

Strange Story of the Turncoat Disc Jockey

ELECTRONICS ILLUSTRATED

By the Publishers of MECHANIX ILLUSTRATED

JANUARY 1970 50c

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RONALD L. WOOD, Fargo, N.D., holds a First Class FCC License and is employed as a studio and master control engineer/technician with station KXJB-TV. He wrote to NRI to say, "Many thanks to NRI for the Electronics training I have received."

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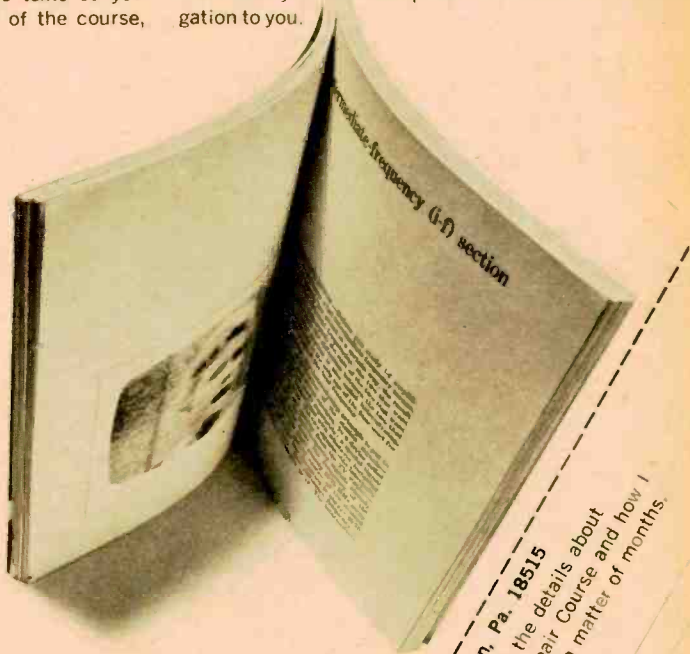
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Uncle Tom's Corner

By Tom Kneitel, K2AES/KQD4552

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

★ *I'm sitting here off the coast of Vietnam. I'm hearing plenty on my eight-band portable. Problem is, I can't get anybody to identify some of the stations I'm hearing. Can you ID any VHF aero stations calling themselves Panama, Peacock and Patty? Also, can you let me know the frequencies used by the Strategic Air Command in Vietnam?*

*Bored Civilian
Near Vietnam*

Your VHF stations are used for ground control at military airbases. They are Panama at Danang on 133.2 mc, Peacock at Pleiku on 142.75 mc, and Paddy (not Patty) in Can Tho on 133.2 mc. The SAC base in Tan Son Nhut operates SSB (which you probably can't copy on your portable) on Channels I-5 (6738 kc), K9 (4732 kc), R9 (11176 kc) and N2 (8989 kc). Saigon Control is on 120.1, 120.9 and 125.9 mc. Search and rescue operations are on 121.5 and 129.1 mc. Hope this gives you enough information to relieve the boredom.

★ *I'm an SWL but my father won't let me send any reports to Communist (or even Communist inspired) countries. Have there been any incidents involving government employees who have received mail from Communist radio stations? Have security positions been endangered? My father is a naval officer.*

*Kim Peek
Virginia Beach, Va.*

While I doubt if the fed fuzz will drag you away kicking and screaming for sending in a reception report, you'll be leaving yourself open for several years of being on the giant mailing lists of these stations. That means an

endless barrage of high-power politico books, pamphlets, banners, posters, greeting cards, etc. Even if you toss all of this stuff into a round file, why send the report in the first place and encourage them to continue broadcasting all of their hogwash?

★ *We have listened to the WWV time signal for 24 hours straight. What do we get?*

*Eric Slifkin, WN2HLJ
Barry Wolt
Millburn, N.J.*

I'd suggest a clock of your own—and hurry.

★ *Would you have any idea as to what frequencies are used for Apollo space shots? I have a military surplus ARN-5 receiver which covers 332.6 to 333.8 mc and this might cover their UHF channels.*

*James M. Labor
Westmoreland City, Pa.*

It might cover their transmissions, but unfortunately it doesn't. NASA people tell me that the channels used for Apollo 10 and 11 varied and have depended upon the location of the craft. During the near-earth phases (lift-off and splashdown) communications were in the 200-mc band. A 5-watt rig transmitted voice on 296.8 mc (259.7 secondary channel) and a rescue beacon operated on 243 mc (voice capability on this channel is secondary). A high-frequency channel of 10.006 mc also has been used for beacon or voice. When outside the atmosphere, the communications switched over to microwave; TV was sent on 2272.5 mc (FM signals), and voice was sent via pulse modulation on 2106.4 mc (2287.5 mc secondary). The lunar module uses the same channels.

★ *While tuning around on my SX-99 I picked up a CW station on 25 meters sending VVV DE WOE ANS 8 OR 12 MC K. Now I know that DE means this is in CW talk, but what is WOE? Woe is me, I guess.*

*Jay Ayers
Endwell, N.Y.*

[Continued on page 8]

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CIRCLE NUMBER 15 ON PAGE 15

January, 1970

7

Uncle Tom's Corner

Continued from page 6

Don't worry, Jay, all's well at Endwell. WOE is a call sign, not a cry of sorrow. The station is operated in Lantana, Fla., by RCA Communications for the purpose of communicating with merchant ships. What you heard was a repeating tape marker loop which advises ships that the station isn't engaged in a contact and that they can call WOE on 8- or 12-mc channels if they have messages to send. You probably heard them on their 12970.5-kc channel. A few years ago they were sending out a nice QSL-type card with their frequencies and traffic schedules.

★ *You may not believe this story (most people don't), but I hear telephone calls when I'm not on the phone. Sometimes I hear them when I'm walking down the street or driving. I hear the ringing sound, people answering and talking, even hanging up. Sometimes I hear the operator. This is annoying. My explanation is that something in my ears is resonant with the telephone lines or other phone equipment. What can I do to stop hearing these calls?*

H.W.S.
Cincinnati, Ohio

Get an unlisted head.

★ **Inaudible Audio Dept.** It's interesting to see how the TV manufacturers have spent so much time hawking their cabinetwork and picture quality that they've ignored the audio portion of the circuitry. There must be an unwritten gentlemen's agreement that no manufacturer will be the first to break the ice with claims to audio fidelity and thereby add another cost factor to the sales race.

And what has this silence meant to the public? Spend even \$500 for a color set and chances are that it still comes with a cheap and raunchy 4-in. speaker. This doesn't really make a difference in the sound, though, because the mediocre audio output doesn't call for anything better. Nevertheless, if you rip

the leads off the TV speaker and connect them to a decent one you'll notice an improvement. Better yet, dig right into the set and grab the audio at the volume control, then run it through your own amplifier and see what happens. Most of the specials and variety programs sound like they're musically oriented so trying to enjoy them with a veneer cabinet, rare-earth-phosphor color picture tube, and walkie-talkie audio seems weird.

★ *The other night I was listening on 20 mc and heard a repeating SSB tape saying, "This is the transmission from the Liberian Telecommunications Service. If there is any station scheduled to operate a radiotelephone service with this station please report in condition B." The station was heard at about 0240 GMT. Please give me any information you have about this station.*

Gregory Clift
Anadarko, Okla.

You heard station ELA29, which is located at Monrovia, Liberia. The station runs 10 kw and is used for telephone calls to New York and London. Condition B means they want New York or London to answer, using SSB. You can send a reception report for ELA29 to the Chief Engineer, Liberian Telecommunications Administration, Monrovia, Liberia.

★ *My VHF FM police receiver has such poor selectivity that it's hard to separate some of the local stations. Checking the schematic, I see that the set has a 10.7-mc IF section. Is there any type of Q-multiplier I can get for this receiver to sharpen up reception? Catalogs show only 455-kc Q-multipliers.*

Richard G. Vavoudis
Evanston, Ill.

You've got a problem there, Rich. If you try to use any sort of Q-multiplier you'll sharpen the set's selectivity to the point where you won't be able to copy the FM transmissions. Either learn to live with the problem or buy a better receiver next time around. A set which offers ± 12 -kc bandpass at 6db should give adequate selectivity while still producing easy-to-read signals.

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Feedback from Our Readers

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

● ANXIOUS BUILDER

I am a regular reader of your magazine and if I am not asking too much, would you please publish this request? I need both schematics and diagrams of some electric guitar amplifiers having a 30-watt output or more. I am a radio technician and want to build one. I will be happy to swap Mexican curiosities with anyone who answers my call for plans.

Francesco G. Raya
Ave. 7 Poniente 853
Oruzaba, Ver., Mexico

● SECOND ON THE AIR

I am writing concerning the letters of Michael Hewton and T. C. Kenney in your September FEEDBACK. Station KCBS (originally KGW) in San Francisco began broadcasting in San Jose, Calif., in 1908, using arc modulation. This information is well documented as KCBS had a big celebration in 1958 to mark their 50th year. How does that grab you. KDKA?

Charles Graham, KGKD2
Grass Valley, Calif.

● CB ALOFT

Your article on CB in the Air (Nov. '69 EI) was most interesting. I especially enjoyed the photographs. However, as you mention in the story, CB in the air is nothing new. Glider pilots like myself have been using CB rigs for quite some time to insure pickup after a flight runs out—and we

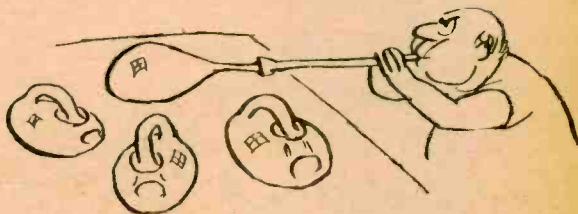
don't use just 100-mw walkie-talkies.

Come along on a ride some time and you'll hear some real CB DX.

Paul Jenkins
Pine Bluff, Ark.

Is the FCC invited, too?

● ELECTRONIC BOTTLES?



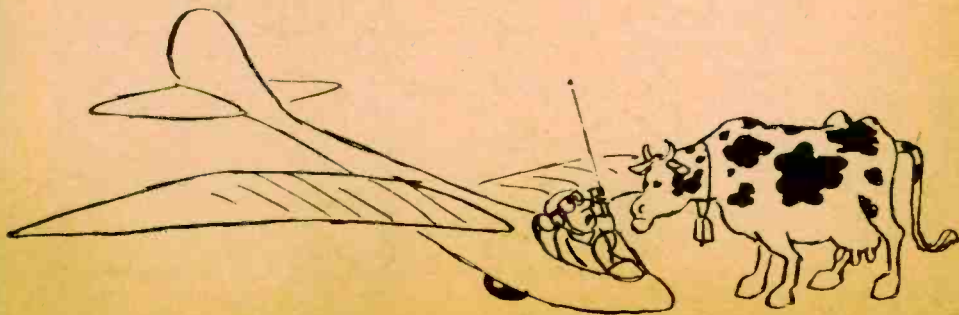
I am a retired glass blower. I noticed your article on the Moebius Strip resistor (Nov. '69 EI). Do you think there is any possibility that the Klein Bottle (more wondrous and amazing than the Moebius Strip) might be put to some equally interesting use in electronics? If so, I will be glad to blow a prototype free of charge.

Horst Jablovsky
Carlisle, Pa.

Okay, all you mathematicians, think!

● LET'S KEEP CODE!

This is in regard to the HAM SHACK piece in your July '69 issue. In my opinion, you are full of beans. You talk about CW being eliminated from the requirements for



Feedback from Our Readers

obtaining a ham license and state that it's not necessary for all amateurs to learn code, depending on which mode they choose to operate. This would be fine and dandy if amateur radio were just a hobby.

Actually, amateur radio is a service in the national interest and requires the most experienced people we can get. It is a fact that code does indeed keep out the scabs and that it must remain a requirement if only for this reason. Just listen to the jabberwocky on 27 mc sometime if you don't believe this. Do we want these bootleggers on CB coming to the ham bands? They'll memorize the theory, get a 2-kw rig and start shouting. God help us.

I have a General Class license and have had a code proficiency award for 20 wpm since I was a Novice. Personally, I would like to see the code test for the General ticket raised to 20 wpm. This would weed out the scabs! I know there are some licensed CBers who use the band for its intended purpose but, gosh, they're sure hard to find.

Ken Celmer, WB8AKG
Somewhere, U.S.A.

● WILL THE REAL . . .



In your Nov. '69 issue I noticed an article based on experiences with a home VTR written by your Managing Editor, Robert D. Freed. In the same issue, a story called NEW FUN FROM OLDEN. GOLDEN RADIOS talks about a Freed-Eisemann radio. Is there a relationship?

Sam Wilson
Brooklyn, N.Y.

He won't admit to being one of those chaps above, but the VTR Freed is, indeed, the son of the Mr. Freed who built the radio.

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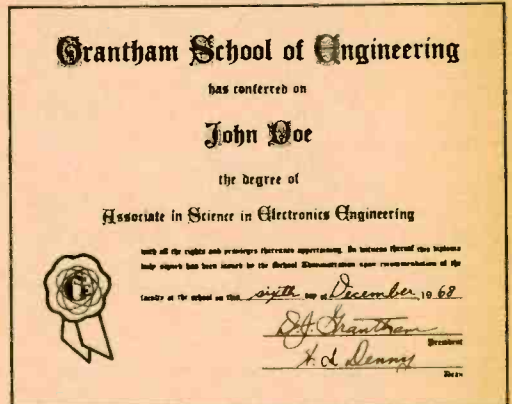
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WRITE FOR CATALOG "EB."



CIRCLE NUMBER 16 ON PAGE 15

Swap Shop

Individual readers (not commercial concerns) may swap electronic gear by sending one listing, name and address to Swap Shop, ELECTRONICS ILLUSTRATED, 67 West 44th Street, New York, N.Y. 10036. Space is limited; only most interesting offers are published.

CITIZENS BAND

LLOYD walkie-talkie (two-channel) with AC adaptor. Want SWR meter or Drake TV1000LP low-pass filter. Steve Lympany, WN3LLX, 9 Buena Vista Dr., Delmont, Pa. 15626.

REGENCY CB-27, Utica T-C2, Gonset G-15, RCA Mark 7, Johnson rigs. Swap for equipment of equal value. Roger Courtois, 18 Summer St., Saco, Me. 04072.

INTERNATIONAL 12-channel CB rig with 23-channel tunable receiver, 6/12/115V. Want SW receiver or scope. Tim Gieseler, 336 Hihn Rd., Ben Lomond, Calif. 95005.

MIDLAND model 13-722 2-watt transceiver, three channels. Will swap for base transceiver. Jack Smeelink, 1910 Pokogon Rd. S.E., Grand Rapids, Mich. 49506.

CRYSTALS for CB channels 2, 5, 18 and 22. Will swap for other crystals or best offer. L. Olson, 269 E. Market #3, Long Beach, Calif.

LAFAYETTE HE-20C CB rig, Avanti Astroplane antenna, accessories. Want power supply or HA-600T SW receiver. Gregory D. Gogates, 326 Conklin-town Rd., Wanaque, N.J. 07465.

REGENCY Range-Gain I Transceiver. Want SWL equipment. Lewis Hurwitz, 2832 Windsor Dr., Alameda, Calif. 94501.

LAFAYETTE HE-20T transceiver. Want Garrard SL-65, SL-45 or best offer. Charles Green, Box 18, Fontana, Calif. 92335.

AMATEUR RADIO

HY-GAIN 80-10 tunable vertical, Antenna Specialist Super Magnum, ham accessories, Lafayette AM/FM/VHF receiver. Want Knight KG-221 VHF receiver or best offer. L. Saunders, 1627 Lamont St. N.W.1, Washington, D.C. 20010.

LAFAYETTE HA-350 receiver and Knight T-150. Want Galaxy V. Tom Wood, WA2DSL, 24 Roxbury Rd., Port Washington, N.Y. 11050.

DRAKE 2NT, with manual and crystal. Will swap for VHF amateur gear or best offer. Dale Merkey, Rt. 2, Myeistown, Pa. 17067.

HEATH HW-16 GR-64, BC-348, T-22 and surplus gear. Want best offer or cash. Bob Davis, 2009 Crums Ln., Apt. 47, Louisville, Ky. 40216.

MONARCH Ham-1 general-coverage receiver. Will swap for Heath Twoer or Sixer, or similar gear. Philip Ragusa, WA2JAF, 2295 West 11 St., Brooklyn, N.Y. 11223.

BC-456-E modulator and T-20ARC-5 transmitter with tubes. Will swap for coax switch or best offer. Jay Carpenter, Box 263, Berryville, Va. 22611.

HEATH HO-13 Ham-Scan scope. Want novice transmitter. Mack Humber, Box 15, Johns, Ala. 35086.

CONVERTER, preamp and transmitter for 6 meters. Will swap for VTVM or best offer. Bob Haller, 2219 Forest Park Blvd., Fort Wayne, Ind. 46805.

KNIGHT T-60, R-100A, V-44 and accessories. Want 6-meter transceiver, TV camera, 35mm slide projector or best offer. Richard Schuh, WA0MDD, 180 E. King St., Winona, Minn. 55987.

GONSET 6-meter Linear III plus spare 816's, Astatic 10D with PTT stand, Topaz mobile power supply. Want Eico VTVM, Heath equipment, linear amplifier or best offer. Richard Jacobs, WA0AIY, 4941 Tracy Ave., Kansas City, Mo. 64110.

AM TRANSCEIVER for 10 meters. 5-watt output. Want Lafayette HE-45, HA-750 or similar. George Cshanian, WB2DYB, 95 Woodland Ave., Fords, N.J. 08803.

HEATH SB-310 plus SSB and CW crystal filter. Want SSB transceiver or cash. Mitchell Kassoff, 252-61 Leith Rd., Little Neck, N.Y. 11362.

HAMMARLUND HQ-110, Heath DX-20, Globe Chief Deluxe. Swap for Galaxy 5MK3 accessories or best

offer. Doug Pongrance, WA3JBN, 316 Donnell Rd., Lower Burrell, Pa. 15068.

HALLICRAFTERS SR-42A 2-meter transceiver with Alliance rotor and Cushcraft A-144-11 beam. Want Lafayette PB-150 police receiver and CB transceiver, or best offer. Greg Linn, 415 California St., Arcadia, Calif. 91006.

KNIGHT T-60 transmitter, DK-60 antenna relay, other items. Will swap for motorscooter, motorcycle or best offer. Bob Conroy, 10902 Pohick Rd., Fairfax Station, Va. 22039.

MOBILE CONVERTER for 10, 15 and 20 meters, homebrew, crystal controlled. Swap for RF signal generator or what have you. Mike Kaufman, K6VCI, 3733 Meadville Dr., Sherman Oaks, Calif. 91403.

KNIGHT R-100A receiver, Globe Chief 90-W CW transmitter, Panasonic tape recorder. Want AM/FM stereo receiver or stereo tape recorder. Thomas Maciaszek, 1200 Fairmount Ave., Elizabeth, N.J. 07208.

SURPLUS MAB transceiver and power supply. Will swap for best offer. Dwight Weidman, RFD 1, Hedgesville, W. Va. 25427.

SURPLUS TRANSMITTER for 75-80 meters and 100-V power supply. Want Heath Twoer or 2-meter FM receiver. R. T. Pollock, VE3PE2LX/PLX, 799 Glen-grove St., Oshawa, Ont., Canada.

CW TRANSMITTER, homebrew, 75-W output on 40-80 meters. Will swap for test equipment or receiver. Charles Nylander, 9459 Bianca Ave., Northridge, Calif. 91324.

KNIGHT T-60 transmitter for 6-80 meters. Want Heath 34, Comstat 19, World Hustler or Eico Sentinel 12 CB rig. Paul Gorrell, Box 228, Mashpee, Mass. 02649.

WRL Globe Chief 90 transmitter, Drake Low-pass filter, screen modulator. Will swap for best offer. Joe Olesik, WA1JQA, Concord Terrace, Somers, Conn. 06071.

SHORT-WAVE LISTENING

NATIONAL NC-60, BC-1333 receiver, T-11B VHF transmitter, IR4-1, -3 isolation and filter amps. Want NC-300 or similar. Peter Zawistowski, 8 Burbank St., Pittsfield, Mass. 01201.

SX-101A and **S-120** receivers; Eico 720, T-150 transmitters. Will swap for best offer. M. Sand, WA3JH, 7544 Brockton Rd., Philadelphia, Pa. 19151.

HEATH QF-1 Q-Multiplier and Sams Photofact Folders. Will trade for inoperative test equipment. James Fred, RR 1, Cutler, Ind. 46920.

KNIGHT R-55 receiver and other gear. Swap for 30-50 or 150-170 mc police receiver, or CB rig. David Drake, K8BRX, RFD 5, Box 277a, Traverse City, Mich. 49684.

KNIGHT Star Roamer, stereo changer, tape recorder, Hallicrafters S-38E, receivers for all bands. Want ham transceiver and test equipment. Robert Vanenburgh, Box 132, Milford, Iowa 51351.

SURPLUS R-435/VRC-2X receiver. Will swap for tape recorder or 5-band aero radio. Alex Yoho, R.R. 2, Topeka, Kan.

HALLICRAFTERS S-120 receiver, modified Knight Space-Spanner. Want Heath HR-10 receiver or similar. Neil Judell, Haviland Rd., Ridgefield, Conn. 06877.

KNIGHT Star Roamer. Want electronic keyer or best offer. Charles Sulana, 205 S. Virginia St., Hobart, Ind. 46342.

ZENITH two-band SW radio (49-16 meters) and Viscout transistor radio. Want Hallicrafters general-coverage radio, CB walkie-talkie or best offer. Lloyd Colston, 825 S. Washington, Hobart, Okla. 73651.

KNIGHT Span-Master receiver. Want 30-50 mc VHF communications receiver or best offer. George Bryson, 8762 Hosmer, Detroit, Mich. 48214.

KNIGHT KG-221A police receiver (152-174 mc). Want new EICO 950K capacitor checker. Joseph Rotello, Jr., 1341 S. Edlin, Tucson, Ariz. 85711.

SURPLUS BC-342-N receiver. Swap for Eico 723 transmitter and 730 driver, or best offer. Ronald Dudinski, 250 Chestnut St., Plymouth, Pa. 18651.

HALLICRAFTERS S-120 with mechanical filter. Want stereo equipment or best offer. John Olson, 3209 Oak Hollow Rd., Oklahoma City, Okla. 73120.

STAR ROAMER or Heath GR-64 wanted in exchange for components and defective radios. Kim Harloff, 2302 Afton St., Hillcrest Heights, Md. 20031.

LAFAYETTE Explor-Air receiver. Will swap for best offer. Michael Blase, 119 Brookmoor Rd., West Hartford, Conn. 06107.

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CIRCLE NUMBER 17 ON PAGE 15

Broadsides

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Talking about **tape**, if you're interested in low-noise audio tapes for professional recording, you'll want to catch a glimpse of Ampex's full-color brochure on their Series 404 and 600. Discussion is succinct but it shows just what to look for if you need quality. Ask for brochure T-343 from Ampex Corp., 401 Broadway, Redwood City, Calif. 94063.

RCA has the perfect companion for your Motorola HEP replacement guide. It's their own

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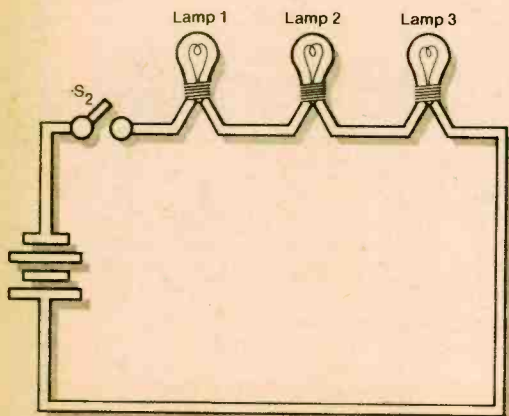
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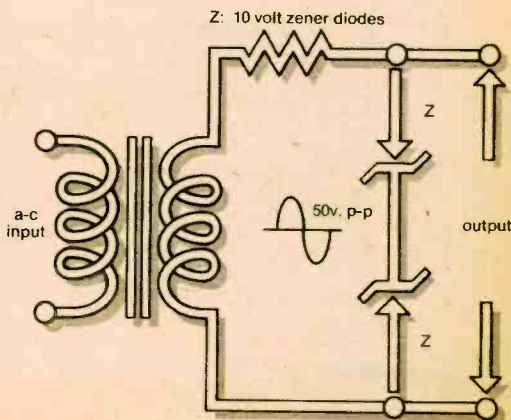
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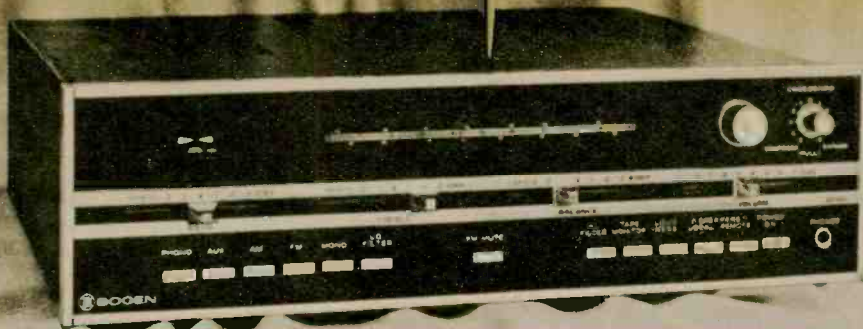
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CRESCENDO. Model BR360 is solid-state AM/FM stereo receiver delivering 100 watts IHF (40 watts rms per channel). THD is said to be 0.5 per cent into 4 ohms at rated power. FM tuner capture ratio: 1.9db; sensitivity: 1.5 μ V for 30-db quieting. Features include sliding controls, mechanical filter on AM and Crescendo Control, a dynamic range expander and compressor providing up to a 5-db effect on program material. \$339.95. Bogen Communications Div., Lear Siegler Inc., Paramus, N.J. 07652.



Convenience Caddy. Introduced a short time ago, Sylvania's portable tube tester and color-bar generator may be the answer for servicemen who are constantly on the go. This solid-state package weighs 27 lbs. and combines two most needed pieces of test gear. The tube tester is a 73-socket unit capable of checking all popular U.S. and foreign receiving tubes. Tester checks dynamic power output, and tests for shorts and leakage, or gas. Multi-section tubes are tested individually. Color-bar generator gives six patterns: raster, color bars, vertical and horizontal lines, dots and a 10 x 13 cross hatch. \$299.95. Sylvania Electric Products Inc., New York, N.Y. 10017.

Highly Selective. Model TX-900 is an AM/FM tuner said to offer professional performance at reasonable cost. Tuner has solid-state circuitry, with 3-FET front end providing two RF stages. IF section uses two crystal filters along with four ICs. Signal-to-noise ratio is said to be 60db at 30 per cent modulation. Features include noise filter on FM stereo, adjustable muting, indicator lights for AM and FM mode, and two tuning meters. One meter indicates FM signal strength, the other shows correct tuning point. Cross modulation is said to be virtually eliminated. \$239.95. Pioneer Electronics Corp., Farmingdale, N. Y. 11735.



A woman with blonde hair, wearing a white short-sleeved button-down shirt and a black and white checkered skirt, is leaning over a dark table outdoors. She is looking towards the camera with a slight smile. The background shows trees and a clear sky.

**What a Beauty,
What a Build
And Boy!!!!
What Performance!**

**"The Perfect 36" is the
up-top CB antenna
for on-top people, from**

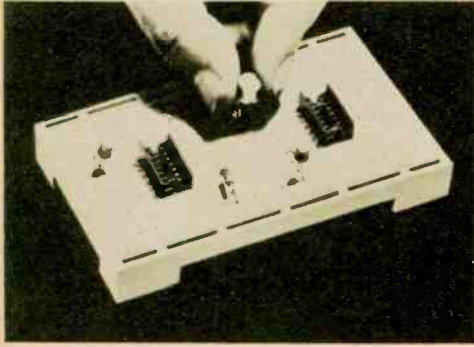
 Shakespeare

C/P Corporation Division, The Shakespeare Co., RFD 3, Columbia, S. C. 29205

CIRCLE NUMBER 2 ON PAGE 15

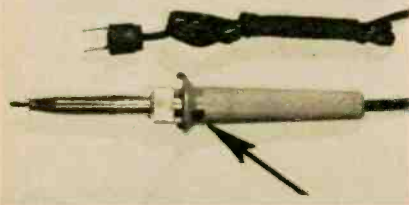
Electronic Marketplace

Solid Setup. Electronics without solid-state devices is unthinkable. To insure that transistors, diodes and ICs will work as planned in circuits you design, breadboarding is the answer. A new line of DeC breadboards expands previous ver-



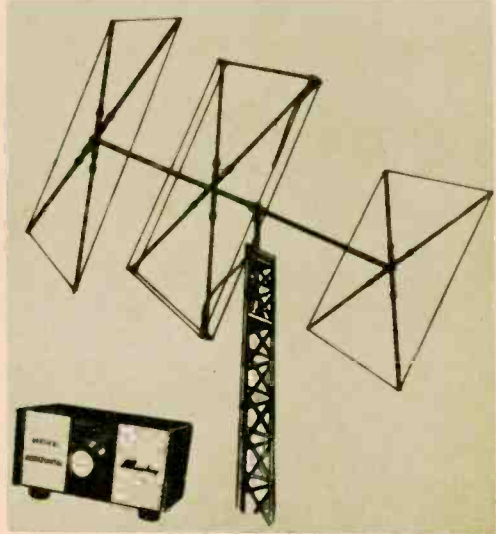
sions of discrete-component boards by providing an IC capability. Connection points number 208, with up to 40 independent junctions. Double-leaf spring contacts are linked in parallel rows and are numbered. Standard push-in carriers are said to accommodate all types of IC packages. Prices range from \$6.75 to \$23.75, depending on model. Intratec Div., British Aircraft Corp., Arlington, Va. 22202.

Variable Heat. Model IDL pencil iron offers instant heat and slim 3-oz. design for either light- or heavy-duty work. Dual-heat element is controlled by a thermal time-delay relay. No transformer is necessary for instant warmup. When switch in handle (arrow) is pressed, high-wattage element brings tip to operating



temperature. Relay then cuts in low-wattage element to maintain proper heat for normal work. When higher heat is required, relay automatically cuts in high-wattage element. Initial input is 180 watts, operation is at 40 watts. Dual heating elements may be changed quickly without tools, according to the manufacturer. Handle is made of polycarbonate plastic; iron plated or regular 1/8-in. plug-in tips are inserted via set screw. \$12.98. Wall Manufacturing Co., Kinston, N.C. 28501.

Polarized Switching. Model MCQ-27VH, the Mod Quad, is three-element cubical-quad CB antenna incorporating a polarization switching system. This permits contact with base stations operating in horizontal plane and mobiles operating vertically. \$122.05. Mosley Electronics Inc., Bridgeton, Mo. 63042.

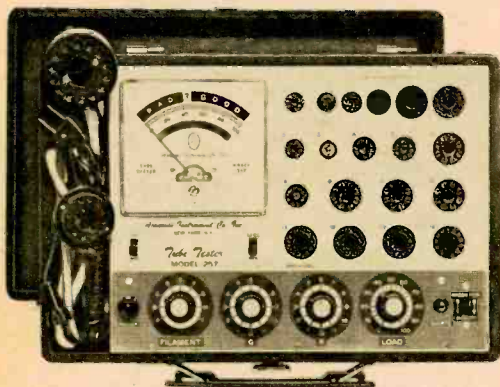


Emergency Broadcasts. New line of solid-state, public-service band receivers includes a low-band model (6254), high-band model (6251) and dual-band Model 6252A (shown). All three incorporate AM broadcast band. Model 6252A covers 30 to 50 mc in one band and 147 to 174 mc in the other. Receiver features three separate tuner and converter circuits and four IF stages. It operates on batteries or AC through a built-in power supply and battery rejuvenation circuit. Specs are same for



all models. Models 6251 and 6254: \$35.95; Model 6252A: \$59.95. Channel Master, Div. of Avnet, Inc., Ellenville, N.Y.

The New 1970 Improved Model 257 **A REVOLUTIONARY NEW TUBE TESTING OUTFIT**



COMPLETE WITH ALL ADAPTERS AND ACCESSORIES, NO "EXTRAS"

STANDARD TUBES:

- ✓ Tests the new Novars, Nuvistors, 10 Pins, Magnovals, Compactrons and Decals.
- ✓ More than 2,500 tube listings.
- ✓ Tests each section of multi-section tubes individually for shorts, leakage and Cathode emission.
- ✓ Ultra sensitive circuit will indicate leakage up to 5 Megohms.
- ✓ Employs new improved 4 1/2" dual scale meter with a unique sealed damping chamber to assure accurate, vibration-less readings.
- ✓ Complete set of tube straighteners mounted on front panel.

The Model 257 is housed in a handsome, sturdy, portable case. Comes complete with all adapters and accessories, ready to plug in and use. No "extras" to buy. Only

BLACK AND WHITE PICTURE TUBES:

- ✓ Single cable used for testing all Black and White Picture Tubes with deflection angles 50 to 114 degrees
- ✓ The Model 257 tests all Black and White Picture Tubes for emission, inter-element shorts and leakage.

COLOR PICTURE TUBES:

- ✓ The Red, Green and Blue Color guns are tested individually for cathode emission quality, and each gun is tested separately for shorts or leakage between control grid, cathode and heater. Employment of a newly perfected dual socket cable enables accomplishments of all tests in the shortest possible time.

\$52⁵⁰

NOTICE

We have been producing radio, TV and electronic test equipment since 1935, which means we were making Tube Testers at a time when there were relatively few tubes on the market, way before the advent of TV. The model 257 employs every design improvement and every technique we have learned over an uninterrupted production period of 34 years.

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Try it for 10 days before you buy. If completely satisfied remit \$52.50 plus postage and handling charge. (If you prefer you may **PAY MONTHLY ON OUR EASY PAYMENT PLAN.**) If not completely satisfied, return to us, no explanation necessary.

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Please rush me one Model 257. If satisfactory I agree to pay at the terms specified at left. If not satisfactory, I may return for cancellation of account

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Save Money! Check here and enclose \$52.50 with this coupon and we will pay all shipping charges. You still retain the privilege of returning after 10 day trial for full refund.

CIRCLE NUMBER 11 ON PAGE 15

Build this exciting Schober Consolette Organ



for only
*\$1040!

*Includes finished walnut console. (Only \$793 if you build your own console.) Amplifier, speaker system, optional accessories extra.

You couldn't touch an organ like this in a store for less than \$1800—and there never has been an organ of the Consolette II's graceful small size with 22 such pipelike, versatile voices, five-octave big-organ keyboards, and 17 pedals! If you've dreamed of an organ of your own, to make your own beautiful music, even if your home or budget is limited, you'll get more joy from a Schober Consolette II than any other "home size" organ—kit or no kit.

You can learn to play it. And you can build it, from Schober Kits, world famous for ease of assembly without the slightest knowledge of electronics or music, for design and parts quality from the ground up, and—above all—for the highest praise from musicians everywhere.

Send right now for the full-color Schober catalog, containing specifications of all five Schober Organ models, beginning at \$499.50. No charge, no obligation. If you like music, you owe yourself a Schober Organ!

The *Schober* Organ Corp., Dept. EI-15
43 West 61st Street, New York, N.Y. 10023

- Please send me Schober Organ Catalog and free 7-inch "sample" record.
 Enclosed please find \$1.00 for 12-inch L.P. record of Schober Organ music.

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ADDRESS _____

CITY _____ STATE _____ ZIP _____

CIRCLE NUMBER 18 ON PAGE 15



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Most often it's mommies and daddies.

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EXPERIMENT WITH A FOUR TRACE OSCILLOSCOPE PREAMP. WORKS WITH ANY OSCILLOSCOPE. SEE FOUR SIGNALS FROM FOUR SEPERATE SOURCES AT THE SAME TIME! COMPARE WAVEFORMS, PULSE TRAINS, ETC. KIT INCLUDES PRINTED CIRCUIT BOARD, PARTS AND INSTRUCTIONS (MINIBOX NOT INCLUDED).

