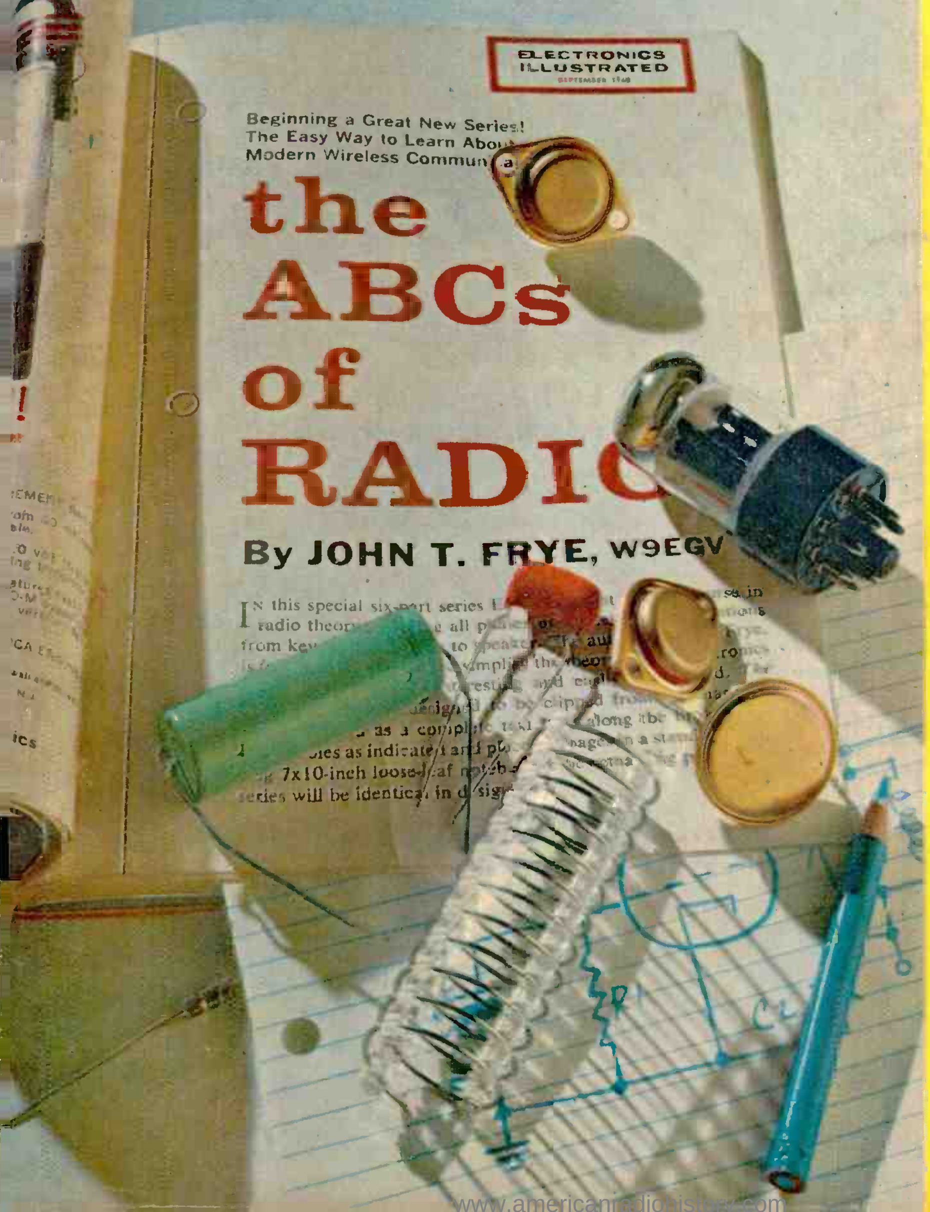
COMPLETE HANDBOOK OF AUTO ELECTRONICS

ELECTRONICS ILLUSTRATED

By the Publishers of MECHANIX ILLUSTRATED

SEPTEMBER • 35¢



Learn Radio Theory the Easy Way from a Famous Expert!

the ABCs of RADIO

By John T. Frye

Survival Course for CBers

How to DX Ships

A Reasonable Guide to Medium-Fi

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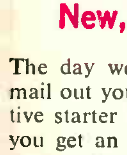
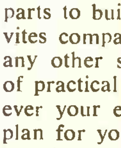
Learning Becomes an Absorbing Adventure with NRI Training Kits

Electronics comes alive with NRI training kits. What better way to learn than by *doing?* NRI pioneered and perfected the "home lab" technique of training at home in spare time. You get your hands on actual parts to build, experiment, explore, discover. NRI invites comparison with training equipment offered by any other school. Begin *now* this exciting program of practical learning. Whatever your need . . . whatever your education . . . there's an NRI instruction plan for you, at low tuition rates. Get all the facts. Fill in and mail the postage-free card today. NATIONAL RADIO INSTITUTE, Electronics Division, Washington, D. C. 20016

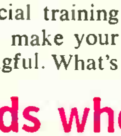
Join the thousands who gained success with NRI



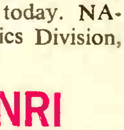
"I average $150.-$170. a month in spare time fixing radio and TV sets, and plan to start my own full-time business. I wish it were possible to tell every man of the wonderful opportunities." WILLIAM L. KING, Yoakum, Texas.



"I am a Frequency Coordinator for the 11th Naval District. The course I completed was priceless in my work. I was a blue collar worker, now I am a white collar worker." JOHN J. JENKINS, San Diego, Calif.



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



"I am a Senior Engineering Aid at Litton Systems, in charge of checkout of magnetic recording devices for our computers. Without the help of NRI I would still be working in a factory." DAVID F. CONRAD, Reseda, Calif.

Pick your field of ELECTRONICS

NOW NRI OFFERS YOU 10 WAYS TO TRAIN AT HOME IN SPARE TIME

Any training—if it is to be worth your time and money — must give you the knowledge and the skills you seek, the knowledge and the skills employers want. That's why NRI puts emphasis on providing a *choice* of carefully developed training plans in Electronics. NRI now offers you 10 ways to train at home . . . 10 ways to meet the challenge of today's job market by training with NRI for a career in Electronics, for part-time earnings, or simply for developing a new, fascinating hobby. The proof of the quality of NRI training plans is in its record of tens of thousands of successful graduates and the reputation NRI holds throughout the Electronics industry. Move ahead now in this exciting, growing field. Select the training plans of most interest to you and mail the postage-free card today. NATIONAL RADIO INSTITUTE, Electronics Division, Washington, D. C. 20016.

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A concise course to teach modern Electronic terminology and components. A wealth of practical, useful information to help you better understand the field, give you some technical knowledge. For anyone who wants a basic understanding of Radio-TV Electronics.

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Not for beginners, but for men with some fundamental knowledge of Electronics who want an understanding of Automation in present use. Covers process control, ultrasonics, telemetering and remote control, electromechanical measurements, other subjects.

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*NOTE: You must pass your FCC Licence exams (any Communications course) or NRI refunds in full the tuition you have paid.

Our 50th Year of Leadership in Electronics Training

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ELECTRONICS ILLUSTRATED

SEPTEMBER, 1965 A Fawcett Publication Vol. 8, No. 5

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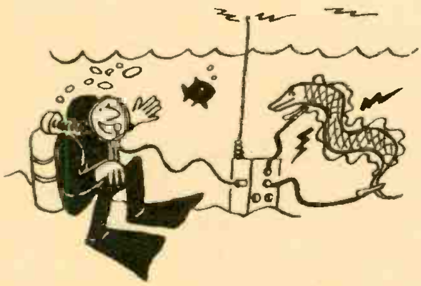
FEEDBACK from our readers

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

● FORGOTTEN



I bought your mag because it said how to hook anything to anything (July '65 EI). Well, it didn't tell me what I wanted to know. I am a scuba diver and happen to know an eel. The eel undoubtedly is electric and presumably could be put to use down below. Only you didn't say how to hook anything to an electric eel.

M. Silvers
New York, N.Y.

You're a scream, M.

● BONUS

Recently I purchased a short-wave receiver with an S-meter. The meter is numbered from 1-30 but the low end is printed in S-units and around 30 it's printed in db. Does my meter read S-units or decibels?

Peter Guldberg
Ann Arbor, Mich.

Both: S-units to 9, db over 9 to +30. An S-unit, by the way, is equal to 6db.

● DOUBLE OOPS

I was reading your story about how the public doesn't care about radios (RADIO'S IMPOSSIBLE IMPASSE, July '65 EI) and I saw a word that said rmaines. Can't you people spell?

J. Swackhamer
Toronto, Ont.

Spel what?

● METERLESS

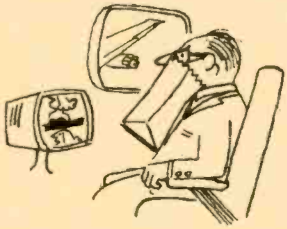
You said we shouldn't blame Detroit if our car doesn't deliver the mileage we think it should (MILES-PER-GALLON INDICATOR/TACHOMETER, July '65 EI). Well why shouldn't we blame Detroit? With all the extras they gouge you for on cars these days they could put in an MPG indicator and then at least you'd know the difference. Or is Detroit afraid somebody will find out what kind of gasoline cannibals they're making?

Joe Wimblacker
Chicago, Ill.

Cannibals?

