THE REAL TRUTH ABOUT USED CB EQUIPMENT

ELECTRONICS ILLUSTRATED®

By the Publishers of MECHANIX ILLUSTRATED

NOVEMBER 1966 • 50¢

25 MOST-ASKED COLOR TV QUESTIONS

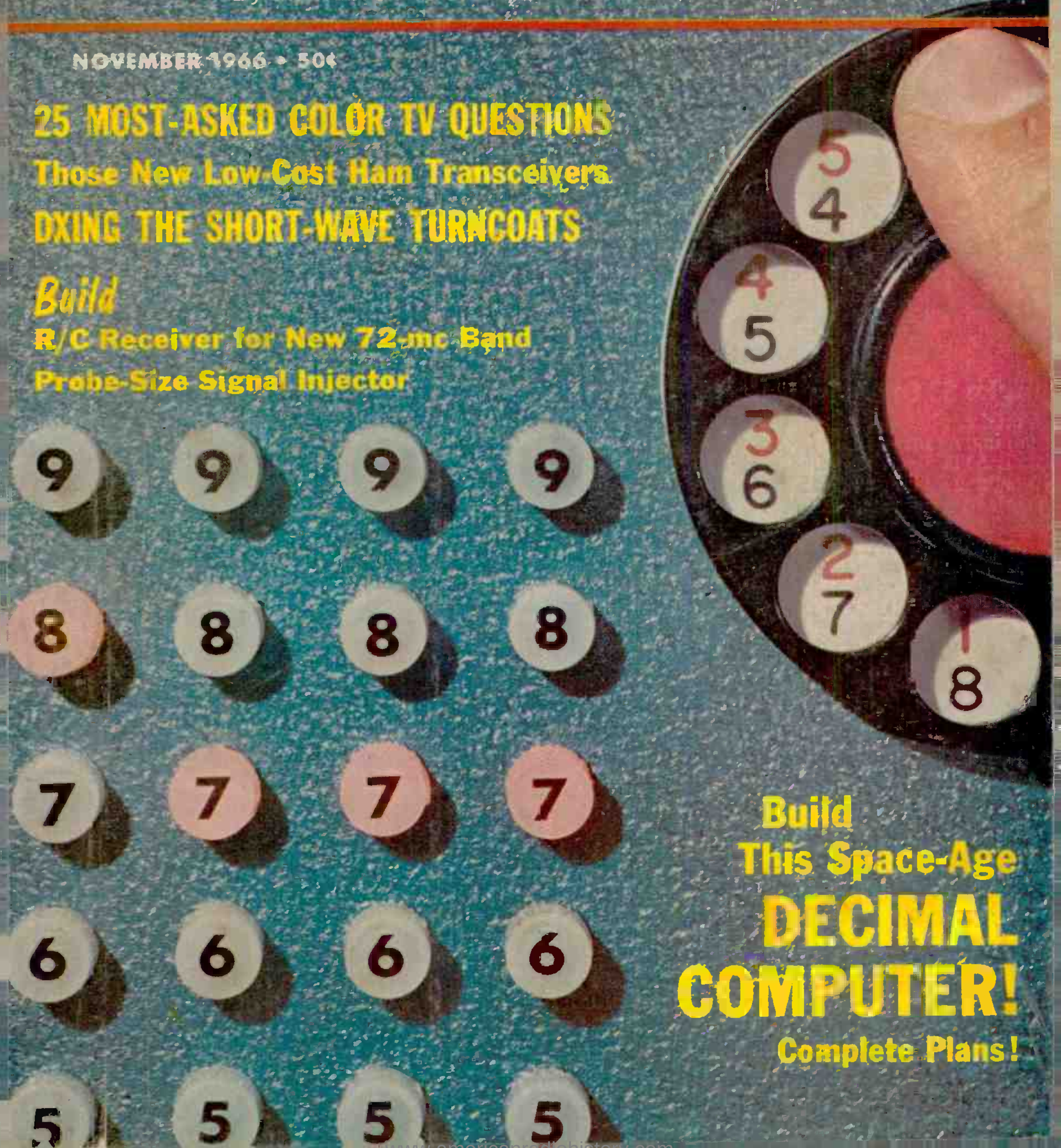
Those New Low-Cost Ham Transceivers

DXING THE SHORT-WAVE TURNCOATS

Build

R/C Receiver for New 72-mc Band

Probe-Size Signal Injector



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ELECTRONICS ILLUSTRATED

NOVEMBER, 1966 A Fawcett Publication Vol. 9, No. 6

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Radio: CB • Amateur • SWL

Audio & Hi-Fi

Theory & Practice

Regular Departments

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FEEDBACK from our readers

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

OUR SON, THE HUMORIST

I was greatly impressed by your article, Try an Attic Antenna, in your September number. It was clever the way you said one could use 300-ohm twinlead and droop the ends if there wasn't enough room in the attic. But that still doesn't solve my problem. Would you believe it if I said I lived in a lighthouse?

Oscar Jordan
Halifax, N.S.

No.

A DISSENTER?

Re Robert Gaulin's article (July) about amateur tape recorders. He advocates the use of one- or two-track recording but this leaves half of an expensive tape's potential unused. He says recording from discs is nonsense. Nonsense! This is an excellent and inexpensive way to build a tape library. His scorn of prerecorded tapes is equally unjust. Recent tapes are every bit as good as their disc counterparts. Selection of titles? Take a look at the new Ampex tape catalog. Mr. Gaulin [was right] when he favored VU meters over eyes and knocked pressure pads. And his paragraph about the necessity of matching tape and recorder almost makes up for the rest of the article.

Sp. 4 Joseph Lafrenz
APO, New York, N.Y.
(Asmara, Ethiopia)

A QUESTION(?)

I have been reading the Feedback section of EI several years. It is seldom I see a sensible answer and when I do in most cases it's the only answer possible. Is it because you don't know the answer or are you just too lazy to write it down?

Hank Shields
Brookings, Ore.

Neither, Hank. It's just that technical questions like yours throw us.

A MESSAGE

Please print this so maybe the FCC may take notice. My message is that the ham bands are too crowded. Listen to 80 meters. Like wipe-out. I have been a ham for only a short time and like any ham with a good pair of ears will tell you, we need more bands. Just listen 8-12 p.m.

Frank M. Bailey, WN4DCW
Spring City, Tenn.

Sorry about that, Frank.

POOR BEN

Was Ben Franklin Crazy?, you want to know. I thought everybody knew the answer. Anybody that would take his front-door key and tie it to a kite string and then go fly his kite in a thunderstorm can't be all there, can he?

Aldo Rodrigues
Los Angeles, Calif.

Probably not for long, Aldo.

BROADSIDES

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

Permanent Magnets—concerning bar, rod, horseshoe and other shapes—is a brochure hobbyists with a yen for experimentation will be attracted to. For a free copy, write to Maryland Magnet Co., 5412 Gist Ave., Baltimore, Md. 21215.

Hobbyists with a broad interest in science—**astronomy, electronics, photography, optics**, etc. —will find everything from a 6-V battery to a gadget that examines snow flakes described in catalog 665. A copy is free for the asking by writing Edmund Scientific Co., 105 E. Gloucester Pike, Barrington, N.J. 08007.

A catalog of **Packaged Electronic Circuits** (with schematics), that also contains information about their testing and selection is what the experimenter will find in Guide No. 8. A free copy is available from Centralab, Division of Globe-Union Inc., Box 591, Milwaukee, Wis. 53201.

The problem of straying off frequency can be solved with the help of Catalog M66. It includes crystal-oscillator theory as well as a listing of **crystals, crystal ovens** and **oscillators.** Write to Monitor Products Co., Inc., 815 Fremont Ave., S. Pasadena, Calif. 91030, for a free copy.

Typical operating characteristics of **compactron tubes** designed for use in color and black & white TV receivers are contained in catalog EI-65. You can get a free copy from General Electric Co., 1 River Rd., Schenectady, N.Y. 12305.

A handy guide to help the experimenter in the selection of **terminal blocks** will be found in catalog 166. For a free copy write Curtis Development Co., 3250 N. 33rd St., Milwaukee, Wis. 53216.

Hi-fi buffs who are in the market for **loudspeakers** will find the brochure giving specifications of the MC8, MC12, and MT12 of interest. Designed with the budget-minded listener in mind, the speakers are priced under $30. For a free copy write to Electro-Voice, Inc., Buchanan, Mich. 49107.

Detailed specs on **coax cable** which can be used by the ham, CBer or general-experimenter are in catalog RF-2. **Connectors** are included, too, along with their dimensioned mounting templates. Write to Amphenol Corp., 2875 S. 25 Ave., Broadview, Ill. 60155, for a free copy.

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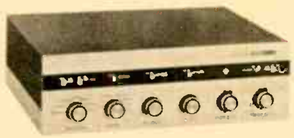
New Model 712 Sentinel 12 Dual Conversion 5-watt CB Transceiver. Permits 12-channel crystal-controlled transmit and receive, plus 23-channel tunable receive. Incorporates adjustable squelch & noise limiter, & switches for 3.5 watt P.A. use, spotting, & Part 15 operation. Transistorized 12VDC & 117VAC dual power supply. **$99.95 wired only.**



Model ST70 70-Watt Integrated Stereo Amplifier. Best buy of highest ranked stereo amplifiers according to independent testing. **$99.95 kit, $149.95 wired.** ST40 40-Watt Integrated Stereo Amplifier, **$79.95 kit, $129.95 wired.** ST97 Matching FM MPX Stereo Tuner, **$89.95 kit; $139.95 wired.**

Model 232 Peak-to-Peak VTVM. A must for color or B&W TV and industrial use. 7-non-skip ranges on all 4 functions. With Uni-Probe.® **$29.95 kit, $49.95 wired.**

New Model 753 The one and only SSB/AM/CW Tri-Band Transceiver Kit. "The best ham transceiver buy for 1966"—Radio TV Experimenter Magazine. 200 watts PEP on 80, 40 and 20 meters. Receiver offset tuning, built-in VOX, high level dynamic ALC, solid state VFO. Unequaled performance, features and appearance. Sensationally priced at **$189.95 kit, $299.95 wired.**

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...electronics in the news

Color Recorder . . . A breakthrough in TV recording has been announced by IIT Research Institute with the unit above, which will record and play back color TV at a price under $500. In a demonstration, instrumentation tape was used, although quality audio tape can do it, too. The tape is driven at 120 ips past fixed heads (most units use rotating heads for a diagonal scan path on wide tape). There's one catch—it's not yet on the market. IIT (Illinois Institute of Technology) is licensing manufacturers to build and sell the unit.

Race Watcher . . . First of its kind, says RCA, is a closed circuit TV system installed at Monmouth Park in New Jersey. Track officials stand by console of system that not only covers race action but will give fans photofinish results within 30 seconds of race's end (it used to take at least ten minutes). Other features include lap dissolve, ability to display words or horse numbers at the bottom of the picture. System will be used to give pertinent information (odds, for example) before race, can then follow entire action, capped by official finish picture.

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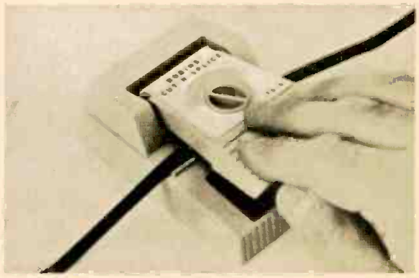
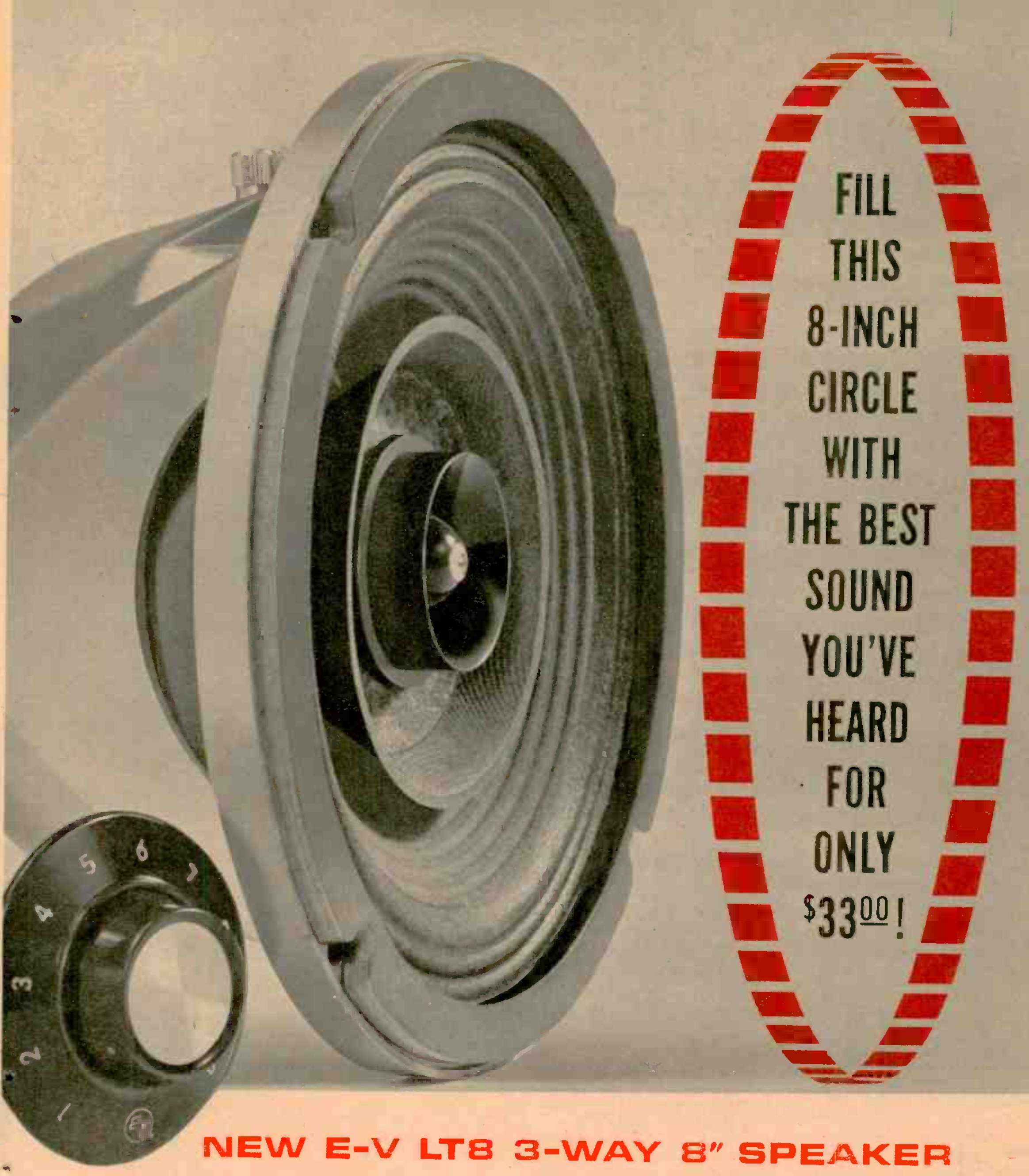
ELECTRONIC MARKETPLACE

ADJUSTABLE . . . The cutting blade on the TS-6 can be set for a 90° splice (for critical work), the standard 45° cut or a 30° cut for minimum possibility of a noisy splice. Cut angle is controlled by a knob on the cutter arm. $5. Robins Industries Corp., 15-58 127th St., Flushing, N. Y. 11356.



Portable . . . If you ever have occasion to edit what you record, the pause control is a special feature you will value on the RK-142T, a transistorized, two-track monophonic tape recorder.

It features two speeds (3¾ and 7½ ips) and two heads (record/playback and erase). It is equipped with a record-level meter and delivers two watts of audio to a 4x6-in. speaker. An extension-speaker jack and alligator-clip cord also are supplied. $59.95. Lafayette Radio Electronics Corp., 111 Jericho Tpk., Syosset, L.I., N.Y. 11791.



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The LT8 mounts almost anywhere—in walls, ceilings, closets, or any suitable cabinet, and its low cost means you can afford high fidelity in every room of your house. Yet, despite its small size and low cost, the sound of the Wolverine LT8—in the E-V tradition—is rich, full, completely satisfying.

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SPECIFICATIONS: Frequency response, 45 to 18,000 cps. Power handling capacity, 20 watts, 40 watts peak. Impedance, 8 ohms. Resonance, 65 cps. Tweeter level control. Size, 8¼-in. diameter, 3⅞-in. deep. Weight, 6½ lbs.

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MARKETPLACE

Solid . . . Many's the CBer who has had the frustrating experience of getting good reports on his carrier strength and poor ones on his modulation. And, given heavy enough QRM, a CBer

of this stripe stands small chance of getting through. The CB-20 transceiver well might be cure for this sort of ill. Reason is, special attention has been paid to the rig's modulation, noise suppression and shielding with a view toward increasing purity of transmitted and received signals. Totally solid-state, the 4-lb., 7 x 6 x 2⅛-in. unit reliably musters a signal sensitivity of less than 1 μv. for 10db S/N ratio and a claimed output power of not less than 3 watts. The five-channel rig comes equipped with one transmit and one receive crystal. $99.95. Hallicrafters Co., 5th and Kostner Aves., Chicago, Ill. 60624.

Discriminating . . . One of the most desirable characteristics for an SW receiver is adequate selectivity. And, though this attribute noticeably is present in middle- and high-price receivers, budget sets tend to be somewhat deficient in this

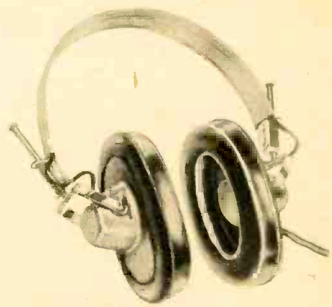
respect. Thing is, selectivity always can be improved by addition of a Q-multiplier such as the Heath GD-125. Equipped with its own 117-VAC power supply and connecting cable, plug and socket, the GD-125 works with any receiver having a 450- to 460-kc IF. Effectively an electronic filter, the GD-125 can be adjusted to make the IF curve sharply peaked, broadly peaked or deeply notched, depending on band conditions and the type of interference discrimination required. Kit, $14.95. Heath Co., Benton Harbor, Mich. 49022.

MARKETPLACE

Color-TV Tonic . . . Many's the fringe-area color-TV set owner who, having invested a pile of the green stuff, has been disappointed to see

washed-out color, snow and other evidences of a weak signal on the screen of his pride-and-joy. Cure for these signal-starved color-TVs lies either in moving closer to the TV station or using a booster like the Lafayette Color-Amp. A transistorized RF amplifier stepping up both TV and FM signals some 20db, the Color-Amp electronically moves antenna closer to signal sources for improved reception of TV and FM. $24.95. Lafayette Radio Electronics Corp., 111 Jericho Tpke., Syosset, N.Y. 11791.

Personal . . . Though daytime DX can be had, it's the wee-hour band openings that often prove most rewarding. Trouble is, squawks and squeals from a receiver in the middle of the night tend to disturb other members of the family who just might be struggling for that 41st wink. A com-



fortable pair of headphones like the CO-S Communicator not only lets others sleep in peace but also makes it much easier to fish out that rare one from the QRM. The CO-S Communicator works off any 4- to 16-ohm impedance and responds to signals from 100 to 10,000 cps. $13.95. Superex Electronics Corp., 4 Radford Pl., Yonkers, N.Y. 10701

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Preparation for this government license essential for interesting jobs in radar, radio, television, communications, guided missiles, many others. Upon completion of this course, if you do not pass the FCC exam for a 1st Class Commercial Radiotelephone License your tuition will be refunded.

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- ☐ Television Servicing (Including Color)
- ☐ Stereo, Hi-Fi and Sound Systems
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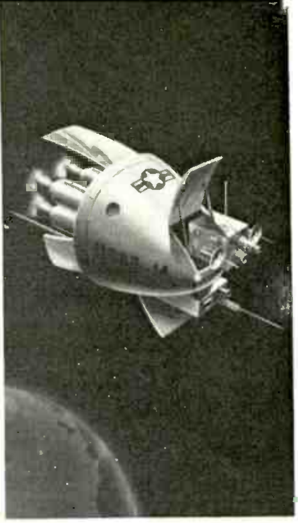

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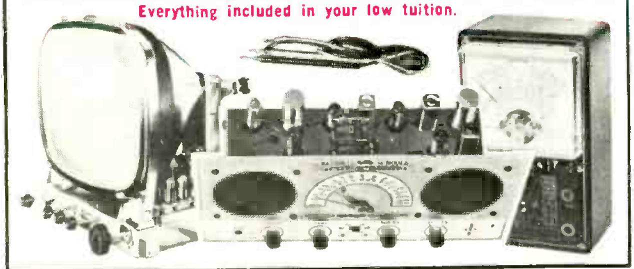

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ELECTRONIC SWAP SHOP

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

TV CHASSIS and other items. Make swap offer. Glenn Glazebrook, 2525 S. Sheridan Blvd., Denver, Colo. 80227.

HAM CW TRANSMITTER, home brew. Will swap for CB transceiver. Randy Hutcheson, 1865 Rusty La, Lincoln, Nebr. 68506.

ASSORTED TUBES. Interested in swap for Kuhn 364B or 6-meter converter. Chris Bowne, 10 Parkway Dr., West Nyack, N.Y. 10994.

BC-611 80-METER walkie-talkie. Want CB transceiver. Lou Poprocos, 1319 Heatherfield, Glenview, Ill. 60025.

SILVERTONE 2-speed stereo tape recorder, other items. Need SW receiver. Alton Sugg, 513 Montague Ave., Ayden, N.C. 28513.

GLOBE SCOUT transmitter, 80-6 meters. Will swap for ham gear. Brian McDermott, K1JNK, Ledge Rd., Chester, N.H. 03036.

50-POWER TELESCOPE. Will swap for VTVM. John E. Evans, 12444 Rte. 4, Mechanicsburg, Ohio 43044.

SANDHURST lab tape recorder. Want Heath Twoer or other 2-meter gear. Lee Hancock, 8 Russell St., Plymouth, N.H. 03264.

LAFAYETTE SPST toggle switches. Will swap for DPDT slide switches. E. Felberbaum, 3505 Decatur Ave., Bronx, N.Y. 10467.

PHILCO AM/FM tuner, other items. Will swap for 5-watt CB transceiver. Ronald Dardano, WPE1GGE, 10 Winter St., Dorchester, Mass. 02122.

KNIGHT Span Master. Swap for tape recorder. Michael Cole, 1345 W. Stover, Freeport, Ill. 61032.

ANTIQUE Receiver, other items. Want SW receiver. Patrick Griffith, WPE9HVW, 824 Blue Lake Ave., Rockford, Ill. 61102.

HALLICRAFTERS S-120 receiver. Will swap for Hallicrafters S-200 receiver. Stephen Mariano, 35 Fernlea Cres., Montreal 16, Que., Canada.

TV POWER TRANSFORMER, other items. Need tubes and coils for Meissner EX signal shifter. Mike Clarson, WA2ZOW, 65 Richard St., Clark, N.J. 07066.

HALLICRAFTERS S-38 receiver. Will trade for CB transceiver. Randy Gassels, 2018-10th Ave., S. Birmingham, Ala. 35205.

LIONEL train set. Swap for Knight Kit T-60 or similar item. Elli Willner, 967 E. 19th St., Brooklyn, N.Y. 11230.

GENERAL ELECTRIC Motors, 1/4 HP. 1,725 RPM. Will swap for walkie-talkie. Joseph Pantola, Jr., 98 Campbell Avenue, Yorkville, N.Y. 13495.

LAFAYETTE KT-135 SW receiver. Will swap for tape recorder. Michael Grenadier, 6 Prospect Rd., Westport, Conn.

INTERCOM, other items. Interested in swapping for European telephones. Leon Buddine, 1700 W. High St., Haddon Heights, N.J.

HAMMARLUND SP-400X receiver, other items. Want a Harley-Davidson motorcycle. Randy Hinrichsen, WA0LPD, 2724 S. Martha, Sioux City, Ia. 51106.

TEST EQUIPMENT. Will swap for oscilloscope, other items. Michael A. Barone, 1637 Steinhart Ave., Redondo Beach, Calif.

SIGNAL GENERATOR. Interested in swapping for Knight Star Roamer. Omar Bose, Jr., Box 71, Wendell, Id. 83355.

OLYMPIC stereo phonograph. Will trade for SW receiver. John Crooks, 391 N. Wellwood Ave., Lindenhurst, N.Y. 11757.

KNIGHT C-540 transceiver. Will exchange for CB transceiver. Bill Adsil, Decker, Mont. 59025.

MINI SPEAKERS. Want novice ham equipment.

[Continued on page 20]

ELECTRONIC SWAP SHOP

Continued from page 19

Gilbert Bush, 158-37 76th Ave., Flushing, N.Y. 11366.

ANTIQUE RADIOS. Want 7JP4 picture tube. Raymond Fisher, Box 234, Charleroi, Pa. 15022.

GO CART, 50 MPH top speed. Interested in swapping for ham equipment. Bob Denaut, Mountain View Dr., Weston, Conn. 06880.

POLICE band receiver. Will swap for SW rig. Gary Caplan, 170 Westview St., Dorchester, Mass. 01234.

HEATH GWW-12 CB transceiver. Will swap for Heath Twoer. Ralph Irace, Jr., 4 Fox Ridge La., Avon, Conn. 06001.

HALLICRAFTERS S-119 SW receiver. Want stereo turntable. James T. Laning, 553 West F. Ave., Kalamazoo, Mich. 49001.

NATIONAL HRO-8 receiver. Want CB transceiver or best offer. James Craft SS #1, Lakewood, St. John, N.B. Canada.

DAVIS reverb amplifier, other items. Make swap offer. Dan Walsh, 8361 Trinette Dr., Garden Grove, Calif. 92641.

HALLICRAFTERS CB-7 and CB3A. Will swap for Drake R4. Kip Vandenberg, 85 Salzburg, Bay City, Mich.

ASSORTED TUBES. Will trade for Knight Star Roamer. Bill Watson, 479 Grand Ave., Central Point, Ore. 97501.

KNIGHT Span Master. Need signal generator. Jeffrey Jacobsen, 1796 Country Club Dr., Logan, Utah 84321.

SEARS 50-mm telescope. Want test equipment. Robert Krowinski, 172 Homestead Dr., North Tonawanda, N.Y. 14120.

LAFAYETTE HE-30 communications receiver, Heath 30-watt amplifier. Will exchange for ham transmitter. Stephen Gray, 620 Lans Way, Ann Arbor, Mich.

RCA stereo tape recorder. Want Roberts 1600 recorder. Stanley Hightower, 3000 Holmes Ave., Huntsville, Ala. 35805.

KODAK camera, assorted tubes. Need walkie-talkies. Harvey Lambert, Rte. 2, Box 128, Thief River Falls, Minn. 56701.

TAPE RECORDER. Will swap for Hallicrafters SX-42. J. Burjak, 645 Beatty St., Trenton, N.J. 08611.

HEATH GW-42 CB transceiver. Will swap for anything of equal value. Mike Ford, Rte. 1, Jonesville, N.C.

SEARS CB walkie-talkies. Will swap for Hallicrafters SW receiver or tape recorder. Patrick J. Delaney, 284 Nichols Terr., Stratford, Conn. 06497.

KNIGHT Star Roamer. Will exchange for tape recorder. John Reis, Rte. 1, Greenfield, Iowa 50849.

EICO 955 capacitor checker, portable TV. Want CB transceiver or Knight Star Roamer. Jack B. Merritt, Rte. 10, Box 109, Lexington, N.C. 27292.

EASTERN ELECTRIC PA amplifier. Will swap for test equippment or FM tuner. Rod Whalen, 6521 Ventura Dr., Pittsburgh, Pa. 15236.

HALLICRAFTERS S-38 receiver, other ham and CB gear. Need VFO, Heath Twoer. Pat Croft, WN9QAJ, 1809 E. 14th St., Muncie, Ind. 47302.

HEATH DX-20 transmitter. Will trade for Hallicrafters S-38 receiver. Abner Woodson, 5045 A Terry, St. Louis, Mo.

PHONOGRAPH MOTORS, antenna rotator. Want Heath Twoer. Kenneth L. Fowler, East Middlebury, Vt. 05740.

KNIGHT R-100A receiver, 200-watt linear amplifier. Want Heath or Knight 5-in. scope, marker generator. Dennis M. Bodenstein, Box 63, Apache, Okla. 73006.

WEBCOR tape recorder. Will swap for telescope or ham gear. Tom Dornback, K9MKX, 21st Pl., Lombard, Ill. 60148.

EICO 232 VTVM. Looking for Heath Twoer or other ham gear. Larry Heberlein, 5730 Coal Mine Rd., Littleton, Colo. 80120.

KNIGHT X-10 crystal calibrator. Will exchange for 24-hour wall clock. Donald Whitner, 49 Wood St., Ringtown, Pa. 17967.

CHEM CRAFT microscope. Need Knight Star Roamer or Ocean Hopper. Bill Laferriere, 93 Summer, Barre, Vt. 05641.

[*Continued on page* 22]

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Wow and flutter, 0.02 and 0.09 per cent, respectively, at 7½ ips, were negligible and significantly bettered the Knight rating of 0.2 per cent. The KG-415 worked flawlessly, producing recordings which at normal listening levels could not be distinguished from the original FM program. Other recorders can do this, too, but they generally cost $500 or more. The Knight KG-415 is, without a doubt, one of today's best values in tape recorders. It is made to order for the hobbyist on a budget who will not compromise his quality standards."

From April, 1966 AMERICAN RECORD GUIDE:

"At $249.95 FOB Allied Radio in Chicago, this recorder is not inexpensive. Still, I think it is remarkably cheap considering what it is and what it provides in the way of features and qualities.

It took me 14 leisurely hours to build the unit—start to finish . . .

Right off the bat, this kit performed right up to, or better than, all its specifications. I am jaded enough not to impress easily, but this got to me.

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From January, 1966 AUDIO:

"This is a kit which is a perfect delight to profile for two reasons—it was a pleasure to construct it, and it performed so well after it was completed.

At the relatively low price of $249.95 plus some 20 hours of pleasurable work, we think the KG-415 is an excellent buy."

From March, 1966 ELECTRONICS ILLUSTRATED:

"When the job is complete the builder has a deck of unquestioned high quality with all the functions and conveniences of a professional model. A comparable factory-wired deck would cost upwards of $400.

The instruction manual is well done, being logical and easy to follow.

Our KG-415 met or exceeded all Knight's specs."

From March, 1966 POPULAR SCIENCE:

"Judging by the almost flawless way it records and reproduces sound, the Knight-Kit KG-415 stereo tape deck costs a full third less than it's worth."

ALLIED RADIO, Knight-Kit Div.
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ELECTRONIC SWAP SHOP

Continued from page 20

AURORA HO model race track. Want RCA Mark VIII transceiver. Dan Palmer, 340 East St., Weymouth, Mass. 02189.

PHILCO BC/SW receiver. Will exchange for AM/FM/SW transistorized receiver. George Gerfer IV, 397 Michigan St., Lockport, N.Y. 14094.

BC RADIO, Deville tape recorder. Will trade for Knight Ocean Hopper. Randy Habeck, 260 Graves Rd., Shawano, Wis.

CRT (5FP7A). Will swap for anything of equal value. Steve Bumpous, Rte. 5, Box 145, Lubbock, Tex. 79410.

GONSET G-11 CB transceiver. Make swap offer. Bernard Birecke, 2136 Courtland Ave., Kittering, Ohio 45420.

CB WALKIE-TALKIES, 21-in. TV set. Need ½-, ¾-, or 2-in. instrumentation tape. D.C. Grafton, 257 E. Summit St., Souderton, Pa. 18964.

AIRLINE 6-tube receiver, old tubes. Need Novice gear or test equipment. Jim Smittle, Rte. 4, Columbus, Kan. 66725.

RECORD PLAYER, records, other items. Want TV repair course. Frank Hereford, 1916 R St. N.W., Washington, D.C. 20009.

ASSORTED COMPONENTS. Will swap for bulk tape eraser or walkie-talkies. Colin Murray, Rte. 3, River John, Pictou Co., N.S.

MODEL rocket equipment. Want 3.5- to 7.5-mc transistorized SW receiver. George Sacco, 8 Curry Ct., Metairie, La.

HALLICRAFTERS S-38 SW receiver. Want tube-type tape recorder. Ray Nazzaro, Box 85, Rocky Point, N.Y. 11778.

ENFIELD 30/06 game rifle with 4-power scope. Will trade for Heath RX1 receiver. C.L. Piester, WØMZV, 304 Alpert St., Fort Collins, Colo. 80521.

AIWA TP50 tape recorder, Philmore VOM. Want VLF or VHF receiver. Scott Hower, 600 Snyder Rd., Whitfield-Reading, Pa. 19609.

KNIGHT CB transceiver. Will exchange for 200-mw walkie-talkie. Jim Izarelli, 512 Fox St., Joliet, Ill. 60432.

STAMP COLLECTION. Want E-V 719 microphone, Ameco PS-2 power supply. Philip Savilonis, 55 Wachusett St., Mottapan, Mass. 02126.

KNIGHT Space Spanner, other items. Will trade for Hallicrafters S-200. Roy H. Stacey, Rte. 3, Delavan, Wis.

ARBORPHONE, assorted old tubes. Need 100-mw walkie-talkies. Nick Szgatti, 21 Harold Ave., Welland, Ont.

VM 720 stereo tape recorder, 20 reels of tape. Need Unimat lathe. Joe H. Sasser, 313 Vermont St., Plainview, Tex.

KNIGHT Ocean Hopper. Will swap for test equipment. Stephen Bennett, 1615 Market St., Lewisburg, Pa. 17837.

CANON/BELL & HOWELL 8-mm movie camera. Want BC/SW receiver. M.D. Worthy, 653 N. 9th St., Reading, Pa. 19604.

HOMEBREW amplifier, assorted components. Will exchange for SW receiver. C. Papas, 453 Washington St., Dedham, Mass. 02026.

HALLICRAFTERS S-119 SW receiver. Make swap offer. Richard E. Loogood, 1221 S. Marsalis, Dallas 16, Tex.

IBM 115-VDC relays. Will swap for anything of equal value. Bob Hughes, 3660 Detroit Ave., Dayton, Ohio 45416.

CLARICON 15-050 walkie-talkie, Knight Space Spanner. Make swap offer. Randy Rogers. 1226 Alaska Ave., Dallas, Tex. 75216.

GE CR7505-H117 photocell. Will exchange for Heath VF-1 VFO. Jim Gorman, Box 157, Mound City, Kan.

ROSS 400 tape recorder, other hi-fi items. Will trade for stereo system with Garrard AT-60. Robert Byrns Jr., Rte. 3, Box 113, Jefferson, Iowa 50129.

KAAR 12-V power supply. Want test equipment. John Strecker, 214 N. 11th St., Tonkawa, Okla. 74653.

[Continued on page 111]

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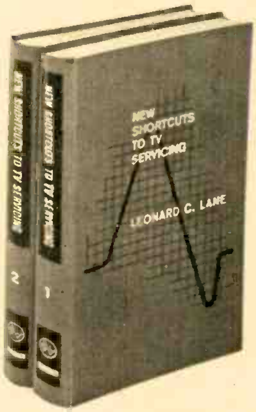

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UNCLE TOM'S CORNER

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

By TOM KNEITEL, K2AES/KBG4303

★ *Whenever I talk on CB, people mistake me for a girl. I've ended up with five different mikes, audio compressors, filters and a stereo mike mixer. After I finished installing them all, I turned my rig on and called my mobile. A voice pops up in the background, "Hello, Honey!" What went wrong?*

P. M.
Rochester, N.Y.

Sorry, Phyllis, but I don't get the question.

★ *Saw your article on How To DX Real Spies in EI and was fascinated. How does the CIA recruit spies? Being a ham, I could probably qualify.*

Don Bartlett
Fayetteville, Ark.

The obvious way to contact the CIA would be to write to them in Washington, D.C. If you want to shake them up, though, write to them at Box 806, Grand Central Station, New York, N.Y. 10017. That's their recruiting address for spies. By the way, if you come right out and tell them you want to be a spy they will file your letter. That's quite an honor, you know.

★ *If solar cells do a good job on walkie-talkies (as EI claimed last May) do you think they will also power a small TV set? Why doesn't somebody come out with this?*

Joe B. Brown
Dallas, Tex.

Probably because daytime TV is so crummy.

Stereo Dept. Now that stereo is here to stay isn't it time that recording companies stopped trying to rake us poor audiophiles over the coals by charging extra dollars for a stereo disc? The recording session for mono and stereo is the same, the pieces of vinyl used for mono and stereo discs are identical, the jackets are the same—so why the extra charge? Seems to me that stereo no longer is a novelty worth additional cost. The public is forced to pay this silly tribute to the record companies without complaining and without analyzing the fact that they are being charged unfairly. We won't even get into the whole situation as to why a few cents worth of vinyl with a few scraggly lines etched into it (mono or stereo) should cost more than a dollar in the first place.