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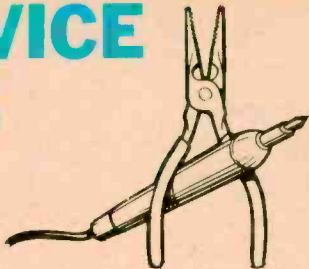
CIRCLE NUMBER 7 ON PAGE 15



PHASE CORPORATION

SERVICE TIPS

By
ART MARGOLIS



If your transistor radio comes on okay but then starts to make frying noises which gradually overwhelm the audio, chances are there is some leakage between the conductors on the PC board. This is especially true in humid weather. Scratching the board between the conductors will generally fix this.

The most common trouble with portable TVs happens to be breakage of the built-in antenna rod. Set owners often do not pull them all the way out of the socket before adjusting for a signal. You can purchase exact replacements rods (see photo). Remove the back of the set and take out the old rod—use a hacksaw if you must. The new one will slide into place and lock with a screw at bottom.



If your record changer can't land on records after just a few have dropped instead of the maximum eight, find the height-adjustment screw usually located on the back of the pickup arm. Try different adjustments until you get a setting which enables the arm to land high enough.

Tough television interference problems result from the FM transmissions in the 40-60 mc range. If you're near one of these transmitters your TV picture becomes instant hash. There are commercial traps you can buy to put in the antenna line, but the big trouble spot (pickup area) is the IF strip that's tuned to around 44 mc. Try installing a copper cage over the IF stages. It might work.

When you're replacing multi-colored wired components, in addition to making a wiring sketch, when clipping the old leads leave some of the colored insulation still attached. This way, if your work is interrupted, you can still rewire the unit correctly.

Safest way to test for the presence of DC high voltage in a CRT is to listen for it. Take a long screwdriver and jumper cord and short the anode connections to ground. (Connect the jumper to ground first.) This discharges the picture tube. Then turn on the TV and listen. If the high voltage is good, you'll hear the CRT shell bristle with it as the picture comes on.

When your electric clock stops, odds are better than even that the motor coil has opened up. Fortunately, these are easy to obtain and the old coil pulls out quite easily. Just notice where you should reattach the two wires. There are no adjustments to make after replacement.

1400-PC. GLASS FIBER OPTIC KIT

It's FUN!

It's Educational!

It's Gifty!

\$4.88

- ★ Make light "pipes"
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OPTICAL SCIENTIFIC BREAKTHRU!
Allows "hair thin" glass fibers (2-ft. long) to transmit & receive cold light energy of any color, by internal reflection. Bundled, jacketed. It guides, knoops, pipes light around corners, walls, even in circles, triggering such devices as light sensitive transmitters, diodes, etc. It CUTS, BENDS, ACTS like wire. Only one's imagination controls its 1000's of uses. PRICE: 12-pc. necessary kit, with "how-to-use booklet".

- \$25 SURPRISE PAK: transistors, rect. diodes, etc. .. \$3
- 50 GERMANIUM GLASS DIODES, 1N34, 1N48 no test \$1
- 40 TOP HAT SILICON RECTIFIERS, no test asst values \$1
- 25 EPOXY RECTIFIERS, silicon asst, no test \$1
- 40 PRECISION RESISTORS, 1/2-W. 1% asst values .. \$1
- 30 TRANSISTORS, rf, if, audio, osc. no test \$1
- 60 TUBULAR CONDENSERS, to .5mf to 1KV, asst \$1
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- 30 POWER RESISTORS, to 25 watts, to 24K ohms \$1
- 10 VOLUME CONTROLS, to 1 meg, switch too! \$1
- 10 ELECTROLYTICS, to 100mf, tubulars too, asst \$1
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- 10 TRANSITOR ELECTROLYTICS to 100mf, asst values \$1
- 60 COILS AND CHOKES, if, rf, ant, osc, peaking, etc \$1
- 65 HALF WATTERS, to 1 meg, 5% popular values too \$1
- 2 FIELD EFFECT TRANSISTORS, n channel, hobby \$1
- 10 PANEL SWITCHES, toggle, slide, micro, rotary .. \$1
- 3 "SUN" BATTERIES, for 100's of lite sens projs \$1
- 5 "IBM" COMPUTER BOARDS, many trans, diodes, \$1
- 40 "MICRO" CONDENSERS, for transistor circuitry \$1
- 50 TERMINAL STRIPS, 1 to 8 lug types \$1
- 4 PHOTO ELECTRIC CELLS, hi. imbl., schematic \$1
- 40 "TINY" RESISTORS, 1/10W, 5% too! to 1 meg.. \$1

ADD POSTAGE, avg. wt: 1/2 lb. CATALOG 10¢

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WORLD'S FINEST CORED SOLDER



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60/40
18 S.W.G.



Latest PC
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CIRCLE NUMBER 14 ON PAGE 15

BIG BROTHER RADIO

and Electronics Circuits

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Training Electronics Technicians Since 1946

PROGRESSIVE "Edu-Kit"® HOME RADIO COURSE

Now Includes

- ★ 12 RECEIVERS
- ★ 3 TRANSMITTERS
- ★ SQ. WAVE GENERATOR
- ★ SIGNAL TRACER
- ★ AMPLIFIER
- ★ SIGNAL INJECTOR
- ★ CODE OSCILLATOR

- ★ No Knowledge of Radio Necessary
- ★ No Additional Parts or Tools Needed
- ★ EXCELLENT BACKGROUND FOR TV
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- ★ Sold in 79 Countries

YOU DON'T HAVE TO SPEND HUNDREDS OF DOLLARS FOR A RADIO COURSE

The "Edu-Kit" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. Our Kit is designed to train Radio & Electronics Technicians, making use of the most modern methods of home training. You will learn radio theory, construction practice and servicing. THIS IS A COMPLETE RADIO COURSE IN EVERY DETAIL.

You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit chassis.

You will learn the basic principles of radio. You will construct, study and work with RF and AF amplifiers and oscillators, detectors, receivers, test equipment. You will learn and practice coding, using the Progressive Code Oscillator. You will learn and practice trouble-shooting, using the Progressive Signal Tracer, Progressive Signal Injector, Progressive Dynamic Radio & Electronics Tester, Square Wave Generator and the accompanying instructional material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. You will build Receiver, Transmitter, Square Wave Generator, Code Oscillator, Signal Tracer and Signal Injector circuits, and learn how to operate them. You will receive an excellent background for television, Hi-Fi and Electronics.

Absolutely no previous knowledge of radio or science is required. The "Edu-Kit" is the product of many years of teaching and engineering experience. The "Edu-Kit" will provide you with a basic education in Electronics and Radio, worth many times the low price you pay. The Signal Tracer alone is worth more than the price of the Kit.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in Radio & Electronics because you want an interesting hobby, a well paying business or a job with a future, you will find the "Edu-Kit" a worth-while investment. Many thousands of individuals of all

ages and backgrounds have successfully used the "Edu-Kit" in more than 79 countries of the world. The "Edu-Kit" has been carefully designed, step by step, so that you cannot make a mistake. The "Edu-Kit" allows you to teach yourself at your own rate. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "Edu-Kit" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "Edu-Kit" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, study theory, practice trouble-shooting—all in a closely integrated program designed to provide an easily-learned, thorough and interesting background in radio.

You begin by examining the various radio parts of the "Edu-Kit." You then learn the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will enjoy listening to regular broadcast stations, learn theory, practice testing and trouble-shooting. Then you build a more advanced radio, learn more advanced theory and techniques. Gradually, in a progressive manner, and at your own rate, you will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional Radio Technician.

Included in the "Edu-Kit" course are Receiver, Transmitter, Code Oscillator, Signal Tracer, Square Wave Generator and Signal Injector Circuits. These are not unprofessional "breadboard" experiments, but genuine radio circuits, constructed by means of professional wiring and soldering on metal chassis, plus the new method of radio construction known as "Printed Circuitry." These circuits operate on your regular AC or DC house current.

THE "EDU-KIT" IS COMPLETE

You will receive all parts and instructions necessary to build twenty different radio and electronics circuits, each guaranteed to operate. Our Kits contain tubes, tube sockets, variable, electrolytic, mica, ceramic and paper dielectric condensers, resistors, tie strips, hardware, tubing, punched metal chassis, Instruction Manuals, hook-up wire, solder, selenium rectifiers, coils, volume controls, switches, etc.

In addition you receive Printed Circuit materials, including Printed Circuit chassis, special tube sockets, hardware and Instructions. You also receive a useful set of tools, a professional electric soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "Edu-Kit" also includes Code Instructions and the Progressive Code Oscillator, in addition to F.C.C. Radio Amateur License training. You will also receive lessons for servicing with the Progressive Signal Tracer and the Progressive Signal Injector, a High Fidelity Guide and a Quiz Book. You receive Membership in Radio-TV Club. Free Consultation Service, Certificate of Merit and Discount Privileges. You receive all parts, tools, instructions, etc. Everything is yours to keep.

Progressive "Edu-Kits" Inc., 1186 Broadway, Dept. 605-AE, Hewlett, N. Y. 11557

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Please rush my Progressive Radio "Edu-Kit" to me, as indicated below:
Check one box to indicate choice of model

- Regular model \$26.95.
- Deluxe model \$31.95 (same as regular model except with superior parts and tools plus valuable Radio & TV Tube Checker).

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- I enclose full payment. Ship "Edu-Kit" post paid.
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- Send me FREE additional information describing "Edu-Kit."

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- SET OF TOOLS
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- MEMBERSHIP IN RADIO-TV CLUB
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- PRINTED CIRCUITRY

SERVICING LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairs on the sets that you construct. You will learn symptoms and causes of trouble in home, portable and car radios. You will learn how to use the professional Signal Tracer, the unique Signal Injector and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do many a repair job for your friends and neighbors, and charge fees which will far exceed the price of the "Edu-Kit." Our Consultation Service will help you with any technical problems you may have.

FROM OUR MAIL BAG

J. Statitis, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money. The "Edu-Kit" paid for itself. I was ready to spend \$240 for a Course, but I found your ad and sent for your Kit."

Ben Valerio, P. O. Box 21, Magna, Utah: "The Edu-Kits are wonderful. Here I am sending you the questions and also the answers for them. I have been in Radio for the last seven years, but like to work with Radio Kits, and like to build Radio Testing Equipment. I enjoyed every minute I worked with the different kits; the Signal Tracer works fine. Also like to let you know that I feel proud of becoming a member of your Radio-TV Club."

Robert L. Huff, 1534 Monroe Ave., Huntington, W. Va.: "Thought I would drop you a few lines to say that I received my Edu-Kit, and was really amazed that such a bargain can be had at such a low price. I have already started repairing radios and phonographs. My friends were really surprised to see me get into the swing of it so quickly. The Trouble-shooting Tester that comes with the Kit is really swell, and finds the trouble; if there is any to be found."

PRINTED CIRCUITRY

At no increase in price, the "Edu-Kit" now includes Printed Circuitry. You build a Printed Circuit Signal Injector, a unique servicing instrument that can detect many Radio and TV troubles. This revolutionary new technique of radio construction is now becoming popular in commercial radio and TV sets.

A Printed Circuit is a special insulated chassis on which has been deposited a conducting material which takes the place of wiring. The various parts are merely plugged in and soldered to terminals.

Printed Circuitry is the basis of modern Automation Electronics. A knowledge of this subject is a necessity today for anyone interested in Electronics.

Build the Micro Oscilloscope for Your Test Bench



By WALT HENRY ONE of the more important test instruments to a service technician or serious hobbyist is an oscilloscope, a word which in itself is likely to bring to mind a large and cumbersome chunk of equipment.

But do oscilloscopes *have* to be the elephants of their world? Wouldn't it be nice to have a 'scope that required not much more bench space than a voltmeter and could be slipped into a drawer or tool kit? We thought it would so, we set out to do something about shrinking a 'scope. You can see the results above and on the cover.

Reducing size, however, did not mean a reduction in performance. Our Micro 'Scope shows figures actually superior to many general-purpose instruments. It also features the latest solid-state circuits. Along with a handful of conventional transistors and diodes, it uses four high-performance (yet inexpen-

sive) integrated circuits and five field-effect transistors. The only tube in the 'scope is the CRT. It is a 1EP1 flat-face type with a viewing diameter of 1 $\frac{1}{8}$ in. If size is not important the identical circuitry can be used to drive a 2-in. 2BP1 CRT or a 3-in. 3AQP1. With appropriate modification to the power supply to get the voltage up to about -1,500

SPECIFICATIONS

Vertical Amplifier

AC or DC input
Input impedance: 1 megohm shunted by 20 μ f
Calibrated vertical attenuator: .01, 0.1, 1, 10, 100 V/div.
Bandwidth: DC to better than 1 mc. AC—8 cps to 1 mc

Horizontal Amplifier

AC or DC input
Input impedance: 50,000 ohms
Sensitivity: 120 mv/div., AC and DC
Bandwidth: DC to 150 kc. AC—20 cps to 150 kc

Sweep Circuits

Triggered type with automatic trace-selector switch
Blanked retrace
Trigger level control
Selectable trigger on INT +, INT - or EXT.
Sync indicator to show sweep properly locked to input signal
Six sweep ranges calibrated for 50 ms, 5 ms, 0.5 ms, 50 μ s, 5 μ s and 0.5 μ s/div. Variable control allows rates down to 0.5 sec/div.

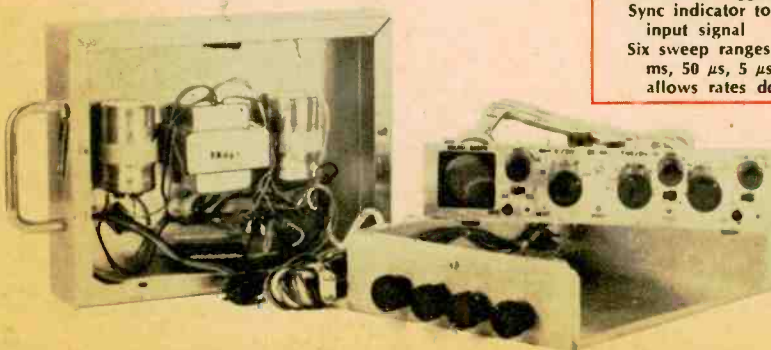


Fig. 1—At far left is scope's power supply which can be tucked away under your bench. At top, right is scope—built on 7 x 9-in. chassis bottom plate. The scope is sitting on 2 x 9 x 7-in. chassis in which focus, intensity, positioning controls are mounted.

Micro Oscilloscope

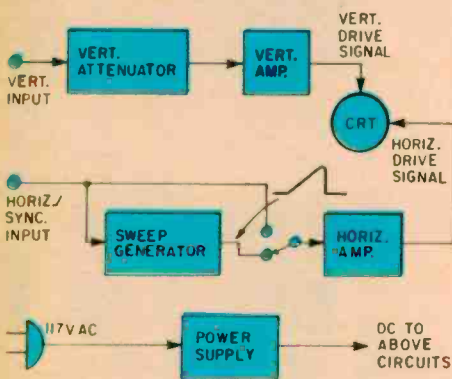


Fig. 2—Block diagram of the scope shows major circuits. The schematic showing each circuit in detail will be published in our March 1970 issue.

VDC, a 5-in. 5UP1 CRT may be used. Everything that can be shown on a 5-in. tube, however, can be displayed on the 1½-in. type. It's smaller but you just move closer to it.

Features

The usefulness of our Micro 'Scope is enhanced by DC-coupled vertical and horizontal amplifiers and a triggered sweep. What's triggered, sweep? Before we can explain it, let's talk briefly about the more familiar recurring sweep that is used in simpler general-purpose scopes. Recurring sweep is a continuous horizontal sweeping of the

CRT's electron beam that goes on and on whether there's a signal to the vertical input or not.

A triggered sweep is just the opposite. That is, the electron beam is not swept horizontally until either a trigger signal (external to the 'scope) or a portion of the signal to be viewed is applied to the sweep generator. Triggered sweep enables you to view irregular wave shapes or non-recurring one-shot signals. A triggered sweep can be adjusted to start at any point of the signal being viewed.

A unique feature of the 'scope's sweep circuit is the synclock-indicator neon lamp, NL2. When an input signal is not present, NL2 is off. When the sweep circuit is properly triggered, however, NL2 comes on. Switch S3 will cause the sweep generator to run continuously when in the *auto* position even though an input signal is not present. When S3 is closed there is no sweep unless the sweep generator is triggered by an input signal. The 'scope's specs are listed in detail on the first page of this article.

Construction

To build the 'scope the size shown here, we used subminiature switches and pots which cost more than conventional-size components. For example, the switch we specify for S6, a four-pole four-position non-shorting rotary switch, costs about \$6. A larger switch costs about \$3. The choice is yours and depends on your budget and the size instrument you want.

This article describes the 'scope's features

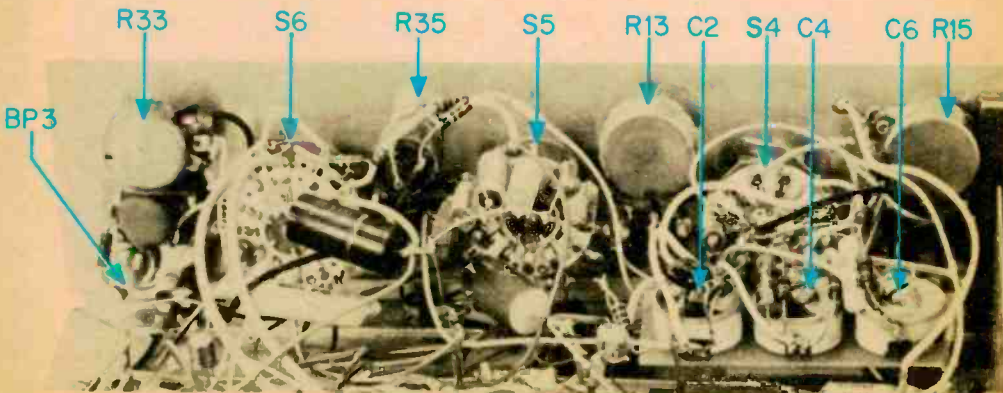


Fig. 3—Photo of rear of left side of front panel. Notice how capacitors are installed perpendicular to switch S5. Trimmer capacitors C2, C4 and C6 are mounted on a 1 x 2¼-in. piece of phenolic board behind vertical-attenuator switch S4. Board is held above chassis bottom plate by small aluminum bracket.

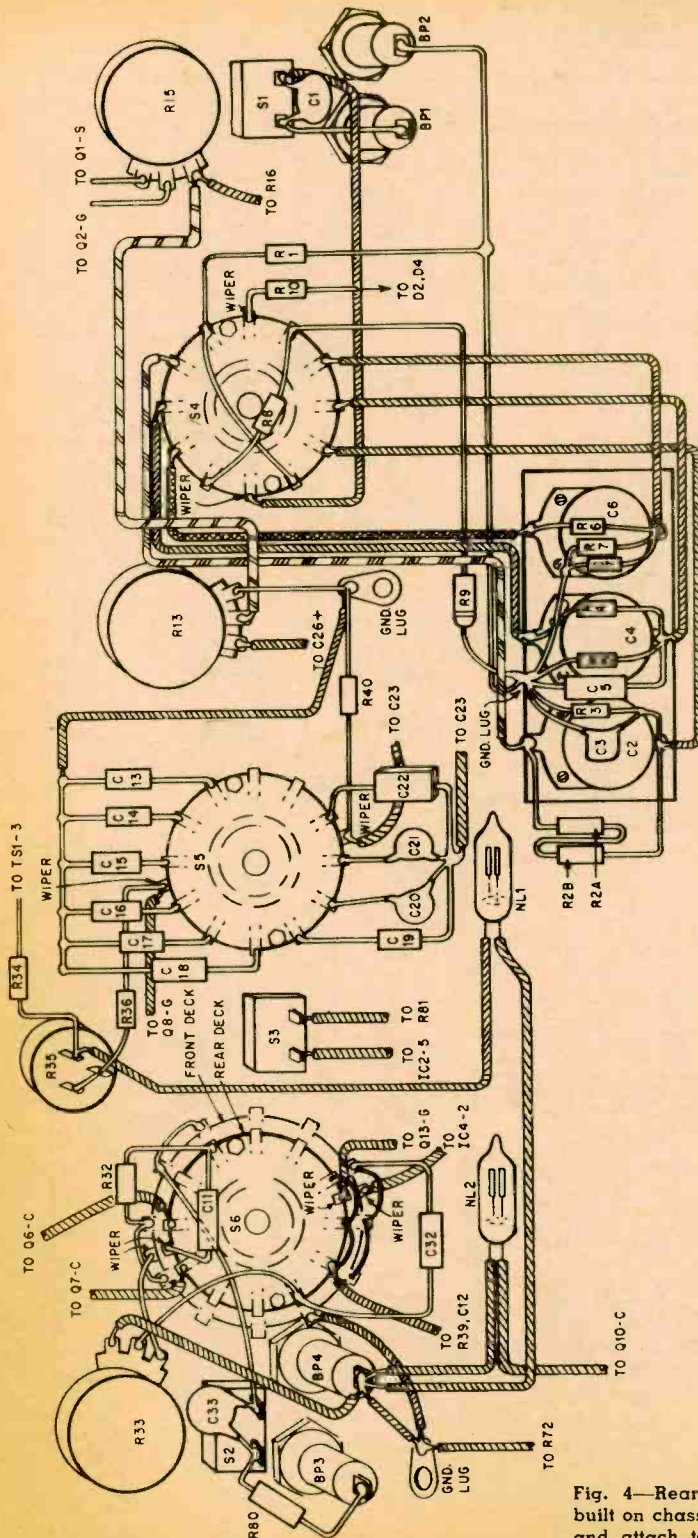


Fig. 4—Rear of front panel. Because 'scope is built on chassis bottom plate, make 2 x 9-in. panel and attach to bottom plate with angle brackets.

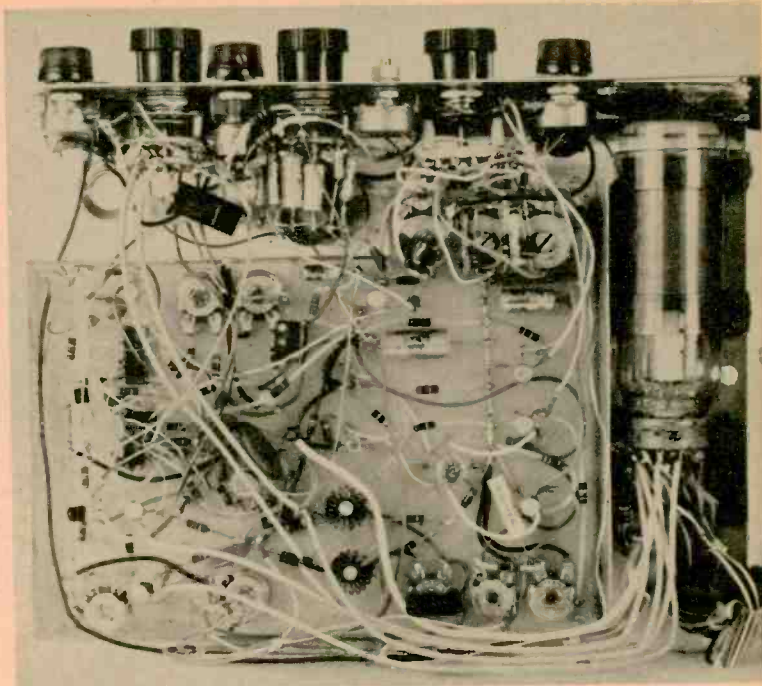
and includes the Parts List; enough information for you to start construction. The second part of the article, which will appear in our March 1970 issue will include the schematics and explanations of how the 'scope works, the calibration procedure and operating instructions.

The 'scope is built in two 2 x 9 x 7-in. aluminum chassis boxes. The power supply is in one box and all other components and operating controls are in the other box. The 'scope is built in two units to keep the main section as small and light as possible. The power transformer and filter capacitors are by far the largest and heaviest components and are in the power supply box which can be tucked away under a workbench or on a shelf out of the way. The main section is small enough to set atop other test equipment or on a shelf.

Of course all parts could be built in one larger case. If you do this be sure to keep the power transformer as far as possible from the CRT since 60-cps noise from the transformer's stray magnetic field may show up as a ripple on the CRT. In our two-cabinet construction some 60-cps ripple shows up on the CRT when the 'scope unit sits directly on top of the power supply.

The interconnecting cable can be made as long as desired. Unused cable length can be coiled up and tucked inside the power supply. We attached a car-

Fig. 6—Looking right down into guts. It's difficult to see here but there's a metal shield between right side of board and CRT. It's necessary to keep AC field of CRT away from vertical-input circuit.



rying handle and clips to hold the two units together for carrying.

The appearance of your 'scope will depend greatly on panel layout and markings. We sanded the aluminum surface then put the lettering on with a Leroy lettering set and India ink. The panel was then sprayed with a heavy coat of clear Krylon to give it durability. Other methods such as transfer lettering will work just as well.

Neon lamps NL1 and NL2 can be cemented to the inside of the case with transparent silicon-rubber adhesive. Circuit layout in the scope unit is important especially in the vertical amplifier section.

Most components in our model are mounted on a $4\frac{5}{8} \times 6\frac{1}{2}$ -in. glass-epoxy circuit board. However, perforated circuit

board and flea clips may also be used. The vertical attenuator is built on a separate $1 \times 2\frac{1}{2}$ -in. board and mounted behind vertical-attenuator switch S4. *Focus*, *intensity*, vertical- and horizontal-position controls R73, R75, R18 and R69 are mounted on the side of the chassis box. All other controls are mounted on the front panel. The chassis was modified by cutting one side (2×9 in.) away and attaching a new side (the front panel) to the chassis bottom plate. This allows good access to all parts. The CRT is mounted with two large nylon cable clamps.

Note in Figs. 6 and 7 that a metal shield is installed between the CRT and the circuit board. It provides electrostatic and thermal shielding between the CRT and sensitive vertical-amplifier input stages. The circuit lay-

Fig. 7—Closeup of CRT shows how it's mounted on $\frac{1}{2}$ -in. spacers with cable clamps. Wood frame at right holds graticule. Note $5\frac{1}{2}$ -in. long \times $1\frac{1}{2}$ -in. high shield behind CRT.



Micro Oscilloscope

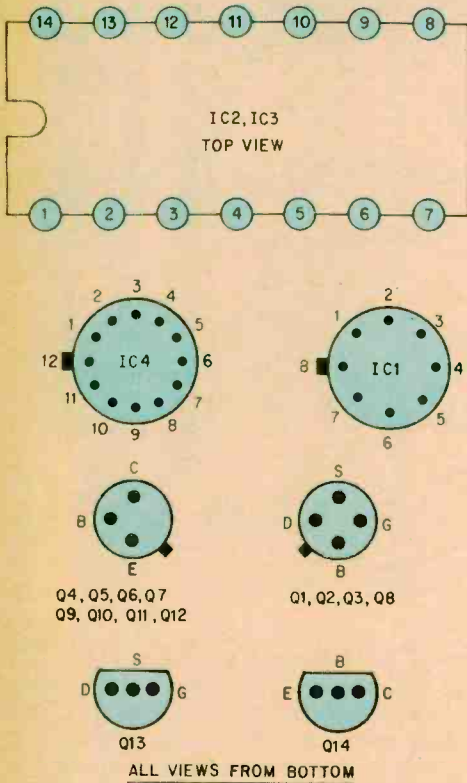


Fig. 8—Use these diagrams to identify semiconductor leads. Note that views of IC2 and IC3 are of top. View is of bottom of other semiconductors.

out should be similar to the one shown. It is necessary to keep the vertical amplifier output well away from the input to prevent oscillation.

Layouts of the horizontal amplifier and sweep generator are not so critical but all signal leads should be kept well separated both on the board and to the various front-panel controls and CRT. Leads to the four controls on the chassis side should be tightly cabled together. Note that the horizontal-position control's wiper lead (center terminal of R69) is shielded. The shield provides ground connection to both horizontal- and vertical-position controls.

We soldered all integrated circuits and transistors directly into the circuits. You may want to use sockets, especially since part of the checkout and calibration procedure requires that transistors Q4, Q5, Q6 and Q7

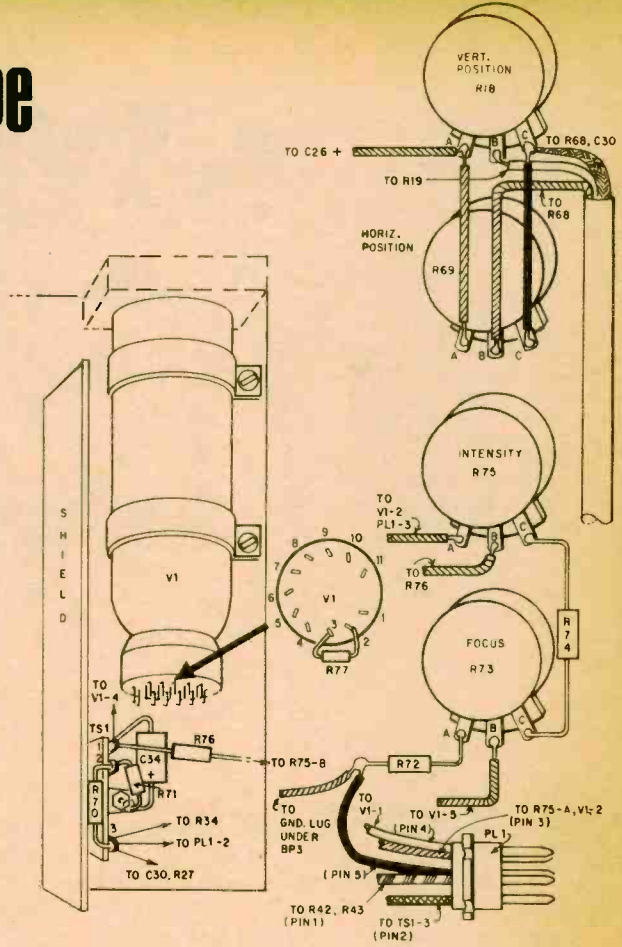
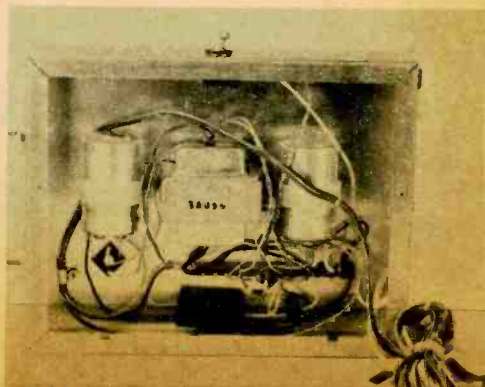


Fig. 9—Left sketch shows parts near CRT's base. Positioning, intensity, focus controls (right) go on side of chassis (cover). PL1 goes to power supply.

to be removed. If you do not use sockets leave these transistors out until told to put them in.

The RCA type 40468A transistor must be handled carefully to prevent it from being

Fig. 10—Power supply is also built in 2 x 9 x 7-in. aluminum chassis. Pictorial and schematic will appear in article in our March 1970 issue.



destroyed by electrostatic charges. The transistor comes with the leads shorted together with a small eyelet. Before removing the eyelet wrap a fine wire around the leads just under the case to keep the four leads shorted together. Don't remove this lead until after the transistor has been installed in the circuit board.

Values of electrolytic capacitors are not important except for C13, 14 and 15. Others may be the nearest available value. Be sure that power decoupling capacitors C26 and

C30 are mounted on the circuit board close to the amplifier stages.

The graticule for the CRT may be made by stretching fine wire across a piece of stiff clear or green plastic. Use a drop of glue on each edge to hold that wire taut. Spray the plastic and wires with a heavy coat of clear Krylon to hold the wires in place.

Sockets for the 1EP1 CRT are not readily available. If you have trouble locating one just solder the leads directly to the CRT's pins.

PARTS LIST

- BP1-BP4—Insulated phone-tip jack
 BR1—Bridge rectifier; minimum ratings: 2 A, 250 PIV (Varo VS 248, Allied 49 D 34 VS248-VA, \$2.15 plus postage. Not listed in catalog)
- Capacitors:**
 C1, C30, C31—.02 μ f, 1,000 V disc
 C2, C4, C6—1.5-20 μ f midget trimmer (Elmenco 402, Allied 43 D 7088, 23¢ plus postage. Not listed in catalog)
 C3, C23—100 μ f, 500 V dipped silver mica
 C5—1,000 μ f, 500 V dipped silver mica
 C7—.01 μ f, 200 V (Sprague 192P10392, Allied 43 C 0347)
 C8—120 μ f, 6 V electrolytic
 C9—70 μ f, 20 V electrolytic
 C10—680 μ f, 500 V dipped silver mica
 C11—.05 μ f, 500 V disc
 C12—150 μ f, 500 V dipped silver mica
 C13—22 μ f, 15 V miniature tantalum electrolytic
 C14—2.2 μ f, 20 V miniature tantalum electrolytic
 C15—.22 μ f, 35 V miniature tantalum electrolytic
 C16—.022 μ f, 50 V tubular
 C17—2,200 μ f, 500 V dipped silver mica
 C18—220 μ f, 500 V dipped silver mica
 C19, C32—.33 μ f, 50 V tubular
 C20—.033 μ f, 50 V tubular
 C21—.0033 μ f, 500 V disc
 C22—330 μ f, 50 V disc
 C24—15 μ f, 6 V electrolytic
 C25—.1 μ f, 1,000 V disc
 C26—100 μ f, 10 V electrolytic
 C27—450 μ f, 100 V electrolytic (Sprague 451F100AA, Allied 43 C 5091)
 C28—4,600 μ f, 15 V electrolytic (Sprague 462G015AA, Allied 43 D 5032, \$2.31 plus postage. Not listed in catalog)
 C29—8 μ f, 500 V electrolytic
 C33—.2 μ f, 600 V tubular
 C34—1 μ f, 450 V electrolytic
 D1-D5—1N914 diode
 D6—8.5 V, 1 watt, 5% zener diode (Sarkes Tarzian VR8.5A or equiv.)
 IC1—CA3028 integrated circuit (RCA)
 IC2, IC3—MC785P integrated circuit (Motorola)
 IC4—CA3018 integrated circuit (RCA)
 NL1—NE-86 neon lamp
 NL2, NL3—NE-2 neon lamp
 PL1—five-prong miniature cable connector (Amphenol 91-MPM5L, Allied 47 A 0570 or equiv.)
 Q1, Q2, Q3, Q8—40468A transistor (RCA)
 Q4, Q5—2N5183 transistor (RCA)
 Q6, Q7, Q10, Q11, Q12—2N5184 transistor (RCA)
 Q9—2N963 transistor (Motorola)
 Q13—2N5459 field-effect transistor (Motorola)
 Q14—MPS3646 transistor (Motorola)
- Resistors:** $\frac{1}{4}$ watt, 10% unless otherwise indicated. Values are in ohms unless otherwise indicated.
- R1, R4, R6, R8—1 megohm (5%)
 R2A—430,000 (5%) R2B—470,000 (5%)
 R3—100,000 (5%) R5—10,000 (5%)
 R7, R10, R12, R47, R49, R52, R80, R81—1,000 (R7, 5%)
 R9—100 (5%) R11, R21, R50—3,900
 R13, R18—1 megohm linear-taper pot
 R14, R26, R39, R48, R66—1,000 ohm printed-circuit pot (Mallory MTC-4, Lafayette 33 E 16718)
 R15—5,000 ohm linear-taper pot
 R16, R71—56,000 R17, R38, R63—5,600
 R19, R68—10,000 ohm printed-circuit pot (Mallory MTC-4, Lafayette 33 E 16783)
 R20, R41, R56—4,700 R22, R23, R24, R25—2,200
 R27, R31—8,200, $\frac{1}{2}$ watt R30, R53, R57—470
 R28, R29—180 R32—220,000
 R33, R69—50,000 ohm linear-taper pot
 R34—24,000 (5%)
 R35—500,000 ohm linear-taper pot
 R36, R70, R74—47,000 R37—22
 R40—2,700
 R42, R43, R51, R54, R55—6,800
 R44, R78—150,000 R45, R64, R67—18,000
 R46, R76—39,000 R58—270,000
 R59—62,000 (5%) R60, R82—390
 R61—27,000 R62, R77—470,000
 R65—47 R72—560,000
 R73—250,000 ohm linear-taper pot
 R75—100,000 ohm linear-taper pot
 R79—200 (5%)
- S1, S2, S3—SPST miniature slide switch
 S4—two-pole, five-position non-shorting miniature rotary switch (Centralab PS-105, Allied 56 D 5352, \$5.04 plus postage, not listed in catalog)
 S5—two-pole, six-position non-shorting miniature rotary switch (Centralab PSA-203, Newark Electronics Corp., 500 N. Pulaski Rd., Chicago, Ill. 60624, \$4.80 plus postage)
 S6—four-pole, four-position non-shorting miniature rotary switch (Centralab PS-111, Allied 56 D 5355, \$6.30 plus postage, not listed in catalog)
- S7—SPST toggle switch
 SO1—five-prong miniature socket (Amphenol 78-PCG5, Allied 47 A 0332)
 SR1—Silicon rectifier; minimum ratings: 1 A, 400 PIV
 SR2—Silicon rectifier; minimum ratings: 1.5 A, 1,000 PIV (International Rectifier 1N5054 or equiv.)
 T1—Power transformer. Available from Universal Transformer Co., Wylie, Texas. \$7.50 plus postage, part No. 13699.
 V1—1EP1 cathode ray tube (RCA)
 Misc.—2 x 9 x 7-in. aluminum chassis (Bud AC406), 7 x 9-in. bottom plate (Bud BPA-1593), two of each required

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Eugene Frost, Columbus, Ohio, was stuck in low-paying TV repair work before enrolling with CIE and earning his FCC License. Today, he's an inspector of major electronics systems for North American Aviation. "I'm working 8 hours a week less," says Mr. Frost, "and earning \$228 a month more."