● PLAGUED

In my line of work I have occasion to fly from New York to California and back on the average of twice a week. Considering air turbulence and what not, I normally do well at keeping my wits about me, or at least I



used to. But now that I seem destined to be plagued with The Vast Wasteland even in the air (COFFEE, MILK OR TV? July '65 EI), I can only say that I'm afraid I'm going to be very sick.

H. C. Orville
Bronx, N.Y.

Take a bus.

● IGNITED

I have read with interest your article on transistorized ignitions (A PRACTICAL

[Continued on page 8]

Announcing World-Famous NATIONAL RADIO INSTITUTE'S

Completely New Training-at-Home

for the man who wants to SAVE MONEY and MAKE MONEY
— spare time or full time — cashing in on the demand for men who know how to

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FOR 50 years, NRI has been successfully training men like you to become top-notch Technicians. Now NRI training is bigger and better than ever — YOU gain bigger and better profits from it!

NRI's *new*, completely revised and *expanded* home-training course offers you EVERYTHING YOU NEED TO KNOW—whether you want to fix your own appliances to *save* money, or *make* money.

Easier Than You Think!

You DON'T need technical experience. You DON'T need higher education. Everything is *explained* in plain English — *shown* in big, detailed, clear pictures. You start from scratch — learn how electricity works — then rapidly advance to installing new outlets, rewiring, fixing and servicing every kind of home, farm and business appliance.

NRI's special new section on modern air conditioning and refrigeration gives you complete know-how in this fast-growing field. Other sections are invaluable for men who work on farms, or in stores or plants. No matter what you're called on to fix, in no time you'll be making repairs like a pro. And — you now get special bonus lessons on 2- and 4-cycle gasoline engines!

Make Extra Money

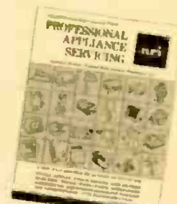
More than a MILLION appliances and engine-powered tools are sold *each week!* Once you can fix them, you'll "cash in" on this boom. It's a fact: NRI-trained men earn $3.00 to $5.00 an hour *in spare time alone!*

Don't worry how little you may *now* know about repair work. Former student John D. Pettis, who works out of his basement, says: "I had practically no knowledge of any kind of repair work. Now I am busy almost all my spare time and my day off — and have more and more repair work coming in all along."

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

MAIL COUPON TODAY

Wouldn't you like *right now* to be able to repair your own broken appliances? Wouldn't you like *right now* to have money coming in each week? Let NRI show you how. Free Book and Free Sample Lesson describe the new, expanded, low-cost NRI Course in full . . . show how you can quickly master repairing appliances in your spare time. Mail coupon TODAY (or write direct to) *National Radio Institute, Dept. 504-095 Washington, D.C. 20016.* (No obligation, of course — and no salesman will call on you.)



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will open your eyes to a whole world of new opportunities for making money, saving money, through time-tested, low-cost NRI training.

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FEEDBACK

Continued from page 6

TRANSISTOR IGNITION, May '65 EI) but alas for my vehicle the cost would be prohibitive. My vehicle is a DKW Auto Union which features a three-cylinder, two-cycle engine. To overcome any need for gearing, such as a rotor in a distributor, the manufacturers provide three sets of points with a common can leading to three separate coils and plugs. As the rpm of two-cycle engines is normally high and the fouling of plugs not unusual, transistor ignitions seem practical but not at the cost of three sets. Apart from getting a more conventional car have you any ideas?

N.R.
Greenwood, N.S.

Yes. Sell it.

BEAUTEOUS

I got hold of my hubby's copy of your magazine and jumped for joy at the thought of a radio hat (RADIO'S IMPOSSIBLE IMPASSE, July '65 EI). All it needs is a speaker on the top and we women will have found a new thing. We're always looking for something to make us more beautiful, you know. Just think, we could have a different color radio and speaker for every outfit we wear.

Mrs. J. Kensington
Miami, Fla.

We're thinking.

MEOW!

Hey, EI. My wife had me build her an electric doorbell for her cat.

Pete Wilkins
Los Angeles, Calif.

That's what she told YOU it was for.

Pursuing The Pirates

BRITAIN got its first commercial AM station and DXers a chance to pick up a pirate when a shipboard broadcaster opened up just far enough off the English coast to place it beyond the reach of British law. Called Radio Caroline, the station and its sister, R. Atlanta, were introduced to EI readers nearly a year ago (BRITAIN'S FLOATING FREEBOOTER, Nov. '64 EI). But this peculiar pair were only the beginning.

Early last winter, while the Dutch were thinking of squelching the world's only pirate TV station, R. Atlanta amalgamated with R. Caroline and changed its name to R. Caroline South. Programs were carried on 1495 kc from a point near Frint-on-the-Sea in international waters off the coast of southeast England (No. 1 on our map). The old R. Caroline became R. Caroline North, operating on 1520 kc off the Isle of Man (No. 2 on our map).

Four shipboard pirate stations currently bombard the British with U.S.-style AM radio programming. Stations are 1) R. Caroline South, 2) R. Caroline North, 3) R. London and 4) R. Invicta.

Shortly after, R. Sutch (the present R. London) came aboard on 1523 kc. Located off the Isle of Sheppey near the Kentish coast (No. 3 on our map), the station reputedly

[*Continued on page* 117]

IF THE RCA MARK VIII C-B TRANSCEIVER IS SO GREAT AT 114^{95}*...

- 9 crystal-controlled transmit and receive channels
- Tunable receiver for reception of 23 C-B channels; dial marked in both channel numbers and frequency
- Exceptionally good voice reproduction
- Highly selective superheterodyne receiver with one rf and two if amplifier stages
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- Illuminated "working channel" feature
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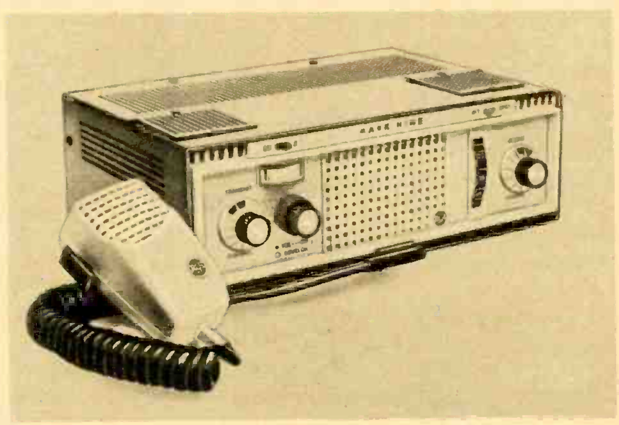
...HOW COME THE NEW MARK NINE IS WORTH 20^{00}* MORE?

It has all the Mark VIII features— PLUS these additional features...

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

*Optional distributor resale price.



GET THE FACTS. Write for free descriptive folder on either the Mark VIII or Mark Nine to: Commercial Engineering, Department H134R, RCA Electronic Components and Devices, Harrison, N. J.

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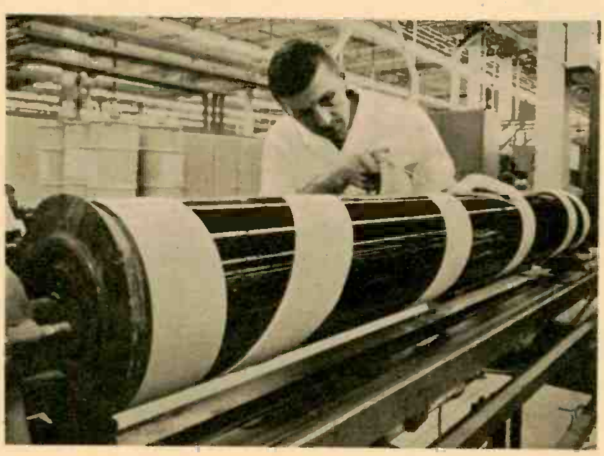
PORTHOLE PEEPERS . . . Testing a piece of gear that's intended to work in the void of outer space is enough to set any technician to head-scratching. Reason is there's nowhere on earth a body can find that kind emptiness. Closest thing to outer space we earthlings have come up with is a little something called a vacuum chamber. Our photo shows an ion engine being readied for testing in such a chamber at Hughes Aircraft. Personnel peeping into the chamber keep close tabs on the space propulsion plant, which can be seen in front of the bottom right porthole.

...electronics in the news

Great Gauss! . . . Standard way to show magnetic lines of force calls for a bar magnet and a spoonful of iron filings. But GE's Dr. Carl Rosner (the man in our photo) goes in for a bigger show. His equipment includes a keg of nails and a superconducting magnet developing a record-breaking 132,000 gauss.



Power Sponges . . . The trend toward gnat-size components well may have backfired with the resistors Corning Glass is supplying to NASA. Satellite tracking stations use the 4-ft. resistors as dummy loads and as part of rhombic antenna systems to soak up as much as 40 kw of RF power. Made of tin-oxide film fused into 5-in. Pyrex glass cylinders, the jumbo power dissipators accept full-rated input even with temperatures as low as −40°F. The technician in our photo is spiraling the resistive elements on the Pyrex form.

ELECTRONIC SWAP SHOP

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

RECEIVER, 1-tube regenerative with plug-in coils. Make swap offer. M. Behlen, 4744 N. Temperance, Clovis, Calif. 93612.

SIMPSON 1000 tube checker. Want tape recorder. W.H. Simpson, Box 376, Armstrong, B.C.

KNIGHT Space Spanner receiver, other items. Want Novice equipment. James Marcum, 315 Bryant St., Glasgow, Ky. 42141.

METERS, transistors, diodes, tubes, other parts. Want watch-fobs, medals, etc. John Hayes, Doe Run, Mo. 63637.

