   R8—1 megohm
SO1—Miniature 7-pin tube socket
Misc.—Miniature alligator clips

Our model was built in a 2¾-in.-dia. shoe-polish can. A larger housing, and consequently a larger dial, will enable you to make more accurate measurements. Socket SO1 should be right next to the edge of the can. And put tape on all connections so they don't short to the can. PL1 mates with phone jack on your transistor radio.





VISITING THE GHOSTS OF RADIO

By
HOWARD S. PYLE, W7OE

ANTIQUE displays of any kind—furniture, statuary, paintings—always have been sure-fire attention-getters. And a few years ago radio amateurs discovered they had the makings of some antique displays all their own. Result is that most anyone now can pay a visit to the ghosts of radio in the scores of museums that dot the U.S. countryside.

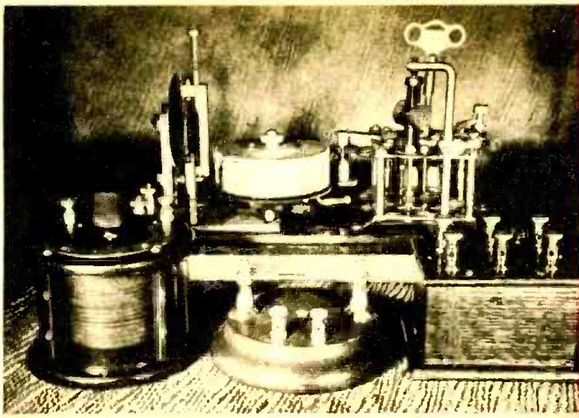
Thing that first set the ball rolling was plain curiosity about the types of equipment hams used to effect communication in the good old days. Vaguely remembered were home-brew spark transmitters, regenerative receivers and other gear that had been reposing in attics and basements for decades.

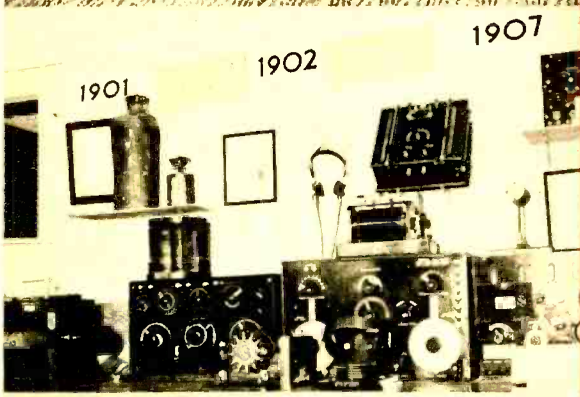
A little musty-corner prowling unearthed a surprising number of such relics from the past. After nostalgically blowing the dust from some of the choicer tidbits, the owners began to bring a few items to club meetings from time to time, to the delight of other members.

But dragging cumbersome gear early proved a chore for the old-timers. Result, quite logically enough, was growth of displays in odd corners of private homes. Once suitably set up, such displays brought the Mohammeds to the mountains. And many's the ham who lunged at the chance to visit the ghosts of radio.

Word was passed through over-the-air contacts as well as by the way of bulletins exchanged by clubs across the country. Other clubs have put the bee on pioneer members and generally have been successful in digging up one or two hoary old-timers who had gear from the early ham days stashed in some forgotten corner of the barn, attic or cellar.

Metal polish and elbow grease soon put tuning coils, helixes, spark gaps and the like in a fairly presentable condition. Space for an unused table generally could be found in the basement or ham shack and it wasn't long before these displays began to assume the appearance of miniature museums. Old-timers who lacked space to set up gear began to add some of their prize old equipment to the collections of those who more ade-





VISITING THE GHOSTS OF RADIO

Ghosts on display at amateur-radio museums across the country represent most every kind of wireless gear ever used. Photo at upper left shows a variable capacitor (circular box at left), a self-decohering coherer (front center), a fixed capacitor with several terminals to provide a choice of values (box at right) and an Omnigraph for self code instruction (at rear); Vance Phillips, W6GH, has equipment in his Santa Barbara, Calif., home. Photo at lower left shows portion of gear contained in the New England Museum of Wireless and Radio at E. Greenwich, R.I.; items are arranged chronologically from 1900 to 1925. Photo at right shows samples of equipment that Wayne M. Nelson, W4AA, has on exhibit in Concord, N.C.

quately could accommodate it, space-wise.

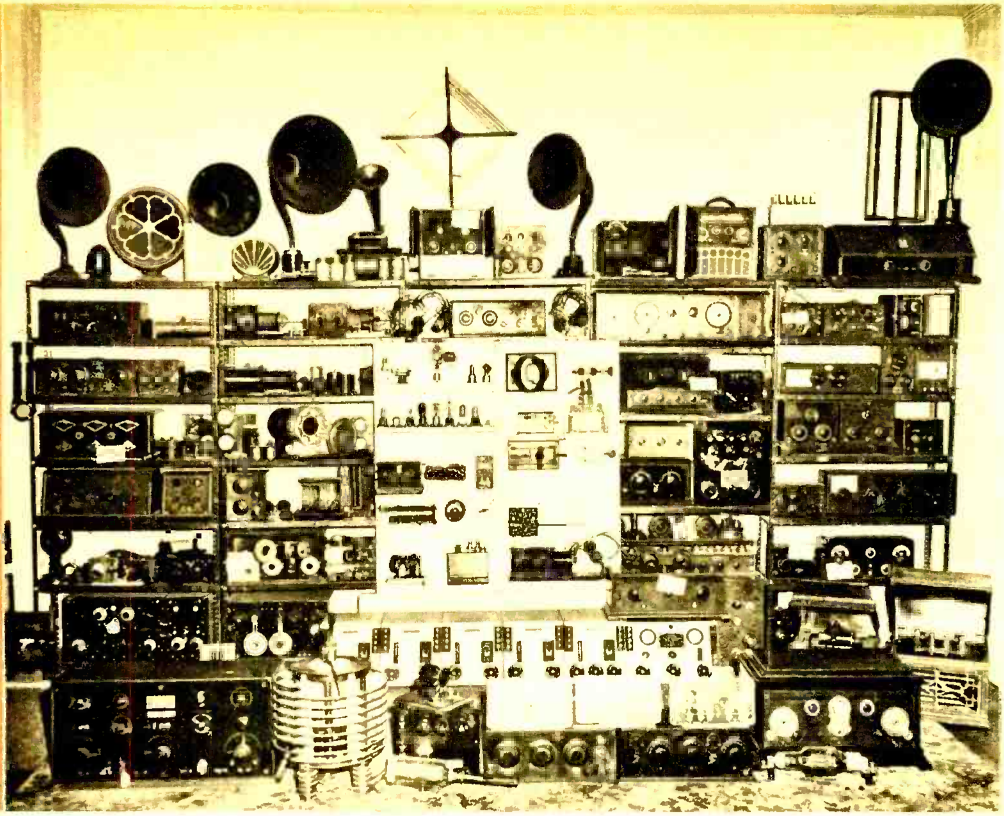
The spark had been struck and it wasn't long before a bit of swapping started. One pioneer might come up with a couple of duplicate pieces, only to trade one to another old-timer for something else which better fit his picture. Throughout the country the antique-wireless fad grew rapidly. Many enthusiastic collectors who possessed adequate display space let it be known that they were in the market for odds and ends of pioneer wireless equipment. A few even placed ads listing certain specific items which they wanted to incorporate in their collections.

Later, some of the national amateur organizations, notably the Quarter Century Wireless Association, joined the museum movement (the American Radio Relay League long has maintained a ham museum, now located in the ARRL's new headquarters in Newington, Conn.). The QCWA's Northwest Chapter, for example, lacking permanent club quarters of its own, talked several electronic parts dealers into donating display space in their establishments. Soon the chapter had filled showcases in prominent stores in Seattle, Spokane and Tacoma, Wash., and in Portland, Ore.

Other organizations followed suit and arranged for exhibits in commercial establishments. Visitor registers for such displays quickly revealed signatures from most every state in the Union, not to mention Canada, Mexico and other countries.

In time it became apparent that increased public interest would result if early broadcast receivers were shown. Further, since many hams at one time or another had been professional wireless operators or radio officers in the Merchant Marine or armed forces, requests soon were forthcoming that pioneer wireless and radio equipment of the Army, Navy and commercial variety be displayed. Collectors obliged and most of the ham museums today show not only early amateur equipment, but early broadcast, military and marine gear as well.

Dozens of these museums are scattered from coast to coast (our list at the end of this article contains a regional sampling). One



probably exists in your vicinity (your electronics dealer or radio club will know for sure). Having located such a display, it's best to telephone the owner to ascertain visiting hours. This done, you can spend an enjoyable and entertaining hour or two examining these relics of an earlier age

Most of these ghosts patiently and laboriously have been restored to their original glory. Shiny brass rods; polished knobs, panels and tubing; sparkling, newly varnished hardwood bases bespeak the care hams have accorded old-time gear. Many pieces, in fact, have been restored to original operating condition, though most are not in operation as displayed.

All of these museums, by the way, are maintained on a non-profit basis. There is no admission charge. They exist solely for public pleasure and the displays mostly are presented by the nostalgic old-timers who enjoy explaining the workings of the various items used in bygone days. The ghosts, clearly, are there for the visiting, so why not pay them a call?

Regional Roster of Radio Museums

Eastern

The New England Museum of Wireless and Radio (Bob and Nancy Merriam), Tillinghast Rd., E. Greenwich, R.I. 02818 Tel. (401) TU4-1710 (R)

Antique Wireless Association Museum (Bruce Kelley, Secretary), Main St., Holcomb, N.Y. 14469 Tel. (315) 657-7489 (R)

The W2ZI Historical Wireless Museum (Ed G. Raser), 19 Blackwood Dr., Trenton, N.J. 08628 Tel. (609) 882-6645 (R)

Wayne M. Nelson, W4AA, Box 72, Concord, N.C. 28025 (R)

Northern Central

Joseph R. Pavek, WØOEP, 55 S. 12th St., Minneapolis, Minn. 55403, Tel. (612) 339-5566 (R)

Francis A. Nichols, W9AKH, 720 E. Eldorado St., Appleton, Wis. Tel. (414) RE4-4021 (R)

Western

Quarter Century Wireless Assoc. (Dr. F. Clifford J. Spike, Chairman, Northwest Chapter) 1015 Medical Arts Bldg., Tacoma, Wash. 98402 Tel. (206) MA7-2424 (R)

Vance Phillips, W6GH, 1010 Monte Dr., Hope Ranch Park, Santa Barbara, Calif. 93105 Tel. (805) 967-2865 (R)

Louise Ramsey Moreau, WB6BBO, 1036 E. Boston St., Altadena, Calif. 91001 Tel. (213) 791-1818 (T)

C. J. Emerson, W6QIP, 9766 Rio Hondo Pkwy., El Monte, Calif. 91733 Tel. (213) G18-0560 (L)

L—library devoted to old radio books and magazines; R—includes ham, commercial, broadcast and military equipment; T—primarily telegraph keys, sounders, recorders and similar equipment.

ALL-PURPOSE TONE SOURCE

By BERT MANN

Whistling into a mike is one way to check the performance of audio, ham or CB gear. But you'll need a rock-steady sine-wave tone like this one if you want to make reliable tests.

REMEMBER what it was like trying to track down an intermittent in a microphone or its connecting cable? By the time you repeated *testing . . . one . . . two . . . three . . . four . . .* a dozen times, you were tongue tied. Or after whistling into the mike for ten minutes, you started having dizzy spells. These were the hard ways to do the job.

By using our 1,000-cps tone source to feed a clean sine-wave tone into the mike, you'll be free as a bird to concentrate on locating the trouble instead of making sounds. And hams and CBers will find the tone source mighty valuable, too, when troubleshooting modulator distortion.

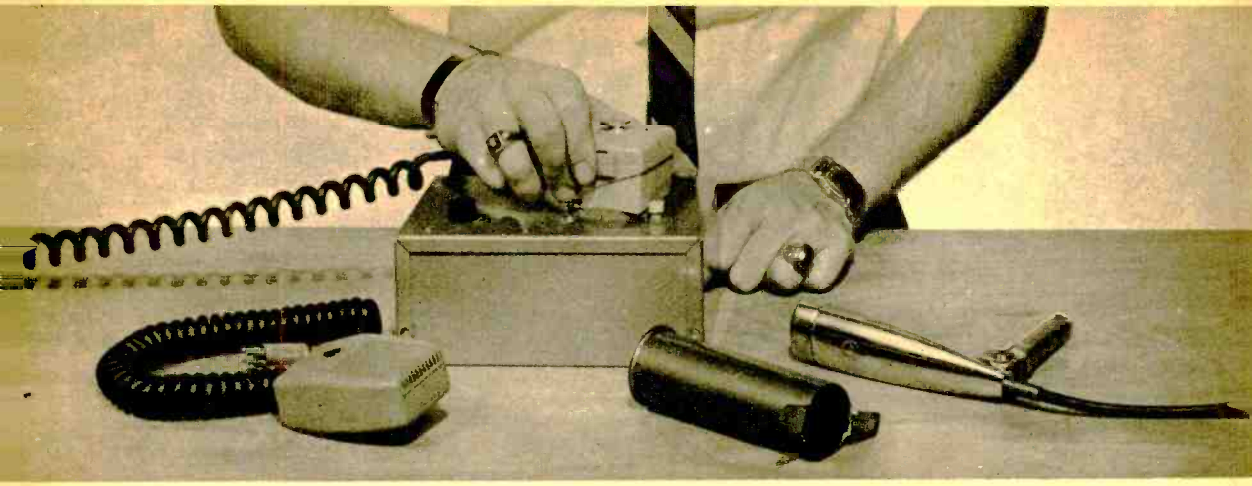
When making a live stereo recording, a tone source could be a big help when balancing the mikes. Here's how: Put the left-channel mike over the tone source's speaker and set the left-channel gain control for a normal recording level. Then, without changing the tone source's output level, do the same thing for the right-channel mike.

The tone source has two important features: First, it won't rupture the diaphragm of a mike. The output level can be varied, yet the maximum level into the mike is slightly more than that of a loud voice. Second, there is a rubber pad over the tone source's speaker that forms a tight seal with the mike to prevent extraneous noise from getting in.

Construction. We built our model in a 3x5x7-inch Minibox since a smaller cabinet would not provide a large enough support area for the microphone. To insure dependable performance, use the capacitors specified in the parts list for C1, C2 and C3 and not electrolytics or low-cost bargains.

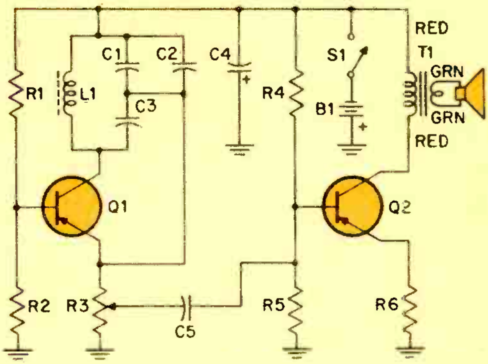
Make a small pad slightly larger than the speaker opening from a piece of foam rubber. Cut a one-inch hole in the center of the pad and glue the pad on the cabinet over the speaker. Hand-held mikes should be pressed firmly into the pad when testing them. If your mike is a long thin tubular type, make an adaptor for it, as shown in the photo above, with a piece of brass kitchen-sink drain pipe. Cut off the length needed and form two tabs at one end. Bend the tabs at right angles to the pipe so they will fit over the two diagonally-installed speaker mounting screws whose threads are above the cabinet. Use thumb nuts to hold the adaptor in place and be sure they pull it firmly into the rubber pad.

Hand-held mikes should be taped to the box for firm contact with the rubber pad. (You'll have to tape their push-to-talk buttons in, too.) The weight of most tubular mikes will keep them held tightly against the rubber pad. If it doesn't, put a piece of tape over the top of the adaptor.



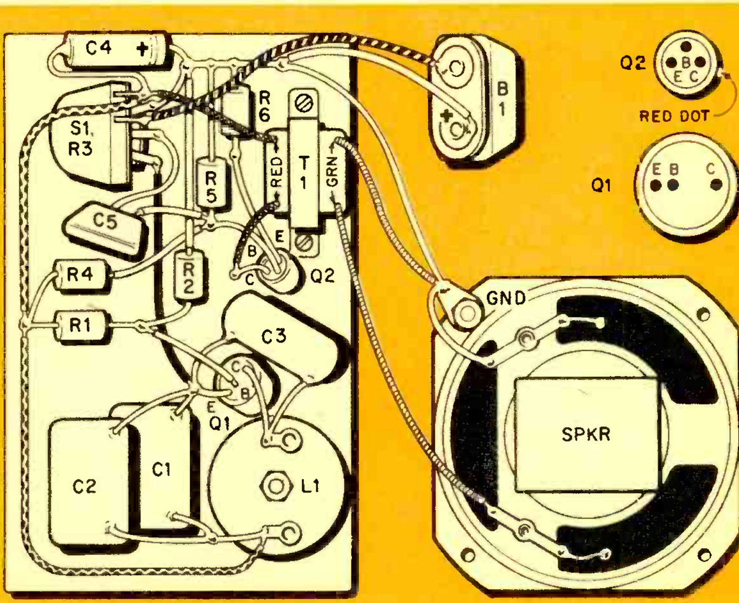
PARTS LIST

B1—9-volt battery
C1,C2—1-µf, 100-V paper capacitor (Arco-Elmenco IDP-5-105. Lafayette 34 G 6727
C3—.2-µf, 100-V paper capacitor (Arco-Elmenco IDP-3-204. Lafayette 34 G 6720
C4—50-µf, 15-V electrolytic capacitor
C5—.25-µf, 75-V ceramic disc capacitor
L1—100 mh RF choke (J. W. Miller 860 or equiv.)
Q1—2N586 transistor Q2—2N217 transistor
R1,R2—10,000-ohm, ½-watt resistor
R3—5,000-ohm potentiometer with SPST switch
R4—100,000-ohm, ½-watt resistor
R5—4,700-ohm, ½-watt resistor
R6—62-ohm, ½-watt resistor
S1—SPST switch on R3
SPKR—10-ohm, 2½-inch speaker
T1—Transistor output transformer: primary, 2,000 ohms; secondary, 10 ohms (Lafayette 99 G 6101 or equiv.)



We specify a 100 mh choke for L1 for a 1,000 cps output, but value may be from 80 to 125 mh. Lower inductance raises frequency of tone and vice versa. Potentiometer R3 controls output level.

Mount all parts with flea clips on a 2¾x4¼-inch piece of perforated board. Position the board in the main section of a 3x5x7-inch Minibox to first determine where to drill a hole for R3's shaft. Then secure the board at four corners with screws and spacers. Put another piece of perforated board on the cabinet over the speaker to protect its cone. Install two long screws, with their threads sticking out above the cabinet, to hold the tubular-mike adaptor. Leads of C1, C2 are very heavy, so bend them before soldering to other components.



THE HAM SHACK

BY ROBERT HERTZBERG W2DJJ

SHACK DE LUXE . . . All the comforts of home and then some seems an apt description of Madison County (Ind.)'s elaborately fitted Civil Defense communications van. Staffed by local hams under the direction of Charles R. Jones, K9TZJ, the mobile masterpiece boasts coverage of every band from 2 through 80 meters. And weather makes no never mind: the van is electrically heated in winter, air-conditioned in summer.