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EI-85

The Ham Shack

By Wayne Green
W2NSD/1



RADIO amateurs have by virtue of their personal interest in electronics a distinct advantage over non-hams. It makes a world of difference when you're learning because you are interested instead of learning because you must.

The field of electronics is an extremely complicated one and getting worse every day, right? So if you are going to be successful, don't you have to plan on going for at least a Master's degree, and perhaps even a Doctorate?

Perhaps. I guess that depends upon how you define success. If you are speaking in normal terms, success means that you will spend most of your life in debt, just barely paying off one long-term debt in time to incur the next. It means being careful of your expenses for the rest of your life and always making do with less than you would like.

College and all those degrees suit you for work with the larger corporations, where you trade away any possibility for making big money for security. There is, practically speaking, no real possibility of earning more than your wife can spend while working for a large corporation. Virtually every book in print on how to succeed warns of the pitfalls of college.

On the other hand, perhaps you are one of those adventurous individuals who likes the idea of shooting for more than a life-time salary. If you are, and your interest is electronics, you are the right person in the right place at the right time. There will be more fortunes made in electronics in the next few years than in probably any other field. If you're willing to invest a few years of hard work you should have little difficulty in ending up with a million dollars. How few years? I'd say it might take about ten years, at the outside. It could take a lot less. And that time is measured from right now, not from graduation.

Now I'll admit that there is a lot of satisfaction to be gained from being able to make

do with old clothes, inexpensive food, junk cars, and just barely eking out a living. You don't have to worry about taxes much and when you want to travel you hitch-hike. But it is a lot nicer to be able to do what you want, when you want, without having to worry about how much it's going to cost.

Perhaps also you should understand that millionaires can't really live like millionaires. Inflation cut into that bag. For instance, let's say you've retired with your megabuck and have invested it in 5 per cent tax-free municipal bonds. Fine, you get \$50,000 a year tax free. Now, after a trip to Europe for a few weeks, the expenses of your new home, a new fur coat for the wife, and a few other incidentals, you aren't going to have all that much to put toward a \$50,000 yacht or airplane. You won't be wanting, but you won't be a big spender either. You will have to leave the Rolls for the more wealthy and make do with a nice Porsche.

Here we are spending it, and we haven't even made it yet. How are we going to hitch a ride on that nice gravy train? I hinted that you are going to need an education, but then I talked down college. Is that consistent? Yes indeed. It seems to me that the basics of your education are up to you and once you have the basics, you should get someone else to pay for your advanced education.

Don't be so impatient, I'll be specific. The secret for getting the basics has been under your nose ever since you started reading this magazine. You'll find a number of excellent electronic schools running ads in these pages. I believe that you will get more practical electronic know-how from one of these courses than you will from most four-year courses in college. They are expensive, about the price of a very good receiver. But a receiver will wear out and be junked in a few years, while your education will stay with you for life.

The large companies will have little interest in you and you should have little interest in them. There are plenty of smaller companies that need you. These are the places where you will find real golden opportunities. If you work hard for a small company you will soon be experienced in every phase of the operation and will be in a position to step out when the conditions are ripe and start your own small company.

As electronics expands during the next generation there will be more opportunities

[Continued on page 115]

A LOOK INTO THE 1970s

El's Experts Tell It Like It's Going To Be

What's Ahead For Hi-Fi. By JOHN MILDER

TEN years from now stereo will be an entirely new kind of animal. The audio stimulation obtained from tapes and records will gradually give way to a visual experience.

The term hi-fi just won't do anymore. The new tag may come from some current and unwieldy item like *home entertainment*, or some new mouthful like *home electronics*. But the point to remember is that all electronic goings-on in your household (with the exception, I think, of amateur radio) are likely to combine and be subjected to the same high-performance standards as home audio is today.

High-fidelity video will come in various shapes and sizes. First of all, for those who can afford it, the TV picture is going to come out of the box and go up on the wall in wide-screen glory. One projection-TV system for home use already promises to arrive sometime in 1970, and others shouldn't be far behind. I've already seen examples of this particular chunk of the future—it's powerful stuff. And you'd be amazed by the amount of programming coming you *do* want to see that big and that clear.

At least two other video developments also will make their presence felt. Pre-recorded, packaged video programs, the visual counterpart of the LP record, should come on strong. The CBS EVR system is the likely candidate right now (as the actual medium), but one way or another, you're likely to buy video records of everything from the Smothers Brothers to the Super Bowl to play on your wide-screen TV. Second, the continuing expansion of cable-TV and UHF (maybe) will bring all kinds of new programming and information services that are only hinted at by the present stable of TV facilities.

As for the audio side of things, it's doubtful that the quest for higher fidelity (province of the finicky hobbyist) will be as important as the wider, general demand for high-performance audio (like a good refrigerator or toaster). Developments like the tape cassette will thrive and emphasize through their ease of operation that electronics is itself a convenience instead of a mystery. The cassette (or whatever comes next) still will not be a replacement for the LP record, which is just too convenient, efficient and economical a medium.

Current experiments with four-channel stereo may develop a strong appeal for a small but profitable market of audio buffs, but I suspect that it won't have the impact stereo itself had, unless the kids decide to take it up to experience their own kind of music. The demand for the very expensive perfectionist gear which tries to bring the concert hall into the living room will diminish as audio becomes just one component in the total home electronic setup. People just won't be spending \$500 for a pair of speakers when there's all that other stuff to get.

We'll see. If I'm right, remember you heard it here first.

What's Ahead For CB. By ALAN LEVESQUE

NOW all of 11 years old, CB will pass through the '70s as a gangling, awkward teenager. If the next decade is anything like the last, the future of CB will be bleak but not altogether hopeless. There *are* reasons why the band won't be dead when 1980 rolls around. One reason? One million CBers (with 3 million sets) won't let the band die without a fight. CB may be down for the count but it's not out.

There's a lot to clean up. In most metropolitan areas the channels are so packed with stations it's tough getting a message through. Each month about 20,000 new licenses are shoveled into the pile. Somewhere, somehow, something's gotta give.

As we see it, there's no point looking to the FCC to alleviate this pressure. Big Daddy has no immediate plans to expand CB. There is little hope that additional channels will be added, that the power limit will be raised to 25 watts or more, or that the CB antenna will be elevated to new heights of glory. In fact, we predict here and now that the FCC will lose CB! Not only are the Commissioners disinterested—but they haven't the manpower to administrate the service efficiently. Look for the Federal Department of Transportation or some such to take over. Rules, frequencies will stay the same—just another name on the license.

There is a chance that walkie-talkies may move up to 6 meters but any new channel space which becomes available will be gobbled up by public safety and industrial users before CB even gets in a word. Any big breakthrough away from 27 mc would have to be up to VHF—and there isn't any skip up there, Charley. Hamming on CB is out; there will never be any hobby provisions in the CB regulations. The no-code ham/CB license is just an idle daydream of frustrated CBers.

Of course, things are going to happen. Watch for shirt-pocket 5-watt rigs when the right batteries are developed. Narrow-band FM hasn't been tried on CB but is a definite possibility. Bandwidth will be the same as AM, but ignition noise and interference will be reduced. This would still be at 27 mc.

Look for greater utilization of single-sideband rigs. With SSB, CBers should be able to get 46 channels out of the present 23. The transition from AM to SSB will take several years. Phasing out of standard AM units will have to start with dual-modulation (AM/SSB) hybrid rigs before the SSB equipment can take hold. By the end of the '70s, CB should be totally SSB. Since SSB rigs are more expensive than the AM variety, watch for Japan to slice even further into the American market with low-cost SSB gear.

You can expect CB equipment to become gung-ho with the coming of sophisticated solid-state devices and integrated circuits. First waves of this new tide already are arriving at CB's shores. New advances will permit rigs to be made smaller so manufacturers will come up with more multi-purpose sets (CB plus VHF, etc.). New transceivers will scan several selected channels for calls. And quickie, do-it-yourself servicing via plug-in modules is a sure bet.

We also see CB sets combined with tone functions, much like an automatic garage opener. Audio tones riding CB's 27-mc carrier will enable you to control your home's electrical system from a mobile rig in your car. While you're on the move, at the push of a button you'll be able to turn appliances on and off.

What's Ahead For Ham Radio. By WAYNE GREEN

W2NSD/1

WHAT will amateur radio be like in the generation of the jumbo jet, world television via satellites and the instant telephone in every shirt (at least for those who can afford a shirt) pocket? Since little in the recent past of amateur radio has come upon us with any startling rapidity, looking into the future shouldn't be all that difficult.

Technically speaking, we should see more transistors in amateur gear and then a gradual changeover to integrated circuits. Our commercial gear should follow, by a few years, the technical developments of the experimenter-amateurs who are building these devices of tomorrow today. Solid-state, high-powered transceivers for the higher bands should become popular in the '70s. Getting the cost down, however, will be a problem.

The ITU frequency conference scheduled for the early '70s probably will be postponed, but should the powers that be actually come together it's likely that most of the lower amateur bands will be reduced in size and, as a result, will be of little practical use. As usual, amateur radio won't have a single representative at the conference. Big things are in the offing and hams will be the first to suffer from the bigness!

Virtually every foreign government had plans for cutting up the amateur bands at the last conference held in 1959. Only a last minute maneuver by the Soviet Union saved the day. There is no sign that anything whatsoever was learned from this close call with disaster. In fact, things are worse. As defense electronics (missile defense, etc.) grows in stature, hobby frequencies will be first to go.

The UHF amateur bands may be our salvation if we manage to hold them. Amateur repeaters on the moon and in synchronous satellites could allow every amateur on earth to contact just about anyone else. We are starting in this direction today with our VHF FM repeater nets and our moonbounce experiments. We should expect to see a lot more ham television via repeaters. The development of narrowband TV has been hampered by the ARRL's bitter opposition but it's coming along well, anyway, and holds great promise for the future.

The day of the small 420-450-mc solid-state transceiver and a collection of over 300 countries worked is not far off. RTTY fans will be holding forth on 1200 mc, along with their narrowband TV brothers. Experimenters will be pushing for 10-gc repeaters.

Satellite repeaters will make mobile operations a snap and may encourage the development of an automatic calling system which would permit any amateur to call any other at will. This wouldn't stop fellows from calling CQ, of course, but it would bring amateurs together into an even tighter fraternity. Small portable units like those used by the phone company might permit satellite repeater operations from your hand.

Though many amateurs are grumbling about commercial equipment, it seems to me that we have the same percentage of experimenters as we had in the past. They will be with us in the future, too, building monolithic-IC transceivers in wristwatch cases and match boxes. Ham radio will be as much fun as it ever was, and the amateurs of the '70s will be the engineers and the technicians of the '80s.

What's Ahead For SWLing. By VERNON SIMMS

YOU need no crystal ball to predict that short waves in the '70s will grow lots shorter. Just take a gander at all those nifty receivers which feed on electromagnetic waves measuring 6- not 60-ft. in length. They're VHF public-safety monitors, the most glamorous, fastest-growing aspect of SWLing. People everywhere are discovering (at pinch-penny prices) that they can eavesdrop on cops, fire departments and even Smoky Bear (on Forestry Service frequencies).

So the sounds of the '70s should feature shoot-'em-ups and burn-'em-downs on VHF, along with some veddy, veddy educational BBC lectures down below 30 mc. However, watch for problems with the law if police work should be hampered by people listening in on portable VHF monitors.

What's in store for the old timers who still like (occasionally) to listen in on the 3-30-mc bands? Plenty of action should be the rule there, too. Recent growth in programming on international broadcast frequencies is nothing short of spectacular, but so is the interference. Watch for increased efforts to alleviate congestion with more sophisticated techniques.

Propagation in the ionosphere will be a big problem in the '70s. Old Sol is losing his benevolent radiance as the 11-year sunspot cycle droops toward its next low point. The cycle should bottom out in the mid-'70s, reducing long-distance skip, especially on the higher bands. Conditions, though, should be reasonably good at the opening and closing segments of the decade—and blissful activity on lower bands (which ignore the sun's ionospheric holiday) will continue.

The picture is very bright as far as new equipment goes. Receivers, especially the low- and moderately-priced sets, will no longer be mere orphans in the storm—an AM BCB radio, with a couple of additional coils and a bandswitch tossed in for good luck. RF coverage will go to 30 mc the legitimate route, via general-coverage rigs having FET front ends, mechanical filters, oodles of bandspread tuning, plus automatic noise limiters—all for less than \$100.

Since the new circuits will be solid state, the rigs will operate either off the AC line or on batteries. You'll be able to tune in Dr. Toru Matsumoto direct from NHK, Tokyo, while you cut down the crabgrass out in Cedar Rapids.

But hang on to your headphones! As we read the tea leaves, space communications will come of age in the '70s. Monitoring space chatter, whether it be from the moon, or via men en route to Mars, should be a full-time thing. And signals won't be strained through Walter Cronkite's oohs-and-ahs, either. They'll arrive live and unedited in your own receiver.

Of course, space frequencies are much too high for today's gear—our moon men spoke to earth on 2000 mc—but your UHF TV channels get you to 900 mc, so there's no reason why some of this fancy tuning can't be put into some other kind of box.

For instance, a portable space communications receiver that's crystal controlled on a number of channels and which can dig out signals in the millivolt range. Space signals will be weak and subject to wild propagation influences, but can you think of any better way to learn how to DX? ●



Dirt-Cheap 4-Band Ham Antenna

By JIM WHITE, W5LET

A LOT of hams have had bad cases of antenna-itis and don't know it. That obsessive state of mind compels them to want to rig up *one* more antenna to see whether it will perform just a shade better than the last one. This disease is not too bothersome to the lucky ham with plenty of room for antennas but to the one-antenna man it can be frustrating.

We have an answer to the multiple-antenna problem. It is a four-band antenna that works—and well, too. Known also as a Windom or off-center-fed antenna, it takes about the same space as a half-wave 80-meter dipole, but has the advantage of working on not only 80- but 40-, 20- and 10-meters as well. It won't break even a piggy bank to put it up. A few dollars for 140 ft. of copper wire and TV twin lead, and a couple of hours of work and it's yours.

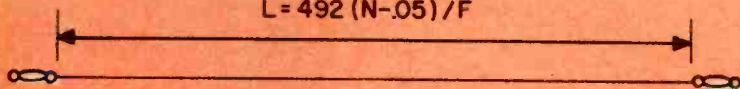
How it Works

In order to understand the operation of this antenna a review of a few basic fundamentals is necessary. If a half-wave dipole is erected in the clear, the radiation resistance at the center will be about 70 ohms. Such a dipole can be fed with a 70-ohm transmission line for a good match. Now if the feed point is moved away from the center toward either end the radiation resistance increases. At the ends this will be in the vicinity of 4,000 ohms.

It is apparent that at some point between the center and either end there is a point where the radiation resistance will be 300 ohms. This point will provide a good match for 300-ohm transmission line.

LENGTH OF ANTENNA

$$L = 492 (N - .05) / F$$

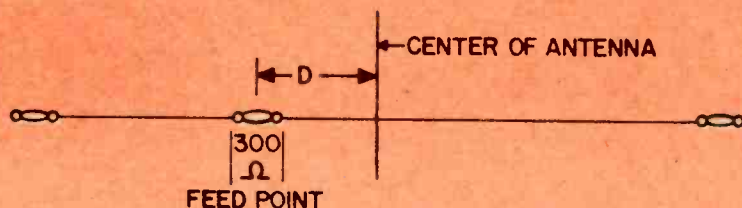


N = NUMBER OF HALF WAVES

F = FREQUENCY IN MC.

EXAMPLE: CALCULATED FOR 28.5 MC

$$492 (8 - .05) / 28.5 = 137.2 \text{ FT.}$$



$$D (\text{FEED-POINT DISTANCE}) = .1625 \times L (\text{LENGTH OF ANTENNA})$$

EXAMPLE USING 28.5 MC:

$$D = .1625 \times 137.2 = 22.29 \text{ FT.}$$

4-Band Ham Antenna

But what happens if the aforementioned 80-meter halfwave dipole is used on 40 meters? On 40 meters it is no longer a half-wave but a full-wave antenna. The radiation resistance is no longer 70 ohms at the center, but is near 4,000 ohms. The radiation resistance at the ends is also about 4,000 ohms.

As the feed-point is moved either way from the center of the full-wave antenna two points will be hit (on either side) where the radiation resistance will be 300 ohms. One of these points coincides with the 300-ohm point for 80-meters. By using this point you will have a good match for both bands.

What happens when an 80-meter half-wave dipole is used on 20 meters? On 20 meters it is two full-wavelengths (four half-wavelengths) long and the number of 300-ohm points either side of center increases from two to four. Again, one of these 300-ohm points coincides with the point used for feeding the antenna on 80 and 40 meters.

What happens when you use an 80-meter antenna on 10 meters? Here the antenna will be four full-wavelengths (eight half-wavelengths) long. By feeding the antenna at the same point, you can have four-band operation from one 80-meter dipole.

Diagram at top shows how to calculate length of antenna that's eight half-wavelengths long on 10 meters (four half-wavelengths long on 20, two half-wavelengths long on 40 and one half-wavelength long on 80). Sketch below shows how to find distance of feedpoint from center of antenna.

Because 15 meters is not harmonically related to the four bands discussed, the antenna will not operate satisfactorily on this band.

Building the Antenna

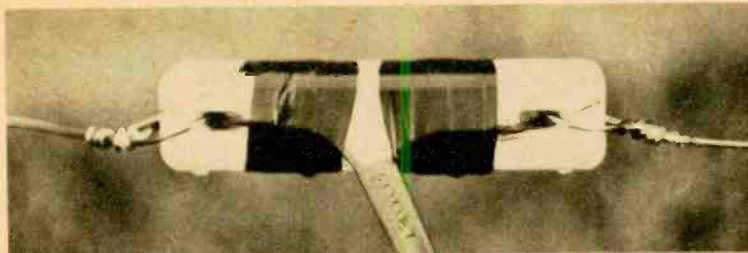
Setting up the antenna is as simple as cutting a piece of wire and soldering a few leads together. That's about all there is to it, except for a slight climb to get the antenna as high as you possibly can. But first you must determine the correct length of the antenna.

All calculations are based on an operating frequency in the 10-meter band. Reason for this is that the length of the antenna is more critical at a high frequency. If you do not plan to operate on 10 meters, then calculate the length by using an operating frequency on the next lower frequency band—20 meters.

The antenna length is determined with the formula.

$$L = \frac{492 (N - 0.05)}{F}$$

In this formula for the length of a long-



At the feedpoint use a good sturdy insulator. Twist the antenna wires a few times and apply solder. Feedline is heavy-duty 300-ohm twinlead which is soldered to the antenna wires. Apply lots of tape to hold twinlead.

MATERIALS

Antenna wire, 140 ft. No. 12 or No. 14 Copper-weld (Allied 11 C 1358 or 11 C 1360)
 Porcelain antenna insulators (Allied 47 C 6051 or 47 C 6052)
 300-ohm TV twin lead.

wire antenna, L is the length of the antenna in ft., N is the number of half wave-lengths on the antenna and F is the frequency in mc.

The formula gives you the length of an 80-meter antenna that is one half-wavelength long on 80-meters, two half-wavelengths long on 40 meters, four half-wavelengths long on 20 meters and eight half-wavelengths long on 10 meters.

Let's go through a calculation using a frequency of 28.5 mc. The length, L , would be

$$L = \frac{492 (8 - 0.05)}{28.5} = 137 \text{ ft. } 2 \text{ in.}$$

After the wire is cut to the proper length locate the exact center. Using the dimensions of the preceding example this would be 68.6 ft. If this were a regular 80-meter dipole you would cut it here, insert an insulator and feed it with 70-ohm transmission line. But ours is not fed at the center; it is fed off-center.

The feed-point is located by multiplying the total length of the dipole by 0.1625 and measuring off this distance from the center. Going back to our example we find this to be 22.29 ft.

With the feed point determined, cut the wire and insert an insulator. The insulator can be almost any type that will support the strain imposed upon it. Two other insulators are required—one at each end.

The 300-ohm line can be any good-quality TV lead-in. If you plan to run high power it is best to use the heavy-duty type. Tie the line to the insulator without spread-

ing the leads too much. Wrapping the leads to the insulator with tape will help keep them close and also help keep some of the strain off the line.

No antenna can be any better than the way it is erected. This is true mechanically as well as electrically. Erect the antenna high and in the clear. Use only enough line to reach your operating position. You will be looking for trouble if you have excess twin-lead coiled up in the corner.

Using The Antenna

If your transmitter uses link coupling from the final tank coil to the antenna you can connect the antenna to this link. If it doesn't load up properly you may have to increase the number of turns on the link.

If your rig has an unbalanced output circuit, such as pi-net, you probably will have to use an antenna tuner or balun coils. Such an arrangement is desirable because not only will it provide a match from the balanced to the unbalanced line, it will match the 300-ohm antenna impedance to 75 ohms.

The antenna works well, but being a multiband design there are a few things you should remember. One of these is its directional pattern. On 80 meters it will perform as any other half-wave antenna in that it will be directional broadside; the pattern will resemble a figure eight. As you move up in frequency the pattern will approach the plane of the antenna. On 80 meters the angle of radiation will be 90° and on 10 meters it will be around 30°. With this in mind it is important that you give some thought to the direction you intend to work on each band and erect the antenna accordingly.

At the author's QTH, the antenna is approximately 40 ft. above the ground. With the transmitter running less than 50 watts input, several DX stations have been worked on 20 and 10. On 80 and 40 meters both the east and west coasts have been worked regularly from northeast Louisiana.

Good Reading

By Tim Cartwright

FELL'S GUIDE TO OPERATING SHORTWAVE RADIO. By Charles J. Vlahos. Frederick Fell, Inc., New York. 177 pages. \$4.95

Though the title doesn't indicate it, this is an introduction to SWLing (and novice hamming) rather than an operating guide. As such, it is full of basic information and enthusiasm, and is definitely the kind of book that should fall into the hands of someone whose interest is just beginning to bud. The information about equipment and setting up a shack is pertinent and up-to-date, and there is one particularly good chapter offering an introduction to code. This is one of those books to give someone to start something.

PROGRAMMING FOR DIGITAL COMPUTERS. By J. F. Davidson. Brandon/Systems Press. New York. 214 pages. \$6.95

If we managed to pique your interest in the last column with the review of a book on careers in computer programming, here is a good follow-up—one that will provide as thorough a briefing as any about just what the mechanics of programming really are and whether you have a feeling for them. The author is English, and this American edition apparently comes two years after the original writing, but the book is (according to my resident computer authority) very much up-to-date in techniques and approaches. I have seldom seen more information packed into any one book.

RTL COOKBOOK. By Donald E. Lancaster. Howard Sams & Bobbs-Merrill, New York & Indianapolis. 240 pages. \$5.50

No, Virginia, this isn't a kitchen guide obtained from the Radio-Television League. It's a book about—all about—the sprawling family of digital-logic integrated circuits, called, collectively, Resistor-Transistor Logic. The book is devoted to the proposition that hobbyists are equal to the job of using IC logic circuitry for themselves in simple circuits. And it is packed with circuit descriptions, diagrams, and descriptions of all kinds of computing applications for all kinds of circuits. This is a working guide and

it assumes both a good bit of knowledge and comfort in dealing with computer techniques. But for those who can deal with it, it's unquestionably a useful guide.

RCA TRANSISTOR, THYRISTOR & DIODE MANUAL. RCA Electronic Components, Harrison, New Jersey. 656 pages. \$2.50

This is the successor to RCA's Transistor Manual Series, and as such it's an even better guide to current circuits and design possibilities. As I've said before, these manuals from the giant manufacturers are always best buys for anyone who needs or wants to keep up. The illustration on the bottom of this page shows this clearly.

And Make Note Of . . .

UNDERSTANDING AND USING UNI-JUNCTION TRANSISTORS. By Stuart Hoberman. Howard W. Sams, New York. 95 pages. \$2.50

KNOW YOUR VOM-VTVM. By Joseph A. Risse. Howard W. Sams, New York. 159 pages. \$3.50

SEMICONDUCTOR CIRCUITS LABORATORY MANUAL. By David J. Comer. Prentice-Hall. Englewood Cliffs, N.J. 123 pages. \$5.50

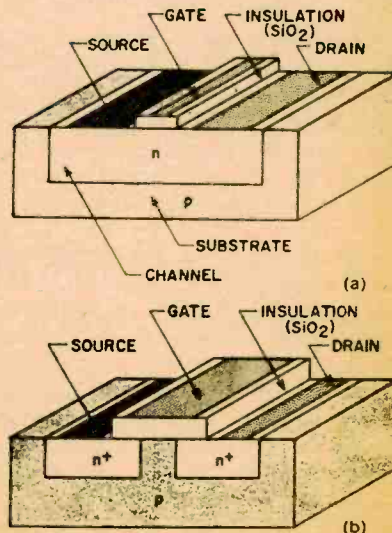
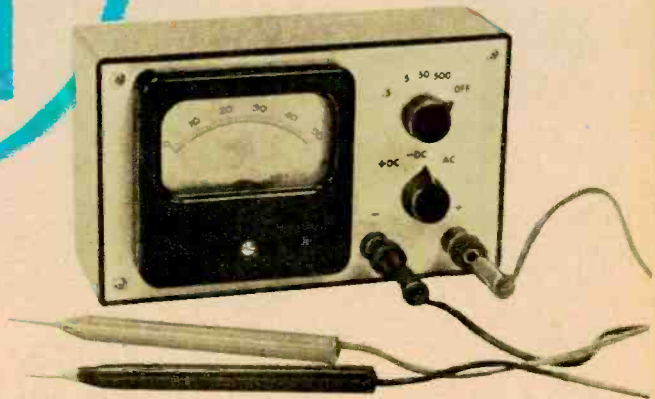
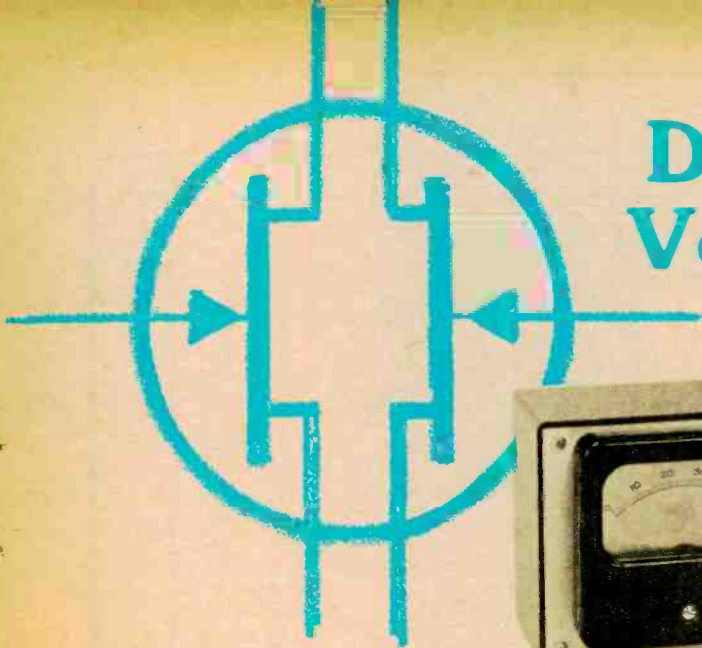


Fig. 12—MOS field-effect transistor structures: (a) depletion type, (b) enhancement type.

Diff-Amp Voltmeter



By HERB COHEN

ONCE the mainstay of the experimenter and serviceman, the old reliable VOM is being pushed off the scene by the field-effect transistor (FET). Because the specs of FETs have improved and their prices dropped, the FET is turning up everywhere. One important place is the multi-range voltmeter, or solid-state VOM.

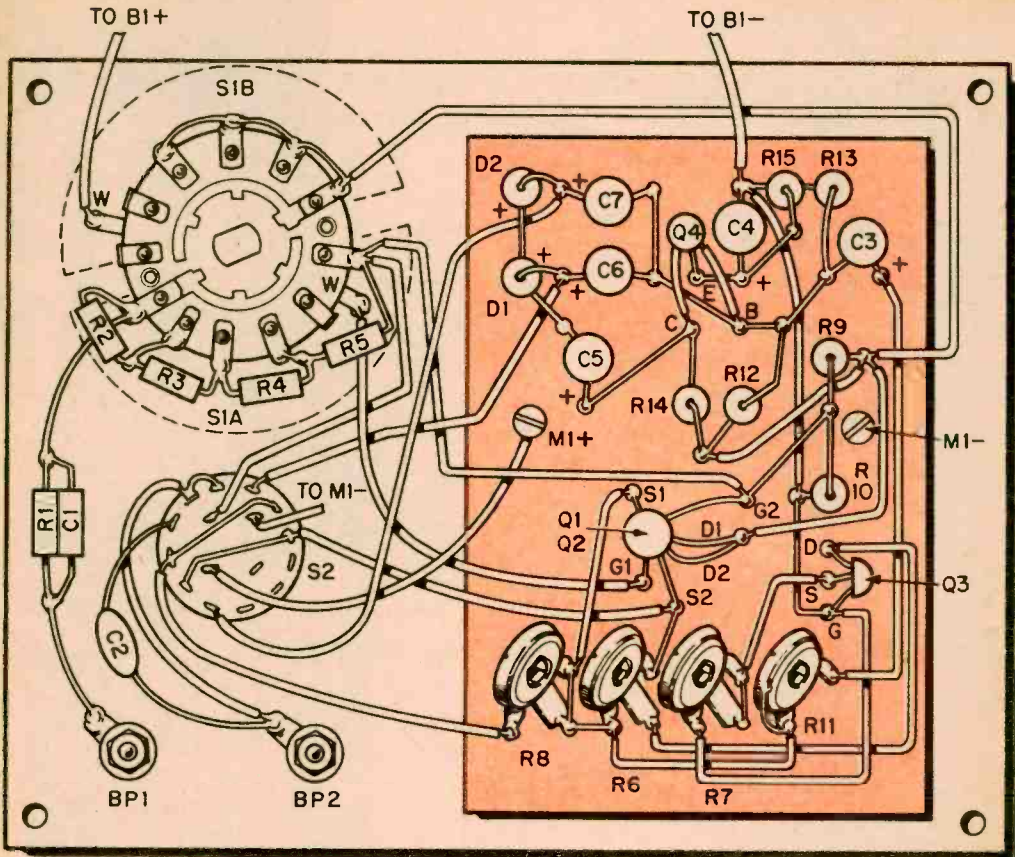
The big advantage of a solid-state VOM is that it has the high-input impedance of a VTVM yet does not require external operating power. The other advantage is that it is smaller than a VTVM—about the size of the VOM.

Our Diff-Amp Voltmeter is a test instrument that you should have on your bench. Matter of fact it should be in your service kit also. It won't take up much room because its dimensions are only 6 3/8 x 3 3/16 x 1 7/8 in.

Now if you could design a dream voltmeter yourself what would you want its specs to be? Would you like to be able to use it anywhere without having to plug it into an AC outlet? Would you like to fit it in your pocket? Then how would this instrument suit you?

- 10-megohm input impedance.
- AC and DC ranges on the same scale.
- 0.5 V scale for low-voltage measurements.
- Power source is a 9-V transistor-radio battery.
- A balance control which once set does not have to be touched.
- A cost of about \$25.

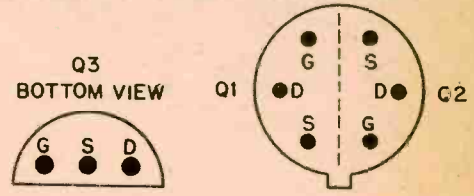
The Diff-Amp Voltmeter has all these features and a few others besides—such as current consumption of only 1 ma. This means you change batteries only once every six months or less. The voltage ranges for both AC and DC are 0.5, 5, 50 and 500-V. As a safety feature the power-switch is on the range switch and is located after the 500-V position. (See the photo above.) Thus, when you switch the meter on, you hit the 500-V range first and the meter is automatically protected against overload.



First install the switches and binding posts on the case's aluminum panel. Note that both binding posts are insulated from the panel. Wiring on the board is tight so take care. To save space mount all the resistors and capacitors vertically.