HALLICRAFTERS SX-62 receiver. Make swap offer. Joe Kittrell, 1015 Lewisohn St., Butte, Mont. 59701.

CROSLEY receiver, miscellaneous tubes, Vibroplex lightning bug. Will trade for LW or VHF receiver. Bill Patrick, Box 23, Booneville, Ky. 41314.

DISC recording deck. Want CB or hi-fi equipment. Jack Stollman, 259-12 149th Ave., Rosedale, N.Y. 11422.

GONSET 10-meter converter and Motorola transmitter. Make swap offer. Jim Sapp, 14 21 St., Apt. 2, St. Petersburg, Fla.

HEATH SB-10 and oscilloscope. Will swap for two 6- or 2-meter transceivers. Dan Turkisher, 6 Pin Oak Lane, White Plains, N.Y. 10606.

STEPPING and reed relays plus telephone keys. Want tape recorder. Ernie Shuldhiess, Rte. 1, Box 97AA, Chaska, Minn. 55318.

GLOBE Scout 680 transmitter, NC-109 receiver, Knight VFO, other items. Want Communicator III or Clegg 99'er. Howard H. Halperin, K9YNB, 9712 S. Merrion Ave., Chicago, Ill. 60617.

PERCO FM tuner. Will trade for transistor tape recorder, AM/FM radio or walkie-talkies. Frank E. Kavenik, Rte. 1, Box 82, Mundelein, Ill. 60060.

LAFAYETTE KT-135 receiver. Want 20-40 meter converter or semi-automatic key. Charles Freedland, VE2BPU, 621 Bloomfield Ave., Montreal 8, Que.

CITIFONE CB transceiver. Will swap for LF direction finder. Wray J. Sheen, 3501 Lee St., Waukegan, Ill. 60085.

TS-182/up NAVY oscilloscope. Need 2-meter receiver. Peri Cosseboom, 1673 Sacramento St., San Francisco, Calif. 94109.

JOHNSON Viking II transmitter. Will swap for 6-meter transmitter or transceiver. Robert L. Gilmore, WA9HSO, 1111 N. McKinley Ave., Rensselaer, Ind. 47978.

WESTERN ELECTRIC ME-9E/U multimeter, two 500V regulated power supplies. Want 6- or 20-meter transceiver. Duane O. Mason, WA4AEU, Box 115, Irmo, S.C. 29063.

TESLA-COIL power transformer. Will swap for pair of walkie-talkies. Steve Hansen, 2404 Gale Ave., Long Beach, Calif.

DONGENE AM/FM tuner. Want tape recorder. Gary Barbee, 3640 Larchmont, Toledo, Ohio.

ATWATER-KENT model-L chassis. Want VTVM. Jim Morrison, 456 Court St., Lachute, Que.

ZENITH Transoceanic receiver and Ithica pump shotgun. Want stereo equipment. Clayton F. Foster, 9 Beech St., Gardiner, Me. 04345.

MOBILE ham transmitter and receiver, accessories. Make swap offer. William Plante, 45 Mayo St., Portland, Me.

COLLINS ART13 transmitter and power supply. Need 8-mm projector and crystal calibrator. Dale W. Stewart, 218 W. 8th St., Elmira Heights, N.Y. 14901.

HOMEBREW six-transistor metal detector, old tubes. Will swap for ham test equipment and 2-meter transmitter. Bob Campbell, 12408 E. 43rd St., Independence, Mo. 64050.

GE, Motorola, Philco and Silvertone receivers, other items. Will trade for CB transceiver and base antenna. Lou Doucet, 4 Gordon Pl., Woodsville, N.H. 03785.

OVER 1,000 tubes dating from 1935 to 1955. Will exchange for 1920-vintage broadcast receivers. D.H. Opperman, 67 Miller Ave., Lemoyne, Pa. 17043.

OBSOLETE tubes. Want two type 10 tubes. Michael J. Klecha Jr., 152 Lawrence Dr., Paramus, N.J. 07652.

KNIGHT RF sweep generator and Polaroid 800 wink light. Want stereo amplifier or tape recorder. Richard Humes, 1211 W. Craig, Alice, Tex. 78332.

HEATH HG-10 VFO. Make swap offer. Ron Evans, 1816 Kenwood, Jonesboro, Ark. 72401.

KNIGHT Span Master shortwave receiver. Want AM/FM/SW portable. Rolf Gunnar, 223 Blooming Bank Rd., Riverside, Ill. 60546.

TRAVLER tape recorder. Will swap for communications receiver or pair of walkie-talkies. Kenneth Edelstein, c/o Mildred Eller, 99 E. Fourth St., New York, N.Y. 10003.

HALLICRAFTERS TR-2 walkie-talkie. Will trade for ham receiver or test equipment. Robert Mezzatesta, 16B Marion Pepe Dr., Lodi, N.J. 07644.

PILOT FM booster. Will swap for radio publications and catalogs. Keith Thompson, Rte. 5, State Park Rd., Greenville, S.C. 29609.

HEATH 10-12 5-in. oscilloscope. Make swap offer. Donald C. Sullender, 100 Columbia Blvd., Cherry Hill, N.J. 08034.

KNIGHT 2-station intercom. Want SW equipment or small tape recorder. David Berger, 508 W. 37th St., Wilmington, Del. 19802.

RCA signal generator. Will trade for FM tuner or Heath MPX adaptor. Otto Woltersdorf, 200 Dorset Way, Chalfont, Pa. 18914.

CRT (17-in.). Want AN/ART-13 transmitter. John E. Carr, Rte. 2, Rockmart, Ga. 30153.

MOBILE STATION with Elmac transmitter, Gonset converter, other items. Need communications receiver. Lance Border, 230 Rosslyn Ave., Columbus, Ohio 43214.

HEATH GW-11 and Lafayette HE-15 CB transceivers. Will swap for tape recorder. William Gibbs, Rte. 4, Box 965 J, Hickory, N.C. 28601.

KNIGHT T-60 AM/CW transmitter. Want Heath Twoer. George Dresser, 927 Pauling St., Peekskill, N.Y. 10566.

ID-6A/APN-4 (5-in. CRT), with all tubes and schematic. Will swap for tape recorder or walkie talkie. William Rawlings, Rte. 3, Sandersonville, Ga. 31082.

RCA RF generator. Want VTVM. Yves Grignon, Box 1029, St. Agathe, Que.

TINY TIGER 300 gasoline-powered 110VAC generator. Will trade for radio-control equipment. Michael Polauf, 1857 Madison St., Queens, N.Y. 10227.

GONSET mobile tri-band converter. Want ham gear. Roderick W. Hart, 4007 Edgewood Rd., Baltimore, Md. 21215.

FM receiver, covers 60 to 250 mc. Will swap for SW receiver or walkie-talkies. Dave Coe, 413 National, Henderson, Nev. 89015.

FIELD DRUM and accessories. Want ARC-5 transmitter. Richard Tygrest, 1625 Dinwiddie Ave., Hopewell, Va. 23860.

SURPLUS 40- and 80-meter transmitters. Will swap for SW receiver or 2- or 6-meter transceivers. Charles Russell, 3849 Germantown Pike, Box 352, Dayton, Ohio 45402.

TRANSMITTING tubes. Need SX-28 receiver or other equipment. Norman Lehman, 6021 S.E. 7th St., Midwest City, Okla. 74354.

TRIPLET 0-1 milliammeters. Want Klystron or Zahl tube. Chuck Haymond, 1931 San Pasqual, Pasadena, Calif. 91102.

RECEIVERS, CPO, audio amplifier and signal generator. Want all-band regenerative receiver. Rudy Povlich Jr., 8018 S. 27 St., Oak Creek, Wis. 53154.

KUHN 353B 26 - 174mc VHF receiver. Want antique superhet, TRF or SW receiver. Charles Rodriguez, 1060 Pleasant St., New Bedford, Mass.

NOVICE code course on tape, oscillator and key. Will exchange for headset. Ned Sebring, WN8OWL, Box 325, Owosso, Mich. 48867.

HE-35 6-meter transceiver, old tubes. Need Q-multiplier. Bill Ringleben, 305 E. Elm St., Hazelton, Pa. 18201.

HEATHKIT GR-91 receiver. Will swap for Hy-Gain 14-AVS vertical antenna. Fred M. Ruzick, WA8GQQ, 221 N. Garland Ave., Dayton, Ohio 45403.

VM 710 tape recorder. Will trade for Lafayette HE-90 CB transceiver. Martin Mayo, 2409 Ocean Pky., Brooklyn, N.Y. 11235.

BC-603 FM receiver with accessories. Need 6/12

[*Continued on page* 16]

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ELECTRONIC SWAP SHOP

Continued from page 14

volt battery eliminator. John Polyakovics, 20-39 121 St., College Point, N.Y. 11356.

KNIGHT Star Roamer receiver, CF Cannon headphones, Lafayette HA-60 walkie-talkie. Will swap for Lafayette HE-80 or Knight R100A receiver. Paul Mayo, 2409 Ocean Pky., Brooklyn, N.Y. 11235.

ASSORTED SYNCHROS and VOM. Want ham receiver. Frank T. Unger, 2230 Lincoln St., Bethlehem, Pa. 18015.

HALLICRAFTERS S-53A receiver, other items. Need ham gear. Herbert E. Whipple, 306 W. Second St., Pevely, Mo. 63070.

HI-FI amplifier and speaker in cabinet. Interested in walkie-talkies. M. Behlen, 4744 N. Temperance, Clovis, Calif. 93612.