A remodeled Army photographic truck, this shack-on-wheels gets its juice from a 6-kw generator mounted just ahead of the engine. We were about to say, "More power to the gang for its spirit of public service," but 6,000 watts should be enough power for awhile!

Tune-Up for Ten . . . Experience is the best teacher and our experience tells us that the gala reopening of 10 meters can't be far off. Matter of fact, between 10 and 11 p.m. one night recently (get that, *night!*) we worked seven California stations in a row. They boomed in like mad. Then, as if the AC line had parted, the band went blank. The next day it revived at the usual hour of 5:00 p.m.

We predict that lads who now own transceivers for 20/40/80 meters only soon will be looking for 10-through-80 jobs. Reason is they're bound to want to take advantage of what to many will be a band they didn't know hams had.

Walking Encyclopedia . . . Anyone who wants to be his club's authority on FCC regs has it made. All he has to do is write the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402, and inquire as to the current price of a subscription to Volume VI (it changes almost as often as a woman's hair style). This done, he has only to buy one, bone up on its contents and take it from there. His pronouncements are guaranteed always to be up-to-date, since the price of Vol. VI includes free copies of pertinent amendments as they are adopted.

Question Time . . . Two queries pop up so frequently in the Ham Shack mailbag we've decided to answer them here. Both, by the way, concern matters spelled out in the FCC's Vol. VI, mentioned above, and represent a sampling of its contents.

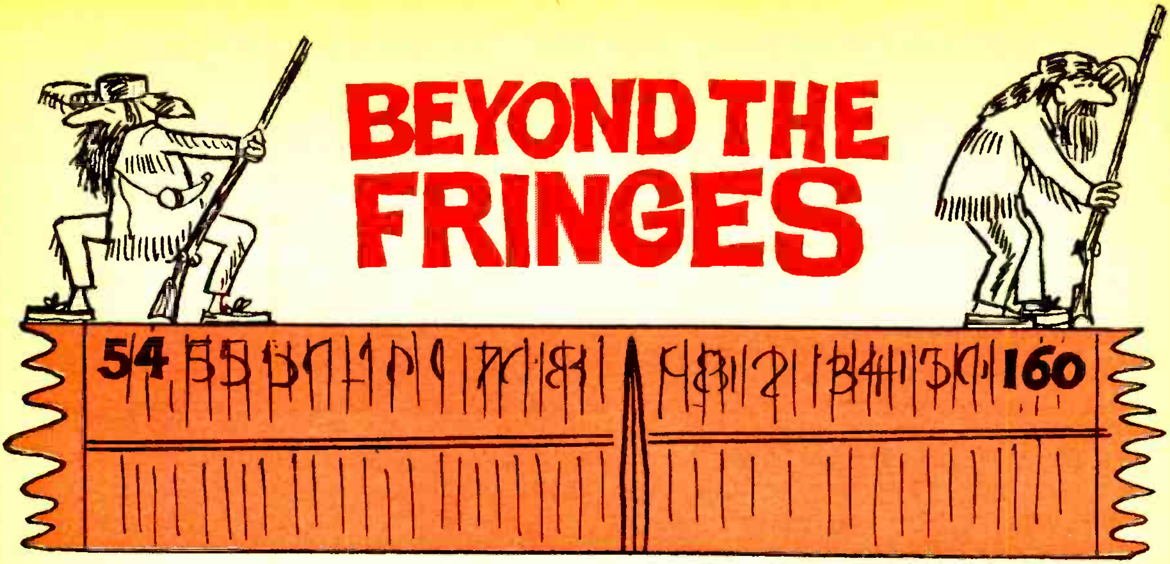
Q. I took my ham ticket to a photostater for an enlargement suitable for framing but he said it was against the law to stat federal documents. Is he right?

A. Not so far as a ham license is concerned. The Rules and Regulations of the

[*Continued on page* 115]

Comfort and coverage go hand-in-hand in this shack-on-wheels devised for Indiana's Madison County Civil Defense team. Lined with acoustical tile, van sports four operating positions with space enough for at least two more.

BEYOND THE FRINGES



By DON CARTER

America owes much more to a brand of men called explorers than most people these days realize (including the fact that it's known at all). And though the days when men discovered whole new worlds have passed, any radio listener is suited to do some exploring on his own in the best Lewis & Clark tradition. Regions ripe for exploring are what we call the fringes—those portions of the radio spectrum just a little above and a little below the standard broadcast band.

Most any broadcast-band receiver can be used to explore this not-so-dark territory. For though BCB stations run from 540 to 1600 kc (represented by the 54 and the 160 in our drawing above), many sets can tune both above and below this range. Reason is they intentionally are designed to do so in order that the listener still will have access to the entire BC band as the set's components age.

Then, too, any competent technician can put you above and below the fringes simply by altering the trimmer (padder) capacitors in your set. Substituting a higher capacitance value will pull you down to at least 510 kc, while a lower value should bring you up to 1630 kc or so. It's unwise to push much beyond these limits, however, as RF and oscillator stages likely would cease to track.

First station you're apt to come across in your explorations is aircraft beacon RAB (1613 kc) at Rabinal in central Guatemala. Like other beacons of this type, it does nothing but transmit an identifier in Morse code. And thanks to that non-stop ID and the lack of QRM, tuning RAB is the easiest way to log Guatemala anyone yet has come up with.

Of course, exactly how well and how often you hear RAB or any other beyond-the-fringes station depends on how and when you listen. An outdoor antenna is important no matter what kind of receiver you have. And given an inexpensive receiver, a strong local station at 1590 or 1600 kc can cause considerable trouble in the 1605-1630 area (just as one on 540 or 550 will do likewise from 535 through 510 kc). If so, it may be wise to wait until the local's silent period to DX in the affected range. But then distant reception in beyond-the-fringes territory is possible only at night, anyway.

In addition to RAB, there are several other interesting Latin American beacons to shoot for above the BCB. Station EPO at El Paso, Colombia (1609 kc), for example, is just 3 kc above the real outer limits of the BCB. (As already mentioned, the BCB runs from 540 to 1600 kc, but the presence of sidebands means it actually makes use of all frequencies between 535 and 1605 kc.) Station MZT (1625 kc) at Mazatlan on Mexico's seldom-DXed Pacific Coast is another rare one. Fact is, it previously took a NASA space station (actually at Guaymas) to make these lands around the Gulf of California available to most listeners.

Beacons, by the way, are reported much like standard broadcast stations. (See our chart at the end of this article for a complete list of stations, frequencies and addresses.) To authenticate your reception, time the identifier to a half second, then do the same for the period of silence between IDs.

Lest you think there is nothing but beacons beyond the fringes, a word about the broad-

cast stations on these channels. Best known is the Swiss Broadcasting Corporation's transmitter at Beromunster on 529 kc. Unlike Swiss SWBC outlets, this one is a real challenge and usually rolls in only when European stations can be heard on the BCB itself.

Another broadcast station to try for is one at Sulitjelma, Norway, on 511 kc. There also are low-power transmitters in Austria, West Germany and Norway on 520 kc but to the best of our knowledge no North American listener ever has had much luck receiving any of them.

Chief competition for Beromunster and other European-based broadcasters comes from beacons, this time of the U.S. and Canadian variety. However, many of these domestic stations make for some interesting targets in themselves.

Station VGB at space-famed Vandenburg AFB transmits on 524 kc; station FH operated by the Royal Canadian Navy at Shearwater, N.S., is exactly 1 kc below broadcast-band limits on 534 kc. And with our current low sunspot count even such Arctic rarities as RB (512 kc) at Resolute Bay, Northwest Territories, have a good chance of sneaking through.

Still other Canadian stations—OX (527 kc) at Comox, B.C., and NB (530 kc) at North Bay Ont., are two—maintain voice facilities on their beacon channels so they can talk aircraft in during emergency conditions. While understandably exceedingly rare, these dramatic life-or-death transmissions are well worth waiting for.

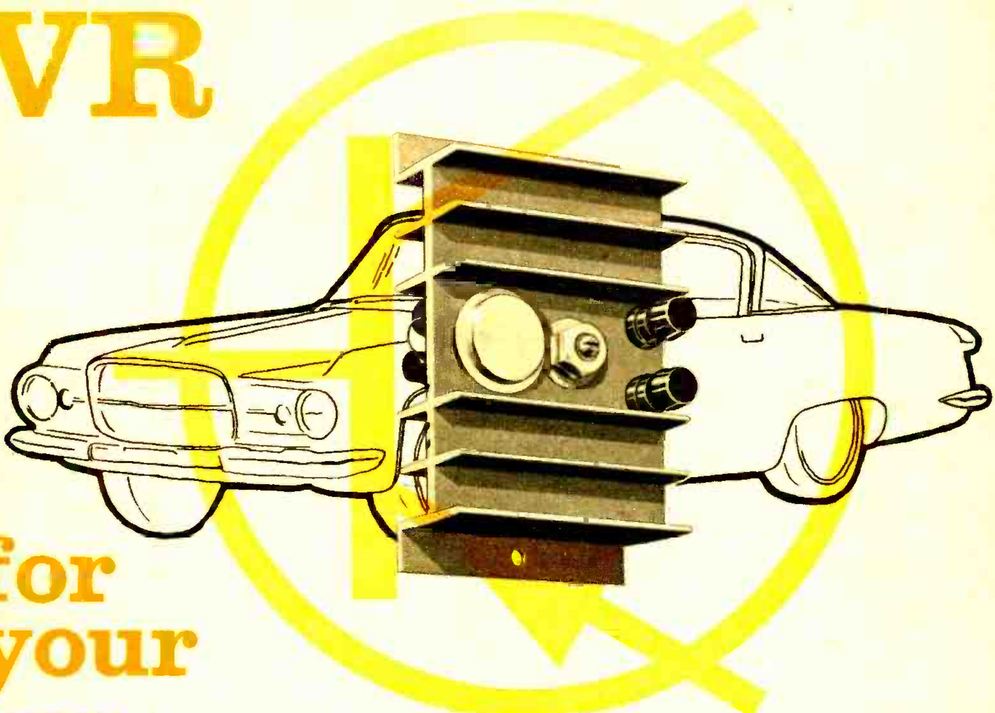
Finally, returning to the region beyond the upper fringe, there are maritime stations on Canada's Pacific Coast on 1630 kc and North Atlantic fishing vessels on approximately 1609 kc. Then, too, some U.S. BCB stations operating cueing units for mobile transmitters on 1608 kc. Such transmitters operate with powers on the order of 100 watts and can be identified readily since they ordinarily will be relaying the main station's programming.

There also are a few police departments still assigned channels as low as 1610 kc, but most have moved up to VHF or will do so shortly. Many properly might be classed as beyond-the-fringes DX, though in this case it clearly is a matter of bagging them while you can.

EI'S READY REFERENCE TO BEYOND-THE-FRINGES DX

FREQ. (KC)	STATION	LOCATION	ADDRESS
512	RB	Resolute Bay, N.W.T.	Officer In Charge (O.I.C.), Radio Beacon RB, RCAF Sta.
	CE	Centralia, Ont.	O.I.C., Radio Beacon HM, Mt. Hope RCAF Station
	BE	Bedford, Mass.	O.I.C., Radio Beacon BE, FAA
	GDL	Guadelajara, Mexico	Jefe, Dpto. Comnes., Cia. Mexicana de Aviacion S.A., Aeropuerto Central, Mexico D.F.
	MAT	Matamoras, Mexico	SEE GDL
516	UP	Ottawa, Ont.	O.I.C., Radio Beacon UP, Uplands RCAF Station
518	OD	Cold Lake, Alta.	O.I.C., Radio Beacon OD, RCAF Station
524	VBG	Vandenburg AFB, Lompoc, Calif.	Technician In Charge, Radio Facility VBG
	FZ	St. Hubert, Que.	O.I.C., Radio Beacon FZ, RCAF Station
	GE	Greenwood, N.S.	O.I.C., Radio Beacon GE, RCAF Station
527	OX	Comox, B.C.	O.I.C., Radio Beacon OX, RCAF Station
529	S.B.C.	Beromunster, Switzerland	DX Editor, S.B.C., Freudenberger Platz, Berne
530	NB	North Bay, Ont.	O.I.C., Radio Beacon NB, RCAF Station
534	FH	Shearwater, N.S.	O.I.C., Radio Beacon FH, RCN Station
1608	EPO	El Paso, Colombia	Jefe, Dpto. Comnes, Empresa Colombiana de Aerodromos, Techo Aerodromo, Bogota
1610	CTG	Cartagena, Colombia	SEE EPO
1613	RAB	Rabinal, Guatemala	Communications Supervisor, Pan American World Airways, International Airport, Miami, Fla. 33148
1615	PSO	Pasto, Colombia	SEE EPO
1618	LMM	Los Mochis, Mexico	SEE GDL
1620	NLD	Nuevo Laredo, Mexico	SEE GDL
	IZT	Ixtepec, Mexico	SEE GDL
1625	MZT	Mazatlan, Mexico	SEE GDL
	TIKX	San Jose, Costa Rica	SEE RAB
1630	VAC	Comox, B.C.	O.I.C., VAC, Dept. of Transport
	VAK	Victoria, B.C.	O.I.C., VAK, Dept. of Transport

SOLID-STATE VR for your car



BY FRANK V. EFFENBERGER

Best way to fix a relay voltage regulator is to junk it and then install our trouble-free transistor VR.

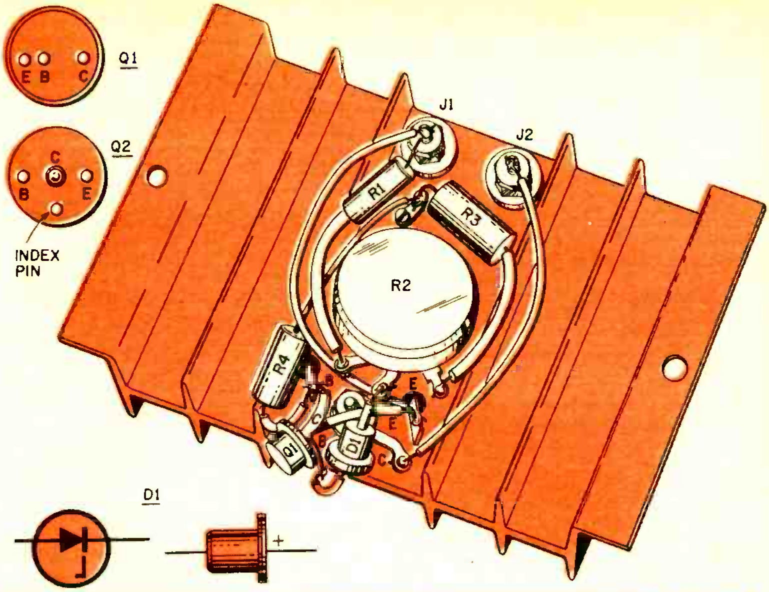
LIKE the Model T, the relay-type voltage regulator is an antique piece of automotive merchandise—except *it* is still around. But now it finally is being replaced by the solid-state regulator, whose performance and reliability leave little to be desired.

Relay regulators, because they are electro-mechanical, have built-in troubles, as do many devices with moving parts. If it isn't pitted contacts it's rust, dirt and consequent erratic operation. More than any other electrical-system component, the regulator is the killer of batteries. Unfortunately, relay regulators give few clues that they are not working properly until the battery is gone.

And a voltage regulator is something many mechanics know little about. Unless you take your car to an electrical-system specialist, you probably will end up paying for unneeded parts or, more often, a new regulator.

Solid-state regulators have no moving parts to wear out and they do not get rusty or require periodic adjustment. They operate rapidly, efficiently

Underside of regulator. Heat sink is supplied drilled for two power transistors. Transistor Q2 fits in one set of mounting holes. Its lugs are visible directly below R2. Holes must be drilled at other end for J1 and J2 and near center for R2. Mount R3's and R4's ground lug in existing hole. Components are crowded together; therefore, use spaghetti insulation on leads to prevent shorts.



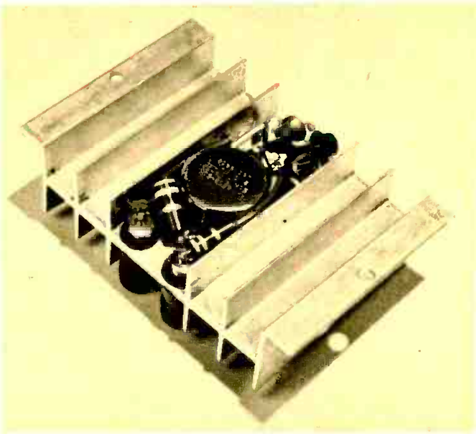
SOLID-STATE VR for your car

and will outlast the car. They keep the alternator's output voltage constant regardless of engine speed, aging of parts or ambient temperature. Look at some of the advantages of a solid-state regulator:

- The life of the car's battery, lamps, points and ignition system will be lengthened considerably.
- Initial adjustment of the regulator will last its lifetime.
- The life of the regulator, which has no moving parts and does not require maintenance, is almost indefinite. Its reliability is limited only by the quality of its components.
- It will not produce radio interference.

Our regulator, which is designed for cars with an alternator (generator-equipped cars cannot use it) and a 12-volt negative-ground electrical system, costs about $10. It will still be going strong when the car is ready for the scrap heap.

Construction of the regulator is straightforward. All components are mounted on the heat sink specified in our Parts List and as shown in the pictorial. Potentiometer R2 is mounted in a ⅜-in.-diameter hole. The dimensions of R2 (11/16-in. diameter and 9/16-in. depth) are critical. If R2 exceeds this size there will be insufficient mounting space for parts, and R2's body will stick out beyond the heat-sink fins. This will make it difficult to mount the regulator on the flat surface of the firewall. The pot we used and specify for R2 is a screwdriver-adjust, corrosion-resistant type.



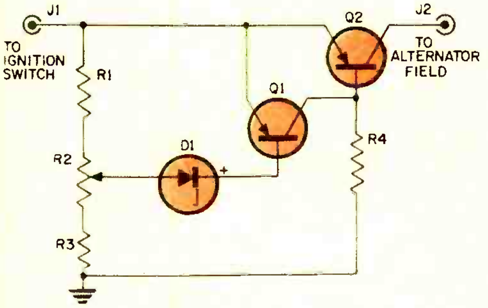
Be sure the back of potentiometer R2 does not extend beyond heat sink's fins and that there's space on sides of R2 for leads from R1, R3, J1, J2.

The case of power transistor Q2 must be insulated from the heat sink by the mounting kit supplied with the transistor. Put a light coating of silicone grease on both sides of the mica washer to insure good heat transfer from Q2 to the heat sink. Resistors R3 and R4 are soldered to a ground lug which is bolted to the heat sink.

Cover the body of zener diode D1 with plastic tubing or tape before soldering in place. Connections to the regulator are made to two insulated terminal posts (J1 and J2) which are mounted in 23/64-in.-diameter holes drilled at one end of the heat sink.

When the unit is wired, inspect it for shorts. Make certain that the case of Q1 does not touch anything since the case also is the base. The regulator should be weatherproofed by coating both sides with moisture-resistant varnish.

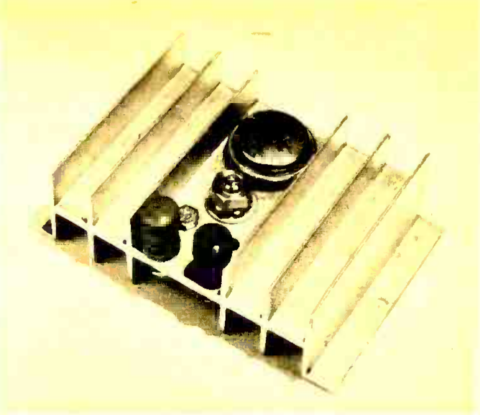
Installation. If your car employs an ammeter-type charging indicator, discard your old regulator. If your car use a lamp-type



A rise in alternator's output voltage (at J1) is fed by R2, D1 and Q1 to Q2. Q2 then reduces current to alternator's field to lower its output.