Q1, Q2
BOTTOM VIEW

Q3
BOTTOM VIEW

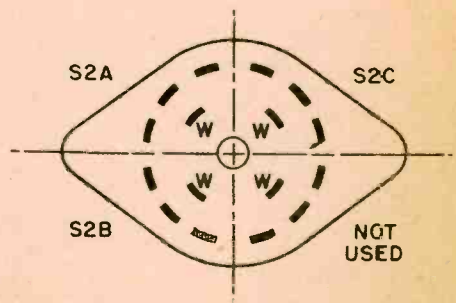


Diff-Amp Voltmeter

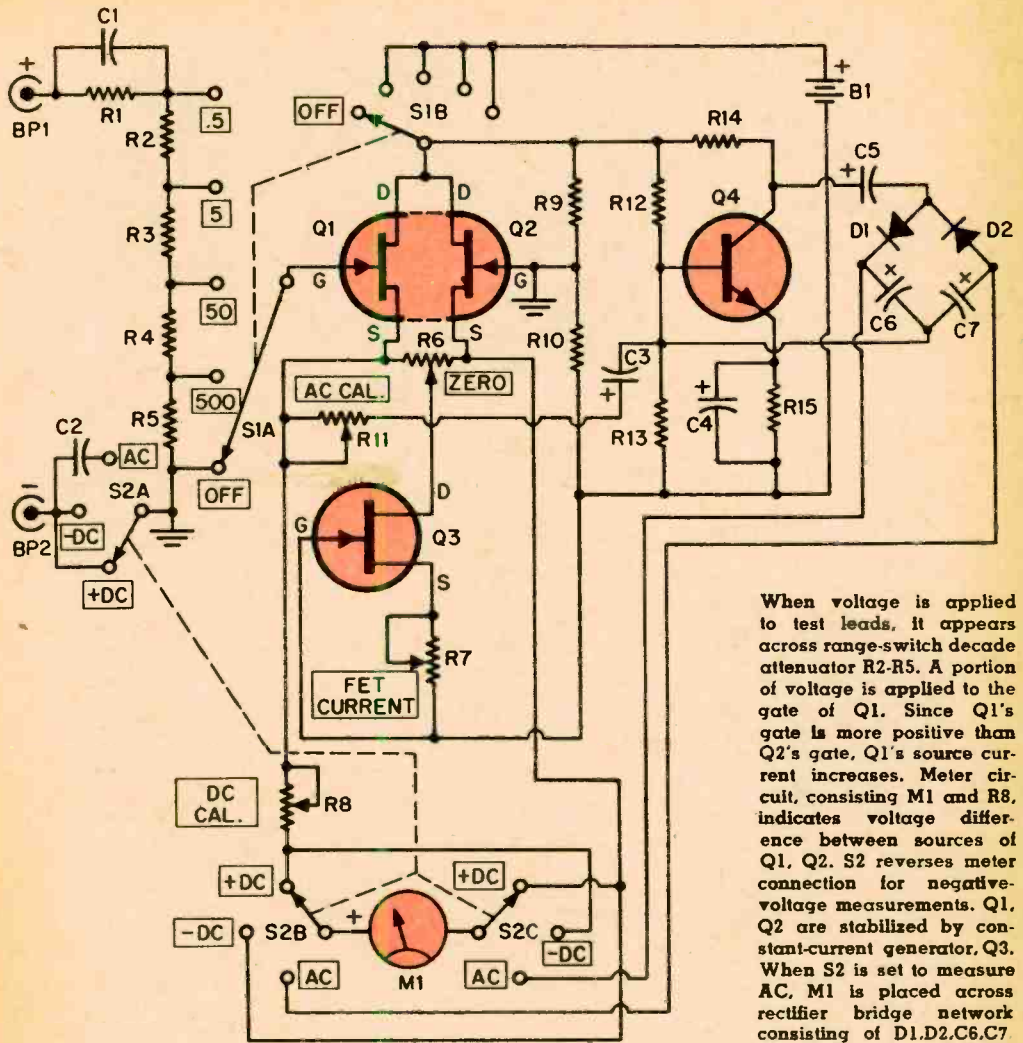
Construction

The meter is built into a readily available Bakelite case that measures $6\frac{3}{8} \times 3\frac{3}{8} \times 1\frac{1}{8}$ in. The circuit is built on $2\frac{1}{2} \times 3\frac{1}{4}$ -in. piece of perforated board on which eyelets or push-in terminals can be used for tie points and mounting the calibration pots. The circuit board is mounted on the back of the meter on its terminals to simplify installation. Parts placement is not critical, but the circuit should be kept as small as possible. The function (S2) and the range (S1) switches are mounted on the aluminum panel. Be sure that none of the circuitry is connected to the panel.

Start construction by drilling and cutting



Be careful to identify the leads of Q1 and Q2 correctly. In diagram of switch S2, letter W identifies wiper lug; only three sections are used.



When voltage is applied to test leads, it appears across range-switch decade attenuator R2-R5. A portion of voltage is applied to the gate of Q1. Since Q1's gate is more positive than Q2's gate, Q1's source current increases. Meter circuit, consisting M1 and R8, indicates voltage difference between sources of Q1, Q2. S2 reverses meter connection for negative-voltage measurements. Q1, Q2 are stabilized by constant-current generator, Q3. When S2 is set to measure AC, M1 is placed across rectifier bridge network consisting of D1, D2, C6, C7.

holes in the aluminum panel for the switches, input binding posts and the meter. Install the switches and binding posts and wire them as shown in the pictorial. Then install all parts on the circuit board. Mount the board on the back of the meter then make connections between the board and the switches.

Calibration

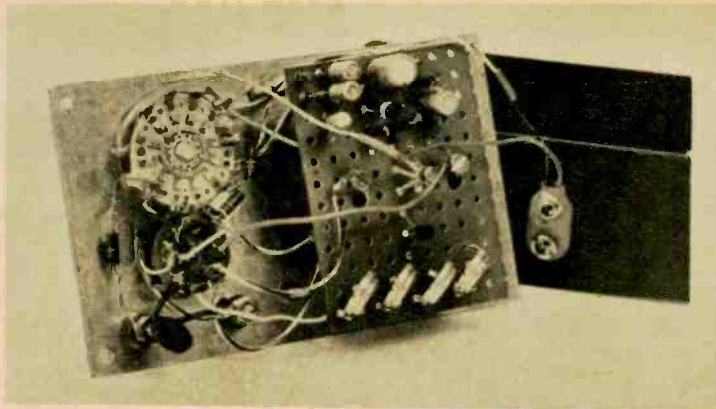
Break the wire going from the wiper of S1B to the drains of Q1 and Q2 and insert a 1 ma DC milliammeter. Set S1 to the 0.5-V position. Switch S2 should be in the +DC position and test leads shorted together. Adjust R7 until the 1-ma meter indicates 0.5 ma. Put a drop of cement on R7 to seal it in position. Remove the meter and connect the

lead from the drains of Q1 and Q2 to S1B's wiper. Adjust R6, the zero pot, until the meter indicates zero. Put some cement on each pot.

To calibrate the DC scale connect three fresh 1.5-V cells in series. Check their voltage with a meter of known accuracy. Then turn the range switch to 5 V and connect the test leads to the batteries. Adjust R8 until the meter indicates 4.5 V.

The AC calibration should be made using an audio generator and an accurately calibrated AC VTVM. If these are not available, you can use an old 6.3-V filament transformer. Connect a 2,000-ohm pot in series with a 4,700-ohm resistor across the winding. (Resistor to one winding lead, pot's wiper

Entire circuit is built on back of case's aluminum panel. Install switches and binding posts first. Then wire the board and install it on the back of the meter. Finally, make connections from board to switches.



Diff-Amp Voltmeter

PARTS LIST

- B1—9 V battery
- BP1, BP2—Insulated binding post
- C1—330 μ f, 500 V silver mica capacitor
- C2—.01 μ f, 1,000 V disc capacitor
- C3—50 μ f, 10 V electrolytic capacitor
- C4—200 μ f, 10 V electrolytic capacitor
- C5—5 μ f, 6 V electrolytic capacitor
- C6, C7—30 μ f, 10 V electrolytic capacitor
- D1, D2—1N34A diode
- M1—0-50 μ a DC microammeter (Lafayette 99 T 5042 or equiv.)
- Q1, Q2—U235 FET differential amplifier (Siliconix)*
- Q3—MPF105 field-effect transistor (Motorola)
- Q4—2N3900 transistor (GE)
- Resistors: $\frac{1}{2}$ watt, 5% unless otherwise indicated
- R1—1 megohm
- R2—9.1 megohms
- R3—910,000 ohms
- R4—91,000 ohms
- R5, R14—10,000 ohms
- R6, R7, R8—25,000 ohm miniature trimmer potentiometer (Mallory MTC-1, Allied 46 C 3673 C. Specify resistance when ordering)
- R9, R10—47,000 ohms
- R11—20,000 ohm miniature trimmer potentiometer (Mallory MTC-1, Allied 46 C 3673 C. Specify resistance when ordering)
- R12—75,000 ohms
- R13—22,000 ohms
- R15—2,200 ohms
- S1—2-pole, 6-position miniature non-shorting rotary switch (Centralab PA-2003, Allied 56 C 4922)
- S2—4-pole, 3-position miniature rotary switch (Lafayette 99 T 6156)
- Misc.— $6\frac{3}{8}$ x 3 $\frac{3}{16}$ x $1\frac{1}{8}$ -in. bakelite utility case with aluminum panel (Lafayette 99 T 6272)

*Available from Siliconix distributors or from Tridac Electronics Corp., Box 313, Aldon Manor Br., Elmont, N.Y. 11003 (\$7.75, includes postage and handling. \$1 extra for Canadian orders)

to the other.) Switch your multimeter to the AC range, and connect it to the wiper and the top of the 4,700-ohm resistor. Adjust the pot until the meter indicates 5 VAC. Put the meter's test leads directly across the multimeter and adjust R11 for 5 V full scale.

The heart of the meter is the Siliconix U235 FET differential amplifier which consists of a matched pair of FETs in a single case. The diff-amp acts very much like the old tube VTVM. When a positive voltage is applied to the test leads it appears across the range-switch decade attenuator. The signal goes from S1A's wiper to the gate of Q1. Since the Q1 gate is more positive than the gate of Q2, Q1's source current rises.

The meter circuit consists of M1 and DC cal. pot R8 (the meter calibration pot). The circuit measures the voltage difference between the sources of Q1 and Q2.

The diff-amp is stabilized by an FET constant-current generator, Q3, which sets the current for the diff-amp. Potentiometer R7 (FET current) is the current adjust for Q3, and once set it will hold the circuit current constant in spite of battery voltage change.

When the function switch (S2) is set to the AC position the meter is placed across the rectifier bridge network consisting of D1, D2, C6 and C7. An AC signal at the test leads is picked up at the source of Q1 by C3, which acts as a coupling capacitor. Pot R11 is the AC calibration pot.

The interesting thing of this circuit is that the bridge rectifier network is the feedback loop of Q4, going from the collector to the base. This makes the meter current proportional to the input signal and keeps the meter linear. It also corrects for the non-linearity of the rectifier conduction curve.

Sideband for SWLs

TUNE an ordinary short-wave receiver across the ham bands or try to pick up certain foreign broadcasts and you often hear Donald Duck chatter instead of clear voices. Those are single-sideband (SSB) stations.

Using SSB, a station can pack as much as two and one-half times more punch into its signal with the same amount of power. Besides, SSB uses less spectrum space and is bothered less by interference from other stations. It's not easy to tune an SSB signal.

Let's compare an SSB signal with an amplitude-modulated (AM) signal. An AM station has a carrier (A, below) which is a radio wave at the frequency to which you tune. The voice modulating that carrier creates extra signals called sideband signals.

One thing is characteristic of SSB: the upper and lower sidebands are identical. A carrier is necessary only so modulation can take place. Since a lot of the transmitter's power is concentrated in the sidebands and the sidebands carry all the intelligence, the carrier can be eliminated as shown in B.

Since the two sidebands are exactly alike, only one is necessary. Therefore, either the upper or the lower is eliminated. The signal shown below in C is now called a single-sideband suppressed-carrier signal.

The missing carrier is what makes an SSB station sound so strange. To produce intelligibility, a sideband signal needs a carrier to beat against or to mix with. A receiver designed to pick up SSB broadcasts generates a carrier and mixes it with the SSB signal. A beat-frequency oscillator (BFO) supplies the carrier; a product detector generally mixes it with the SSB signal to produce audio.

Tuning a Receiver designed for SSB reception takes patience. Start with the receiver set up for ordinary AM reception and tune in the station as best you can. Switch to SSB reception. If a switch is marked USB (upper sideband) and LSB (lower sideband) try both settings and use the one that makes the voice sound clearest. Be prepared to move the dial slightly up-frequency if you're receiving a lower sideband or down-frequency if you're listening to an upper sideband.

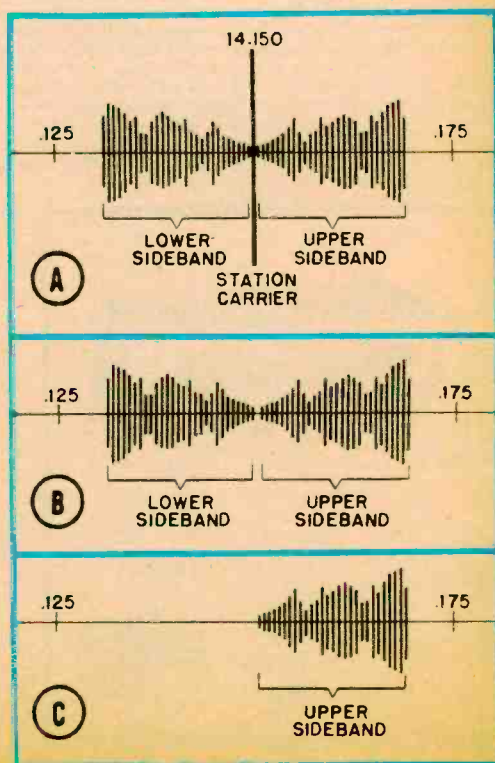
There are ways to receive SSB on an ordinary short-wave receiver. The only requirement is that the set have a BFO for receiving code (It might be a switch labeled CW).

When you hear a Donald Duck signal do this:

1. If there's an AVC switch, turn it off.
2. Turn the RF gain control to minimum and the audio gain (volume) control wide open. Keep the BFO off.
3. Carefully advance the RF gain enough to hear and tune the station to its loudest. If you have trouble picking this point, tune both directions to see where you lose the station and then set the dial between those points.
4. Turn on the BFO and adjust its pitch control until the voice is about natural.
5. Readjust pitch if receiver is unstable.

When you're listening to hams, SSB may be a little hard to tune in step No. 3. Reason for this is that hams often use voice-operated switching which means the signal goes off the air during pauses between sentences.

You can't tune SSB with many cheap short-wave radios and portables. You'd have to alter the circuits to add a BFO, and this would be impractical.—*Forest H. Belt*



Exciting New Home & Hobby Kits

New Heathkit[®] "Component Credenza"



• Combines all solid-state FM stereo receiver, 4-speed automatic turntable with diamond stylus and two full-range, two-way speaker systems into a luxurious Mediterranean cabinet • 15 watts per channel music power output • Full range tone controls • Very low Harmonic & IM Distortion • Excellent channel separation • Transformerless output circuit for minimum phase shift, wide response • Electronically filtered power supply • Stereo headphone jack • Auxiliary input • Filtered tape output • Excellent FM tuner selectivity & sensitivity • 4-stage IF • AFC • Stereo indicator light • SCA filter • High quality BSR McDonald 500A Automatic Turntable with low mass counterbalanced aluminum tone arm plays up to 6 records • Comes with Shure diamond stylus magnetic cartridge • Vernier stylus pressure adjustment • Anti-Skate control • Cue/Pause control • Two ducted-port reflex 2-way speaker systems for performance comparable to fine component-type separate speaker systems • Each system contains 10" high compliance woofer & 3 1/2" ring-damped tweeter for 60-16,000 Hz response • Complete system housed in a magnificent factory assembled Mediterranean cabinet of beautiful oak veneers with solid oak trim • Easy assembly with the famous Heathkit Manual ... build only the receiver & install the components • The finest value anywhere in quality stereo consoles

Mediterranean Styling ...
30-Watt FM-Stereo Receiver
... 4-Speed Automatic
Turntable ... Full-Range
Speaker Systems

Real Stereo Performance Demands Real Stereo Components ... the kind used for custom-designed systems. The new "Component Credenza", as the name implies, integrates separate components into a single functional unit. Here are those components ...

Component-Quality FM Stereo Receiver. The heart of the new AD-19 is the famous Heathkit AR-14 FM-FM-Stereo Receiver circuitry. The amplifier produces a solid 30 watts IHF music power. The FM Stereo tuner features 5 uV sensitivity, excellent separation and flywheel tuning. The AR-14 has been rated as the best value obtainable in a medium power receiver.

Component-Quality 4-Speed Automatic Turntable with such professional features as Cue/Pause control, Anti-Skate control, adjustable stylus pressure and famous Shure diamond stylus magnetic cartridge.

Component-Quality Speaker Systems. Two independent, ported speaker systems, each with a 10" woofer and 3 x 1/2" tweeter deliver 60-16,000 Hz response for remarkable fidelity.

Elegant Mediterranean Oak Cabinet ... a fine example of cabinet-making, flawlessly executed in oak veneer with solid oak trim. Rigidly constructed using fine-furniture techniques.

The New Heathkit AD-19 "Component Credenza" ... A Master-piece in sight and sound. Put it in your home now.

Kit AD-19, 158 lbs. ... **\$299.95***

NEW Heathkit GR-78 Solid-State General Coverage Receiver ... Tunes 190 kHz To 30 MHz In Six Bands

The new GR-78 combines wide coverage, superior performance and portability with sharp styling to provide a remarkable value in general coverage receivers. Tunes AM, CW & SSB signals from 190 kHz to 30 MHz in six switch-selected bands. The all solid-state circuit employs modern FET's in the RF section and 4 ceramic filters in the IF to deliver maximum sensitivity and sharp selectivity. Bandspread Tuning is built-in, and can be calibrated for either Shortwave Broadcast or Amateur Bands. Completely portable ... comes with a nickel-cadmium rechargeable battery pack and built-in charger that operates from 120 or 240 VAC and 12 VDC. Many built-in features ... 500 kHz crystal calibrator ... switchable Automatic Noise Limiter ... switchable Automatic Volume Control ... Receiver Muting ... Headphone Jack and many more. Order yours today. 14 lbs.

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The next best thing to a personal doorman. The "wireless" factory assembled transmitter operates up to 150 feet away. Just push the button and your garage door opens and the light turns on ... and stays on until you're safely inside your home. The giant 7 ft. screw mechanism coupled with the 1/4 HP motor mean real power and reliability and the adjustable spring-tension clutch automatically reverses the door when it meets any obstruction ... extra safety for kids, pets, bikes, even car tops. Assembles completely without soldering in just one evening. Easy, fast installation on any 7' overhead track (and jamb & pivot doors with accessory adapter). Order yours now. 66 lbs.

Adapter arm for jamb & pivot doors, Model GDA-209-2, \$7.95*



NEW
Kit GR-78
\$129.95*

NEW
Kit GD-209A
\$149.95*

CIRCLE NUMBER 3 ON PAGE 15

From The Leader



NEW Heathkit Ultra-Deluxe "681" Color TV With AFT . . . Power Channel Selection & Opt. RCA Hi-Lite Matrix Tube

The new Heathkit GR-681 is the world's most advanced Color TV with more built-in features than any other set on the market. Automatic Fine Tuning on all 83 channels . . . power push button VHF channel selection, built-in cable-type remote control . . . or you can add the optional GRA-681-6 Wireless Remote Control any time . . . plus the built-in self-servicing aids that are standard on all Heathkit color TV's. Other features include high & low AC taps to insure that the picture transmitted exactly fits the "681" screen, automatic degaussing, 2-speed transistor UHF tuner, hi-fi sound output, two VHF antenna inputs, top quality American brand color tube with 2-year warranty. With optional new RCA Matrix picture tube that doubles the brightness, Model GR-681MX only \$535.00.

GRA-295-4, Mediterranean Cabinet shown **\$124.95***

Heathkit "295" Color TV

With Optional RCA Matrix Tube . . . with the same high performance features and built-in servicing facilities as GR-681 above . . . less AFT, VHF power tuning and built-in cable-type remote control. You can add the optional GRA-295-6 Wireless Remote Control at any time. New optional RCA Matrix tube doubles the brightness, Model GR-295MX, \$485.00.

GRA-295-1, Contemporary Walnut Cabinet shown **\$64.95***

Both the GR-681 and GR-295 fit into the same Heath factory assembled cabinets; not shown Early American style at \$109.95*

NEW Deluxe Heathkit "581" Color TV With AFT

The new Heathkit GR-581 will add a new dimension to your TV viewing. Brings you color pictures so beautiful, so natural, so real . . . puts professional motion picture quality right into your living room. Has the same high performance features and exclusive self-servicing facilities as the GR-681, except with 227 sq. inch viewing area, and without power VHF tuning or built-in cable-type remote control. The optional GRA-227-6 Wireless Remote Control can be added any time you wish. And like all Heathkit Color TV's you have a choice of different installations . . . mount it in a wall, your own custom cabinet, your favorite B&W TV cabinet, or any one of the Heath factory assembled cabinets. GRA-227-2, Mediterranean Oak Cabinet shown **\$109.95***

Heathkit "227" Color TV

Same as the GR-581 above, but without Automatic Fine Tuning . . . same superlative performance, same remarkable color picture quality, same built-in servicing aids. Like all Heathkit Color TV's you can add optional Wireless Remote Control at any time (GRA-227-6). And the new Table Model TV Cabinet and roll around Cart is an economical way to house your "227" . . . just roll it anywhere, its rich appearance will enhance any room decor.

GRS-227-5, New Cart and Cabinet combo shown **\$64.95***

Both the GR-581 and GR-227 fit into the same Heath factory assembled cabinets; not shown, Contemporary cabinet \$64.95*

NEW Heathkit Deluxe "481" Color TV With AFT

The new Heathkit GR-481 has all the same high performance features and exclusive self-servicing aids as the new GR-581, but with a smaller tube size . . . 180 sq. inches. And like all Heathkit Color TV's it's easy to assemble . . . no experience needed. The famous Heathkit Color TV Manual guides you every step of the way with simple to understand instructions, giant fold-out pictorials . . . even lets you do your own servicing for savings of over \$200 throughout the life of your set. If you want a deluxe color TV at a budget price the new Heathkit GR-481 is for you.

GRA-180-1, Contemporary Walnut Cabinet shown **\$49.95***

Heathkit "180" Color TV

Feature for feature the Heathkit "180" is your best buy in color TV viewing . . . has all the superlative performance characteristics of the GR-481, but less Automatic Fine Tuning. For extra savings, extra beauty and convenience, add the table model cabinet and mobile cart. Get the value-packed GR-180 today.

GRS-180-5, Table Model Cabinet & Cart combo **\$42.50***

Both the GR-481 and GR-180 fit the same Heath factory assembled cabinets; GRA-180-2, Early American Cabinet \$94.95*

Add the Comfort And Convenience Of Full Color Wireless Remote Control To Any Rectangular Tube Heathkit Color TV . . . New Or Old!

Kit GRA-681-6, for Heathkit GR-681 Color TV's **\$64.95***

Kit GRA-295-6, for Heathkit GR-295 & GR-25 TV's **\$69.95***

Kit GRA-227-6, for Heathkit GR-581; GR-481 & GR-180 Color TV's **\$69.95***

Now There Are 6 Heathkit® Color TV's To Choose From

2 Models In 295 Sq. Inch Size

NEW
Kit GR-681
With AFT
\$499.95*
(less cabinet)



Kit GR-295
\$449.95*
(less cabinet)

2 Models In 227 Sq. Inch Size

NEW
Kit GR-581
with AFT
\$419.95*
(less cabinet)



Kit GR-227
NOW ONLY
\$379.95*
(less cabinet & cart)

2 Models In 180 Sq. Inch Size

NEW
Kit GR-481
with AFT
\$359.95*
(less cabinet)



Kit GR-180
NOW ONLY
\$329.95*
(less cabinet & cart)

Reception Is Simulated
On All Sets Shown



a Schlumberger subsidiary



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Please send model (s)
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CL-367

CB Corner

By Len Buckwalter, KQA5012

More Power to Go Mobile

TODAY'S CB sets include solid-state gems which make the old gear look like electronic elephants. Now you can buy a 23-channel, 5-watt rig hardly larger than a pocketbook. But somehow, as manufacturers have crammed more sophistication into a small chassis, they've overlooked one important basic: the homely old power supply. Teentsy transceivers often work in a car (12 V) or at home (117 V), but what if you're a snake hunter or spelunker? Unless you buy a high-power walkie-talkie or some other special rig, you'll have to shout mayday through a sheet of paper twisted into a cornucopia.

Our complaint is that most manufacturers offer no convenient, universal power supply to convert a small, 5-watt transceiver into a truly portable unit. Just think of what you could do with it . . .

You might operate the rig on an outboard runabout where there is no 12-V source. If you're a Sir Thomas Lipton type, you could use the rig on a sailboat where electricity is as rare as a fishing rod. Or, to foil the pirates, you can pop the rig out of the car and temporarily install it in your craft. You save the cost of an extra set and spare the equipment from the hands of local kids—Capt. Kidds.

Also, you can use a mobile rig as a base station while hunting or at any other campsite to banish the fear of getting lost, or to summon help when the Tasmanian Devils are prowling the bush.

In summer you'll probably operate the rig in a tent, possibly at the annual Brotherhood of Boilermakers bash. A CB comm center at these affairs can help find a lost toddler, or handle a real crisis, like sending for more ice.

Are you sold on portable CB? Don't pout over the power problem, if you are. The answer is to make your own battery pack! Careful about the batteries, though, or you'll ooze managanese dioxide over the egg salad in your picnic lunch.

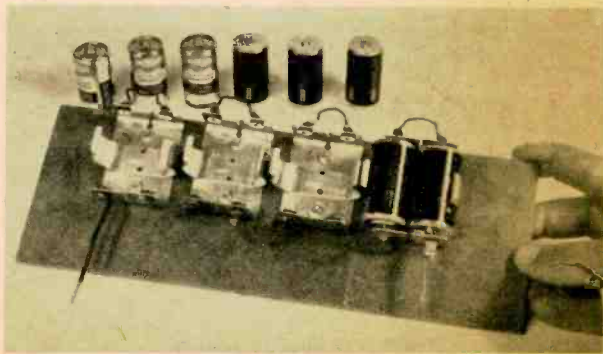
Here's how to do the job: Begin by checking the set's instruction manual. The specs should say how much current the circuit uses when operating on 12 VDC during receive and transmit. We checked several sets and discovered they're all in the same category—

about 200 ma on receive, and about 700 ma when transmitting. (Circuits with tubes are ruled out because filaments gobble too many amps.) If current draw is below 1A, you can go to the next step—getting the right cell.

We've toyed with battery sizes from pen-lites to big lantern jobs but the choice usually narrows to the standard D size for flashlights, and the next smaller C size. Avoid the common carbon-zinc cell, however, and pick an alkaline type. It can power the rig and it works well at temperatures up to about 130° F. We favor the C cell because it's a good compromise between size, weight and life. It has an operating time of between 10 and 20 hours. This is based on long receiving periods punctuated by short transmitting intervals. If you want to double these times and can tolerate a size and weight penalty, go to the heftier D cell.

Regardless of size, you'll need eight energizers wired in series to provide a total of 12 V (close enough to the nominal DC voltage for mobile operation). As you can see in the photo, we've wired together four battery holders to hold the eight C cells. The series connection is made merely by hooking the terminals from plus to minus throughout. The cells can be mounted on a panel.

It is worth it? We think so. Eight C cells cost about \$3 and they let you shout for help if you're ever up the river without a paddle—or power source. ☛



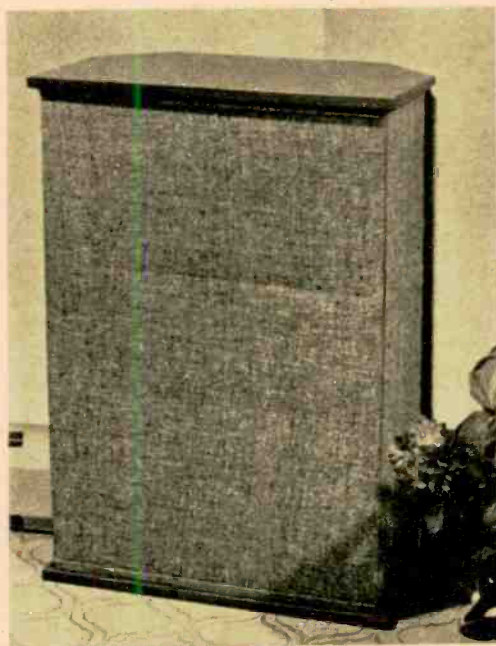
If the current drawn by your solid-state transceiver is less than 1 amp, C- or D-size alkaline-energizer cells will get you off the beaten path.

UNTIL about a decade ago speaker systems tended to be large. Bass-reflex and horn enclosures were the popular designs of that era. Because of their size, they created problems when it came to blending them into a decorating scheme. Then around 1957 the bookshelf speaker made the scene and quickly caught on as the most popular style and size.

But big enclosures haven't quite gone the way of the 5¢ beer yet. They're still around and, in fact, are rising in popularity again. The circle hasn't been completed but there is a noticeable shift back to what some serious audiophiles call the Big Sound that they

Cornered Horn for Bigger Bass

By HARRY KOLBE



feel can be achieved only with an enclosure whose volume is 3 to 5 cu. ft.

The volume of EI's Cornered-Horn (horn-loaded bass-reflex) speaker system is about 4 cu. ft. Its cost is rock bottom and its performance top drawer. Woofer, tweeter and crossover network will set you back \$35. The lumber, grille cloth and other incidentals come to another \$30, making a total cost of \$65.

A pair of these horn-loaded bass-reflex speaker systems will be perfect for that large room you want to fill with really *big* sound. This particular design couples to the air so well that the bass response will not just be heard—it will be *felt*. Because of the high

Cornered Horn for Bigger Bass

efficiency of the system, amplifier power as low as 10 watts (rms) per channel will produce highly respectable sound output.

The Design

Bass-reflex enclosures offer the best approach to utilizing the energy generated by the back radiation from a speaker. When the rear wave produced by a speaker is not baffled, it interferes with the wave radiated from the front. The bass-reflex enclosure adds the speaker's back radiation to the front radiation. The addition (in phase) of the rear to the front radiation produces almost twice the output for a given cone excursion than would be obtained if the speaker were mounted in an enclosed box (an infinite baffle, for example).

Horn-type enclosures act as acoustical transformers. That is, when a large horn is coupled to the small cone of a speaker, each motion of the cone area is multiplied. Thus, small-area radiation is transformed into large-area radiation. The effect is to present to the small cone at the throat of the horn a high but consistent acoustical impedance. Another effect is that the high-pressure, low-particle-

Hole for speaker was made with saber saw. Beveled corners are assembled with glue gun. Run bead down center of joint then join parts quickly.



PARTS LIST

- Two-way crossover network (Lafayette 90 E 00218)
- 12-in. woofer speaker (Lafayette 21 E 47205)
- 3½-in. ceramic-magnetic tweeter (Stock No. TS-6070, \$3.95 plus postage. McGee Radio Co., 1901-07 McGee St., Kansas City, Mo. 64108)
- Grille cloth
- Adhesive-back foam strip
- ¾-in. birch-core lumber (see text)

velocity wave from the surface of the cone is transformed into a low-pressure, high-particle-velocity wave with a low impedance that matches that of the air in the room as it reaches the mouth of the horn.

Our speaker system incorporates both the bass-reflex principle and the acoustical horn. The design begins with a properly matched bass-reflex enclosure and speaker. The port of the enclosure is the long slot in the rear of the cabinet.

The port also serves as a throat for a double horn formed by the sides of the speaker enclosure and the corner walls of a room. This results in the matching of the rear radiation of the speaker to air in the room. Polar response and sound distribution are good. At normal listening distances, the output from both port and the horn will be heard. As the distance from the speaker and the volume of space increase, the walls of the room increase the horn length and size, which results in increased low-frequency response.

The back corners of the top and bottom panels should be cut off at a 45° angle. Start the cut 4½ in. back from the front of the two panels.



3/4" THK BLOCKS
FASTEN WITH
WOOD SCREWS
& GLUE - 4 PLACES

3/4" BIRCH
LUMBER CORE

DIA. & MTG.
HOLES TO SUIT
TWEETER

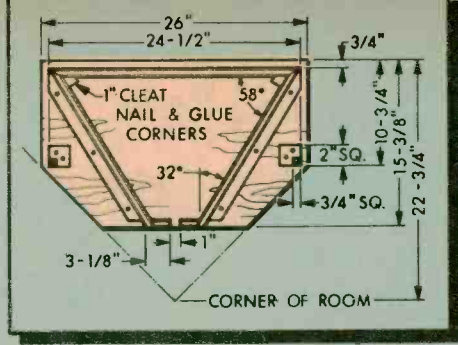
5"
34-1/2"

12"

ADHESIVE BACK
FOAM STRIPS

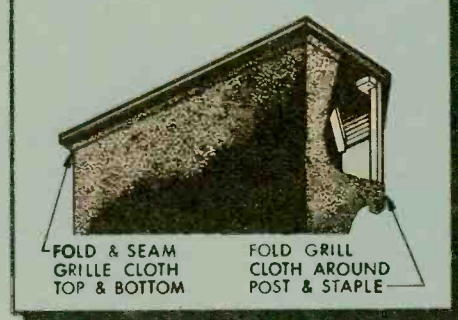
3/4" BIRCH
LUMBER CORE
FASTEN WITH
WOOD SCREWS

VIEW LOOKING UP AT TOP



- 1" CLEATS - FASTEN WITH WOOD SCREWS & GLUE FRONT, SIDES & BACK
- 3/4" FIR PLYWOOD (NOVOPLY)
- 10-1/2" DIA. MTG. HOLES TO SUIT SPKR. USE TEENUTS FROM OUTSIDE
- 3/4" x 3/4" POST - SCREW TO BLOCKS

GRILLE CLOTH DETAILS

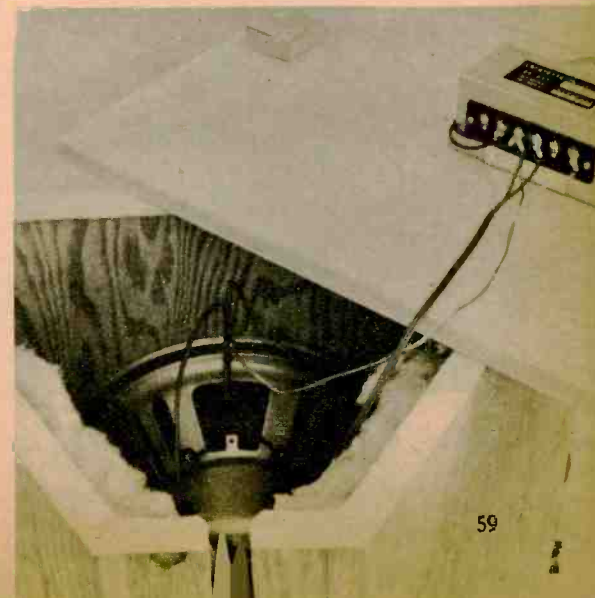
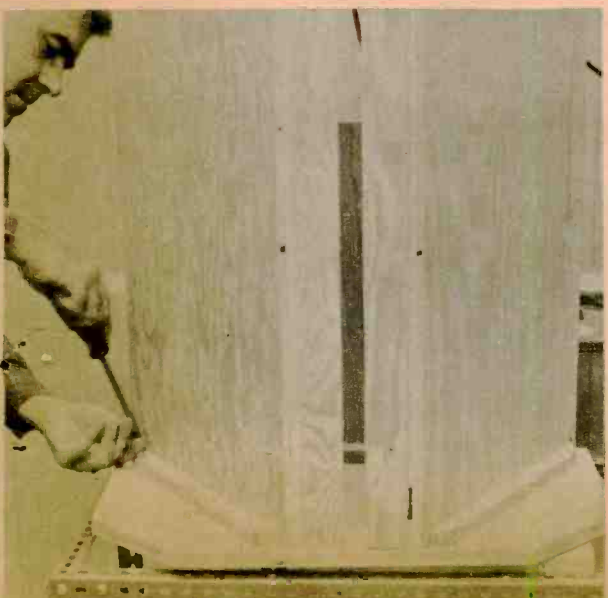


FOLD & SEAM GRILLE CLOTH TOP & BOTTOM
FOLD GRILL CLOTH AROUND POST & STAPLE

Because tweeter and woofer will be difficult to install and make connections to with top and bottom panels on, install speakers before attaching panels. Mount crossover securely on bottom so it won't rattle. Put a seam in the grille cloth on the top and bottom otherwise edge will have sloppy appearance.

Attach top of cabinet with 1-in. cleats, wood screws and glue. To attach bottom, simply run wood screws up through bottom into front and sides.

Put fiberglass wool on inside as shown and mount crossover on bottom. Attach adhesive-foam strips on the edges of the sides, the front and the back.



Cornered Horn for Bigger Bass

Construction

First thing to do is cut all lumber to the sizes shown in our drawing. Because the top and bottom of the cabinet are going to be visible, it's a good idea to use a better grade of lumber for these parts. Birch with a lumber core is ideal because this wood is relatively close-grained and can be finished by staining and varnishing.

Since the vertical parts of the cabinet will be covered with grille cloth, you can use less-expensive material, such as fir plywood or particle board, for these parts.