EI S-Niner. Make swap offer. Dean B. Shook, Box 155-A, Rte. 4, N. Fiske Rd., Coldwater, Mich. 49036.

AMPROBE RS-3. Will trade for signal generator or EICO 722 VFO. O.D. Scarbrough, 708 Paulin Ave., Calexico, Calif. 92231.

SPARTON AC 62 and Atwater Kent 35 receivers. Want ham gear. Finis Gream, Box 144, Bluford, Ill. 62814.

HALLICRAFTERS S-38 and Lafayette Explor-Air receivers. Need VTVM or VOM. James Whitehurst, 16 David Rd., Latham, N.Y. 12110.

REALISTIC VTVM with probes and manual. Make swap offer. M.G. Rousselin, 91 Remsen St., Brooklyn, N.Y. 11201.

AUDAX A-150X speakers, Yashica 8-EM movie camera and Mansfield Reporter editor. Will swap for NC-109 receiver. Miles T. Willis, 224 Malvern St., Monroe, La.

LAFAYETTE HE-30 receiver. Will swap for Knight R-100A. Steve Gray, 620 Lansway, Ann Arbor, Mich.

HEATHKIT GR-91 and HR-10 short-wave receivers. Want VFO and Knight Ten-2 CB checker. Richard Stout, WN9LXU, Maple Spring Farm, Chatham, Ill.

LAFAYETTE HE-29C walkie-talkie. Make swap offer. Gregory Tillman, 3436 Ave. S., Minneapolis, Minn. 55406.

HOHNER electronic cembalo/piano. Make swap offer. Gerd S. Grombacher, 323-5 Pope Ave., Fort Leavenworth, Kans. 66027.

GO-CART. Want CB transceiver, test equipment or ham gear. Duane Sharpe, Rte. 1, Stamford, Ill. 61774.

ELECTRONICS course. Will swap for oscilloscope or CB transceiver. Calvin Baker, East Main Rd., Leroy, N.Y. 14482.

TRAV-ELECTRIC SR. inverter. Want Radiola 21 receiver. Harry Marzke, New Auburn, Wis. 54757.

LETTINE 240 transmitter, Hallicrafters S-38 receiver, other ham gear. Make swap offer. Bud Wilhelm, WØHOG, 315 Third Ave., N.E., Aberdeen, S.D. 57401.

TECRAFT 2-meter transmitter, EMC 204 tube tester, other items. Want ham gear. A.R. Terry, Box 42, Tilden, Ill. 62292.

HEATH SB-10 and homebrew KW linear. Will swap for transceiver and mobile accessories. Lawrence Krasnow, 8 Pin Oak La., White Plains, N.Y. 10606.

RCA Voltohmyst VTVM and Heathkit GD-1B GDO. Make swap offer. Jerry Brown, 6801 N. 24th Dr., Phoenix, Ariz. 85015.

MASCO public-address amplifier. Will swap for 20-watt stereo amplifier. Dominick Mauro, 50 Fawn La. W., Centereach, N.Y.

TV and radio tubes, $500 worth. Will exchange for CB walkie-talkies or ham receivers. Neal Tenhulzen, 1327 Fifth Ave. N., Denison, Iowa.

HICKOK 19XD crystal-controlled signal generator. Will swap for CB transceivers. Martin Gary, 807 Westham Pkwy., Richmond, Va.

CRT (3BP1) and three-tube phono amplifier. Make swap offer. George Girod, 159 Mill St., Winona, Minn. 55987.

CPO, wireless broadcaster, other items. Make swap offer. David L. Griffin, 613 Pershing Dr., Silver Spring, Md.

HEATHKIT CT-1 capacitor checker, Vibroplex bugs, surplus receivers. Want RCA, EICO or Heath VTVM. William H. Ray, Jr., 36 Cortland St., W. Hartford, Conn. 06110.

BC-603 surplus FM receiver. Will exchange for crystal-lattice or electro-mechanical SSB filter. Harley Engel, WAØASR, 323 Bryant Ave. S.W., Wadena, Minn.

SILVERTONE phono amplifier, other equipment. Will trade for walkie-talkies. Steven Ruggiero, 2216 Cherry St., Erie, Pa.

MALLORY TV101 UHF converter. Will swap for small VOM. Samuel S. Tucker, 1502 Conoga St., Norfolk, Va. 23523.

REGENCY RC600 TV converter. Interested in amateur gear. Lindell Pinegar, 405 S. Maple Ave., Fredricktown, Mo. 63645.

HALLICRAFTERS S-120 receiver. Make swap offer. Jeff Cantor, 142-14 26th Ave., Flushing, N.Y.

LAFAYETTE multitester. Want small oscilloscope or Garrard changer. Paul Munch, Box 268, Larchmont, N.Y. 10538.

ATWATER KENT and Firestone Air Chief receivers. Interested in CB walkie-talkies or CB transceiver. David Slagel, 1933 Gunbarrel Rd., Chattanooga, Tenn. 37421.

CENTURY tube tester, DeVry oscilloscope and signal generator. Will swap for Hallicrafters receiver or CB transceiver. Roger Bradshaw, Box 139, Waterdown, Ont.

HEATHKIT T-3 signal tracer and SG-6 RF signal generator, radio servicing course. Will trade for tape recorder. Roman Kwashuk, Weasel Creek, Alta.

POLY-COM 2 transceiver. Will trade for Vocaline PT-27 or other 1-watt walkie-talkie. Larry Bartsch, 78 Camdike St., Valley Stream, N.Y. 11580.

TRIPLETT 2413 tube tester, Magnavox 45-rpm radio/phono combination and CB gear. Want ham equipment. F.M. Grimble, WA4WVR, 144 S. Carroll St., Bruceton, Tenn.

KNIGHT T-60 transmitter and Atwater Kent receiver. Will exchange for oscilloscope or stereo amp. R. Wilson, 56-09 137 St., Flushing, N.Y. 11355.

BRYANT double fuse holders and double fuse switch. Will exchange for anything of equal value. Donald Brandt, 421 Juniper St., Quakertown, Penn. 18951.

EICO 425 oscilloscope. Will trade for combination signal generator/tracer, VOM or radio/TV diagrams. Jack W. Jones, Box 234, Eclectic, Ala. 30624.

PHILCO TV chassis 19F1. Will swap for short-wave receiver. Ronald Webb, 1212 Dorothy Pl., Memphis, Tenn.

HEATH GR-91 receiver. Need VTVM. Benjamin Schaffer, 32 N. Howard St., Allentown, Pa. 18101.

ZENITH AM/SW/phono combination and multitester. Will trade for oscilloscope. Berry Tocher, Lyndeboro, N.H. 03082.

HEATH QF-1 Q-multiplier, 6 V inverter, homebrew converter and modulator. Will swap for anything of equal value. Bob Heim, 1216 Vine St., Sandusky, Ohio.

HARMAN KARDON Melody II amplifier and Counterpoint II FM tuner, Metzner Starlight turntable and AR-2 speaker. Will trade for HQ-100 or NC-109 receivers. David Sarna, 370 Riverside Dr., Apt. 6B, New York, N.Y. 10025.

LAFAYETTE HE-100 walkie-talkies. Will exchange for CB transceiver. Carl Capasso, 421 Queen St., Woodbury, N.J.

OLD TUBES—80's, 24A's, others. Will swap for anything of equal value. George Dussault, 441 Kimball St., Manchester, N.H.

EICO HF-12 amplifiers and Knight stereo remote-control unit. Will swap for 6-meter receiver. Raymond E. Pierce, 4304 Walpine La., Knoxville, Tenn.

ELECTRO-VOICE 714SR ceramic mike and USL 12 V vibrator. Need 15-meter converter, crystal calibrator and CW monitor. Wirtley Lipscomb III, WN4TNS, Rte. 4, Box 148, Powhatan, Va.

STAR-LITE A-120 receiver. Looking for CB transceiver or FM tuner. Anthony Scrivani, 209 Willow Ave., Hoboken, N.J. 07030.

VIKING PB 70 playback preamp. Dominick J. Rappoccio, 20 Adams Ave., Cranford, N.J. 07016.

CONVERTER. 6-meter. Want bug or other ham gear. Will Smith, 1003 Bluegrass, Louisville, Ky. 40215.

RCA Radiola 60. Will swap for CB walkie-talkie. Dennis Kramer, 76 Elliot St., Passaic, N.J. 07055.

TECHNICAL ASSOCIATES geiger counter. Will exchange for equipment of equal value. Alan D. Gray, WA2WNX, 5 Windsor Pl., Mt. Holly, N.J. 08060.

LAFAYETTE TK-10 multitester, TV transformer, 24 V dynamotor. Looking for receiver, VTVM, VOM, tape recorder or record player. Lewis Brenner, 1314 Fanshawe St., Philadelphia, Pa. 19111.

HALLICRAFTERS CB-6 walkie-talkie. Want Hallicrafters S-120. Michael Pearce, 605 Memorial Dr., Ahoskie, N.C.