PARTS LIST

D1—Zener diode: 6.8V, 10%, 1 watt (International Rectifier Corp. 1N3016 or Z-1106-C)
J1, J2—Insulated terminal post (H. H. Smith 378 or equiv.)
Q1—2N241A transistor
Q2—2N278 transistor
R1—33 ohm, 1 watt, 10% resistor
R2—50 ohm, 2 watt, wirewound potentiometer (Clarostat 43C2-50, Newark Electronics Corp. 8F406)
R3—33 ohm, 2 watt, 10% resistor
R4—150 ohm, 2 watt, 10% resistor
Misc.—Double-fin heat sink, 70.28 sq. in. radiating surface, Lafayette 19-1533, $1.60 plus postage. Not listed in catalog.



Top of regulator. Make certain Q2 (top) is centered so its case doesn't touch heat-sink fins. After R2 (center) is set, tighten its locking nut.

charging indicator, leave the old relay regulator in place so the lamp-operating section still can be used. The voltage-regulator section is bypassed by our regulator.

Install the regulator on the engine side of the firewall, making certain there is good electrical contact between the heat sink and the firewall. Before making any connections, check the following things: 1) make sure the ignition switch is off; 2) don't ground the field terminal [J2] of the regulator when the regulator is supplied with 12 volts at J1. Even a momentary ground may damage Q2.

Make the following connections: if your car has an ammeter charging-indicator circuit, connect the wires from the ignition switch and alternator field coil to lugs J1 and J2, respectively, on the regulator.

If your car has a lamp-type charging indicator, connect a lead from the ignition terminal on the relay regulator to the ignition terminal (J1) on the transistor regulator. Disconnect the alternator field lead from the relay regulator and connect it to J2.

Connect a voltmeter from the alternator output to ground. Set R2 to about mid-rotation then gradually increase the engine speed. The voltage should rise with engine speed, then become constant. This point is the regulated voltage R2 is set for. If it is above or below that recommended (typically 14.4 volts) by the auto manufacturer, try another setting of R2.

Again, increase the engine speed to the point where the voltage becomes constant. Repeat this procedure until the voltage remains at the value you want

The LISTENER

C. M. STANBURY II

BCB TIME . . . With atmospheric interference on the way down and hours of darkness on the way up, DXer after DXer is thinking of returning to the good old broadcast band. Thing is, the BCB won't be what it was last season. The sunspot count then had reached bottom and conditions were so fantastic that stations from Cairo to Peking repeatedly rolled into North America in fine shape. But this year BCB DX promises to be closer to normal.

While an occasional transatlantic and/or transpacific signal still will be heard, most foreign stations this season will be of the Latin American variety. And though not nearly so spectacular as Egypt or China, this region can provide its share of noteworthy loggings. Matter of fact, some Latins regularly heard only a few years ago already have become genuine collectors' items. (Our illustration shows QSLs from four such stations.)

To mention only a few, R. Caribe in the Dominican Republic stirred up its share of hornets during the Trujillo dictatorship. Now known as R. Santo Domingo (HISD), it was taken over by the rebels during the civil war last spring and presently can be heard on 620 and 860 kc. Other prize catches were HIAQ, R. Norte (723 kc), a pro-rebel station at Santiago, Dominican Republic (ultimately blasted off by the military junta); and HRUC, R. Centro, at Tegucigalpa, Honduras, in and out of trouble with that nation's government but currently back with a good signal on 865 kc.

As for domestic BCB DX, conditions will be about the same as last year, with QRM from all-night stations increased only a little and coast-to-coast reception down but slightly. However, the occasional ionospheric storm well may block out upper- and mid-latitude signals, leaving channels clear for stations in Latin American and the South.

As usual, any DXer with broader interest can tune for news of local happenings—floods, fires, church bazaars, what have you. But something new will be added this season in the form of the telephone opinion program.

Now accepted by countless stations as the latest hot format, this craze and its variations account for much of the schedules of New York City's WNBC (660 kc) and Buffalo's WGR (550 kc). In theory, such programs should give inquisitive BCBers an idea what each community really is thinking. But you'd best take them with a grain of salt. For unless friend moderator markedly is on his toes his station can be taken over by the habitually discontented, crackpots or most any other group.

An opposite extreme is the moderator who smothers the program with his own views or uses it as a vehicle for some cause or other. Matter of fact, one too-sensational operator cost CJOR (600 kc) at Vancouver, B.C., its license (if the decision is not reversed by the Canadian Minister of Transport).

Another Countries List . . . It seems we

[*Continued on page* 118]

Latin American QSLs frequently become collectors' items because of the region's political turmoil. Each of these cards falls in the collectors' category.

All-Master Intercom

By D. DEREK VERNER Experts tell us that people don't know how to communicate with each other. We don't have the psychological solution to this problem but we do have a reliable and inexpensive way of establishing at least acoustic contact. Called the All-Master Intercom, our system will satisfy almost every communication requirement in apartments, homes or offices.

Every station of an ideal intercom system should be a master so that any station can call any other. The system should not consume power when not in use and, most of all, it should not be expensive. The All-Master Intercom sports all these features. It is transistorized and costs less than $7 a station. It allows you to have an almost unlimited number of stations, has a centrally located, low-cost battery power supply, instant warmup and visual as well as audible signaling.

The heart of each of our system's stations is a preassembled transistor amplifier. All stations normally are connected in the listen mode (but they don't consume power). That is, the input of each is connected to the common line. To make a call you turn the selector switch on your station to the station you wish to call. One section of the switch connects the battery to your station's amplifier and pilot light. The other section of the switch connects the battery to the station you are calling to power its amplifier and to turn on its pilot light.

When you press your push-to-talk switch the output of the amplifier in your station is switched from the speaker to the line and the amplifier's input is connected from the line to the speaker (which becomes a microphone). Your message is amplified and fed to the line which is common to all stations. The called station further amplifies the signal and feeds it to its own speaker. The person you call then presses his push-to-talk switch to reply. At the conclusion of the conversation your station selector switch it set to off, removing power from both amplifiers.

Since the signals are amplified at the calling station and the called station, the gain of the system is sufficient to overcome small losses due to impedance mismatch. In fact, there may be too much system gain as the first amplifier may overdrive the second and cause distortion. To eliminate this distortion, a few simple modifications are made to the amplifiers to reduce their gain and, as a bonus, improve frequency response.

All Master Intercom

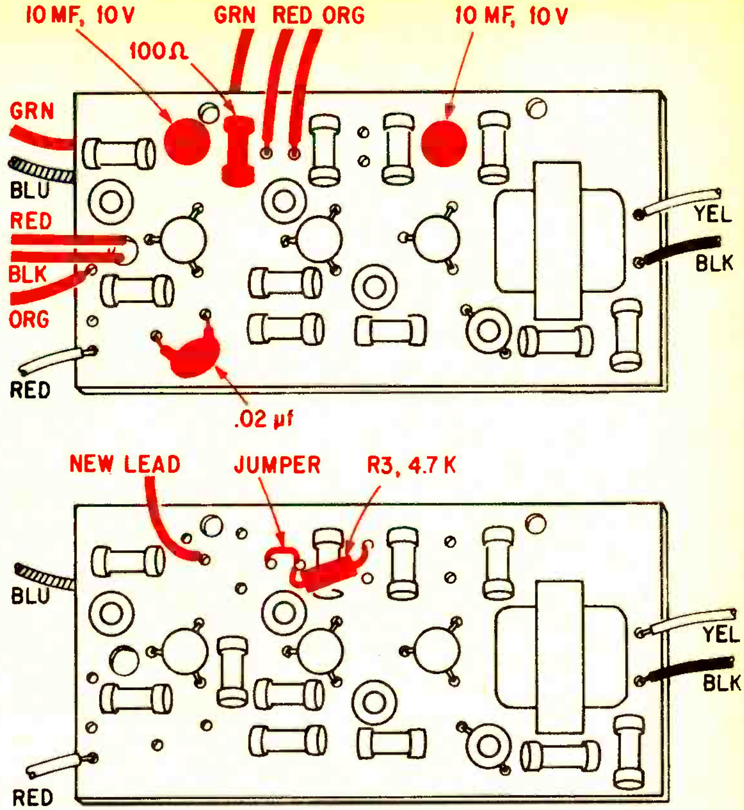


Fig. 1—Pictorial at the top shows unmodified amplifier. The components and leads to be removed are in color. Carefully unsolder each wire with a small-tip iron and do not apply the heat too long. Pictorial at the bottom shows the amplifier after removal of parts. The added 4,700-ohm resistor, jumper and new lead are shown in color. New lead is connected in hole from which the negative lead of the 10-µf, 10-V capacitor was removed.

Construction

All stations (with the exception of the door station) are similar. The only difference between them is the marking of switch S1's positions and the wiring terminals. The stations are built in small Bakelite instrument cases. Wiring is straightforward; the only precaution necessary is that you keep the amplifiers' input leads away from its output leads. The number of stations is limited by the number of positions on S1. Our system uses a five-position switch, but a switch with up to, say, 24 positions could be used.

Begin construction by modifying the transistor amplifiers. Use a pencil-type iron and work quickly to prevent damage to the circuit boards. The parts and wires in color in the top pictorial in Fig. 1 are removed. Carefully unsolder the two 10-µf, 10-V capacitors and the 100-ohm resistor. Remove the red, green and orange leads that normally would be connected to a volume control. Connect a 4,700-ohm ½-watt resistor (R3) between the ground point shown and the point from which the orange lead was removed. Also connect a short jumper from the point where the orange lead was to the point from which the red lead was removed.

Unsolder and discard the green input lead, the red and black battery-connector leads and the orange leads. The .02-µf disc capacitor also may be removed since it serves no purpose in this application. Solder a five-inch lead to the point from which the negative lead of the 10-µf capacitor (upper left corner) was removed.

Mount the modified amplifier and the remaining components, with the exception of S1, on angle brackets on the box's cover as shown in our pictorial and photo (Figs. 3 and 4). Make a bracket for S2 from a piece of scrap aluminm (Fig. 2) and mount it with 4-40 machine screws as shown in Fig. 3.

Mount switch S2, using the screws provided with it, and install a small lug under the speaker mounting screw near S2. After all components are mounted, wire the unit as shown in the schematic and pictorial diagrams (Figs. 2 to 5). If additional stations are to be added later, connect leads from the

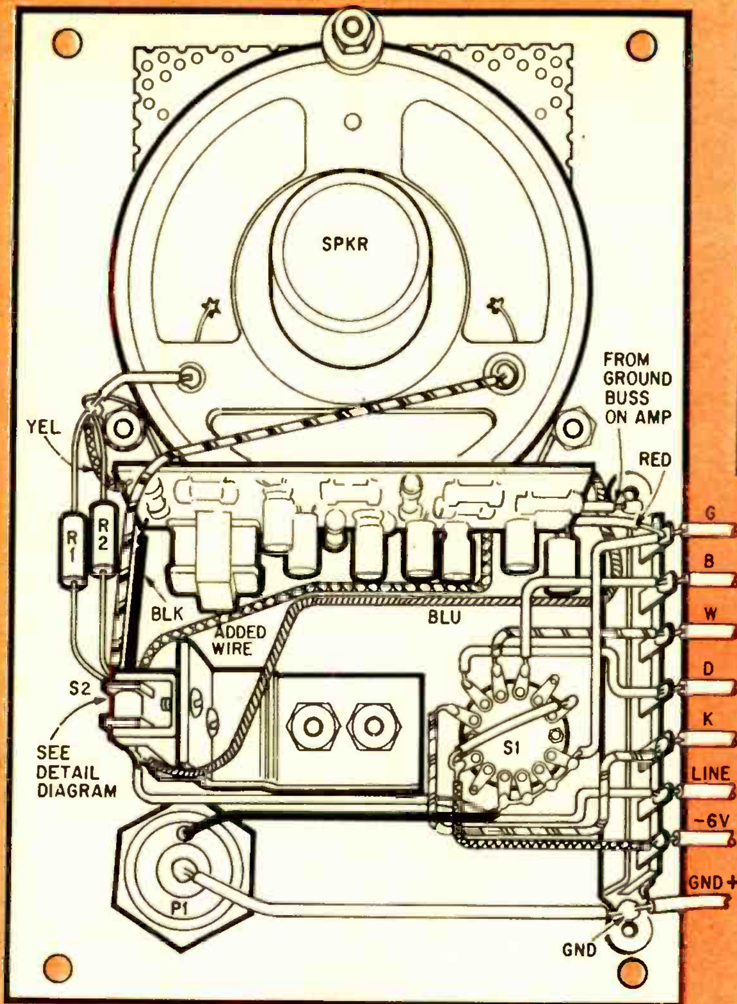


Fig. 3—To the right of station-selector switch S1 (left), mount a terminal strip to which connections to other stations are made. Note that the top lug on the terminal strip is marked G. This is because garage station is shown. On other stations, top lug is marked with abbreviation for that particular station. Other lugs are marked with letters of other stations.

Fig. 2—Wiring to push-to-talk switch S2 and mounting bracket for S2 are shown below. Ground lug to which R1 and R2 are connected is mounted under screw that holds speaker.

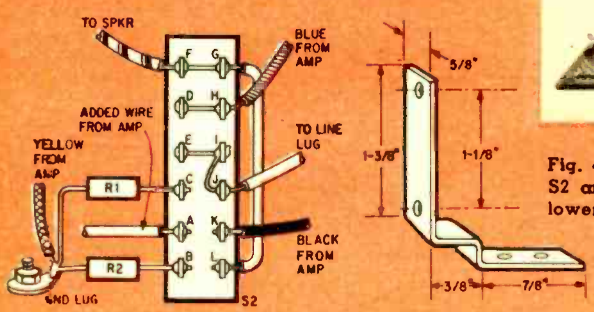


Fig. 4—Photo of side of garage station. Note how S2 and the amplifier are mounted. Component at lower right corner is the holder for the pilot light.

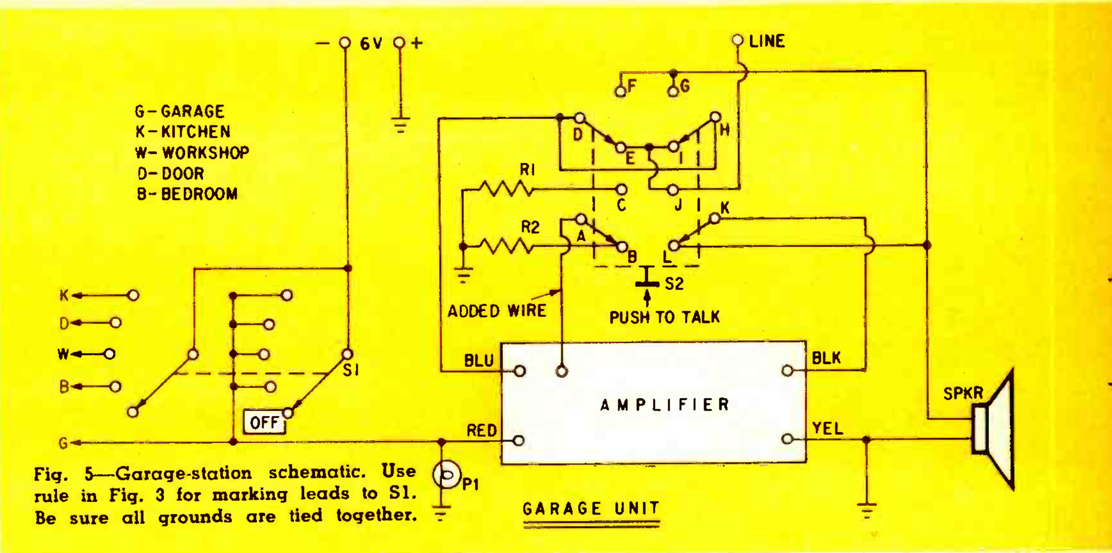


Fig. 5—Garage-station schematic. Use rule in Fig. 3 for marking leads to S1. Be sure all grounds are tied together.

All-Master Intercom

lugs on S2 to the terminal strip to the right of it. In our system, there are five stations: front door, workshop, garage, bedroom and kitchen. The stations are represented by their initial letters in our diagrams.

Our schematic and pictorial are of the garage station; therefore, the terminal-strip lug to which the red lead from the amplifier is connected is marked *G*. Leads from the other four stations, B,W,D and K, are connected to the other terminal-strip lugs. The only difference between stations is that the lug to which the red lead of the amplifier is connected is marked with the letter representing the location of that particular station. That is, if the station shown were the workshop, the top lug, to which the red lead from the amplifier is connected, would be marked *W*. The lug below now marked *W* would be marked *G*. The other lugs are marked with the letters representing the *remaining* stations.

When assembling the unit put a piece of perforated metal or aluminum screening between the speaker and its 2½-in.-dia. opening in the panel. One section of S1 supplies power to the local amplifier and pilot light. Connect all these lugs together except the *off* lug and the lugs for stations that will be added later. This will prevent the local amplifier and pilot light from being powered should S1 inadvertently be set to a position for which there is no station.

If desired, a locking-type switch, such as Lafayette's 99 G 6158, may be used for S2. This switch can be locked in the *talk* position.

It may not be necessary or desirable for a front-door station to be able to originate calls. In such cases, eliminate S1 and all leads going to it and connect the negative 6-V lead directly to the red amplifier lead. Since visitors are not likely to be familiar with the operation of the intercom, it would be a good idea to put a piece of translucent plastic on which are the words *push-to-talk* over the door-station pilot light. Put your regular doorbell button on the station's front panel and label it clearly *doorbell*. When the bell rings you go to the nearest station and set S1 to *door*. This will illuminate the *push-to-talk* sign, which will tell the visitor to identify himself.

Before installing the system check out the units by connecting them, a pair at a time, as shown in Fig. 7. Note that the negative side of the battery is connected to the lug marked with the code letter of the station under test. This permits operation regardless of S1's position. Place the stations at least 12 feet apart and put a friend at the other station. Test the units by talking back and forth. Ignore distortion, this will be cleared up later. Check to see that each station functions both as a transmitter and as a receiver. If any pair fails to function, check out each station with one known to be operating prop-

PARTS LIST

P1—No. 47 pilot lamp and socket
R1—680 ohm, ½ watt resistor
R2—100 ohm, ½ watt resistor
R3—4,700 ohm, ½ watt resistor
R4—10 ohm, 4 watt wirewound potentiometer
S1—2 pole, 5 position rotary switch (Lafayette 99 G 6164 or equiv.)
S2—4 pole, double throw spring-return switch (Lafayette 99 G 6175 or equiv.)
SPKR.—3 in., 8 ohm speaker (Lafayette 99 G 6099 or equiv.)
Misc.—Three-transistor amplifier (Lafayette 99 G 9039)
6¼x3¾x2-in. bakelite box and cover (Lafayette 19 G 2001 and 19 G 3701 respectively)
6 V lantern battery (Eveready No. 731 or equiv.
Multiple-conductor audio cable (Alpha wire type 1172 to 1181/30 depending on the number of conductors, or equiv.)