Our drawing shows that we used mitered joints where the front and side panels are joined. If you find this construction difficult you can butt these joints together. If the joints are butted they can be held with finishing nails and glue. A handy way to apply the glue is with a glue gun, as we show. If you don't have a glue gun, use ordinary white glue. If the joints are mitered, use glue only, but be sure to apply pressure to the pieces while the glue is drying.

To eliminate screw holes through the top,

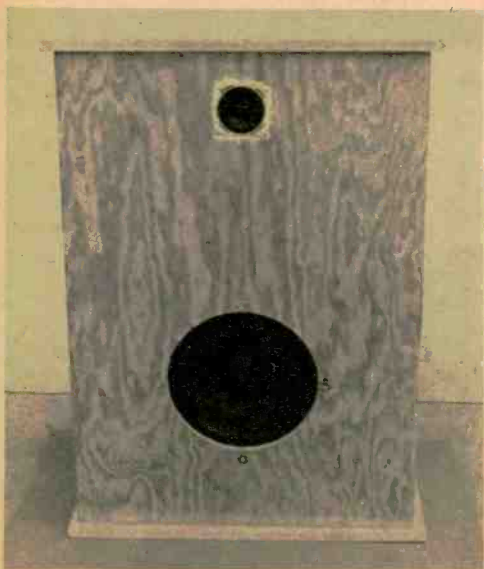
attach the top panel with cleats. Because you won't see the underside of the bottom panel, it can be screwed on directly without using cleats. A strip of adhesive-backed foam (weather stripping) along the top and bottom edges must be used to make a good airtight seal.

Next, install the tweeter (remove the capacitor) in the top of the cabinet. It should be installed from the front (not the rear) as shown. Use a sealer between the tweeter and the front panel to get an airtight seal. Mount the woofer with tee-nuts installed from the outside of the front panel.

Connect the speakers to the crossover network (wired for a 2,000-3,000-cps crossover frequency) and securely mount the crossover on the bottom panel. On the inside of the cabinet cover the sides with 2-in. thick fiberglass wool. Cover the bottom with a 4-in. thick layer of fiberglass wool.

Since most grille cloth is sold in 3-ft.-sq. pieces, we suggest you purchase a loose-weave piece of cloth material from a fabric store. Before installing the grille cloth, paint the front panel a flat black. The cloth is installed by attaching it to one corner post, wrapping it around the cabinet and attaching it to the other post. Use staples and place them toward the inside so they won't show.

Good listening! 🎧



Note that tweeter is installed on outside of front panel; use sealer around it for airtight fit. Paint the enclosure's front panel with flat-back paint.



Rear view shows the grille cloth attached to post on each side. High-frequency level control is mounted half way up on the right side panel.



The Strange Story of Granny Goose



**A misfit decides to go it alone and fight the war
in Vietnam with recorded tapes and propaganda.**

By ROBERT ANGUS

UPI Photos

MOST likely you've never heard of Radio Liberation or Radio Stateside. If you live in Southern California the name Granny Goose may mean a certain brand of potato chips; elsewhere in the country it recalls a character in a children's story. But to the troops serving in Vietnam early in 1966, Granny Goose was very real. For a short time Granny was the most important disc jockey beamed south from transmitters in Hanoi.

There's nothing new about expatriates making propaganda broadcasts. Britisher William Joyce rag chewed for Berlin during World War II as Lord Haw-Haw. Mildred Gillars, an American citizen, tried to peddle sex to American servicemen as Axis Sally. But while the troops could laugh at (and occasionally with) Joyce and Gillars because of their broad propaganda strokes, there was something different about Granny Goose. GIs who heard his high-pitched voice night after night grew to hate him.

He was a propagandist with a difference. Unlike Joyce and Gillars, who made their homes in wartime Berlin, Granny Goose—better known as a 27-year-old, self-styled psychologist named Ronald B. Ramsey—did it without ever leaving home. Ramsey's abode was a rambling two-story frame house in the Watts section of Los Angeles. There he set up a recording studio for Radio Liberation and Radio Stateside. While alternately appearing as deejays named Granny Goose and Joe Libre Epstein, he cranked out hour after hour of local news, current pop hits and anti-Vietnam propaganda.

"When Radio Liberation first started," Ramsey once told a reporter, "we had nothing except a Japanese tape recorder and a lot of friends. The friends



Strange twosome from World War II. Lord Haw-Haw (above) and Axis Sally (at right) were two most famous broadcasters of propaganda for Axis powers. Lord Haw-Haw was William Joyce, a British citizen. Axis Sally was Mildred Gillars, an American. Photo shows her waiting trial in prison.



Granny Goose

would feed me material and I'd record it." Granny mailed the finished tapes to a friend in Canada who forwarded them to an address in Prague. Within weeks, they were broadcast to the South from Hanoi.

A sample Granny Goose broadcast went something like this: "Hi guys, this is Radio Stateside. We're worried about you out there, in the rot, heat and sweat of Vietnam. We are concerned about you, the American GIs—our buddies who have had nearly 700 pals killed in a war you don't know why you're fighting." (At some such point, Ramsey usually spliced in a platter of Frank Sinatra, the Beatles or some other pop group taped off the air.) "Now for some news from home. Private Robert Haynes of Compton, California, just finished a 19-week course in helicopter repairs at Fort Eustis, Virginia. Before joining the army, he worked for the Big Wheel shop here. We hope he has better luck than those bodies brought back home last week from the war."

"You couldn't just laugh that sort of thing off" says a corporal who tuned in regularly. "What he said together with the way he said it, just made you mad. But for those of us

from Los Angeles he had more local news that our own radio had, so we all listened." Also, the Hanoi transmitters were so powerful that they provided better reception throughout much of Vietnam at that time than did Saigon.

Tape made all the difference to a Granny Goose broadcast, Ramsey admitted to an interviewer. With tape you can edit out all goofs (including Ramsey's high-pitched nervous giggle); you can splice in music at the appropriate place. And you can erase material which becomes outdated and insert new material at will. Best of all, you don't have to prepare an entire half-hour program at one sitting—you can do it over several days, if you like. From the time Radio Liberation opened for business in October 1965 until Ramsey hotfooted it out of California the following February, he apparently produced only 11 half-hour broadcasts.

When Ramsey left—a few steps ahead of a subpoena from the House Un-American Activities Committee—he left behind a recording studio that might have been the envy of any tape hobbyist. "Shortly after we started, it became evident that I'd need more and better equipment to do the job right," he told reporters. "Several friends from the African Freedom movement and the civil rights movement chipped in to buy a tape recorder and accessories. Before long, we were



Ronald Ramsey, alias Granny Goose of Radio Stateside, spoke to reporters across the street from the United Nations on Feb. 22, 1966. Ramsey vowed to continue smuggling anti-war tapes into Vietnam.

able to add a Norelco Carry-Corder so we could record outside the house. Then the next thing was a Crown tape deck. I liked the irony of using a piece of gear like that designed for use by a religious radio station for this purpose. We had a couple of broadcast quality mikes at the end, plus tape splicers and even a console with a control panel."

Actually, there's no evidence—despite Ramsey's constant reference to friends—that anybody else ever took part in the broadcasts. News easily could have come from community newspapers to which he had access. Ramsey told reporters in New York after he arrived there that he was using borrowed apartments in Harlem and the Bowery to do his broadcasts. The tapes he said, were mailed to an individual in Quebec—someone believed to be active in that province's separatist movement—then on to Prague.

The strange thing about Granny Goose is that even though the broadcasts would have been heard by American troops, it might have been years before anybody tracked down their source had Ramsey not mailed program samples anonymously to radio station KPFK in Los Angeles. This station has a policy of airing the widest range of opinion, but when the station manager heard what was on the tapes, he reached for the phone and called

the FBI (one such item—"We're not asking you to shoot your commanding officer or sergeant in the back—not at this time").

Shortly thereafter, Ramsey called the station to ask why the tapes hadn't been broadcast. He was told that excerpts would be aired on January 1, 1966 (the tapes were broadcast simultaneously on KPFK's sister stations, WBAI in New York and KPFK in San Francisco). His next step was to call the Los Angeles bureau of *Newsweek* and tell a reporter about his operation. "I don't consider myself a Communist," he explained. "I consider myself a super-patriot. What I am doing is in the best interest of the United States."

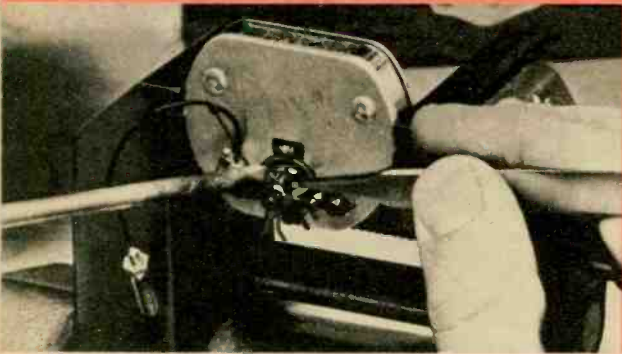
Ramsey left Los Angeles hurriedly in February. The Justice Department has been unable to decide on what to do about him since the United States hadn't declared war in Vietnam. Since there was no war, the Department reasoned, there could be no treason. The House Un-American Activities Committee, however, made no such distinction. It sent an investigator with a subpoena. But when he arrived in Watts, Ramsey had gone.

Not one to stay out of the limelight for long, Ramsey called a press conference on March 9, 1966, at United Nations Plaza, just outside the UN Secretariat building in New

[Continued on page 117]



THE MAKING OF MICRO-TECHNICIANS

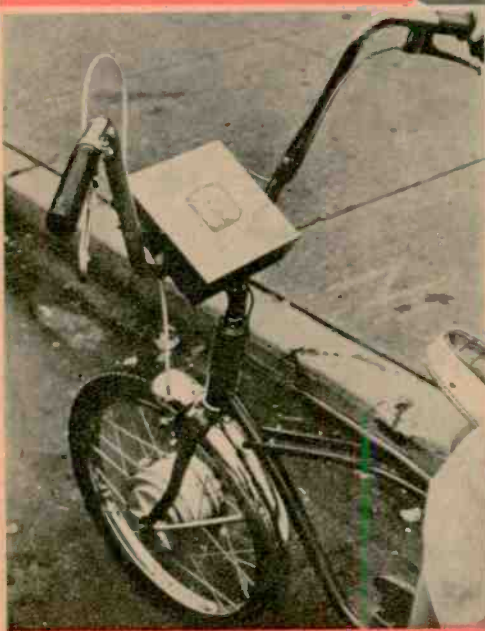


THE University of Illinois has launched a program to relieve the shortage of technicians trained in the demanding skills required to build or service precision instruments. Dr. Hugh G. Wales, Supervisor of the Micro-Precision & Watch Technicians Project, believes that the seven-month program is unique in this country. It combines instruction and laboratory work on the instruments with studies in such related fields as electronics and applied economics.

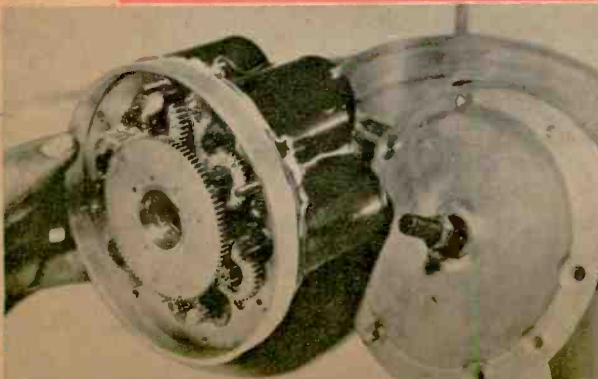
Two scholarships are available—both provided by watch companies. The timepiece industry is a major beneficiary of the program, of course, but the electronics field also has more and more need for persons trained in working with Lilliputian equipment, what with the advent of microcircuitry and related apparatus. The demand for Illini micro-technicians is so great that jobs were available for the entire first class before it had been enrolled.

The student in the photo at top is in the process of disassembling a voltmeter for cleaning. Another meter movement is being repaired at right (note jeweler's loupe, needed in seeing fine detail). At left, the meter's hairspring is soldered in position.—Robert Hegge —

Bike with a Real Charge



Above, lever on right handlebar is the accelerator; brake is mounted at left. Control box is located in center. Below, six small motors are linked together by gears to provide nominal output of 1 horsepower.



CAL TECH AND MIT may have had their electric car race but this gal is content to ride down her block at a leisurely 15 mph and enjoy the whistles.

That's an electric bike she's riding, natch, and it's about as nifty an electrical convenience as you'll find anywhere. Just the thing for a change of pace when you're tired of pushing pedals.

Stelber Industries, Elmhurst, N.Y., is still putting on the finishing touches and they plan to market this pollutant-free vehicle sometime this year. Price should be about \$200 for the two-wheeler and \$300 for a three-wheeler (actually a single-passenger electric car).

Six small Japanese motors team up to provide the necessary torque. They're located right in the hub of the front wheel. While the bicycle is not designed to run on battery power all the time, power is sufficient to carry a 200-lb. rider at speeds to 15 mph for more than three hours. After that you simply recharge the battery overnight.

Power can be switched on and off; once you're over that hill you can resume pedaling. A control box mounted on the handlebars contains a series of voltage-dropping resistors to control the speed of the motors. There's also an ammeter which indicates the discharge rate of the battery. —

Mini Metronome



By ADOLPH A. MANGIERI WHEN studying a musical instrument, one of the things which you must pay strict attention to is playing speed. An excellent aid to establishing a sense of time is a metronome which ticks away at a constant speed while you play. With a range of about 35 to 220 beats per minute, our Mini Metronome (1¾x3x3½ in.) will help your practice sessions greatly. In addition, the metronome can be used as an audible darkroom timer when set to 60 beats per minute.

Construction. For the sake of appearance, to simplify construction and to keep the cost down, use the speaker we specify in the Parts List. It comes in a plastic case (shown above) with two pots.

Remove all wires from the two 20-ohm pots and remove their bracket. If the knobs are stuck, apply a drop of lacquer thinner on the shaft near the knob to soften the cement. Note the eyelet at the *off* position on one of the 20-ohm pots. Solder a wire from this eyelet to the eyelet on the resistance wire (on the bushing side of the pot) to eliminate the *off* position.

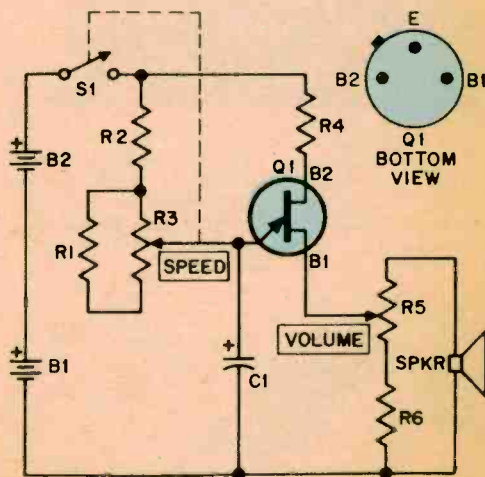
Install S1 on R3, then mount R3 and cut the shaft to length. Bend the outer lugs of R3 back towards the shaft. Install a long solder lug on the upper speaker mounting screw for a ground tie point. Secure the pots to the bracket and install the bracket.

Solder the B1 pin on the transistor socket to R5's center lug for support. Cut two battery connectors in half to make the battery

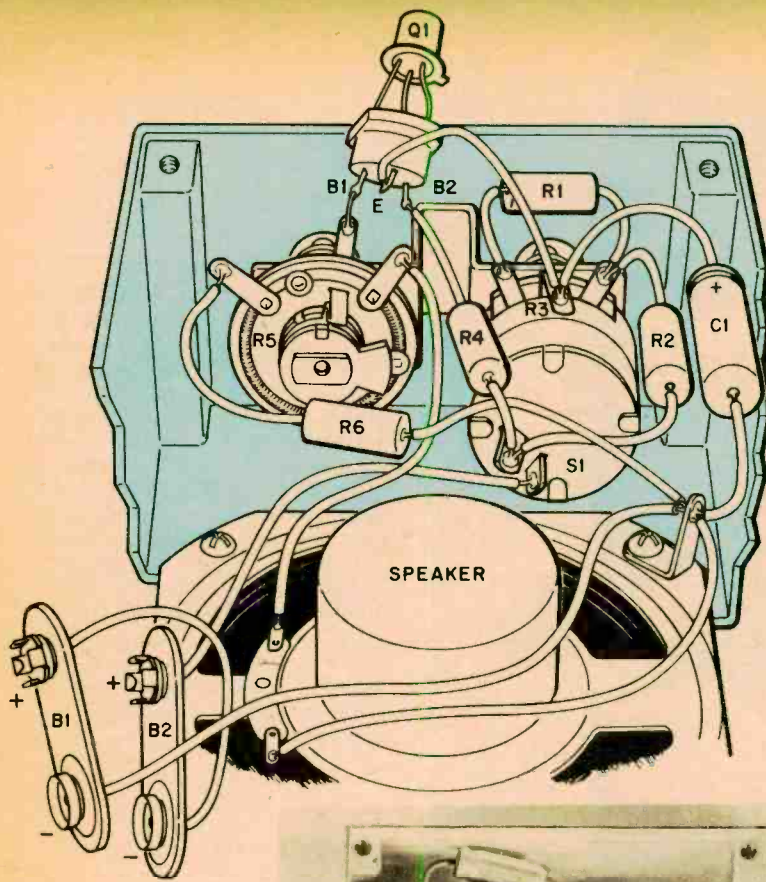
leads and a jumper. A scale for R3 can be calibrated by counting beats per minute.

Resistor R2 determines the fastest speed and R4 determines the slowest speed for a given value of C1. To reduce the fastest speed increase the value of R2. To increase the slowest speed decrease the value of R1.

Operation. Pot R3 sets the tempo and R5 sets the volume. The metronome also is a handy darkroom aid. Mark the dial setting of R1 at sixty beats-per-minute. Let the metronome run continuously at reduced volume and listen to the count when needed.

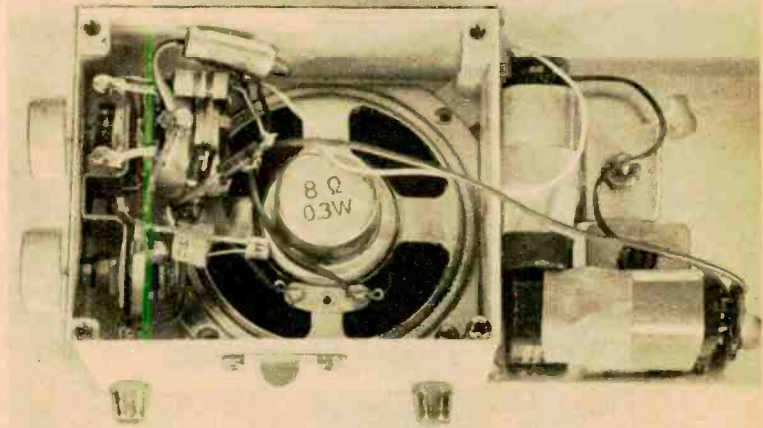


When S1 closes, C1 charges through R2, R3. When C1's voltage is 70 per cent of voltage across B1, B2; Q1 conducts, C1 discharges, sound is produced.



Speaker cabinet we specify comes with speaker and two 20-ohm pots on bracket. Bottom pot (R5) is original. Top pot has been replaced with 50,000-ohm log-taper pot with switch. Homemade brackets hold two 9-V batteries on back plate, as shown at the right.

In our model we used socket to hold unijunction transistor Q1; however, Q1 may be soldered directly into circuit. Note solder lug installed under right speaker mounting screw. It serves as circuit's ground tie point.



How it Works. When you close S1, capacitor C1 begins to charge through R2 and R3. Unijunction transistor Q1 does not conduct current until the voltage across C1 builds up to about 70 per cent of the voltage across bases B1 and B2. At this voltage, Q1 conducts heavily and discharges C1 rapidly through base B1 and the speaker voice coil. This produces the click. When the voltage across C1 falls to about 2 V, Q1 stops conducting and the cycle repeats.

PARTS LIST

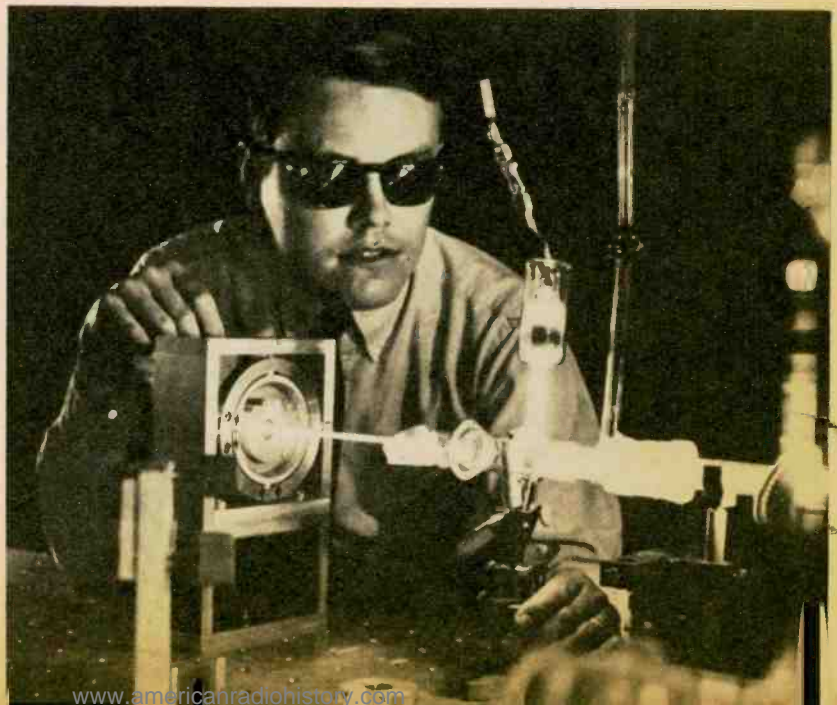
- B1,B2—9 V battery
 - C1—35 μ f, 25-V electrolytic capacitor
 - Q1—HEP-310 unijunction transistor (Motorola)
 - R1—56,000 ohm, $\frac{1}{2}$ watt, 10% resistor
 - R2—4,700 ohm, $\frac{1}{2}$ watt, 10% resistor
 - R3—50,000 ohm, log-taper potentiometer
 - R4—1,000 ohm, $\frac{1}{2}$ watt, 10% resistor
 - R5—20 ohm potentiometer*
 - R6—2.7 ohm, $\frac{1}{2}$ watt, 10% resistor
 - S1—SPST switch on R3
 - SPKR.—2 $\frac{1}{2}$ -in., 8-ohm speaker*
 - Misc.—transistor socket, battery connectors, knobs, 2 x 3 x 4-in. plastic case*
- *Components supplied in remote speaker (Allied 16 A 3515)



X-RAYS! Worried about X-rays coming from your color TV? Well, help is on the way—in the form of a high-voltage diode now in production at Victoreen Instruments. Designed for use in solid-state TVs, the diode acts as a voltage regulator which permanently sets the voltage level at which your set operates. No misadjustment is possible. Since the diode is a fail-safe device, there's no danger of X-radiation from the face of the picture tube should the voltage regulator break down. When conventional regulators go, a higher-than-normal voltage is applied to the CRT and this results in a dangerous radiation level.

Electronics in the News

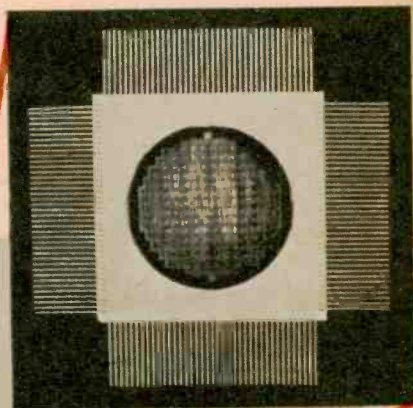
Laser Light . . . Finding substances which lase can be a fun activity. Yet, who knows what practical applications such laser light may have? At Bell Telephone Labs, the latest generators of the light fantastic are metal vapors mixed with helium gas. These have proved to be the most efficient and possibly least expensive CW lasers ever developed. Metals used include cadmium, tin and zinc; resulting light is in the ultraviolet, visible and infrared portions of the spectrum. At the right, William Silfvast lines up the discharge tube of one such laser.





Moon Beams . . . The next earthlings who go to the moon will have more time for experiments, so the program of Apollo 12 calls for setting up a lunar surface magnetometer—a device which will send back measurements of the magnetic field on the moon's surface for a year. The magnetometer, manufactured by Philco-Ford, has more than 6,000 components and three magnetic probes supported by tubular arms which fold up during the flight. It's one of seven geo-physical instruments aboard.

Tiny Tim . . . Don't look now, but the microcircuit on the right has more electronic components than 50 color TVs! The disc is the size of a half-dollar; the golden wires are electrical connections. This fantastic array of subminiature ICs is the result of a process called large-scale integration (LSI), a technique that implants 10,000 components in a silicon wafer. Below is a computer developed by Texas Instruments for the Air Force. It uses 34 LSI arrays.





NEW DX AWARDS

25 COUNTRIES

FOR our Ninth Award Period, opening with the publication of this issue, EI is offering the 25 Countries Award—one award for SWLs and one for hams. The countries may be in Canada as well as the United States. (Equivalents to counties in Alaska are Election Districts and in Louisiana they are Parishes.) Applicants must log 25 countries—two-way communications in the case of hams, reception in the case of SWLs. In addition, all our past awards are being offered again. A list of former awards is below.

On the next two pages is the Official DX log which must be used to apply for any of the awards. If you need additional copies of the log, copy it exactly by hand, or duplicate it on an office copying machine.

You must be able to substantiate each entry on your log with a valid QSL. Pay

attention to transmitter location—which counts for all awards except Major Cities-25, for which the studio location counts. Don't send your QSLs with the log. (We'll request them later if they have to be checked.) Mail your log to:

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

All entries must be postmarked no later than April 30, 1970—the end of this Award Period. Entries postmarked later will be returned.

If you want a complete list of all countries, cities and outposts that qualify for the awards offered in the past, write for our Official World DX List. Send your request with a self-addressed, stamped envelope to EI's DX Club at the above address.

HANDY GUIDE TO EI'S DX AWARDS

CLASS OF AWARD	TYPE OF AWARD		FREQ. LIMITS	REQUIREMENTS
	SWL	HAM		
General 100 (DX Century)	X	X	None	Reception of or two-way communications with stations in at least 100 different countries.
General 50	X	X	None	Reception of or two-way communications with stations in at least 50 different countries.
Special	X	X	None	Reception of or two-way communications with stations in at least 10 different countries.
BCB Stateside Special	X		535-1605 kc	Reception of stations in at least 25 different states or provinces.
Broadcast Band	X		535-1605 kc	Reception of stations in at least 15 different countries.
All-Continents	X	X	None	Reception of or two-way communications with stations on all six continents.
United Nations-25	X	X	None	Reception of or two-way communications with stations in at least 25 different UN member countries.
Major Cities-25	X	X	None	Reception of or two-way communications with at least 25 of the most populated world cities. (Populations based upon 1967 Information Please Almanac published by Simon & Schuster, New York, N.Y.)
Outposts-6	X	X	None	Reception of or two-way communications with at least 6 different outposts (complete list in Official World DX List).
25 Countries	X	X	None	Reception of or two-way communications with at least 25 American or Canadian countries.



OFFICIAL DX LOG

INSTRUCTIONS: PRINT neatly or use typewriter—DO NOT WRITE! Check SWL or HAM to designate type of Award and enter class of Award you are applying for (see chart on opposite page). In listing below, complete all blanks for each entry. Under *Date*, use figures (such as 12-1-69); all log entries must be dated January 1, 1950 or later. Under *Time*, use Greenwich Mean Time and 24-hour clock (0000 to 2359 hours). Make up identical copy of this log if you need more space. Ninth Award Period ends April 30, 1970.

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

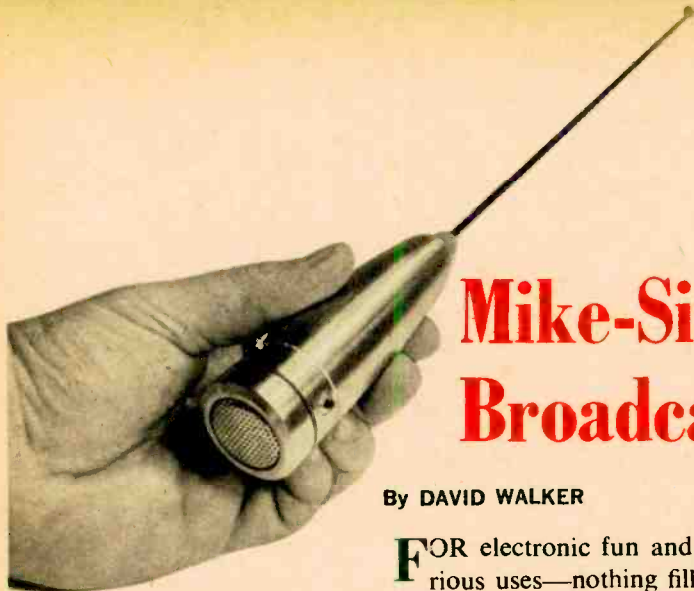
ADDRESS

CITY STATE AND ZIP (or country)

TYPE OF AWARD } SWL CLASS OF AWARD DATE
 } HAM

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Mike-Size Broadcast Station

By DAVID WALKER

FOR electronic fun and games—and even some serious uses—nothing fills the bill like a wireless microphone. Only thing is, that word wireless is somewhat misleading because the usual set up involves a mike with a wire going to its transmitter, and an antenna. You call this wireless? We don't.

Here's a wireless mike that really does live up to its name. Our Mike-Size Broadcast Station is a complete three-transistor broadcast-band transmitter built inside a mike case. Instead of a cord hanging out the back of the mike, there's a telescoping whip antenna. Frequency is adjustable from about 700 to 900 kc and range is about 20 ft.

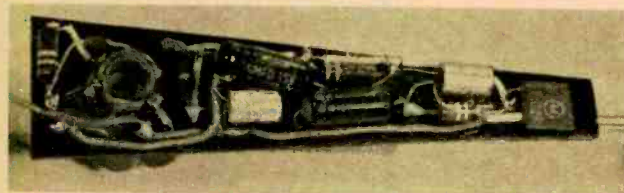
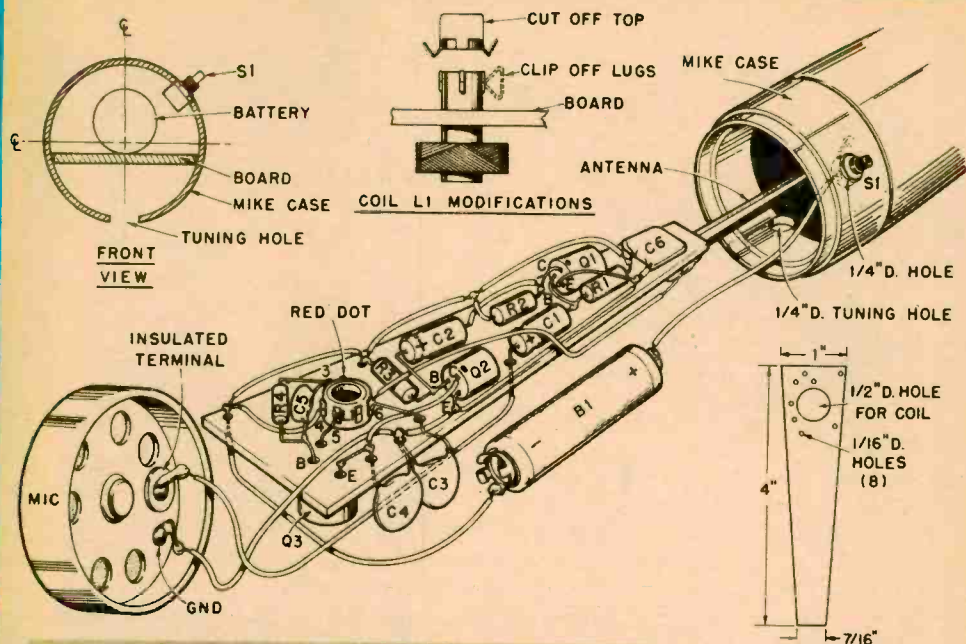
Construction. Most assembly is shown in the pictorial, so lets look at not-so-obvious details. Open the mike. Cut the circuit board to fit into the case, then drill the holes for the coil and parts leads. Mount the coil, battery and whip antenna by cementing in place with epoxy. But before you cement in the coil, cut off the top part—the end with the mounting clip—and clip off the metal *loop* at each lug. The coil can now be cemented into its hole.

Before installing the antenna unscrew its tip then slide the bottom section off. Next, solder a length of hookup wire to the bottom of the whip. The antenna may now be cemented to the board. The grommet through which the mike's wire passed is used to insulate the whip from the case. Cement or tape the battery on the board.

Watch the lead placement to prevent shorts and use spaghetti on wires that cross. Be sure there are no bare wires or parts at the edges of the board that might touch the mike case. To be doubly sure, line the inside of the case with heavy paper.

Drill two ¼-in.-dia. holes in the case where shown in the pictorial. Push-button switch S1 is mounted in one by simply force-fitting it in place. If it's loose, install the mounting nut outside the case. Now bend one switch lug against the case and solder it there. To the other lug solder a 5-in. length of No. 26 enameled wire. The other end of the wire will be soldered to the positive battery terminal. Drill the other hole in the case so it will be right over L1's slug.

Initial Test. Before attempting to slide the board inside the case.



Broadcast Station

As our mike's case is narrower at rear, board is tapered. Before cutting board for your mike, determine size with a piece of cardboard. Sketch at top shows modification to be made to L1 to reduce its size. Cross-section sketch at upper left shows approximate location of board, battery and holes for push-button switch and tuning slug on coil L1.

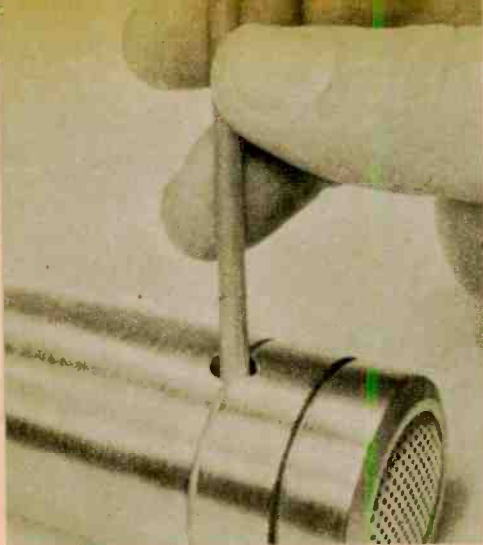
make a quick electrical check. Place a radio nearby and tune it to a clear spot on the dial around 800 kc. Connect a temporary jumper wire between the two metal parts of the mike case (that is; from the mike element to the main barrel). Remember that when the case is open it's possible for the whip antenna to touch the case and this will damage the battery.

Push S1 and check if there's a signal in the radio. Tune the radio dial as you talk in the mike to find the signal and adjust L1's slug with a plastic alignment tool. If you want to shift to a different spot on the broadcast band, use a different capacitor for C3; more capacitance (about 400 μmf) lowers the frequency, a smaller capacitor raises it.