[*Continued on page* 118]

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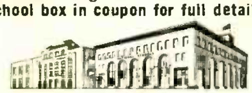

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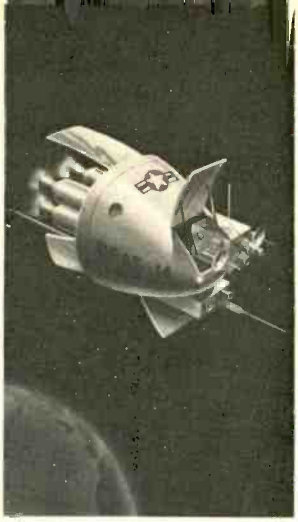

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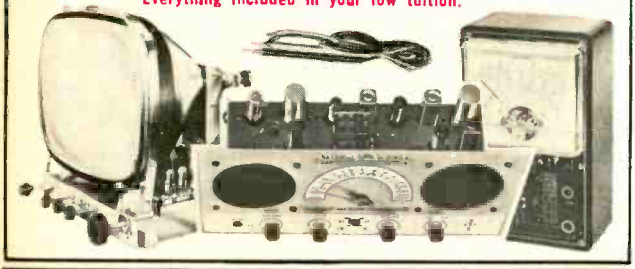

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Instrumentation for **Bio/Medical Research** is the title of an article which will be of interest to bio/med electronics buffs. Electron microscopy, contact microradiography and X-ray spectrography are among the topics discussed in this pamphlet. Copies are available free of charge from Philips Electronic Instruments, 750 South Fulton Ave., Mt. Vernon, N.Y. 10550.

Professional **earphones and headsets** in 11 basic types are the subject of the Roanwell TV Specials catalog. The publication includes schematics and dimensional drawings of the company's entire line, in a variety of impedances and in both monaural and binaural models. For your copy, write the Roanwell Corp., Roanwell Bldg., 180 Varick St., New York, N.Y. 10014.

A new catalog from General Electric offers full information on the company's nine basic models of **soldering irons**, in tip sizes ranging from 1/16 to 2 in. and heat dissipations from 12 to 1,250 watts. Also included are catalog numbers and prices for use in ordering renewal parts. Copies may be obtained by sending a request to the General Electric Co., Schenectady, N.Y. 12305.

Dimensional drawings of **relays** with 18 different contact arrangements and inputs ranging from 6 to 230 volts are contained in Eagle Signal's new catalog. A copy is yours for the asking if you write Eagle Signal Div., E. W. Bliss Co., 736 Federal St., Davenport, Iowa 52803.

Microwave products, semiconductor testers and infrared devices are among the items described in bulletin 10-1. A copy can be obtained by writing American Electronic Laboratories, Inc., Richardson Rd., Colmar, Pa. 18915.

Variable capacitors in a variety of types and sizes are pictured and described in a new Hammarlund publication. Sizes range from 3 to 320 $\mu\mu$f and applications from trimmer to transmitter tank. Available only to members of the electronics and communications industries, the catalog should be requested on company letterhead from the Hammarlund Mfg. Co., 73-88 Hammarlund Dr., Mars Hill, N.C. 28754.

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ELECTRONIC MARKETPLACE

TRAVEL HAPPY . . . Whether you choose the dynamic or the noise-cancelling carbon version of the Telex TEL-66 communications microphone, you'll have a palm-fitting mike with a man-size PTT switch. Further, a transistor preamplifier, said to be stable even under conditions of varying voltage and load, ups the dynamic's output to a level suitable for most any speech amplifier. A twist of a screwdriver readily adjusts preamp gain and, thanks to special placement of its mounting bracket, the TEL-66T is face up and ready for action soon as it's picked up. TEL-66C (carbon), $41.65; TEL-66T (dynamic), $54.35. Telex Corp., 3054 Excelsior Blvd., Minneapolis, Minn. 55116.

Wireless(es) . . . Calling the wife on the home squawk box in the midst of base-station CB operations used to require two systems. Now you can do it with one—if the one happens to be a

Selectacom, an ingenious combination of wireless (RF) intercom and a CB transceiver in a single cabinet. Operating on CB channel 5, the Selectacom runs 100 mw as a wireless intercom and 3 watts as a CB transceiver. A dictate position on the talk/listen switch is just the thing for long-winded orders of the day. $49.95 each; $99.50 the pair. Radio Shack Corp., 730 Commonwealth Ave., Boston, Mass. 02117.

MARKETPLACE

Low Profile . . . Push a button on this nine-band SWBC converter and — *presto!* — commercials disappear as the exotic sounds of worldwide shortwave broadcasts fill your car. In addition to permitting normal operation of an AM car

radio, the converter in our photo enables the same set to tune nine SW bands between 3200 and 21750 kc. A simple connection between receiver and antenna readies the 1⅜ x 7 1/16 x 5⅜-in. unit for action. Designed for under-the-dash mounting, the converter is supplied with necessary hardware and instructions. The unit is compatible with all 12-volt cars and those employing a 6-volt negative-ground electrical system. J. C. Whitney & Co., 1917 Archer Ave., Chicago, Ill. 60616.

Modish . . . Speaker systems tend to radiate sound in a semicircular pattern, which just might explain why such systems frequently are placed against the listening-room wall. But the satellite system in our photo easily can be made the center of attraction because it radiates sound in a circular pattern. Available in a variety of woods, the Satellite boasts an appearance no decor-conscious listener will want to make apologies for. $49.50 the pair. International Electrohome, Inc., 2333 Arthur Ave., Elk Grove, Ill. 62931.

MARKETPLACE

Adaptable . . . Matching mikes and amplifiers sometimes is like trying to add apples and oranges. But the MK-3D dynamic mike, available with output impedances of 200 or 10,000

or 50,000 ohms, can be purchased to match any amplifier you have a mind to. Frequency response is said to be 50 to 12,000 cps; output is —62db. Supplied with a plastic stand, the MK-3D also can be handheld. $17.50. Audiophonics Corp., 95 Rantoul St., Beverly, Mass. 01915.

Inverted . . . While most pieces of electronic gear rely on converting AC to DC, the 12T-RME-1 goes about its business in reverse fashion. This inverted approach comes in handy for using the family car's electrical system to operate small home appliances on trips and out-

ings. Weighing just 14 lbs. and supplying up to 140 watts of power, the 12T-RME-1 DC-to-AC inverter can power small TV sets, radios, shavers and similar devices. A four-position switch provides for adjustment of output voltage. $39.95. ATR Electronics, Inc., 300 E. 4th St., St. Paul, Minn. 55101

ELECTRONICS ILLUSTRATED
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the ABCs of RADIO

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IN this special six-part series EI will present a basic course in radio theory, covering all phases of wireless communications from key or microphone to speaker. The author, John T. Frye, is famous for his ability to simplify the theory side of electronics and make it at once interesting and easily understood. *The ABCs of Radio* is designed to be clipped from the magazine and assembled as a complete text. Cut along the broken line, punch holes as indicated and place the pages in a standard three-ring 7x10-inch loose-leaf notebook. The remaining parts of the series will be identical in design.

PART 1—THE TRANSMITTER

PRE-RADIO scientists wishing to transmit sound instantly over great distances had a sticky problem. Sound waves couldn't make the trip on their own. Stentor, that ancient loudmouth with the voice of 50 men, probably couldn't be heard more than four or five miles, even downwind. And if sound somehow could be amplified to span the distance without shattering windows and fracturing eardrums along the way, it was too slow. A sound wave would require four hours to travel from New York to San Francisco.

Fortunately, the problem was not without clues to a solution. Mr. Bell had proved the effective speed of sound waves could be upped tremendously by translating them into electrical currents and sending them along a wire. And it was known in the old days that a slow-moving object could be hurried through a medium it could not traverse alone by loading it on a speedy carrier —a train, packet boat or balloon, say—that would take it to its destination, where it could be unloaded and put to use.

Combine these ideas as in Fig. 1-1 and you have the basic principle of radio: 1) we use a transmitter to generate a carrier composed of high-frequency electromagnetic waves that can zip through space at 186,000 miles per second; 2) we translate sound into electrical currents and load these on the carrier by means of a modulator; 3) the modulated carrier travels through space from the transmitting to the receiving antenna; 4) a receiver takes the modulation off the carrier, and a speaker turns the electrical currents back into sound waves.

A radio-frequency carrier is a kissing cousin of the 60-cps alternating current flowing in your house wiring. However, there is one important difference: your house current goes through a complete cycle 60 times a second; a broadcast-station carrier goes through 540,000 to 1,600,000 cycles per second, depending on the operating frequency of the station.

Obviously, no mechanical alternator can turn fast enough to generate that high a frequency so we must seek another source of stable high-frequency generation. A *crystal oscillator* is one solution. If a thin slice of piezo-electric quartz crystal is fastened between two metal plates and connected in the circuit of Fig. 1-2, it displays an interesting property. When the tuned circuit of C1/L1 is resonated in the right band of frequencies, the crystal slab (XTAL) starts vibrating mechanically. Frequency of the vibration depends on the cut and mechanical dimension of the crystal, especially the thickness. Changing these factors can set the frequency anywhere from a few thousand to several million vibrations per second. For each finished crystal, though, the vibrating is strictly a one-note performance, with the frequency never varying more than a small fraction of a per cent.

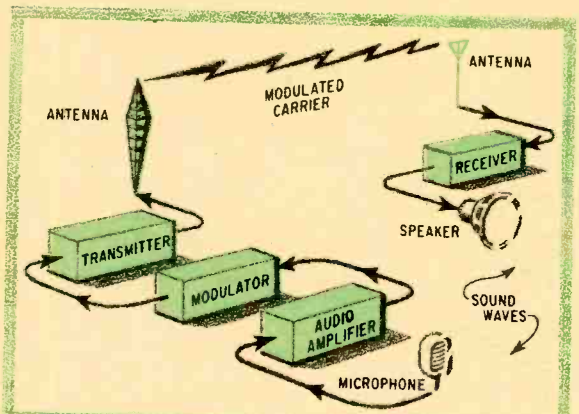


Fig. 1-1

As the crystal lies there, panting like a lizard, each pant produces a cycle of weak alternating voltage between the metal plates and, consequently, between the grid and ground of the vacuum tube. We won't go into vacuum-tube theory at any length here (see BASIC COURSE IN VACUUM TUBES, July '64 EI), but suffice it to say a varying voltage between the grid of a vacuum tube and ground exerts a continuous valving action on the stream of electrons flowing from the cathode to the plate. Consequently, it also affects the plate current flowing through the parallel-tuned circuit of L1/C1.