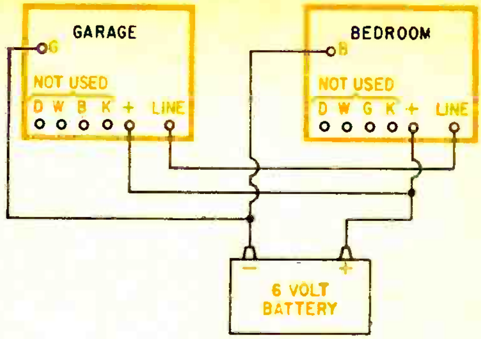


Fig. 7—Preliminary test setup. S1's setting is unimportant with stations connected as shown. Check each station against one that you know is working.

erly using the setup in Fig. 7.

Wiring between units is much simpler than it appears in Fig. 6. All terminals with the same letter are connected together. Remember that the number of connecting wires required is three more than the number of stations in the system. Assign one color to each station, one to the negative battery terminal, one to the common line and another to system ground (+). Connecting the stations is simply a matter of connecting like colors. Locate the battery anywhere and run two wires from it to the closest station.

Testing

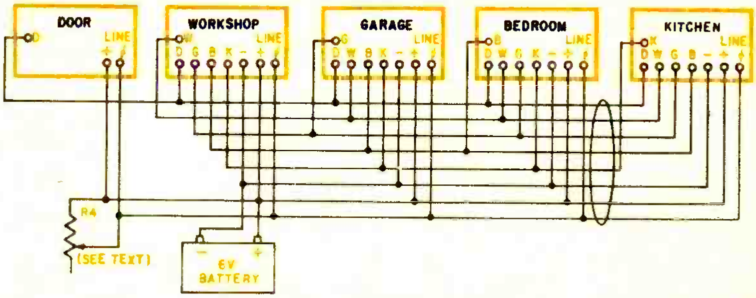
After installation, check that all stations are working properly by calling each station in turn from every other station. The pilot lights for both the calling and called station should light. Speak at a normal conversation level about a foot from the speaker.

Depending on the number of stations in the system and the length of cable, some distortion may be present. If you detect distortion, connect a 10-ohm potentiometer (R4) anywhere in the system between system ground (positive side of battery) and the *line* wire. The resistor attenuates the input to the receiving amplifier to prevent it from being overloaded. Place a radio or other sound source near one station, fasten down the *push-to-talk* switch and listen at the station where the potentiometer is located. Gradually decrease the resistance until the distortion disappears. Leave the potentiometer at this setting.

When using the intercom as a baby minder lock the *push-to-talk* switch at the nursery station in the *talk* position and leave S1 in the *off* position. In this way, the system may still be used normally for other purposes and any station may be tuned in on the baby by setting its selector switch to *nursery*.

A simpler system can be built by eliminating the selective-call feature. In this design, all stations would be powered when S2 is pressed. Because power is removed when S2 is released, eliminate the pilot lights. Since the current drain will be lower, use a smaller battery. And only four-conductor cable will be necessary to connect all stations.

Fig. 6—Interconnection of several stations looks complicated but it isn't. Use colored wire to connect all lugs with same letter. Battery can be located near any station. Its positive lead goes to + lug and its negative lead goes to − lug on station it is near. R4 is optional and reduces distortion.



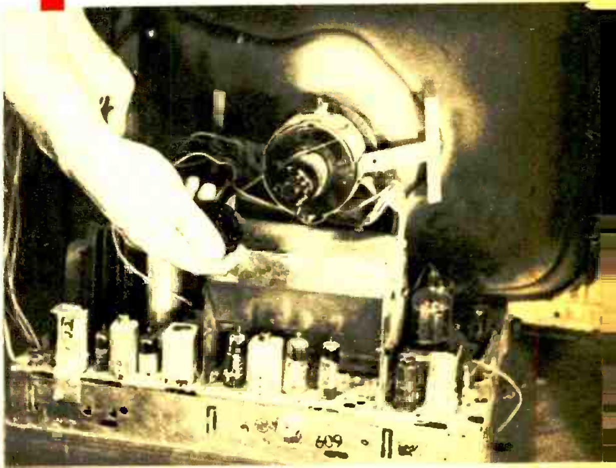
Safety goggles, long-sleeve garment comprise required picture-tube-changing costume. Though rare, implosion always is possible, so best bet is to play safe.

HOW TO CHANGE A PICTURE TUBE

By ART MARGOLIS

GIVING an idiot box a new eye is a chore most hobbyists shy away from. Reason, of course, is that high voltages and possible implosion spell danger. But approached with reasonable caution and care, the operation can be as safe and easy as adjusting a pair of rabbit ears. Our photos depict a time-proven, ten-step procedure. —◆—

Unplug picture-tube cap after TV set's chassis and/or CRT have been removed from cabinet. Cap ordinarily will come free without difficulty, though so-called frozen connections will demand extra-careful handling.

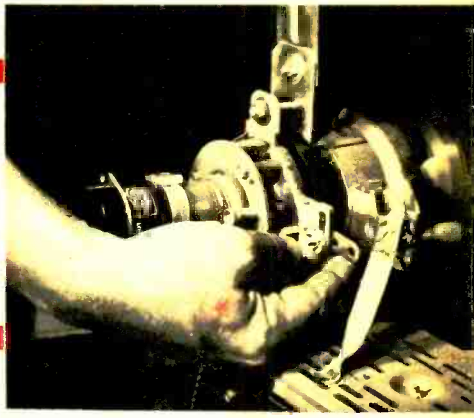


Ion-trap centering devices (if present) and yoke (if mounted on CRT) must be slid off neck of tube. As in other steps, keep track of order in which individual operations are performed since procedure will be reversed during reassembly.

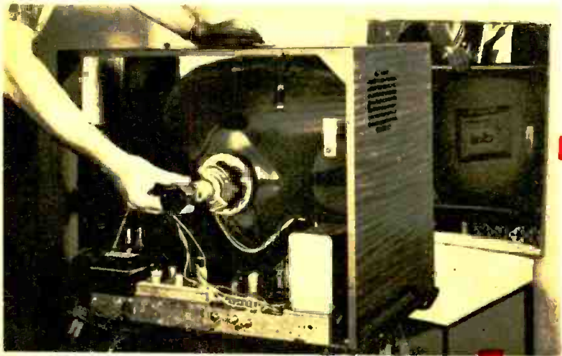
High-voltage anode lead unclips from small well on side of picture tube. Screws or bolts holding tube to chassis also must be removed.

Focus controls should bring picture into focus if focus jumper strap is connected correctly. Defocused picture is deceptive but focus is at best setting when individual scan lines are sharpest.

Tilted picture can be righted by rotating yoke and watching mirror. Clean CRT mask and glass before reinstalling in front of new pic tube.

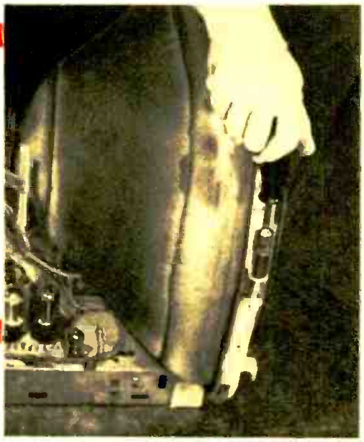


Turn on TV, turn brightness control ¾ up, adjust ion trap for maximum brightness at position nearest rear of set. Reset centering device if image should prove to be off-center.



Reconnect leads, etc., in reverse order from that used in disassembly. Place mirror at proper angle in front of set so results of adjustments can be viewed from the rear.

Gingerly tug picture tube free from yoke, slide tube out of TV set and place face-down on soft surface. (Should CRT be frozen in yoke, mask or hardware, stop and call for skilled help.)



Remove new tube from box, put old tube in its place, then slide new tube into set. Be certain that high-voltage connection is on proper side.

THOSE less-than-$20 tape recorders aren't likely to be mistaken for the big hi-fi models but they *do* have uses. One important feature missing from these machines which could help you is a record-level indicator. Without one, you have no way of knowing about or controlling the amount of signal that goes on the tape.

For only about $2.50 and an hour of your time you can eliminate this shortcoming by adding a level meter. The improvement in your recordings will surprise you.

And you don't have to break into the recorder to connect the meter. Simply plug it in the recorder's earphone monitor jack.

PLUG-IN LEVEL METER for Budget Recorders

By FRED BLECHMAN, K6UGT

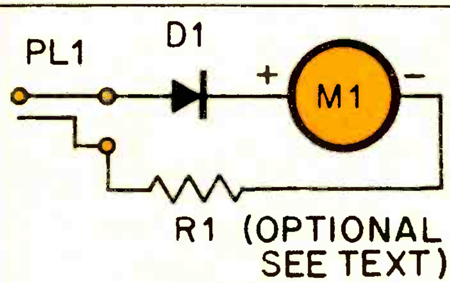
From then on it will be an easy matter to get the correct recording level, whether you're taping telephone conversations, dubbing or recording from a radio, tuner or record player. Even live mike recordings will be much better controlled.

If you can now monitor recordings with a low-impedance phone, the level meter should work well when plugged into the phone's jack. However, if you are not able to monitor through the earphone jack *while recording*, or if you must use a high-impedance phone (1,000 ohms or more), the level meter won't work satisfactorily.

The schematic below gives you an idea of how simple the setup is. Although any sensitive meter could be used, the type we specify is best since it is small, inexpensive and has a level-meter scale. The resistor is necessary only if the signal to the recorder tends to overdrive the meter when recording at the correct level. Choose a resistor (22 to 470 ohms) whose value will cause the meter to deflect about ⅔ full scale when recording at the right level. A few trial tapes will help you find the value.

Get hold of a small plastic box, cut a hole in it for the meter face, glue the meter in place and paint the box. That's about all there is to construction. The finished product appears in our photo.

When making recordings, set the recorder and program-source level controls near mid range. Since our level meter is not damped like a professional VU meter, the needle may swing around a bit more, but you'll get used to this in no time at all.



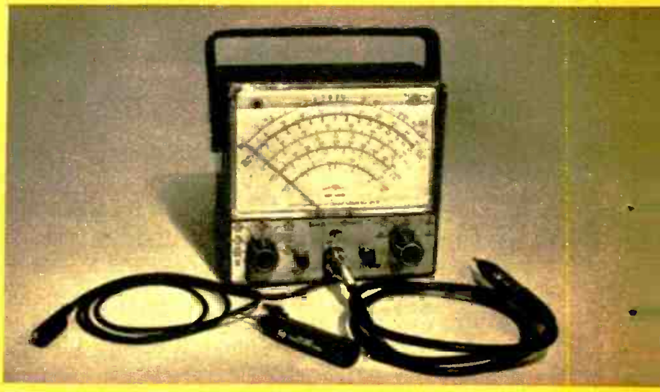
Schematic of plug-in level meter.

PARTS LIST

D1—1N34 diode
M1—Miniature level meter (Lafayette 99 G 5036)
PL1—Phone plug to match recorder phone jack
R1—22-470-ohm, ½-watt resistor (see text)

KIT EI REPORT

EI builds the GRANDADDY OF THE VTVMs



RCA WV-98C(K) Senior VoltOhmyst

KIT: RCA WV-98C(K) Senior VoltOhmyst
MANUFACTURER: Radio Corporation of America, Harrison, N.J. 07029
PRICE: $57.95 kit; $79.50 factory wired
CONSTRUCTION TIME: about 10 hours

ASK a serious electronic hobbyist or serviceman what his most useful test instrument is and the answer most likely will be a VTVM. And the reply well might have been the same back in the middle or late 1930s when RCA introduced its first VTVM. Called the Rider VoltOhmyst, it sold for $57.50 factory wired and measured only DC voltage and resistance.

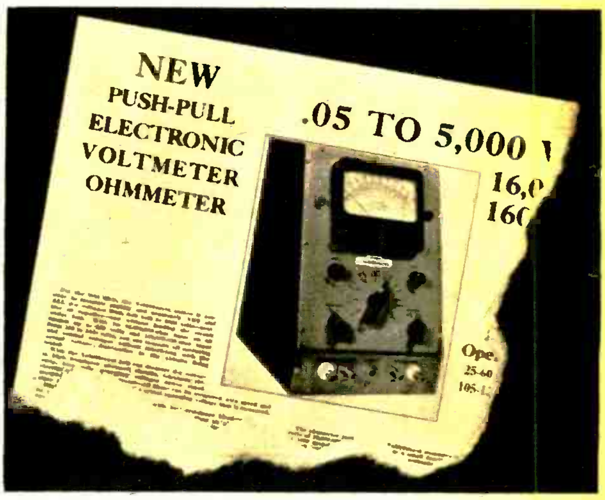
Though not the first VTVM on the market at that time, it was what RCA considered the first *practical* VTVM at a price the broadcasting and service (and later television) industries could afford.

Now, many years and design refinements later, RCA's top-of-the-line VTVM is called the Senior VoltOhmyst, Model WV-98C(K). The ranges and features of its DC and ohmmeter functions are about the same as those of the Rider VoltOhmyst. However, the WV-98C(K) can measure AC as well as DC and resistance.

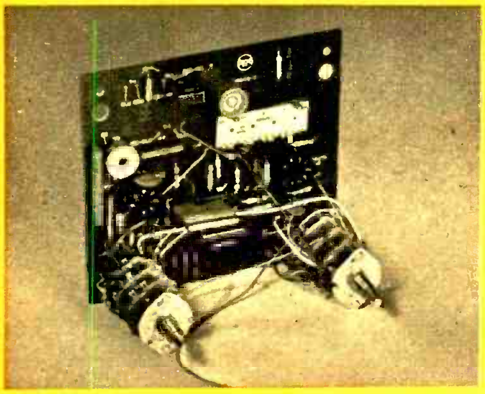
But the bridge circuit, or what could be called the heart, of the WV-98C(K)—and practically every other VTVM in existence—fundamentally is the same today as it was in the Rider VoltOhmyst. So the instrument, now known as the WV-98C(K), rightfully can claim to be the patriarch of the clan.

Why is the WV-98C(K) called Senior? It does have a 6½-in. easy-to-read meter face and is exceptionally accurate and stable but these alone aren't the reasons. The feature that makes the WV-98C(K) different from ordinary service VTVMs is that, in addition to being able to measure the rms value of sine-wave voltages, it can measure the peak-to-peak (P-P) voltage of *complex* waveforms.

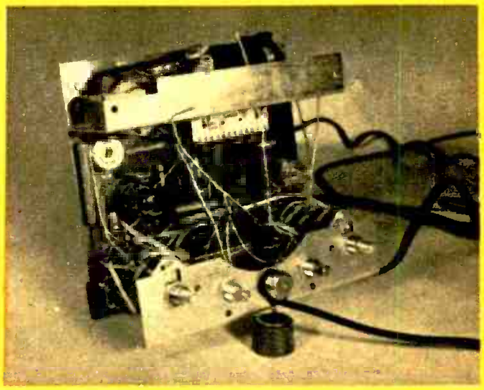
Most VTVMs, though they have a P-P scale, respond to, or can measure accurately, only sine-wave voltages. The P-P calibration



Part of an RCA circular that dates back to the '30s shows what the Rider VoltOhmyst looked like.



Completely wired circuit board before installation of brackets. White rectangular component in the upper right corner is four calibration pots.



Meter is installed at this stage of construction, then instrument is put in case. Upper bracket contains the power transformer and one D cell.

on the meter face simply is the rms value of sine-wave voltage multiplied by 2.828. Such meters do not indicate accurately the P-P value of complex (non-sinusoidal) waveforms such as are found in a TV set. Nor can they measure a string of pulses.

The DC full-scale ranges of the WV-98C(K) at 11-megohm input impedance are 0.5, 1.5, 5, 15, 150, 500 and 1,500 volts. The 0.5-V full-scale range makes the lowest calibration mark 0.01 V—perfect for transistor-circuit voltage measurements.

The AC rms ranges are the same as the DC ranges except there is no 0.5-V range. The AC P-P ranges for sine and complex waveforms are 4, 14, 42, 140, 420, 1,400 and 4,200 volts.

The ohmmeter measures from 0.2 ohms to 1,000 megohms in seven ranges. The mid-scale resistances are 10; 100; 1,000; 10,000; 100,000 ohms and 1 and 10 megohms.

The WV-98C(K) went together without hitches. The construction manual is well illustrated and we did not run into difficult steps. Most parts are mounted on a printed-circuit board. The instructions told us to solder each part as it is installed but we preferred, as you might, to install several components, solder them, then install another group of components. The illustrations of the range and function switches were quite clear considering the number of connections to be made to them.

Mechanical assembly of the circuit board, the support brackets and other large components did not give us trouble. We completed the construction in a shade under nine hours.

To insure stable and accurate calibration, the WV-98C(K) must be aged before calibration by letting it sit with the power on for at least 50 hours. Although RCA recommends a 36-hour aging time, our instrument required 50 hours for rock-steady stability.

To calibrate the DC ranges you use a D cell supplied with the instrument and two 1 per cent resistors (1,000 and 472 ohms). The resistors are connected in series across the cell to provide two reference voltages of 1.06 and 0.5 volts. There are three DC calibrations to be made. One is for all +DC ranges, the other is for all −DC ranges and the third is for the 0.5-V DC range.

To assure accurate AC calibration, the WV-98C(K) does not rely on the AC line voltage as a reference because it could be anywhere from 100 to 130 volts. Instead, you use the D cell, which you connect in the circuit at the point where the DC output of the 6AL5 rectifier would appear. All AC ranges are then calibrated with one potentiometer.

The accuracy of our instrument (which took about an hour to calibrate) was much better than the claimed ±3 per cent full scale. When checked against a standard DC voltage cell we could not observe an error (within the limits of parallax). Since we did not have an AC standard we checked the

[*Continued on page* 119]

DX GUIDE TO VOA

By ALEX BOWER

EVERY American knows something of the Voice of America. More importantly, every SWL has logged it. And reasons for this state of affairs aren't hard to find.

A world-wide complex constructed at a cost of well over $100 million, the VOA beams its messages in some 38 languages and is on the air for more hours weekly than all major U.S. radio networks combined (our photo above shows the Voice's main broadcast console located at VOA headquarters in Washington, D.C.). VOA transmitters radiate an astounding total of 12,116,500 watts which, jamming notwithstanding, explains how the Voice manages to reach a substantial portion of the world's ears.

But when it comes to DX, many aspects of the VOA are anything but public knowledge. Fact is, VOA relays can provide real DX, though few DXers would seem to take advantage of all they offer. Further, at least one of the VOA's so-called relays does considerably more than relay, thus affording DXers with some variety in the bargain.

Considered strictly from a DX viewpoint, the most important VOA relay may be that 35-kw facility at Colombo, Ceylon. Reason is not that R. Ceylon itself can't be heard in North America, since that government's commercial service is a regular visitor on our West Coast. Trouble is, the station's verification policies are erratic at best and obtaining a QSL often demands patience the average DXer doesn't possess.

Needless to say, there is no such problem with the VOA relay. Anyone looking for a means of putting Ceylon in his book has merely to log the VOA on 11835 kc between 0700 and 1300 EST (or any other channel on which he may find it), then send his report to Voice of America, Washington, D.C. 20547. This same address, incidentally, applies to all other VOA reports.

Another awkward country to QSL in which a VOA relay frequently proves of value oddly enough is England. To be sure, the U.K. hardly is rare DX, though there's nothing wrong with having a QSL from England to boost a country total. And while the British Broadcasting Corp. answers all reports, question is whether its card (which does little more than acknowledge that a report is in accord with published schedules) necessarily constitutes a verification.