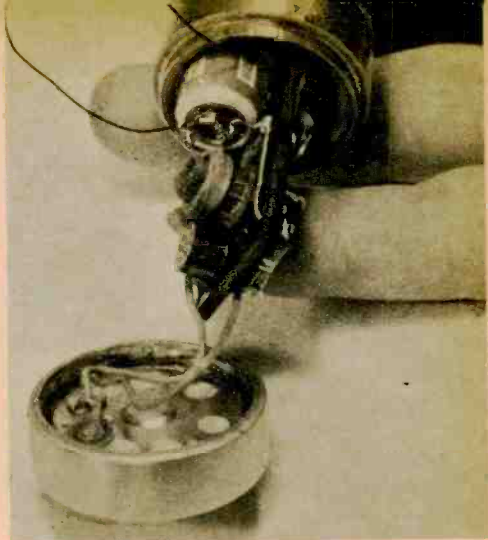
Sliding the Unit Together. Hold the case and look into the opening. As shown in the upper left of the pictorial, switch S1 should

PARTS LIST

- B1—9.8-V mercury battery (Mallory TR177 or equiv.)
- C1,C2—6 μf , 15 V electrolytic capacitor
- C3—360 μmf , 15 V or higher disc capacitor
- C4—.01 μf , 15 V or higher disc capacitor
- C5—.001 μf , 15 V or higher disc capacitor
- C6—.02 μf , 15 V or higher disc capacitor
- L1—Miniature oscillator coil (J. W. Miller 2023, Lafayette 34 E 87022
- Mic.—Tubular crystal microphone (Lafayette 99 E 45874
- Q1—2N408 transistor (RCA)
- Q2—2N2613 transistor (RCA)
- Q3—GE-1 transistor (GE)
- R1—270,000 ohm, $\frac{1}{4}$ watt, 10% resistor
- R2,R4—3,300 ohm, $\frac{1}{4}$ watt, 10% resistor
- R3—1 megohm, $\frac{1}{4}$ watt, 10% resistor
- S1—SPST normally-open miniature push-button switch (Grayhill 39-1, Allied 56 A 4968)
- Misc.—52-in. telescoping whip antenna (Lafayette 99 E 30082), No. 26 enameled wire, perforated circuit board



Plastic alignment tool fits through 1/4-in. dia. hole in side of case; it adjusts slug of coil L1. Final tune up should be made with board in case.



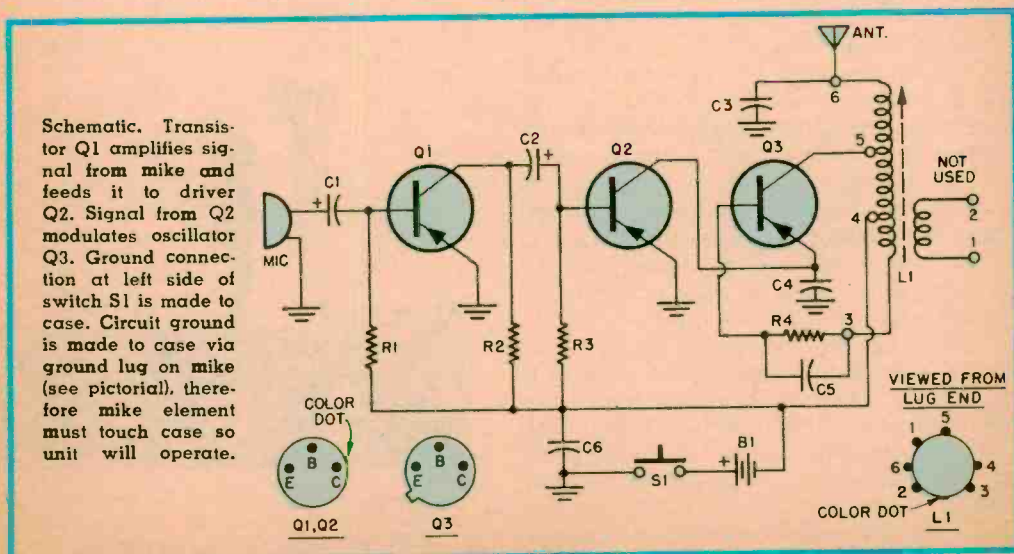
Board being fitted in case: The wire loop is No. 26 enameled wire which goes from positive contact on battery to push-button switch in case.

be at the upper right; the tuning hole is down. Insert the board into the case keeping the battery on top. As you do this carefully position the wire from the switch to the battery so the board slides in easily.

Don't Press the Button. Place one probe of an ohmmeter on the metal case and the other on the antenna. You should read several thousand ohms one way and a few hundred-thousand ohms after reversing the probes. Put the positive probe on the case and the negative on the antenna. Press the button and the meter should indicate the battery voltage.

Operation. Several factors affect range and performance. Turn on the radio, tune to a clear spot near 800 kc and turn volume to the usual listening level. Grip the mike, but be careful not to touch the antenna. Press the button and talk. You'll have to adjust coil L1 *while you speak*. Insert a plastic alignment tool in the tuning hole. Talk into the mike and turn L1's slug for the clearest sound from the radio.

You'll get the best range by trying the whip in various positions while talking, or you can turn the radio. Greater range can be achieved by adding an antenna to the radio.



The Listener

By C. M. Stanbury II

Portables for the 70s?

THERE is a good chance that the peoples of the world will experience a revolution in communications during the next decade. It seems likely that nations will be carving out their own turfs in which they will exercise strict control of public opinion.

Electronic communication would then become a form of information exchange (culture or propaganda) between power groups, thus making radio and television a means for extending one's sphere of influence. Now, cultural exchanges may be fine, but the propaganda boom of the '60s does cast a real shadow over the future.

An important manifestation of the growing influence of propaganda has been the development of high-power portable broadcasting stations. These portable transmitters will enable the super powers to exercise greater control over their own turf and to make encroachments on the turfs of adversaries.

Such units provide flexibility in the struggle to control people. Obviously, the DXer, equipped with relatively sophisticated receiving gear, will have a ringside seat from which to observe the great portable struggle of the '70s.

The '60s. Our first encounter with the sometimes secret world of portable transmitters began with Radio Americas, operated on Swan Island—presumably starting in 1960, as Radio Swan.

Any island station such as R. Swan would have required some high-powered portable units. The first of these (which reportedly required two weeks to put on the air) supposedly belonged to the VOA and originally went on the air at Marathon, Fla. in November 1962 (during the Cuban missile crisis). The Cuban problem seems to have been the catalyst for the rapid increase in the use of such equipment.

Next, in 1968, we were informed by a reliable government source that an American, 50-kw portable built by Gates Radio had been put on the air at Francistown, Botswana (then Bechuanaland) in December 1965. This operation took 24 hours to complete. Then, early in 1969, the VOA admitted that an additional station had been set up during

the Cuban missile crisis at Dry Tortugas, an island just west of Key West, Fla. Such a fast operation as this one obviously demanded portable equipment also.

The next question was whether the Dry Tortugas unit was a brand new rig similar to the station used in Botswana, or if it was an older portable predating VOA's model and therefore of the same vintage as equipment used by R. Swan in 1960. Following up on our Francistown lead, we went to Gates Radio City. In the terminology of the armed reports provided the rest of the story.

In August 1962, the Gates Radio Co. received an order from the U. S. Army to design and build what they now call a Flying Radio City. In the terminology of the armed services the system is called the AN/TRQ-20.

The system is actually five units in one. The 50-kw BCB station (AN/TRT-22) includes a 150-ft. telescoping, jack-up antenna. While original press reports described this unit's possible range as 60 mi.—hardly what you'd expect from a 50-kw rig—the actual coverage of the AN/TRT-22 is much greater. In fact, while in operation at Khan Kaen, Thailand (HSKN on 843 kc) it was heard several times in North America (under optimum conditions, of course).

Also included in this portable broadcast-



Atop transmitter shelter, GI tightens feed line carrying 50 kw to one of nine antennas included in U.S. Army's Flying Radio City, built by Gates.

ing system are a 50-kw SWBC facility (AN/TRT-21), a monitoring station (AN/TRR-18), a complete studio facility (OA-6021) and a 2.5-kw shortwave studio-transmitter link (AN/TRC-95). There are 23 portable shelters in all; less sensitive items such as generators and antenna towers are mounted on open skids. Each unit can be carried into position by helicopter, and installation time for the system is just under eight hours. This assumes, however, that the crew is experienced.

Because of the studio-transmitter link, control and monitoring facilities may be set up in one location, while the transmitters can be erected at another site up to 1,200 mi. away. The Army's Psychological Warfare Dept. first used the AN/TRQ-20 system in a test program during the spring and summer of 1963. The main studio complex was located at Ft. Lewis, Wash.; the auxiliary transmitter site was in Yuma, Ariz., about 1,000 mi. away. Programs were beamed to the Panama Canal Zone. After completion of the test program, the MW station (AN/TRT-22) was sent to Thailand. The United States Information Agency is currently assisting the Thai government in its operation.

It should be mentioned that Gates has been out of the Army program for several years now. The Psychological Warfare Dept. has since used a Gates AN/TRT-22 unit as a training system for personnel at Ft. Huachuca, Ariz., but they are now setting up their own equipment (along Gates lines). Apparently, the Army intends to go it alone



GI announcer broadcasts from Arizona desert to Panama Canal Zone. Announcements were added to programs originating at Ft. Lewis, Wash.

from now on with regard to portables.

The test programs broadcast from Ft. Lewis, Wash. and Yuma, Ariz. were heard by DXers on 11760 and 15380 kc during the summer of 1963. While VOA transmissions were relayed, this was at least eight months after the VOA Dry Tortugas unit went on the air. Therefore, the DT portable must have been an earlier model than the Gates AN/TRQ-20. We now have testimony that the Dry Tortugas transmitter was made by Westinghouse and was acquired by the Navy from a commercial broadcaster and then installed in trailers. This unit was eventually moved to Sugar Loaf and was finally damaged severely by a hurricane.

Thus, we get a picture of the portable movement being generated by the crisis in Cuba—the Army and other U.S. agencies first using makeshift portable equipment to answer the crisis, and then turning to specific manufacturers for special units. And now they want to work alone in the propaganda field.

[Continued on page 116]



Announce-teletype center is one of 23 shelter units making up AN/TRQ-20 portable broadcasting system. Every unit is transportable by helicopter.

AMERICAN PORTABLES IN THE 60s			
STATION	DATE	MAKE	INSTALLATION TIME
R. Swan VOA Dry Tortugas	May 1960	unknown Westing- house	Three weeks (probable)
VOA Marathon	Nov. 1962	Alpha	Three weeks
VOA Monrovia	Dec. 1962	Alpha	Two weeks
HSKN Khan Kaer	Fall 1963	Gates	Two weeks eight hours
VOA Vietnam (Hue)*	Sept. 1964	Gates	eight hours
BBC Francistown	Dec. 1965	Gates	24 hours (inexperi- enced crew)

*Heard occasionally on 760 kc despite QRM from R. Peking

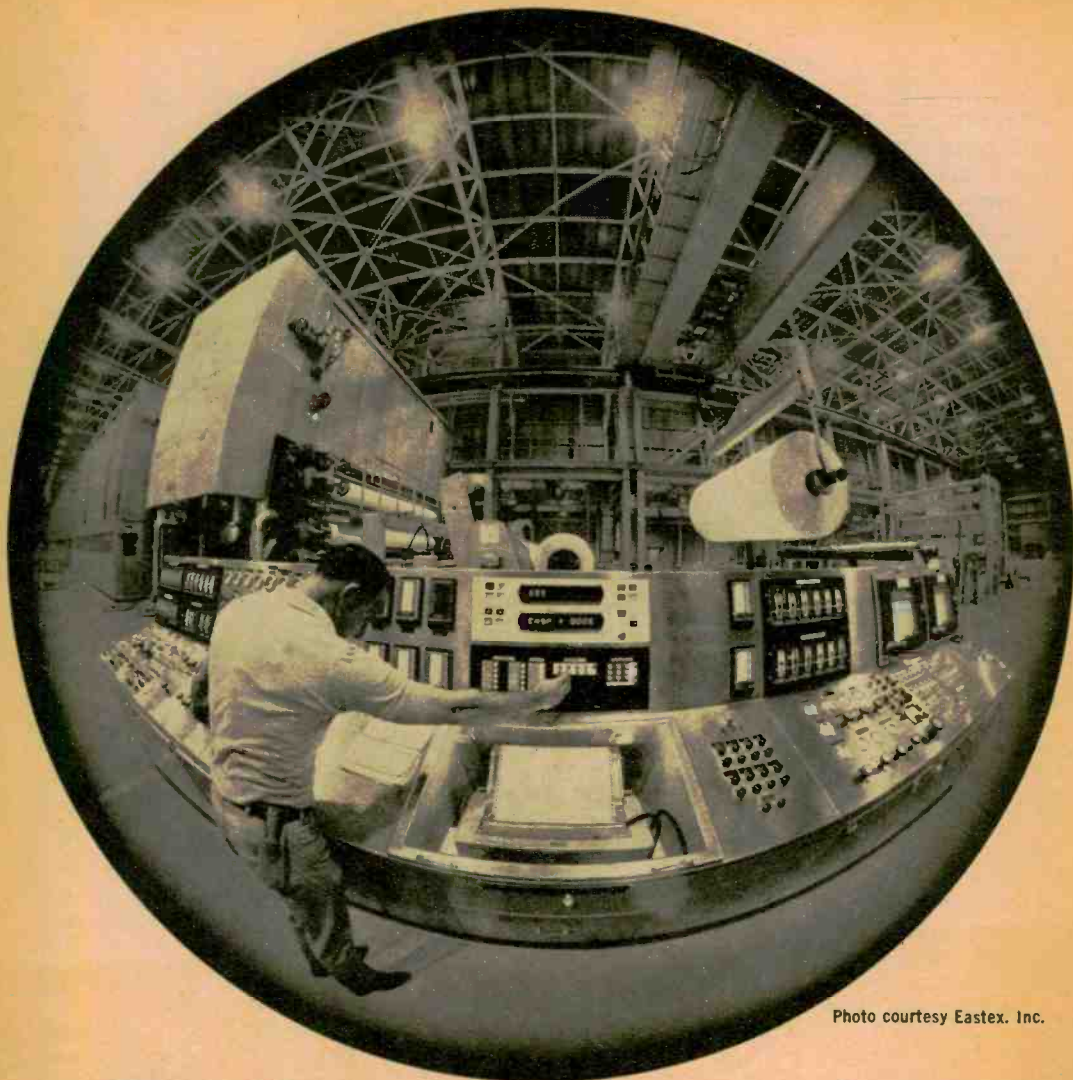


Photo courtesy Eastex. Inc.

Be the man in control

The man in control—today—is the technician who has mastered electronic operations. A specialist in the most sophisticated phases of electronic instrumentation and computer controls. The operations-oriented expert who makes automated equipment work. The trouble shooter who keeps it working.

Electronic Operations Technicians are in greater demand than ordinary electronic technicians. They have a higher skill level and they earn more. They understand digital and analog computers. They know computer logic, computer applications and computer technology.

How about you? Are you caught in a dead-end job with a dead-end salary? If you are, it's time to break out. To grow. To mail the facing card and get ready for a great future!

You can learn, Electronic Operations Technology and Computer Control, even if you have no electronic background. An exclusive new home study program, developed by Bell & Howell Schools, takes you through all the fundamentals . . . integrated circuits, semi-conductors, pulse and digital circuitry, field-effect transistors, and more.

You'll be expert in the latest technological advances, including every phase of computer controls. You'll even have a working knowledge of computer applications and computer programming . . . another Bell & Howell plus!

Other advantages, too! Personalized instruction, counseling service, post-graduate classroom study, a nationwide job placement service, and the exclusive Electro-Lab shown on the following page.

You'll design, build and test your own circuits with the exclusive Bell & Howell Electro-Lab®. Nothing could be easier. All you need is a good design, the Bell & Howell School Design Console and our patented Modular Connectors. Just plug in the transistors, diodes, capacitors etc. Circuits go together quickly—in any combination of components—without soldering. And suddenly, you're an expert.



Yet this three-dimensional system of breadboarding is only part of the exclusive Electro-Lab you receive with every Bell & Howell Schools home study program in electronics.

You'll have everything you need to set up a complete electronics laboratory in your own home. Every item is up-to-date equipment any Electronic Operations Technician might use, including a wide-band oscilloscope, a transistorized voltmeter and the unique Design Console. No other course lets you duplicate



actual industrial experiments with such a flexible, easy-to-use system of breadboarding your own test circuits. No other course matches it for professional quality equipment!

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- **Rodney Dresher, Lees Summit, Missouri**, testing microwave radio relay equipment, upped his income and upgraded his job three levels. Says: "A big thank you for the very excellent lessons. The home lab work is very good."
- **Richard A. Beltz, Lincoln, Nebr.**, more than doubled his salary in 2½ years with a TV firm. Says: "My home study course is one of the best investments I ever made. Thank you very much for helping me get where I am today."

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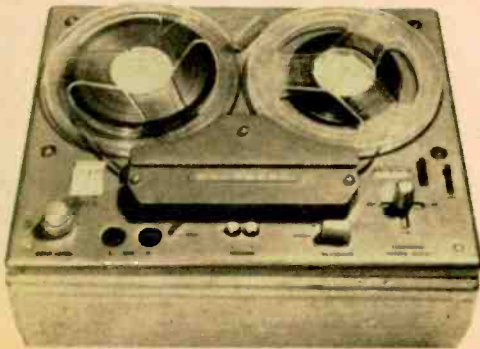
By John Milder

* What Strikes My Eye

MOST of the time, I spend this column mentioning trends in equipment or some major new development. But once in a while I get onto a single product (recently, the Sennheiser headphones) that seems worth some discussion. This time, I'd like to put several pieces of equipment together under the general heading of products which have impressed me lately. They include:

- The Sony 252-D stereo tape deck. For \$119.50, this is a full-fledged stereo deck that seems virtually indistinguishable in general performance from Sony's 255, which at \$180 has represented the entry level to good recording for many people. The trim and heft aren't the same, but the basic components seem to be there, including a facing pair of record-level indicators. Sony is doing all sorts of other things with decks up to \$750, but this is the one that gets to me.

- Another new tape deck, the Tandberg 1600X. Like many other people, I've had a liking for Tandberg machines for many years (particularly their simplified control layout and straightforward mechanical design). But I've always felt they were more expensive than necessary, especially in view of the far lower selling price in Europe. The 1600X takes care of that by supplying everything I've come to identify with Tandberg—including the crossfield head used in their latest and most expensive units—for a cost of only \$249. The function lever moves in the direction of



Tandberg Model 1600X tape deck offers such advanced features as a crossfield head for only \$249. Frequency response is 40 to 20,000 cps at 7½ ips.

tape motion and is locked in a depressed position. The controls are well organized.

- The Advent loudspeaker. This is the first product marketed by the Advent Corp., a new company headed by Henry Kloss, who has previously been a founder of both AR and KLH, and a designer of something over a dozen excellent speakers and quite a few other major products. The company's main concern is a projection color-television system due shortly, but this loudspeaker—the only one the company says it now plans to make—is quite something in its own right. It claims, for \$110, performance equivalent to the best speakers around. Since my objectivity is affected by having worked with Henry Kloss in the past, I can't presume to verify or dispute that claim. I can only say that the speaker sounds wonderful.

- The Dynaco A-25 loudspeaker. This, too, is an absolutely fine loudspeaker and its cost is \$89.50. Dyna has always been in that handful of companies preoccupied with lowering the cost of good sound, and their first speaker is right in line with this philosophy. It is simple and inexpensive and good to listen to. The only real difference in philosophy is that it's not a kit.

- The Thorens TD-125 turntable. If by now you think that only cost reductions turn me on, here's an unabashedly expensive turntable (from \$185 basic to \$385 with arm, cartridge, base and dust cover) that seems to augur the return of the manual turntable. The TD-125 uses a push-pull, low-power amplifier to drive its motor (like the Sony and such departed units as the Fairchild), and combines this with the usual Thorens precision and a very effective shock-mounting system. The result is a super-quiet turntable with a very low order of eccentricities of any kind. For the well-heeled perfectionist, a good buy.

What all the above products seem to share, in my opinion, is an approach to advertising and product information that doesn't claim that they have somehow made all other tape recorders, speakers, and turntables obsolete or unlistenable. In my experience, the products which claim to obsolete all others are usually the first to go.

The ABCs of Color Television Servicing

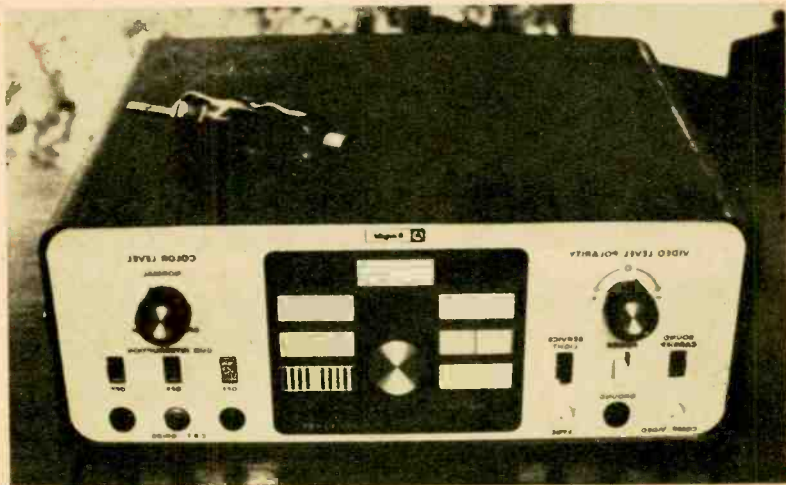
By Forest H. Belt

Part IV: Dynamic Convergence & Chroma Servicing

ADJUSTMENTS for dynamic convergence are about the trickiest steps in a color-TV setup. Before going ahead with this stage of your work, review Part III of this series thoroughly and then take the quiz appearing on the last page of this installment. Now you're ready to complete the following color adjustments.

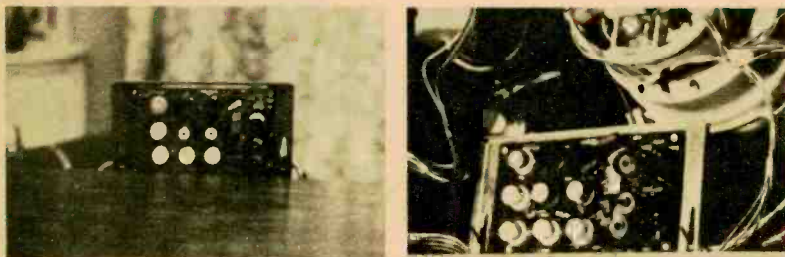
Dynamic Convergence. Once static convergence is completed, examine the screen of the color CRT at its edges. Use either a TV station picture which has sharp lines in it or the crosshatch pattern from your color-bar generator (Fig. 4-1). If there is any color fringing away from the center of the picture tube you'll have to go through the procedure called dynamic convergence.

This part of color-picture-tube convergence affects the electron beams as they sweep across the screen with each line and down the screen with



Knight-kit KG-685 is one of many color-bar (or rainbow) generators available.

FIG. IV-1



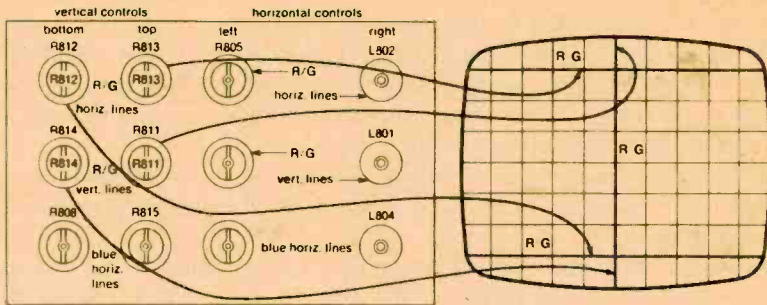
Dynamic convergence adjustments can be made from front of set if subassembly (convergence board) is in service position at left. Usual location is at right.

FIG. IV-2

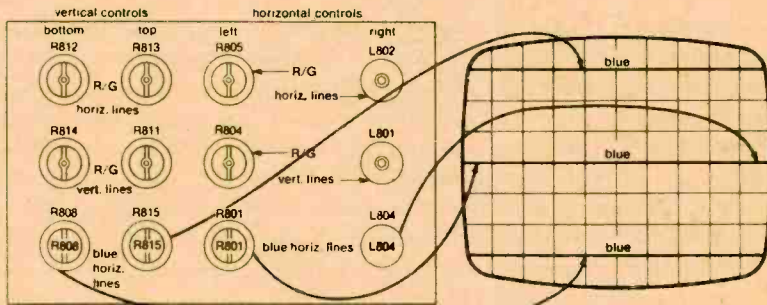
each field. The circuits controlling dynamic convergence are rather complicated, but all adjustment controls are gathered in a single subassembly called the convergence board or convergence panel. Fig. 4-2 shows two views of a typical convergence board. Note that in the servicing position you can see the screen and watch the results of your adjustments without the aid of a mirror. This is virtually a necessity; use of a mirror is hardly an efficient method. The procedure is not complicated but it takes time. You may even have to go through some steps several times if the set is far out of convergence, because the controls interact. Adjustments previously made will require touching up.

Fig. 4-3 is a complete chart of convergence procedures (static and dynamic) for the RCA CTC-25 color chassis. It is a good example of charts found in most service manuals. The diagrams show which controls on the convergence board affect which areas of the crosshatch or dot pattern on the CRT screen. The instructions (caption below) are brief. To help you understand them, short commentaries on each step follow (the numbers correspond to the steps outlined in the chart). Be sure to study both carefully before you start a color convergence. After a little practice you'll be able to do the whole job without the chart or commentary.

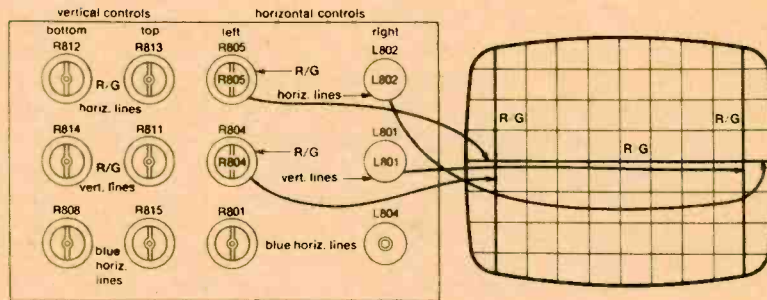
- (1) The dot pattern is best because lines tend to mask any slight center mis-convergence.
- (2) This is static convergence of the center dot.
- (3) Use crosshatch or vertical lines alone. Pay attention only to the center red and green lines. It's easier if you kill the blue gun. Don't superimpose the red and green lines to make a yellow line yet; merely make them parallel.
- (4) Switch back to dots. If the center dots aren't precisely together, do step 2 again. Don't forget to reactivate blue if you killed it for step 3.
- (5) Use either crosshatch or horizontal lines. The centers of the top and bottom horizontal lines are the most important areas. Ignore the middle and sides of the screen, no matter what happens there. Again, you can kill blue. In this step converge the lines, don't merely parallel them. Make the halfway points of the top and bottom horizontal lines yellow.
- (6) You can kill both red and green. Your aim is to straighten the single blue line across midscreen. The raster lines are a good guide. Any straight edge (ruler, etc.) is also okay.
- (7) Kill red and green. Use the crosshatch so you have a guide to where center is. Pay attention only to horizontal blue lines; make them all parallel along their midpoints.



STEPS 3 AND 5 ADJUSTMENTS
Effect of R811, R812, R813
and R814 Adjustment



STEPS 6 AND 7 ADJUSTMENTS
Effect of R801, L804, R808 and R815 Adjustments



STEPS 10 AND 11 ADJUSTMENTS
Effect of L801, R804, L802, and R805 Adjustment

1. Use either crosshatch or dot pattern for center converge. 2. Converge center of screen with red, green and blue magnets and blue lateral magnet. 3. Adjust R811 and R814 for convergence (parallelism) of R/G vertical center line. 4. Readjust center convergence if necessary. 5. Adjust R812 to converge bottom R/G horizontal lines and R813 to converge top R/G horizontal lines at center line of screen. 6. Adjust R801 and L804 for straight horizontal blue center line. 7. Adjust R808 and R815 for uniform displacement of blue horizontal lines along center vertical lines. 8. Converge blue horizontal lines with R/G hori-

zontal lines by adjusting the blue convergence magnet. Adjust red and green magnets if necessary. 9. Repeat steps 6 through 8 if necessary. 10. Adjust alternately L801 and R804 for right and left side convergence of R/G vertical lines. 11. Adjust alternately L802 and R805 for convergence of R/G horizontal center line. 12. Converge center of screen and repeat steps 10 and 11 if necessary. 13. Minor touchups may be made using the appropriate controls. If wide blue correction is necessary, loosen yoke and adjust wide blue correction screw. If wide blue correction is adjusted, purity must be rechecked.

FIG. IV-3

- (8) This is like static convergence. However, use only the horizontal-line pattern. With all three guns activated, converge the blue lines with the yellow ones by moving *only* the blue vertical magnet (not the blue lateral). If you absolutely must move red or green, move them only slightly.
- (9) This step is included because of interaction among the controls. If the set was far out of convergence when you started, you may have to go through the sequence three or four times.
- (10) Kill blue again. Use the vertical-line pattern only. These two controls interact considerably so go back and forth between them several times if necessary.
- (11) Switch to horizontal lines and keep blue killed. Converge the red and green lines across the center of the screen to form a yellow line.
- (12) This is a double step: First repeat static convergence, then steps 10 and 11. Then repeat step 2 again. If the set was far out of convergence, it may help to begin at step 2 and come through the whole procedure again. When you finish, the crosshatch pattern should be all white lines without any noticeable color fringing except near the edges of the CRT.
- (13) So-called minor touchups can foul you up if you're not experienced with convergence controls. You should turn only the control that affects the portion of the pattern that is fringed. But note the position of the control before you start. If your touchup doesn't help, you then can go back easily to the starting position. Otherwise you may have to begin all over. Resist any temptation to improve convergence when none is needed. Ignore a slight misconvergence at the very edges of the screen—it isn't noticeable in normal viewing.

That concludes dynamic convergence. Now you can go back and recheck the purity adjustment. Follow that with a recheck of gray scale. If you have to correct very much this time around, check convergence once again. Troublesome though this seems, you'll do the best job by going back and forth on these adjustments because they interact so much. What if some adjustment just won't work properly? Suspect trouble in the circuits associated with that control. In fact, an attempted adjustment is a fast way to spot difficulties.

Finding Faults in Chroma Sections. It should come as no surprise that 1-2-3-4 troubleshooting (analyze, inspect, isolate and pinpoint) fits perfectly into chroma servicing procedures. Whether you're dealing with tubes or transistors makes no difference. Components and circuitry do the same jobs in either kind of receiver. DC supply networks may be more complex in solid-state receivers, however, even though transistors have fewer internal elements than tubes. Interstage coupling is often via DC and a supply-circuit fault in one stage affects all circuits around it.

The chroma section is the most interesting one in a TV set—so many different kinds of circuits are used. Still, they're much the same as circuits and stages found in other sections of b&w and color receivers. Watch for these similarities. They'll help you understand color servicing.

Is Your Trouble Chroma? You should know the first two steps of troubleshooting well. Take a look at the block diagram (Fig. 4-4) of the chroma stages in one color receiver. While troubleshooting, assume the chroma section ends up with the color demodulators (or color amplifier stages, if they follow) and begins where the chroma signal is separated from the video.

Chroma problem symptoms aren't limited to those which appear during color programs. Certain changes in raster color can be traced to the chroma section. An example is a raster that has turned green because a difference am-

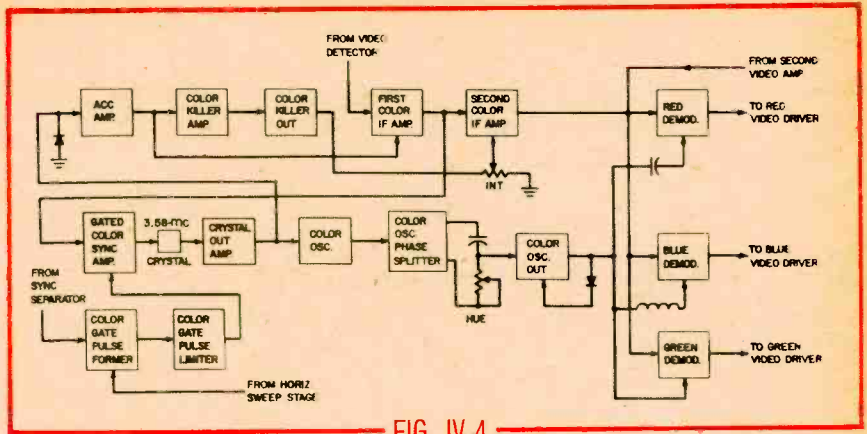


FIG. IV-4

plifier has gone bad. In some models the raster could turn magenta. As you become experienced with various brands and models, you begin remembering symptoms like these. They are a shortcut to understanding a malfunction. Until then, the sure way to isolate trouble is the 1-2-3-4 system.

Another symptom is seen best without a picture—in fact, with the set tuned away from a station. That's colored snow (or confetti) caused by a defective or poorly adjusted color killer stage.

A symptom easy to spot is that of no color. If a circuit or part goes bad in a chroma-signal amplifier or color oscillator, color programs come through in plain black-and-white. This particular symptom demonstrates how important it is that you see interstage relationships. In Fig. 4-4 you can see that the color IF amplifiers are affected by voltages or signals coming from the automatic color control (ACC) stage and the color killer. Obviously, a defect in either stage could disable a color IF amplifier. Analyzing the no-color symptom leads your diagnosis to the color IF amplifiers. But you still must isolate the trouble further to be sure just which chroma stage actually has a defect.

Sometimes, instead of no color at all, you see weak color. This can be caused by weak or misaligned bandpass amplifiers (color IF stages). If this trouble is accompanied by a lack of one of the primary colors, it points to a problem in one of the color demodulators. For example, lack of red in a color picture can result from a faulty X-demodulator tube (in sets with X-Z demodulation; see THE ABCs OF COLOR TV, parts 4 & 5, July-September '67 EI).

Another distinct chroma symptom is visible only during color programs. Colors seem to run or float as bars in the picture. The colors gather in the picture because they are no longer synchronized by the color-sync signal. This symptom is called lack of color sync or no color sync.

These are just a few of the symptoms that indicate trouble in the chroma section. When you see them on the screen during the analysis and inspection steps of your troubleshooting procedure, your diagnosis should lead you to the chroma section. Your diagnosis may even lead you to a particular stage. The third step—isolating—then lets you find out if the stage you diagnosed is actually the one at fault.

Isolation might seem difficult in a section which has so many interrelated stages, but it isn't. There are two techniques that are especially appropriate for isolating trouble in the chroma section. One is alignment—by going through a step-by-step adjustment of stages in the section you can spot most troubles.

Among technicians, there are a few old timers and beginners who still avoid alignment if they can. But the ones who really know what they're doing with modern color sets use alignment as their chief tool for diagnosis. Try tuning a coil anywhere in the chroma section, for example. If it doesn't respond, or you can't get the results you should, it may be bad. Or a part connected with it. Or the tube or transistor it works with. At least you've narrowed down the possibilities and have only a few parts to test.

The other technique is a combination of signal *injection* and signal *tracing*. You inject a color-bar signal at the input of the chroma section and trace it through with an oscilloscope. This method requires that you be familiar with what waveforms to expect. However, a few sessions with a normally functioning set and these two instruments will teach you a lot about how a chroma section works. You'll soon be at ease with this quick and dependable troubleshooting technique, too.