★ *I've got hold of a chart showing international radio call-sign allocations and it says that the prefix block of letters from CAA through CEZ is assigned to Chile. On the other hand, broadcasting stations here use the calls CBF and CBM. Somebody's got their wires crossed because I don't think that Canada has been taken over by Chile yet. Whose call signs are they?*

Monty Golden
Montreal, Que.

Matter of fact, you've touched a sore toe of international radio goings-on. Chile officially owns these call signs but Canada had its stations on the air before Chile was assigned the prefix. So it's a deadlock with both Chile and Canada using the prefixes. The FCC got into a similar bind a few years back when it started giving numerical prefixes to CB stations. Seems they overlooked the fact that numerical call signs are owned by several countries.

[*Continued on page* 26]

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UNCLE TOM'S CORNER

Continued from page 24

★ *You guys at EI ought to get together on your opinions. Wayne Green, EI's ham columnist, has stated that flying saucers are "intruders in our skies landing in our country and our military doesn't know what to do about it." He said that in the January 1966 issue of 73 Magazine, his own publication. In the July issue of EI you casually sluff off saucers as humbug and say those who believe in them are "a few steps away from the funny farm." Does that mean Wayne, too?*

Louis E. Daugherty, K7YXP
Tucson, Ariz.

Wayne has been gunning sacred cows and flying saucers for many years now and none of us who love him would want him any other way.

Legal Dept. Don't look now but Uncle Sam is kicking around the possibilities of a new law that would force the registration of a great many radio antennas with the FCC. The registration would affect hams and others wishing to erect antennas more than 200 ft. above ground (even on existing apartment houses) or above 20 ft. if within a few miles of an airport. The registration would have to include an accurate geographic survey, correct to the nearest second, by a licensed surveyor. Whole crazy thing is a result of the FAA's complaining that such antennas are the cause of so many private aircraft accidents. Someone ought to ask the FAA to spend more time checking the alcoholic content of the pilots who get hung up on antennas. This is an old story known to airport insiders. Some of those pilots are flying even before they get to the airport.

★ *Recently I made an excellent deal on a piece of military-surplus radio equipment, a BC-640 VHF transmitter. It's brand new and in perfect condition. How can I convert it for non-military use?*

Roger Erskine
Rapid City, S.D.

The BC-640 from World War II, designed for aircraft communications, without doubt is the biggest, most-powerful television-interference generator ever built. When only half warmed it can blank out all VHF and UHF TV channels for miles around—even if it's turned off, some say. Unload it, Rog.

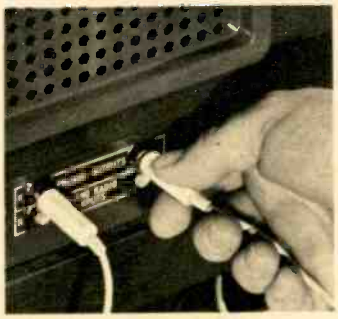
Kodak
TRADEMARK

Some plain talk from Kodak about tape:

Double or nothing... or the noble art of dubbing

One good tape deserves another. That's another way of saying that half the fun in having a good-quality, home tape-recording system should consist of being able to make tape duplicates. The reasons for dubbing can be as varied as you want. Perhaps as simple as sending your Aunt Mabel a particularly good tape of the kids — a tape you also want for your own tape library . . . or because you want to exchange tapes with a fellow audiophile . . . or because you want to edit a tape to go along with a movie or slide film without chopping up the original tape . . . or simply to preserve your early tape recordings on modern, more efficient KODAK Sound Recording Tape.

Takes two to swing. If you already have a second tape recorder on hand, you're ready to get started. If not, find a good friend that will lend you his. But do be particular about your friend. Because that old cliché about the weakest link applies in spades as far as dubbing equipment goes. Also be particular about the tape you use . . . but as they say on radio, more on this later.



Read the instructions. First off—and though it may seem obvious — make sure your two tape systems are in the best possible condition. Look at it this way — the dubbed recording will be at best a second generation recording . . . it's going to combine all the deficiencies present in your original tape recording, in the playback recorder, and in the recording equipment. So read both instruction books . . . then clean the heads with one of the commercial preparations available for that purpose . . . and demagnetize the heads if you can lay your hands on a degausser.

Next, connect your two tape machines — the "master" and the "slave." If you have a choice, take your output from the master at the pre-amp stage rather than at the amplifier. No reason to add its distortion to your dubbing. For the input to the slave, you usually have a choice—one marked "mike" or "high-impedance" (usually in the 50,000-200,000 ohms range), the other marked either "radio," "phono," "tuner," "tape" or "low-impedance" (in the 500-ohm range). You want the latter one.

Choose your tape. Signal-to-noise is the touchiest area in dubbing. Picking a tape that will give you the lowest noise level on the duplicate without lowered output makes a lot of sense. We've got just the tape for you: KODAK Sound Recording Tape, Type 34A. It packs five or more additional decibels of undistorted output than the usual low-noise tapes. When dubbing on KODAK Sound Recording Tape. Type 34A, set the recording level on your slave unit at 4 decibels over your normal level—that's just slightly higher than normal if you set your level by a VU meter. Because you can put a lot of signal on this tape, you can play it back at lower gain . . . and, Eureka, there's your low noise!

KODAK Tapes — on DUROL and Polyester Bases — are available at most electronics, camera, and department stores. To get the most out of your tape system, send for free, 24-page "Plain Talk" booklet which covers the major aspects of tape performance. Write: Eastman Kodak Company, Department 940, Rochester, N.Y. 14650.

EASTMAN KODAK COMPANY, Rochester, N. Y.

ICs GO CIVILIAN!!

At last integrated circuits are reaching the home, bringing space-age micropackaging down out of the blue.

By MILES DILLARD

AT first glance the 12-in. TV at right looks much like any other portable. First thing you would notice if you had one in your home is that it's fast—tug the pull switch and the sound goes on instantly; then nine seconds later the picture tube flashes into living black and white.

But speed isn't what puts the RCA Minikin in a class by itself. In fact, you can't see what makes it this year's big news in TV until you yank off the back cover. Even then, without score card you still probably would miss it.

On a printed-circuit board snuggled down between two miniature transformers sits an aspirin-size metal transistor case. Nothing remarkable about it—except that ten leads snake out of the can in place of the usual three. And inside is what may be the most important development to hit electronics since the invention of the electron.

In the tiny can is an integrated circuit—a fantastic silicon chip with more talents than an ambidextrous trumpet-playing stripteaser. "This versatile integrated-circuit chip, no larger than the letter O on a typewriter," says John B. Farese, vice president of RCA's Electronic Components and Devices division,

ICs GO CIVILIAN!!

"can replace 26 discrete circuit components. And the single chip performs the functions of sound IF amplifier, AM and noise limiter, FM detector and audio preamplifier."

Now, following the appearance of the RCA integrated-circuit TV this summer, IC products are busting out like mushrooms after a rain. General Electric has announced a complete new IC line of consumer electronic gear. The first device—a cigarette-pack-size rechargeable-battery radio—will come on the market about the time you read this. A portable phonograph will follow later this autumn. By next year, says a GE spokesman, the company will be marketing IC-equipped home radios and phonographs, TV sets and tape recorders.

Integrated circuits have been around for several years and are used widely in space, military and industrial gear. But until now the wonder-working chips cost too much to use in consumer electronic devices. (In 1963, Zenith put one in a hearing aid, a high-cost item where the extremely small size justified the stiff tab.) Today, however, prices have dropped sharply. In the early days a single chip cost more than $700; now some types cost only a dollar or two. The ones in the RCA TV set, for example, sell for $1.25 in production lots and replace components worth many times that amount. The IC in the GE radio, the company says, goes for about 80¢.

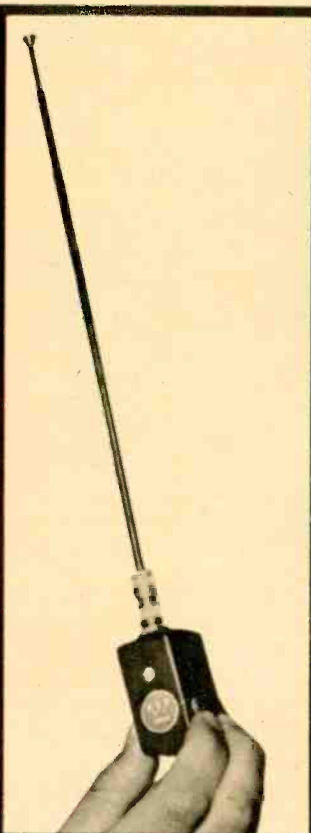
ICs, in other words, suddenly have become not only practical but profitable for the manufacturer. And before long they'll be sprouting in everything from CB gear to electronic baby-bottle warmers. In fact, experts are falling over themselves predicting the goodies the IC will bring in the next few years. Among them:

- A radio so small you won't put it in your shirt pocket—you'll plug it in your ear.
- A phonograph cartridge or tape head containing its own preamplifier (virtually eliminating hum pickup and high-frequency loss of the usual shielded cable).
- Test instruments (signal generators, frequency standards, tiny IC replacements for the VTVM) small enough to fit in a pocket. Such units even might be routinely built into military and industrial equipment at critical points. Troubleshooting and repair would become virtually automatic.
- Your own computer. The home computer, small enough to keep in a cigar box, has been predicted for a long time. ICs will make it possible—at a price you can afford.

First consumer product to use ICs was hearing aid designed by Zenith to fit within the wearer's ear. Although comparatively expensive, freedom from loose wires made it worth the price.

Some pundits are predicting really far-out items—some way down the road. They foresee, for instance, a flat-screen TV. Once the problem of the screen itself is solved (which may not take too long—see EI, January '66) then all the electronics could be fitted easily into a thin, picture-type frame or designed into a fraction-of-an-inch-thick sandwich to fit behind the screen. In either case you could hang the whole thing on the wall like a picture. Also visualized is a black box for your car that will help you make a panic stop in the shortest distance without skidding or losing control. And a radar set that would sound an alarm if you approach another car at too great a closing speed—and do it in time for you to mend your ways.

Clearly, with the introduction of ICs in



Model's tweezers hold one of the tiny ICs used by Westinghouse to build wee TV model at the far right.

Also built by Westinghouse to dramatize molecular electronics capabilities is this tiny transmitter and a matching receiver.

consumer products, electronics stands on the verge of another wave of change as great as that begun in 1955 when the first transistor radio hit the market. Now that the transistor is entrenched in every production line where it has been able to gain a toehold, along comes the chip. And it promises to make the transistor revolution of recent years look like just a curtain-raiser for the main event.

Says Dr. James Hillier, vice president of RCA Laboratories: "We expect that the benefits of integrated circuits can soon spread throughout the entire communications industry. This can lead to radical advances in the design, capability, and economy of many types of systems."

The reasons technical experts are excited about ICs are simple:

If the transistor is small, the IC is smaller.

If the transistor is reliable, the IC is more reliable.

If the transistor is stingy at power consumption, the IC is a real miser.

If the transistor is getting cheap, the IC will be even cheaper.

With so many advantages on the horizon, you'd think the introduction of the first chip into consumer gear would excite feelings of glee on the part of industry leaders. There's excitement, all right. But it's the kind you find in the girls' locker room when a football player wanders in by accident. They squeal; but they don't quite know what to do about it.

The trouble is caused by the fact that most radio and TV manufacturers were figuring on ICs in consumer goods about 1968 or 1969. That would give everybody plenty of time to get ready, redesign equipment, retool plants and introduce the new circuits in a leisurely way. But then things began to get out of hand.

A rumor got out last year that Admiral was going to put an integrated circuit into one of its TV sets. RCA, perhaps, not wanting to be outdone or perhaps just as an unusual coincidence, soon went into production with an IC set of its own. Now RCA has on

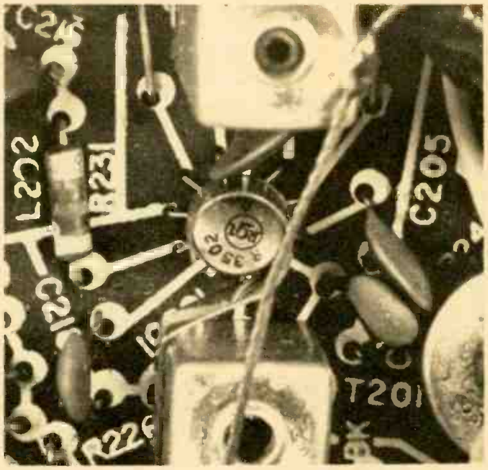
ICs GO CIVILIAN!!

the market that one set—the 12-in. portable—and will soon begin sprinkling ICs through other sets in its line and probably in FM receivers as well. And GE, also rushing into production, is coming out with a wide line of IC-equipped gear.

Most competing manufacturers, consequently will be forced to go along with the new trend, like it or not. Any maker who doesn't soon will be as out of style as a 2-car garage in Southern California. Manufacturers are having to shell out a lot of loot to redsign their sets and get their production lines in high gear with ICs. "It's definitely forcing us to move up on our production plans two or three years," says one company official.

And there are problems inherent in integrated circuitry. It's hard to design large capacitors, for example. Capacitance is determined by the area of the plates and the distance between them. An IC simply is too small to make room for large plates or wide spacing. When large capacitors are needed designers just have to run a few leads off the IC and hook in a conventional unit on the outside. Since this tends to defeat the purpose of having a single, monolithic circuit, engineers don't like to do it.

"We try to design circuits so we don't need capacitors larger than we can make," says



IC element (R 3502) looks like this mounted on circuit board of RCA Victor Minikin TV chassis.

Richard Lewis of Westinghouse's Molecular Electronics division in Baltimore. "Often you can use transistors to take their place." Using extra transistors in conventional circuitry would increase costs sharply. With ICs, you just build them in while you're making the chip.

Inductors are more of a problem than capacitors. And so far nobody knows of any good way to grow inductances into an IC. Consequently, the hang-it-on technique still has to be used here, too.

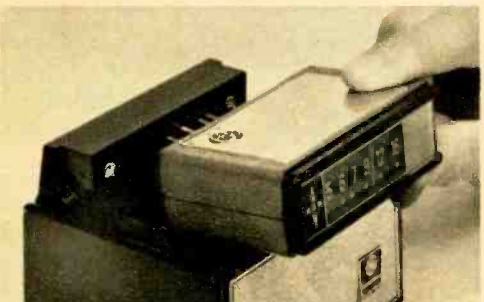
Despite these disadvantages, though, ICs still offer a bundle of plusses. When the Minuteman missile was redesigned in 1962, engineers turned to ICs in place of conventional transistor circuitry. The reduced weight was counted on to give the missile the added range it needed without redesign of the rocket.

Two years later, the first birds using the new system were fired. Weight of the electronic system had been reduced by half. And reliability, far from being sacrificed, was better than it had been.

Following the triumph of ICs in the Minuteman, the silicon slivers were put to work in other space and military equipment. The weapons-control radar on the Phantom F-4 and the F-111 make use of integrated circuits to increase reliability and cut weight, as does advanced tactical ground-to-air radar.

ICs pay off in space, too. The IMP (Interplanetary Monitoring Platform) space ve-

[Continued on page 111]



General Electric's first unit with ICs is a cigarette-pack AM radio, shown with a recharger base.

WWV's new home

NATIONAL Bureau of Standards station WWV, perhaps taking Horace Greeley's advice, is pulling up stakes at its long-time home in Greenbelt, Md., to migrate westward. The new abode is a spot on the High Plains near Fort Collins, Colo., with the towering Rockies as a backdrop (see photo).

A new transmitter building and a sizable farm of eight antennas are in the final stages of construction at present and the big switchover from East to West, although postponed once before, now is scheduled for 0000 hours GMT on Dec. 1. However, because of the difference between Greenwich and local time, at Fort Collins it still will be . . . November. Specifically, 5 p. m., Mountain Standard Time, Nov. 30 (7 p.m. EST).

WWV, which gives time and identification in voice every 5 minutes between beeps and clicks, will issue a special first-day QSL card for hams, SWLs—and anyone else, for that matter. To make a report, copy the voice message exactly. The wording will change next day so WWV's report readers will know whether you're only kidding (address: WWV, Fort Collins, Colo. 80521).

There are two main reasons for the move. Fort Collins is in more of a central location and the signals, propagationists figure, will be uniformly stronger in most parts of the country. Greenbelt beeps get weak as you go west. Secondly, the NBS frequency-standard lab at Boulder, Colo., now will be close at hand.

WWV's low-power, low-frequency cousins, WWVL on 20 kc and WWVB on 60 kc, have been at the Fort Collins location for some time. Separate transmitters are being added for each standard frequency: 10-kw rigs on 5, 10 and 15 mc and 2.5-kw on 2.5, 20 and 25 mc. There will be a standby transmitter for each type.

In the center of our photo is a 10-mc dipole antenna, at left an 88-ft. standby monopole and at right a 400-ft. WWVL mast. A 3⅛-in. coax transmission line snakes off to the right from the 10-mc antenna. In left background, the old WWVB-VL transmitter building. Out of sight to the right is the new WWV transmitter building. In the background . . . the Rockies—which, by the way, are not supposed to affect the new signals because the distance makes them quite low, angle-wise.—*Marshall Lincoln, K9KTL*

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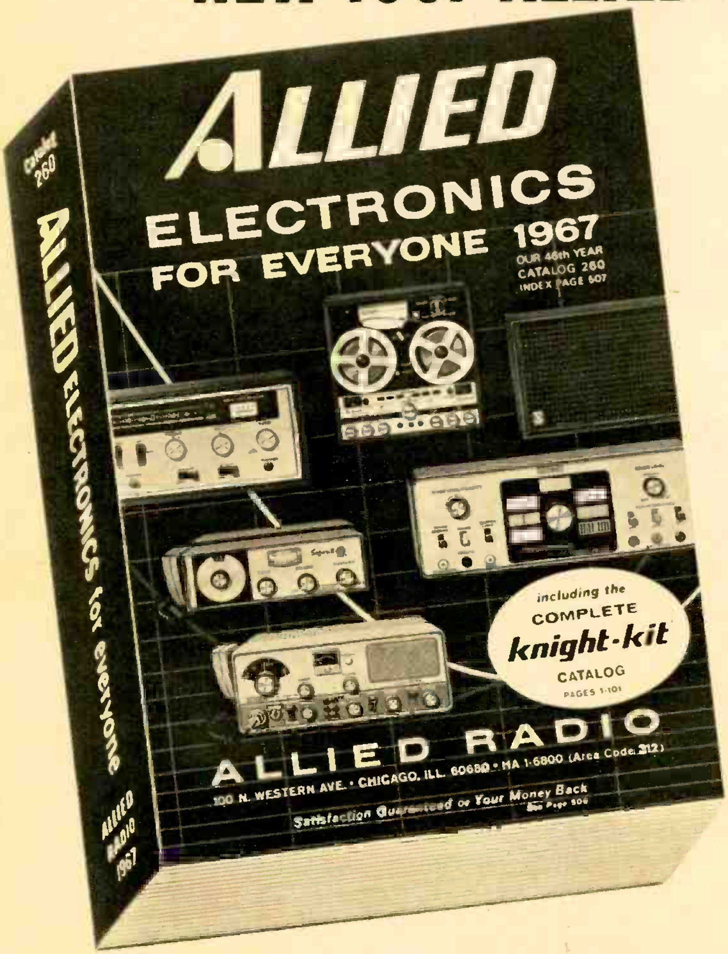

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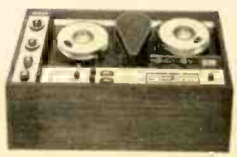

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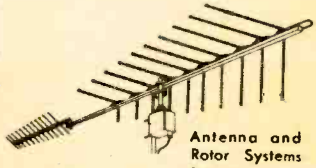

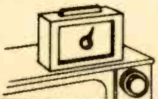

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HI-FI TODAY

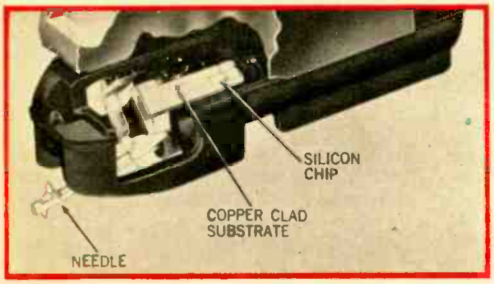
By John Milder

✓ *Question for today*

✓ *You're welcome, Dyna*

TO anybody out there who is an expert in semantics, my question for today is: what the heck is a solid-state cartridge?

I thought I knew about a year ago when Euphonics came out with the Miniconic pickup in which a pair of silicon chips was supplied with DC from an external power source and produced a signal according to the changes of resistance that occurred when the chips were strained by a stylus. It didn't



seem a bad idea. In fact, it was a latter-day version of the old Weathers FM cartridge that I'd looked for.

But then Grado produced *its* solid-state pickup. This one uses no DC. It is just an ingenious (and excellent-sounding) ceramic cartridge, to my way of thinking.

Then came Sonotone with a line of semiconductor pickups (see cut) similar to the Euphonics and meant mainly for substitution by manufacturers in integrated phonograph designs. But before you could say *solid-state* Sonotone issued a Grado-type ceramic and also called it . . . guess what?

That phrase—solid-state—has always confused many people anyway. It was originally coined to contrast with vacuum tubes. But is a dynamic cartridge un-solid?

I think at this point that *solid-state* deserves some clarifying, maybe by the IHF. The DC-excited pickup has some promising possibilities because it relies on the silicon chips only to modulate rather than generate a signal, thereby opening the way to still lower dynamic mass in pickups (for extended highs and less record wear). And the new ceramics sound awfully good. But, gentlemen, let's define our terms.

Seldom these days can the appearance of a new transistor amplifier be called real news. But the Stereo 120 from Dynaco definitely is. It is the first solid-state design from a manufacturer who has never advanced the notion that transistors have any significant edge in performance over tubes. Dyna's claim for the Stereo 120, which delivers 60 watts of continuous power per channel into 8 ohms, is simply that its sound is the equal of that from the best tube equipment. The advantages, presumably, are reduction in size and heat—plus long-term freedom from servicing and adjustment.

Despite the low-key style of promotion, the Stereo 120 looks like one of the most promising solid-state products in a long time—and also makes us wonder where they got the name. By coincidence (?) EI once (Jan. '64) published plans for a 120-watter called . . . Stereo 120. If we gave them ideas, we're delighted to have helped.

Entries in the cost-no-object speaker game are few and far between. Most activity is centered in the low-price battleground, where some dramatic improvements have come along in the past two years. But KLH has an ambitious new speaker system, the Model Twelve, that definitely is in the don't-worry-about-money league at a price of $275.

Besides being what KLH calls the best-performing moving-coil speaker it ever has made, the Model Twelve offers a unique Contour Control that the listener can place remotely (preferably next to his chair) to adjust octave-to-octave musical balance for different situations and types of program material. The idea is to let the listener make subtle adjustments of sound quality that the manufacturer normally, in a lower-cost speaker, would have to make for him once and for all.

Build This

ELECTRONIC COMPUTER

At the quick spin of the dial it adds, subtracts, multiplies or divides.

By MORRIS GROSSMAN

MARVEL of the space age, the electronic computer in a fraction of a second can solve problems which would take a team of mathematicians years to work out. Unfortunately, the giants are much too expensive and sophisticated for solving down-to-earth problems involving ordinary arithmetic.

Using many of the techniques found in its bigger brothers, our computer can add, subtract, multiply and divide. And it does so in decimal numbers with direct readout to six figures (999999). Operation couldn't be easier. Push a button to clear, turn a switch to the column of figures you want to add, then dial in the numbers. You see the answer instantly and directly on glowing neon lamps.

The computer is a complicated and expensive project. However, you'll be paid back many times over by the use and experience you'll get from it.

The Big Picture

The computer consists of four *functional* parts (see Fig. 14). They are: 1)

ELECTRONIC COMPUTER

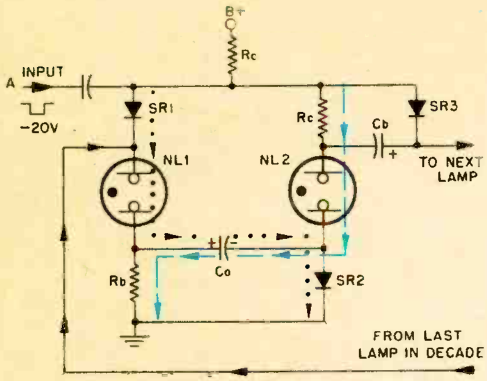


Fig. 1—Simplified counter: NL1 is on, NL2 off. Input pulse turns NL1 off, NL2 on. Next input pulse turns NL2 off, next lamp on. NL1 stays off.

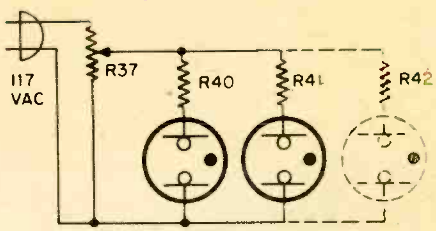


Fig. 2—Neon-lamp aging circuit. Adjust the potentiometer until the voltage drop across the resistors averages out to about 30 V.

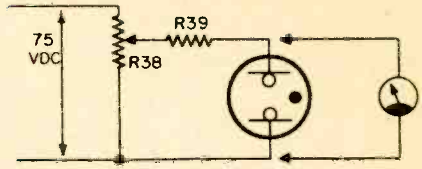


Fig. 3—Lamp classifier. Raise voltage on each lamp and measure when it lights. Lower voltage and measure when lamp goes off.

Six decimal decade counters which count pulses and provide a readout on neon lamps. 2) Six buffer/inverter amplifiers which carry pulses from one decade counter to the next higher decade counter. 3) A regulated power supply. 4) A telephone-dial input device. A reset switch sets all the decade counters to zero. A six-position rotary switch selects which decade counter the telephone dial's output is fed to.

How it Adds

You may not realize it but when you used your fingers to help you with addition and subtraction, you operated the first computer.

Our computer's operation is based on the same principle. Let us say you want to add 3 and 5. You would first count 1, 2, 3 on your fingers by bending them. Then you would continue: 4, 5, 6, 7, 8. In a similar manner, dialing a 3 into our computer, puts three counts, or pulses, into a decade counter, and the 3 lamp lights. Dialing the number 5, introduces five more pulses, and the computer continues on from lamp 3 to lamp 8, which is the answer.

As you may recall from finger-counting, if the sum of two numbers is greater than 10, a problem arises. You had to remember when you passed 10 after you continued counting from your second hand back to your first hand. Thus, if the numbers to be added were 9 and 3, you would have first counted to the number 9 on both hands. Then you would have continued: 10, then 1 and 2 on the first hand again.

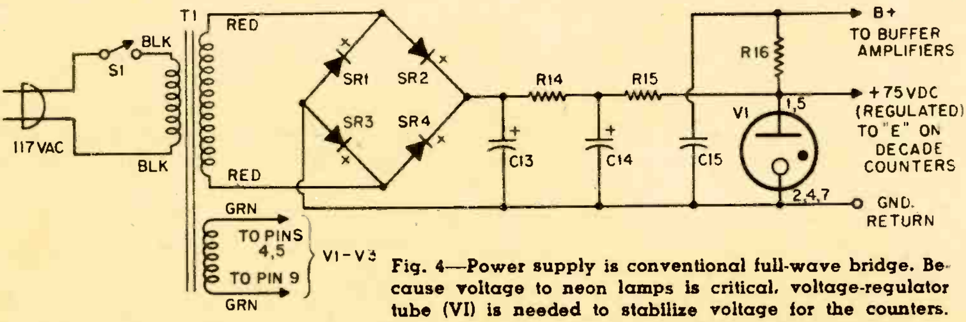


Fig. 4—Power supply is conventional full-wave bridge. Because voltage to neon lamps is critical, voltage-regulator tube (VI) is needed to stabilize voltage for the counters.

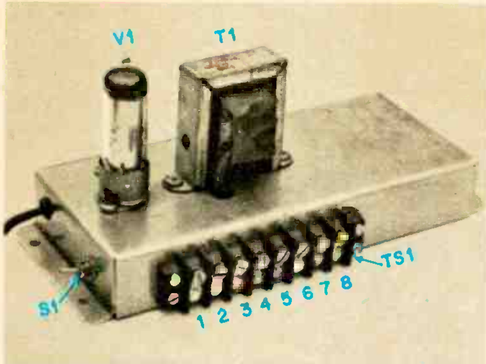


Fig. 5—Power supply is built on 3 x 6⅛ x 1¼-in. aluminum chassis. Barrier-type terminal strip simplifies making many connections to power supply.

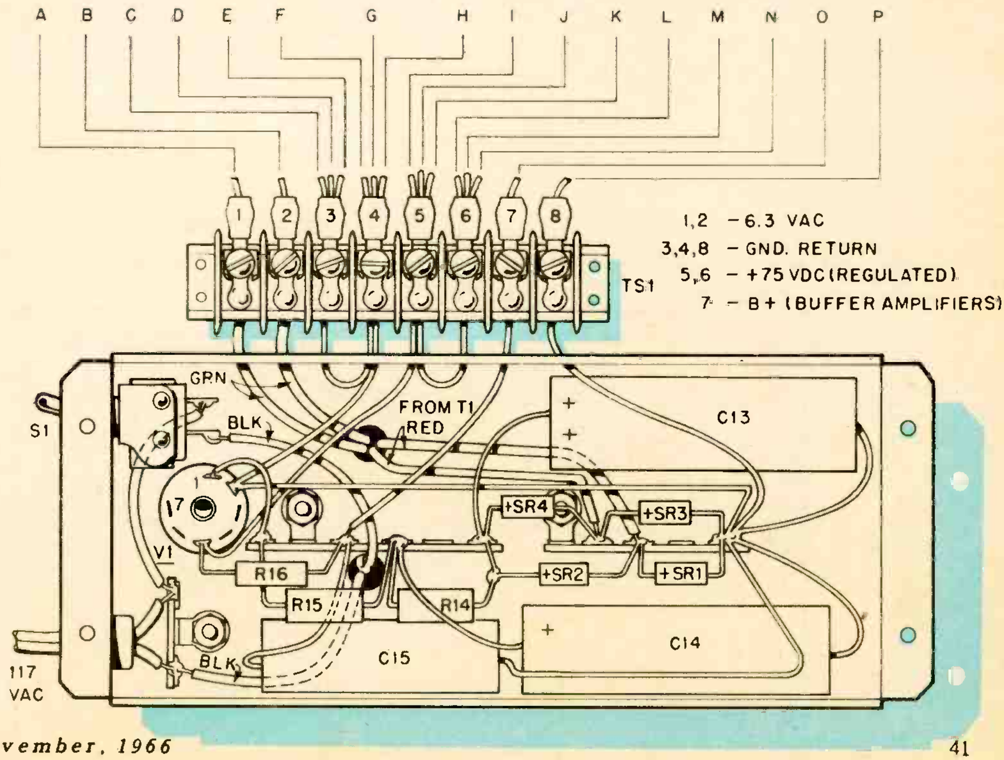
When you passed 10 you had to make 10 plus 2, or 12, your answer. The computer does the same thing. Take a look at Fig. 14. With S2 set to 1, you dial a 9. The dial generates nine pulses which are fed to and registered in the first, or units, decade counter. The decade counter counts to nine, and the 9 lamp lights up and stays lit. Dial a 3 and the counting continues from the 9 lamp. However, when the first pulse of the number 3 goes into the units decade counter, the zero lamp comes back on and a pulse is automatically sent to the second, or tens, decade counter lighting its 1 lamp.

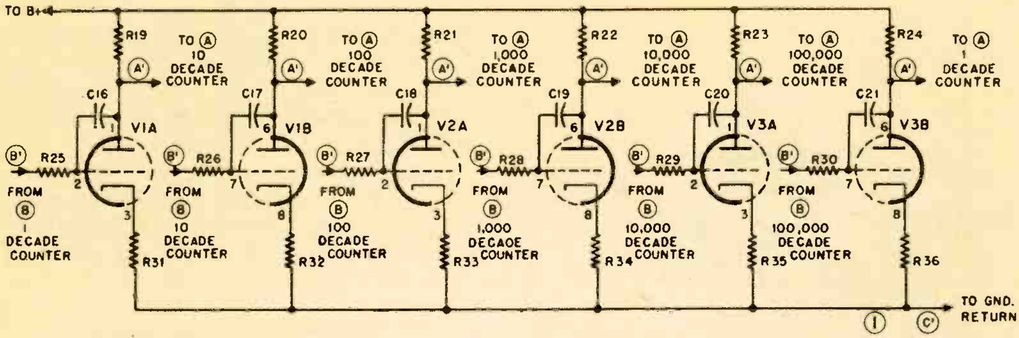
Then the units decade counter continues to count the two additional pulses and registers a 2. The computer now indicates 12. In other words, the tens decade counter, by registering

Power Supply Wire Destinations

Wire	Destinations
A	J, buffer amplifiers board
B	K, buffer amplifiers board
C	C, 1 decade counter board
D	C, 10 decade counter board
E	C, 100 decade counter board
F	C, 1,000 decade counter board
G	C, 10,000 decade counter board
H	C, 100,000 decade counter board
I	E, 1 decade counter board
J	E, 10 decade counter board
K	E, 100 decade counter board
L	E, 1,000 decade counter board
M	E, 10,000 decade counter board
N	E, 100,000 decade counter board
O	L, buffer amplifiers board
P	I, buffer amplifiers board

Fig. 6—Underside of power supply. Layout is wide-open, making wiring easy. Table in right column above tells where leads marked A through P are connected. Don't put more leads on lugs than are shown or there may be trouble. Drill oversize holes in chassis and deburr them for leads coming out to terminal strip.





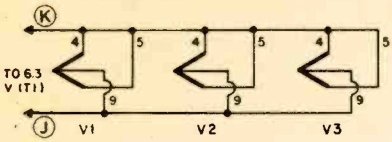


Fig. 7—Buffer/inverter amplifiers. Each amplifier's input (B') receives signal from zero lamp (NL1) of each decade counter (B, Fig. 11), inverts it and feeds it to input (A, Fig. 11) of next higher decade. To perform end-around-carry (subtraction), V3B's output goes back to units decade.

ELECTRONIC COMPUTER

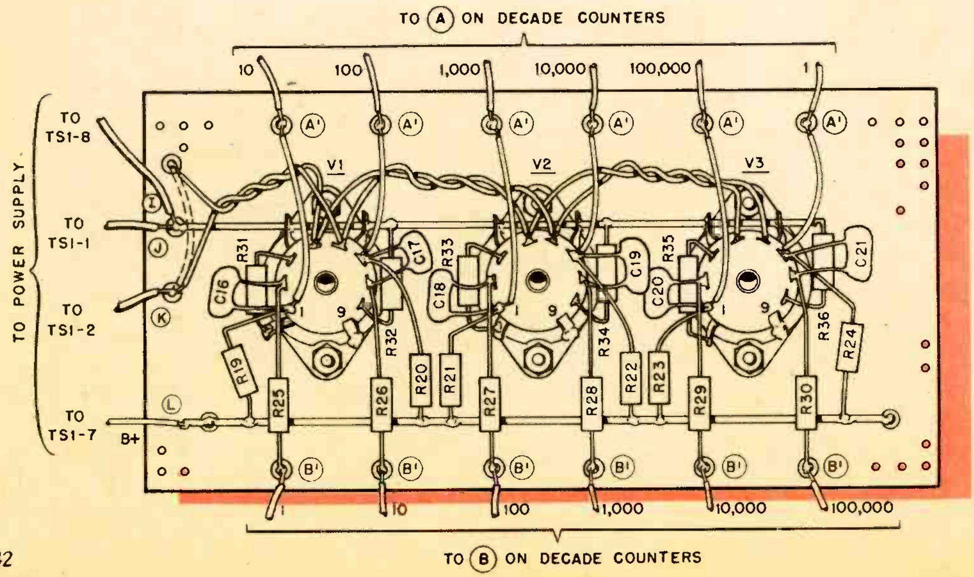
a 1, every time the first decade counter's zero lamp comes on, acts as a memory to tell you that the sum is 10 or larger. This operation is called carrying.

When each decade counter goes past 9, it sends a carry pulse to the next higher decade counter. If say 000999 is indicated by the lights, and an additional 1 is dialed into the units decade counter, the units decade counter would switch its 9 lamp *off* and its zero lamp *on*, and feed a pulse to the tens decade counter. The 9 lamp on the tens decade counter would go off, zero lamp would come on, and a pulse would be sent to the hundreds decade counter. The hundreds decade counter would do the same, but since the thousands decade counter is registering a zero it would merely indicate 1. The computer would now register 001000 which is the sum of 000999 plus 1. We'll get to subtraction, multiplication and division later.