One easy way around this dilemma is to log the BBC facility at Wooferton while it's relaying the VOA to Europe, then send a report to Washington at the address given above. A frequency often used by Wooferton is 11760 kc. Try for it around noon EST.

An equally important relay for DXers is the one at Rhodes in the Dodecanese Islands. These islands represent the only Greek territory in Asia and, because of this fact, EI's

DX Club counts the Dodecanese as a separate country (OFFICIAL COUNTRIES LIST, Mar. '65 EI). And, so far as EI knows, the only non-amateur way to log the Dodecanese Islands is via the VOA.

Interesting, too, is this operation's unusual DX history. Rhodes originally was anchoring site for the U.S. Coast Guard's Courier, first floating broadcast station in postwar radio history. In 1952, after making a few daytime tests off the East Coast of North America, the Courier sailed for Panama on its shakedown cruise. Transmitting from the Canal for a few days, it provided DXers with a rare one-shot logging (those lucky enough to bag it during that brief span were rewarded with a special QSL card).

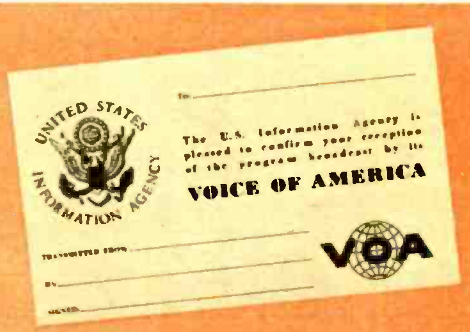
The Courier took up duties at Rhodes on September 7, 1952, and served there until replaced by the present land-based facility in the summer of 1964. The VOA installation at Rhodes now is composed of two 50-kw SW transmitters plus a 150-kw medium-wave job (1259 kc). Easiest place to log Rhodes currently is on 7130 kc at 2300 sign-on and again around 1600 EST.

All told, the Voice of America has 44 transmitters in the U.S., 56 overseas (our map at the end of this article shows where VOA transmitters are located and indicates the approximate scope of coverage). In addition to those already mentioned, the VOA operates relays in Okinawa (the only SWBCer in the Ryukyu Islands—try 11715 kc after 1900); Thessaloniki in Greece itself (try 7205 kc just before 1700); Honolulu; Hue in South Viet Nam (760 kc only); Munich; Tangier (once a separate country but now part of Morocco); Manila, and Monrovia, Liberia.

The latter, in addition to rebroadcasting programs from the VOA in Washington, produces many programs of its own specially for the African service. To do this, VOA Monrovia (officially known as the African Program Center) deploys correspondents in major African cities. After this material is collected and disseminated by Monrovia, it is sent on to Washington for possible use there.

This giant network literally began with nothing. When the United States declared war on Nazi Germany, Italy and Japan late in 1941 the U.S. government neither owned nor operated one SWBC station. It promptly was forced to lease private facilities from NBC at Bound Brook, N.J. (now WBOU); General Electric at Schenectady, N.Y. (which became WGEO); CBS at Brentwood, N.Y., and Crosley Broadcasting at Bethany, Ohio (now WLWO). Shortly afterward private facilities at Dixon (NBC) and Delano (CBS), Calif., and Wayne (CBS), N.J., were added.

From then until March 1963, the VOA's North American lineup stood pat. But in 1963 the Voice's long-dreamed-of, superpower central station at Greenville, N.C., became a reality. With this giant step completed, both WGEO and the antique facilities



QSL card issued by Voice of America, shown greatly reduced in size, bears seal of parent U.S. Information Agency. See text for VOA's address.

DX GUIDE TO VOA

at Brentwood were retired. Simultaneously, work was begun on modernizing WLWO and the California stations.

The Greenville facility includes six 500-kw, six 250-kw and six 50-kw transmitters, plus a microwave link with VOA's Washington studios. Completing VOA's North American array is a 50-kw job on 1180 kc at Marathon Key, Fla., which is the portable variety, and another on 1040 kc at Sugar Loaf, Fla. Once used by Baltimore's WBAL for standby purposes, the latter was purchased hastily by the Voice during the Cuban crisis. Significantly, this Florida pair are the only U.S. BCB stations without call letters.

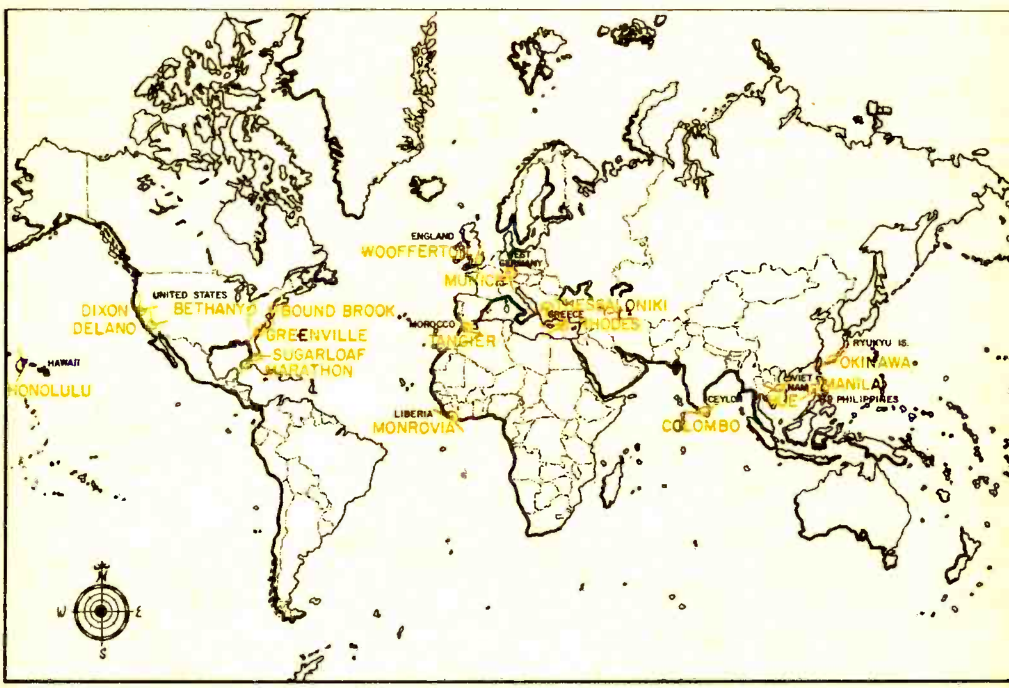
The VOA's overall policy best has been stated by the late, great Edward R. Murrow, who once headed the parent U.S. Information Agency. In Murrow's words, "The Voice of America stands upon this above all; the truth shall be the guide. Truth may help us. It may hurt us. But helping us or hurting us we shall have the satisfaction of knowing that man can know us for what we are and can at least believe what we say."

It seems to be an effective strategy. Both Havana and Peking counter the Voice with a battery of jammers. And Moscow has done likewise, though it appears that jamming gradually is being phased out of Soviet propaganda policies . . . maybe. (Fact is, Moscow has not jammed the VOA since June of 1963.)

And not all attacks on the Voice come from the Communist bloc. One of its most vocal critics is Carl McIntire, who airs his views via WINB (EI's DXers are well acquainted with McIntire and the station).

Says Dr. McIntire: "The tragedy is that we are not meeting the Soviet propaganda. In the ideological struggle the Communists are blasting away. I listened by short wave to Radio Peking, also Radio Moscow. Constant tirades against America, capitalism! I then listened to the Voice of America. What a contrast! We are not fighting anybody! We are not exposing the Communists' fraudulent propaganda. The 'no-win' policy is being reflected in what is told on the Voice of Amer-

[*Continued on page* 112]



Map shows locations of VOA's 100-odd transmitters around the globe. Nearest city or town appears in color near caliper-shape symbol indicating approximate scope of beam. VOA's main studios are in Washington.

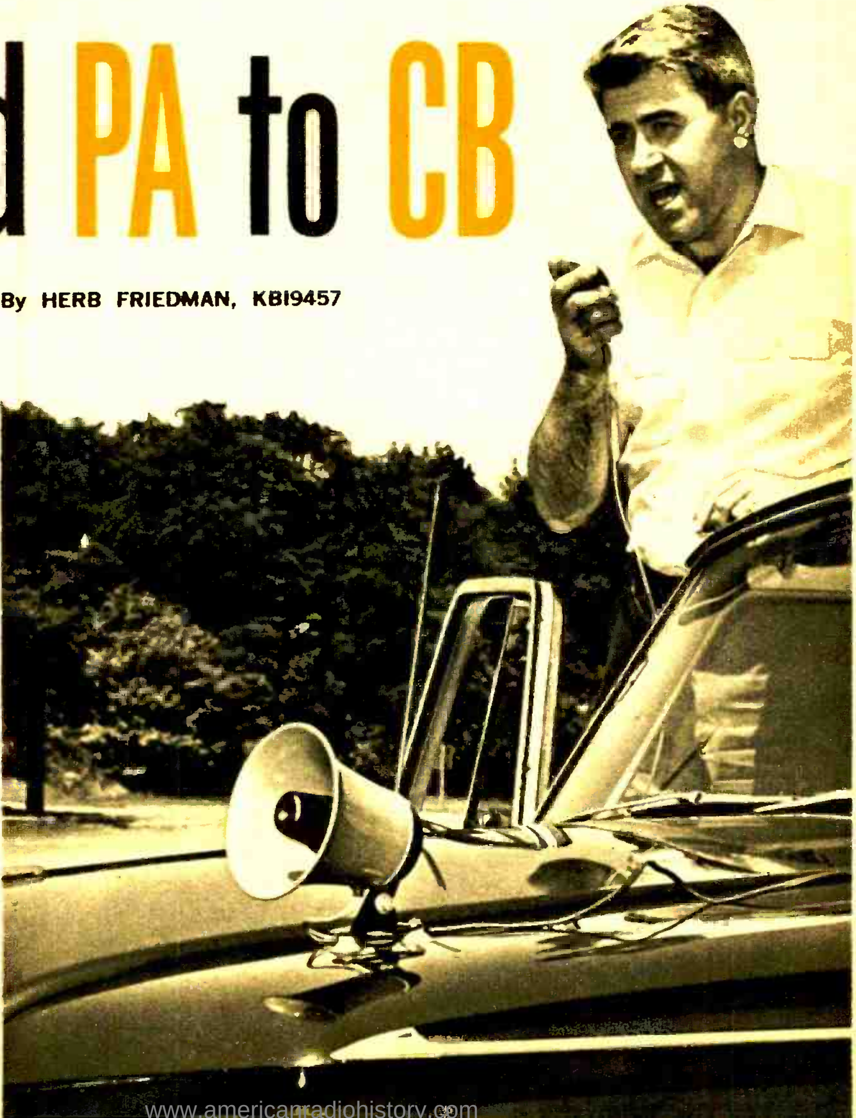
ONE of the most popular—and handiest—selling points found on modern Citizens Band transceivers is a public-address (PA) feature. PA can be mighty useful if you're involved in the doings of an emergency organization, such as REACT, or some public-service operation. For example, when you have to control crowds at a show or fair or auto race a PA system projects your voice to hundreds or thousands of people.

Adding PA to an older transceiver isn't difficult. Since the modifications required for a relay-switched transceiver are different from those for rigs with electronic switching, we'll cover each individually.

Relay Switching. Figure 1 is a simplified schematic of the typical transceiver circuits involved in a PA modification. Normally, when the transceiver is in the receive mode (as shown) the audio preamp's input is connected by a pair of PTT relay contacts to the volume control. Similarly, one side of the speaker is grounded through another set of relay contacts. While we show a speaker lead connected to ground through the contacts, in some transceivers switching is accomplished in the output transformer's ground lead. So far as the PA modification is concerned, it

add PA to CB

By HERB FRIEDMAN, KBI9457



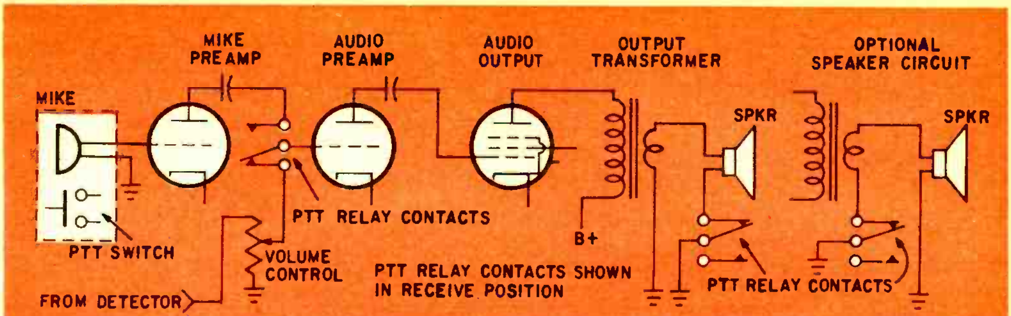


Fig. 1—Simplified schematic of a portion of a typical CB transceiver that has relay PTT switching. The PTT relay contacts are shown in the receive position. Signal from receiver goes through volume control, closed PTT contacts, through audio stages and continues to the transceiver's speaker.

add PA to CB

doesn't make any difference which lead is switched.

To convert to PA, you add a DPDT switch, a jack and an L-pad—as shown in color in Fig. 2. With the transceiver in the receive mode (shown) one set of the added switch contacts connects the mike preamp to the audio preamp. The second set of contacts disconnects the internal speaker and connects a remote PA speaker.

The remote speaker is connected to the rig through an L-pad (to control volume) by means of a standard phone jack mounted on an unused corner of the transceiver's rear chassis apron. Insulate the jack from the chassis with a set of shoulder washers. If there is no room on the chassis for the L-pad, mount it in the remote speaker's cabinet.

When switch S1 is in the receive position the transceiver operates normally. With S1 set to PA, the receiver will be disabled and you simply talk into the mike. But make certain you don't press the PTT button or the transmitter will be activated.

An optional hookup will let you listen to the receiver from the remote speaker. Instead of using a DPDT switch for S1, use two SPDT switches. When both switches are set to PA, the operation will be the same as with a DPDT switch. But if only the speaker switch (S1B) is set to PA, you will hear CB calls through the remote speaker.

Electronic Switching. You'll have to study your transceiver's schematic for this conversion because each rig is different. Figure 5 shows a typical circuit. When in the receive mode (shown), the speaker is connected to ground through the PTT switch and a cutoff bias is applied to tubes in the transmitter and to the mike preamp.

When the PTT button is pressed the negative bias voltage is removed by grounding the bias line. Simultaneously, the speaker cir-

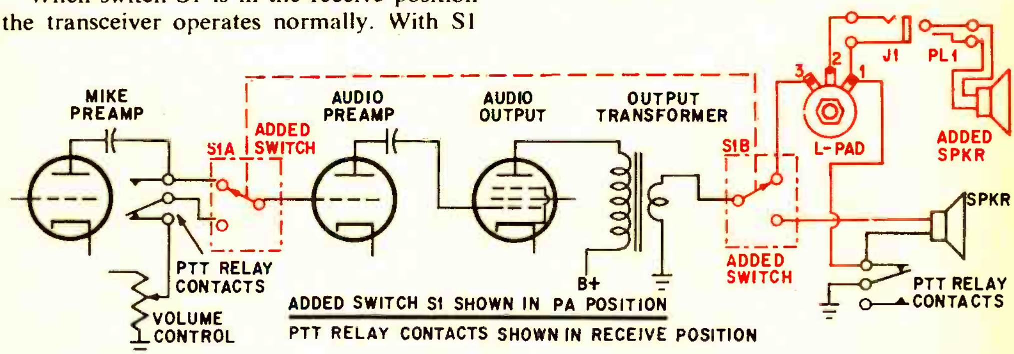


Fig. 2—Additions to the transceiver for PA are shown in color. PTT switch is left in receive position. When added switch S1 is set to PA, signal from mike is fed to preamp, amplified, then connected by S1B through an L-pad to the external speaker. L-pad may be installed on rear of rig or in speaker cabinet.

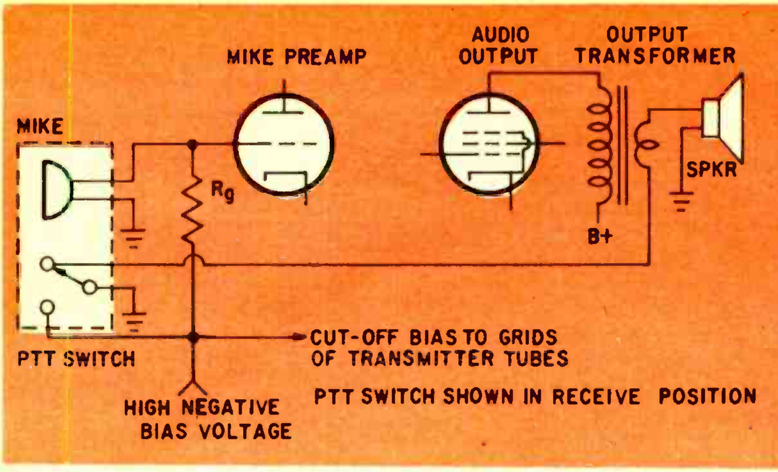


Fig. 5—Simplified schematic of typical rig with electronic switching. When PTT switch is in receive position (shown) negative bias cuts off mike preamp and transmitter tubes. In transmit mode, bias is removed and the speaker is disconnected from the rig's output transformer.

cuit is opened. Since the receiver and transmitter are always connected to the antenna the transmitter's high RF output overdrives the receiver and cuts it off.

To add PA, connect a DPDT switch as shown in Fig. 4. In addition to connecting the remote speaker, the switch removes the negative bias from the mike preamp and grounds the bottom of grid resistor Rg.

However, the received CB signal also will come through during PA operation, since the circuit from the volume control (not shown) is not disconnected. Therefore, in electronically switched rigs, it is necessary to turn the volume control full *off*. (unless you want to hear CB calls).

Inexpensive speakers can be used for the remote speaker. You'll get the greatest volume from an 8-, 10- or 12-in. PA speaker mounted in a wooden baffle. For greater coverage we recommend a trumpet or horn speaker.

PARTS LIST

J1, J2—Phone jack
PL1, PL2—Phone plug
S1, S2—DPDT toggle switch
L-pad—8 ohm L-pad (Lafayette 99 G 6134 or equiv.)
Spkr.—Lafayette 99 G 4508 or Olson S-453 trumpet speaker

Fig. 3—Photo at left shows PA/receive switch installed on front panel of CB transceiver. Photo at right shows jack added for external speaker.

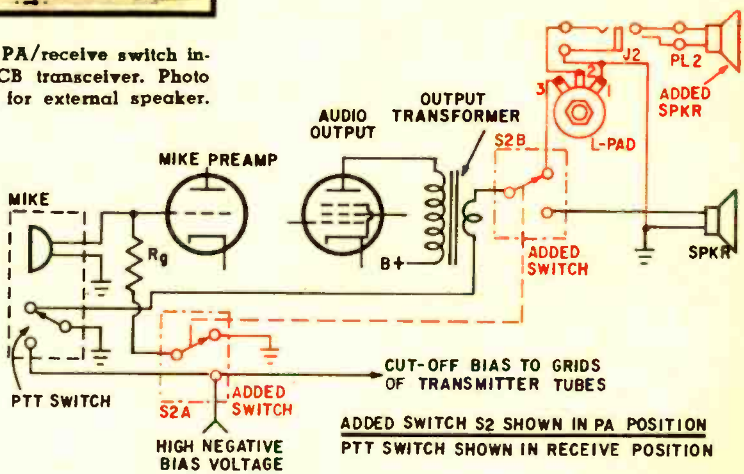


Fig. 4—Additions to transceiver with electronic switching are shown in color. When S2A is in the PA position negative bias is removed from the grid of mike preamp tube and audio is fed to external speaker. Rig's volume control must be turned down to keep signal from the receiver from coming through speaker.