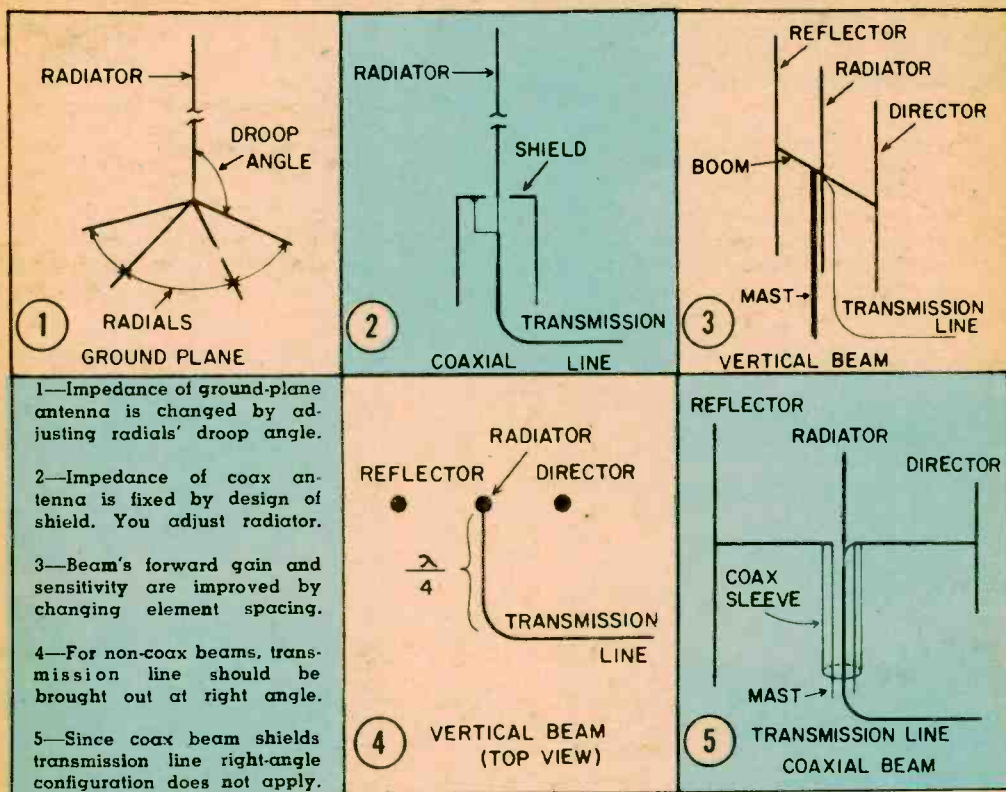
In Part V of this series, you'll learn exactly how the stages of a chroma section operate. Later we'll go on and examine one of these two isolation procedures.

Examination on part III

1. Put these steps in proper sequence for a color setup.
 - a) Gray-scale adjustment
 - b) Dynamic convergence
 - c) Monochrome adjustments
 - d) Purity adjustments
 - e) Static convergence
 - f) Horizontal and high voltage
 - g) CRT and chassis degaussing
 - h) Pincushion correction
2. Why must you be careful to set the High voltage correctly?
3. Gray-scale adjustment is needed when:
 - a) pink spots show up in white raster.
 - b) the entire screen is reddish or greenish at low brightness.
 - c) the contrast range of black to white isn't sufficient.
4. When you do static convergence, you:
 - a) converge only the vertical red and green lines
 - b) converge only the center dot of a dot pattern.
 - c) converge only the outside edges of the CRT screen.
 - d) converge the blue vertical and blue lateral magnets.
5. Once purity adjustments are completed there is no need to check them any more. True or false?

[Turn to page 119 for correct answers]

Next Issue:
Chroma Circuits: Operation & Troubleshooting
Plus Examination on Part IV



How To Tune A CB Antenna Razor Sharp

ANTENNAS are a nitty-gritty subject, but from the beginning of CB one problem which never really occurred was that of antenna tuning. Whether the CBER used a simple ground-plane or a three-element beam, the factory antenna tuning usually was close enough to make for a pretty good antenna match.

However, few antennas are mounted in an ideal position—away from metal objects which can affect tuning, at right angles to

the transmission line or over a symmetrical ground. Just about anything—houses, power lines, nearby TV antennas, phone lines, etc.—can affect an antenna's tuning and radiation characteristics.

For peak performance an antenna should be tuned in its mounting location. Even a simple ground-plane often can be trimmed for better performance. And while a complete tune-up of a complex antenna like a beam can take hours, just a little effort should result in a noticeable improvement in performance.

Ground-Planes. There's little you can do to tune a ground-plane antenna. Important is the droop angle of the ground-plane's radials; they affect the antenna's impedance (radiation resistance) and, therefore, the match to the transmission line. Your first step is to connect an SWR (standing-wave ratio) meter between the transmitter and the transmission line. If the meter shows an SWR of 2:1 or lower, add approximately 4 ft. of transmission line and take another reading.

If the indication remains the same you've

How To Tune A CB Antenna Razor Sharp

no work to do. The antenna system is okay. If the indication changes when the 4-ft. line is added, your antenna is not matched to the transmission line. (Trimming the line to obtain the lowest SWR reading possible does not improve the antenna-to-line match. It insures only a transmitter-to-line match—line-to-antenna losses remain.)

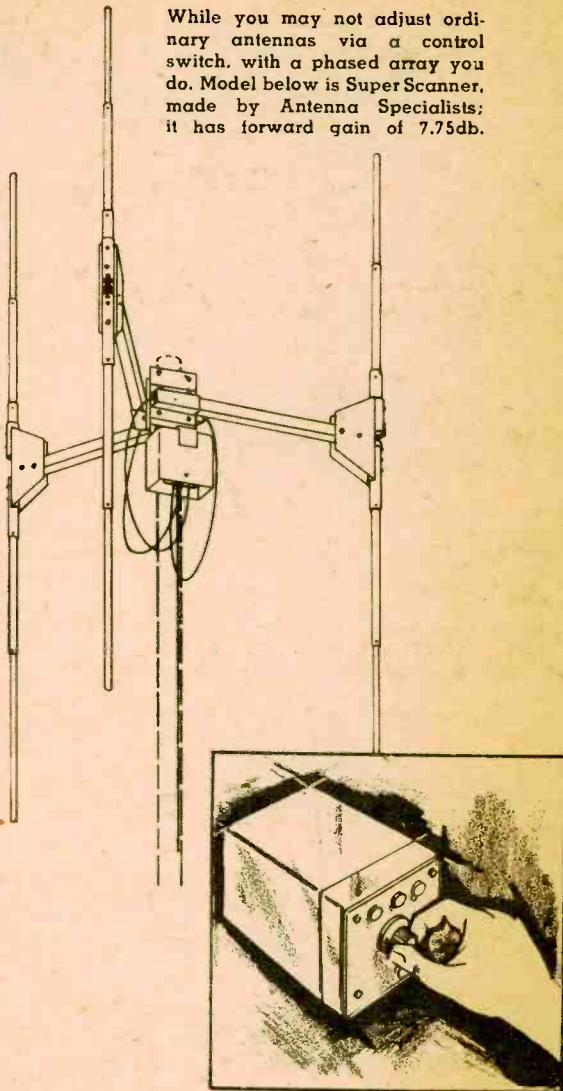
Note the highest SWR indication and change the droop angle of the radials (by bending, if necessary) until the indication decreases. If the indication increases only when you change the droop angle try changing the length of the radiator. Remember that in all antenna tests and adjustments it is a good idea to run the transmission line away from the antenna at least a quarter wavelength (108 in.) at right angles to the radiating element except in the case of a ground-plane antenna. The ground-plane radials act as a shield, whereas a non-coax beam doesn't shield a radiator from the transmission line.

Coaxial antennas. A coax antenna is basically a ground-plane with all radials brought down to form a shield around the transmission line. Since you aren't going to cut away the shield, about the only adjustment you can make is to lengthen or shorten the radiator. If you cannot obtain an SWR indication of 1.2:1 or lower, most likely the antenna is positioned too close to another antenna, near a rain gutter or near wires. The same is true of ground-plane antennas whose SWR isn't as low as it should be.

Beams. Tuning a beam antenna can be tricky because there are good beam designs and there are some quick-and-dirties which offer better performance than a ground-plane model but not the really top performance a beam should offer. Our comments refer only to *vertical* beams. Ideally, a vertical beam should have a coax radiating element to shield the antenna from the transmission line. If the transmission line is within the radiating field it can change the antenna's radiation pattern, perhaps causing the beam to shoot the signal skyward rather than down along the ground. A lot of beam signals often get lost this way.

The worst such case occurs when a beam

While you may not adjust ordinary antennas via a control switch, with a phased array you do. Model below is Super Scanner, made by Antenna Specialists; it has forward gain of 7.75db.



designed for horizontal use—where the transmission line should fall away at right angles to the radiator—is used as a vertical beam, for the transmission line then runs alongside almost half the radiator. Again, if you are using a non-coax vertical beam, try running the transmission line out at a right angle (horizontally) for a quarter wavelength. While this may be difficult to do, the improvement in performance is worth the effort.

The length and spacing of the beam's elements determine three important characteristics: (1) the impedance of the antenna (radiation resistance), (2) forward gain and (3)

front-to-back ratio. Front-to-back ratio is simply the difference—measured in db—between the antenna's forward and rear sensitivity (or forward and rear gain). It is easily determined by comparing station signals with a calibrated S-meter.

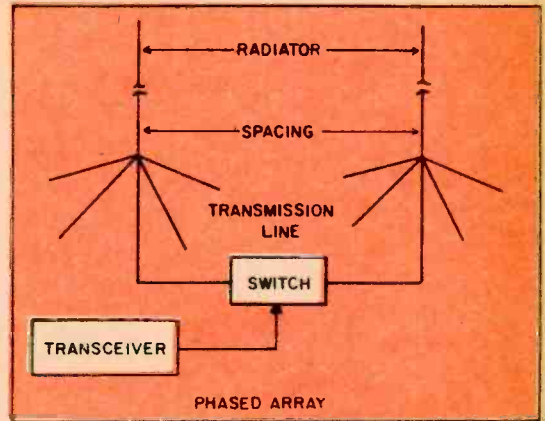
First point the antenna directly at the station and note the S-meter indication. Let's assume the S-meter shows 10db over S9. Then point the back of the antenna at the station and note the S-meter indication again—assume it shows S9. The front-to-back ratio (difference) is 10db. This is important in the receiving mode because it means that unwanted signals coming from the back of the antenna will be attenuated 10db.

As a general rule, a beam cannot be tuned for both maximum front-to-back ratio and maximum forward gain. You must choose between the two. These adjustments are done by checking your signal on a receiver equipped with an S-meter. Tune the beam by adjusting the length of the telescopic elements and the spacing. Simply adjust both until the receiver (or a sensitive, remote field-strength meter) indicates the performance you want. However, don't deviate too far from the manufacturer's recommendations because it will affect the antenna's impedance and there's no point in having a high-gain antenna if it won't accept RF from the transmission line.

Normally, beams are supplied with a feed device so the antenna can be matched to the transmission line. Using an SWR meter, adjust the matching device for the lowest SWR indication. Keep in mind, however, that beams often do not give a solid match to the line. An SWR of 2:1 or even 3:1 is not unusual.

Often a beam's radiation pattern can be improved by using a balanced feed. If your vertical beam has non-coaxial elements, a coax transmission line can result in most of the signal heading skyward rather than staying near the ground.

Most manufacturers suggest a balun or balanced matching device that is made of ordinary coaxial cable. It will insure that both ends of the radiator are *above* ground. (Whenever a symmetrical antenna is fed with coax, one side of the antenna is grounded through the coax shield; the radiation pattern is then non-uniform, i.e., it's shifted to one side.) When a balancing device is used, however, the transmission line must feed the antenna system at right angles to



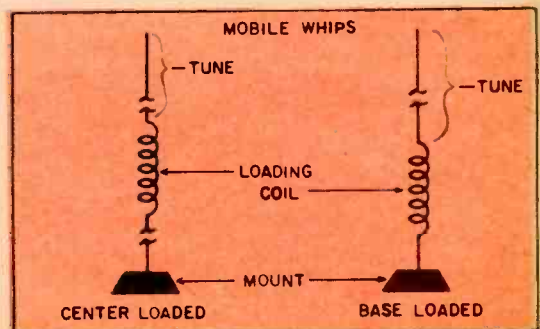
Phased array links two or three ground-plane antennas to resonant transmission lines to achieve a directivity pattern controlled via a switch.

the radiator for a quarter wavelength.

On *coaxial* beams, the coax sleeve shields the transmission line and the line feeds straight up from the base. Tuning is accomplished the same way, by adjusting the elements and the spacing, only you don't have to adjust the length of the sleeve. Be sure to stick very close to the manufacturer's original settings.

Phased Arrays. The phased array (or beam) allows you to change directivity by modifying the phase of the signal fed to two or three fix-positioned, vertical ground-plane antennas. The combination of the electrical spacing of fixed vertical elements and the length of the transmission line feeding each antenna determines in which direction the system radiates. A switch used to cut in and out different sections of transmission line to

[Continued on page 114]



Mobile antennas are tuned by adjusting length of radiator above loading coil. Change in length of radiator makes big difference in performance.

Notes from EI's DX Club

THOUGH certainly a rare DX country, the Easter Islands are worked from time to time in North America via CEØAE. Member Ronald Rose, WB6LDV (California), can boast a 20-meter QSO at 2330 EST (2030 PST).

Our old friend, the Voice of the Purple Pumpkin, is back on the scene. Bob Hagerman (Michigan) logged him on 7295 kc around 1800 EST while friend Pumpkin was combining music and SSB. Bet the Chesapeake Bay hams really appreciate this bird.

From EIDXcer Marvin E. Robbins (Nebraska) we learn that R. Biafra is heard best now on 7302 kc between 0500 and 0600 EST. This is their home-service broadcast.

A 3-kw transmitter, apparently belonging to the Far East Broadcasting Co., reportedly began test transmissions this summer from the Seychelles Islands. Frequencies tried were 15165, 17755 and 21460 kc.

A new experimental station heard these days on 6030 kc is KB2XBQ. It's operated by the Hudson Laboratories at Sterling Forest, N.Y., putting out 50 watts. Other frequencies assigned are 2412, 4025 and 4824 kc. It IDs with CW (A1) on the hour and half hour—otherwise its transmissions consist of nothing but an open carrier used for propagation research.

A station listed as R. Australia's new Darwin installation is heard by regular Gerry Dexter (Wisconsin) on 9650 kc using oriental languages until 0629 EST sign-off. Another Dexter catch is R. Bukavu in the Democratic Republic of the Congo on 4839 kc until fade-out around 2345 EST. Program commentary is in French, music is African.

For the first time, the Burma Broadcasting System has moved up into 31-meter territory. It is logged by a Pakistani source on 9730 kc at 2130-0230 (1930-2230 PST). The last half hour is in English.

A country whose BC station operates only on the tropical bands and on medium wave is

French Guiana. However, Bob LaRose (New York) has noted the French Telecommunications Service at Cayenne broadcasting with a test tape on 15556 kc at 2200 EST.

Everything in short-wave broadcasting seems to be changing. The BBC Far East station at Tebrau, Malaysia, one of the world's oldest relay bases, is currently undergoing antenna construction and modification. A new frequency for this unit is 11845 kc—watch for it around 0630 (0330 PST).

DX reports to the U.S. Army station in the Panama Canal Zone (ACA) should be addressed to Drawer 924, USA Stractcom Facility Canal Zone, APO New York 09827.

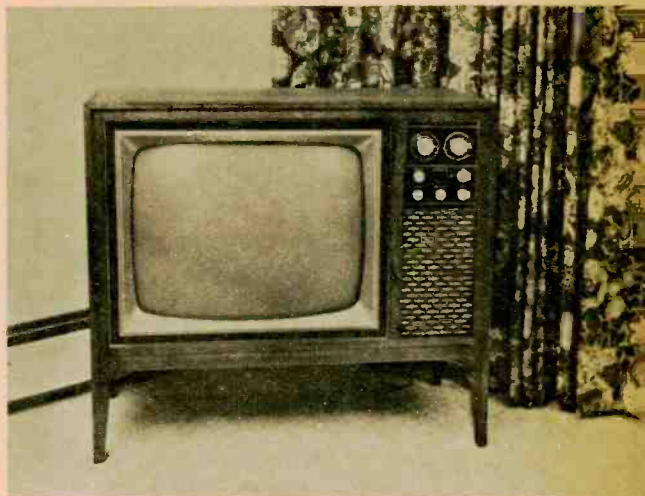
Propagation: During winter months, conditions change abruptly around sunrise and sunset (local time). These sharp transition periods occur because the sun is closer to the earth than at any other time, and thus, solar radiation is most intense. During periods of daylight the range of useful frequencies is higher than at any other time of the year, but once the sun has set, solar energy is abruptly removed and the range of propagated frequencies plunges rapidly.

The opposite effect takes place during sunrise periods. Nights are longest during the winter (in this hemisphere) and the relatively long period without sunlight weakens the ionosphere significantly. So the range of useful frequencies is at its lowest level during nighttime periods. At sunrise, however, the sudden illumination of the ion-starved ionosphere by intense solar radiation causes a sharp increase in the range of useful frequencies.

Radio conditions over a given path are at their worst during winter when part of the path lies in daylight and part of it in darkness. The frequencies which are optimum over one half are radically different from those which are optimum over the other half. On circuits to the east, for example, conditions will be at their worst several hours before sunset, because the transmission path will already be so divided. On circuits to the west, the hours after sunset will be worst for similar reasons.

De Luxe Color TV Receiver

Heathkit GR-681



WHEN we reported on Heath's first color TV kit, the Model GR-53, in our July '64 issue we implied it was rather courageous for them to market a kit of this complexity. As it turned out, Heath was quite successful and has been with all subsequent color TV kits.

The GR-53 sold for \$398 (\$349 for the set plus \$49 for the cabinet). It had a 21-in. round tube and did not have UHF. (The GR-53A, which cost \$49 more, did have UHF.) Heath's newest top-of-the-line color TV kit, the Model GR-681, has a 295-sq.-in. (23-in. diagonal) rectangular rare-earth-phosphor tube, UHF and automatic fine tuning (AFT). Add to that wireless remote control and it can truly be called a de luxe color TV.

Since 1964 an increasing number of complex kits, such as large organs, have made the scene and have gone over well. Instead of deterring kit builders, complexity has been accepted as a challenge.

Today we feel there's no reason why someone considering buying a color TV should worry about tackling the GR-681. The major difference between building a color TV kit and, say, a ten-transistor radio kit is that there is simply a lot more work to building the TV.

If you can understand and follow instructions carefully, know how to solder (or can learn), don't get bored or impatient, assembling the GR-681 is not an insurmountable job. A wide-angle view of the inside of a color TV would throw anyone. But when you build a kit you do it resistor by resistor, wire

by wire, screw by screw; your viewpoint is always extremely small. It's simply several hundred small steps that add up to a large piece of equipment. You never have to grasp the thing all at once (except to move it).

In fact our builder, who previously had tackled the Heath GD-983 organ and the AR-15 stereo receiver, found the GR-681 a relatively easy job. However, we don't suggest it as a first kit. A few smaller kits under your belt would be good for experience in point-to-point and printed-circuit-board wiring and soldering, component identification as well as following instructions and working

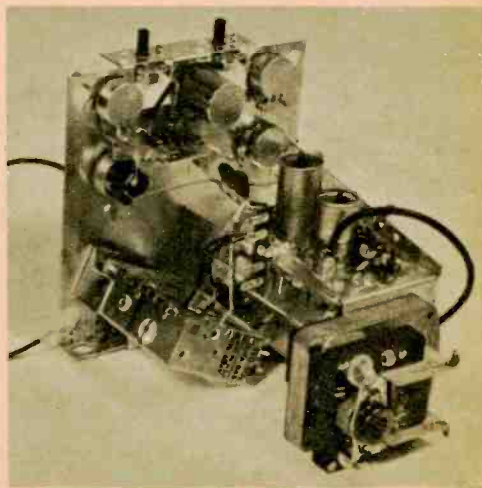


Fig. 1—Partially-completed tuner assembly. Solid-state UHF tuner is at lower left; VHF tuner is at right. The motor (foreground) drives the VHF tuner.

Color TV Receiver

from pictorial diagrams.

Our kit arrived in the dead of winter when nights are long and time hangs heavy on weekends. There were four cartons. One contained the picture tube, another the cabinet. A third was packed with all the electronic parts and metalwork. A fourth was the wireless remote control. We got ready for another big adventure.

As we sorted things out we wondered about how much money one would save (if any) by building a kit instead of buying a comparable factory-assembled RCA, Motorola, Magnavox, Zenith, Admiral, or other name-brand set. This was difficult to answer because, first off, there are choices of kit components such as wireless remote control and three different cabinet styles. (And don't forget the price of your time.) The number of permutations and combinations becomes greater when you shop around because of such variables as discounts and cabinet styles.

The cheapest GR-681 would cost \$562.90, which is based on \$499.95 for the set plus \$62.95 for the contemporary walnut cabinet. The most expensive model would come to \$679.40 which would be for the same set plus \$59.95 for the GRA-681-6 wireless remote control and \$119.50 for the Mediterranean oak cabinet. To these prices you would have to add the cost of freight from Heath. The model we built, shown on the first page of this article, is in Heath's contemporary walnut cabinet. With the wireless remote control it would cost \$622.85 plus shipping.

If you go out to shop price for a factory-assembled console, keep in mind these fea-

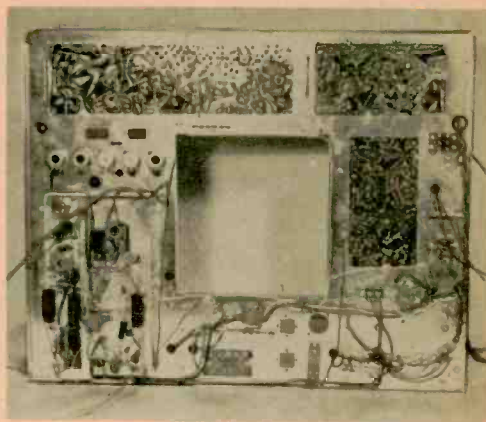


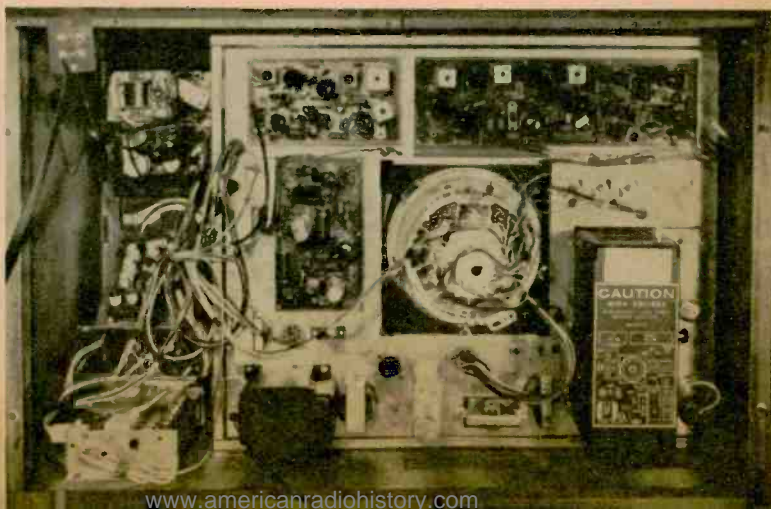
Fig. 3—Partially completed main chassis. Circuit boards, pots, high-voltage section and other parts have been installed, but much work remains.

tures of the Heath when making comparisons: 295-sq.-in. viewing area (23-in. diagonal), automatic fine tuning, wireless remote control (optional), built-in dot generator.

Building It

Let's get to the nitty-gritty of building it. Construction starts with three printed-circuit boards. In the photograph of the rear of the set (Fig. 2) they are the color circuit board in the upper right and the sound-sync board at the left, center. The convergence circuit board is shown in Fig. 4. In the upper left corner of the chassis in Fig. 2 is the IF circuit board, which is supplied wired and aligned. After the boards you go on to the main-chassis parts which consist of the convergence-bracket assembly, the tuner assembly in Fig. 1 (UHF and UHF tuners are supplied built and aligned) and the main chassis

Fig. 2—Rear view of set. Chassis in lower left corner of cabinet is wireless remote control receiver. Circuit board in upper left corner of main chassis and high-voltage cage at lower right corner are supplied assembled. Main chassis is hinged at left so it can swing out more than 90°. This simplifies servicing.



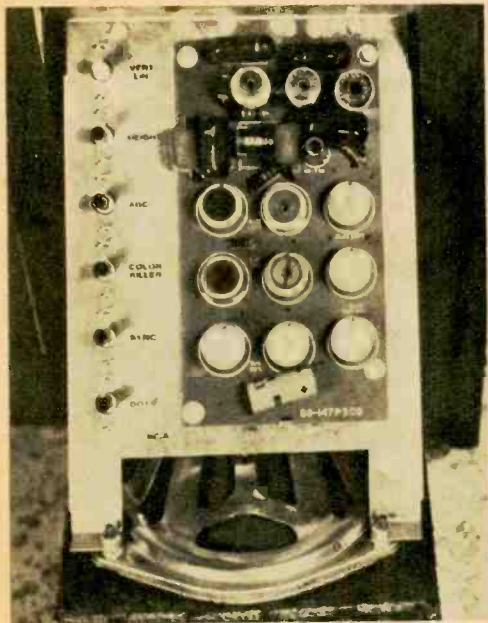


Fig. 4—Dynamic-convergence board is attached to rear of hinged (at bottom) speaker panel. It swings out to convenient angle for adjustments.

which is shown in Fig. 3.

Another time saver is the horizontal-output assembly (lower right corner, Fig. 2.) It is supplied wired and checked. You bolt it in place and make connections to it. After installing cable harnesses, parts, and the AFT assembly on the main chassis (Fig. 3) you attach the picture tube to the mask and build up the metal shield around it. Then come connections to the tuner assembly, degaussing, connections to the deflection coils and the preliminary checks.

What happened when we turned it on? Would you believe a picture? Of course it wasn't perfect because we did not make convergence, pincushion, gray-scale or purity adjustments. These came later.

Up to this point we put in 28 hours. With the exception of the wireless remote control we had no problems. The difficulties we had with the wireless remote control we brought on ourselves, in a way. Here's why. The wireless remote control is sold as a separate kit and its construction manual is prepared with the idea in mind that it will be added to a completed set. We realized that to finish the set, then undo a lot of work to add the wireless remote control receiver would require extra time and double work.

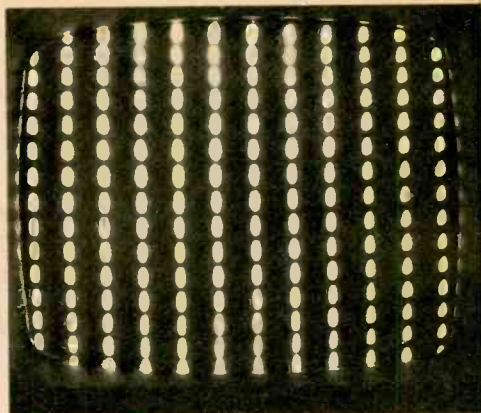


Fig. 5—You don't need an external dot/bar generator for convergence because one is built in set. The pattern shown above is produced by it.

We decided to interleave modifications for the remote control while building the set. It wasn't easy, because it required going back and forth from one manual to the other. We don't recommend that you try it. Often we didn't know where we were. But we didn't fare too badly. At first check the wireless remote control didn't work. The error was a simple one and consisted on interchanging a white and blue/white wire from a cable harness which picks up power in the main chassis for the wireless remote control receiver. We were lucky.

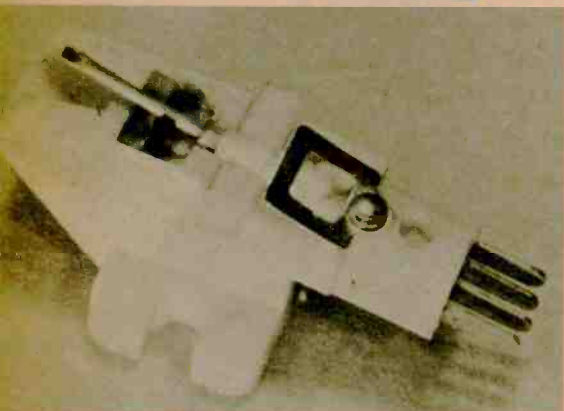
Static convergence (using the built-in dot generator), purity, gray-scale, dynamic-convergence and pincushion adjustments took about two hours the first time. On the second round we went through them in about one hour. After a trip from our lab upstairs (we slid the set upside down in its cabinet down a carpeted flight of stairs and wheeled it into the den on a dolly) we went through another one-hour convergence then sat down to enjoy it.

In Living Color

The GR-681's color (and b&w) picture is excellent. Reception 50 miles from New York (on Long Island) with the master-antenna system in our house is excellent. No problems with operation of the set. However, the wireless remote control kicks up once in a while. When switching channels you may accidentally stop on an unused channel where there's a lot of noise. Sometimes the channel-selector signal (38 kc) won't break

(Continued on page 115)

Out-of-Sight



Cartridge

TWENTY or so years ago one of the bigger radio manufacturers decided that the magnetic cartridge, which had just appeared on the consumer market, wasn't the last word, after all. The result: a *resistance* cartridge (good idea) in which the stylus moved a carbon-covered rubber band (bad idea). Since the life expectancy of the rubber band was about the same as that of a fly in a vat of lava, the cartridge never made it.

The variable-resistance cartridge has been resurrected (without rubber band) in modern form in the Miniconic Model CK-15-P, made by the Euphonics Corp. (Box 233, Guaynabo, Puerto Rico, 00657). Not only is the CK-15-P what we consider the most outstanding cartridge around—it also is the most obscure. Just try to find one! In both performance and availability it is really out of sight. Price is about \$40 for the cartridge and its power supply/amplifier.

After failing to find a ready source of supply, we wrote to the public-relations firm that handles Euphonics and asked where we could buy the cartridge. The answer was that the Miniconic is distributed nationally and that our letter was forwarded to Euphonics.

Euphonics told us the cartridge is sold by hi-fi dealers throughout the world. Promotion money for the cartridge, it was pointed out, was limited because the company was promoting its new security products (ultra-sonic burglar alarms). The Miniconic, we were told, would be pushed more actively in

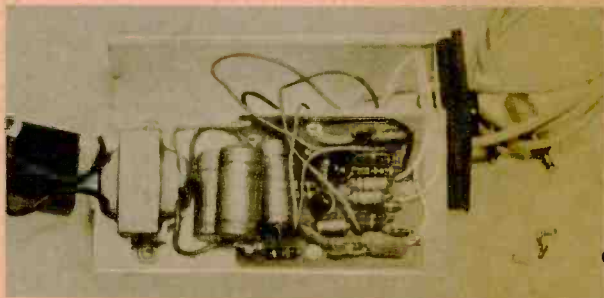
the near future. Distribution, though perhaps worldwide, is on the thin side, we would judge. If your audio store hasn't heard of the Miniconic, write to Euphonics for the name of a dealer.

Unlike a magnetic cartridge, in which the stylus moves a magnet located within a coil of wire (or vice versa), the CK-15-P's stylus flexes a small piece of silicon whose resistance changes in proportion to the applied force. Since a changing resistance does not generate an output voltage, a small DC bias current is fed through the silicon bar. The moving stylus causes the silicon's resistance, and consequently the DC current, to change. This change produces, via the amplifier, an output.

The power supply and the amplifier are in a small box. The amplifier plugs into either the auxiliary (high-level) or magnetic-phono (low-level) input on a stereo amplifier. A switch on the cartridge amplifier selects the proper output voltage and equalization.

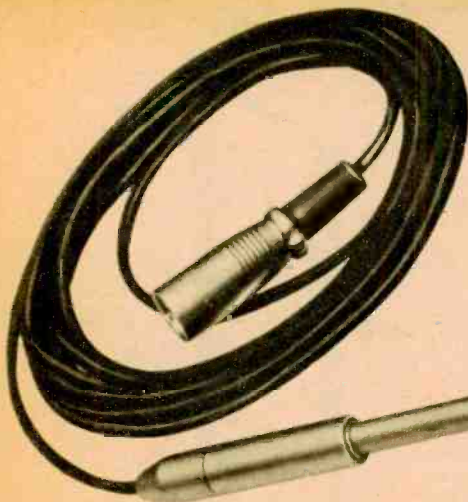
Because the cartridge is so light, a set of weights is supplied so it can be used in most tone arms. We say most because the cartridge has a rear connector which may crowd the tone arm's shell, and it won't fit in.

We made tests with a stylus pressure of 2 grams using a CBS lab test record. System (cartridge plus amplifier) frequency response was within ± 2.5 db from 25 to 20,000 cps—essentially identical to any other high-quality cartridge. Separation at 15 kc was 18db and 27db at 1 kc. The big difference, though, was in clarity, or definition of sound. The CK-15-P had spectacularly clean sound with no breakup at high frequencies. It was possible to distinguish every instrument in an orchestra. Noise level was extremely low, too. If you're looking for way-out performance, get a CK-15-P. If you can find one.



Power supply/amplifier provides power for variable-resistance (semiconductor) cartridge and amplifier/equalizer. It goes behind stereo amp.

The Amazing Gizmo Nobody Knows



Sony electret telescoping-wand mike. Model ECM-51, functions somewhat like condenser microphone but hasn't usual power supply.

By JORMA HYYPIA

... the electret, that is. A component from the 1920s that's here to stay.

THE ELECTRET! It's as old as an Atwater Kent radio and as new as tomorrow's telephone. It's a scientific freak that is suddenly blossoming into a glamorous electronic component.

An electret is a remarkably simple device capable of holding an *electrostatic* charge permanently—if you're willing to concede that a few hundred years is permanent in practical terms. Because it keeps this charge so long (as compared with other types of electrostatic charge carriers) an electret may be considered the electrostatic analogue of a permanent magnet. Beyond that, however, it's difficult to say exactly what an electret is because there is still no satisfactory atomic-level explanation of its unusual properties.

Ball of Wax. The first electret was made by a Japanese scientist, Eguchi, back in 1925. Eguchi sandwiched a slab of carnauba wax between two metal electrodes, then applied a high voltage while the wax was first heated and then cooled. When he removed the electrodes, Eguchi discovered that the wax had acquired an electrostatic charge far more stable than more common static charges which had been applied to the surfaces of different materials. Further research revealed that the wax had acquired a charge beneath its surface rather than on it.

The electret also proved to be an entirely new kind of electrostatic device because it exhibited an increase in its permanence of charge when the opposite sides of the electret material were electrically shorted. This

characteristic also has a magnetic analogue—any permanent magnet retains its strength longer during storage if its north and south poles are shorted together by means of an iron bar called a *keeper*.

Though practical applications were evident immediately, they couldn't be realized at first because Eguchi's wax electrets weren't permanent enough. Unfortunately, Eguchi did his pioneering work during the Celluloid age, before the advent of modern plastics. Had these more sophisticated materials been available, the electret might then have become commonplace.

After Eguchi discovered his wax version of the electret scientists started to hunt for other materials which might make more permanent devices. It developed that all materials having electret properties are dielectric (insulating) materials. However, not all dielectrics make electrets. For example,

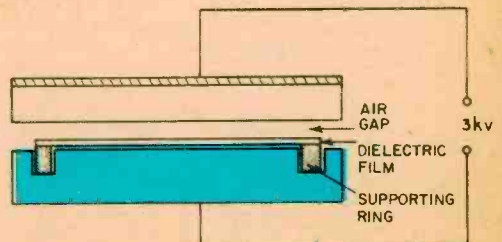


Fig. 1—Charging setup used at Northern Electric Labs in Ottawa to make electret telephone mikes.

The Amazing Gizmo Nobody Knows

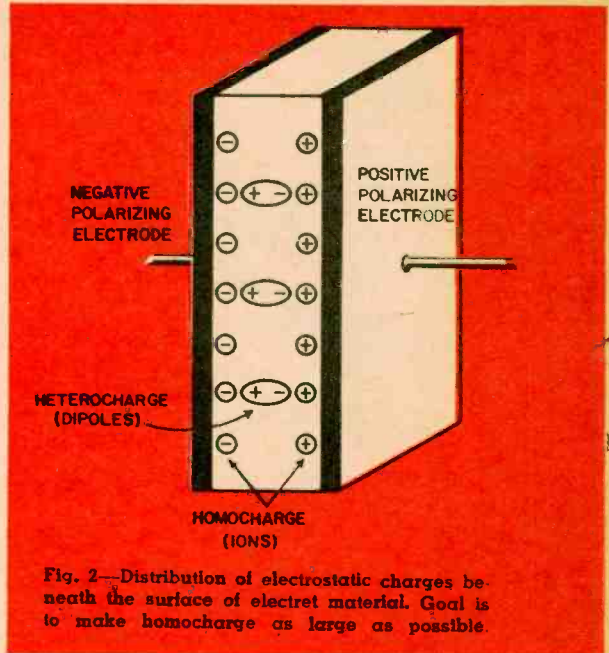
though vegetable waxes—including carnauba—produce electrets, mineral waxes such as paraffin don't work. Lacquers, shellac, sugar, ice and some plastics have electret properties. Glass is not an electret material, though some types of ceramics do exhibit the desired properties. In recent years, the search for electric materials has focused mainly on plastics. Useful substances include nylon, neoprene, Mylar, Teflon, methacrylates such as Lucite, vinylidene chloride and polycarbonate plastics.