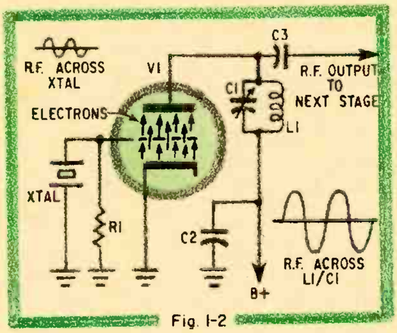


Fig. 1-2

Any disturbance in a parallel-tuned circuit starts a current oscillating back and forth through the coil at the resonant frequency—in this case, a frequency somewhat higher than the vibrating frequency of the crystal. The electrical oscillation dies out quickly, though, the way the mechanical oscillation of a rocking chair does—unless additional, properly-timed energy is fed into it. Exactly such energy is supplied to the tuned circuit by the grid-voltage-dictated undulations of plate current. These plate-current surges time the alternating current zinging back and forth through the coil so they produce an AC voltage across the coil agreeing on a cycle-for-cycle basis with the voltage across the crystal. However, the radio-frequency (RF) voltage across the plate coil is much greater than that across the crystal.

In this circuit, a small amount of energy feeds back through the tube from the plate to the grid to keep the crystal vibrating. The whole operation is similar to the balance-wheel-and-escape movement of a watch. The oscillating balance wheel causes the escape movement to release precisely timed pulses of power for driving the hands but a little power from the movement must be applied to the balance wheel to keep it oscillating vigorously.

Power output of a crystal oscillator seldom is more than a watt or so and we need several hundred watts of power to radiate a substantial broadcast signal. RF voltage generated by our crystal oscillator must be amplified before it is delivered to the transmitting antenna as a carrier. Amplification ordinarily is performed in two or more stages. The last stage, the one working into the antenna, is called a *power amplifier* or *final*. Intermediate stages are called *RF amplifiers* or *buffers*. To understand this last term you must know that the modulation of a power amplifier affects the momentary demands this amplifier makes on a preceding stage. If that preceding stage were a crystal oscillator, the changing demand might influence the frequency slightly, the way going up and down hill affects the rpm of a car motor. Inserting a buffer stage between the modulated or keyed power amplifier and the oscillator prevents this.

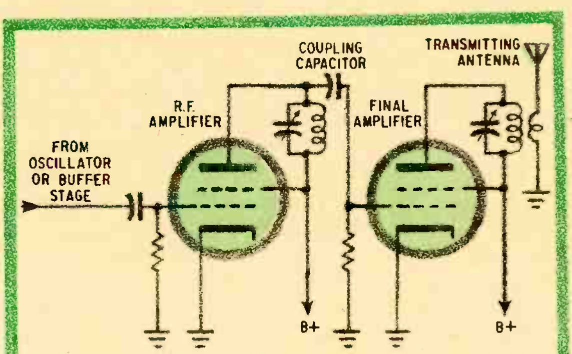


Fig. 1-3

As you can see from Fig. 1-3, buffer and final-amplifier stages bear a strong resemblance to each other and to a crystal oscillator. RF voltage on the grid of an amplifier, though, comes via a coupling capacitor from across the tuned circuit, called a tank circuit, in the plate lead of a preceding stage instead of from a vibrating crystal. Amplifier tubes usually are of the screen-grid type that lessens feedback from the plate to grid circuits. But unlike our oscillator, where such feedback is necessary to sustain oscillation, we do not need or want the feedback in an amplifier. Its presence might cause our amplifier to act like an oscillator and generate a frequency of its own altogether different from the one dictated by the crystal.

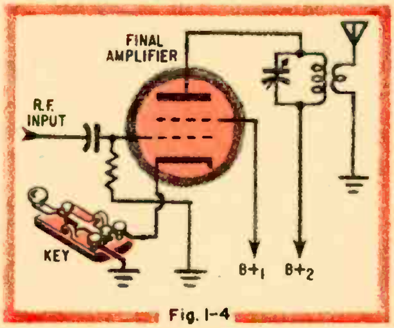


Fig. 1-4

Transmitting amplifier tubes are sturdier than oscillator tubes and employ higher voltages. This is especially true of a power amplifier tube, which may have thousands of volts on its plate and several amperes of RF current circulating through its tank coil. RF transformer action transfers a considerable amount of this power from the tank circuit to the transmitting antenna, from which it radiates into space. We'll study the nature of these radiated waves later in this series but right now let's concern ourselves with how we can modulate this radiated carrier with dots and dashes, voice or music.

Modulating with code is easy. We arrange a key, as in Fig. 1-4, so that the carrier is turned on only when the key is pressed. We agree that a short on-time shall be a dot and an on-time three times as long shall be a dash. All letters of the alphabet, numbers and punctuation marks are assigned distinctive combinations of dots and dashes. The off-time spacing between parts of the same letter or number will equal a dit (dot); spacing between letters will equal a dah (dash), and space between words will be twice one dah. Armed with this knowledge, we easily can tap out words and sentences with the key. And if the receiver is arranged to make an audible sound when it picks up the sending station's carrier, the operator can translate the dits and dahs he hears back into letters and words.

When we start loading voice or music on the carrier, complications set in. Sound waves and electrical waves won't mix so we must translate sound waves into some type of electrical waves to get them to mix. We do this with a microphone. There are several types but the dynamic microphone, the basic structure of which is sketched in Fig. 1-5, is one of the best.

Consider what happens when a bass drum is given a lusty whop. The drumhead oscillates in and out. Coming out, it pushes together air molecules next to it. Molecules following it in are pulled away from their buddies and spread apart. Vibration of the drumhead or any other source of sound thus sends out a series of waves traveling through the air. Each wave is composed of an alternate compression and rarefaction of air molecules. When the compression part of a wave reaches the diaphragm of the microphone, the diaphragm is shoved back. The rarefaction part of the wave reduces the pressure in front of the diaphragm and the pressure from behind pushes it forward. Stronger waves cause greater diaphragm excursion than do weak ones.

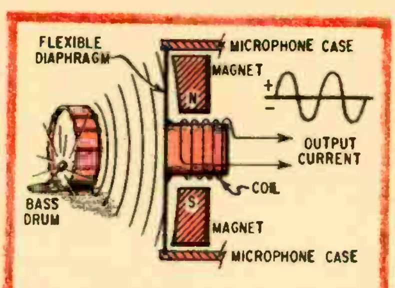


Fig. 1-5

A coil attached to the diaphragm rides in an intense magnetic field produced by a permanent magnet. From

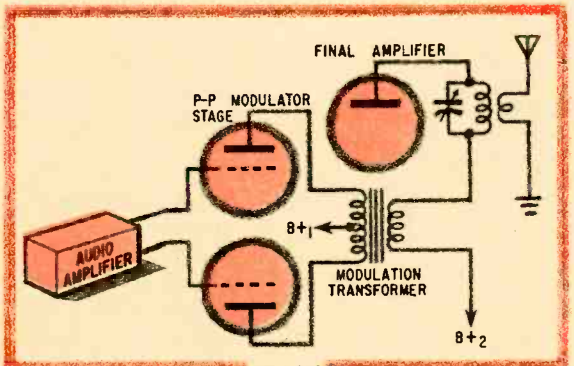


Fig. 1-6

physics you remember that when a conductor moves through a magnetic field a current is set up in the conductor. Direction of this current reverses when the motion of the conductor reverses. The more magnetic lines of force cut—the farther the conductor moves—in a given bit of time, the stronger is the current. Keeping all this in mind, you see back-and-forth movements of the diaphragm caused by sound waves produce alternating currents in the coil. Frequency and amplitude of these currents are related directly to the pitch and intensity of the sound producing the movement.

It's a simple matter to amplify the weak AC voltage output of the microphone with tubes or transistors and end up with the husky modulator tubes that can deliver thousands of volts of audio frequency across the secondary of the modulation transformer of Fig. 1-6. AC voltage in this secondary is in series with the DC supply for the plate of the final amplifier. The AC voltage thus adds to or subtracts from the plate voltage according to the instantaneous polarity of the voltage across the transformer winding.

At one instant in the circuit of Fig. 1-6, when the top of the modulation transformer's secondary winding is positive with respect to the bottom, plate voltage is doubled. Voltage of the RF carrier is doubled, too. A half-cycle of audio later, when the polarity across the secondary of the modulation transformer is reversed, the audio voltage cancels the power-supply voltage and reduces the plate voltage to zero. There is no carrier output at this instant. Weaker audio signals produce lower voltages across the modulation-transformer secondary and result in smaller variations in carrier amplitude.

Fig. 1-7 shows how two different frequencies and three different levels of modulation affect the carrier. From A to B no sound enters the microphone and the carrier is unmodulated. From B to C a moderately strong, 2,000-cps note furnishes partial modulation. And from C to D a loud 1,000-cps note fully modulates the carrier. Note that the carrier bulges each time the audio signal swings positive and dips each time it swings negative. The stronger the audio signal the higher the bulges and the deeper the dips! We have succeeded in imprinting the carrier with every detail of sound entering the microphone.