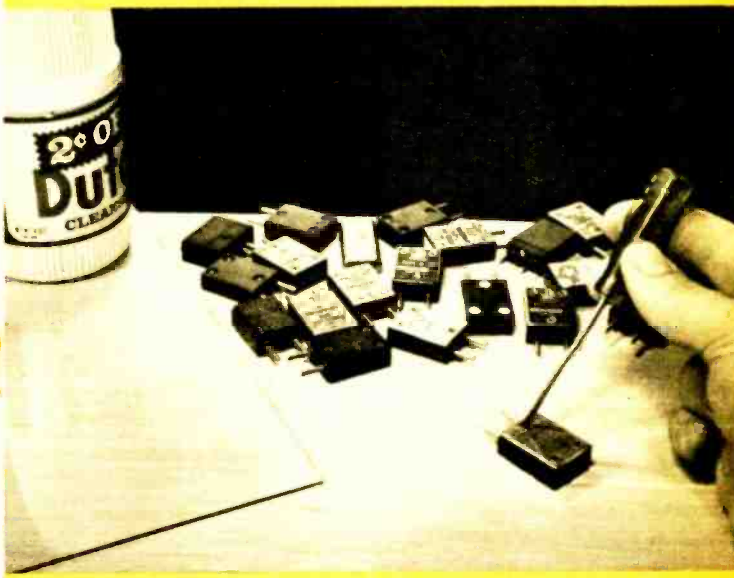
GRIND YOUR OWN CRYSTALS!

By LEN BUCKWALTER, K1ODH

BEST feature of any crystal also is its worst—it's rock-bound at a single frequency. Win a General Ticket and you're stuck with Novice rocks. Get a half-price steal on surplus crystals and they're right where you wish they weren't—just outside the band. Join a net on 7060 kc and your closest piece of quartz likely will prove shy by something like 5 kc.

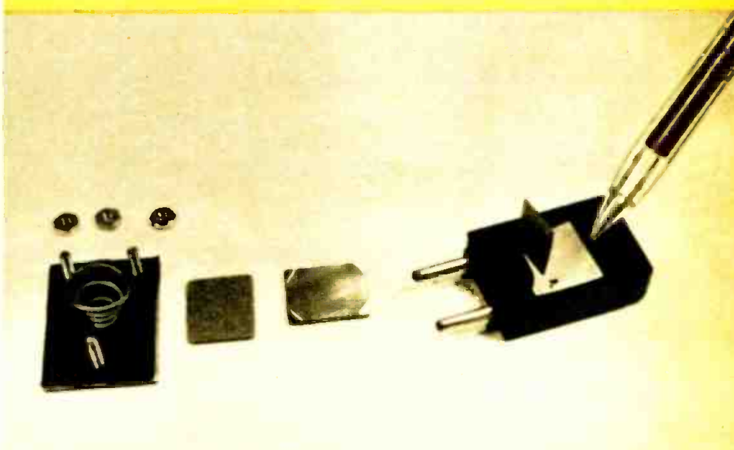
But don't mind it—grind it! Our photos show you how. Just follow our step-by-step instructions and you can shave standard crystals up in frequency or pad them down a bit.

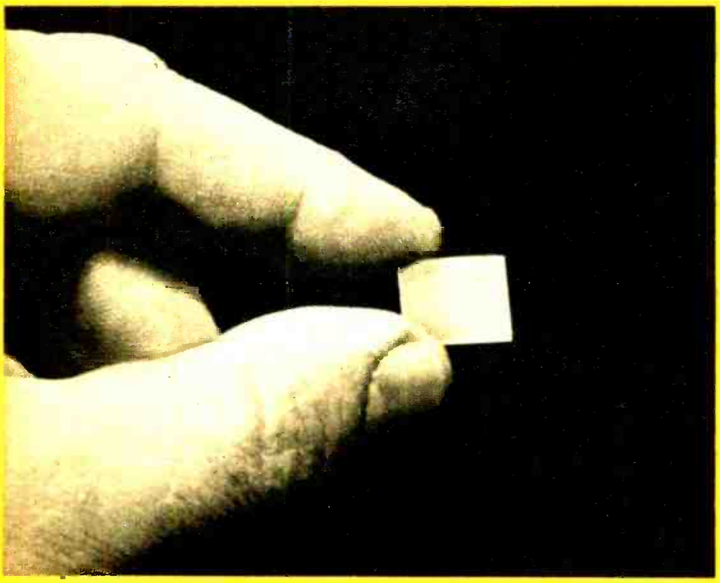
One word of caution: don't try any of these tricks on small overtone or fancy gold-plated types—they're best suited to the usual ham crystals in the common FT-243 case. And bear in mind that the secret of any successful grinding operation lies in keeping crystal and other parts completely clean, using reasonable amounts of both water and detergent where required.



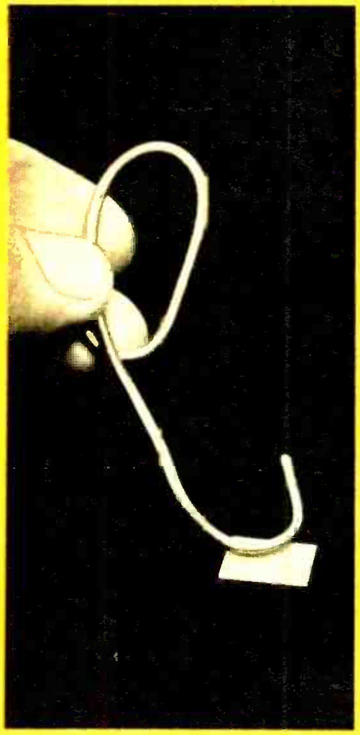
Necessary equipment for raising a crystal's frequency consists of a piece of glass and a can of cleanser. Crystal can be exposed by loosening three screws on case; take case apart slowly and carefully, keeping label side face up.

Crystal parts should be laid out neatly, kept free of dust and dirt. Pencil points to crystal itself, which can be taken out after metal tab is bent gently out of the way. Actual assembly frequently will vary slightly from that shown here.





Crystal is strong but brittle. Grip by edges, being careful not to drop or scratch. And touch only crystal, not other parts, or oil later will interfere with proper operation. Grinding crystal against cleanser on glass (below) removes slight amount of surface to raise resonant frequency. Place cleanser on glass and add water to obtain wet mix. Put two fingers on crystal, push down evenly with moderate pressure and move crystal across glass in figure-8 pattern, grinding one side only.



Six figure-8 movements are maximum to make before checking new frequency. Wash crystal in water and detergent, reinstall in case after it's thoroughly dry. Grinding process should be repeated if frequency still isn't high enough.

Rubbing slight amount of solder on one crystal surface can drop crystal as much as 10 kc (added mass reduces resonant frequency). Don't overdo or crystal may be rather sluggish.

HOW TO BEAT THE CCs

By DAVID WALKER

Though some of these cruddy-contact decontaminators are optional, others pretty much are necessities. Among the latter are a solvent, a lubricant, a crocus cloth and fine steel wool.

ANY piece of electronic equipment more than a year old probably suffers from the CCs—cruddy contacts. Said sickness leads to shot pots, twitchy switches and, worst of all, putrid performance. Hi-fis make less sound, more sizzle; TVs begin to go for snow; CB sets don't 10-4 like before.

Right then and there is when you should set Mr. Clean on those cruddy contacts. The bout won't equal the Olympics, but cleanliness, godliness and the Mister are certain to walk off with every medal. Your equipment and you, meanwhile, can set about operating the way you always have wanted to—the way you did when both were young.

Unless your gear is built computer-style, it has neither sealed parts nor gold-plated contacts. And when the better half cooks hamburgers, tiny grease particles ride the air stream that's sucked into any hot-operating circuit. Give the matter a minute's thought and . . . Eureka! You've realized what every friend of Mr. Clean well knows: those particles sure as shootin' are going to coat the contacts.

In other cases metals simply oxidize. Spring tension in wafer switches relaxes. Or the moving metal finger in a control flakes out noisy dents in the carbon element. But no matter what the cause, CCs almost always will respond to ready cures freely available. Prescription is to give your contacts a shot in the armature (our photos show you how).

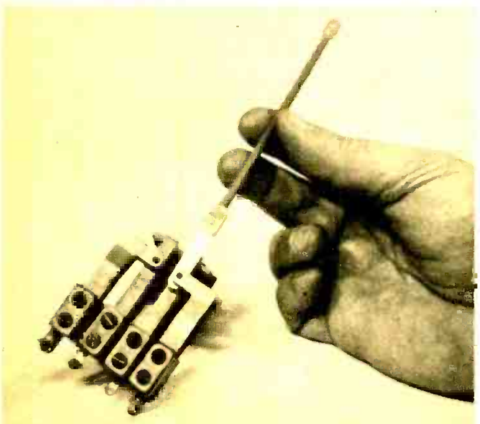
Crocus cloth is excellent for removing crud from phone plugs and other components having large surfaces. Use steel wool for cleaning chassis in areas where good electrical contact is required.

Though contaminated contacts frequently mimic other problems—noisy tubes, an intermittent capacitor, maybe hum in the power supply—there are ways to pin them down. Let's say the volume mysteriously varies on an auto radio or a hi-fi amplifier. Tap a finger sharply on each knob or switch. If the trouble clears up the control likely is due for a clean-up.

Another symptom is snowy TV pictures. Grab the channel knob, then rock it slowly in and out of position. If the picture clears at any point the contacts probably are oily.

Thin cardboard or kraft paper drawn through contacts will clean dirty relay. Finger pressure creates friction; operation will be more effective if contacts first are sprayed with a suitable solvent.

Tuner cleaner is good general-purpose solvent for cleaning all sorts of CCs, including channel-selector switches on CB transceivers. Apply short spray burst to both sides of each switch wafer.



Contact-burnishing tool is required for touching up pitted relay contacts. Take care to remove only oxide and corrosion, not good metal. Too much pressure may change shape of the contacts.

Thin tube fitted over nozzle of solvent-spray can carries spray into concealed contacts inside slide switches, carbon potentiometers. Technique is to insert tube in case opening, then blast away.

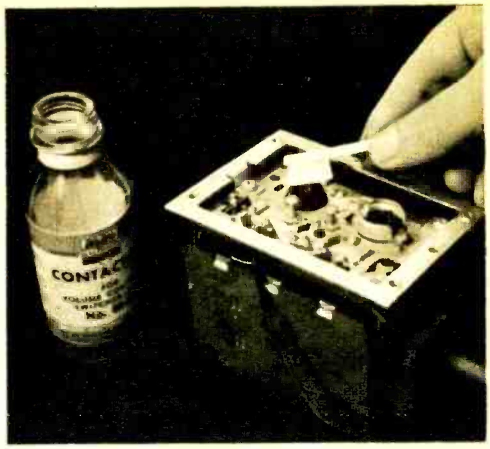
Similarly, scratchy noises while tuning an AM or FM receiver suggest poor contact surfaces (or perhaps dust) in the variable tuning capacitor. Another technique to find dirty contacts: pull a control knob toward you, then push, then wiggle (the knob, that is). Physical disturbance of any sort often restores good contact temporarily and reveals the culprit.

The necessary chemicals and gadgets for beating the CCs can be found in most electronic catalogs and parts stores. Others are hardware items. Cost may total several dollars but these items make a big difference in performance. They also bring back that creamy, like-new feeling to controls.

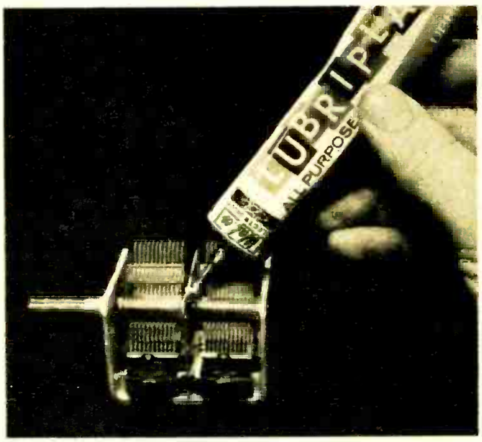
Most anyone can benefit from a vigorous session of uncruddying contacts. Owners of test equipment, for example, should find that regular contact-cleaning helps restore instrument accuracy and improves the action of calibrating controls (the ohms-adjust on a VTVM, say).

Hams well may see the end of a case of keyclick once they've completed a thorough job of contact-cleaning. Hi-fi buffs enjoy siz-

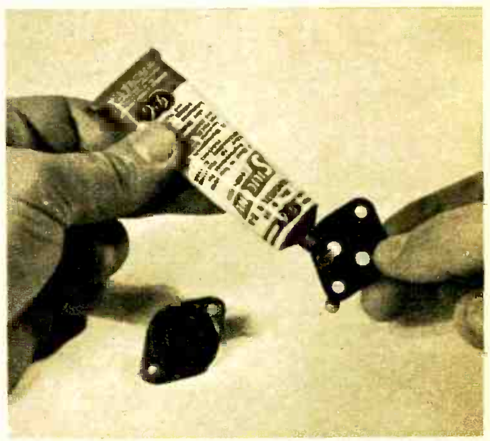
Light lubricant (this is GC's Lube-Rex) applied to wirewound controls reduces electrical noise, prevents oxidation. Control's rear cover must be removed if wirewound element isn't accessible.



Toothbrush dipped in or sprayed with solvent makes handy tool for cleaning leakage path between closely spaced contacts. Area surrounding tube socket of TV tuner is likely candidate.



Heavier lubricant (such as Walsco's Lubriplate) spread on ball bearings of variable tuning capacitor will reduce radio noise substantially. Use vacuum cleaner to remove dust between plates.



Silicon compound (GC's Silicone is one) can prevent a non-electrical CC. Spreading compound on transistor heat-sink before installing transistor usually will increase heat dissipation markedly.

zle-less sound on a hum-free background after Operation Contact Clean-Up. CBers, too, often find those mere 5 watts mightier when CCs bite the dust. Biggest bonus: since you need just a dab or squirt at a time, the cleaners last for years.

Rule No. 1 in CC cleaning is to keep the contacts moving as you apply cleaner. Turn a volume control briskly as the cleaner enters and give it a few extra rotations as the cleaner dries. Rotary switches should be moved repeatedly through all positions to spread the cleaner where it will count. And don't overlubricate if you're using one of the sticky compounds because excess goo will trap dust. Matter of fact, it always is best to go easy when applying any of the various CC beaters, since a little will go a long way. Further, more can be applied if contacts don't come clean the first time around.

If the cleaner is inflammable, be sure the equipment's AC plug is pulled out of the wall. And to avoid sniffing the stuff, keep a window open. Finally, eschew carbon tet. This old standby now is considered out (it leaves a residue).

WIRELESS SWEEP TESTER

By AL TOLER

NEXT time the boob tube does a fast fade-out, don't start worrying about the price of a new picture tube—at least not right off. Just point our Wireless Sweep Tester at the screen, push its button and you'll know exactly where to start looking for trouble.

The lack of a picture usually doesn't mean a new CRT. Often the trouble is a failure in the TV set's horizontal-deflection circuit. While the vertical sweep circuit in a TV set only moves the beam up and down, the horizontal sweep circuit—in addition to moving the beam from left to right—develops the high voltage that lights up the CRT. Should any part of the horizontal sweep from the oscillator to the deflection coils fail, the high voltage vanishes and the CRT goes dark.

The sweep tester detects the 15,750-cps horizontal-deflection current flowing in the deflection coils mounted around the neck of the CRT. When placed in front of the CRT the tester picks up some of the signal and causes it to produce an indication on Meter M1. If the horizontal oscillator fails, the meter needle won't budge—which means no sweep. On the other hand, if there is no picture and the tester indicates the sweep circuit is working, start looking up CRT prices.

Construction

The values of components are somewhat critical; therefore, substitutions should not be made for C1, L1 and Q1. The tester can be built in any plastic or Bakelite cabinet but don't use metal.

Antenna coil L1 should be mounted so its core is parallel to the long dimension of the cabinet by soldering its lugs to two adjacent terminal-strip lugs, as shown. Before mounting L1 connect C1 across its lugs as shown in the pictorial. Keep C1's leads as short as possible. Don't solder C1 until L1 is ready to be soldered to the terminal strip.

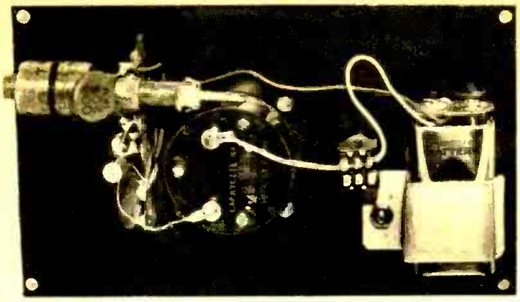
Since the meter indication is relative, any meter with a full-scale range up to 500 microamperes can be used. If you want to keep the cost down to rock-bottom you even can use a low-cost imported tuning meter, the thumb-size type that fits a small rectangular hole.

B1 is a standard 9-V transistor-radio battery that is held in place with a bracket made from scrap aluminum or tin. Power switch S1 can be a low-cost push button.

Alignment

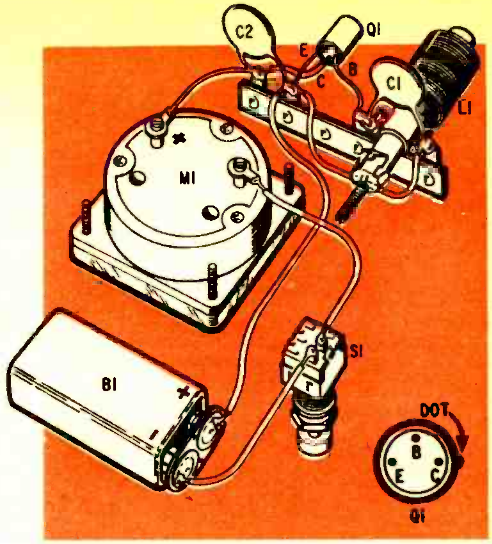
Easiest procedure is to preset L1's slug-adjustment screw with an AF signal generator. Set the generator to approximately 15,750 cps and adjust the generator's output-level control so it is just cracked open. Connect the generator's hot lead in series with a .05-μf or .1-μf capacitor to one of L1's lugs. Connect the generator's ground lead to L1's other lug. (If the generator has a built-in isolating capacitor don't use the series capacitor.)

Using a plastic alignment screwdriver, and with S1 depressed, adjust L1's slug for highest indication on M1. If the tuning appears excessively broad don't worry about it—just set the slug to the approximate peak posi-



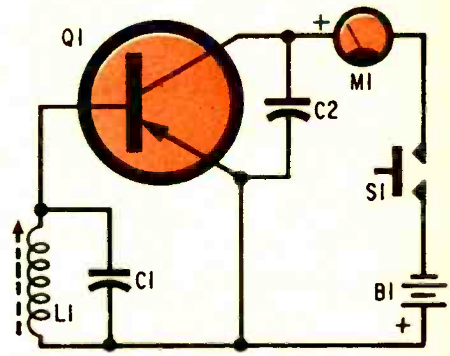
WIRELESS SWEEP TESTER

Our model was built on the cover of a 6¼x3x2-in. bakelite box (Lafayette 19 G 2001). Simplest approach is to install all parts on a five-lug terminal strip. Mount L1 so its axis is parallel to the long dimension of the box.