How the Decade Counters Count

The most important parts of the computer are the six decade counters. (Fig. 10, 11 and 12.) Their circuit is known as a ten-count ring counter because as pulses are fed into it, one neon lamp after the other lights until

Fig. 8—Underside of buffer/inverter amplifiers board. Leads at top go to input A on each decade counter. Leads at bottom go to output B on each decade counter. Use heavy wire to tie I, J, K, L to power supply.



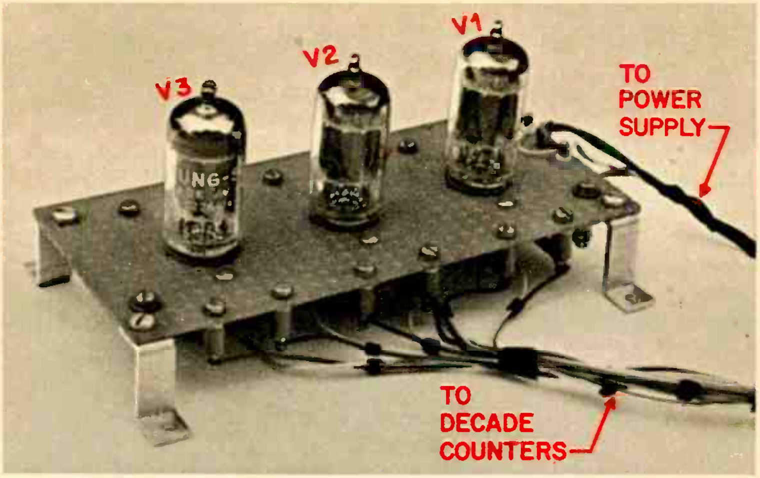


Fig. 9—Photo of buffer/inverter amplifiers. Our model was built on perforated board. Small brackets are used at corners to keep above cabinet and for mounting. However, you could build circuit on same size open-end chassis as power supply. Tie posts are used to connect leads to decade counters but ordinary terminal strips will do the job just as well.

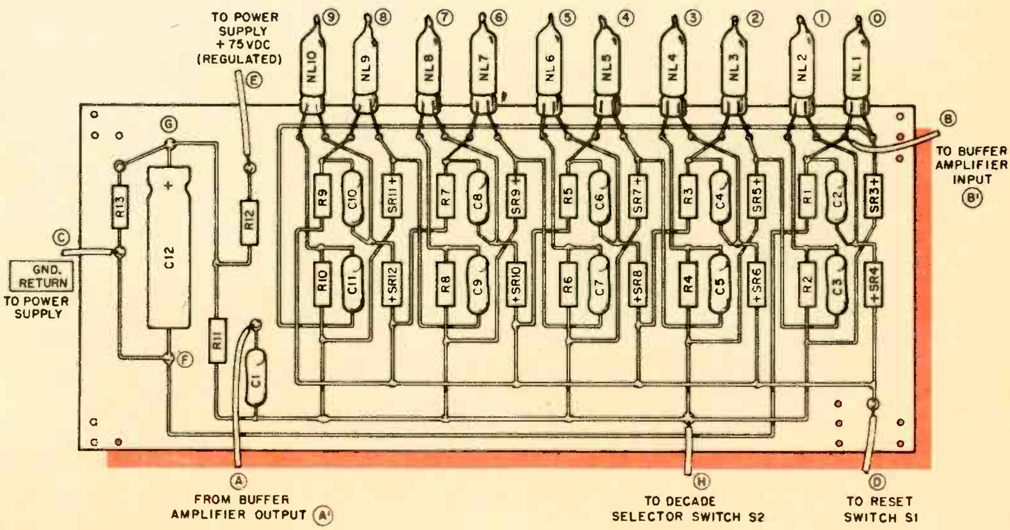
the last, or ninth, lamp is lit. On the tenth pulse, it starts all over again from zero. If the lamps were arranged in a ring, they would appear to run around in a circle as pulses are fed to them.

To see how they work, take a look at Fig. 1, a simplified circuit showing only two neon lamps. Consider neon lamp NL1 *on* and neon lamp NL2 *off*. In this condition Ca is charged from B+ via the dotted path through diode SR1, NL1 and SR2 to ground. When a pulse of approximately −20 V is applied to the input, the voltage on NL1 drops below its extinguishing voltage, and NL1 goes off.

The charge on capacitor Ca now acts along the dashed path. Ca's voltage, therefore, is now in series with NL2 and the main B+ supply. This causes NL2 to light as soon as the negative pulse disappears. Capacitor Cb is then charged with the polarity shown. Cb then turns on the next lamp (not shown) in a similar fashion, when the next pulse is applied, and so on along the line.

The value of Ra is chosen so when one lamp is lit, the voltage on the input buss will be below the firing voltage of the other neon lamps in the decade. This keeps the other lamps off. When another input pulse arrives and extinguishes the lamp that happens to be lit, only the next higher lamp (to the right) goes on. The reason only the succeeding lamp goes on is that it gets an extra voltage boost

Fig. 10—Decade-counter circuit board (build six). A 3 x 7-in. piece of perforated board is large enough but you could make it bigger to simplify wiring. Use spaghetti on leads wherever they cross.



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from its adjacent capacitor, such as Cb.

Construction

Aging the Neon Lamps. The secret of the computer's stability and accuracy lies in the aging and then selecting matching sets of neon lamps. Very little equipment, but a good measure of patience, is required. Since at least 60 lamps are needed, it is wise to start with a quantity of 100 since some may not work properly.

Figure 2 is a schematic of the aging circuit. Using a 10,000-ohm 4-watt (wire wound) potentiometer (R37), adjust the voltage to all the lamps so that there's a 30-V (AC) drop across the 100,000-ohm ½-watt resistors (R40, R41, R42, etc.) in series with each lamp. Leave the lamps on for a period of at least 24 hours. Forty-eight hours is better if you're not in a hurry.

You will find some of the lamps will cause a higher or lower drop across the resistor. Choose a setting of R37 to average out the voltages. After this initial period, reduce the voltage across the resistors to 10 V and leave power on for an additional 24 hours. Since a 100,000-ohm ½-watt resistor is required for each lamp, the 100 lamps can be aged in batches of 25 to keep the cost down.

The Power Supply

The power supply is a conventional full-wave circuit which uses a voltage-regulator (VR) tube (Figs. 4, 5 and 6). Such a tube is required as the neon-lamp decade counters' operation is very dependent on correct voltage level. They will not operate properly if the voltage is too high or low. While the lamps are aging, build the power supply as you'll need it for lamp selection and for the final adjustment and checkout of the decade counters.

Build the supply on a 3 x 6⅛ x 1¼-in. aluminum chassis. Except for the normal precaution of observing electrolytic polarity, the power supply should present no problems. To provide isolation, you must use several power and ground lugs on TS1 for the decade counters and buffer amplifiers. Hence, the reason for so many connections to terminal strip TS1 in Fig. 6. It is a good idea to turn on the power supply, and let it burn in for a period of 24 hours, to stabilize the VR tube.

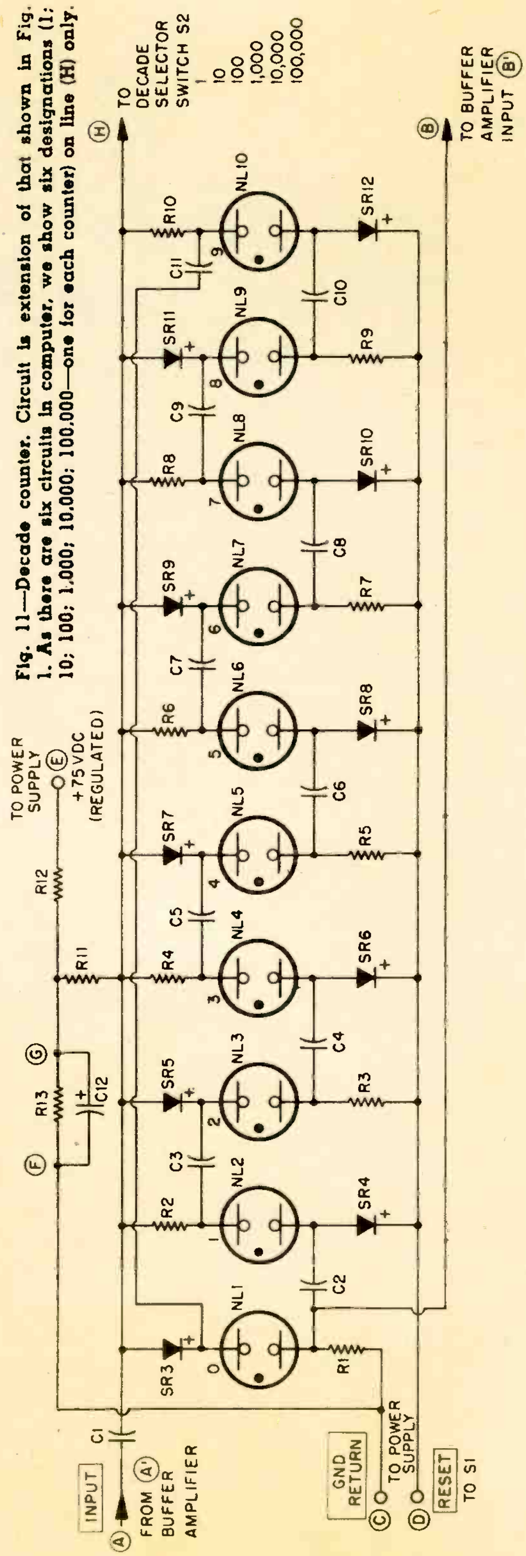

Fig. 11—Decade counter. Circuit is extension of that shown in Fig. 1. As there are six circuits in computer, we show six designations (1; 10; 100; 1,000; 10,000; 100,000—one for each counter) on line (H) only.

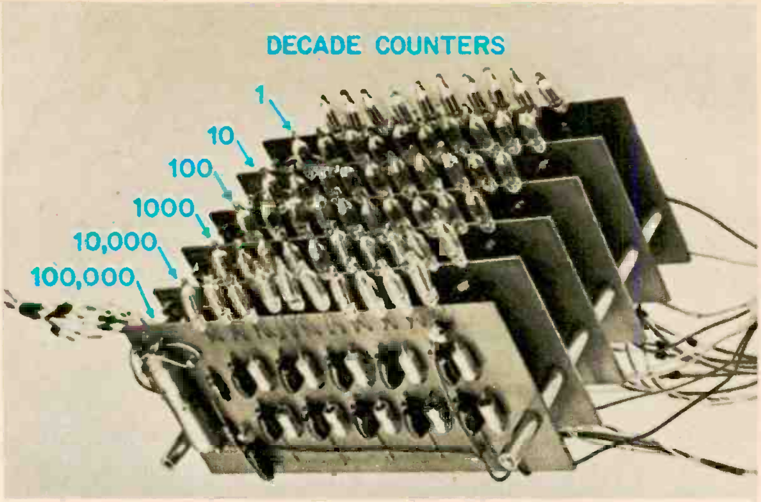

Fig. 12—Decade counters. Author used printed-circuit boards instead of perforated board and flea clips. After all neon lamps are installed, join boards with ½-in.-long spacers at ends. Entire assembly is held to side of cabinet with spacers which appear at bottom of the photo.

Lamp Selection

After all lamps have been aged, start selection. Using the circuit in Fig. 3, and the 75 VDC output of the power supply, turn potentiometer R38 slowly until the lamp fires. Measure the voltage across the lamp. (The firing voltage will range from about 63 V to 75 V.) Reduce the voltage until the lamp goes out. Measure the lamp voltage again. Write these voltages on a piece of masking tape and stick it on the lamp. Repeat this for every lamp and then arrange them in groups according to *firing* voltage. Within each firing-voltage group sort the lamps according to extinguishing voltage.

When selecting the lamps for the decade counters, start with the lower-firing-voltage group, and select batches of ten lamps whose firing voltages are within 3 V of each other. Also, choose those that have the lowest ex-

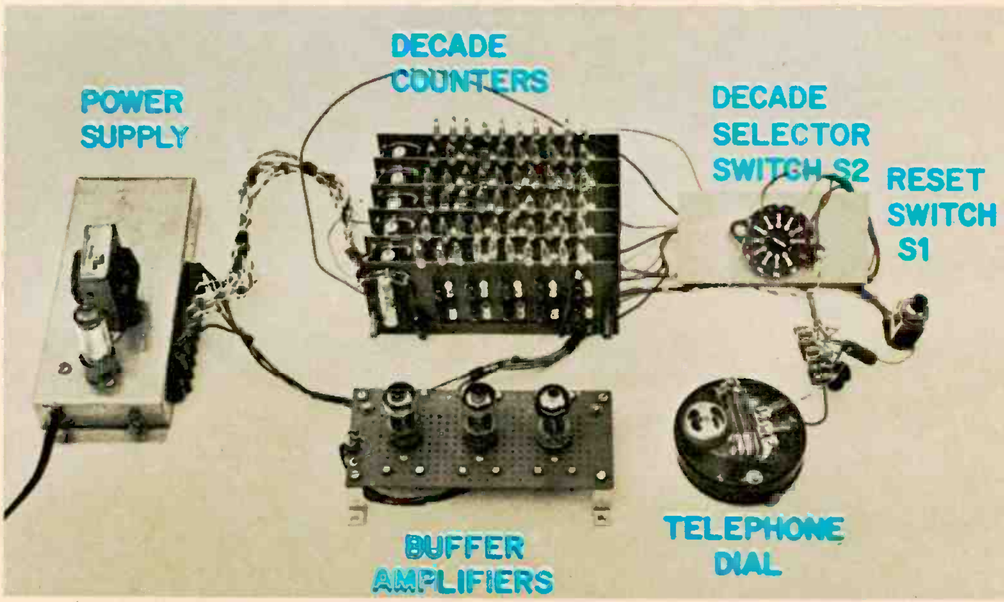

Fig. 13—Individual computer parts. Use long wires to hook up parts so they can be connected before they are installed in cabinet. Once put in cabinet, it will be almost impossible to connect the wires. Mount decade-selector switch S2, reset switch S1 and the telephone dial on bottom of cabinet's front panel.

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tinguishing voltage (if you have enough to choose from within each group). We found that the lower-firing-voltage lamps tend to be more stable. Another tip: leave a few extra lamps in each of the voltage groups for final selection during later circuit adjustment.

The Buffer/Inverter Amplifiers

Figure 7 is the schematic of the buffer/inverter amplifiers. Each amplifier's input (B^1) is connected to the load resistor (R1, Fig. 11) of the zero lamp of each decade counter. The output of each amplifier goes to the input of the next higher decade counter. To perform the end-around-carry for subtraction (more about subtraction later), the output of the hundred-thousands decade-counter amplifier (V3B) is fed back into the units decade counter. This has no effect on normal addition.

PARTS LIST

Capacitors: 100 V silvered mica unless otherwise indicated
C1, C24—.01 µf
C12—12 µf, 150 V electrolytic
C13, C14—40 µf, 150 V electrolytic
C15—1 µf, 200 V tubular (not electrolytic)
C16 through C21—150 µµf
C22—.05 µf
C23—.1 µf
NL1 through NL10—NE-2 neon lamps (60 reqd.)
Resistors: ½ watt, 10% unless otherwise indicated
R1 through R11—68,000 ohms
R12—10,000 ohms
R13—See text
R14—500 ohms, 2 watts
R15—2,700 ohms, 2 watts
R16—4,300 ohms, 1 watt
R17—11,000 ohms, 5%
R18—27,000 ohms
R19 through R24—47,000 ohms
R25 through R30—270,000 ohms
R31 through R36—2,000 ohms
R37, R38—10,000 ohm, 4-watt wirewound pot
R39, R40, R41, R42—100,000 ohms
S1 (power supply)—SPST toggle switch
S1—DPDT pushbutton switch
S2—1 pole, 6 position non-shorting rotary switch
SR1 through SR12—Silicon rectifier; minimum ratings: 50 ma, 100 PIV (power supply, 400 PIV)
T1—Power transformer, secondaries: 125 V @ 25 ma, 6.3 V @ 1 A
TS1—8 lug barrier-type terminal strip
V1 (power supply)—OC2 voltage-regulator tube
V1, V2, V3—12AU7A tube
Misc.—10 x 8 x 8-in. sloping-panel cabinet, telephone dial, 7- and 9-pin tube sockets, 3 x 6⅛ x 1¼-in. open-end chassis, 2½ x 6-in. piece of perforated board, insulated tie posts (13 reqd.), flea clips

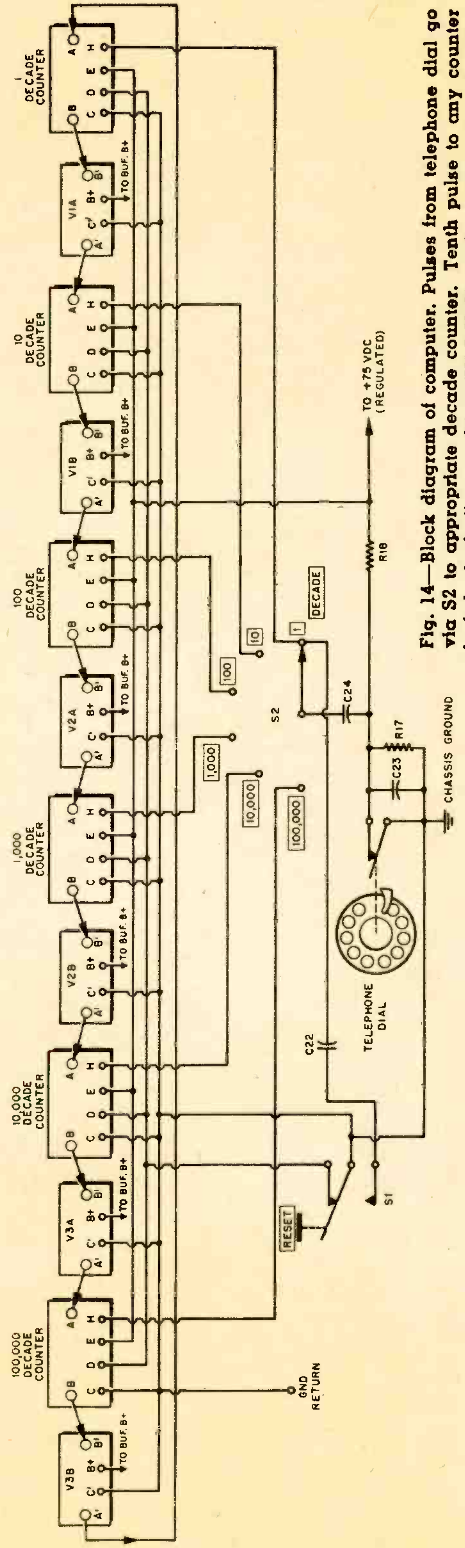


Fig. 14—Block diagram of computer. Pulses from telephone dial go via S2 to appropriate decade counter. Tenth pulse to any counter is fed via buffer amplifier (V1A-V3B) to the next higher decade.

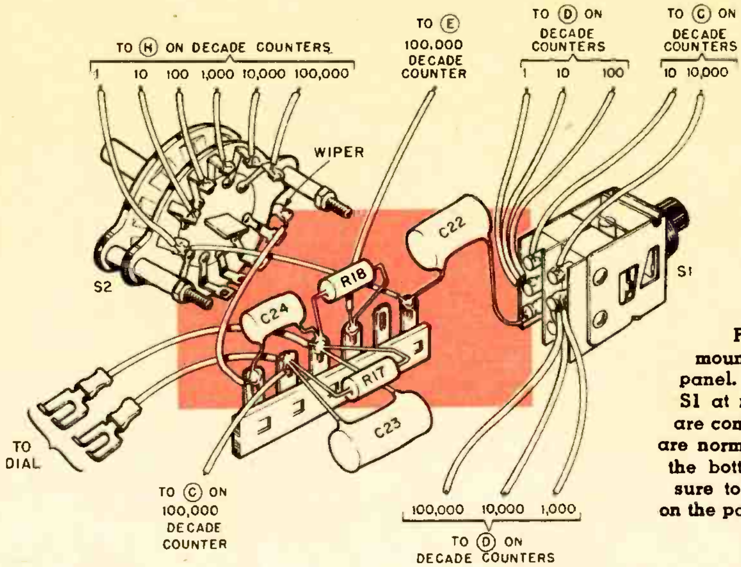


Fig. 15—Pictorial of parts mounted on bottom of the front panel. On reset push-button switch S1 at right. contacts at the bottom are common. Contacts in the middle are normally closed. The contacts at the bottom are normally open. Be sure to get the connections correct on the particular type switch you use.

The buffer amplifiers are built on a 6 x 3-in. piece of perforated board which is mounted in the cabinet on ½-in. brackets. The construction is conventional. Follow the layout in Figure 8.

Decade Counters

All decade counters (Fig. 10) are the same except for the value of resistor R13. They can be built on a 3 x 7-in. (or larger) piece of perforated board. All leads to connect the board to other parts of the computer should be about 20-in. long. The voltage to each decade counter must be individually established by selecting the value of resistor R13 (Figs. 10 and 11). Do not install the neon lamps or R13 yet.

Front Panel

Next thing to do is to mount the telephone dial (and its associated voltage-divider circuit C22, C23, C24, R17, R18), S1 and S2 on the front panel as shown in Fig. 16. Connect the circuit as shown in Fig. 15. Then connect the power (+75 VDC) and ground leads of this circuit to the power supply (see Fig. 14).

Determining R13's Value

After separating the neon lamps into six groups of ten lamps each, connect them to the decade-counters. The lamps for each decade counter should be selected with respect to firing voltage so as to fall within a close range (about 3 V between highest and lowest) of each other.

Go back to the circuit just mounted on the front panel (Fig. 15). On any decade-counter board, temporarily connect a 500,000-ohm potentiometer in place of R13. Also, connect a lead from capacitor C24 to input-capacitor C1 on the decade counter. Connect the decade counter's ground return lead (C) and power supply lead (E) to the power supply, and connect a normally-closed push-button switch across the reset leads (C and D).

Turn on the power supply and check to see that the VR tube glows orange. If it doesn't, check the power supply for a wiring error. Set the potentiometer at maximum resistance (clockwise). You will probably find that more than one of the neon lamps lights. Turn the potentiometer counterclockwise until all the lamps go off.

Push reset switch S1 and see if the zero lamp lights. If it doesn't, increase slowly (turn clockwise) the potentiometer's resistance until the zero lamp *only* goes on when S1 is pushed. If after pushing switch S1 it is difficult to find a potentiometer setting where only the zero lamp stays on, replace the lamp or lamps that stay on with others from the same voltage group from which the decade counter's lamps were selected.

Chose lamps from the higher-voltage end of the group. If the zero lamp fails to fire as readily as the others on the board it is the offender. By carefully observing its behavior for several settings of the potentiometer this can be determined. It may be helpful to choose the zero lamp from the lower-firing-voltage end of the group.

After you find the right potentiometer setting, turn the telephone dial and note if the proper number of pulses are counted. If you find that more than one lamp fires, or that some lamps don't light and resetting the potentiometer does not help, more lamps may have to be replaced.

If a lamp tends to not light consistently, it means that its firing voltage is too high, or its pulse-width requirement is too long for the group. The lamp should be replaced.

Careful observation of the lamps' behavior will tell you which lamps to replace. Above all don't become discouraged. Our experience was that after the initial selection, as many as 20 of the 60 lamps required replacement—almost four per decade counter. On the other hand, some boards worked properly right off.

Do not discard removed lamps. They may work perfectly on another board. Upon removal they can be rechecked for firing voltage and put back among your spares.

When a good set of lamps and a workable setting of potentiometer are obtained, measure the resistance of the potentiometer and substitute a resistor of the same value (more than one resistor may be required) in its place. A range of ±10 percent should make little difference. Repeat this procedure for each decade counter.

Final Assembly

Do not use the schematics to connect the decade counters, power supply, buffer amplifiers, telephone dial, decade selector switch and reset switch. Instead, use the pictorials in Figs. 6, 8 and 15.

The reason for using the pictorials is that several connections often must be made for grounds, B+, etc., which don't appear in the schematic. Eliminating what you feel are apparently duplicate leads to save wire and time could result in erratic operation.

We used an 8 x 10 x 8-in. sloping-panel cabinet to house our computer. The photographs in Figs. 13 and 16 show the placement of all the major parts. The decade counter boards are held together with ¾-in.-long spacers. The group of six boards is held

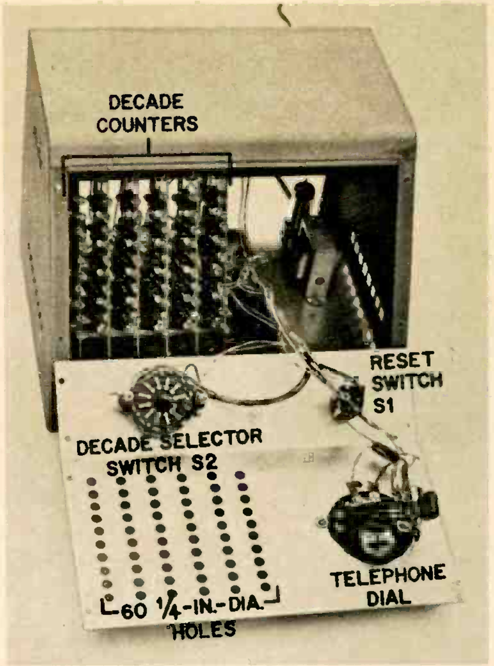


Fig. 16—View of computer before installation of front panel. Carefully position each of the neon lamps so they fit through holes in front panel.

to the cabinet with two 6-32 x ¾-in. screws. Drill 60 ¼-in. dia. holes in the front panel for the neon lamps. Also drill holes for the telephone dial, decade-selector switch S2 and reset-switch S1. All leads from these parts into the cabinet should be long to permit removal of the front panel and allow its placement at a convenient distance to permit testing and repair should it later be necessary.

Operation

After turning on power, let the computer warm up for about 10 minutes before using it.

● **Addition.** Perform the following steps to add these numbers:

```
  26
   9
3081
----
```

1) Press reset-switch S1 and release it. All the zero lamps should come on and all other lamps should go off. If they don't press S1 again.
2) Set decade-selector switch S2 full clockwise—to the units position.

3) Dial 6, 9 and 1.
4) Turn S2 *one* position counterclockwise —to the tens position.
5) Dial 2, then 8.
6) Turn S2 *two* positions counterclockwise —to the thousands position.
7) Dial 3.

The answer should be 3116. Note that you *must not* dial the zero in 3081. Just skip over the hundreds decade when you reach the hundreds column. Matter of fact you *never* use the zero on the dial for any operation. Cover it over.

● **Subtraction.** While addition is performed by counting forward to higher numbers, subtraction is performed by counting backwards to lower numbers. Because the decade counters in the computer only count forward, we use the method known as *adding complements* to subtract.

Let's say you want to subtract 3 from 8. After pressing S1, set S2 to the units position and dial 8. Then dial a 6. Why 6? Because 6 is the nines complement of 3. The nines complement of a number is simply 9 minus the number!

Dialing a 6 will cause the units-decade counter to advance in six steps through 9, 0, 1, 2, 3, and stop at 4 and generate a carry pulse as it goes through zero. All we have to do is feed this carry pulse back into the units-decade counter and the number 5, the answer, will light. This process of adding back the carry pulse is called end-around carry.

The nines-complement numbers should be added to the telephone dial in red right next to the black numbers. Thus, the black number 1 will have a red 8 next to it, and the black 5 will have a red 4 next to it, and the black 9 will have a red 0 next to it, etc. (See our cover.)

When subtracting, dial the minuend (larger numbers) using the black numbers on the dial. Dial the subtrahend (smaller numbers) using the red numbers. When dialing a subtrahend like 000345, you *must* dial all the zeroes (using red numbers).

Reason for doing this is that when you subtract, you are really dialing-in complements. Therefore, since the complement of 0 is 9, all zeros must be dialed. However, a 9 is *not* dialed since its complement is 0. In other words, 0 is dialed in *red* and 9 is not.

Dialing in zeros gets that carry pulse from one decade to the next higher decade, and so on, back to the units decade counter.

● **Multiplication.** To use the computer to multiply, you'll have to brush up on your multiplication tables and plan to do some mental arithmetic. (Paper and pencil are permitted.) Here's how you'd multiply:

```
  3487
   123
 -----
 10461
  6974
 3487
 ------
 428901
```

Set S2 to the units position and multiply 3 × 7 mentally. Dial a 1, the 1 of the answer 21.

Set S2 to the tens position and dial 2, the 2 of 21. Mentally multiply 3 × 8 and dial a 4, the 4 of the answer 24.

Set S2 to the hundreds position and dial the 2 of the former answer 24. Mentally multiply 3 × 4 and dial a 2, the 2 of the answer 12.

Turn S2 to the thousands position and dial a 1 of the former answer 12. Mentally multiply 3 × 3 and dial the answer, 9.

Now that we've finished with the 3 multiplier, repeat the entire procedure with the 2 multiplier. But be sure to start off with S2 in the *tens* position.

After finishing with the 2 multiplier, go on to the 1 multiplier and start with S2 in the *hundreds* position.

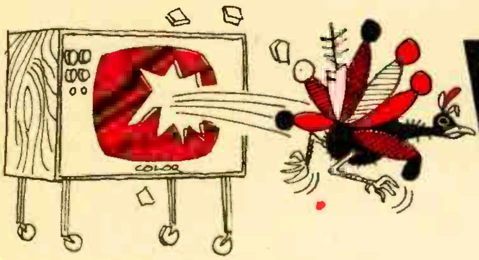
● **Division.** Like multiplication, division is going to rely on mental arithmetic. But the process is more complicated. We'll divide 428901 by 3487.

```
          123     write down answer
  3487 | 428901—dial in black
        −348700—dial in red
         ------
         080201—red on glow lamps
        −069740—dial in red
         ------
         010461—read on glow lamps
        −010461—dial in red
         ------
         999999—read on glow lamps
     (equivalent to zero remainder)
```

First, dial the dividend, 428901, using the black numbers and, of course, setting S2 to the appropriate position for each digit.

By observation, you can see that 3487 will go into 428910 at least 100 times. Mentally multiply 3487 by 100—you get 348700. Next, subtract 348700 (red numbers, and dial all zeros) from 428901. The remainder

[Continued on page 115]



WHAT'S THE

A well-known expert on color-TV servicing

By
ART MARGOLIS

"WHAT is the *worst* color TV?" the chubby blonde in the tight slacks asked me angrily as I entered her living room, tube caddy in hand. I was a bit surprised. She was a new customer and those were her first words.

Two men and a brunette were having coffee with her. The small fellow turned out to be the Mr. Wilson who had phoned me.

"We've had nothing but trouble with color TV," staccatoed the blonde. "I'm dead set against it."

I pulled the TV away from the wall, removed the back and installed my cheater cord. The dark-haired woman, a little embarrassed by the blonde's outburst, tried to change the subject by asking, "Well, which is the *best* color TV?" *(Question No. 1)*

Her husband laughed. "The one you sell, right?"

I turned on the TV with the back off and said, "Like in the old saying, beauty is in the eye of the beholder. The best color TV is the one that appeals to you. RCA claims to have the most experience in color. Zenith harps on good, old-fashioned hand wiring. Admiral and Motorola are pushing new features, such as thin cabinets and extra color controls. Muntz and Silvertone are doing their darndest to produce the least expensive color TV."

The brunette smiled wisely, "If *you* were buying a color TV, which one would you buy?" *(No. 2)*

I took a deep breath. "I guess you think I'd go into a factory with some kind of a meter," I said, "and pick the best one off the assembly line, right?"

"Right," her husband chuckled.

"Wrong!" I laughed. "I'd go into a TV showroom and turn on all the color TVs. Then I'd take home the one with the brightest, sharpest picture, right off the showroom floor. If you get one that starts off with perfect performance, proper maintenance will keep that excellent picture through the TV's life. Also, you probably can swing a better deal with a showroom model."

The blonde got a funny look and asked, "Wouldn't you insist on a color TV from a sealed carton?" *(No. 3)*

I knew she wasn't going to like it when I answered, "Well, Mrs. Wilson, I personally prefer not to deliver a color set in a sealed carton. Cars must go through a dealer's service department before you get delivery. To some extent, a color TV should, too. Sometimes they come out with broken or loose parts. Anyway, they should be played a few hours in the shop as a sort of a road test."

I looked at the tubes in the set. The horizontal output tube was developing cherry red plates. I knew what the problem was. Pulling out the cheater cord, I opened the high-voltage cage and felt the rectifier. It was hot.

At this point Wilson asked, "Color TV really isn't perfected yet, is it?" *(No. 4)*

I shrugged. "What *is* perfect? But color TV is pretty darn good—magnificent under ideal conditions, with a good location, fine antenna system, well-adjusted set and an owner who knows how to operate the color controls."

The blonde spoke up, "How come when I switch stations the people turn green or pink?" *(No. 5)*

"There is no national standard for the color oscillator frequency so that

WORST COLOR TV?

creates a dramatic narrative to answer the 25 questions he is asked most often.

colors actually aren't quite standardized. When you switch from station to station, the performers go from normal to pink or green. All you have to do is touch up your hue control. But eventually they'll straighten out this problem."

Mrs. Wilson continued, "If color is so wonderful, how come I can't move it around the room?" *(No. 6)*

"The color picture tube is sensitive to the earth's magnetic field, like a compass. The tube builds up a magnetic field, measured in gauss, if it is moved through or rotated in the earth's field. When this happens splotches appear around the edges of the tube in green, pink or what have you. To clear it up, a demagnetizing or degaussing coil is passed near the splotches. The only problem is that unless you own a degaussing coil you must call a serviceman."

One of the male coffee drinkers said knowingly, "Well, all the new sets have automatic degaussing, don't they?" *(No. 7)*

"It's an optional feature," I answered. "If your set doesn't have it you can buy a small degaussing coil for less than $10 and use it once every few weeks. The only problem is that these coils have low field strength and won't get rid of a stubborn splotch. Then you will still need a repairman. Best thing, though: try not to move the set."

The brunette said, "I was looking at a color portable. But if you advise not moving it . . . " *(No. 8)*

I laughed. "That's a good point! Portables come on a wheeled cart so they will move easily but there still is the major problem of maintaining color purity. In addition to automatic degaussing, get the supplementary degaussing coil and keep it near the TV if you do get a portable. Degauss after every move. With the coil plugged in, move it around and around the perimeter of the tube, flat against the picture area. If the TV is on, you'll see a great swirling display of colors."

I pulled out the hot high-voltage rectifier tube and placed the tube on the floor next to my caddy. Mrs. Wilson was watching me. I removed the horizontal output tube that was running cherry red and placed it next to the rectifier. She snapped, "Why does it cost so much to service color TV?" *(No. 9)*

I took new replacement tubes out of their carton, "I guess you can think of a color set as the Cadillac of TVs." I held up the large horizontal output. It was impressive with the cap on its top. "This color tube has a list price over $8. It's black-and-white counterpart goes for about $4."

I pointed to the neck of the color tube. "If you go through the color set piece by piece you'll find that the prices of all sorts of components are considerably higher than they would be in a black-and-white. Also, there is a shortage of skilled color TV technicians, so those who *are* available get more money."

The brunette glanced at her husband: "Jack always fixes our black-and-white set. Do you think it's a good idea for a person to try to repair his own color TV?" *(No. 10)*

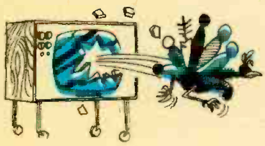
"Well, frankly, ma'am, if a person has been successfully repairing his black-and-white TV, with a little bit of briefing he can just as easily do minor repairs on the color set."

Her face fell.

I continued, "However, even an experienced monochrome serviceman doesn't just attack his first color TV. He sits down, reads service information and tries to understand what he's up against. That's important. It will tell him how to proceed but it will also tell him when to stop and call for help—before he gets into deep water."

Mr. Wilson asked, "Do you find there is more trouble with color sets than black-and-white?" *(No. 11)*

I thought for a moment, then said, "On the contrary, although they haven't really been around long, it seems to me the color TVs are a lot more reliable than black-and-white. The color picture tubes are many times more complicated, yet they seem to hold up better. And I find fewer replacements necessary in other components, too—even tubes. This means the serviceman is able to



WHAT'S THE WORST COLOR TV?

accomplish a greater percentage of repairs right in the home. The home handyman should be able to do better than with black-and-white, too."

I replaced the two tubes and turned on the TV. First the sound came on, then a picture hove into view.

The big fellow asked, "What goes out the most on color sets?" *(No. 12)*

I laughed. "Coincidentally, what I just repaired in this one. In fact, I'd say one out of every three color service calls has been this exact condition. Evidently the design engineers didn't count on the destructive effects of the color high voltage on the rectifier."

I held up the old rectifier, a 3A3 tube. "This high-voltage rectifier shorts under the strain. That causes the horizontal frequency to become erratic and reduces the input to the horizontal output tube. The chain reaction makes the output tube burn up. As soon as I look in a color set and see the plates of the output tube lighting up I change those two tubes right off. Nine times out of ten that's the ball game."