Though we have referred glibly to it as modulation, the process of mixing two frequencies together actually has many names. It also is called frequency conversion, heterodyning and beating. Later you will learn much more about the process, but right now you best had accept on faith, the way you accept restaurant hash, the statement: when signal A modulates signal B, two new signals called *sidebands* are generated, and they equal the sum and difference of frequencies A and B. For example, if we modulate a 1,000-kc carrier with a 1,000-cps au-

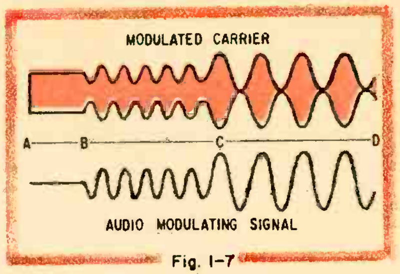


Fig. 1-7

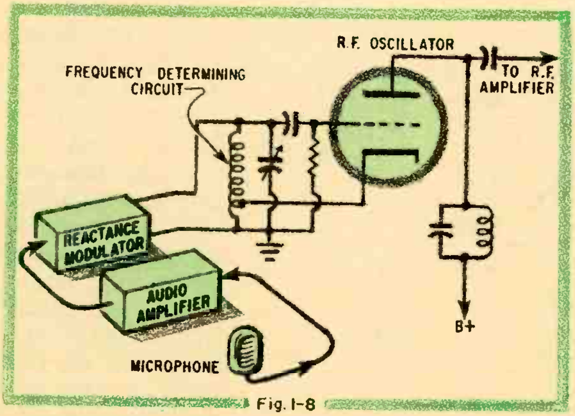


Fig. 1-8

dio signal, we produce an *upper sideband* signal at 1,001 kc and a *lower sideband* signal at 999 kc.

A carrier is like a geometrical line; theoretically the line has no thickness, and a carrier occupies only a single frequency. But when a carrier is modulated with music, voice or other multi-frequency sound, the presence of multiple sidebands widens the signal to a width equal to twice the frequency of the highest-pitched sound. If the pitch of this sound is 5,000 cps, our carrier-plus-sidebands signal is 10-kc wide. Do not confuse the amplitude of the signal shown in Fig. 1-7 with the width of the signal. Changing the amplitude of the modulation—up to a maximum of 100%—does not widen the signal but increasing the frequency of the modulating audio does.

There is another way our audio signal can operate on the carrier. Instead of varying the amplitude of the signal, the audio can vary the frequency of the carrier. See Fig. 1-8 for a sketch of how this is done. The audio signal from the microphone is amplified and applied to the grid of a *reactance modulator*. This nasty-sounding device simply is a tube that is persuaded to act like a variable capacitor, the capacity of which goes up and down with grid voltage. When the reactance modulator is connected properly to the frequency-determining circuit of an oscillator, the oscillator frequency varies back and forth in step with the variable audio voltage on the grid of the modulator. How far the frequency swings each side of a center frequency depends on the amplitude of the audio signal. A 1,000-cps audio signal wobbles the carrier back and forth 1,000 times a second. A weak signal may move the frequency only 10 kc each side of center but a strong signal will move it 75 kc for 100% modulation. Every sound entering the microphone causes a change, frequency-wise, in our radiated signal.

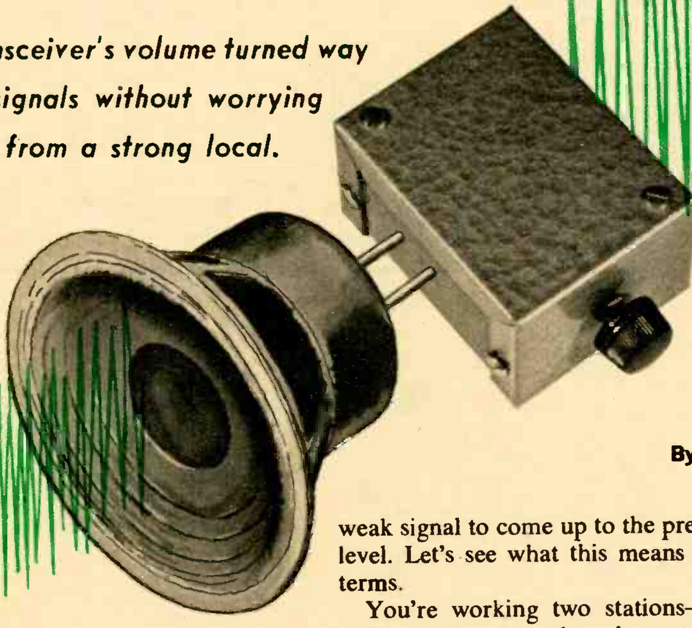
Though a frequency-modulated broadcast station occupies 150 kc as opposed to 10 kc for a conventional amplitude-modulated station, FM has marked advantages. FM stations, for example, are free to broadcast the full audio range; AM stations, in contrast, must limit their audio coverage to frequencies below 5,000 cps in order to keep within their allotted 10-kc bandwidth. Then, too, static and most man-made noise affect an AM receiver much more than an FM set. Finally, audio power needed to modulate an FM station is only a tiny fraction of the power needed to modulate an AM station of equal carrier strength.

To sum up, we have seen how a crystal oscillator can supply the basic signal that radio must have to carry a message from one point to another. We also have seen how this signal is increased hundreds or thousands of times by buffer and final-amplifier stages. And we have investigated three different ways in which our signal can be modulated in order to convey the information we wish to send to another point.

NEXT ISSUE: THE CARRIER

CB VOLUME LEVELER

Keep your transceiver's volume turned way up for weak signals without worrying about a blast from a strong local.



By AL TOLER

YOU know the scene: you've got your ear pressed against the speaker to hear a weak station when suddenly — *pow!!!* — the guy down the block opens up. The volume is enough to shake rust off a screen door. While a CB receiver's AVC (automatic volume control) protects the receiver against overload from a strong signal, it does little to guard the speaker or your eardrums when you've got the volume cranked wide open to hear a weak signal.

But with our CB Volume Leveler hooked to your rig you can keep any signal loud enough to copy and still not live in fear of sonic boom. No more sharp jabs in the ear, irate neighbors or waking the family in the wee hours. The Leveler maintains constant volume regardless of the strength of the received signal or the volume control's setting.

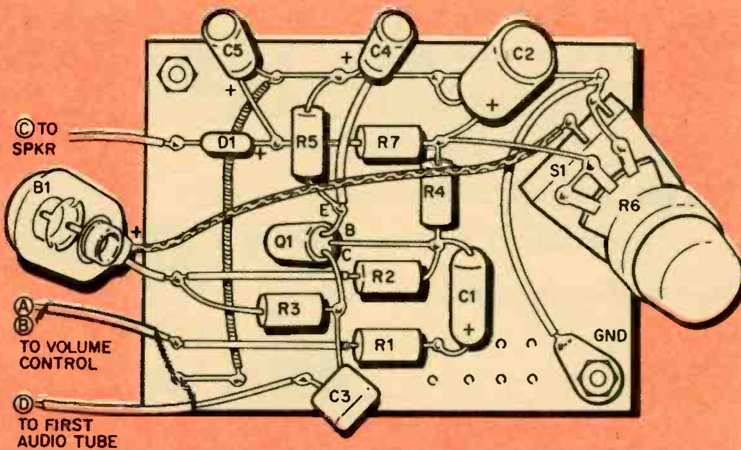
On the other hand, if you must run the rig's volume control wide open to dig a weak signal out of the noise, the Leveler permits the weak signal to come up to the pre-set volume level. Let's see what this means in practical terms.

You're working two stations—one weak and one strong—and you've got the volume full-up so you can hear the weak station. Because the signal is weak the Leveler does not affect it and the receiver's audio stages operate at full gain. When the local comes on there's no need to reach frantically for the volume control. The Leveler automatically reduces the audio gain and the local comes through at just about the same level as the weaker station.

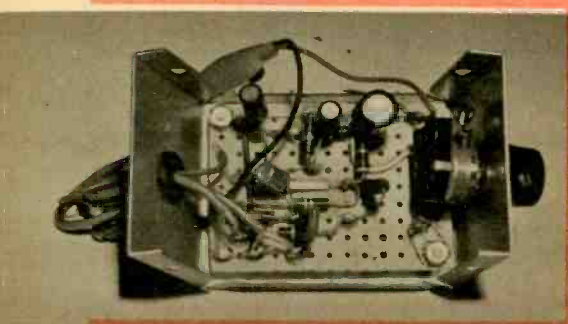
To permit you to return to normal transceiver operation and volume, the Leveler is adjustable from full off to full on. Transistorized, it uses a standard 9-volt transistor-radio battery which lasts from 6 to 12 months. While the transceiver must be modified, it is a minor job which can be done by anyone who can handle a soldering iron.

Construction. The Leveler is assembled on a 1⅞ x 2½-in. piece of perforated board on which flea clips are used for tie points. If there is room inside the transceiver, the Leveler can be built in by mounting it on the chassis. Compression control R6 then could be mounted on the rig's front panel. Otherwise, mount the board in the main section of a 2⅛ x 1⅝ x 2¾-in. Minibox.

The leads on Q1 and D1 must be short



Perforated board on which all parts except R6 and S1 are mounted is 1⅞x2½ in. It can be installed in transceiver if there's room or in main section of 2⅛x 1⅝x2¾-in. Minibox. Be sure to scrape the inside of the cabinet where the mounting screw at lower right passes through to get good ground connection.