Frozen Charges. Techniques for making electrets improved significantly during the half century when they remained laboratory curiosities. But the basic procedure remains the same: you apply a high voltage to the electret material while it is heated, then you cool the material in order to freeze the electrostatic charges within.

At the Northern Electric Laboratories in Ottawa a revolutionary electret telephone is being designed; the favored dielectric material is a polycarbonate film, 0.3 mil thick. The charging set-up used is shown in Fig. 1.

When the sandwich is heated to 120° Centigrade and a 3-kv potential is applied, the plastic film gradually acquires the electrostatic charge. The air gap provided by a slight roughness on the epoxy electrode surface is vital. As the voltage is applied, a charge builds up across this gap. When the breakdown point is reached the charge is automatically transferred to the plastic film. This charge transfer process is repeated until the film can't hold an additional potential.

Fig. 2 shows how these charges are distributed throughout the plastic film. Note that near one surface (but not on the sur-



face), a positive ionic charge is formed, while a negative ionic charge develops near the opposite surface. These charges are called *homocharges*. This term indicates that in each location the charges are of one kind only.

The space between homocharges is filled with dipoles (paired positive and negative charges). Because these are mixed charges, they are called *heterocharges*. The goal of the electret manufacturer is to make the homocharge as large as possible by a proper choice of the dielectric and by controlling the charge application.

Fig. 3 shows the resulting electret assembly as it's used in a modern electret microphone. Note that in a conventional condenser

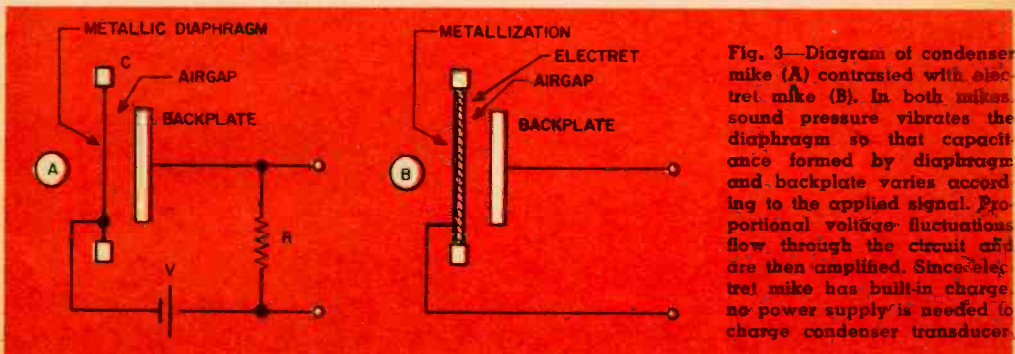
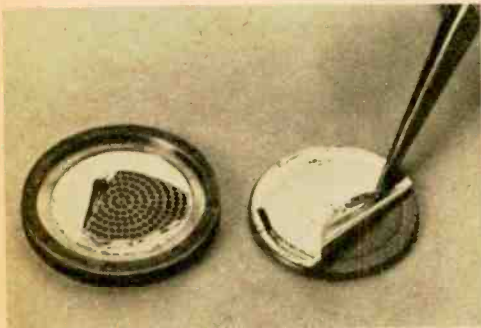


Fig. 3—Diagram of condenser mike (A) contrasted with electret mike (B). In both mikes, sound pressure vibrates the diaphragm so that capacitance formed by diaphragm and backplate varies according to the applied signal. Proportional voltage fluctuations flow through the circuit and are then amplified. Since electret mike has built-in charge, no power supply is needed to charge condenser transducer.

mike an electrostatic field is generated in the air gap between a metallic diaphragm and a fixed backplate. This requires the use of an external battery. No external voltage is needed to create an electrostatic field in an electret mike because the diaphragm has its own permanent electrostatic charge. Thus, the electret mike is simpler and ultimately will be cheaper to produce.

In both microphones, the conversion of sound waves to electrical impulses works the same way. When wave pressure vibrates

Northern Electric Co.



Prototype electret mikes developed at Northern Electric use either perforated (left) or sintered (right) backplates bonded to assembly during heating.

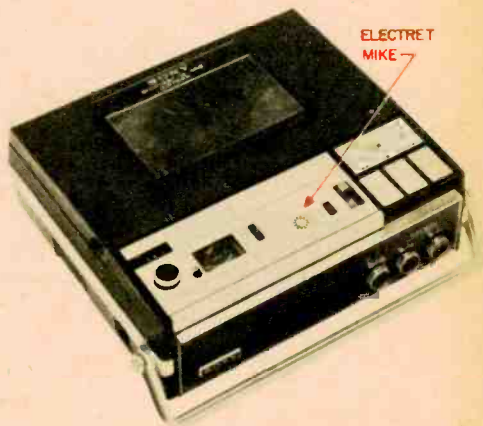
either type of diaphragm, the capacitance of the condenser formed by the diaphragm and backplate varies, thereby producing proportional voltage fluctuations in the circuit. Because the electret diaphragm is only 0.3 mil thick, the electret mike has a higher capacitance per unit area than the condenser model. In prototype electret mikes used in telephones, the film diaphragm touches the slightly roughened surface of the backplate, so the film is actually supported by the many raised points on the surface. The electret, therefore, is really a large number of very small condensers (transducers) connected in parallel.

Good and Getting Better. Electret mikes already stack up well against condenser models and some researchers predict that electrets will eventually eliminate all the disadvantages of conventional condenser models and do it at lower cost. Hum pickup, for instance, is virtually nonexistent in an electret mike.

Electrets are likely to become commonplace in telephones of the future because they offer better sound reproduction, the possibil-

ity of lowering line currents by as much as 90 per cent and a probable ten-fold weight reduction of hand sets. There is little noticeable difference in the sound quality achieved with electret and carbon mikes except that the electret version offers better intelligibility because of its low harmonic distortion. However, background noise of high intensity can be a problem with the electret mike and still remain a drawback.

In telephone applications, an electret transducer requires a semiconductor preamplifier to provide electrical matching between the high-impedance output of the electret film and the low-impedance input of the telephone line. This preamp/film combination helps in another way. The gain of the amplifier (20db) is independent of the length of the line to the central office. In contrast, the outputs of carbon transducers drop as much as 8db over long lines—a significant loss since the human ear can detect changes as small as 3 db.



Sony Model 800-B Servocontrol portable tape recorder features built-in electret mike with integrated-circuit (IC) amplifier—probably a first.

The first electret device to reach the consumer was probably a microphone installed as a built-in pick-up in Sony's Servocontrol 800-B portable tape recorder. This company also offers several other professional electret mikes (see photo on opening page) for use with recording equipment.

Though it's hard to predict just where electrets will pop up next, the list of potential applications could include Geiger counters, generators, electrometers, transducers to measure vibration, pressure and altitude, or electron-beam focusing devices.

Electronics At Sea



By
FOREST H. BELT

**A career in marine electronics may be just
the breath of fresh air you're looking for.**

THERE are eight million or so owners of pleasure boats in the U.S. Add to this figure the number of working vessels which are ocean-going and those that populate our lakes, rivers and harbors and you have a tidy bit of sea traffic. Just as with aircraft, boats must carry passengers and cargo safely to their destination. Be they large or small, most depend on some form of electronics to provide safe passage and to meet safety regulations which, as the Coast Guard will tell you, are about the most strict around.

The inland waterways alone (navigable rivers and intracoastal canals) carried about a half-billion tons of cargo in barge traffic last year. Over 100 million tons were moved on Great Lakes ships, not counting overseas cargoes. Several thousand river towboats and hundreds of lake ships ply our inland waters. Helping them find their way is a job that falls naturally to electronics. Sad fact is, however, that for all this traffic, there are few people around to service the equipment. For marine radars alone, there are scarcely two dozen expert repairmen in the whole country!

Besides radars, there also are radiotelephones, depth sounders, navigation systems (Decca, Omega), automatic pilots and compasses. All of this gear is electronic and needs trained experts when trouble develops. The manufacturers usually have service facilities and hire skilled technicians (often called field engineers). But, as we said, there are so few of these men that they are something of an elite.

Take Earl Walton, for example. Walt specializes in river electronics. He has a reputation as being one of the best on our river system.

He has watched marine electronic companies come and go. "About 15 years ago," he says, "Radiomarine (then an RCA subsidiary) was a big name on the rivers. Sperry-Piedmont was doing pretty well, too. Then for a few years, the rising star was Raytheon. Now it's Decca. Companies appear and disappear, but the same men wind up doing the servicing."

Walt got into electronics in high school. He spent most of World War II in the Sig-

nal Corps. That's where he learned communications and radar. After a few years teaching he joined Raytheon's Electronic Services Division in 1958. He lived along the Ohio River and he's worked there ever since. In 1962, Raytheon turned its marine servicing business over to Lorraine County Radio Co., a large sales and service firm that covers the Lakes and most rivers. Walt suddenly was getting his paycheck from another boss.

Another long-timer, Ray Wodjik, is at home with lake boats. He joined Raytheon right out of technical school in 1956 and within a couple of years was installing and troubleshooting complex radar installations. Ray was a casualty of the Raytheon-Lorraine County shift. But two years later Raytheon started getting back into the marine business through pleasure-craft sets. Ray then left his job with NASA to come back to the Lakes.

"That's the pattern," Ray said recently. "It gets into your blood. I get tired sometimes of the crazy hours and all the traveling. But really I like it. And," he adds, "the money's not so bad, either."

The business is almost a fraternity. Talk to a few of these fellows for a little while and you find they all know—or know of—each other.

Perhaps it's the equipment that attracts these men. Successful ones, almost to a man, say they enjoy working on the gear. It's complicated and usually a challenge to service. But they agree it's actually easier than other gear—television, for example. Marine equipment is built more dependably and laid out with servicing in mind. Test jacks and built-in meters help with much of the diag-

nosis. Easy access to components is the rule.

And the customers? Ship captains are kings in their castles—whether on an ocean liner or the tiniest tugboat. Yes, they're finicky, but they're also among the most reasonable customers you can find. They're intelligent and self-assured, and don't have to vent the day's irritations on the first outsider who shows up.

Marine technicians often recount being treated royally; even being invited to dinner at the captain's table, and so on. "The only catch is," says Earl Walton, "you'd better know what you're doing. They can spot a phony almost before he climbs up the ladder to the bridge."

Customers on yachts and small pleasure boats tend to be more of a problem. Like TV owners, they don't know much about the equipment and often expect too much from either the gear or the technician. But pleasure boats are a field that's wide open. The dealers and boat builders who sell electronic apparatus to pleasure-craft owners are looking desperately for technicians. They'll often pay better than a large company.

So the opportunities are there, it's just a matter of liking the water and not minding travel (up to 60,000 miles a year). You have to like rivers, lakes or oceans. Most of your days and nights will be spent on or near them. For pleasure cruisers, you'll go to a yacht club or marina for the service work, or do installation work in winter time when the boats are in drydock storage.

On the lakes you'll fire up the equipment in early spring, after the upper Great Lakes begin thawing. The ships are stored all winter at various shipyards. Through the shipping season, you'll meet ships requiring servicing at coal, ore, stone and oil docks. Or you may be called to service ocean vessels that have come down the St. Lawrence Seaway to grain elevators and other kinds of docks.

For commercial craft, you may get the call in the middle of the night. Or the boat may not dock until the wee small hours. On the river, the captain may not want to wait while you work—you may have to ride. You'll get off somewhere up- or down-river and take a taxi or bus back to your car.

A ship will usually dock only long enough to load or unload cargo. That may take from three hours to several days. If you're short a special part, you may have to hand the job off to the next service point. But you



Technician prepares to open radar indicator unit which houses the CRT, power supplies and video circuits. Many radar problems are mechanical.

Electronics At Sea

still must diagnose the fault accurately so the next man can have the right part with him. You have to be a fast, thorough troubleshooter.

Also, you'll have to do all the repairs on the job. There's no take it with you philosophy in the marine business. Imagine carrying a 600-lb. transmitter/receiver unit down a ship's ladder. Forget it—they wouldn't sail without it anyway.

Service calls usually come in bunches. No one can explain why. You may work many long hours one week and spend the next week sitting around in the sun (or watching snow). If you work for a company you are usually guaranteed pay for a 40-hour week. If you work nights or weekends and do a lot of it, you get overtime pay. During off-seasons, it's nice to have free time (downtime, the company calls it) and still get paid. But the long hours in the rush period make up for it.

Marine equipment has always been attractive. On the rivers, most radiotelephones are VHF nowadays. The old HF gear (operating in the 2 to 3 mc band) is about gone. Ships and boats that need long-distance communications use single-sideband HF equipment, operating in the 4 to 8 mc band.

The VHF equipment is narrowband FM, with a permitted deviation of ± 5 kc. Marine radio uses several channels just above 156 mc. RF output power can be as much as 50 watts, but range depends mostly on terrain. Boat-to-boat, for instance, with high-gain VHF antennas is about 15 miles; boat-to-shore can be 25 miles or so. On the lower rivers, lakes, or ocean, 50 and 75 miles is feasible.

In December 1970, some new FCC rules go into effect. RF power will be reduced to 25 watts, with only 1 watt permitted on some frequencies. All frequencies will have to be held to 0.0005 per cent tolerance, so all remaining wideband FM sets (± 15 -kc deviation) will be obsolete. Several new channels will be activated to relieve congestion on others. All this means lots of work for marine radio technicians.

By sometime in 1971, AM radios for marine HF bands won't be licensed anymore. Everything from then on will be SSB. Only the upper sideband is used now, thus filling

about 3 kc of spectrum above the channel frequency. Power of SSB transmitters runs to 150 watts PEP (peak envelope power) input. For effective range, that's as good as running almost 500 watts into an old AM transmitter.

Several companies make radiotelephones. One brand that has become popular for marine VHF use is General Electric. This multichannel unit is sold or leased (and serviced) by Lorraine County Radio. Another name often encountered is R. F. Communications Co., of New Jersey. And some marine people say a Japanese brand, Standard, is a good low-output, medium-priced set.

River radars, for both commercial and pleasure craft, operate in the X band (9.4 gc). They're often called 3-cm radars, because of their wavelength. On Lake and ocean vessels, S-band radars are also popular. They operate at 3.4 gc (9 cm). Pulse lengths are longer for extra range and beam widths are not as narrow as at X band.

Brands of river radars until recently were Radiomarine, Sperry, Raytheon, Decca and Bendix. Last year, more than two-thirds of the radars installed on river towboats were Decca; their model 219 is a hot one. On the

Transmitter-receiver unit for 3-cm radar made by Decca Radar, a British firm. Note small waveguide coming from top. Decca is one of leading suppliers.





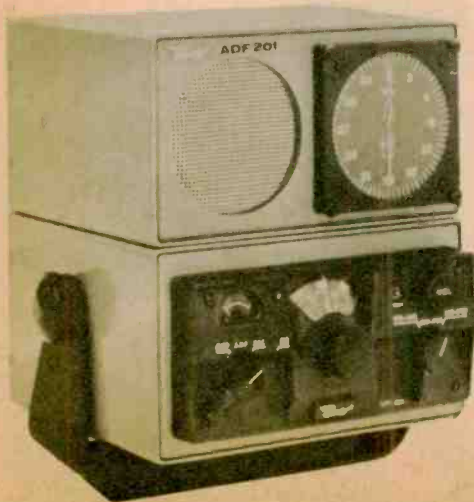
Raytheon Model 1500 radar along with a Fathometer Depth Sounder are especially useful for commercial fishermen who have to spot fish.

oceans, both Bendix and Decca are well known.

If you get into marine electronics you'll be asked to service a lot of different kinds of equipment. Depth sounders are one example. They are miniature radars that send out ultrasonic pulses into the water and measure depth on the basis of how long each pulse takes to return to its source.

To aid navigation, automatic direction finders (ADF) give a bearing on coastal broadcast or beacon stations. Loran is a navigation system for ocean ships that shows

Model ADF-201 automatic direction finder (ADF) made by Bendix. It's also called a radio direction finder (RDF) and is least expensive navigation aid.



position by using co-ordinates broadcast by shore stations. The Decca Navigator is another, newer system using shore stations which cover the busiest coastal waters of several countries. It won't be long until commercial ships are equipped with Omega receivers to make use of the pinpoint accuracy of satellite navigation.

Electronic compasses are common. And automatic pilots and steering mechanisms take much of the burden off the helmsman on the Lakes, oceans and wide stretches of the lower Mississippi. Even many small cabin cruisers have autopilots.

The next couple of years will see the introduction of more electronics for ships. Inertial navigation is one probable addition to Lake and ocean-going ships. Computers are going to work on ships, too. A couple of large river towboats being built right now will be equipped with a new telemetering/computerized engineroom monitoring system. The Decca ISIS-300 employs a printout so simplified it will literally type out a diagnosis of impending trouble.

Something else new to inland waterways is the radioteletype. A few boats already are
[Continued on page 113]

New FCC requirements are met by Raytheon's Ray-42 VHF-FM radiotelephone. Maximum output is 25 watts; narrow bandwidth is included.

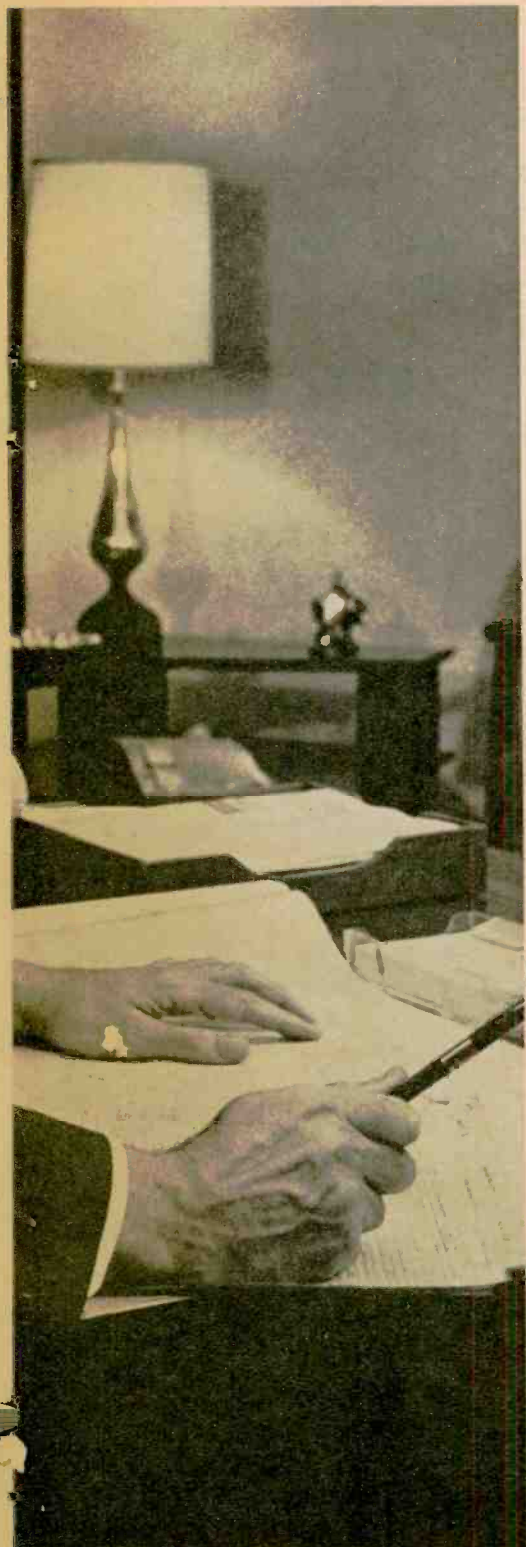


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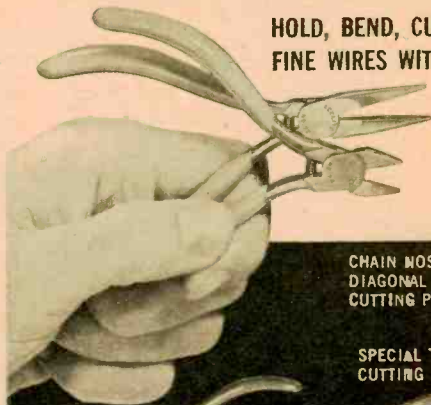
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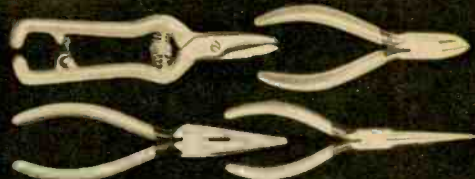
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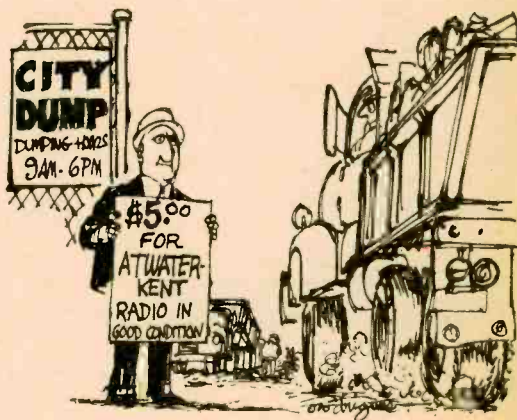
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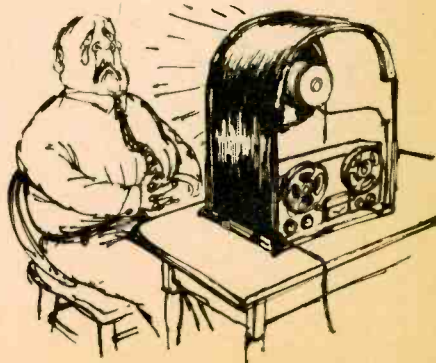
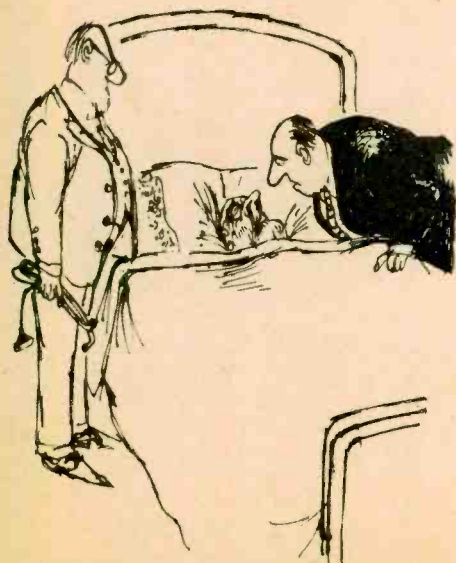
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Electronics at Sea

Continued from page 103

trying it out. They receive barge traffic orders typed out automatically which are transmitted from a shore station on a special communications channel. If this works well, more advanced machines will be developed to start a new era of river communications.

While the field holds a lot of promise for the right men, there are some preparations to make. Thorough electronics training is probably the most important first step. This means several years of hard work—particularly in communications. The next step is to get your FCC Radio-Telephone Operator License (Second or First Class) with a Radar Endorsement.

If you're a crackerjack in electronics school, the third step might be right into a job in the marine business. If you're average, though, you'll probably spend at least a couple of years getting experience repairing radio, TV, two-way land-mobile units, or similar equipment. Ham radio is also a helpful background for marine electronics.

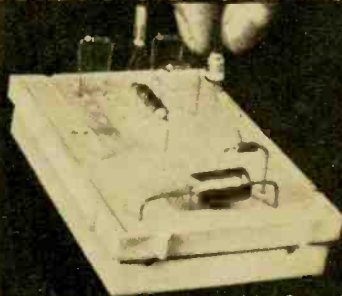
A background in military electronics, particularly in communications, radar and navigating aids, might provide the easiest entry into the marine field of all.

You can earn a pretty good salary. Field engineers for top companies earn from \$9,000 to \$14,000. The best old-timers earn more (what few there are). You'll have a car mileage and expense allowance, usually generous. You can count on anywhere from 20,000 to 60,000 mi. per year.

If you go in business for yourself, you should be able to do even better. However, you should have a knack for selling your services—and of collecting on them. You'll have to be a better businessman than usual, but the rewards are worth the extra study and business training.

You can work your way into sales, too, if you really understand the business and the customers. A radiotelephone can sell for two or three thousand dollars. Small radars for pleasure cruisers sell for \$2,600, and a larger one for a commercial ship costs \$15,000. There are juicy commissions to be had, but you have to be knowledgeable about the equipment and service problems. More than for any other reason, radars and other marine equipment are sold because good maintenance is available

THROW AWAY THE SOLDER OR MY DADDY USES CUSS WORDS



Some years ago two men, Mr. S. and Mr. deC had an idea. Wearing white hats they dutifully offered it to the giant electronics conglomerate under whose roof they laboured. He sneered so they left and developed it on their own.

It's a solderless breadboard and the secret lies in a precision clip of firm grasp and low resistance. These clips are leafspring contacts of phosphor bronze or silverplate.



As with all good things customers came up with more ideas in using S-DeCs than the originators believed possible and the demand for added flexibility resulted in a box with two interlocking S-DeCs known as DeCSTOR, (pronounced DeCk-Store). Not content with this, users circuits outgrew the DeCSTOR and so a 4-DeC kit was created for the man with ideas bigger than his breadboard. Today there is a whole range of DeC solderless breadboards covering conventional and integrated circuit requirements.

So, if you need to throw away the solder, keep the skin on your fingers and the black words buried down below write to us for more information, or better still send us a check.

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How To Tune A CB Antenna

Continued from page 91

one or more of the fixed verticals determines the radiation pattern (or directivity).

Since you are not likely to change the mounting arrangement of the verticals, your tuning will be limited to adjusting the length of each radiator (if this is possible) and modifying the length of the transmission lines to obtain the desired shift in the radiation pattern. If the length of each vertical can be individually adjusted (and the manufacturer says it can be done with your specific antenna) feed each vertical separately and adjust either length or the tuning coil for the lowest SWR indication. When making the SWR test, all transmission lines other than the one going to the radiator being adjusted should be disconnected or switched out of the circuit.

Next, connect all the antenna elements to the selector switch, and using a receiver equipped with an S-meter (or a sensitive field-strength meter positioned far from the array) check the different radiation patterns. If they are off-angle—say a switch position that should change the direction 90° doesn't come near this—make up a few lengths of transmission line (about 2, 4 and 6 ft.) and add them to the vertical antenna feeders. Note the change in radiation pattern they produce and then splice in exactly the sections you need. But keep your eye on the SWR meter feeding the entire antenna system; if it starts to climb above the rated SWR, stop where you are.

Mobile Antennas. Unless it's mounted directly in the center of the roof—and a metal roof at that—the mobile antenna is at best a compromise. You can't do much with the ordinary 108-in. steel whip other than use a transmission line that's an exact half wavelength long. This enables the transmitter to see a resistive load at the input to the transmission line so it can deliver maximum output. But the line-to-antenna losses remain.

Loaded antennas are very critical with regard to tuning and can be improved considerably. Connect an SWR meter between the line and your transceiver and then adjust the length of the steel antenna above the loading coil for a minimum SWR reading. Note that with center-loaded antennas the adjustment may be within ¼ in.; with base-loaded antennas, perhaps ½ in. Adjusting

the length of the antenna below the loading coil will have little or no effect.

Even if the manufacturer has made no provision for tuning a loaded antenna, the top section usually is held in place with a set screw and the adjustment is made by loosening the screw. Some mobile antennas have a built-in loading coil adjustment, but if this setting isn't tight it will loosen as you drive. If necessary, it can be locked tight with a dab of GE's RTV silicon rubber adhesive.—Herb Friedman, KBI9457

Color TV Receiver

Continued from page 95

this noise barrier. You must get up to change channels.

The 213-page construction manual had no errors, though there was an addenda sheet with a few corrections. It contains color reproductions of TV pictures which are a great aid when making adjustments and troubleshooting. Sections on troubleshooting and color-TV theory are included. The wireless remote control book has 92 pages.

That's the story. It wasn't a bad job after all and our total time for the set (with three convergences and the wireless remote control) was 38 hours. Nothing's tight, tricky or beyond understanding. It's worth every minute of your time and, as we said, the picture is outasight!

Ham Shack

Continued from page 38

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CIRCLE NUMBER 19 ON PAGE 15

The Listener

Continued from page 77

The '70's. The portable broadcasting stations of the Soviet Union (which were demonstrated during the invasion of Czechoslovakia in August 1968 and possibly after the Tashkent earthquake in 1966), may not be as advanced as American hardware, but we can expect that the Russians will make a concerted effort to catch up.

We can also expect that other world powers will soon become competitive in the struggle to control opinion. The media race is about to explode, but in the area of BCB and SW portables it is unlikely that equipment more sophisticated than the Gates AN/TRQ-20 system will come along. Instead, the new tactics of the '70s will demand high-powered, portable TV stations—especially as the role of visual information takes on importance in underdeveloped nations.

The basic problem with portable TV sta-

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tions is the need for greater antenna heights. Airborne projects such as the famed Blue Eagle are one answer. Others will be forthcoming.

Portable SW studio-transmitter links (such as the Gates AN/TRC-95) will almost certainly be replaced by communications satellites. Order of the day then will be portable satellite tracking facilities such as the one flown to Caracas for the broadcasts of Apollo XI to Venezuela and Columbia.

These developments indicate that the struggle for control of communications media will quickly take on global proportions

The Strange Story of Granny Goose

Continued from page 63

York. He had spoken there previously on February 22. He announced that the State Department had warned him that he faced arrest and a fine if he tried to use his passport or leave the country. He was explaining his operation to reporters when two burly bruisers approached the gathering. Ramsey muttered something about government investigators and then disappeared up a flight of stairs. Somehow he managed to leave the United States—his present whereabouts is unknown.

What sort of man created Radio Liberation? Unfortunately, much of the biographical information about Ronald Ramsey is supplied by Ramsey himself. He was born in Compton, Calif., a suburb of Los Angeles, in 1939, apparently of middle-class parents. In 1953, while a student at Enterprise Junior High School, he was dismissed from school for making speeches on behalf of convicted atomic spies Ethel and Julius Rosenberg. At this time, he was being raised by a grandmother. There is no evidence that he ever returned to school.

Two years later, he was publishing *The Nationalist Summary* for a group called Americans for America. Articles in the paper asserted that Eleanor Roosevelt and Bernard Baruch were acting together as part of a Red plot. The paper editorialized against involvement in the Korean War, and was characterized by the Anti-Defamation League of B'nai B'rith as antisemitic. The paper supported the actions of the White Citizens' Councils opposing integration in the South.

[Continued on page 118]

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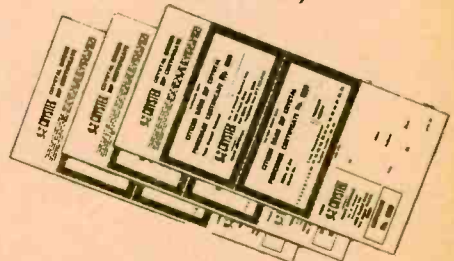
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The Strange Story of Granny Goose

Continued from page 117

A few years later, according to Ramsey, he was arrested in the South for taking part in a civil rights march. In any event, when the 1960 presidential campaign rolled around, Ramsey, a registered Republican, was hard at work in the Nixon campaign. The following year he went into the Army and was discharged toward the end of 1962 when he became, as he later called it, a non-student at the University of California's Berkeley campus.

Evidently the student life didn't agree with him. The spring of 1964 found him in Kenya where, it has been charged, he made anti-American broadcasts for Jomo Kenyatta's black supremacist government. However, life in Kenya apparently didn't agree with Granny Goose. On June 10 he borrowed \$1,000 from the American embassy to go home. If the State Department thought it had heard the last of him, it was wrong.

The American Embassy in Algiers learned on February 15, 1965 that the Algerian police were holding an American psychologist on unspecified charges in the prison ward of the Mustapha Hospital. The Embassy sent a representative to visit the psychologist, who proved to be Ramsey—he had a fantastic tale to tell.

He said he had been invited to Algeria by strongman Ahmed Ben Bella for the purpose of broadcasting propaganda. It was in Algiers, he later implied, that he learned the rudiments of radio broadcasting, including tape recording, program production and tape editing. Without warning, on the night of December 29, he continued, the Algerians had arrested him on an unspecified charge and had tortured him, damaging a kidney. Hospital authorities thoughtfully arranged a press conference so he could tell his story to American and European reporters. Nevertheless, the hospital refused to release him. On April 14, the hospital arranged a second press conference at which Ramsey alleged that he was being tortured with electric shock treatments. A spokesman for the American embassy termed the statement reliable.

On May 5, the Algerians apparently had had enough of him and released him to the embassy, provided he agree to leave the country immediately and not come back. Ramsey was broke and borrowed another \$1,000

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from the State Department to get home. As soon as he was gone, the Algerians admitted they had picked him up because his activities were suspicious. They clearly believed he might be working for the CIA.

Between May and October of 1965, Ramsey said later, he had time to demonstrate in Washington against the Vietnam war and was finally arrested. Then came the Granny Goose idea. "I was staring into space one day trying to think how I could do something about the war, when this potato chip truck goes by," he told reporters. "I see the name on it and it starts me thinking. A number of us opposed the war in Vietnam, but we hadn't done anything about it. I had a tape recorder, and I had contacts in Canada and Europe. Why not make tapes which would urge the troops to go home? Obviously, our government wouldn't use them. But the Viet Cong might. That's how it started."

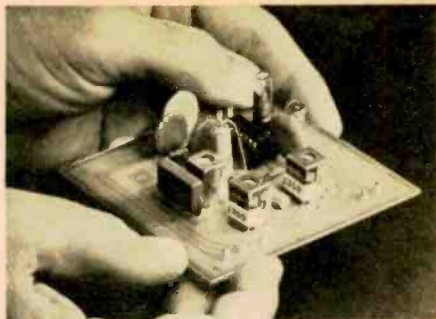
As you know, the name on the potato chip truck was Granny Goose. Granny's picture appears on the first page of this story. 🍌

The ABCs of Color Television Servicing

Answers to Examination on Part III:

Continued from page 88

1. The correct sequence for a color setup is: c), g), d), f), a), h), e) and b).
2. Setting the horizontal and high-voltage adjustments too high may cause soft X-radiation. A setting which is too low or too high also affects the setup of the controls.
3. b). The entire screen is reddish or greenish at low brightness.
4. b). You converge only the center dot of a dot pattern.
5. False. After you complete convergence, it is wise to check purity again. 🍌



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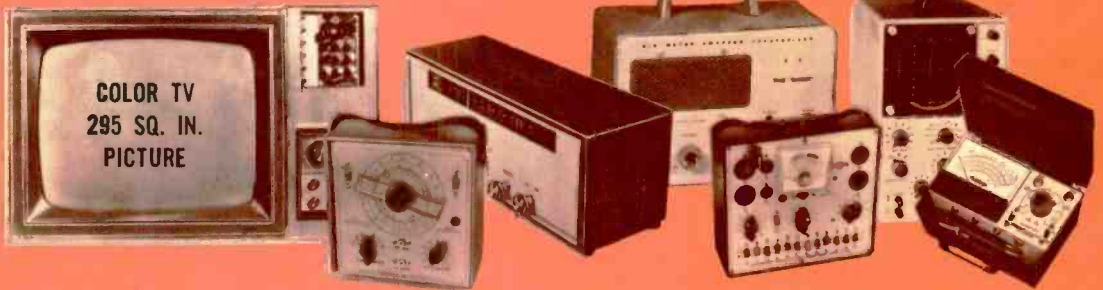
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