"Well it's not the ball game with this set!", the blonde said.

Her husband chimed in, "Yes, look at that picture! It's not black-and-white, it's all green. What's doing that?" *(No. 13)*

I walked around to the front of the TV. The picture was shades of green instead of gray. I smiled. "That ought to be easy." The Wilsons glared.

I pulled out my service mirror and set it in front of the TV. Then I turned down the red, green and blue screen controls; the picture went black. I turned up the red screen and a red picture appeared. Then I turned up the green screen and the picture became yellow. Finally, I turned up the blue screen gingerly and the picture gradually turned to varying shades of gray, black and white. The large man gave me an approving glance.

Mrs. Wilson threw back her blonde head. "The picture isn't green but look at all the blue and yellow around the figures. What is that?" *(No. 14)*

I produced my best business-like smile and said, "Even though we have all three colors mixed in proper proportions they are not producing their three images at quite the same spot on the screen. This causes these color fringes. Would you like me to converge the colors? It's a little extra."

When they agreed that I should do whatever was necessary I went to the truck for my dot-bar generator. Returning to the TV, I hooked the generator to the antenna terminals and turned it on.

"See how the blue and yellow are sticking out of the edges of the large dots in the center of the screen?", I asked. I began adjusting the red, green and blue static convergence magnets around the neck of the picture tube. In a few moments the colored dots at screen center converged into white.

The blonde persisted, "What about the dots around the edges of the picture? They still have colors peeking out."

I switched my generator to a cross-hatch pattern and began adjusting the knobs on the dynamic-convergence board inside the cabinet. Only a few turns cleared the fringing on the cross-hatch lines. I went back to the static magnets, moved them another hair and then touched up the dynamic controls. All the horizontal and vertical lines were white all over the screen. I disconnected the generator. A black and white picture was on.

The brunette sighed, "Isn't that wonderful! Look at the black-and-white picture; you'd never know it was a color TV."

At that moment a color commercial flashed on the screen. Mrs. Wilson almost yelped, "The black and white may be all right but look at the announcer! It's the same old trouble. He looks like the Jolly Green Giant."

The big fellow asked, "What causes that?" *(No. 15)*

"There are two main color controls that are not on a black-and-white set," I replied. "In fact, if you turn them while a monochrome show is on they will seem to have no effect. They have a dramatic effect on color programs, however. The No. 1 control is the hue control." I turned it. The TV performer turned from green through normal to pink and purple. "This control actually changes the colors on the screen. To be technical, it varies the color oscillator. You can judge the correct setting by looking for flesh tones.

"The other color control does this." I cranked up the color-intensity control. The TV performers' faces turned orange. "This is like a color-contrast control. It can make the color intense, normal, faded or gone completely.

"Admiral and Motorola have a third color control," I added. "It varies the black-and-white picture from shades of brown through gray to blue, but the set becomes a little more complicated to adjust."

I touched up the controls and stood back. It was color TV at its best. I replaced the back on the set and asked, "Were there any other problems?"

The Wilsons were sitting there glumly. Finally, Mr. Wilson said, "Try channel 3; it never comes in as well as the rest."

There was a color show on 3 but it wasn't as vivid as the previous station. The reds were brownish. I adjusted the fine tuner. At the point of adjustment where the picture turned into sound bars the colors came in perfectly but with a strong herringbone overlay.

"That's what I mean," he perked up. "Why do we get interference on color shows?" *(No. 16)*

I nodded. "That interference pattern," I said, "is a major problem of compatible color TV. Notice how it moves in time with the announcer's voice. In order for the FCC to approve color TV, it must make an acceptable image on black-and-white receivers as well as color sets. The designers simply added color information piggyback on the black-and-white signal. That way, a black-and-white picture appears on all TVs unless they are equipped for color.

"All things considered, the best place to mount the color subcarrier was next to the sound carrier, exactly 920 kc away. This causes a weak 920-kc beat signal between the color and the sound. It's suppressed, of course, as much as possible. You can make the herringbone beat appear on both color and monochrome TVs by mistuning the fine tuner like I have it here. You can fine-tune it out when the signal is strong. But your channel 3 is just too weak."

The big fellow asked, "Would a special color aerial help?" *(No. 17)*

I nodded. "There's a definite difference between a monochrome and color antenna system," I replied. "While a color antenna will do a great job on a black-and-white TV, the reverse isn't true."

The brunette asked, "What would you advise to [*Continued on page* 112]

GOOD READING

By Tim Cartwright

BASIC PIEZOELECTRICITY. By John Potter Shields. Howard W. Sams & Bobbs-Merrill, New York & Indianapolis. 128 pages. $2.50

If, like me, you think of piezoelectricity as an old-fashioned phenomenon whose chief fame (notoriety, if you prefer) lies in its duties in the non-hi-fi pickups in cheap phonographs, you'll be surprised to learn that it has a place in such modern applications as sonar and ultrasonic cleaning. If you already know that, you probably also know about its uses in X-ray equipment, ceramic filters and light-beam modulators. But for the uninitiated, here is a good introduction to all the things that have followed the discovery that certain crystalline materials develop an electrical charge when placed under pressure. The author makes no pretense of supplying an exhaustive treatise but he provides solid coverage of the basics, winding up with some suggested experiments for the beginner's edification.

ANTENNA ROUNDUP. Edited by Tom Kneitel. Cowan Publishing Corp., Port Washington, N.Y. 160 pages. $4

Here's a compilation of fairly valuable information on antennas, primarily (or perhaps exclusively) from the pages of CQ. The continuity and organization of material in the book hardly are perfect and the presentation is anything but slick, but there is a lot of information on just about every application for which someone somewhere wants to send out or bring in a radio signal. Lots of line drawings and photos help. So do cartoons—if not the English (see our illustration).

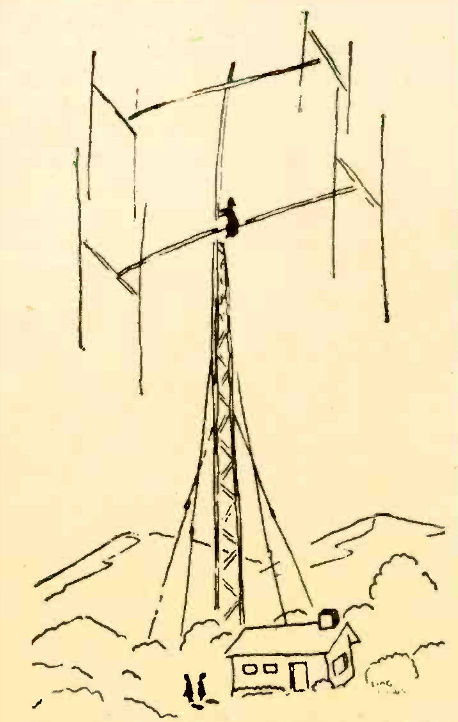
ABC's OF MODERN RADIO. By Walter G. Salm. Howard W. Sams & Bobbs-Merrill, New York & Indianapolis. 128 pages. $1.95

Every so often an ABC book that looks about as promising as last month's newspaper turns out to be more so. That's the case here. This little tome, after getting off to a bad start with one of those instant introductions to electricity, turns out to be an unpretentious, easy-to-read description of basic radio. Radio in this case means strictly the entertainment variety but within that framework the coverage is fairly complete, culminating in a description of stereo FM. If somebody's been badgering you to teach your kid brother all about radio, here's an easy way to do it. But stick around to wake the kid up when he starts snoring in those first, awful pages.

ELECTRONICS CONSTRUCTION TECHNIQUES. By George L. Ritchie. Holt, Rinehart & Winston, New York. 427 pages. $4.95

EI readers seemingly think of electronic

[*Continued on page* 115]



"Sometimes I almost wished he drank or chased women like other men."

Probe-Size Signal Injector

Troubleshooting is a snap with this 600-cps to 30-mc signal generator.

By CHARLES GREEN, W3IKH

IT always comes as a blow when you discover that the dead tubes in a radio or amplifier check out good. Don't kick the tube tester! Chances are, it's telling the truth. What next? Only one thing—you've got to get into the circuit to find the defective stage and component.

But you don't need a shop full of test equipment to do this. Our signal injector, with the help of the inoperative equipment itself, will enable you to pinpoint the trouble in a matter of minutes.

Heart of the seven-component injector is a unijunction transistor which generates a basic 600-cps signal. This frequency is ideal for audio work. Harmonics up to 30 mc are produced by the circuit for troubleshooting RF stages. The injector is housed in an easy-to-hold, inexpensive plastic toothbrush case.

How the Unijunction Transistor Works

Before we get to the construction and use of the injector, let's see how the unijunction transistor and the circuit work.

A unijunction transistor basically is a diode to which an extra connection is made (for this reason it first was called a double-base diode). As shown at the left in Fig. 1, the transistor consists of a bar of doped silicon to which connections are made at the ends—called the bases (B1 and B2). In the center of the bar there's a semiconductor junction which forms the emitter (E).

The silicon bar acts like a resistance; therefore, if a voltage is applied across B1 and B2 current will flow through the bar. Assume that the voltage applied to B2 (positive) and B1 (negative) is 20 V. Because the bar's resistance is uniform, the voltage at the P-N junction will be 10 V positive with respect to base B1.

Apply another voltage (+ to E, − to B1) that is less than 10 V to the E/B1 junction and the junction will simply be reverse biased.

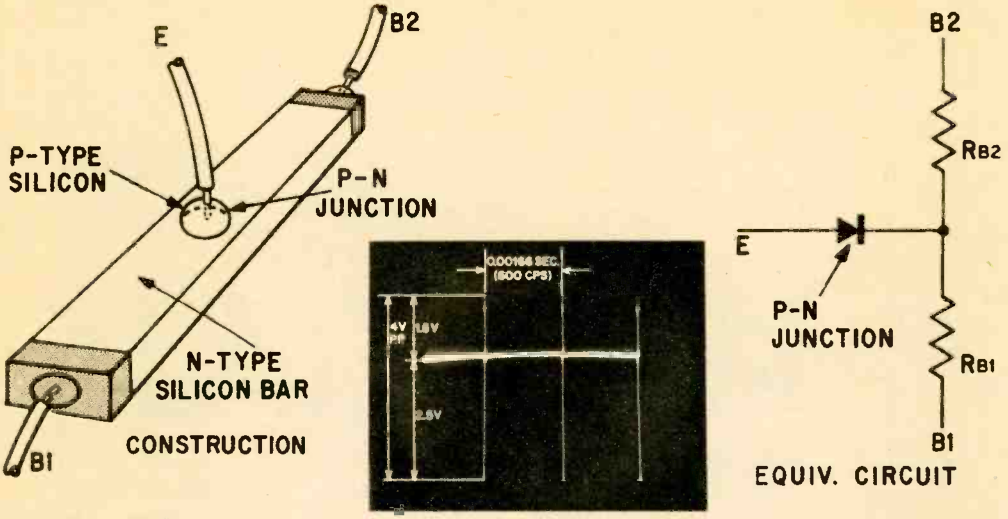


Fig. 1—Simplified diagram at left shows construction of unijunction transistor. In equivalent-circuit schematic at right, diode represents P-N junction between emitter and bar. RB1 and RB2 represent resistance of doped-silicon bar. Injector's fundamental output (center photo) is 600-cps, 4-V (P-P) spikes.

Probe-Size *Signal Injector*

Only a small reverse current will flow in the E/B1 junction. (Schematic at right, Fig. 1.)

But apply a voltage (with the same polarity) *greater* than 10 V to E/B1 and a heavy current will flow through the E/B1 junction because it is forward-biased. The resistance of the bar between E and B1 will drop abruptly to a low value.

This, in turn, causes the resistance of the bar between B1 and B2 to decrease markedly. As a result a heavy current flows through the bar from B1 to B2. When the voltage is removed from E, the bar's resistance increases and the current flow from B1 to B2 returns to normal.

Take a look at the injector's schematic in and the voltage at Q1's emitter (the junction Fig. 3. When S1 is closed, C2 begins to charge of R2 and C2) begins to rise. When Q1's critical firing voltage is reached, Q1's E/B1 junction conducts and discharges C2. This causes a sharp current pulse to flow through R1 and L1. The pulse is fed through C1 to PL1.

The values of R2 and C2 cause the pulses to be produced at a rate of about 600 per second. (The frequency can be raised or lowered by changing the values of R2 and C2.) Because the pulses are sharp they are rich in harmonics—this is why the injector's output goes up to about 30 mc.

PARTS LIST

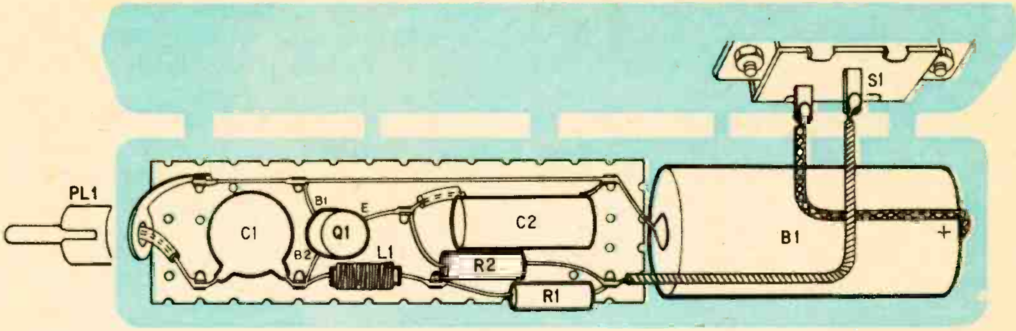
- B1—8.4 V mercury battery (Burgess H126 or equiv.)
- C1—.005 µf, 1,000 V ceramic disc capacitor
- C2—.1 µf, 200 V tubular capacitor
- L1—1 mh subminiature iron-core RF choke (J.W. Miller 70 F103A1. Allied 61 Z 885, 75¢ plus postage. Not listed in catalog.)
- PL1—Phono plug
- Q1—2N2160 unijunction transistor
- R1—47 ohm, ½ watt, 10% resistor
- R2—18,000 ohm, ½ watt, 10% resistor
- S1—SPST slide switch
- Misc.—plastic toothbrush case, perforated board, flea clips.

Construction

Our model is built in a plastic toothbrush case which can be obtained at drug or variety stores. The component layout is not critical and may be changed to suit any housing.

Cut a hole in one end of the case to accommodate the neck of phono plug PL1. Carefully solder a ground lug on the neck of the plug inside the case. Solder a length of insulated wire to PL1's center pin. Mount slide switch S1 at the right end of the lid. Position the battery temporarily near the switch to determine the remaining space. Cut a 2¾ x ¾-in. piece of perforated board to fit in the left side of the case.

Mount the components shown in Fig. 2 on



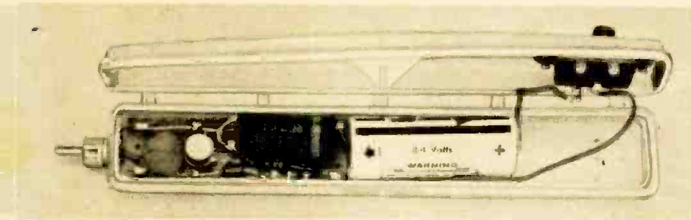


Fig. 2—Diagram above shows location of parts on a 2¾ x ¾-in. piece of perforated board. Layout isn't critical; you may change it to suit whatever enclosure the injector is to be built in. Board is held in place by ground lug fitted over plug PL1's neck and soldered to flea clip in upper left corner of board. Use flea clips for tie points for parts.

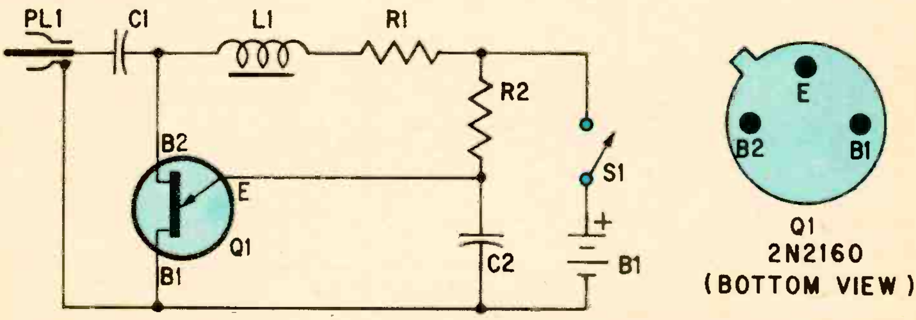


Fig. 3—Injector schematic. When S1 is closed, voltage builds up across C2 until E/B1 junction conducts. C2 then discharges and sends a pulse through L1. Pulse is rich in harmonics and output goes up to 30 mc.

the perforated board with flea clips, then install the board in the case. Connect PL1's ground lug to a flea clip on the board to provide mechanical support for the board. Make sure the connecting wires to S1 are long enough to allow the case to be opened easily.

Do not use a low-voltage capacitor for C1. The reason we used a 1,000-V capacitor for C1 is to prevent the injector from being damaged should you touch PL1 accidentally to a point in the circuit at which there is high-voltage DC. A low-voltage capacitor would break down and most likely would destroy the unijunction transistor.

Operation

The output voltage of the injector depends on the impedance of the stage to which it is connected. Without a load, the amplitude of the pulses is 4-V, P-P, as shown in the photo in the center of Fig. 1. The injector's output impedance is high, which means it will work best with high-impedance tube circuits. It cannot be used to check, say, speakers.

The way to use the signal injector is to place PL1's center pin on the grid or base of a tube or transistor (with the volume control at maximum gain) and listen for the signal in the speaker. Always start, in the case of a radio, near the output and work your way back toward the input. When the signal disappears, you have located the inoperative stage.

For some RF and low-gain audio circuits, the level of the signal from the injector can be increased by touching your finger to PL1's outside shell or by connecting the shell to the chassis.

The LISTENER

C. M. STANBURY II

A CASE OF MURDER . . . When Britain's R. Caroline hoisted a radio version of the Jolly Roger two years ago most observers predicted a short and unprofitable career. Instead, her formula of American-style disc jockies playing pop music attracted both a large audience and advertisers. There currently are reported to be ten buccaneer broadcasters with 7 million listeners.

But, now that the doings of the radio pirates are falling into the tradition of Captain Kidd and Blackbeard, the government is having second thoughts about the 3-mi. limit and how far the arm of the law can reach.

As might have been predicted, the pirates have fallen into disputes. Sabotage has occurred so often that some stations have armed guards. But now comes a case of murder.

In early summer Reginald Calvert, owner of Radio City (formally known as R. 390) was shot to death. Charged with the killing was former British war hero William Oliver Smedley, who reportedly had an interest in a rival station, Project Atlanta.

Radio City, unlike most of the pirate stations, was not on a ship. It occupied an abandoned World War II anti-aircraft battery called Red Sands in the Thames estuary. Eerily enough, the site formerly was occupied by another pirate, R. Invictus, which also came to bad ends, beginning with sabotage and climaxing in the death by drowning of the owner, a disc jockey and an engineer in circumstances still not sorted out.

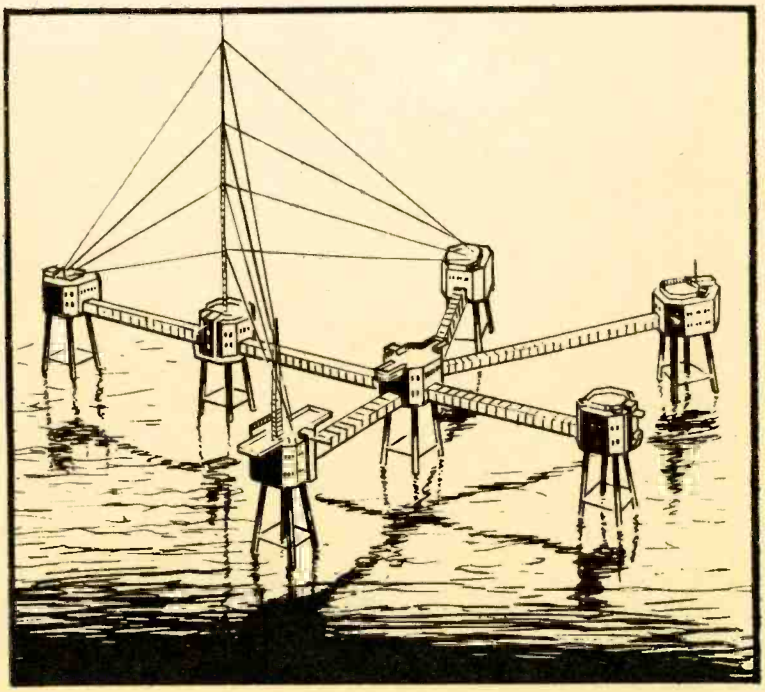
The dispute between Calvert and Smedley supposedly concerned rights to the site and payment for Radio City's transmitter. A boarding party (led by Smedley, the romantics said with uncertainty) that included ten British ship riggers and a lady writer seized Radio City and put it off the air. Police did nothing (3-mi. limit, you know).

Calvert and Smedley met to iron out differences, Calvert was shot and Smedley was accused. He denied everything.

So, to put it in Blighty terms, Her Majesty's Government is all shook up and wondering what to do. They could take a cue from the Dutch, who sent out a gunboat to close a similar station. But that wouldn't be cricket, would it? Especially not with 7 million voters involved.

One solution proposed by a member of Parliament is for the BBC to start a pop net-

[*Continued on page* 119]



Unusual location of Radio City is evident from our sketch, which is based on drawing appearing on an old QSL card. Transmitting on 773 kc (390 meters), Radio City is located on an abandoned anti-aircraft fort in the estuary of the Thames.

WHY NOT TAPE YOUR TRAFFIC?

HAM RADIO operators are as gadget-conscious a crew as you'll find anywhere, though there's one useful accessory they often overlook. That gadget is a tape recorder, which can be one of the handiest additions to any ham shack. It doesn't need to be a fancy, expensive one, either. Fact is, just about any medium-quality monophonic recorder will suffice.

No need to worry about someday trading it for a different model, either. Transmitters and receivers may come and go. You yourself may run the gamut of ham activity from Novice CW operation through AM and SSB fone, RTTY, VHF, satellite monitoring and what have you. But the same tape recorder probably can stay with you. And all in all it'll be as reliable an old friend as the stubby pencil you use to fill in the log book.

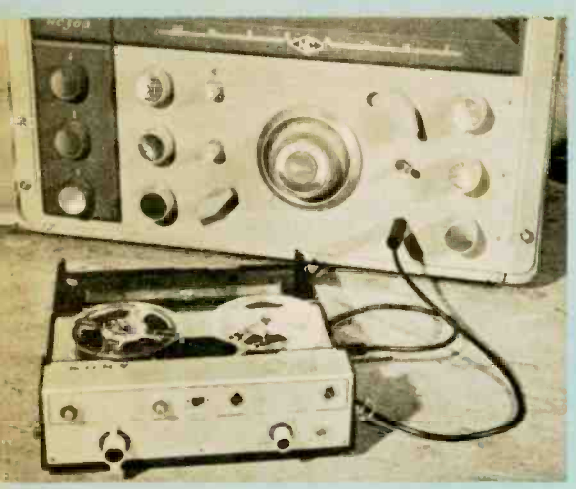
Beginners find a tape recorder an excellent helper in learning to send *and receive* Morse code. Simply connect the recorder to your receiver and you can build up your own library of code-practice tapes. Tune in one of the ham stations sending code-practice material or any station sending with a clean fist at the speed you want to practice at.

Further, by recording your own sending with a code-practice oscillator, you can study the sound of your own fist. Pick out the characters you seem to have trouble with and concentrate on them. Your tape recordings will give dramatic testimony of improvement.

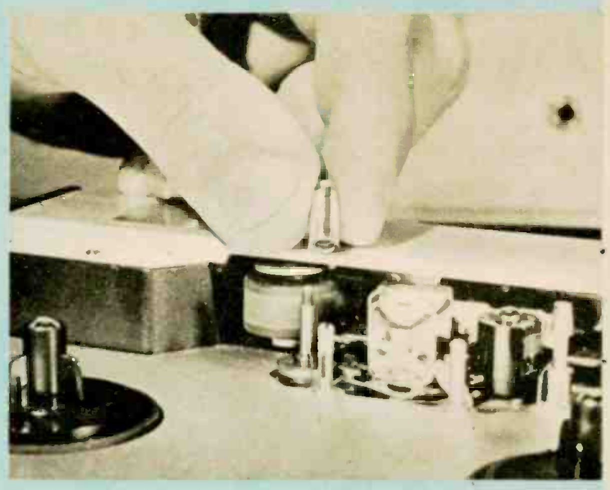
While you're doing this you'll find another use for the recorder—copying stations that are sending at speeds faster than you can handle. For this, you'll need a two-speed recorder. Set it for the higher speed and record that speed-demon CW artist. Then play the tape back at the slower speed. For example, if you record at 3¾ inches per second and play back at 1⅞ ips, you'll hear the code at exactly half the speed it was sent at. To get a pleasing tone on playback, set the receiver BFO for a higher-than-normal beat note when making the recording.

Recorders can be useful accessories for fone men, too. To be sure, a scope is the best instrument to detect overmodulation, and to detect distortion you also need an audio signal generator. But you can dispense with both and still do a fair job of checking general signal quality with a simple tape recorder.

Easiest way to turn this trick is to connect the recorder to the headphone jack on the receiver to mute the speaker. Then disable the circut that normally mutes the entire receiver when you are on the air. This way, the re-



Proper patch cord is about all it takes to add a tape recorder to most any ham shack. Fone jack on receiver feeds tuner input on recorder.



Recorder can make even machine-spewed CW readable by playing back at a fraction of original speed (effected here by changing capstans).

ceiver will pick up your own transmitted signal, yet there will be no feedback howl. Just don't forget to reduce the receiver RF gain to prevent overloading.

If your recorder has provision for an ear plug or headphone monitor you can use it to receive while you're recording. If not, connect the recorder input in parallel with your headphones and plug your headphones into the receiver. When you play back the tape you'll get a true idea of how your signal actually sounds to the fellows you are working.

You also can use this arrangement to record another fellow's signal as you hear it, so you can play it back to let him learn how he sounds. If you connect the output of the tape recorder to the audio input of your transmitter (a matching transformer or pad may be necessary here), you can play the tape back for him over the air.

A word of caution: to avoid running afoul of the FCC, don't play back on the air anything you have taped unless you have permission from the person you recorded. Also, be careful never to transmit material recorded from a broadcast station or other radio service —make it ham radio or nothing.

Other uses for tape in the ham shack are limited only by your imagination. If you're a member of a fone net, for instance, you can speed up your operating by recording incoming messages right off the air as the transmitting operator reads them. This will permit you to handle a much greater volume of traffic in a much shorter time than if you had to write everything longhand and it can help you avoid mistakes.

After the net is over, you can play back the tape and jot down each message to be relayed on another net or delivered on the landline.

Similarly, contest hounds can build an audio-triggered relay for connection between the tape recorder and transmitter to key the transmitter automatically and send CQ. Matter of fact, the machine can send the next CQ while you're logging the last QSO. Just don't let it run too long or you'll have fellow hams ready to smash your electronic marvel for creating too much QRM.

Fone patches for overseas servicemen also are a natural for taping. Chances are, most of the families you patch them to would love to have their own tape-recordings of those exciting radio visits. A lot of folks have tape recorders in their homes nowadays and would be willing to pay the cost of your tape for a copy of their fone-patch visit. Treasured like the family picture album, the tape would be excellent public relations for ham radio in general and for you in particular.

To stick with the letter of the law, however, make sure the persons using the telephone clearly understand that the conversation is being recorded. They shouldn't mind; what they say can be heard by anybody tuned in.

—Marshall Lincoln, K9KTL

Notes from EI's DX CLUB

Novice hams who want to test their DX prowess might try for Hawaii on 40 meters. Richard A. Gridley, WN8QIY, pulled this one off by working KH6EXJ one summer sunrise.

R. Tirana, Albania, now has two English transmissions for North America. The one at 1900 EST on 7265 kc still is much with us (but don't be surprised if that frequency is changed shortly), along with a comparatively new one around 9525 kc at 2130 EST.

British Guiana now has become the independent nation of Guyana and Fidel Castro soon may deal himself into the action. So watch for just that—*action!* Walt Levine (New York) reports reception of Guyana's only SWBC station, R. Demerara, on 3265 kc at 2145 EST sign-off. Its 5980 kc channel also has been reported on the West Coast at 0115 PST sign-on.

A new Brazilian on the upper bands is ZYY9, R. Timbira, operating on 15215 kc from Sao Luiz. Bob LaRose (New York) reports strong signals during the afternoon. Another Brazilian, PRK5, R. Inconfidencia at Belo Horizonte, has boosted its power on 6000 kc to 25 kw. Result is that it now often gives the controversial R. Americas a hard time around 1800 EST.

An excellent bet for Turkey these days is R. Ankara, which has English at 1700 EST on 15160 kc. Reports indicate that this one is being heard from coast to coast, a somewhat surprising fact since logging Turkey usually is pretty rough out West.

David E. Sinclair, K3YGU, reports a nice catch in the form of OY2Z, Faeroes Is. This rare Arctic location can be found on 20-meter CW.

The former R. Santo Domingo-TV now is called R. Television Dominicana. Still on 6090 kc, station also has returned to 9505, which it used before the Dominican crisis. The 6090 frequency occasionally carries taped programs, complete with confusing IDs, from other well-known stations such as R. Nederland.

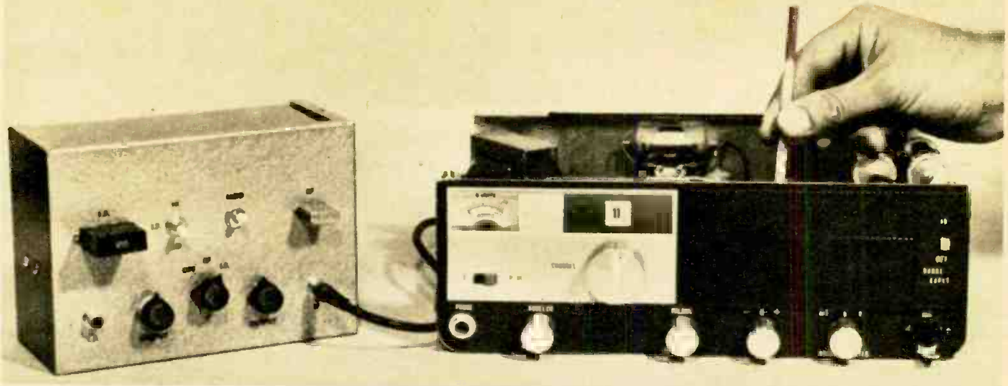
A mystery VOA station is being heard evenings on approximately 7650 kc, relaying Greenville transmissions. Though probably a point-to-point facility, station uses regular AM modulation rather than single sideband so it just might bear watching.

Bill Sparks (California) reports the Guatemalan speaking through the Costa Rican QRM on 6205 kc is R. Nacional Tikal. Station signs off at 2330 EST.

R. Tashkent, Uzbekian S.S.R., again is coming through on 25 meters (11925 kc, to be exact). Edward J. Pyatt (South Carolina) reports hearing English at 0700 EST.

Beginners should take note that HCJB in Quito, Ecuador, has moved its afternoon transmissions in the 19-meter band to 15325 kc. Station has English at 1345 EST.

Propagation: During the late fall and winter months the range of useful frequencies runs from very high during daylight hours to low at night. Peak daytime conditions occur from around sunrise to noon, local time. During this period the 21-mc broadcast band will be receivable every day and on some days even 26 mc will be heard. The amateur 10-meter band also will be open with some regularity during these hours. During the afternoon and evening, conditions change markedly until 6 and 9 mc are the only bands open for transatlantic paths. Latin Americans will be audible up to 11 mc and possibly 15 mc on some nights. Broadcast-band DX will reach its peak in November. However, it should continue to be reasonably good throughout the winter.



CB Alignment Generator

You can peak both RF and IF circuits with this 3-transistor instrument.

By HERB FRIEDMAN, KBI9457

IT'S the receiver section of a CB rig that makes the difference between reliable and undependable communications. You can have the biggest antenna on the street but if the receiver's RF and IF stages aren't tuned up perfectly you'll simply be spinning your wheels.

So far as the transmitter is concerned, even if its output decreases slightly or the modulation percentage drops from, say, 85 to 50 the loss will often go unnoticed. But if the receiver isn't up to snuff the effect will be apparent immediately. A loss in input sensitivity means you won't hear weak signals at all. And a change in IF alignment, caused by aging components, will lead to annoying adjacent-channel interference.

While normal wear and tear and component aging have only slight effect on transmitter circuits, receiver alignment can be altered drastically. All it takes is a simple receiver alignment job to produce a startling improvement in performance.

While most service-grade RF signal generators could be used for alignment, the job should be done with a crystal-controlled generator, such as our CB Alignment Generator.

Our generator provides modulated or unmodulated crystal-controlled IF signals of 455 kc or any frequency from 1300 to 2000 kc. And the generator also supplies an RF (26.96-27.25) signal produced by a third-overtone CB transmit crystal. The output levels of both the IF and RF oscillators are adjustable—maximum output being about 150,000 microvolts.

The output frequencies are user-selected. It is necessary only to plug in the crystals needed for your particular receiver. The generator is designed for single- or double-conversion receivers. It should not be used with receivers that have frequency-synthesizing circuits. Such rigs generally require special test equipment.

Figure 2 is the generator's schematic. Note that there are three separate circuits. Q1 is the IF oscillator. When S1 is in the *high* position, an IF signal will be produced in the 1300-to-2000-kc range, depending on the crystal in SO1. Plug a 455-kc crystal in SO1, set S1 to *low*, and the output frequency will be 455kc.

Transistor Q3 is the RF oscillator. Plug a third-overtone crystal into SO2 and you'll get a signal anywhere in the Citizens Band.

Transistor Q2 is the modulator oscillator. When S2 is open the modulator is disabled and either Q1 or Q3 will produce unmodulated IF or RF output signals. When S2 is closed, battery voltage is applied to the modulator and the RF and IF signals will be modulated about 25 per cent by a 1-kc signal.

Switch S3 controls power to *either* the RF or IF oscillators. Simultaneous RF and IF outputs cannot be obtained.

CB Alignment Generator

Construction

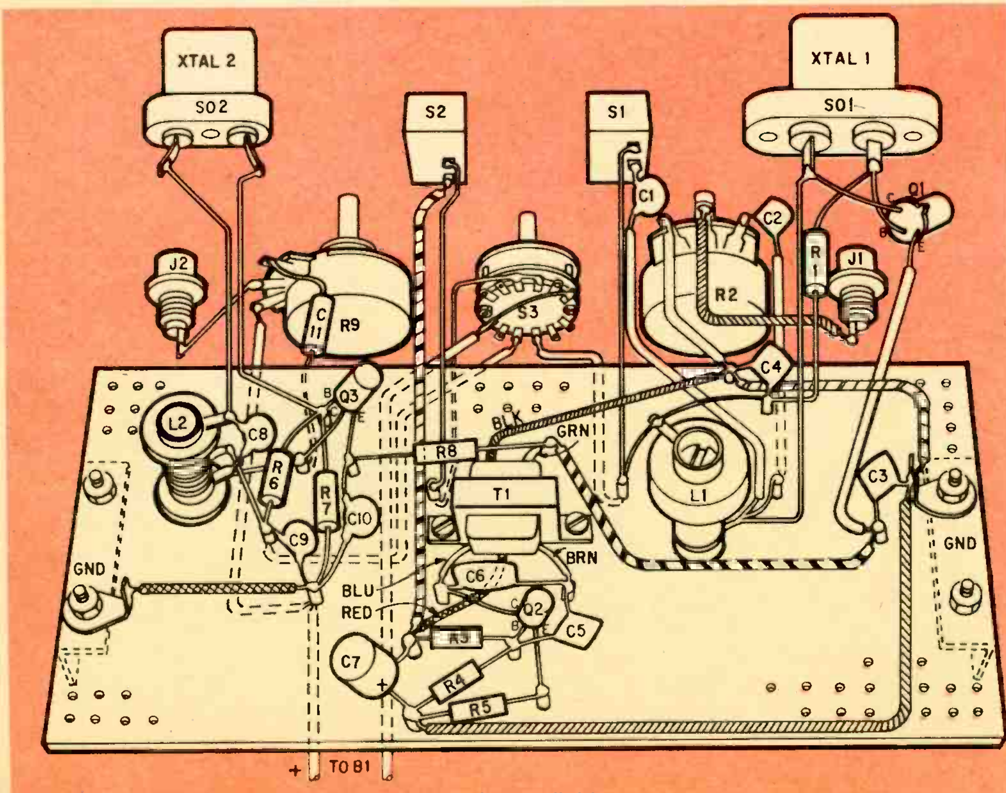
To insure proper operation, the generator must be built exactly as shown in the pictorial and photographs. Use only the components specified—make no substitutions.