PARTS LIST

- B1—9V battery (Burgess 2U6 or equiv.)
- C1—.003 µf, 500 V ceramic disc capacitor
- C2—.005 µf, 500 V ceramic disc capacitor
- L1—10-50 mh adjustable inductor (J. W. Miller No. 9006, Lafayette 34 G 8989)
- M1—0-50 microampere panel meter (Lafayette 99 G 5049 or equiv.) See text
- Q1—2N2613 transistor (RCA)
- S1—Single-pole push-button switch
- Misc.—Plastic cabinet, terminal strip



Parallel-resonant circuit (C1/L1), is tuned to 15,750-cps horizontal-oscillator frequency by L1's slug. Signal then is amplified by Q1 to drive the meter.

tion. Place the tester in front of the TV screen (as close as possible). Press S1 and rotate the tester slightly until the meter indication reaches a position on the dial that can be observed easily. Then adjust L1 for peak meter indication. If the meter goes off scale just move the tester back an inch or so from the TV screen. If you can't preset L1 with an AF generator you still perform this adjustment procedure—it will just be more difficult.

If you use a 50- or 100-microampere meter there will be a slight residual indication (10-20 microamperes on a 50-microampere meter) when S1 is pressed. Ignore this reading. The most important thing is that there be a *substantial* increase in M1's indication when the tester is placed in front of the screen.

It may be that on some TV receivers little 15,750-cps signal will be radiated from the center of the screen. Try moving the tester around and rotating it if you can't get an indication. It's not a tricky procedure. If the horizontal oscillator and deflection circuits are working you'll get some indication within an inch or two of movement.

If the meter indicates the horizontal-oscillator is working and there is no picture, there are one or two more things to try before buying a new tube. Look near the base of the tube to see if the filament is glowing. If it is not, you need a new tube.

If the filament is glowing, the lack of a picture may be due to very low emission because of the tube's age. Thing to do in this case is to add a booster which will step up the filament voltage which increases cathode emission. This should do the trick—for a while. You'll get a brighter picture, but the tube's life will be shortened.

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Notes from EI's DX CLUB

BAD news for our ham members: The Voice of America has dropped its Radio Amateurs' Notebook. No explanation was given in the VOA's one-sentence anouncement.

Donald Jensen of Wisconsin reports Radio Mogadiscio, Somali, with a potent new transmitter on 7160 kc. Sign-on is at 2230 EST, followed by news in English at 2245.

Not yet heard on this continent, R. Ulan Bator, Mongolia, reportedly is on 11850 kc until 1730 EST sign-off, with English on Tuesdays, Wednesdays, Fridays and Saturdays. Wonder who'll be first in North America to bag this one?

After many falsely reported starts, Trans World R. at Bonaire, Netherlands Antilles, finally has begun SW relays of R. Nederland's programs. Latest schedule shows TWR rebroadcasting R. Nederland's English to North America at 2030 EST on 9590 kc. However, this frequency may be subject to change.

Arthur F. Cacella, Jr., WB2OHK, came up with one of the most unusual ham QSLs reported during our recent awards period. Most North American amateurs bag Antarctica via the KC4 route. But WB2OHK did it the hard way—by working OR4YN in Belgian territory down there.

Good tidings for those addicted to 120-meter DX. VL9CG at Gororka, Papua, now is on the air on 2410 kc. Another good 120-meter target is the all-night commercial service of R. South Africa on 2376 kc.

H. L. Chadbourne of California reports a station on 7105 kc at 0500-0600 *P*ST with American music and commentary in an oriental language. This one, definitely not R. Nepal, never seems to identify. Can anyone solve the mystery?

Windward Islands Broadcasting Service's main BCB transmitter at St. George's, Grenada, almost has left the band. Reason is that it's operating exactly on 535 kc, which puts the upper sideband on the BCB and the lower sideband in what normally is considered long-wave territory.

Latest frequency for Beirut, Lebanon's 2030-2300 EST beam to the Americas is 9710 kc. The shift isn't surprising since these Near East stations move constantly.

Possibly the most widely heard 60-meter African is R. Ghana on 4915 kc. Station has been picked up both at 1700 and 0100 EST.

R. Sweden now will play favorite recordings for the asking during its English-language broadcasts. Letters go to Record Requests, R. Sweden, Box 955, Stockholm 1.

A new Angolan now received in North America is R. Comercial de Angola at Sa da Bandeira (4775 kc with sign-on at 0030 EST). Rumors circulated about this one for nearly three years before it came on the air. Power reportedly is 10 kw.

Propagation: With winter approaching and the number of sunspots following an upward trend, the higher SW frequencies will see more use than at any time during the past several years.

During daylight hours there will be an increase in the number of amateur 10-meter DX openings, particularly into South America. There even may be some transatlantic DX during the morning hours, local time. SWBC conditions during daylight hours also should be much improved, with plenty of DX on 15, 17 and 21 mc.

At night, 6, 7 and 9 mc should be best DX bets. And though conditions will not be quite as good as they were last year, BCB DX should improve considerably during November and December.

how to tape from

RADIO LISTENERS and TV watchers of any sort—DXers, SWLs, BCBers, Late Show viewers, pop music fans and most everyone else you can think of—frequently wish to put a program on tape. And while their reasons for doing so are as different as the broadcasts they dig, the way to do it is the same in each case.

To be sure, the audio buff with a nice component hi-fi setup can tape from the system's FM or AM tuner in a fashion too easy to deserve special comment. An out-to-tape jack is provided, of course. Into it he plugs an appropriate patch cord—or cords if he's rigged for stereo. Then he records. That's that.

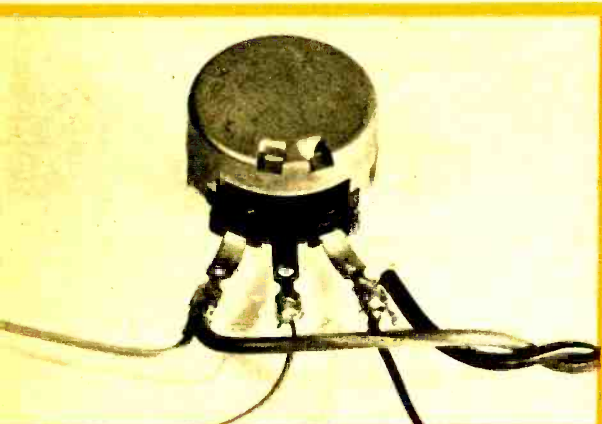
What do you do, though, when you want to record an airborne signal from some source which doesn't have an out-to-tape jack? In other words, how do you pipe an audio signal into a tape recorder from an AM or FM radio, communications receiver, transistor portable or TV set?

As an emergency measure, you *could* place your recorder microphone in front of the speaker on your radio or TV, but this approach is downright unprofessional and unsatisfactory. Far better to go inside the cabinet and tap off the signal from a point where it still is all-electronic. The resulting recording will be of much higher quality, and there'll be no need to worry about room noises being put on tape. The signal you want will be the signal you'll have as soon as you set the tape spinning.

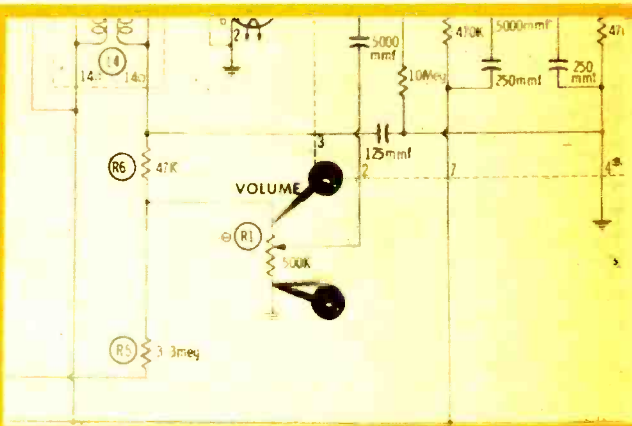
Before tapping into your radio or TV circuitry, ascertain whether you're working with a piece of AC/DC equipment. Problem with such gear is that the chassis is direct-connected to one side of the power line. And, depending on how the power plug is inserted in the socket, the chance of damage to the equipment and shock to the operator is exactly 50-50.

Best solution to this dilemma is to plug an isolation transformer into the wall outlet and the AC/DC gear into the transformer. It'll cost you a few bucks, of course, but it's one sure way to end shock problems. Naturally, it's wise to select a transformer large enough to handle the item with the biggest power drain—your TV set, presumably.

Your best recording signal probably will come from the *outside* lugs of the radio or TV set's volume control for a couple of reasons. For one thing, the signal is as good in quality here as it ever will be. Then, too, this point actually is ahead of the set's volume control and independent of it for recording purposes. If the phone rings, for example, you can turn down your listening volume to answer and the recording will



Good taping starts with good signals, and a radio or TV set's volume control is one good source. Twisted leads feed into recorder's high-level input.



Pins bracket volume control on typical receiver schematic. For minimum hum, use shielded cable with shield connected to control's grounded side.

ANY radio or tv

go on undisturbed.

A signal taken from the volume control will pick up hum and noise unless carried in a shielded cable or twisted pair. If there is plenty of room to get at the volume-control lugs with a soldering iron, start directly with shielded cable, connecting the shield to the grounded side. Should quarters be cramped, it may be safer and easier to start with a twisted pair. Run the pair out through a hole in the back panel, then terminate it in an appropriate phono jack to accept the plug of a conventional shielded patch cord to the recorder. And take care to wire the jack so the grounded lug of the volume control eventually joins the shield on the patch cord.

If the volume-control lugs are hopelessly inaccessible you always can take your signal from the speaker lugs. This source usually is easier to reach, though the signal quality isn't quite as good.

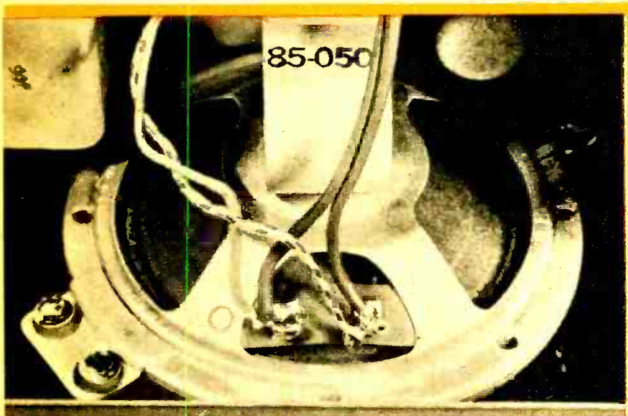
A transistor portable may be assembled too compactly to allow access to its volume control or even its voice-coil lugs. But the earphone jack probably is a good signal source, though you may have to do some rewiring to keep its speaker operative for monitoring purposes.

Most communications receivers also provide a jack for phones, but here the speaker almost surely will be disconnected when the phones are plugged in. Monitoring the recording again becomes a problem, and in this case it's best to forget this jack as a signal source. There is plenty of room in the cabinet of a ham or SWL receiver to make a conventional tap from the volume-control or speaker lugs.

Just one thing more: should the meter or tuning eye on your recorder force you to operate the machine with its volume control barely on, your input signal is too strong. Solution here is a voltage divider composed of two resistors (see our illustration).

As for the value of the resistors, it's wise to start with a pair such that the sum of the two is about 500,000 ohms. First try a pair of 270K's. If the signal still is too strong at the recorder, try a 470K and a 22K. Keep right on juggling resistors until you find the correct ratio; the exact values aren't critical.

In every instance, by the way, it has been assumed that your recorder has two input jacks—one marked *mike* and the other probably marked *hi-level* or *radio*. You should use the less-sensitive input jack exclusively, since you will be recording from a high-level source. If your recorder has only one input, it will be *mike*, whether it says so or not, and you surely will need a voltage-divider network—even on a volume-control installation.—*Lewis A. Harlow*



Though less desirable, speaker voice coil is another possible take-off point for taping. Polarity is of no importance unless one lug is grounded.

Simple voltage dividers often come in handy for reducing signals to levels recorders can handle. See text for tips on what size resistors to use.

The Attaché 80

Continued from page 58

receive and turn antenna-loading switch S2 to maximum capacity. Set antenna-tuning capacitor C19 to mid-range and plate-tuning capacitor C9 to full capacity. Turn on the power and let everything warm up for a few minutes.

Set S1 to transmit, close the key and quickly adjust C9 for a sharp dip in plate current. This dip should occur around C9's mid-position. Do not tune C9 to minimum capacity as a spurious sharp dip also will occur at this point. Operation at this setting will result in out-of-band signals.

Open the key and set S2 to the next-lowest-capacity position. Close the key and tune C9 for a dip. Repeat this procedure until the plate current at dip is about 70 to 80 ma. Antenna-tuning capacitor C19 should be used for adjustment as the current approaches 70 to 80 ma. (Do not turn S2 with the key closed or you may burn out S2's contacts.)

While the key is closed, an audio tone should be heard from the speaker. If it is not, try a new neon lamp (NL1) and/or change the value of R13. The tone frequency can be varied by changing the value of C16. The volume can be changed by using a different value for C15.

● **Receiver.** Set S1 to *receive*, turn regen control R19 full clockwise and turn gain control R5 full counterclockwise. Close the key and turn C2 until you hear the beat note. If you don't hear it, set the dial to a point near the transmitting-crystal frequency and adjust L1's tuning slug until you hear a beat note. By plugging other 80-meter crystals in SO1, C2's dial can be calibrated.

Remove the 100-watt lamp and connect an antenna to J2 and a ground lead to the frame as shown in Fig. 8. Tune the receiver to the phone portion of the 80-meter band. Back off on R9 until the oscillation stops and you hear phone signals. IF transformer T1 should be peaked by removing the meter and the aluminum strips on the top of the main frame to allow a long alignment tool to reach T1's top tuning slug.

When your antenna is connected, load the transmitter using the same technique as was used with the dummy load.

As we mentioned earlier, the transmitter always should be operated with a final plate current of 70 to 80 ma. A standard 80-meter dipole can be used for operation at home. For portable operation, see Fig. 8. The clip lead on the loading coil and the transmitter controls should be adjusted until M1 indicates 70- to 80-ma plate current.

A New Look For CATV

Continued from page 35

"Suppose you have a real hot school-bond issue in Paramus, N.J.," Rosenbloom said in a recent interview. "Paramus has no station of its own, so any televised discussion would have to be over one of the New York City stations. But they have to serve a metropolitan area of 15 million people, of which Paramus is only a small part.

"This means that if the school-bond issue ever did get on the air it would be for a brief time and probably at an inconvenient hour. But if Paramus had a CATV system, an operator could put the opposing sides in front of a TV camera one evening and let them have a go at each other for as long as it takes —without disturbing the normal entertainment programming from the New York stations. Every home in Paramus connected to the cable could watch."

Rosenbloom's big point: that CATV may be able to offer truly local (suburban, community or even sub-community) news and public-affairs programming not now possible in metropolitan areas.

Still another aspect of CATV's new look is in the added programming it currently is offering foreign-language minorities. In upstate Maine recently, a radio station operating in a predominately French-speaking community applied for affiliation with the Canadian Broadcasting Corp.'s French network. The request was denied, whereupon the CATV operator promptly added a CBC French-network TV station to the U.S. stations he already carries. Spanish-speaking residents of Southern California receive the same sort of service from CATV operators who relay Mexican TV programs almost 100 miles into the U.S.

In short, CATV has grown up. Once the exclusive property of the small town and the local businessman, it presently is marching on major metropolises. And its new look offers even big-city viewers additional programming they likely could get in no other way.

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ELECTRONIC SWAP SHOP

Continued from page 21

CRV Navy communications receiver. Will exchange for SSB transceiver. Joseph Yasment, Morrisonville, Box 66, N.Y.

HEATH GW-10 CB transceiver. Want oscilloscope or signal generator. Dennis Kauble, 419 A. W. Catawba Rd., Port Clinton, Ohio.

TESLA COIL, 200,000 V. Will trade for VTVM, audio generator or tube tester. Roger King, Rte. 1, Thompson Rd., Perrysburg, Ohio.

GILBERT 60X refracting telescope with tripod. Looking for 80-meter Novice receiver. Charles Spern, Star Rte., Indian River, Mich. 49749.

GLOBE SCOUT 60-watt transmitter, Heath VFO. Interested in CB walkie-talkies. Ed Maxwell, Box 701, Los Alamos, N.M.

HEATH GW-52 walkie-talkie will exchange for 5-watt base unit. Danny Sunderman, 913 N. 5th St., McAllen, Tex.

MIDLAND 13-109 CB transceiver. Will trade for SW receiver. Michael J. Adelman, 745 Leland Ave., University City, Mo. 63130.

PATIO SPEAKERS, with enclosures. Will swap for hi-fi speaker system. Les Gaspar, 151 Hillcrest Rd., Mt. Vernon, N.Y. 10552.

KNIGHT Space Spanner. Want CB walkie-talkies. Mike Behlen, 4744 N. Temperance, Clovis, Calif.

NIKKOREX 35-mm reflex camera. Will exchange for communications receiver. Charles Kuttner, 4522 Waring, Houston, Tex. 77027.

KNIGHT-KIT 600 tube tester, EICO 1140 R/C box, Solar R/C bridge. Want Knight R-100A receiver. William C. Dougherty, 4441 Parnell Dr., Sarasota, Fla.

MAYFAIR transistor tape recorder. Will swap for Star Roamer or other SW receiver. Al Van Dyke, 4227 Cabot St., Portage, Mich.

TV CONSOLE, 21-in. Will trade for CB transceiver. Sal Pellegrino, 5544 S. Troy, Chicago, Ill. 60629.

FANON-MANSON portable CB transceiver. Will swap for 5-watt mobile CB rig. H. C. Ebbers, Demorestville, Ont.

HEATH GR-91 SW receiver and HD-11 Q-multiplier. Will swap for anything of equal value. Fred Crane, North St., Morrisville, N.Y.

AUTO RADIOS. Want Lafayette HA-85s. Sam K. Gino, Box 2943, Hollywood, Calif. 90028.

ADMIRAL 12-in. TV. Need 2-speed mono tape recorder. Alan L. Remington, Rte. 1, Box 9, Kilkenny, Minn. 56052.

DUMONT 44 oscilloscope. Will swap for 2-meter ham gear. Philip Monego, 6 Willowbrook Rd., Freehold, N.J.

TK 12 semi-automatic key. Will swap for CB walkie-talkie. Stan Nafziger, Rte. 1, Mackinaw, Ill. 61755.

PANEL METERS. Will trade for roof-top 2- and 6-meter antenna. Robert Bollard, 436 W. Spencer St., Philadelphia, Pa. 19120.

TRANSFORMER, 7,500-V secondary @ 30 ma. Want dwell tachometer. Fred Cerne, 2809 S. Austin Blvd., Cicero, Ill. 60650.

STROMBERG-CARLSON dial telephone. Will trade for Novice transmitter or 2-meter receiver. Dale Harrison, 419 GA Ave., Bremen, Ga. 30110.

KNIGHT Span Master SW receiver and Webster Electric intercom. Will swap for test equipment. Mike Post, Box 93, Silver, Tex. 76949.

COYNE 1963 7-volume job-training course. Will exchange for 30- to 50-mc window-mount antenna. Charles J. Beaumont, 439 Central Ave., Brooklyn, N.Y. 11221.

CROSLEY 50 and Atwater Kent 83C receivers. Will trade for ham or SWL gear. Joe Hofstetter, Rte. 1, Eldon, Iowa.