The generator is built on the main section of a 7 x 5 x 3 inch Minibox. Start construction by mounting the oscillator-board support brackets. Then install all the components on

PARTS LIST

B1—6-V battery (Burgess Z4 or equiv.)
Capacitors: 10 V or higher
C1—50 $\mu\mu$f silvered mica
C2—15 $\mu\mu$f silvered mica
C3,C4,C5—.05 μf, ceramic disc
C6—.25 μf, ceramic disc
C7—50 μf, 10 V electrolytic
C8—25 $\mu\mu$f silvered mica
C9,C10—.001 μf, ceramic disc
C11—.5 $\mu\mu$f, 600 V temperature compensating tubular (Centralab Type TCZ. Lafayette 33 R 2131 or equiv.)
J1,J2—Phono jack
L1—3.46-5.8 mh adjustable RF coil (J.W. Miller 21A473RB1. Lafayette 34 R 8886 or equiv.)
L2—RF coil wound on J.W. Miller 4400 form (Lafayette 34 R 8752 or equiv.) See text
Q1—GE-1 transistor (General Electric)
Q2—2N217 transistor (RCA)
Q3—2N274 transistor (RCA)
Resistors: ½ watt, 10% unless otherwise indicated
R1—330,000 ohms
R2,R9—5,000 ohm linear taper potentiometer
R3—270,000 ohms
R4,R7—10,000 ohms
R5—150 ohms R6—220,000 ohms
R8—560 ohms
S1,S2—DPDT subminiature toggle switch (Lafayette 99 R 6162) See text
S3—2 pole, 5 position subminiature rotary switch. Lafayette 99 R 6164 or equiv.)
SO1—Crystal socket for type FT-241 crystal.
SO2—Crystal socket for type HC-6/U crystal.
T1—Transistor output transformer; primary: 500 ohms, center tapped. Secondary: 3.2 ohms. (Argonne AR-119. Lafayette 33 R 8558)
XTAL-1—IF-frequency crystal. Available from Texas Crystals, 1000 Crystal Drive, Fort Myers, Fla. 33901. Prices are postpaid. 455 kc: Type TC-21, .01%, $1.25. 1001 to 1600 kc: Type TC-23, $4.50. 1601 to 2000 kc: Type TC-23, $3.55. Specify frequency when ordering.
XTAL-2—Third-overtone CB transmit crystal.
Misc.—Perforated board, flea clips, 7 x 5 x 3-in. Minibox

Fig. 1—Leads shown as broken lines go from front-panel controls to board's underside. Sockets SO1, SO2 and switches S1 and S2 are mounted above the board. J2,R9,S3,R2 and J1 are installed under the board.



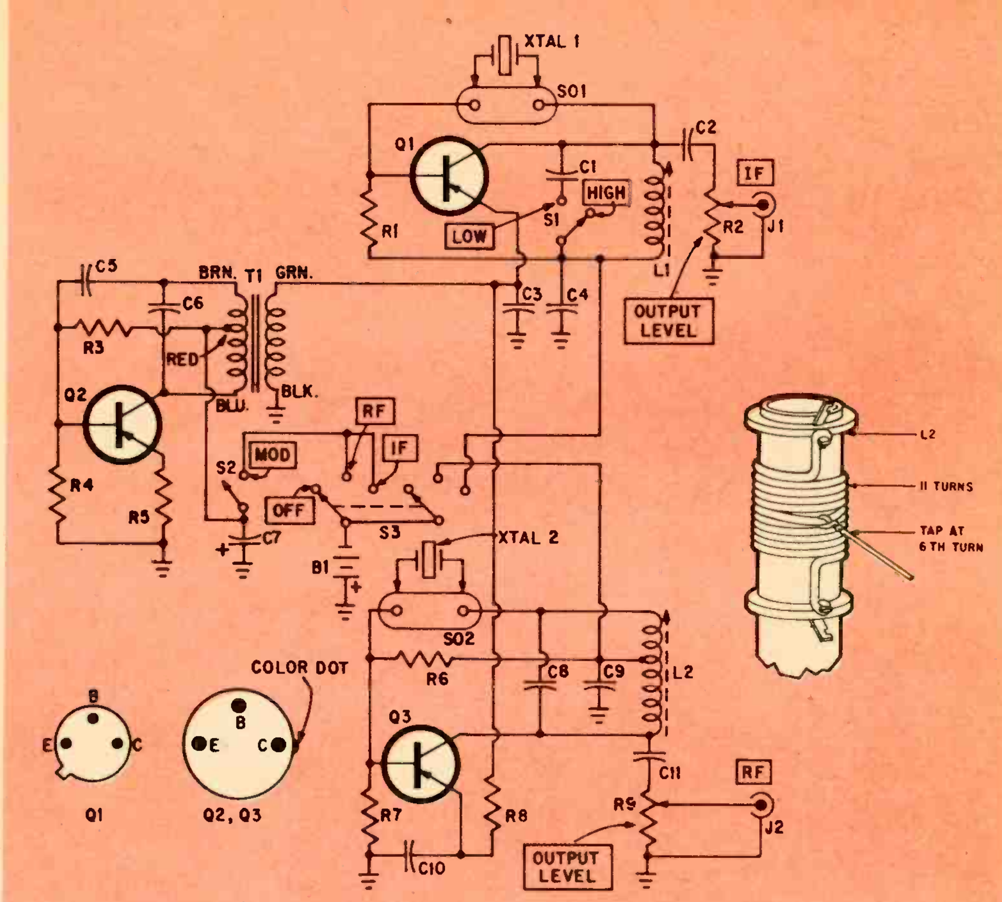


Fig. 2—Generator's schematic. Circuit at top, associated with Q1, produces IF signal. Circuit associated with Q3 at bottom generates RF signal. At left-center is oscillator which produces 1-kc signal to modulate RF and IF oscillators. RF-oscillator coil L2 is shown in detail at the right.

the front panel as shown in Fig. 3. The brackets for the oscillator-board are made from a piece of 1-in.-wide x 4-in.-long scrap aluminum.

Switches S1 and S2 are the subminiature type: if you use larger standard toggle switches move their mounting holes ½-in. above the crystal sockets.

The circuit has two ground busses—you must use them. Do not simply connect to the nearest ground point. For example, note that the ground lugs on R2 and R9 are not soldered to their case. They are wired to the ground busses on the board.

Wire the oscillators on a piece of perforated board approximately 2⅞ x 6¾-in. To avoid damage to the board, drill the mounting holes for L1, L2, T1 and the four mounting holes for the support brackets *before* you install the board to the cabinet.

Fig. 3—Mount components on front panel as shown, before installing circuit board. Jacks, pots and rotary switch are on line 1¼ in. up from bottom. Crystal sockets and toggle switches are on line 3 in. above bottom. Circuit-board brackets are 2½ in. above bottom.

CB Alignment Generator

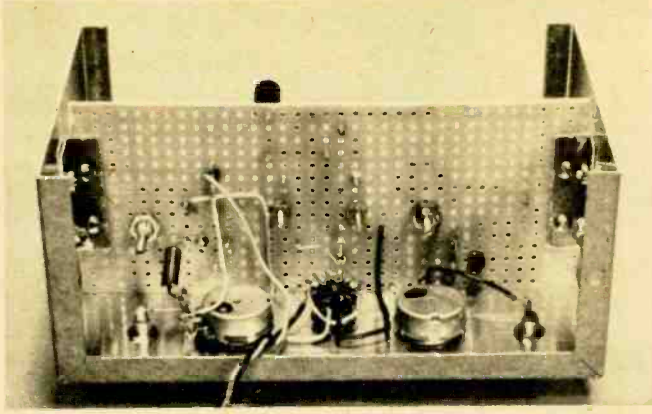


Fig. 4—Underside of circuit board. Note the board's mounting brackets at each side. Screws protruding through board at left and right are slug-adjustment screws of L1 and L2. Leads from components under board are wired to tips of flea clips. Wires running out of cabinet go to battery which is mounted in the cabinet's cover.

L1 is a stock coil and is used as is. Coil L2 is made by winding #22 enameled wire on a J.W. Miller Type 4400 RF coil form. Take about 2 ft. of the wire, clamp one end in a vise and pull on the other end until the wire goes dead slack (tensilized). Scrape off ¼-in. of enamel from one end of the wire and solder it to the lug nearest the form's mounting nut. Run the wire along the form for 3/16 in. and then wind six closewound turns. Bring the wire out from the form for about 2 in., fold it back to the form making a loop, twist the loop together and then wind five more close, tight turns in the *same direction* as the first six turns. Scrape off about ¼ inch of insulation from the free end of the wire and solder it to the lug at the other end of the form opposite the starting lug.

Scrape the insulation off the loop and solder the two loop wires together. Then cut off the excess, leaving a ¼ inch stub—this is L2's tap.

To avoid damage when soldering, assemble the oscillator board in this order: S1 to L1 and the remainder of Q1's circuit (do not connect Q1's emitter yet). SO2 to L2, C8, then the remainder of Q3's circuit with the exception of R6. Q2's entire circuit, T1's green lead to Q1's emitter and R8 from Q3's emitter to T1's green lead.

Finally, complete the wiring on the underside of the oscillator board as shown in Fig. 1. Mount the battery in a standard D-cell holder centered at the bottom of the cabinet cover. Make certain it is at the bottom so it doesn't short any of the terminals sticking through the board. Connect only B1's positive (ground) lead. Do not connect B1's negative lead to S3, as a meter must be connected in this part of the circuit for final adjustment.

Adjustment

Connect an 0-10 ma DC milliammeter between B1's negative lead and S3's wiper—the meter's positive terminal connects to B1 and the meter's negative terminal goes to S3. Adjust L1's slug-adjustment screw so it sticks out ⅜ in. Do not plug a crystal into SO1. Set S3 to IF and note the meter indication—it should be about 0.8 ma. If you are using a 455-kc crystal, close S1 and insert the crystal—the meter indication should drop to about 0.5 ma.

If the meter's indication does not fall, the oscillator isn't working. Try adjusting L1's slug until the meter indication drops with the crystal in the socket. When L1 is adjusted for 455 kc, it will also be aligned for crystals in the 1200- to 2000-kc range. If you plan to use crystals for only 1200- to 2000-kc, the ⅜ in. slug adjustment should require no further change.

Next, plug a third-overtone CB transmit crystal (preferably a center-band frequency like channel 11) into SO2 and set S3 to the RF position. Adjust L2's slug-adjustment screw until the meter indication *rises*. Then try a low-(channel 1) and a high-(channel 23) frequency crystal. Note the meter indication with no crystal in SO2, then plug in the crystal again. If the high- or low-band crystal does not cause an increase in the meter indication, readjust L2's slug very slightly until there is an increase in meter indication regardless of the frequency of the crystal in SO2.

Finally, with crystals plugged in, close

[*Continued on page* 118]

KIT
EI
REPORT

Compressor-Preamp

Knight-Kit C-577

MOST every ham or CBer operating in heavy QRM has at sometime or other turned the mike gain control way up. Although this will get your modulation indicator up to 100 per cent, you may not cut through the QRM any better since that 100 per cent is reached only on modulation *peaks*. Average power could be, say, 10db less. And this means modulation will only be around 30 per cent.

The ideal modulating signal is one whose level remains fairly constant regardless of the level of the signal from the mike. The way to produce such a signal is with the Knight-Kit C-577 compressor/preamp. For $19.95 this kit will give you a supercharged signal which will really cut through the QRM.

The compressor actually is two instruments in one: a speech compressor and a preamp which provides 10db of gain. This means the preamp circuit will boost the output of a mike rated at -40db to -30db. There are three controls: one is an on-off switch that connects the mike directly to the transceiver or switches in the compressor (simultaneously applying power from the built-in 9-V battery). The compression control never shuts off the compression entirely. Instead, it adjusts the level at which compression starts. The output-level control adjusts the level of the signal to the transceiver or transmitter.

A meter indicates the compression action of the unit. The meter proved to be calibrated accurately. That is, compression started exactly when the meter indicated it did.

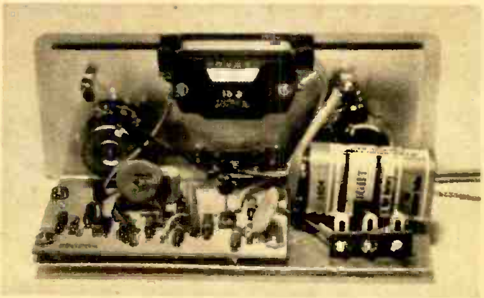
Putting it Together. Hardware is packaged neatly in plastic bags. Other components (capacitors and resistors) are mounted on cards and are identified by schematic-diagram designations. A printed-circuit board makes wiring the kit almost a game. About the only problem we encountered was a packaging error. We received a duplicate of R10 and no R11. The manual was well illustrated and we ran into no difficulties during construction. We had the kit working in two hours.

Compression action is excellent. With the control adjusted for minimum compression, the output remains essentially constant once the input level exceeds -40db. And -40db is the output of a typical CB microphone with moderate voice levels.

Advancing the compression control causes compression to start at a lower level. At the 50 per cent setting of the control, compression is increased about 10db—the actual amount being determined by the output level of the microphone.

Although -40db represents the average output level of most popular mikes, the peaks of the waveform are some 10db higher, or -30db. Since it is the *peaks* that determine how much the transmitter will be modulated, compressing the peaks means the signal level into the transceiver can be increased by an amount equal to the compression.

But a note of warning. The compressor's input impedance is somewhat lower than that required to match a crystal or ceramic mike's impedance. The loading results in a slight loss of low frequencies. This is to the good since it makes the modulation crisp. However, if a crisp signal bothers you, switch to a dynamic mike. The C-577 is worth the money simply because it makes an old rig sound like a gold-plated special.



Most parts go on a printed-circuit board which is first wired, then mounted on a metal chassis. Four wires connect the board to the front-panel controls.

THE VERSATILE VOM

By LAWRENCE GLENN

DESPITE all the esoteric test equipment around these days, it is the Volt-Ohm-Milliammeter—a versatile little gadget most people know as a VOM—that still is the workhorse of the test bench. Properly used, it's capable of measuring three all-important phenomena: volts, milliamperes and ohms. And since voltage, current and resistance represent the Big Three of electronics, the versatile VOM stands ready to tell you what you need to know about the goings-on in most any circuit.

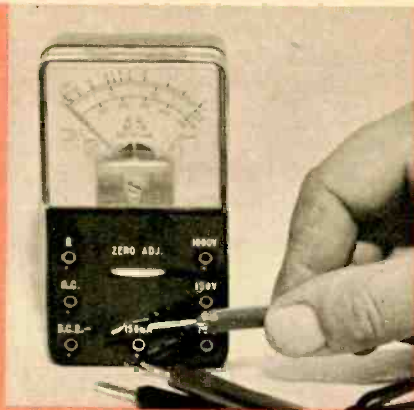
Highly specialized test gear usually only can identify or localize a defect. It still takes voltage, current and resistance measurements to lay your finger on the precise component or components which create electronic problems. After all, the ohm is as basic to electronics as inches to feet. And it's the VOM that can take the measure of the ohm.

Basically, all VOMs do the same thing: they measure E, I and R. They differ only in the specific ranges covered and in the degree of operating convenience offered. While VOMs combining other functions—capacitor checks, say—do appear from time to time, they never have achieved substantial popularity (the additional functions complicate their operation). And, of course, convenience of operation is a desirable feature in any VOM.

Major difference between VOMs is the ohms per volt (usually written ohms/volt) figure. It's a sort of merit rating for VOMs, telling you about the loading that the meter will place on a circuit being tested. Loading refers to the fact that putting a VOM across a DC circuit is just like connecting a resistor across it. For example, a VOM rated at 20,000 ohms/volt will load the circuit with 20,000 ohms for each volt shown on the scale you are using. If the meter is set to the 100-volt range, the meter load is 100 × 20,000 or 2 megohms. Result is that the circuit being tested will perform just as though a 2-megohm resistor were connected across it.

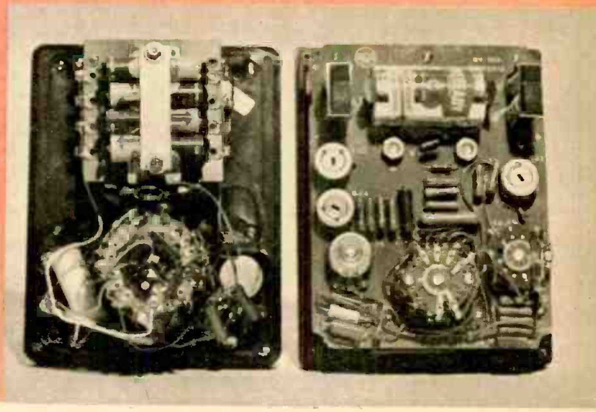
Particularly in its lower ranges, a VOM easily can lead to excess circuit loading. Measuring a 2-megohm AVC buss with a 20,000-ohms/volt VOM on its 5-volt range would result in the buss' being shunted with 100,000 ohms. However, so far as the electronic hobbyist is concerned, there are few instances where a VOM rated at 20,000 ohms/volt DC will cause such serious loading as to preclude its use.

On the other hand, a VOM rated at 1,000 or 5,000 ohms/volt DC results in excessive loading under most conditions. For example, a 5,000 ohms/volt meter set to the 100-volt range would represent 100 × 5,000, or 500,000 ohms. Should this meter, for instance, be used to measure the plate voltage of a tube with a 470,000-ohm plate resistor, errors clearly will be present in the reading. And a 1,000 ohms/volt meter is even worse. On its 100-volt range such a meter represents 100 × 1,000, or 100,000 ohms, obviously too



Factory-wired meters vary widely in price, differ in degree of accuracy, size of meter scale and the number of features offered.

Kits offer a $10 to $15 saving and require minimal skills to assemble. Note calibration pots on somewhat more costly printed-circuit model at right.



high a load for testing much of anything save perhaps a toaster.

Rule of thumb is that a VOM for DC measurements should be rated at 20,000 ohms/volt or higher. The additional moolah that a 20,000 ohms/volt meter will run you is a small price to pay for the greater accuracy the unit will provide.

As for AC ohms/volt ratings, most meters weigh in at 5,000 ohms/volt. And, while you usually can't use such a meter to measure amplifier gain, it certainly is adequate for checking power supplies, transformers, heater voltages and the like.

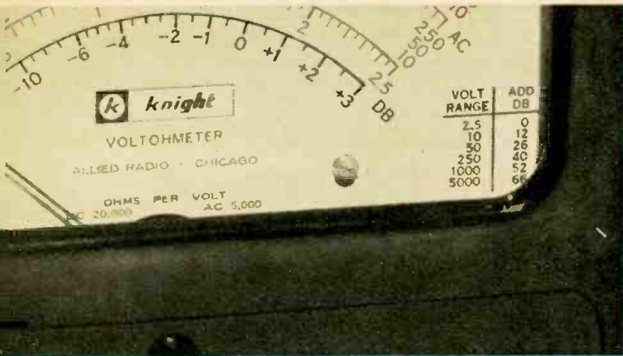
Further, any AC meter can be used to measure an amplifier's output into a speaker load. Most VOMs—except those stripped to the bone with but a handful of ranges—have a db scale specifically for power-output measurements. Some models have conversion charts on the meter face to correlate the db reading with the AC range switch; others require that you refer to a conversion chart in the instruction manual. Many VOMs provide an output jack, essentially nothing more than an internal blocking capacitor which permits the user to measure the AC component in the presence of DC.

Naturally, the more ranges and functions a VOM has, the greater its adaptability to a variety of tests. While no VOM can do more than measure voltage, current and resistance, it is the specific ranges provided and the convenience of operation which determines the VOM's practical value. Buying the right VOM for you becomes simply a matter of selecting a meter with ranges and functions tailored as closely as possible to your particular field of interest.

Nearly all VOMs priced below $80 are general-purpose units and it's the differences between them that make each particularly suitable for a specific field of the electronics hobby. Meter sizes and ranges vary widely. Then, too, one unit might have a polarity-reversing switch while another has overload protection built into the front panel. And one model might control all functions and ranges through a single switch while another requires connecting the test leads to a different set of jacks each time a function or range is changed.

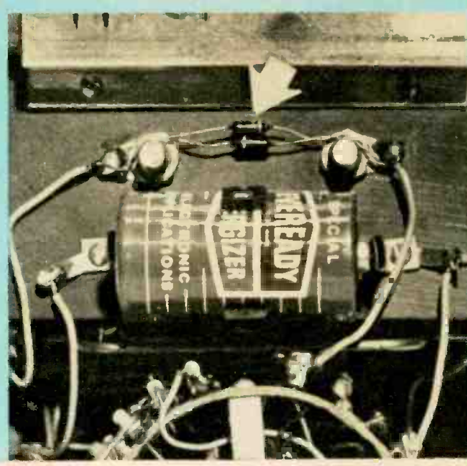
Still other considerations come into play if your work is in a specific field requiring an unusual range. For example, if you work primarily with transistors, where accurate measurements are required down around 0.1 volts, a VOM with a bottom range of 3 volts will be about as useful as a 150-volt AC voltmeter. A full-scale range of, say, 0.25 V then would be the thing to have.

Another important point to ponder is convenience. To reduce both the possibility of measurement error and damage to the meter it shouldn't be necessary to move the test leads to a different set of jacks for AC, DC and resistance ranges (though special low and high ranges usually require separate



Large, easy-to-read meter scale is significant feather in the cap of any VOM. Db/volts chart (lower right in photo) comes in handy for making audio measurements.

Diodes (arrow) protect mechanism against accidental overload in many VOMs, thus preventing bent pointers, burned-out meters.



THE VERSATILE VOM

jacks). A single set of jacks with all ranges and functions selected by a switch is the maximum in convenience.

Worth having, too, is an AC/DC function switch separate from the range switch. Usually the extra switch also provides for reversal of test-lead polarity, making it unnecessary to reverse leads when measuring a negative voltage or current. The polarity reversal works on the resistance ranges, too, which means it's easier to check the ratio of a semiconductor's forward-to-back resistance.

Another item under convenience is test-lead jacks and plugs. Pin jacks usually work loose and are difficult to adjust. Let them lose tension and you'll have to wiggle the test-lead pin-plug to make contact. Better to have the more commonly used banana jack, which depends on the plug for tension. Not only does the plug tension hold over long-term use but readjustment is a two-second job.

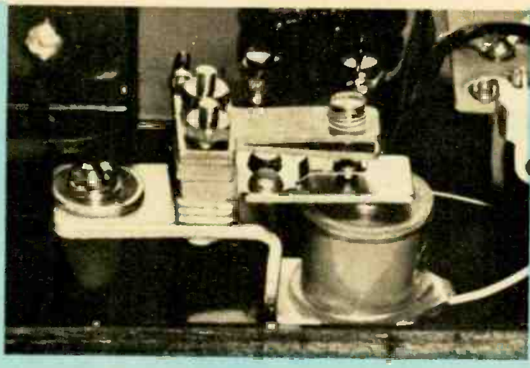
So far as ranges are concerned, it's the ohmmeter ranges that are the most troublesome to the experimenter. Unlike the VTVM, which decades the resistance multiplier in steps of ten from R × 1 to R × 1 megohm, the VOM usually has three, sometimes four, multipliers. (If the meter has only one or two resistance ranges, better pass it by. You'll find it almost useless for serious hobbyist applications.)

As a general rule, the American standard is 10 to 15 ohms center-scale. Combine this scale with the multiplying ranges and nearly complete, accurate coverage to 5 megohms is assured. True, there will be certain areas where it will be difficult to interpolate the readings accurately, but the problem isn't serious. On the other hand, some meters of the inexpensive imported variety have a 30- to 40-ohm center scale which results in several difficult-to-interpolate resistance ranges.

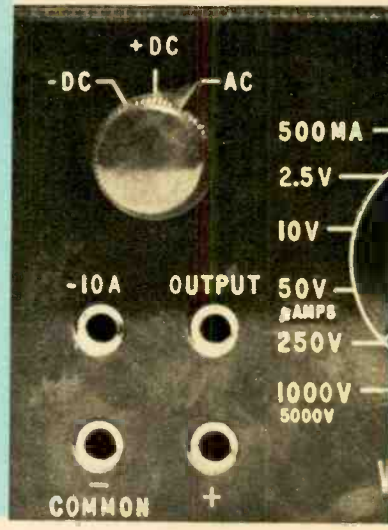
The long and short of it is always to check the ohmmeter ranges of any VOM you're interested in. Make certain the scale times the multipliers covers the resistance values you commonly work with. We stress this point strongly because one VOM we ran across placed such commonly used resistance values as 4.7k, 10k and 100k at the extreme ends of the scale where accuracy of interpolation is extremely poor.

Voltage ranges vary from model to model but most units cover 1 volt to about 1 KV with readability. Again, it is the extreme ends of the scale which are important. For example, if you're a radio amateur you probably work with high voltages so your VOM should go at least to 3 KV. If you work with even higher voltages you'd want 5 or 6 KV coverage. On the other hand, a transistor experimenter needs accurate readings down to about 0.1 volts, so he'll want a full-scale range of about 0.25 volts with current measurements down to about 50 microamperes.

Speaking of current measurements, while



Built-in buzzer on some models serves as simple continuity tester. Buzzer sounds automatically if resistance of circuit under test should measure less than 4 ohms.



DC reversal switch (at upper left in photo) provides means to reverse the test-lead polarity without interchanging the leads.

a 1 ma to 100 or 500 ma range is adequate for the amateur or general experimenter, a transistor specialist will find a range of about 50 μa to 5 or 10 amperes most convenient.

Among minor conveniences which might be attractive are an outside fuse or circuit breaker or the more recent feature, diode protection of the meter movement. A set of diodes connected across the meter terminals bypasses excess current around the meter once the pointer has been driven off scale. While the diodes don't protect the multiplier and shunt resistors from burnout, it's cheaper to replace a resistor than a meter. Several VOMs—actually the same model with a different brand name—offer an unusual convenience, a built-in buzzer for aural continuity check of circuits having under 4 ohms resistance.

The size of the meter movement plays an important part in overall convenience and this brings up the subject of imported, budget-price VOMs. A large meter face permits the scales to be spread out with relatively large numerals. Conversely, a small meter jams the scales and calibration together (and the size of the numerals is reduced proportionately). If the meter face is excessively small it is necessary virtually to stick your nose against the glass to take a reading.

Some imported meters create the impression of being bigger than they actually are by using a large cabinet and an oversize meter face. Even so, careful inspection will reveal that the scales utilize only a portion of the total face. So, though you might be paying extra for what you consider a large meter, you are in fact buying a small or pocket-size VOM.

Of course, the really big question governing choice of any VOM is price vs reliability. More than one hobbyist has questioned the need to spend anywhere from $25 to $60 for an American meter offering the same conveniences and performance as an imported meter selling for much less. In terms of when-new accuracy, both low-cost imports and service-grade American instruments essentially are the same. The big when-new difference usually lies in legibility—an expensive scale usually is easier to read and doesn't require that you take second looks. But long-term performance can be something else.

Throw a $40 meter into the tool-box or bounce it around in the trunk of the car for a few months and it still will give accurate readings. In contrast, a low-cost meter usually cannot withstand rough handling. Given a few bounces, the pointer gets knocked off the pin and never can be properly zeroed again. We also have found that rock-bottom-price meters are more sensitive to overload burnout. The same overload that will burn out a cheap meter movement may not even bend the pointer of an expensive meter.

[Continued on page 112]

By ALEX BOWER

POWER is the name of the game, short wave is the playing board and the pawns are turncoats.

Only now that Castro, the CIA and Mao are playing 1966 style, you hardly can tell the players without a score card. *Traitor* becomes *refugee*, treason becomes freedom of speech (and vice versa), truth and slander seem to be interchangeable.

Consider Dr. Ronald Ramsey, a Los Angeles psychologist who makes anti-war tapes for Radio Hanoi. While visiting Canada recently to tape a TV interview for the CBC, he came up with this pronouncement (in a telegram to Prime Minister Lester Pearson):

"On behalf of free speech and the right to travel, I beseech you and the great Canadian people for refuge as a dissenter to my own country's policy of genocide and denial of self-determination in Vietnam."

No old-time turncoat of the era of Axis Sally and Lord Haw-Haw would have been caught dead with such a fancy approach. Today a so-called refugee broadcaster is likely to say he supports causes that most people accept: freedom, justice and equality. Back when short-wave broadcasting first hit full stride, during World War II, the turncoat's weapons were simpler: hate, greed, bigotry and fear.

When William Joyce (the Englishman dubbed Lord Haw-Haw) came on the air over his New British Broadcasting Station from Nazi Germany, he and his staff of disgruntled prisoners of war simply quoted from the Imperial Fascist League about what was called Jewish ritual murder, then followed this up with the astounding news that Hitler merely was defending himself (against the Communists, of course) and certainly would win. *Now*, they said, was the time for Britons to get on the right side.

Then there was the case of Norman Baillie-Stewart. An ex-officer in the Seaforth Highlanders, he had spent almost five years locked in the Tower of London for passing secret information to German agents. On his release in 1937, he promptly disappeared. The next his countrymen heard of him was his wartime broadcasts out of the Austrian Tyrol (where he eventually was picked up by American forces in 1945).

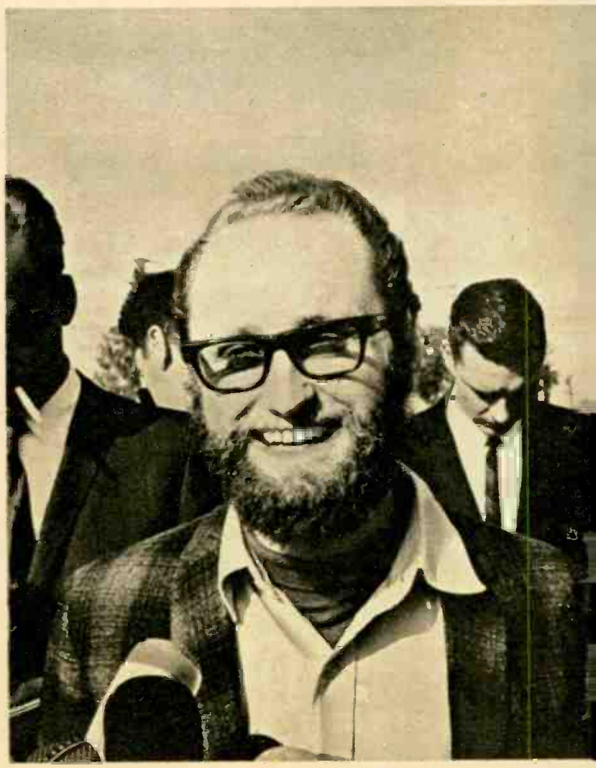
Simultaneously, on this continent, Doc Brinkley's XERA at Acuna, Mexico, aired the views of William Dudley Pelley (leader of the pro-Nazi Silver Shirts) and his friends, who included Gerald B. Winrod, a Wichita preacher who has been called the Kansas Fuehrer. The following direct quote indicates the XERA approach:

"Franklin Roosevelt imagines himself to be the greatest military strategist of all time and [has] conceived the idea of involving his country in a war that would eventually make him President of the world."

Haw-Haw was hanged. Baillie-Stewart drew another five years. Pelley served a stretch in the federal pen for sedition, after which he became involved in spiritualism and flying saucers. Winrod was indicted for sedition but not convicted.

It is interesting to note that some major short-wave broadcast stations, including a few that are deeply involved in the cold war, use virtually no turncoat/refugee broadcasters. In this group we find the BBC and,

tuning in the



Ronald Ramsey, who claims to be Granny Goose of Radio Stateside, says he heads organization that produced pacifist tapes for broadcast on R. Hanoi.

to a large extent, the Voice of America. Even Radio Moscow, doing its best to sound respectable, uses almost none. R. Moscow painstakingly announces the names of all on-the-air personalities and — though their American accents are letter-perfect, if somewhat flat—all seem to be home-grown Russians.

Turncoat originally meant a soldier who had deserted his comrades-in-arms and gone over to the other side. He was literally and legally a traitor. Because of the term's origin, the use of such a personality on the air, even if he tells the absolute truth, is considered filthy pool by most listeners back home.

One could question whether this attitude always is justified. When such East European nationals as George Ionescu (Romania), Julius Firt (Czechoslovakia), Jan Nowak (Poland), Mileo Meteff (Bulgaria) and Istvan Bede (Hungary) broadcast over American-sponsored Radio Free Europe, who would call them traitors? Or what about Luis Conte Aguero, who broadcasts back to his native Cuba over WRUL and the controversial R. Americas?

At Baillie-Stewart's second trial he pleaded that he had become a German citizen before embarking on his broadcasts—and that, therefore, he could not be called a traitor. Nonsense, answered the court, a man can't change his nationality in wartime!—and they sentenced him.

In so doing, the court did not need to take up the question of Baillie-Stewart's motives in broadcasting for the Nazis, nor the truth or falsehood of what he had to say. It is only in these terms, however, that *turncoat* or *refugee* take on meaning. And in those terms, let's examine the estranged Americans who

TURNCOATS

John Amery (shown here with his French wife and the English captain who questioned him on his capture in Milan in 1945) pleaded guilty to charges of having actively aided Germany by making propaganda broadcasts. The English son of a Secretary of State for India, he was sentenced to hang for treason.

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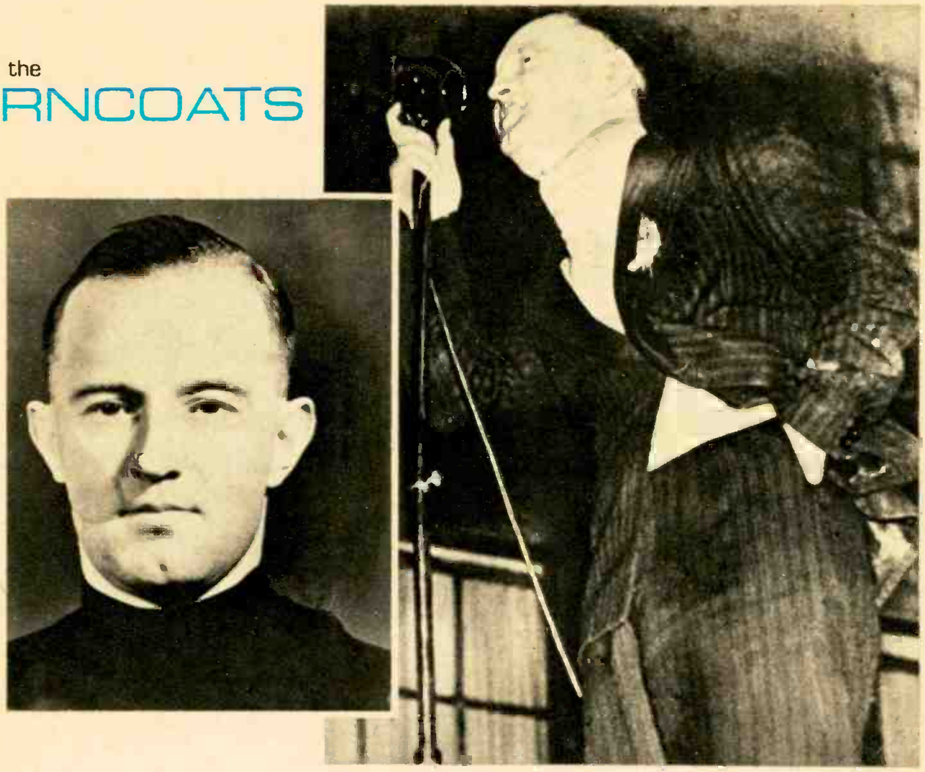
TURNCOATS



William Joyce was best known as Lord Haw-Haw to British listeners because of his supercilious delivery. His broadcasts from Nazi Germany led to his sentencing for treason.

are exploited by the biggest users of this kind of programming in the Communist world: Peking, Hanoi and Havana.

In charge of Peking's English-language scripts is American Anna Louise Strong, a career Communist who also has worked in Moscow. She fell briefly into disgrace during the last days of Stalin, was returned to good standing by Khrushchev but has since sided with Mao—apparently for doctrinaire reasons. Her hatred of America is based more on theory than it is on bitter experience. This probably accounts for the prevailing dullness that afflicts Peking's transmissions to the United States—plenty of smoke and soot but little real fire.

A second American member of Radio Peking's staff is Gerald Tannenbaum. His motive is simply love—for Madame Sun Yat-sen, widow of China's universally revered hero. Madame Sun, who was many years younger than her husband (and is a sister-in-law to Chiang Kai-shek, the Nationalist leader) probably is not a Communist but she does head Peking's Welfare Institute, whose activities include hygiene, child welfare and cultural projects.

Tannenbaum is officially an employee of the Institute. This ex-Marine captain has a long career in Chinese short-wave broadcasting. Before World War II he ran U.S. military station XMHA at Shanghai. One of the world's first AFRTS-type stations, it used the slogan, Call of the Orient, and operated on 25 meters (mostly 11860, where it was widely heard by West Coast SWLs) and the BCB at 600 kc. The relationship between Tannenbaum and Sun Yat-sen's widow goes back many years and is well-known to Far Eastern experts.

Another American employee of the Welfare Institute who turns out propaganda scripts is Talitha Gerlach. She is a former YMCA secretary who spent many years in China before the Communists took power.

The fourth expatriate on Peking's team is Sid Rittenburg. After World War II, when he was stationed in China (then under the Na-

Looking like the teacher she had become, Mildred Gillars, the Axis Sally of World War II broadcasting, was photographed in Ashtabula, Ohio, in 1961.

tionalists), he accused fellow army officers of several crimes, including black marketing in UNRRA relief supplies. The only result of his accusations was his speedy discharge (an honorable discharge, incidentally). After this, he became increasingly disgusted with the general corruption existing in China of that day, blamed the United States for these conditions and eventually went over to the Reds. If Rittenburg were in charge of Peking's English-language propaganda efforts, our ears really would burn.

Miss Strong, at least, seems to have no legitimate grievance against the U.S. None of the four ever *really* tells the truth. When reporting activities inside Red China, nothing uncomplimentary is ever included. Needless to say, their coverage of the Vietnam war is blatantly biased.

The chaos, corruption, hunger and despair of postwar China seems to have been just the right thing to create anti-American Americans. An equally dangerous breeding ground is the racial hostility that exists within the U.S. So far, this battleground has produced only one major defector/broadcaster—Robert Williams. He has been heard occasionally over R. Havana (Cuba) and R. Peking but most of his efforts are on behalf of R. Free Dixie, a Cuban-based BCB network using the

[*Continued on page* 114]

EI GUIDE TO TURNCOATS ON THE AIR

FREQ. (kc)	STATION	LOCATION	TIME (EST)
670	R. Free Dixie	Cuba	Fri. & Sun. 2300-2400
680			Sat. 2400
690			
700			
6135	R. Havana	Cuba	from 2200
6170			from 2000
9760	R. Hanoi	N. Vietnam	from 2400
9840	V. Vietnam	N. Vietnam	from 0800
11760	R. Liberation	N. Vietnam	from 1000
11840	R. Stateside	N. Vietnam	from 1800
11820, 9457	R. Peking	China	2200-2400
11945, 9480	R. Peking	China	2000-2200

The descendants of such propaganda broadcasters as Axis Sally and Lord Haw-Haw can be heard on the stations listed in the accompanying guide. With the exception of those stations transmitting from North Vietnam—on the BCB—most can be tuned in by North American listeners.

Here Are Just 7 Of The 250 Values

NEW Heathkit® /Magnecord® 1020 4-Track Stereo Recorder Kit

Kit AD-16
$399.50
(less cabinet)

Save $170 by doing the easy assembly yourself! Features solid-state circuitry; 4-track stereo or mono playback and record at 7½ & 3¾ ips; sound-on-sound, sound-with-sound and echo capabilities; 3 separate motors; solenoid operation; die-cast top-plate, flywheel and capstan shaft housing; all push-button controls; automatic shut-off; plus a host of other professional features. 45 lbs. Optional walnut base $19.95, adapter ring $4.75

NEW 4-Speed Transistor Portable Phonograph Kit!

Worth at least 50% More!
Assembles in 1 to 2 hours ... just wire one small circuit board, mount the 4" x 6" speaker and plug in the preassembled changer. Features automatic mono play of all 4 speeds; dual Sapphire styli for LP's or 78's; 45 rpm adaptor; olive and beige polyethylene over sturdy, preassembled cabinet. Compact size and light weight for suitcase portability. Operates on 117 v. AC. 20 lbs.

Kit GD-16
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All-Transistor 30-Watt FM /FM Stereo Receiver Kit

Kit AR-14
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(less cabinet)

Features 31 transistors, 10 diodes for transparent transistor sound; 20 watts RMS, 30 watts IHF music power @ ±1 db, 15-50,000 Hz; wideband FM/FM stereo tuner, two preamplifiers and two power amplifiers; compact 3⅞" H x 15¼" W x 12" D. size. Assembles in around 20 hours. Mounts in a wall, or optional Heath cabinets (walnut $9.95, beige metal $3.95) 16 lbs.

Deluxe 10 Band Transistor AM /FM /Shortwave Portable Radio Kit

10 bands tune longwave, broadcast, FM and 2-22.5 MHz shortwave. Features 16 transistors, 6 diodes, 44 factory-built and aligned RF circuits; separate AM and FM tuners; two built-in antennas; 4" x 6" speaker; battery-saver switch; earphone and built-in jack. Operates anywhere on 7 flashlight batteries, or on 117 v. AC with optional charger/converter GRA-43-1 @ $6.95. Assembles in 10 hours. 17 lbs.

Kit GR-43
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In The New FREE Heathkit® Catalog

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Kit SB-301
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(less speaker)

Complete coverage of 80 thru 10 meters with all crystals furnished, plus 15 to 15.5 MHz coverage for WWV; full RTTY reception capability; built-in switch-selected ANL; front-panel switching for control of 6 and 2 meter plug-in converters; crystal-controlled front-end for same rate tuning on all bands; 1 kHz dial calibrations — 100 kHz per dial revolution; plus the same styling and features of the famous Heathkit SB-300 Receiver. 23 lbs.

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Kit SB-610
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Operates with transmitters 160 thru 6 meters, 15 watts thru 1 KW, and with receiver IF's through 6 MHz; displays envelope, AF & RF trapezoid patterns; function switch position for RTTY; full mu-metal shielded CR tube; two-tone audio test oscillator with balance and output level controls; full capability with Heath SB-series equipment; manual contains discussion for use with CB units. 14 lbs.

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NUVISTOR SWL BOOSTER

There's gold in them thar SW bands and this hot preselector will prove it.

By HERB FRIEDMAN, W2ZLF

REVOLUTIONISTS transmitting on a flea-power rig during an uprising in a Latin-American country. Hopeful politicians in a newly independent nation broadcasting fuzzy music from their country to show the world that theirs is a land of importance. Now that's real DX!

But rare is the budget SWL receiver with enough sensitivity to dig those stations out of the mud. While some receivers offer quite a bit for a modest price, their sensitivity on the important SWL frequencies—5 to 15 mc—is likely to be something like 16 microvolts for a 10db signal-to-noise ratio. And that's like not much. To dig out the rare stations you need a sensitivity of 1 μv or better. The best way to get it, short of buying a gold-plated receiver, is with EI's Nuvistor SWL Booster.

The booster has been designed specifically to give super sensitivity to budget receivers—that is, receivers without a tuned RF stage. Construction has been tailored for the beginner. Even if you're a novice at building projects you should be able to construct the booster with a minimum of problems.

Using a tetrode Nuvistor, the booster has up to 40 db gain from 5 to 15 mc. Theoretically, this would give a receiver with a sensitivity of 16 μv a sensitivity of 0.16 μv. In practice, however, noise and other troubles get in the way and the actual sensitivity will end up being in the neighborhood of 0.5 to 1 μv. In tests with a popular budget receiver that was near dead from 12 mc up, the addition of the booster filled the dial with stations.

Construction

Because of its extremely high gain, the booster may tend to be unstable (will oscillate) unless it is built *exactly* as shown. Follow the pictorial and Parts List to the letter, make no substitutions or changes and there'll be no trouble.

Using the dimensions in Figs. 1 and 2, drill the front and rear panels of the U-section of the Minibox. Then cut and drill the internal shield. The shield can be made from a piece of scrap aluminum or an old Minibox. Start construction by mounting V1's socket on the shield.

Depending on its style (there are two types), the Nuvistor socket may not be the easiest thing to mount. We suggest this pro-

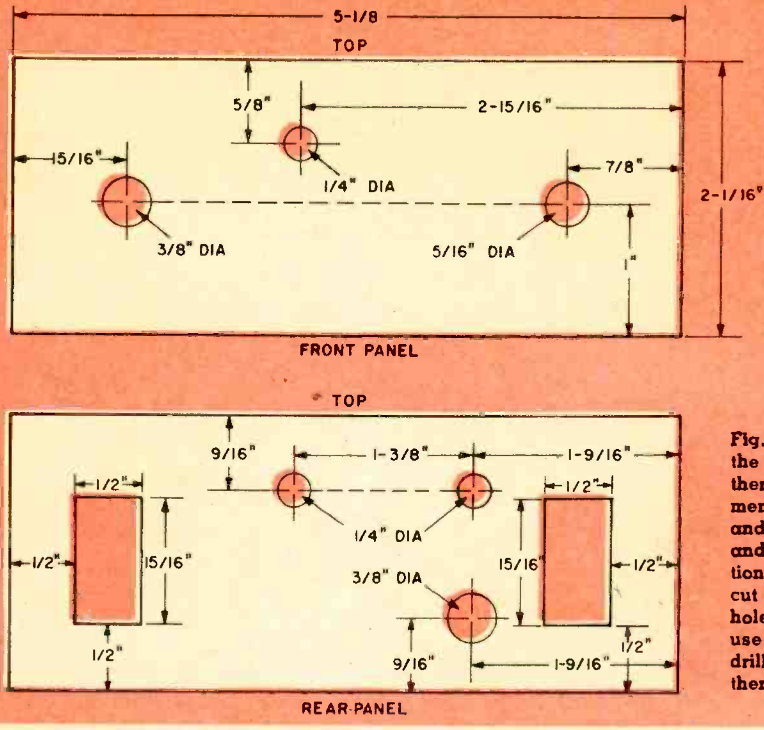


Fig. 1—Position of all the parts is critical; therefore, use these dimensions for cutting and drilling the front and rear of the U-section of the Minibox. To cut the rectangular holes in the rear panel, use a nibbling tool or drill several small holes then file away metal.

cedure: bend out the two mounting straps so they are in the same plane as the top of the socket. Hold the socket in place and fit two screws or rivets through ⅛-in.-dia. holes drilled so they are adjacent to each tab. The screw or rivet heads will secure the straps insuring a solid, well-grounded mounting. Make certain the socket is oriented correctly. If it is turned 180° *do not* cross the leads to it; instead, remove the socket and install it correctly. Put a ¼-in. rubber grommet in the ¼-in.-dia. hole in the shield for R3.

Locate tuning capacitor C5 about ⅛-in. behind the front panel. Using the tapped holes in C5's underside as a guide, mark the hole positions in the bottom of the U-section of the Minibox for C5's mounting screws. Drill the holes but do not mount C5 yet. Next, position the shield so it is centered behind the hole for switch S1. Mark the shield's mounting holes in the bottom of the cabinet. If you prefer, a phono jack can be substituted for the terminal strip TS2. If your antenna transmission line is coax, you also can substitute a phono jack or a coax connector for TS1.

Mount the components in the following order: TS1, TS2, the shield, C5, C1 and S1 (with a jumper across its bottom terminals). Don't forget to mount a terminal strip with the shield (see Fig. 3, bottom). Resistor R3 is mounted in the grommet in the shield. Connect all components associated with V1.

The plate cap for V1 is on the right side of the shield and should be installed last. Note that there are two main ground points. Don't change connections to them or you're likely to have oscillation problems. Finally, mount and wire L1 and then L2. Make certain C7 is mounted as close as possible to L2; C7's ground lead can be long but the lead to L2 must be short.

The coils you receive for L1 and L2 may

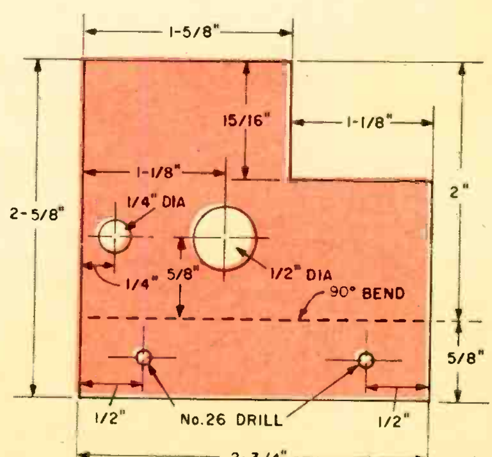
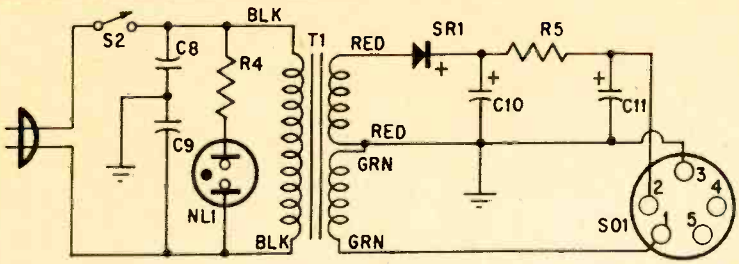


Fig. 2—Shield plate. Nuvistor socket is mounted in ½-in.-dia. hole; resistor R3 fits in grommet in ¼-in.-dia. hole. Bend the bottom toward you.



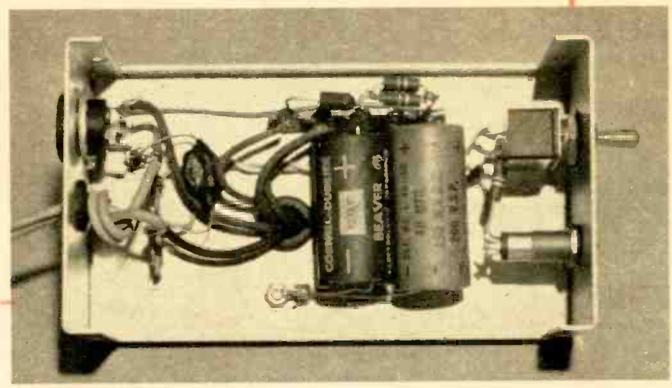


Fig. 6—Power supply schematic and layout. Line cord and socket SO1 are mounted at left. Rectifier SR1 and R5 (we paralleled three 22,000-ohm, ½-watt resistors) are mounted on terminal strip above electrolytics. Power switch and neon lamp are at the right side of the cabinet.

NUVISTOR SWL BOOSTER

nect an antenna to TS1 and tune in a station close to 15 mc or below (WWV is a possibility at this frequency and those listed below) —but not above 15 mc. Adjust the receiver's RF gain control (or use a shorter antenna) so you barely can hear the signal with the audio gain wide open. Then set S1 to *on*. Slowly turn L2's slug-adjustment screw counterclockwise for maximum volume. Then adjust L1's slug for maximum volume. Next, tune in a 10-mc signal and adjust C5, then C1 for maximum volume and mark the panel. Do the same for 5 mc. Finally, put on the 15-mc marks.

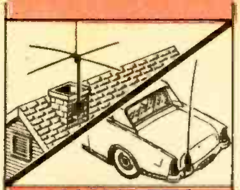
Operation

If your layout is sloppy, the booster may oscillate. Normally it will start below the frequency to which you try to tune the booster. For example, if you try to tune a 13-mc signal by adjusting (turning counterclockwise) C1 and C5 from the high side—the 15-mc position—you'll have no problem. If you attempt to tune (turning clockwise) from the low side—the 5-mc position—it's possible the booster will break into oscillation and jam the receiver.

If oscillation is so severe it always jams the receiver, lower the booster's gain by connecting a 3,300-ohm, ½-watt resistor from the junction of R2 and C4 to the nearest ground lug. If oscillation persists try increasing R1 a few hundred ohms at a time up to 1,000 ohms. If the oscillation continues, move the wiring around slightly and look for poor ground connections. Also check to see whether the antenna wire isn't near or crossing the booster's output cable. Reduced-gain adjustments still will provide between 20 and 30db of gain—3 to 5 S-units.

In normal operation C1's tuning is quite broad while C5's is razor sharp. Always set C1 to the approximate position, for example, between 5 and 10 mc or between 10 and 15 mc and then peak C5. Then go back and peak C1.

The booster should be used only when you're trying to dig for weak stations. Using the booster to receive a normally strong station such as the BBC, VOA or Radio Moscow can result in distortion caused by booster or receiver overload. If there is overload, simply flip S1 to its other position. This will bypass the signal around the booster and feed it directly to the receiver.



CB CORNER

BY LEN BUCKWALTER KBA4480

BOiL SOME WATER!!!

CB has its seamy side, but it also has heart for people in trouble. CB has delivered its first baby! Vital statistics—sex: female; name: Cyncelia Rae; weight: 8 lb., 9½ oz; bouncing—of course!

It began in Des Moines when Mrs. Lloyd Miller erred in figuring her baby wasn't due for another week. But the blessed event ignored her calculation and commenced to happen anyway. Hubby, like Alice, grew more nervous by the minute. Call for help? Dash to the hospital? Sorry . . . neither telephone nor automobile was available to the Millers.

So Mr. Miller did the next best thing. He fired up the CB rig and broadcast his growing dilemma. An answer came from Mrs. James Tipton, who happened to be monitoring the channel. Little did she know she was about to become a mid-channel midwife. Her instructions by radio enabled Miller to perform a less-than-routine, but nevertheless successful delivery.

What did Mrs. Tipton say to Mr. Miller via CB? Much as we'd like to tell, regulations prohibit us—a third party—from revealing transmissions of a first party.

Cash Benefit. . . Maybe Grandpa never strayed more than 50 miles from home, but chances are one in five that you'll move this year. That's what the Census Bureau tells us. And the tab for footloose CBers has been $8 per move. Just changing address meant filing a completely new application, plus fee.

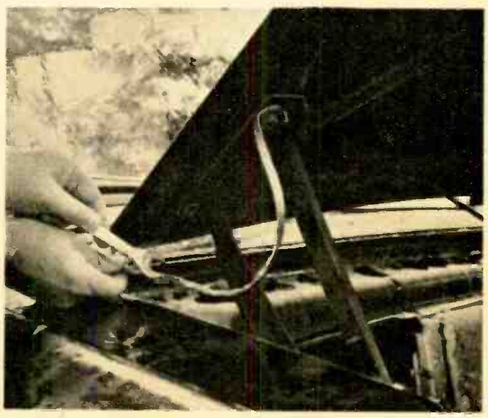
But if you're king of the road, operate from a moving home, or fall victim to statistics, there's cause to rejoice. An FCC order now in effect kills the $8 license fee if you merely change address. To obtain the cost-free modification to your ticket, write a letter to the FCC, Gettysburg, Pa. 17325. Tell the Commission your new address, call sign and class of station authorized by your license. Be sure to keep a copy of the letter at your station. That's all there is to the modification.

Another new twist is that the name of a licensee (but not the station's *owner*) may also be changed the same way. Just a letter, no fee. This, however, will apply to only a few CBers since most licensees are also station owners.

A sidelight on the new rule might have shocking, though temporary, effect on your ear. If you live in Iowa you might be called by California or New England. But these signals won't be arriving via skip. More likely they're distant CBers who have taken up residence in your area. After notifying the Commission of an address change, their original call sign—first issued on a district basis—will move with them. Thus, prefixes are no longer a reliable clue to a station's home QTH.

Sinking a Hood. . . Your car has a big, expensive shield against ignition noise—it's the hood. That mass of metal over the engine helps confine noise escaping from the sparkplugs and other wires. But frequently the hood is poorly grounded to the car frame. This causes the hood to float (electrically, that is) and possibly increase the ignition noise. The sheet-metal behaves something like an antenna plate.

[*Continued on page* 114]



If not electrically connected to car body, hood will radiate ignition noise. Remove dirt under bolts and connect hood to body with wire braid.

the case of the VANISHING BATTERY

By J. K. LOCKE

IN A BASEMENT in Cleveland a rabbit circles its cage. Beneath its skin an aspirin-size transmitter detects electrical signals generated in its muscles. A nearby receiver picks up the muscle signals and records them as a series of squiggly lines on a graph. Because of this, paralytics some day may walk.

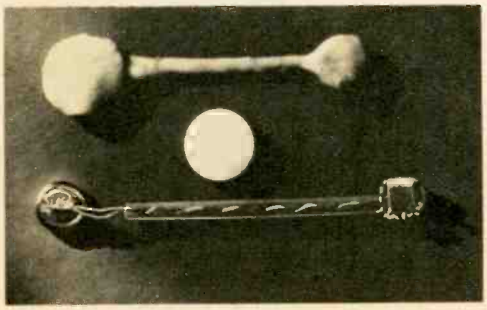
Ten thousand feet over North Vietnam, a surface-to-air missile smashes into a U.S. fighter. The wounded pilot ejects, then passes out. Minutes later, a helicopter buzzes into view, homes in on the still-unconscious pilot and picks him up—even though the chopper did not see the pilot go down. A cigarette-pack-size radio beacon built into the flier's parachute automatically began sending electronic help signals when the chute opened.

A woman lies in bed, asleep. Beneath her mattress an antenna picks up faint radio signals coming from a tiny transmitter in her body. This setup sharply increases her chances of having a much-wanted baby.

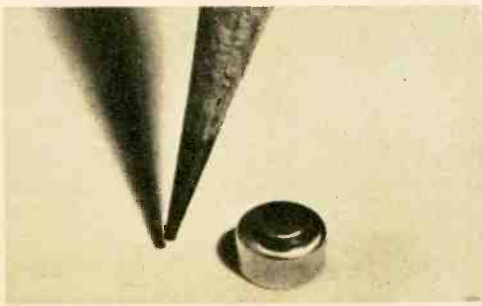
These miniature, battery-powered devices —the muscle-signal transmitter, the emergency beacon, the fertility indicator—are but three offspring of the fruitful marriage of two rapidly-advancing technologies: solid-state electronics and electrochemistry. The first has produced the transistor, the tunnel diode and, more recently, integrated and thin-film circuits. The second has come up with super-small, super-powerful, long-lasting batteries to power them. The combination makes possible a series of devices able to perform a wide range of previously-impossible jobs.

Take that birth device, for example. Doctors long have known that a woman's fertile period is signaled by an abrupt change in temperature. Dr. Alvin Singer of Colmar, Pa., and electronics experts from the American Electronics Laboratory of Lansdale, Pa., began work a few years ago on an experimental device called a Basalog that could keep the kind of continuous record that a would-be mother would need.

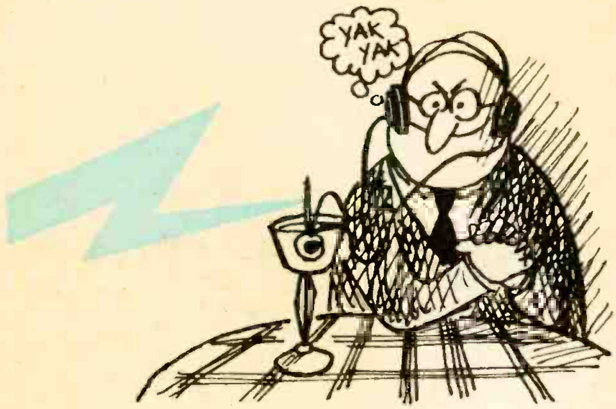
The patient wears a tiny, battery-powered



Aspirin tablet gives scale of unit that transmits myo signals from rabbit muscles. In unencapsulated unit (bottom), battery is at the left.



High-energy mercury battery delivers 1.35 volts at a high watt-hours-per-pound ratio. Pencil dramatizes small size of cells now on market.



transmitter internally at night. As her basal temperature changes, so does the transmitter's frequency. An antenna under the mattress picks up the signal and sends it to a receiver-recorder next to the bed. There, a line showing temperature through the night is drawn on a moving chart. With the continuous temperature record, the patient can pinpoint ovulation far more accurately than has been possible before.

The Basalog even may help patients determine the sex of an unborn child. Research indicates that more boys are born if fertilization takes place just before or near the time of ovulation; girls are more likely with late fertilization.

The Basalog, while a dramatic new use of subminiature electronics, is far from the first submini medical application. In fact, one of the most successful uses began helping critically ill patients more than five years ago.

The normal human heart is kept beating by electrical signals generated in a special bundle of cells called the pacemaker. Sixty to 70 times a minute, these signals spread through the heart, timing its vital rhythm as precisely as an orchestra conductor.

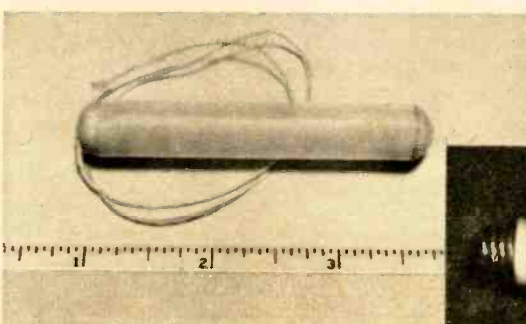
But sometimes the pacemaker fails. The heartbeat falters, becomes slow and irregular. Unconsciousness can result, sometimes death.

In the late 1950s, doctors and electronic experts developed an artificial pacemaker hardly larger than a pocket watch. It can be buried in the body and wired directly to the heart. Today, more than 10,000 patients with faulty natural pacemakers lead virtually normal lives with this electronic substitute in their bodies. Long-lived mercury batteries run the unit for three years or more. When they run down, the batteries can be changed in the doctor's office, under local anesthetic.

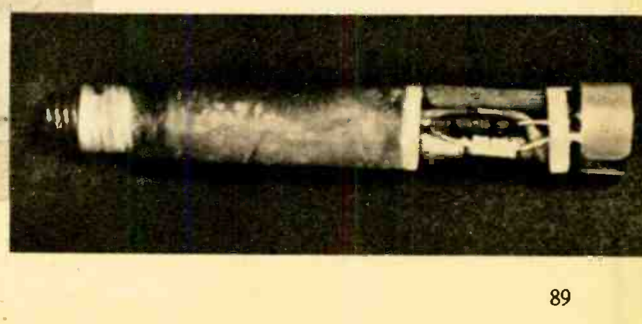
Other parts of the body can be made to work with electrical prodding, too. Dr. Seymour Schwartz of the University of Rochester, for example, found that sending streams of electrical pulses to the carotid sinus nerves of dogs with high blood pressure instantly lowered the pressure. He tried the procedure on human patients—and found that it worked there, too. "The pressure drops dramatically right on the operating table as we connect the unit," says Dr. Schwartz.

So far, these silver-dollar-size units, called baropacers, have been implanted in a handful of patients and results are impressive. Doctors now are waiting to see what the long-range effects are before putting the technique into wide use.

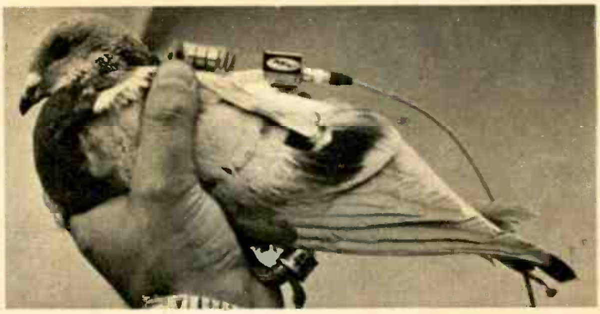
Dr. W. T. Liberson of the Hines VA Hospital near Chicago has worked out yet another device. Patients partially paralyzed on one side of the body have difficulty walking normally. Liberson developed an electronic splint that sends little jolts of electricity to



The Basalog transmitter, designed to be worn internally, responds to slight temperature changes by shifting frequency. Signal from transmitter element (below) is picked up to graph temperature as aid to would-be mother.



Emergency unit helps downed U. S. pilots two ways: rescue craft can home on 243-mc beacon with direction finders or get visual fix on flashes from xenon tube.



Transmitters like this one by American Electronics Labs are used by naturalists to trace migration patterns. Other models for human use can monitor physiological variables.

the case of the VANISHING BATTERY

This tooth contains a 6-channel, battery-powered transmitter designed to send out inside information on workings of teeth and mouth for study. Object: creation of better fillings and dentures.

paralyzed leg muscles as the patient walks. The stimulated muscles contract and help the patient walk more normally.

Ultimately, far more sophisticated devices may be developed to help paralytics. Since normally contracting muscles give out small electrical signals of their own—so-called myo signals—it might be possible to hook small sensing devices to muscles that a partially paralyzed patient rarely uses—say, for example, a muscle in the neck. When the patient moves the neck muscle, the myo signal would be picked up, amplified and applied to another muscle, perhaps in the arm. In this way, a paralytic who could not move his arm directly might be able to do so indirectly by flexing various muscles.

Dr. Wen Hsiung Ko of the Case Institute of Technology, Cleveland, has been doing experiments that might lead to such a system. Dr. Wen has built tiny transmitters smaller than shirt buttons and implanted them in the muscles of rabbits. When the rabbits move, the transmitters send out the myo signals generated in the muscles. Now Ko is working on equally-small receivers that could be buried in muscles and used to stimulate them internally. Similar devices also are being used in several countries to control the motion of artificial limbs.

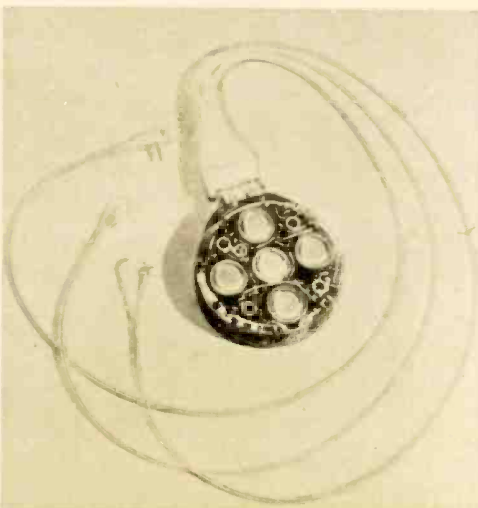
Already it has become routine for patients to gulp down radio pills hardly bigger than ordinary medical capsules. The pills send out inside information on pressure, temperature and what you had for breakfast. Dr. Major M. Ash of the University of Michigan has built a radio tooth containing a six-channel transmitter. Mount it in a patient's mouth and it telemeters detailed information on how the choppers chop. With its help, dentists hope to design better fillings and false teeth, and learn more about how the mouth works. And then there are the fantastically small hearing aids that slip completely in the ear.

Although medicine is an important field for small battery-powered electronic devices, it is far from the only one. Surreptitious listening devices—from a wired-for-sound martini olive to a bug for your telephone—have been much in the news recently. Naturalists use microelectronic devices attached to anything from birds to sea turtles to answer questions about migration.

Military uses for tiny electronic gadgets are multiplying, too. If a combat pilot has to bail out, he takes with him a small transceiver mounted in what looks like an olive-drab sardine can. The battery—enough for almost 24 hours of continuous operation—is another sardine can in his pocket. With this unit, he can call for help, or, if he's unconscious, that beacon transmitter packed into his parachute goes into operation automatically.

Rescuers even can come in at night. Pilots now carry a shirt-pocket device that puts out high-intensity xenon flashes which can be seen for 20 mi. It also has a built-in beacon in case something happens to the one on the chute.

Scientists at Electro-Optical Systems, Pasadena, Calif., have produced binoculars that can be used to see in the dark. The transistorized, battery-powered circuitry (which is in effect an ultra-sensitive closed circuit TV system) is hardly bigger than standard binoculars and the battery lasts about a year.



Artificial pacemaker keeps patient's heart going when natural timing mechanism fails. Photograph shows unit by Cordis Corp.; X-ray at right—of patient's chest—was made after implantation of pacemaker. Battery can be changed (after 3 years) in doctor's office with local anesthetic.

Most of these modern-day miniature electronic wonders were made possible by a single discovery during World War II. The batteries then available—standard carbon-zinc cells, such as we still use in flashlights—couldn't stand up under heat. An independent inventor, Samuel Ruben of New Rochelle, N. Y., solved the problem by building a practical, heat-resistant, mercury-alkaline cell. The Signal Corps immediately began buying them and by war's end more than a million were coming off production lines each day.

But Ruben found that his new mercury cell had another important property: it packed far more power into every ounce of weight than did the old standard zinc-carbon cell. Where the zinc-carbon battery produces perhaps ten to 15 watt-hours per pound, the mercury cell cranks out 45.

Then, once the mercury cell was established, Ruben invented the high-current-drain manganese alkaline cell, now used principally for photoflash and such motor-drive applications as movie cameras and small tape recorders. Finally, he invented the silver-alkaline cell, which produces a somewhat higher voltage than the other two. It is expensive and used for the most part in space applications, where the extra voltage is important and cost is not.

The new high-energy batteries, especially the mercury cell, really came into their own in the 1950s when the transistor went into production. The cells used by the heart pacer, for example, are only some ¾ in. in diam-

[*Continued on page* 118]

KIT EI REPORT

EICO 753

3-BAND -MODE TRANSCEIVER

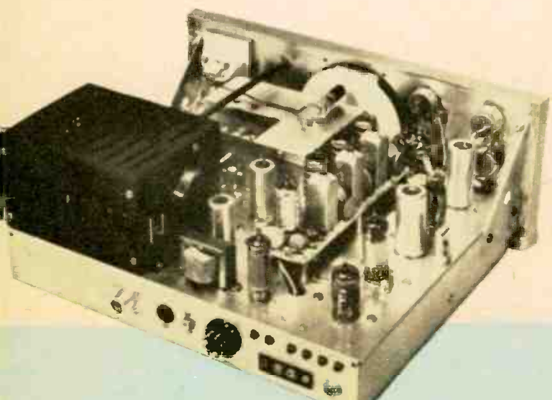
IT wasn't long ago that the typical ham shack was a floor-to-ceiling pile of equipment off in a corner of the basement or attic.

Today there's a good chance the shack is right in the living room. But instead of an ugly pile of gear connected with dozens of cables, the station is very likely to be a transceiver—a transmitter, receiver, switching relay and all wiring tucked into one smartly-styled 1- x 2- x 3-ft. cabinet. In fact, transceivers now are the hottest thing in ham radio. They're compact, yet have all the advantages of a component-type station. And then some.

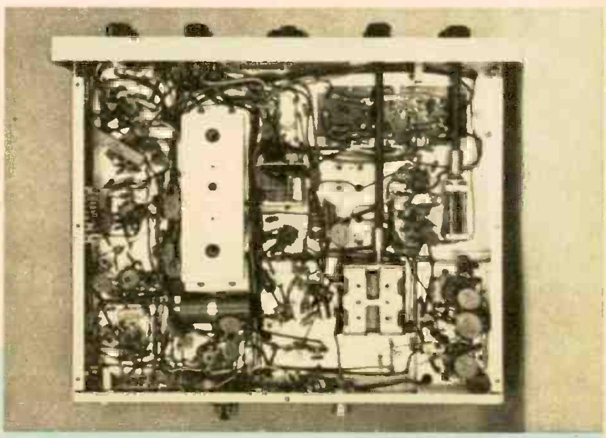
The modern ham transceiver is VFO-controlled on both transmit and receive. Nevertheless, the receiver's frequency can be offset several kc from the transmit frequency without detuning the transmitter. Input power usually runs a healthy 200 watts or more (SSB and CW), transmit/receive switching is internal and voice control (VOX) is almost always included. The operator need only connect a microphone and an antenna to get on the air. Best of all, the transceiver's cost usually is much less than that of a comparable component-type station. The owner may be called an appliance operator—but he's on the air.

A typical example of what can be squeezed into a small cabinet is EICO's $189.95 ($299.95 wired) Model 753 Tri-Band SSB/AM/CW transceiver kit. An AC power supply/speaker (Model 751) or 12 VDC (Model 752) power supply are extra at $79.95 each ($109.95 wired).

The 753 is designed primarily for SSB operation. Like several other ham transceivers, it covers the 80-, 40- and 20-meter bands. On 80 and 40, lower sidebands are transmitted. On 20 meters upper sidebands are transmitted. A front-panel switch enables you to



Final is enclosed at left. Rear apron has antenna connector; xtal-calibrator power socket; power plug and VOX, S-meter and final balance controls.



The 753's underside is jam-packed with parts. For this reason you must take care during construction since mistakes will be difficult to locate later.

select SSB, CW or AM operation. As is typical of low-cost SSB transceivers, AM phone operation is more-or-less a throw-in. It's included because the circuits can be adapted easily for AM operation.

The 753 contains the usual transceiver features: crystal lattice filter, VOX, PTT, fast-attack AGC (automatic gain control), ALC (automatic level control—speech compression when transmitting), a 40- to 80-ohm pi-net output and plate-current metering of the final's output tubes.

Additional features are receiver offset tuning (which permits the receiver to be detuned ± 10 kc from transmit frequency) and a user-adjusted hairline set for VFO dial calibration. A switch on the microphone gain control supplies operating power to an external crystal calibrator (extra).

Though the 753 has 16 tubes, the VFO is solid state to provide greater frequency stability in mobile service. By not using a tube (whose filament and operating characteristics are sensitive to voltage variations) VFO stability is not affected by a car's fluctuating voltage. The VFO's voltage is stabilized by a zener diode.

Except for the final's neutralizing capacitor, which need be adjusted only once, all controls are on the front panel or rear chassis apron.

Assembling the Kit. If you haven't become a ham because of the high cost of equipment the 753 transceiver may be a solution to the problem. But it could raise a whole new set of problems as it is a difficult rig to put together. There's a lot of hardware to be packed into limited space and if the rig doesn't work troubleshooting will be a major undertaking.