KNIGHT T-150A transmitter. Looking for stereo or CB equipment. Harold Dalton, Box 641, Easley, S.C. 29640.

KNIGHT Star Roamer and Heath HD-11 Q-multiplier. Want ham gear, oscilloscope or power meter. Lawrence J. Bennett, 72-50 Kessel St., Forest Hills 75, N.Y.

BC-459 transmitter modified for ham use. Will swap for anything of equal value. Ronnie Moody, 215 Hawthorne, Houston, Mo. 65483.

STAR LITE walkie-talkies. Will trade for Lafayette HB-115A CB transceiver or other 8-channel rig. Walter M. Kaplin, 936 S. 19th St., Newark 8, N.J.

DX Guide To VOA

Continued from page 94

ica throughout the world. It is sad."

Reactions by Americans to VOA seem typical of our political selves: those who oppose (such as Dr. McIntire) are loud with criticism, those who are in support or who don't care (sadly enough) just aren't heard from. One reason the Voice is criticized, of course, is that only a portion of its programs are political. News and commentary are interspersed with talks on the arts and sciences. Time also is allocated for jazz (the only distinctly American musical form) and folk music.

But programming aside, DX—some of it of A-1 order—is a significant extra the VOA offers any listener. America's voice around the clock and around the globe clearly merits every DXer's ear.

Hi-Fi Today

Continued from page 36

can't find it in a record store you can order direct from CBS Laboratories, 227 High Ridge Rd., Stamford, Conn. 06905.

Once you've arrived at the correct pressure for your setup you should take a reading with a reliable stylus-force gauge like the AR or Weathers, then check it every few months. In fact, it'll pay you to look into the matter even more often if your arm's tracking force is spring-controlled.

Since I can't seem to let a column go by without some mention of transistors, I'll take another look now at amplifiers. Word is that those high IM distortion readings at low power levels no longer are to be taken for granted—if they ever were. Good transistor units still may show a slightly different IM characteristic from tube amplifiers, but those readings of 3% or 4% at low power are not to be found in the new crop of designs. As a result, a lot of that artificial (and tiring) zinginess is gone from the sound of practically all the new amplifiers.

Though you might not guess it from the ads, there still is no real agreement among engineers on what kind of output transistors are best. Some pump for silicon, others for drift-field germanium. I'm for whichever makes an amplifier sound best to me.

The Dope On Coils

Continued from page 47

is about two or three times coil diameter. Another rule to keep in mind is to use the largest coil for the available space. For our field-strength meter, we selected a 1-in.-dia. coil form but a 1¼- or ¾-in. form could have been used.

Now we know coil diameter (1 in.) and inductance (7.5 µhy). There still are two unknowns: wire size and coil length. Since the coil is being used in a receiving rather than a transmitting application (no significant power and voltage), we can use enameled wire and it can be the convenient No. 20 size. Smaller or heavier sizes might be difficult to handle.

The calculator tells us that a 7.5 µhy coil wound of No. 20 wire on a 1-in.-dia. form will be ⅝-in. long. (Thinner No. 26 wire would have occupied ¼ in. on the same diameter form.)

Since the calculator also tells how many turns per inch for different size wire, we find that ⅝ in. of No. 20 equals 18 turns. (No. 20 winds at approximately 30 turns per inch; therefore, ⅝ in. x 30 = 18 turns.)

Another approach to coil winding is to use factory-wound coil stock. (Air Dux and Miniductor, Fig. 1.) All calculations are done as described above, but instead of winding turns, you merely snip off turns. Charts supplied with the stock state how inductance is related to number of turns.

A useful accessory for coil winding is a grid-dip meter. It can tell you quickly the tuning range of a coil/capacitor combination and enables you to add or remove turns until you get the desired inductance.

Finally, there are slug-tuned coils whose adjustable iron or ferrite core permit coil size to be reduced and inductance to be changed easily. Slug-tuned coil forms are used chiefly where space is limited. Winding instructions usually are provided by the manufacturer or the coil can be wound by trial and error, using a grid-dip meter to check resonant frequency.

You'll find coil forms and coil stock in parts distributor's catalogs. Stock is made by Barker & Williamson (Miniductors) and Illumitronic Engineering (Air Dux). Manufacturers of slug-tuned forms are J. W. Miller, National and Cambridge Thermionic.

—*H. B. Morris*

Tapes for Touring

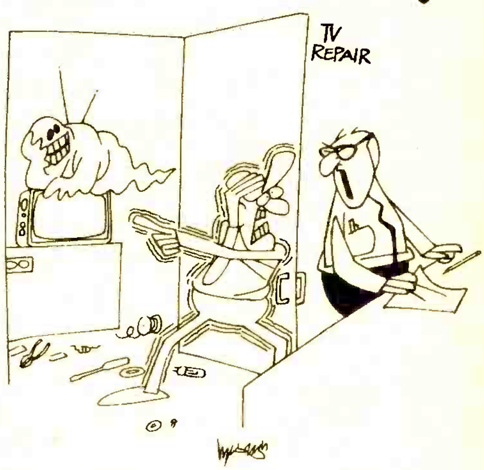
Continued from page 60

is Mad Man Muntz, with some 2,300 titles.

As our chart shows, the Muntz (Fidelipac) cartridges can be played on all but two of the systems now on the market. In addition, cartridges recorded by Craig Panorama (from the Mercury, MGM and United Artists catalogues), Metra (MGM, Dot, Impulse), Quality Audionics, Martel Electronics, Viking and Trans-World all are interchangeable. Prices are based on the amount of playing time the cartridges contain—from \$3.95 to \$6.95 for 30 minutes of stereo music and up to \$20.95 for an eight-hour program.

Significantly, all present models are playback-only units. Tape hobbyists can make their own prerecorded cartridges, however, by buying back-lubricated tape from such companies as Minnesota Mining and RCA Victor, recording on a conventional recorder, packing the tape in a Fidelipac cartridge and splicing the ends together before sealing.

How complicated is installation of the cartridge players? It depends, of course, on the system involved. Some, such as the Telepro and Orrtronics monaural units (see our photos), play through an existing car radio and installation requires only bolting the player to the dashboard and connecting a few leads. Most others necessitate installation of stereo speakers, which involves wiring the car for stereo and in some cases cutting holes in the door panels to mount the speakers. The Lear Jet system currently must be installed by the car manufacturer.



"A ghost? Well, fix it!"

The Infallible Filter

Continued from page 64

been monitored on nine separate occasions and pegged as overblabbing. Worse still, the monitoring dates listed in the docket were spread out over more than a year, scarcely leaving time enough for a five-minute breather.

Detroit Talking. CB, it seems, is getting up in the world and is making its share of influential friends in the process. For example, CB recently was praised by a manager of General Motors Research Labs.

"On a trip from Detroit to Phoenix," he told the SAE, "one of our engineers reported that he always was in touch with either a mobile or base unit operated by businessmen, farmers or other travelers." (This was a boost for the GM-backed HELP program, a nation-wide network intended to aid motorists in distress.)

But the juiciest part of his comments was yet to come. He pointed out that CB's limited range troubles some users and that vehicle and radio-equipment makers are seeking effective solutions. Who knows? Maybe the billion-dollar automaker can help convert our five watts to 50. Or maybe the GM official didn't do his homework. The FCC regulations remind you constantly that CB is a short-range service.

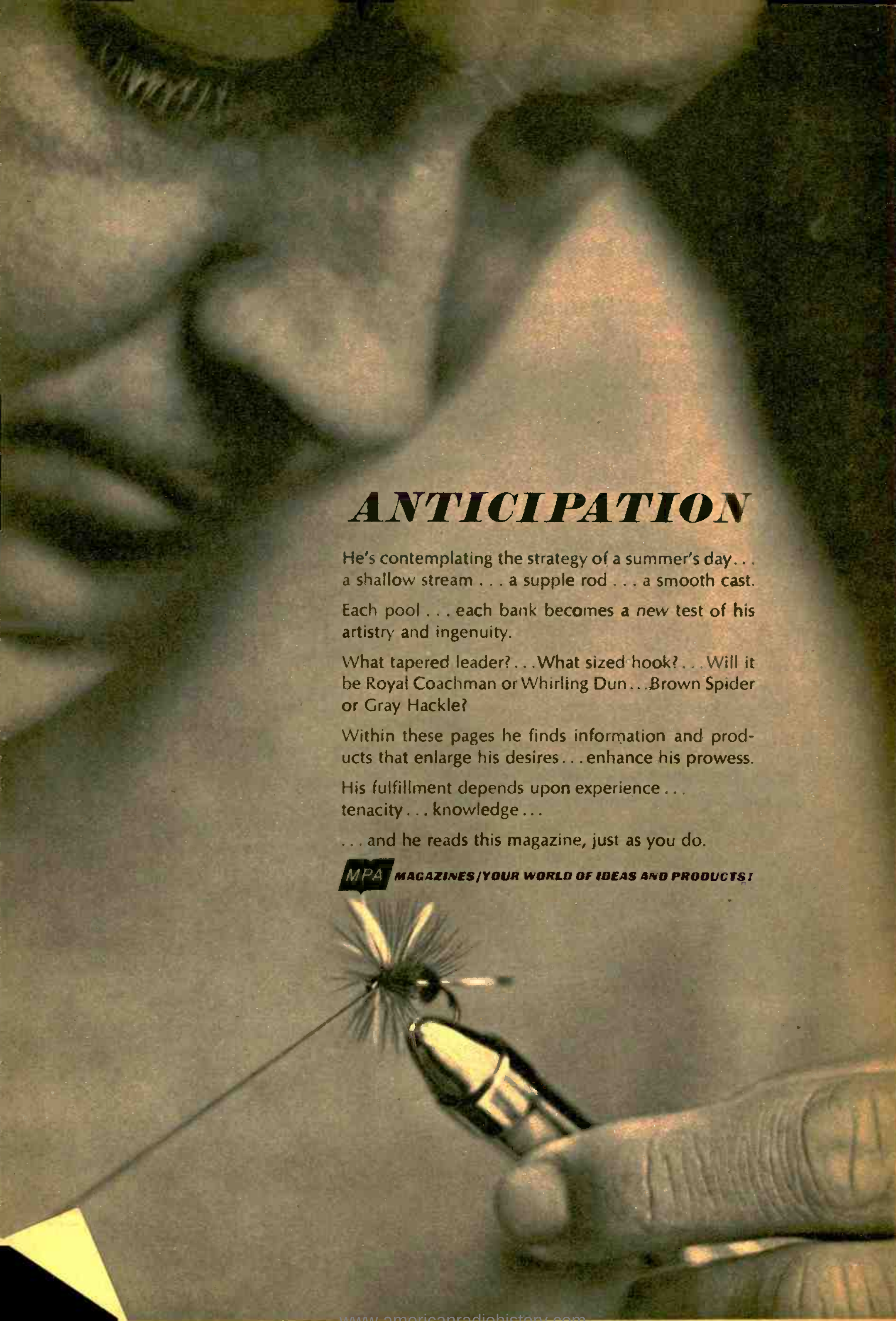
The Ham Shack

Continued from page 72

FCC, Vol. VI, Part 97, Section 97.83, state specifically: "No recognition shall be accorded to any photocopy of an operator license; however, nothing in this section shall be construed to prohibit the photocopying for other purposes of any amateur radio operator license."

Q. What sections of the fone bands are assigned to AM and SSB?

A. All of them. In the FCC Regulations, fone is identified simply as Telephony A3—an admittedly broad classification of emissions that can be anything in the AM category. In the FCC's own words, "Unless otherwise specified, A3 includes single and double sideband with full, reduced or suppressed carrier."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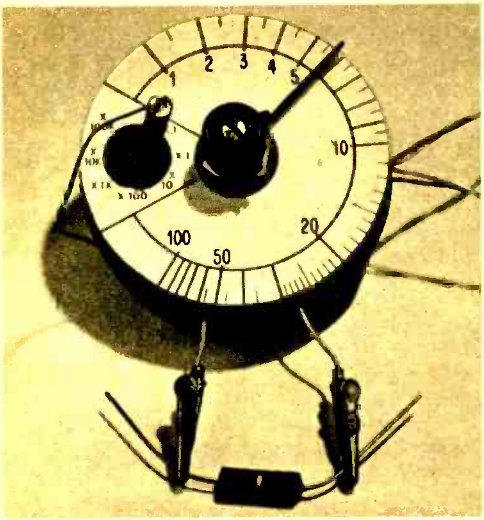
Canned Ohmmeter

Continued from page 66

Remove pot A and connect pot B to the alligator clips without moving R1. Adjust pot B for null (pot B's resistance is now 2,000 ohms). Connect pots A and B in series and again adjust R1 for null. Mark this as point 3. Remove pot A and connect pot B to the clips. Adjust pot B for null. (Pot B's resistance is now 3,000 ohms.) Connect pots A and B in series and to the clips. Adjust R1 for null. Mark the dial 4. Continue in this manner until you calibrate the dial from 1 to 10. Just remember that pot A *always* remains set at 1,000 ohms and pot B is adjusted



Cut a piece of cardboard to fit over the top of the can and draw a circle on it ¼-in. in from the edge. Cut a V-section out of the cardboard for SO1. R1's mounting nut holds the cardboard.

to produce a null at the newly found resistance. When you reach 10 on the dial the pointer should be right over the 10 mark.

Mark the rest of the dial as follows: place PL2 in the ×1,000 hole in SO1, set R1 at 2 (connect pot B to the alligator clips), and adjust it for null (pot B's resistance is now 2,000 ohms). Move PL2 from ×1,000 to ×100 and turn R1 for null. Mark this as point 20. Place PL2 in ×1,000, set R1 to 3 and adjust pot B for null. Put PL2 in ×100, turn R1 for a null, and mark 30 on the dial. Continue this procedure until you reach 100.

The Listener

Continued from page 78

started something . . . maybe. A few months back EI came out with a set of rules for determining what counts as a country (EI's DX CLUB OFFICIAL COUNTRIES LIST, Mar. '65 EI). As such, we were first in DX listener circles to do so. But now the National Radio Club has come up with rules of its own which makes it the first independent organization to fill the void.

By way of explanation, the NRC is a broadcast-band-only club and, therefore, has taken into account nothing but BCB stations. Its rules are similar to EI's except that land bodies of the same nationality separated by 50 miles of foreign territory and/or international waters count as separate countries. EI's rules specify 100 miles.

The NRC rule would seem to work pretty well for the BCB and the club, therefore, seems satisfied. But if the country concept is to have any meaning at all, whatever counts as a country on the BCB also must count as a country on every other band. And when we apply that 50-mile standard elsewhere on the spectrum some very interesting situations immediately arise.

Under the NRC rulings, for example, part of the state of Florida becomes a separate country (the South will rise again?). We're referring to Dry Tortugas and its historic Fort Jefferson, some 75 miles west of Key West. Of course, there's no law that says you can't declare part of Florida a separate country for DX purposes. Even so, before adopting standards, one should be aware of the overall ramifications. After all, BCB is *not* a separate DX world unto itself, as the NRC rulings would imply. What holds for the BCB should hold for most if not every other band or Robinson never knew Crusoe.

Those wishing to bag this little-known bit of U.S. territory have two choices. Radioteletype QRM permitting, they can log fishing vessels and yachts within the three-mile limit, working the Tampa Marine Operator on 2009 kc. Alternatively, if they own a long-wave set, they can try for the Coast Guard beacon on 286 kc. This beacon, by the way, is a real puzzler. It identifies as — — —., which translates only as a letter of the Russian alphabet. Who knows? Maybe they speak Cyrillic down there.

Grandaddy of the VTVMs

Continued from page 91

WV-98C(K) against a laboratory-grade AC meter. Again, our eyes could not see an error.

The ohmmeter accuracy was excellent. When checked against a 200-ohm standard, the meter indicated 201 ohms on the 1,000-ohm scale and 200 ohms on the 10,000- and 100,000-ohm scales.

Decading, or overlapping-range accuracy, also is excellent. For example, when the applied voltage indicated 15 volts full scale, switching to the 50-volt range produced a reading slightly under 15.5 volts.

Zero-set stability is about average for a quality meter. Except for the lowest DC range (0.5 volts), which must be zeroed every time it's used, the zero-set holds within one scale division from range to range and function to function. However, in order to obtain this stability the meter must be warmed up for at least 15 minutes. Matter of fact the current consumption of the WV-98C(K) is so small you might just as well leave the AC power on all the time.

The WV-98C(K) is supplied with a single test probe (in addition to a ground lead) with a switch on its side to select the DC or AC/ohms function. An optional accessory is the clip-on crystal-diode RF probe (WG-301A, $7.75 assembled) which you use to measure RF voltages up to 250 mc. Unlike the usual RF probe, which must be connected in place of the DC probe, the crystal-diode probe simply clips on the end of the regular test probe.

High meter damping reduces pointer overshoot sharply. Even when the applied voltage is great enough to produce a full-scale deflection, the meter doesn't rise quickly and slam into the pin. Instead, it rises slowly, overshoots just slightly and then settles down to the correct reading.

Another feature is an anti-static coating on the inside of the plastic meter face. This prevents the pointer from moving when you rub (to clean) the meter face with a rag. Don't try to clean the *inside* of the meter face or you'll remove the anti-static coating.

All in all, the Senior VoltOhmyst is an outstanding test instrument which lives up to its long pedigree. It is priced considerably higher than most VTVM kits—but it's worth the price.

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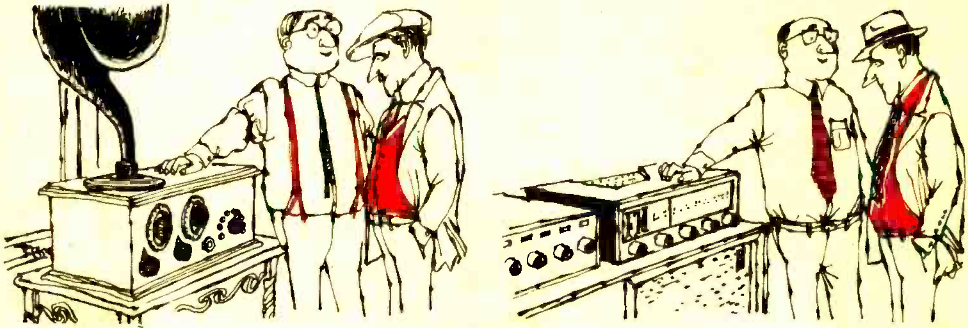

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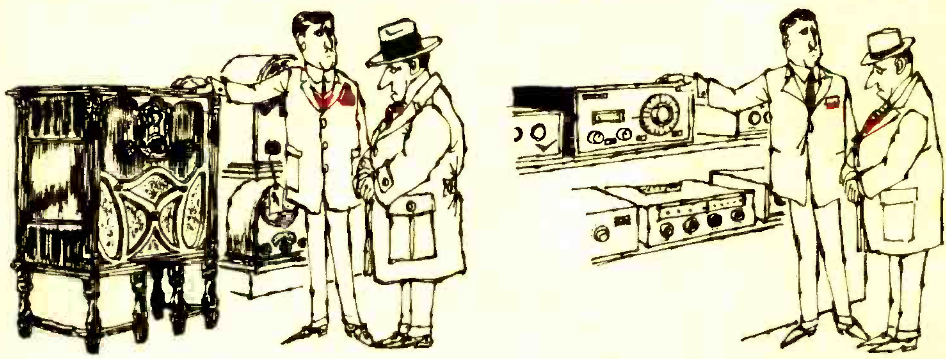

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