The manual is easy to follow and well illustrated but we found a few errors in it (these errors now have been corrected by EICO). At one point the instructions told us there were three leads to be soldered to a particular lug. Only two were shown in the pictorial. As it turned out, the pictorial was correct. At another point, the illustration did not look like what we saw on the chassis.

It took us about 25 hours to assemble the transceiver, four hours to get the AC power supply/speaker together and three hours to finish the mobile supply. It required less than 30 minutes for a full tune-up after the kit was completed.

How it Worked. The 753's performance was excellent. With 200 watts of input power to the final, it delivered (in the SSB and CW modes) 110 watts into a 50-ohm load on 80 and 40 meters and 95 watts on 20 meters. Microphone gain is exceptionally high—a low-level broadcast mike required only one-quarter rotation of the mike-gain control for maximum SSB modulation. Typical of SSB transceivers (where AM is added because it's convenient) AM output was about 40 watts when the input power was 120 watts.

The receiver's sensitivity requires an explanation. Originally, we found the sensitivity for a 10db S + N/N ratio to be 1.8 μv on

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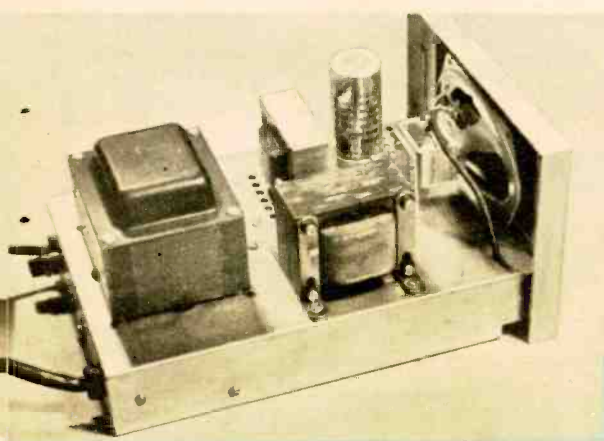
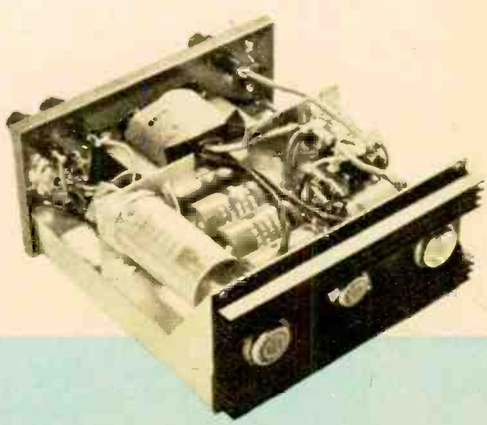


Transceiver won't work alone. You must purchase AC power supply and speaker to go with it. Supply's front panel is styled to match transceiver.



For 12-V mobile operation you need this solid-state power supply. The unit is protected against both overload and accidental polarity reversal.

BEGINNER'S CORNER

3 Basic Radios

THAT transistor portable in your pocket and the five-tube AC/DC at home—as broadcast radios go, they're not the only fish in the sea. There are much cheaper and simpler receivers that you can build which will not only pull in local broadcast stations, but will demonstrate several important basic concepts of radio reception.

We'll begin with the most basic radio—a crystal set—then improve it with an amplifier. The third receiver we'll build is an extremely sensitive regen. By building them in succession you'll be able to use the same parts and observe differences in each circuit's performance.

Crystal Radio. This one's a classic since it's so old and does so much with so little. It demonstrates fundamental concepts applicable to any receiver: tuning, detection and audio reproduction. Its schematic is shown in Fig. 1 along with oscilloscope photos that show the incoming signal and what happens to it.

All radio signals reaching the antenna induce small voltages in it. Coil L1 and capacitor C1 *tune*, or select, the desired station's frequency. Signals whose frequencies are higher than that to which L1 and C1 are tuned flow to ground through capacitor C1. Lower-frequency signals are grounded by coil L1. Only the desired (tuned) signal *resonates*, or is built up in intensity in the tuned circuit. Since the coil's inductance is adjustable, you can select any station you want.

Our scope photos show what the signals in the radio look like. When audio is not transmitted, a steady unmodulated RF carrier (in this case, 800 kc) appears at the top of L1. When an audio signal modulates the carrier, it puts peaks and valleys on the carrier. The receiver's next job is detection—the recovering of the original transmitted audio.

Crystal-diode D1 performs the first step in the detection process. Since D1 is a rectifier, it removes one-half of the RF signal. (In our circuit D1's polarity is such that only the positive part of the RF signal will get through D1.) Unless half of the RF signal is removed, the positive and negative halves will

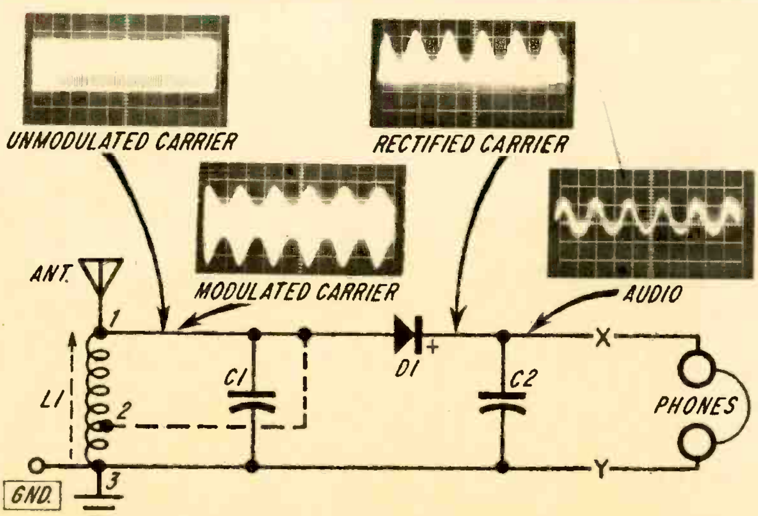


Fig. 1—Simplest radio is a crystal set—a modern-day version of the old cat's-whisker design. It requires no operating power. Incoming signal is tuned by L1,C1 combination. Selected signal is rectified by D1. RF is stripped away (filtered) by C2. Remaining audio signal drives phones directly. Photos show signals in circuit when the radio receives an 800-kc RF signal which is modulated by a 1,000-cps audio signal. To improve the selectivity, connect (broken line) D1 to the tap (2) on L1.

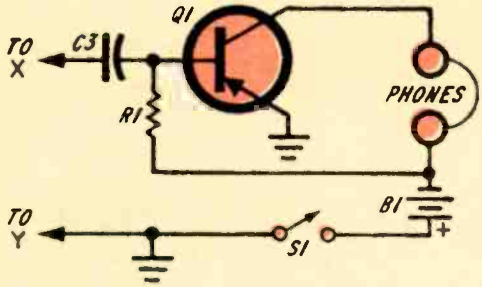


Fig. 2—Connect this simple one-transistor amplifier to points X and Y in the basic crystal set in Fig. 1, and you'll notice a big boost in volume.

cancel each other out. After you build the crystal radio, reverse D1 and note that the radio works equally well on the positive or negative halves of the signal.

The third photo shows what the rectified RF carrier looks like. But the signal cannot yet be applied to the headphones. Reason is the rectified signal is still RF—not audio. Next step in the detection process—filtering—converts the RF to audio. Capacitor C2 stores voltage during each peak in the wave and discharges it back into the circuit between peaks. The signal is now converted to a smooth-changing DC signal corresponding to the original audio-modulating signal. This is shown in the photo at the right. Fed to the phones—the reproducer—it's converted to audible sound.

Since the crystal receiver produces only a small signal, you must use a good antenna and ground. The antenna should be 40 to 100 ft. long. The ground can be a cold-water pipe.

The crystal set's ability to separate close-spaced stations is not good. But you can improve it with some sacrifice in signal strength by removing the lead from D1 that goes to C1 and connect it (broken line) to the tap on L1. This reduces the short-circuiting effect D1 has on the tuned circuit and should improve selectivity. This connection may be left in place if there are strong local stations interfering with each other.

Amplified Crystal Radio. Volume can be considerably improved by adding the 1-transistor audio amplifier shown in Fig. 2. The transistor will amplify the former weak headphone signal. You should be now able to hear stations that were formerly faint or inaudible. The amplifier is connected to points X and Y—where the phones were originally connected.

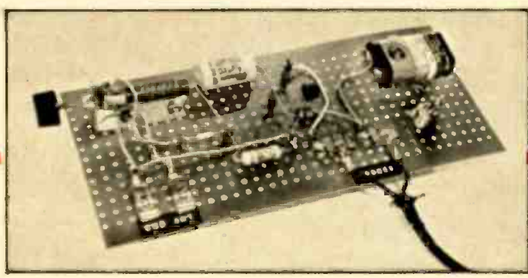


Fig. 3—Photo at left is of basic crystal set to which one-transistor amplifier has been added. Wide-open layout allows you plenty of room to experiment with circuit.

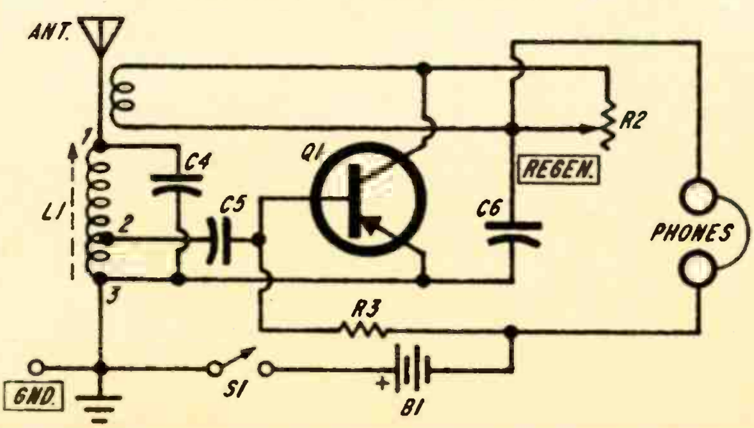


Fig. 4—Schematic of regen receiver. Tuned RF signal is amplified by Q1 and fed to tickler winding (shown between antenna and L1) which is wound over L1's winding. Signal is coupled to L1 and fed back to Q1 where it is further amplified. R2 controls amount of feedback. Signal is detected in Q1's base-emitter junction, fed to phones.

3 Basic Radios

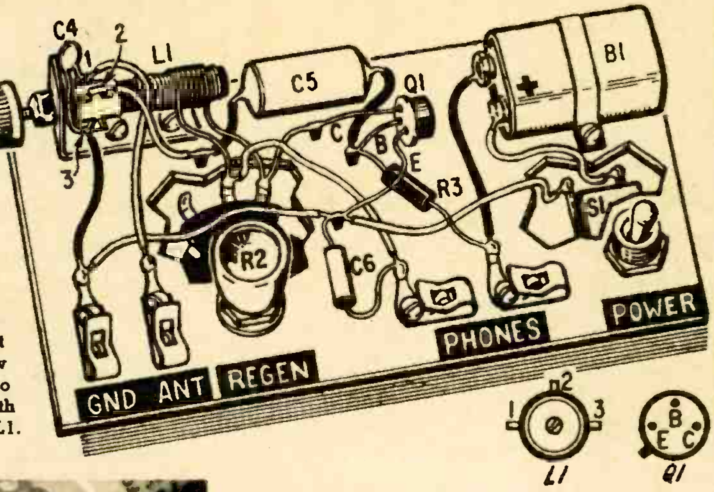


Fig. 5—Diagram at right shows regen's parts layout on a 8½ x 3½ in. piece of perforated board. Arrangement isn't critical, but allow yourself enough space so you can experiment with tickler winding on L1.

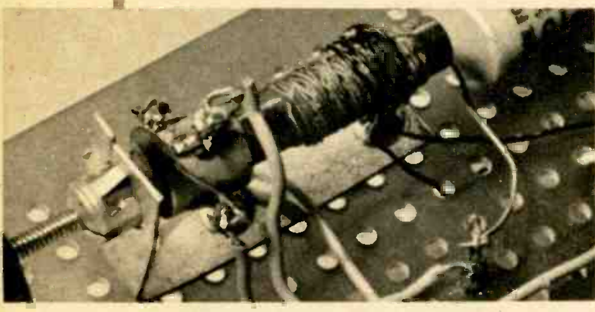


Fig. 6—Closeup of coil L1. Note where and how the tickler winding (shiny dark wire at top) is wound on coil. Wind it loosely so it can be moved.

PARTS LIST

B1—9 V battery
C1,C4—330 μμf, 1,000 V ceramic disc capacitor
C2,C6—.001 μf, 400 V tubular capacitor
C3,C5—.1 μf, 200 V tubular capacitor
D1—1N60 diode
L1—Loopstick antenna (Superex VLT-240. Allied 91 U 286)
PHONES—2,000 ohm headphones (Allied 86 U 083 or equiv.)
Q1—GE-1 transistor (General Electric)
R1—470,000 ohm, ½ watt, 10% resistor
R2—10,000 ohm, linear taper potentiometer
R3—1.5 megohm, ½ watt, 10% resistor
S1—SPST toggle or slide switch
Misc.—No. 22 enameled wire, 8½ x 3½-in. perforated circuit board, flea clips, fahnestock clips.

Although the amplifier improves receiver performance, there's an even better circuit which uses only one transistor. By adding a coil, a few other parts and making minor changes, the receiver will be hundreds of times more sensitive than the previous circuits.

Regenerative Radio. In this radio (Fig. 3) a transistor (Q1) is connected as a straight RF amplifier. Note that D1 (the detector) is missing. The RF signal from the tuned circuit is applied to the base of Q1 and is amplified as is—unchanged except for strength. But this modification to the tuning circuit provides an amazing amount of amplification. Here's why.

Note the tickler coil, that extra winding between the antenna and L1, in Fig. 3. When the RF signal is amplified in Q1, it is not converted directly to audio. Instead, it is fed from Q1's collector to the tickler coil. The coil feeds the signal back into the tuned input circuit. This is known as regenerative feedback. That is, the original weak signal keeps circulating around and around and is amplified far more than if it simply went through Q1 in conventional fashion.

The amount of feedback must be controlled. If feedback is too great, Q1 becomes an oscillator and produces a howling sound in the phones. The coil is called a tickler because in older radios, it was rotated mechanically (tickled) until it coupled just enough signal back to the main tuning coil. Our circuit has a fixed coil, but the coupling is controlled with a regeneration control (R2). By varying resistance of R2, the amount of signal fed back can be controlled easily.

Another feature of this radio is that a diode detector is not needed. In this circuit, the sig-

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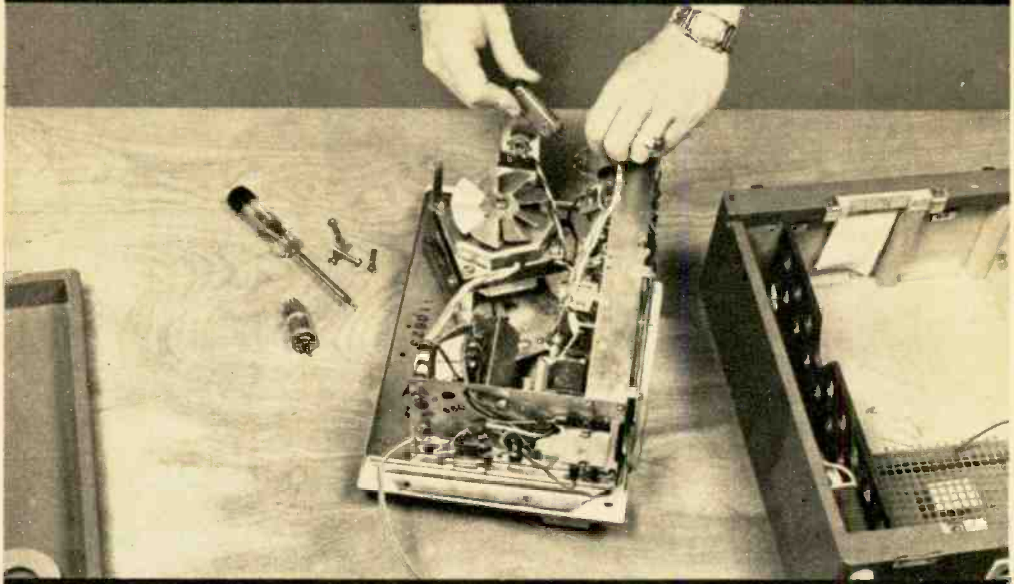


TONICS FOR TAPE RECORDERS

By
HERMAN BURSTEIN

SURE, it may have seen better days and played sweeter music. And it probably could boast that enough tape has passed its heads to reach the moon. It has aged quite a bit since it was unpacked but, like most old tape recorders, it just won't lie down and die. It's pooped-out, all right, but a shot or two in the arm will give it new life.

Heads go askew, dirt accumulates in the wrong places, the drive mechanism falters and tubes give up the ghost. It's an easy matter to rescue a recorder long before sounds get soggy. All it takes are sharp ears, a few accessories, plus a VTVM and an audio generator.

Preliminaries

Even if your machine still produces good sound, a bit of routine maintenance will help keep it that way. Most important thing is to keep the heads clean. Swab away bits of dirt and tape oxide with a Q-tip moistened in tape-head cleaner. Remove deposits from the erase, record and playback heads as well as tape guides, rollers and posts. And all those metal parts that contact the tape also should be demagnetized at this time. If your machine uses drive belts, replace them if there are signs of stretching. Replace all rubber that's worn flat or is rock hard.

Gently move the connecting cables between input and output connectors and the machine's electronics while making a test recording. Do the same with leads to the erase, record and playback heads. If hum level changes or there's noise, look for a broken or loose connection. Lubricate the machine exactly as explained in the manufacturer's instructions. Don't squeeze the oil can too hard and wipe away all excess oil—especially if it's near the rubber parts. Check all tubes on a tube tester.

Playback Response

Those preliminaries will take care of small

AUTUMN

TONICS FOR TAPE RECORDERS

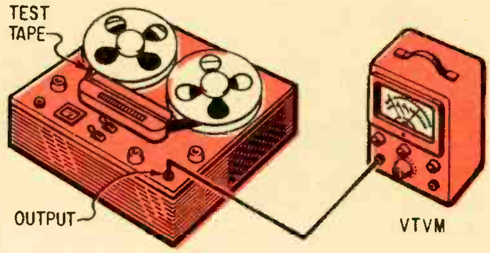


Fig. 1—For playback frequency-response test, measure the machine's output with a test tape that has constant-level tones from 50-15,000 cps.

but nagging things that cause general degradation of performance. If you want to check the results of your efforts, run a frequency-response test. The setup to use is shown in Fig. 1. A test tape (such as Ampex No. 31321-04) is required to provide a series of constant-level signals from 50 to 15,000 cps. If the machine has good playback response it will reproduce each tone equally well, as indicated on the VTVM.

The procedure is to use the tape's 1,000-cps frequency to first establish a reference level on the VTVM. The machine is doing fine if the meter indicates that frequencies from 50 to 15,000 cps are reproduced within 2 or 3 db of the reference-tone's level. (That's for a tape speed of 7½ ips. At 3¾ ips, don't expect the same high-end response.)

Test tapes cost plenty—as high as about $20 for the Ampex we specified. One way to get around this expense is to check response by ear. It's a cinch if you taped a new record when the recorder was unpacked and in mint condition. Play that tape now and compare it with the sound from the disc. The test isn't an end all, but it can offer valuable information about playback quality.

A similar test requires a few dollars for superior-quality prerecorded tape and a disc recording of the same musical selection. When new tape and disc are played back simultaneously on comparable-quality equipment you should be able to make a reasonably good comparison.

Most common fault during playback is loss of high-frequency, or treble, response. This could arise from a worn playback head, which, of course, can be replaced. But if a component in the machine's electronics (other than a tube) is defective, the repair might require the skill of a service technician. Another treble killer is poor head alignment, which we'll get to in a moment.

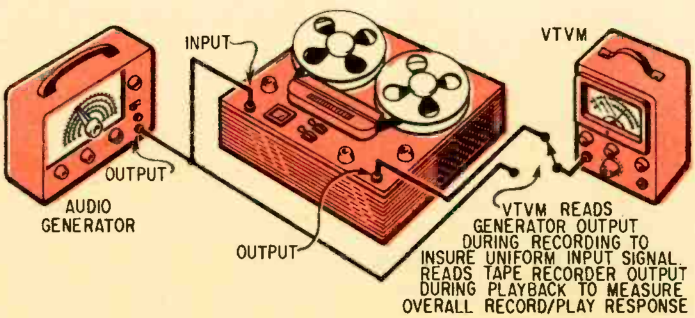
Record/Playback Response

If the recorder passes playback tests, there's still no guarantee it will make it on a record test. An ear test is helpful. Copy a brand new record on tape, then compare disc against tape at playback.

You can make a more critical appraisal if you have an audio generator and VTVM. The test setup is shown in Fig. 2. Begin by recording frequencies from 50 to 15,000 cps. Make sure the output from the generator is kept constant (using the switch, connect the VTVM to the recorder's input) and well below the recorder's overload point. Play back the recorded frequencies. The VTVM will indicate how well the recorder performs during record.

If an audio generator isn't available, next choice is a test record with series of tones that you copy on the tape. This test, of course, assumes your hi-fi equipment has substantially flat response. These frequency tests provide a valuable profile of how wide and

Fig. 2—Setup for measuring record/playback response of a machine. You record audio signals from 50 to 15,000 cps, then measure the playback level with the VTVM. Purpose of the switch is to connect the VTVM to the recorder's input when making the tape. This enables you to keep the level of input signal constant.



smooth the machine's response is.

Head Alignment

High frequencies will disappear if the tape doesn't move past the heads at a 90° angle, as shown in Fig. 3. If a head's position shifts it must be corrected. If your machine has only one head for both record and playback —and you never intend to play a tape recorded on another machine—head alignment is less critical. The error cancels itself. But a head that has moved slightly could adversely affect the quality of your older tapes. Best practice, therefore, is to adjust to 90°.

A test tape on which is recorded a steady high-frequency signal is the best thing to use for azimuth alignment of a head. Again, the indicator is a VTVM connected to measure the recorder's output. As you play back the tape, tilt the head very slightly to the left and right, using the adjustment screws near the base of the head, until the meter indicates maximum output.

If you don't have a VTVM, your ears will do, too. If the frequency of test tone is too high for you to hear, cut the tape speed in half. This will make a 15,000 cps tone drop to 7,500 cps. If neither meter nor test tape is available, you can take a crack at head adjustment while playing a prerecorded tape. Simply listen for best treble response. The technique may appear sloppy, but some audio engineers prefer the ear-only, rather than the instrument, approach to aligning a head.

If your machine has separate record and playback heads, first align the playback head. Then align the record head with reference to it. You do this by recording a high frequency signal and simultaneously playing it back (usually possible on three-head machines that have provision for monitoring while recording).

Using the VTVM to monitor the playback signal, adjust the record head for maximum indication on the meter. If you cannot get an audio generator, try one of the other methods mentioned earlier: that is, a test record or judging by ear using music as a program source.

Bias Current

This adjustment isn't for Sunday putterers, but we'll include it anyway for serious audiophiles. (If your machine does not have a bias-adjust control skip over this section.)

Bias is a high-frequency signal (usually between 50 and 100 kc) which is applied to the record head simultaneously with the signal being recorded. It improves the signal-to-noise ratio and reduces distortion. But you can have too much or too little of a good thing. Ideal bias for one brand of tape might cause treble loss in another. If you want to attempt this adjustment, here's the general procedure: Find out what the manufacturer of the recorder recommends for the bias test frequency (usually between 1,000 and 3,000 cps). Then record that signal. Play back the tape and note the playback level.

Record the tone several times each at different bias settings. The setting that produces the highest playback level is the correct one. But remember, this setting is for the particular tape you used. Switch to a different brand and you should set the bias again for optimum performance.

A second method of adjusting bias is shown in Fig. 4. You determine bias current by measuring the voltage drop developed across a 100-ohm resistor inserted in one lead of the record head. Using Ohm's Law ($I=E/R$) divide the voltage indicated on the meter by 100 and you get bias current. Compare this current with the manufacturer's recommended current and make the necessary adjustment to the recorder. If you attempt bias adjustment without test equipment, you'll have to try for flattest record/

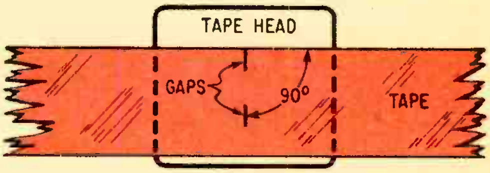


Fig. 3—Azimuth angle (angle between tape edge and gaps in head) always must be 90°. Head's mounting screws are often used for alignment.

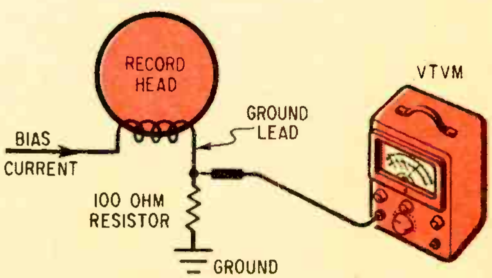
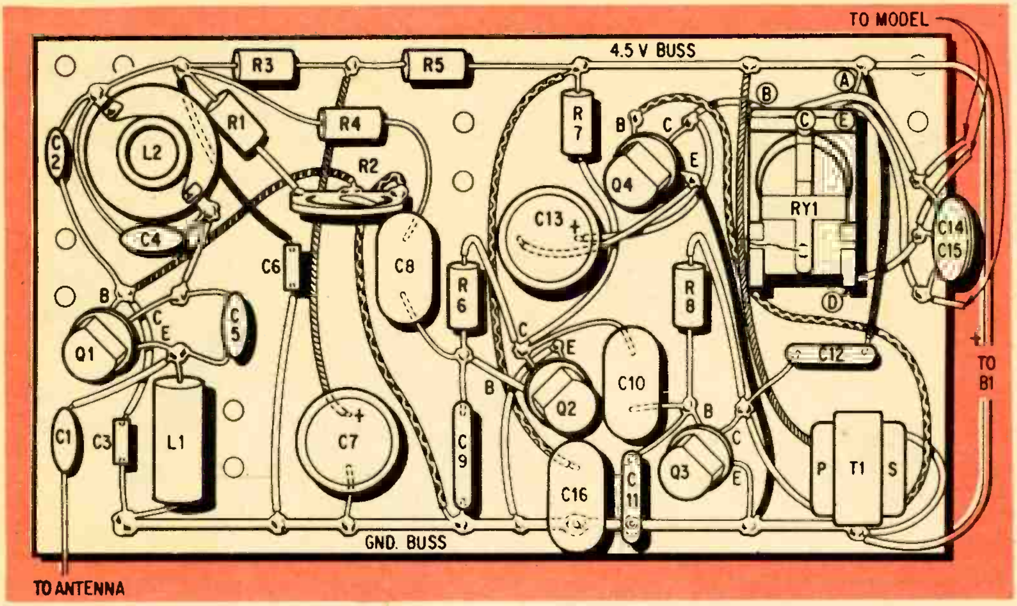


Fig. 4—Measure voltage drop across resistor connected in series with record head's ground lead, then use Ohm's Law ($I=E/R$) to find bias current.



R/C RECEIVER

Fig. 1—Because receiver operates near 72 mc, follow layout exactly at left side of board near Q1. Most wiring in our model is on rear of board. We used a dual .01 µf disc capacitor for C14 and C15.

which our model had.

Several parts are available only from Ace Radio Control. They are marked with an asterisk in the Parts List and the individual prices are included after the description. Ace's address is at the end of the Parts List.

Construction

All parts can be mounted on a 3 x 1¾-in. piece of perforated phenolic board. We used brass eyelets for tie points, but you could use flea clips. Install a piece of heavy wire lengthwise on one of the board's edges. One end of the buss is retained by an eyelet. The other end is soldered to one of T1's mounting tabs. A shorter buss connection runs partially along the top edge of the board, for positive-supply-voltage connections.

Enlarge the holes for the eyelets (not necessary for flea clips) and fasten them in place. Also enlarge the holes for the coil form, the relay mounting screws and transformer T1. When mounting L2, C7, C13 and T1, add a drop of cement to hold them firmly in place.

Leave the transistors until last and be sure to heat sink their leads when you solder them. Note that the collector and base leads of the transistors are reversed from the positions you'd generally expect them to be in.

The leads of T1 should be bent outward a bit, to fit in the holes in the board. Do this job carefully with small pliers or tweezers before you mount T1.

Note that parts layout is very similar to that of the schematic. With reasonable care it's pretty difficult to make a wiring error.

When all parts are installed, carefully check the wiring—especially the transistor connections and the polarity of the electrolytics. If all appears okay, you are ready for a test. The receiver is designed to operate on from 4.5-4.8 VDC—however, it will operate down to about 3.5 V, and as high as 6 V.

The relay will close at around 15 ma and open at about 10 ma. This is satisfactory, but spring tension could be changed a bit to shift these values, as relay current at 4.5 V is around 40 ma. Greater spring tension might be necessary, if vibration in a model causes contact chatter.

Adjustment

Set R2's wiper at the ground end and then connect a 50-ma meter in series with one battery lead. You should read a current of about 2 ma, and the needle should be very steady. Now slowly advance R2, until you'll see the meter jump suddenly to about 20 ma, then drop back as you move the arm farther toward the positive end.

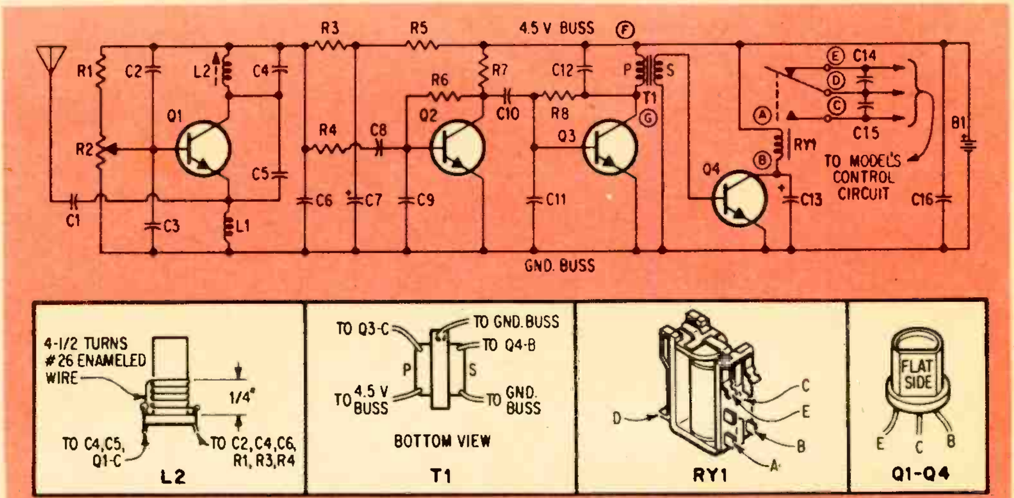


Fig. 2—Superregen detector Q1 is followed by three stages of audio to boost level of signal to actuate relay RY1. Sketches show coil, transformer, relay and transistor details. Wind L1 with care or receiver won't tune near 72 mc. If necessary, expand or compress L2's turns to tune around 72 mc.

The proper setting is when the indication is 3 to 4 ma (no input signal of course). The needle should be slightly unsteady, too. If you connect a pair of high-impedance (crystal) phones in series with a 500 $\mu\mu$f capacitor to points F and G, you will hear nothing with R2 set at the ground end. As you reach mid-range, you'll hear a loud rushing noise, with a vague squeal at first, which will change to a smooth hiss as R2's arm is advanced. The sudden change in noise and meter indication occurs when Q1 breaks into oscillation.

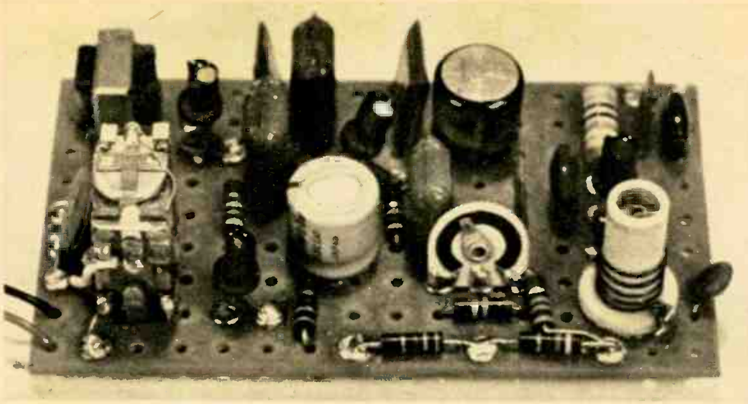
With T2 set to give an indication of 3 to 4 ma, you are ready to tune in a signal. Chances are that if you adjust L2's core over its full range, you might pick up a TV station (channels 4 or 5 if they are in your area). Fully collapse the antenna of your R/C transmitter, turn the receiver on and adjust L2's core for highest indication on the meter. The receiver is designed to tune from around 69 to 77 mc.

Key the transmitter to send a tone or you might miss its frequency. Tuning in an un-

PARTS LIST

B1—1.5 V battery (3 reqd.)
Capacitors:
C1—5 $\mu\mu$f, 500 V silvered-mica (Arco-Elmenco type DM-10. Lafayette 30 R 3504 or equiv.)
C2—100 $\mu\mu$f, 25 V mylar (Lafayette 99 R 6089)
C3,C6—.001 μf, 75 V mylar (Lafayette 99 R 6060)
C4—24 $\mu\mu$f, 500 silvered-mica (Arco-Elmenco type DM-10. Lafayette 30 R 3511 or equiv.)
C5—18 $\mu\mu$f, 500 V silvered-mica (Arco-Elmenco type DM-10. Lafayette 30 R 3508 or equiv.)
C7—50 μf, 6 V electrolytic (Lafayette 99 R 6077)
C8,C10,C16—.1 μf, 75 V mylar (Lafayette 99 R 6066)
C9—.05 μf, 75 V mylar (Lafayette 99 R 6068)
C11,C12—.02 μf, 75 V mylar (Lafayette 99 R 6064)
C13—100 μf, 6 V electrolytic (Lafayette 99 R 6078)
C14,C15—.01 μf, 1,000 V ceramic disc (Lafayette 32 R 0943 C)
*L1—10 μh subminiature molded RF choke (Ace 17K8, 35¢)
*L2—Coil wound on Ace 2175-4-3 coil (form only, 65¢)
Q1—2N3662 transistor (GE)
Q2,Q3—2N2924 Transistor (GE)
Q4—2N3414 transistor (GE)
Resistors: ¼ watt, 10% unless otherwise indicated
*R1—33,000 ohms
*R2—25,000 ohm, subminiature trimmer potentiometer (Ace 29K15, 69¢)
*R3—4,700 ohms, *R4—15,000 ohms
*R5—330 ohms, *R6,R8—470,000 ohms
*R7—3,300 ohms
*RY1—SPDT subminiature relay. 100-ohm coil (Ace 27L17, $4.50)
*T1—Subminiature driver transformer (Ace 17K25, $1.25)
Misc.—Perforated circuit board, eyelets (available from Ace; stock No. SE33. 30 for 10¢)
*Starred items are available at prices indicated plus postage from Ace Radio Control, Higginsville, Mo. 64037. ¼-watt, 10% resistors are 10¢ ea.

Fig. 3—Closeup of receiver. If board did not have to be mounted in the model it could be much larger. Shown here it is about ¾-in. wider than life size. Parts are packed together, but with care you won't have trouble. Relay is at left, white object to right of it is C13, part with round black band is R2. Coil L2 is in right corner.



R/C RECEIVER

modulated but fairly strong signal (like your R/C transmitter with antenna collapsed) will simply cause the test-meter indication to drop from the unsteady 3 or 4 ma to a steady 2 ma. Modulation will cause it to jump to 40 to 48 ma, depending upon battery voltage.

With four freshly charged nickel-cad batteries, it will go well over 50 ma. Relays of higher resistance (up to 300 ohms) will work in the receiver and, of course, battery drain will be much lower. However, the subminiature relay used here is readily available from Ace Radio Control, so you shouldn't have to make a substitution for it.

Once R2 is adjusted, you'll never have to change its setting. In fact, for the general run of transistors, you could use a fixed resistor R2. However, transistors are still highly variable critters, and an adjustment of R2 will enable you to set it for optimum performance from Q1.

Actually R2 can be varied for other purposes. For example, when R2's wiper is near the ground buss (but after the receiver current has taken a decided jump from a steady 2 ma) the receiver is most sensitive. Tuning is also sharpest at this point. If you can call a superregen sharp.

If you do not need as much sensitivity in your application, R2's wiper may be moved toward the positive buss. Noisy servo motors in a model (noisy in the sense that they produce excessive interference from commutator arcing) might make it necessary to cut receiver sensitivity considerably.

If you want to try a different battery voltage, again, you'll need to adjust R2. Generally, you'll want to operate with R2's wiper as close to the positive buss as possible, consistent with reliable reception under all conditions. This includes distance and model position, falling battery voltage, etc.

A transmitter with variable modulation frequency will enable you to peak the receiver for optimum performance. Our model peaked at about 600 cycles—about par for the usual R/C transmitters.

It is too early yet to know just what modulation frequency will be settled upon as the best for 72-mc transmitters. On 27 mc, it's around 600 or 700 cps. Like most superregens, the receiver works best when the received signal is modulated close to 100 per cent. Again, however, the receiver will work well on much less.

When used in a model plane, the receiver should be shock mounted to prevent vibration from rattling the relay armature and to protect the other components from shaking to pieces. The optimum antenna length for this receiver is 15-18 in. It is preferable to operate a servo motor from batteries separate from those powering the receiver.

Magnetic actuators or escapements can usually be operated from the receiver batteries. Many servo motors are supplied with a capacitor across the motor brushes. If the one you wish to use doesn't have such a capacitor, install one yourself. A low-voltage .01 μf capacitor is fine. It should be connected across the brush lugs with very short leads.

Always keep the receiver antenna as far as possible from servo motors, battery leads and other metal parts. Shield the receiver and mount it as far as you conveniently can from servo motors and batteries. Good flying!

THE HAM SHACK

BY
WAYNE GREEN
W2NSD/1

CODE, YOU SAY? . . . In the beginning all amateur contacts were via Morse code (fone operation not yet having been invented). And many of the top experts of those days flatly stated that voice never would be sent by radio because there was no possible way to modulate damped waves. (You might think about that next time an expert speaks up.)

Then, in the '30s, amateur operation began to swing toward fone. Came the time we were put off the air to make room for World War II and about half the operators were yakking it up on our fone bands.

After the war fone was more popular than ever and the great revolt against the ARRL came when more fone frequencies were wanted and the League refused to recognize the trend. Amateurs by the thousand joined the National Amateur Radio Council and over 20,000 dropped out of the ARRL in protest. This pressure resulted in opening of the fone band on 40 meters and widening of the one on 75 meters.

As fone equipment became easier to build and buy, fewer amateurs went the CW route. In the '50s we had a great expansion of mobile operation, followed by the SSB explosion. SSB particularly decimated the thinning ranks of CW operators because old timers found the major advantage CW always had offered—the ability to get through when QRM was bad or signals weak—no longer held. Reason was that sideband made it about as well as CW.

So in the '60s we now find ourselves with only about 10 per cent of active amateurs still using CW much of the time. DXing used to be almost entirely a CW activity, with a few heretics trying to work fone DX. Now the great bulk of the DXing is on sideband.

Many of us can remember the day when the entire 300 kc of 40 meters was about solid with CW rag-chews. Today you can tune the 40-meter band and, outside of the Novice segment, often hear but a dozen CW contacts in progress. Those thousands of fellows that used to be in there have gone to the Great Ham Shack in the Sky—or to some other hobby or sideband.

Unfortunately, our rules have not kept up with our way of life and we find that today, as a generation ago, code remains the biggest hurdle a newcomer has to pass in order to get his amateur license. Worse yet, thousands have been scared away from amateur radio by the threatened license-requirement upgrading which the ARRL has been spearheading. Most outstanding change the ARRL has requested is an increase in the code-speed requirement from 13 to 20 words per minute for the fone license.

To be sure, the League expends a good deal of its organizational energy on traffic nets. These consist of groups of fellows who send messages among themselves by CW. Since the letters ARRL stand for American Radio Relay League and the relaying all is done on CW, perhaps it is understandable that they go a bit overboard for CW. Thing is, the rest of us look on in amazement and wonder what possible reason there is for demanding a 20-wpm test for someone to operate on fone.

The days when fellows operated CW because that was all their rigs could handle are about over. Now those that use CW do it because they enjoy it, not because they can't do anything else. And I for one wonder if we shouldn't recognize this change in the scheme of things and adapt our rules to the existing facts of amateur life.

Admittedly, international regulations call for a code-proficiency test as part of the amateur license requirement. But what they don't specify is any particular code speed. And it seems to me that the 5-wpm code test that we give for the Novice and Technician licenses should be adequate for the General. Those interested in CW will develop the ability to handle CW and those who aren't won't waste a lot of time and effort on something of no value or importance to them—something that disuse soon enough will cause them to forget.

Such a change will be hard to bring about in view of the ARRL's push for increased CW speed requirements. On their side they have an enormous and largely unquestioning

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THE TRUTH ABOUT

Hey, Buddy! Want to save yourself 50 bucks? Then don't buy that dog! Learn, instead, how to get a good buy in used CB.

By ALAN LEVESQUE

USED CB EQUIPMENT

HAS a used CB salesman tapped you on the shoulder lately and whispered, "Pssst! Hey, buddy . . . this little gem was just used by a little old lady on Sundays to speak to her son down the block."

Possibly not, because CB radio seems to be one of the few consumer industries where the older equipment, for the most part, drifts off into a mysterious never-never land to be heard from no more.

Think about it: how often have you seen used CB equipment offered for sale? How many CB sets do you think have been produced over the years? Would you believe 4 million? And doesn't everyone you know use a rig that is only a year or two old? Right! So where are all the old sets if they aren't being offered for sale second-hand?

Some used gear is drifting around the market. An electronics dealer near you probably has some sitting on the shelf and several companies have been offering used sets by mail of late. How do you estimate their worth?

Where did the oldies go? Those CB rigs that once graced a proud operating table or bounced merrily along the open highway 'neath the dashboard of a shiny new 1959 Chevy, issuing forth 10-4s and other such CB expressions . . . where are they now? We researched the subject with CBers, manufacturers, CB dealers and repairmen.

If the rig was inexpensive to begin with it probably was removed from service the first time the operator found a serious (and expensive) servicing problem. It wasn't thrown into the ash can, mind you; it was dismantled. The tubes were removed to be kept around as spares, the speaker was taken for use in a long-broken kiddie phonograph, the chassis (complete with transformers, capacitors, resistors) was put in a basement or closet to be used just in case.

A more expensive set usually lasts through the first major breakdown and one or two subsequent minor ones. After that, it is to be found on the owner's list of pet hates. Why should he keep pouring money into an old set when he could get a new one? And so he does, often bringing the offender down to the shop to be offered as a trade-in.

But by the time the set arrives at the dealer's it is at least two years old. Presuming that it has been given the usual care, it will contain assorted fingerprints, scratches, paint chips, dents and possibly a few coffee stains. As you can imagine, such sets have little resale value and, therefore, few reach the public the second time around.

This is not to say that even the most dilapidated piece of CB junk always will be refused as a trade-in by a CB dealer. Some dealers will accept just about *anything* as a trade-in to allow a little price cutting. The old set then is scrapped.

Another factor in limiting the number of used sets offered for sale is the result of what we call the CB tamper syndrome. Few older sets still are free of modifications, ranging from a painted cabinet to redesigned circuitry and including any number of other changes to improve appearance or operation. CBers, it seems, simply *must* customize, with the result that these sets are almost worthless for resale.

Some used sets make it. A check of used equipment bulletins from the mail-order houses and the prices quoted by CB shops indicate that the going price for a 4- to 8-channel set in good condition ranges between $50 and $100. A 23-channel set in good condition will command $100 to $150. Buyers of used gear seem to know which specific rig they are seeking and usually cannot be made to take a substitute—even a newer model at a better price. In fact, some of the real oldies are becoming vintage classics, hard-sought by a surprisingly large number of buyers.

Buying guide. If you decide that the used equipment route might be the next path you traverse, here are some buying hints culled confidentially from those experienced in such things.

THE TRUTH ABOUT USED CB EQUIPMENT

1. When buying used CB equipment buy only from a reputable dealer rather than an individual. A dealer hopes to do additional business with you in the future and will not make fantastic claims. An individual seller may tell you just about anything to unload a bomb.

2. Is there a warranty on the equipment? No standard practice has been found in the used-equipment market so you'll have to play it by ear. Ask for a 90-day parts warranty or a 30-day warranty on both parts and labor. They are about equal in value.

3. Try to make the seller agree to let you try the set at home on your own antenna for a specified time with the option to return it for a full refund or exchange if it does not live up to the claims made for it. One dealer admitted that he ran his used transceivers through a linear amplifier during the sales pitch to make the sets sound better on the air.

4. Will the dealer agree to service the equipment after his warranty expires? If he doesn't want to, don't buy his set.

5. Don't be dazzled by the word *reconditioned*. Ideally, it would mean a top-to-bottom checkout of all major components and circuits with all necessary adjustments and replacement of weak parts. It has been known to mean little more than a dusting of the front panel. Do not settle for less than replacement of weak or poorly-functioning components, tied in with a frequency check on each channel by a technician.

6. Sometimes you will find sets that are of a homebrew design, are greatly modified or customized, or are sold as-is. Avoid them like the plague.

7. Buy only sets made by companies that still are in the CB radio business. Many companies have come and gone since CB began in 1958 and some outfits that still are operating no longer sell CB gear. Parts for their equipment can be touchy and many service shops will not attempt to repair it. If you feel the need to buy such a rig, make certain you get the complete operating and service manual with it or at least the schematic and parts list. Some companies no longer producing CB gear include: Chickasha, Babb, Rutherford, DeWald, Dunlop, Morrow, Acton Labs, Bendix, Kay Townes.

8. Give the set a complete on-the-air checkout. If the receiver sounds scratchy or distorted, then the rig either has a busted speaker or something is messed up in the audio circuit. Does the volume control make crackling noises or is it intermittent when it is adjusted? Does the squelch work? What about the S-meter, the receiver tuning calibration, the condition of the transmit/receive relay?

9. Have someone a few miles away listen to the transmitter for modulation and signal strength.

10. If the set offered is claimed to have been souped up to make it run more than 5 watts input, pass it by. In addition to being illegal, such sets seldom offer any bonus in actual communications capability and, more often than not, the souping-up process has caused premature aging of components.

11. Read and listen carefully. The piece of equipment you buy will have certain claims made for it. Sales and advertising claims usually are established according to the standards of those who make them. Know your seller and his ability to sell honestly. Get everything in writing.

These simple guidelines won't guarantee that you [*Continued on page* 116]

IC's Go Civilian

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hicle fired in November 1963, had ICs in its electronic system. And they performed beautifully in the radiation-bathed reaches of space between the earth and the sun. NASA is building more and more ICs into its critical equipment. The computer that will guide the Apollo spaceship on its historic journey to the moon and back will bristle with ICs. And when Apollo crewmen land on the moon, they'll send back live TV pictures, thanks to a hand-held camera that contains about 250 ICs making up some 80 per cent of the camera's circuitry and taking the place of 1,300 conventional parts. First models of the unit have already been delivered to NASA by Westinghouse. They're as big as a cigarette carton, weigh 5½ lbs. and use 6 watts of power.

Meanwhile, back on earth, the future seems unlimited. ICs finally have arrived on the consumer market. But just where they will go from here is hard to predict.

Tonics For Tape Recorders

Continued from page 100

3,000 cps. (The ear is especially sensitive to speed changes in this region.) Wow, a slow-rate change, is a wavering or souring of the tone. Flutter is a rapid change in frequency which imparts a grainy, indistinct quality to the sound.

These errors in tape motion are usually produced in the tape-transport mechanism. They could be due to slippage, worn or hardened rubber parts, mechanical wear, possibly excessive force at the pressure pads against tape heads. But before you get inside the machine, carefully clean all parts that come in contact with the tape. Even small quantities of dirt can introduce friction and drag.

Final Notes

Don't overlook items outside the machine. Get rid of bent reels that squeak when they turn. They could be ruining the edges of good tape. Lubricate your old, squeaky tapes with a silicone compound. And a final autumn tonic: treat yourself to a new, inexpensive, gadget—like a tape threader to help tranquilize fumbling fingers.

ELECTRONIC SWAP SHOP

Continued from page 22

RCA 10K1 all-band receiver. Will swap for anything of equal value. Kim Leeper, 5311 Esmerelda St., Sacramento, Calif.

ZENITH SW receiver, other items. Want 2-meter equipment. Bob Fiduk, WN9QAI, 813 Somonauk, Sycamore, Ill.

STROMBECKER road race set. Want Heath Q-Multiplier, other ham gear. Joe Pavie, 14446 San Ardo, La Mirada, Calif. 90638.

HEATHKIT GR-81 SW receiver. Will swap for Hammarlund or other SW receiver. Jim Litzinger, 315 Cresswood St., Johnstown, Pa. 15902.

HEATH SIXER. Want CB equipment. James Frole, Box 357, Braddock, Pa. 15104.

BELL tape recorder, other items. Interested in swap for ham gear. Alfred Boatman, Box 83, Cookeville, Tenn. 38501.

RCA stereo amplifier, other items. Will trade for SW receiver. Chris Reichlow, 13715 S. Rossburn Ave., Hawthorne, Calif. 90250.

LAFAYETTE HA-70B. Will swap for CB transceiver. Donald Bartone, 62 Mill Rd., E. Longmeadow, Mass. 01028.

KNIGHT Span Master receiver. Swap for Knight T-60 transmitter. Norman Bridge, 2043 S. Gearhart St., Fresno, Calif. 93702.

GLOBE 100A CB transceiver and collinear antenna. Will swap for Heath HO-10 monitor scope. Bob Hollander, WN2VYM, 120 Iroquois Dr., Brightwaters, N.Y. 11718.

KNIGHT C-560 CB transceivers. Want SSB CB equipment. Roy Barnhart, 1102 Forneydale Rd., Lebanon, Pa. 17042.

VHF receiver, 26-173 mc. Will swap for Garrard record changer. Paul Yudell, 1829 Bronson Ave., Hollywood, Calif.

SILVERTONE AM-SW radio-phono with record cutter. Will swap for VHF receiver and 6 or 2 meter converter. T. J. Balint, 7305 Hansford St., Washington, D.C. 20028.

RCA VHF TV tuner. Make swap offer. Steve Peterson, 382 W. 870, N. Sunset, Utah 84015.

TAPE RECORDERS, other items. Make swap offer. Roland Kulish, WA5LTV, 5075 Heisig St., Beaumont, Tex. 77705.

HEATH QF-1 Q-multiplier. Will swap for hi-fi equipment. Scott Marovich, 2407 S. Rose St., Kalamazoo, Mich. 49001.

TAPE RECORDER, other items. Want 4-speed turntable or amplifier. Steven Rechter, 46 Jessie Dr., W. Haven, Conn. 05516.

GARRARD turntable, other items. Will swap for Heath HR-10. Mike Fine, 6 Beechwood Tr., Poughkeepsie, N.Y. 12601.

HEATH AR-3, other items. Will swap for Ranger 1. Joe Turkal, K8EKG, 1020 4th St., SW., Massillon, Ohio 44646.

KNIGHT 50-watt CW transmitter. Will swap for Knight Star Roamer or similar item. Tom Maunu, K7TFS, Box 12, Riddle, Ore. 97469.

SEARS 350X refracting telescope. Will swap for ham receiver. Doug Benner, R#2, 1175 Fillmore Rd., Ithaca, Mich. 48847.

KNIGHT Star Roamer. Interested in VFO, HG-10 preferred. Gil Muse, R.F.D. 2, Finksburg, Md. 21048.

EICO 536 VOM, other items. Make swap offer. Curtis Fitzgerald, 405 Parsons La., Wichita Falls, Tex. 76301.

HEATH GR-81 SW receiver. Interested in swapping for Ameco, other novice transmitter. M. A. Shaw, 211 Oakland Ave., Audubon, N.J. 08106.

KNIGHT KG-667 flyback and yoke checker. Will swap for CB equipment or best offer. H. C. Harmon, Rte. 1, Paris, Miss.

CONAR 1-tube novice transmitter. Will swap for Heath Twoer. Steve Babbitt, WN4CCP, Box 92, Trenton, Tenn. 38382.

HEATH GR-64 SW receiver, other items. Want CB transceiver or make swap offer. George Gardner, 18 Leslie Dr., Scranton, Pa. 18505.

PUBLIC ADDRESS equipment. Make swap offer of similar gear. Brian Thorstad, Benson Rd., Frederic, Wis. 54837

What's The Worst Color TV?

Continued from page 53

get good color reception on all the stations, including UHF?" *(No. 18)*

I replied, "For good color reception on channels 2 through 13 there are a number of 50-mi., 75-mi. and 100-mi. antennas. They are tuned broadly to each channel. They are quite directional, so it's a good idea to install a motor on the mast to rotate the antenna and aim it right at the station.

"Lots of these color antennas will pick up UHF but not as efficiently as they will VHF. For Grade A reception, I find a separate UHF antenna and lead-in wire should be installed. The UHF can be installed right on the same mast and turned with the same motor."

"What's the cost on an antenna like that?" Wilson asked. *(No. 19)*

"A color head runs about $20, the UHF head around $10, the motor $35. Hardware, mast mount, guy wire, ring and hooks, lead-in for VHF and UHF, stand-offs, lightning arrestor, ground rod and ground wire run another $25 and labor around $25," I calculated. "Cost you around $115."

The big fellow asked, "Does it cost a lot more in electricity to run a color TV?" *(No. 20)*

"It does cost twice as much; but a monochrome TV costs no more than a 150-watt light bulb so I doubt you'd notice the difference on your electric bill."

"How about the cost of the TV itself?" he asked. "Don't you think it might be wise to wait until the color sets come down in price like the black-and-whites did?" *(No. 21)*

I answered, "No doubt in time the price on color will come down. But color TV is not a new product. Twelve years of improvements and price reductions already have occurred."

"What about the single-gun color tube?" Wilson asked. "I hear they're coming out soon." *(No. 22)*

"Could be. However, the ones I heard of cost more than three-gun. There's a Japanese version of the Lawrence tube and a European version of a beam-indexing tube. But even if a better basic idea should come along it's going to have hard hoeing in a field where millions are invested in the three-gun system."

The blonde asked quietly, "How long is a color set supposed to last?" *(No. 23)*

I answered politely, patting the top of her TV, "With proper maintenance, a TV shouldn't have any problem reaching ten years. I service 15-year-old TVs and 25-year-old radios every week."

The brunette blinked her eyes, looked away from the screen and asked, "Doesn't color TV hurt your eyes if you watch it too much?" *(No. 24)*

I laughed. "Regular TV increased the optician's business and I guess color is a little more strain than black-and-white—but it's also more fun."

I began writing up the bill. "That's $21, plus tax," I said to Mr. Wilson. But it was the big fellow who reached for his wallet.

His wife asked, "Do you think a service contract is advisable?" *(No. 25)*

I nodded. "It's insurance against large repair bills. If a repair bill for $150 would knock you for a loop it might be a good idea to pay off a policy. Ours costs around $8 a month. Also"—and I looked at Mrs. Wilson—"this set qualifies for a policy. The repair constitutes its medical inspection. It passes with flying colors."

The Versatile VOM

Continued from page 73

However, keep in mind that if you handle a meter with extreme care, even a $9 VOM will give years of reliable service. Also keep in mind that many imported meters are fine instruments, though most carry figures on their price tags not much below those on many American meters. And pitfalls of skimpy meter scales and easy burnout present themselves soon as you try to duplicate a $30 meter for $10. It simply can't be done.

Good way to save a buck is to build your own VOM, though we don't mean from scratch. Several companies—Allied Radio, EICO, Heath and RCA are four—offer kit versions of production VOMs. The kits are simple to assemble and the savings, therefore, aren't tremendous. Even so, a kit costing, say, $25, should wind up as a VOM worth $35 to $40.

With fancy VOMs priced near $100, the extra $40 or $50 doesn't offer much improvement over general-purpose or service-grade VOMs. Reasons are that lab accuracy, oversize scales and parallax-free pointers rarely are needed by the hobbyist.

The Ham Shack

Continued from page 107

organization which passes on the edicts of headquarters down through Division Directors, Section Communications Managers and eventually the membership.

Also on the ARRL side of the fence is the general attitude of many licensed amateurs who feel that since *they* had to put up with the code nonsense someone coming along later shouldn't have life any easier. And this brings up the fact that the 13-wpm jazz has a sort of trial-by-fire aura about it. Most of us have been through it, though most of us hated it. No doubt we all felt a sense of accomplishment in passing our code test . . . certainly a lot more than we felt for the puny little memorizable theory test which took a lot less time and effort for preparation.

This I think is a basic fault in our amateur exams. I think that the code should be minimal . . . 5 wpm, say, and that the emphasis should be on the technical exam. I would like to see some up-to-date exams made up, designed for open-book answering. The tests should show whether you have an understanding of the material.

Twenty years ago you might have argued that a loss in code proficiency by the amateur would hurt his value in an emergency. Now that virtually all military communications are carried on by teletype or fone this argument is a little thin. Little hand-sent code is used outside our ham bands.

What can be done about this? Simple. If you feel that it perhaps is time for a change, then all you have to do is speak up and make yourself heard. But I'm willing to bet that, apathy being what it is in our country, about 100,000 of you will read this column, nod in agreement and say someone sure should do something (or say I'm off my rocker) . . . and then turn the page to see what's there.

Thing to remember is that just one man could start something that might bring about profound changes in amateur radio. And just one man sitting down and preparing the original and 14 copies of a petition to the FCC (Washington, D.C. 20025), asking for the elimination of the 13-wpm code speed requirement for the General Class license, might get the ball rolling.

Any ball-rollers reading this? I thought not.

Tuning In The Turncoats

Continued from page 77

facilities of R. Progreso. Compared to R. Free Dixie, R. Peking sounds almost pro-American.

Williams, whose name achieved some prominence in civil rights agitation in the mid-'50s, left the North Carolina NAACP after advocating violence "when necessary." In August of 1961 he showed up in Monroe, N.C., at a cotton-mill strike that was organized by the National Freedom Council and was forcibly broken by the Ku Klux Klan. Acting contrary to NFC orders, Williams and a handful of others retaliated in kind. Before he was through, he had been accused of abetting the kidnapping of a white couple. Then, with the FBI hot on his trail, Williams fled to Castroland.

On the air, Williams is just as opposed to civil rights legislation as is the KKK—but not for the same reasons, of course. He regularly describes such laws as a sellout and a sham or tokenism and says he would prefer armed uprising to integration.

One could seriously question, however, whether Williams really runs R. Free Dixie, as Castro would have us believe. For example, early this year EI monitored the station while it opened up with a talk on rock-&-roll as protest music. By way of illustration, the station played some U.S.-made recordings. Only trouble was that they weren't R&R but rhythm-&-blues. Many whites don't know the difference but most colored people do. We doubt that Mr. Williams was running the show that evening.

But let's go back to where we started—Dr. Ramsey. His broadcasts over what is known as Radio Stateside, North Vietnam, were designed to persuade American soldiers to withdraw from the war. The tapes were mailed from Los Angeles to an address in Quebec and from there transhipped to Hanoi.

Ramsey's on-the-air approach has not always been exactly truthful. He initially announced that R. Stateside could be reached by mail through Los Angeles FM station KPFK. The station, though sometimes a dissenter itself, had absolutely no connection with R. Stateside. On another occasion his tapes claimed that the song Universal Soldier was selling No. 1 throughout the United States. Universal Soldier, by Buffy Sainte-Marie, is a popular pacifist song (which nobody seems to have bothered translating for the Viet Cong), but sales were hardly *that* good.

Ramsey obviously considers himself to have legitimate gripes, however. While he might, with reason, be accused of giving comfort to the enemy, it has not been in order to make his fortune. In fact, says the State Department, he twice has found it necessary to ask them for repatriation loans (a total of some $1,000 which, they say, he neither used for repatriation nor paid back).

If a man doesn't change allegiance for gold, must it be necessarily for ideology? To what extent may ego play a part? After all, a turncoat or even a refugee draws plenty of attention—usually from both sides. As we said earlier, the game is much more complicated than it used to be.

CB Corner

Continued from page 87

It's easy to sink a floating hood. Fasten one end of a length of heavy copper braid under one hood bolt, as shown in our photo. Connect the other end to a body bolt below it. Allow enough length for the hood to open. For a more thorough job, connect a piece of braid on the other side. Braid is available from parts distributors, but you can also strip some off coax cable.

It's Little, It's Lovely . . . A book-size Raytheon rig, the TWR-7, has won distinction as one of the best-designed products of the year. That's in a citation by *Industrial Design*, a magazine that annually reviews outstanding work in product and package design. We believe Raytheon's Marine Products division, which is responsible for the TWR-7, deserves the plaudit. We suspect Raytheon originally had something else in mind.

When the TWR-7 first bowed in, a spokesman for the company told me that here was a rig aimed at the H.E.L.P. market. And that explains the unit's look. The front panel is designed to resemble closely an ordinary car radio. It's intended to assure the general public that one doesn't have to be a technical whiz to enjoy the benefits of 2-way radio. Apparently Raytheon's instincts were correct—as evidenced by the design award and the growing number of rigs joining the trend to small and simple CB.

Good Reading

Continued from page 54

construction as a matter of breadboards, leftover Band-Aid boxes and such other homespun techniques as calling on the Almighty, but it wouldn't hurt to have a look at some of the real hardware of modern electronics. This book was intended to help technical-institute students toward the construction of prototypes but its material will be of interest to advanced hobbyists, too. Coverage ranges from chassis-punching to printed-circuit techniques and the material is well organized and presented.

YOUR TAPE RECORDER. By Joel Tall and Martin Clifford. Elpa Marketing Industries, New Hyde Park, N.Y. 32 pages. $1

This slim volume, despite a pretty heavy orientation toward products marketed by the publisher, is a concise and valuable little handbook, particularly for those who would like to improve tape editing. It's available directly from the publisher.

And Make Note of . . .

NORTH AMERICAN RADIO-TV STATION GUIDE. By Vane A. Jones. Sams. 128 pages. $1.95

INTRODUCTION TO ELECTRICAL CIRCUIT ANALYSIS. By Robert C. Carter. Holt, Rinehart & Winston. 500 pages. $9.95

Electronic Computer

Continued from page 49

of this subtraction should be 080201 on the lamps.

Again, by observation we see that 3487 will go into 080201 at least 20 times. On paper multiply 3487 by 20—you get 69740. But since 69740 will be subtracted from 080210, a zero must be added to it at the left to make it a six digit number.

Now dial 010461 (dial all zeros). The result of this subtraction will be 999999 on the lamps. This means division is completed. In the complements of nine method of subtracting, this result is equivalent to 000000. If the remainder is other than zero (999999), but smaller than the divisor, the division should be carried further.

3-Band 3-Mode Transceiver

Continued from page 93

80 meters, 1.7 μv on 40 meters and 2.5 μv on 20 meters. We discovered that the zener diode in the VFO was generationg noise. By connecting a .01-μf capacitor across the diode the sensitivity for a 10db S+N/N ratio was improved to 0.4 μv on 80 meters, 1.1 μv on 40 meters and 1.0 μv on 20 meters. We suggest that if you have an early-model 753, install the capacitor across the zener.

Selectivity was just about average—2.5 kc at 6db down. The audio quality of a received SSB signal was crisp and clean. AM reception was somewhat muddy—due to the compromise-design AM circuits.

Maximum audio power output was a little less than 2 watts into 3.2 ohms. It required only an 8.5-μv input signal modulated 30 per cent to obtain full audio output power. S-meter calibration is 90 μv for S9 with each S-unit representing 1 to 3db (depending on which part of the meter's scale you're at).

Frequency stability was excellent (for the price): less than 400 cps drift after a 10-minute warm-up, and less than 100-cps drift after a 30-minute warm-up.

The VOX is one of the best we've used. With the microphone placed in front of and slightly to the right of the speaker, and using a comfortable (not low) volume level, the VOX circuit could be adjusted so there was no false tripping.

While measurements look good on paper, on-the-air performance often can be disappointing. But in the case of the 753, performance exceeded our expectations—mainly because of effective modulation. W8GJF's comments were typical of many we received: "Very clean modulation. You're under severe QRM but I'm reading you 100 per cent." In fact, the SSB modulation was so good we got an 85 per cent response to our CQs.

The receiver-offset tuning feature (first time we've used a transceiver with this circuit) was an extra blessing. From a cold start we tracked a received station, K8RKF, without shifting the transmit frequency all over the dial.

Our only gripe with the 753 is that there is no BFO adjustment for CW reception (though this is typical of other transceivers in the same price range). It is necessary to adjust the receiver offset control to obtain a pleasant tone.

For fine tuning, the 753 is provided with a dual-range vernier dial. The basic dial-drive ratio is 6:1 but by tuning slightly past the desired frequency and then backing off, the drive automatically shifts to a 30:1 ratio. The fine tuning is effective for about 10 degrees of scale: at the limits the dial shifts back to 6:1 automatically.

All in all, we'd say the 753 is one of the best transceiver buys on the market.

Truth About Used CB Equipment

Continued from page 110

will be able to get a $200 dream rig for $50. But they may stop you from throwing away your $50.

Ask the man who sells one. The sales manager of one of the largest CB-equipment chain stores in the New York area told us, "Used CB equipment is a gigantic pain in the neck. We are forced to take used sets in on trades but only a small percentage of them go anywhere but straight to the scrap heap because of all th work it would take to get them back in shape. The sets we eventually do sell are good but I've seen some really awful rigs being offered by some dealers. Sharpie dealers who do a quick patch-up job on a dog to sell it fast are hurting legitimate dealers who offer only selected used gear."

Questioned about used electronic equipment markets (ham and hi-fi in particular), one dealer told us, "A hi-fi bug usually trades in fairly good gear to get newer or more elaborate equipment. His old gear may only be a few months old and often it still sounds as good as new; it's just that his fancy has been captured by something new.

"A ham operator knows how to keep his gear in good repair and seems ashamed to bring in a rig in poor condition. Hams also do a lot of selling of used gear among themselves, bypassing dealers; they have an unwritten law whereby one ham will not palm off a piece of junk on a brother operator."

One attitude toward reconditioning used CB equipment was expressed by the owner of a mail-order used CB outfit. He says that sets must operate before we will accept them in trade. It is not practical to recondition the sets, says he, due to cost—about $20 at the least. To give top dollar trade and sell low he must have a working set.

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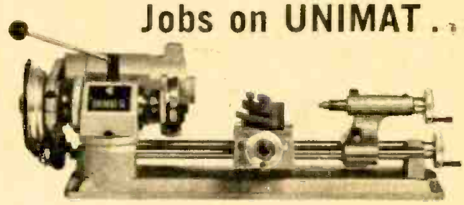

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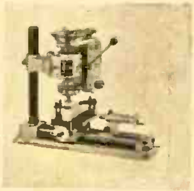

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Vanishing Battery

Continued from page 91

eter and ½ inch thick, although they will operate reliably for more than three years. Shirt-button-size batteries have made possible such devices as Bulova's Accutron watch (which runs for a year on a single cell) and radio pills.

Now research scientists are working to pack even more power into every ounce of battery. "Right now," says Gene Errico of the Mallory Battery Co., "we can build a battery that would give 400 watt-hours per pound compared with the 45 watt-hours we figure for mercury batteries, the best we've got now. But there's a catch. We make it today; tomorrow it's dead. It's unstable. We're trying to solve this problem now."

That business about wrist radios that Dick Tracy started several decades ago finally is coming true—such units have already been built. And pocket TV is coming, too. You won't be able to buy this year or next but big TV makers are working on it.

With a new generation of devices, medical uses will multiply. Not long ago, a team of doctors in Los Angeles buried tiny electrodes deep in the inner ear of deaf patients, then applied electrical signals representing speech and music to the electrodes. In several cases, patients were able to understand words, giving hope that some day the deaf may hear electrically. Might it be that at some time in the future, even the blind might see with television-like devices feeding visual signals to their brains?

As electrical circuits get smaller and button-sized batteries more powerful, there seems to be no limit to what may ultimately be possible.

CB Alignment Generator

Continued from page 68

modulation-switch S2. The meter indication, with S3 in either the IF or RF position, should increase by 3 to 5 ma. If it fails to increase there is a wiring error in Q2's circuit.

Using The Generator

Connection between the generator and the equipment being serviced should be made with coax cable such as RG58/U. To align an IF amplifier use a modulated signal and align the receiver for maximum audio output (in this case you must reduce the generator's output to the minimum usable value to prevent the receiver's AVC from masking alignment changes). Or, use an unmodulated signal and adjust for maximum receiver AVC voltage.

Similarly, for RF alignment, align either for maximum audio output from the receiver or maximum AVC voltage. Many lower-cost receivers can be aligned to a center channel such as channel 11 or 12. Some receivers will require two-point alignment on channels 1 and 23, while some receivers must be aligned to channel 1, 11 and 23. In every case, always follow the alignment instructions supplied with the rig.

3 Basic Radios

Continued from page 96

nal is rectified in Q1's base emitter junction—the equivalent of the PN junction in the diode. Filtering, however, is required, and is provided by C6.

To add the tickler coil, loosely wind 7 turns of No. 22 enameled wire around as shown in Fig. 6. Its exact position can only be determined with the radio on.

With antenna and ground connected and power on, turn R2 full clockwise. Move the tickler coil back and forth until you hear either a howling sound or loud hiss in the phones. Adjust the coil's tuning knob while doing this as the howl will only be heard when a station is tuned in. Then reduce the howl by turning R2 counterclockwise. Best reception should occur when R2 is set just below the point where oscillation starts.

There's a chance that you won't hear any howl at all. This is because the tickler coil is connected in reverse and is feeding back a signal which produces just the opposite effect. That is, it bucks and reduces the level of input signal. To correct this, merely reverse the tickler coil's connection to R2.

As you tune across the band, you may have to reposition the tickler coil. (This is because the repositioning of the coil's slug changes coupling between tickler and main coil.) If this happens, move the tickler coil slightly. It takes a little practice, but by juggling R2, the tuning knob, and the tickler coil, you'll get startling sensitivity and volume.

—H. B. Morris

Continued from page 58

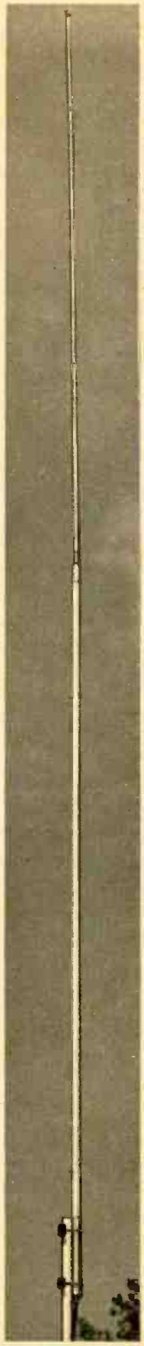
work to compete with the pirates, thus forcing the boys out of business.

Britain now suddenly is faced with the possibility of losing its distinction as the world's only pirate radio power. A station seems to be in the offing for the coast of New Zealand. And two former managers of Sonny and Cher (a folk-rock duo) reportedly are planning a floating station on New York's own watery doorstep. If this one ever opens, which seems unlikely, listeners may have difficulty telling the pirate from what was on the dial before.

British pirates still can be logged with difficulty by BCB DXers east of the Mississippi. Outside the New York City area, best bets are R. London on 1133 kc. New York City listeners might try for R. Caroline North on 1520 despite interference from WKBW and KOMA. Best time is Monday after 0100.

In Brief. Since more than one newcomer asks certain questions repeatedly, it seems safe to assume that answers to some of the queries will be of interest to a good many DXers. Here, in capsule form, are the replies:

To address most SWBC stations you merely need the station name, city and country . . . Alpha Alpha Echo Six Zero is station AAE60 operated by the U.S. Army at Sandia Base, Belem, N.M. Station at last report *was* verifying. . . . Don't worry about the SINPO reporting system. Despite elaborate claims made for it, the thing is no better than plain English. . . . Such CW calls as J8S, AØL, etc. (which are minus a prefix of any sort) are of the tactical variety and used by the military. Locations are classified information. . . You and the fellow next door just have started a new radio club, expect to have four members in even fewer months and want EI to publicize your new and fast-growing organization. We won't, and our reasons for not doing so should be obvious. . . . Please don't ask us to pick one receiver over all the rest. If something new and important comes along, we certainly intend to tell you about it, objectively. Otherwise, the SWL generally gets exactly what he pays for. . . . Yes, you *can* identify foreign-language stations. All it takes is practice and patience.



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

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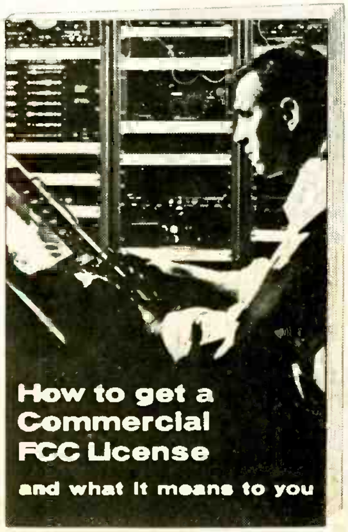

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