To prevent flea clips, which are used as tie points, from touching the inside of cabinet, put ¼-in. spacers on the two mounting screws.

PARTS LIST

B1—9 V battery (Burgess 2U6 or equiv.)
C1—4 mf, 6 V electrolytic capacitor
C2—30 mf, 12 V electrolytic capacitor
C3—.05 mf, 75 V, or higher, disc capacitor
C4, C5—10 mf, 6 V electrolytic capacitor
C6—.1 mf, 400 V tubular capacitor (see text)
D1—1N34A diode
Q1—2N217 transistor
Resistors: ½ watt, 10%
R1—220,000 ohms
R2—270,000 ohms
R3—10,000 ohms
R4—4,700 ohms
R5, R7—1,000 ohms
R6—5,000 ohm, miniature audio-taper pot with SPST switch (Lafayette 32 G 7363)
S1—SPST switch on R6
Misc.—2¾x2⅛x1⅝-in. Minibox, perforated board, flea clips, shielded wire.

CB VOLUME LEVELER

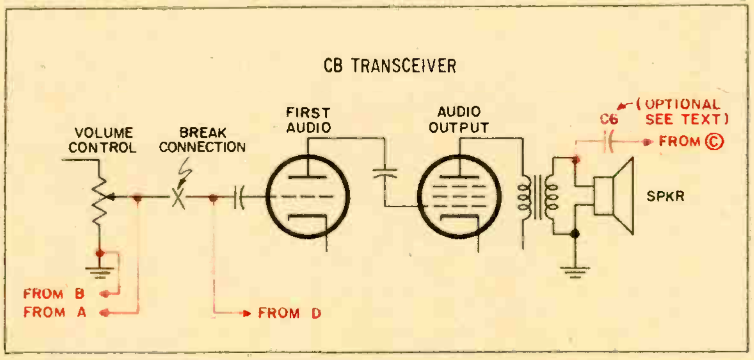
so use a heat sink on them when soldering. Make certain D1's polarity is correct or the Leveler will provide additional gain but no compression (normally it amplifies weak signals slightly). The cathode end of D1, marked with a + or a color band, is connected to R7.

Note that while the shields of both the input and output cables are connected to the Leveler's ground buss, only the shield of the *input* lead is connected to ground in the transceiver.

Transceiver Connection. Unsolder the lead from the center, or wiper, lug of the transceiver's volume control. Connect the center conductor of the Leveler's *input* lead to the wiper lug and solder the shield to ground. Connect the center conductor of the Leveler's *output* lead to the wire formerly connected to the volume control's wiper lug. There is no output lead shield connection—the shield should be cut short. The remaining lead from the Leveler—the speaker lead—is connected to the lug on the speaker that is *not* grounded. If your transceiver uses a type of electronic switching in which a high DC voltage is present in the speaker lead during transmit, connect the Leveler to the speaker through a .1-mf, 400-V capacitor (C6).

Using the Leveler. Whether or not you use it for compression, the Leveler always must be turned on when you operate the transceiver. Rotate compression control R6 clockwise so power switch S1 just clicks on. You should hear stations and be able to control the volume in a normal manner.

For full compression, rotate R6 full clock-



Schematic of typical receiver shows points to which Leveler is connected. Cut off the shield on wire from Leveler that is connected to grid of first audio tube. Capacitor C6 is used if transceiver has electronic switching and there is a high DC voltage present in speaker circuit when rig is in transmit mode.

wise. Weak to moderate signals will be heard with little or no distortion. A strong signal —one that pins the S-meter—will cause the Leveler to clip so there will be a moderate amount of distortion. However, intelligibility will not be seriously degraded.

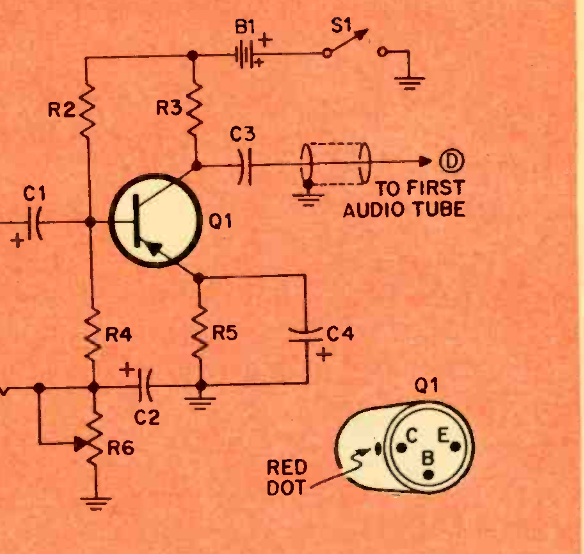
If you want the Leveler to permit a higher-than-normal speaker volume, just back off R6 until the volume is at the desired level. For best results use full compression.

If your volume control is part of a noise-limiter circuit, that is, if the volume control wiper is not connected to the first audio tube through a coupling capacitor, you cannot use the Leveler with your transceiver.

Troubleshooting Tips. Use a VTVM (set to measure DC voltage) with the common lead connected to the transceiver chassis for all tests.

- If you cannot obtain compression, measure the voltage at Q1's base. It should be between 0.2 and 0.4 volts negative. If it is positive, check the battery's polarity. If it is more negative than 0.4 volts, check for a wiring error.
- With the transceiver's volume control turned up, the voltage at the junction of R7 and D1 should be between 0.2 and 0.5 volts positive. If the voltage does not rise above 0.2 volts even at full volume, check C2's and C5's polarity. The negative leads of both capacitors should be connected to ground. If the voltage at the junction of R7 and D1 is negative, D1's leads are reversed.
- Severe distortion, even on weak signals, indicates that the battery may be bad.

Leveler is a one-transistor audio amplifier whose gain is controlled by signal at transceiver's speaker. At same time, high-level signal from rig's volume control is applied to base of Q1, strong signal at speaker is rectified by D1 and applied to Q1's base to reduce circuit gain and the volume from the speaker.



ALL THE SHIPS AT SEA

By TOM KNEITEL, K3FLL/WB2AAI

YOU can keep your ham stations, AM broadcasters and international shortwavers. Take them all and dump them in a corner with their jammed frequencies, wicked interference and operators who sometimes QSL.

Friend, I've found the greenest DX pasture in the world. Come to think of it, my pasture isn't really green, it's more blue-green. But it offers easy grazing and there are enough blades of grass to appease my DX appetite for years to come.

What is this mysterious place? Truth is, it's as simple as a little harbor tug scooting along with a coal barge. It's as ready for action as a tuna fleet sighting a school of fish. It's as sophisticated as a chic Caribbean cruise liner with dinner-jacketed passengers. It's as adventurous as an oceanographic expedition on the hunt for answers to the mysteries of the deep.

Yup, you've guessed it—I'm hooked on marine DX. Each time I listen, the marine bands offer me some new and exciting adventure. And most of the time I am able to obtain a prized verification to hang on the wall of my shack. Fact is, I already claim QSLs from what amounts to a huge flotilla of ships, ranging from the 96-ft. brigantine Yankee (the sailing ship in our photo) to the 1,031-ft. Queen Elizabeth (above), largest liner afloat in terms of tonnage.

Where To Listen. Unlike most other radio services, ship and coastal marine stations

aren't crammed into one or two small segments of the spectrum. And, while these stations do operate on specific frequencies, the marine bands are numerous and scattered over a wide range. They lie at approximately 2, 4, 6, 8, 13, 16 and 22 mc and there also are ships on long wave (our chart at the end of this article provides full details).

Most receivers covering these frequencies will pull in dozens of marine stations. Naturally, if you have a hot receiver you will hear even more stations. If you can receive single sideband you will further increase your DX capabilities and if you are one of the lucky DXers who can read CW (code), you will know practically no limits.

For the beginner, the 2-mc band probably is the best place to pitch your tent. I spend most of my hours listening there and probably I'll always use it as my primary band because of the wide variety of stations it offers. Here are some of the key frequencies to tune in this band:

2003 kc	**Great Lakes Intership**
2182 kc	**International calling & distress**
2638 kc	**Intership**
2662 kc	**U.S. Coast Guard**
2670 kc	**U.S. Coast Guard**
2698 kc	**U.S. Coast Guard**
2716 kc	**U.S. Navy**
2738 kc	**Intership**
2782 kc	**Inland waterways**
2830 kc	**Gulf of Mexico Intership.**

Way I do it is just to sit tight on one of these frequencies for hours at a clip and simply log everything I hear. The most interesting frequency is 2182 kc, though there is seldom a dull moment on any of the ones noted. Fact is, the Coast Guard stations (which have a number of 2-mc channels in addition to the ones listed) offer swashbuckling heroics and feats of derring-do that make those seagoing TV adventures look like cartoon shows.

Marine Operators. Certainly, the most dominant feature of the 2-mc marine band is the marine operator. As it happens, there is a different marine operator in each large city along the coast. And some cities have so much marine radio activity that the marine operators use as many as three different frequencies simultaneously to handle all the ship-to-shore calls. These stations operate between 2450 and 2600 kc and there are scads of them in the U.S. and Canada.

Running more power than ships, they usualy offer longer-haul DX (though not necessarily more interesting DX) than the ships do. Most of the time you'll hear only half of a ship-to-shore call because the operator runs a busy signal over the other half (the periods when the ship station is transmitting). Sometimes this signal isn't used, however, and you can hear the complete conversation. But don't think you are hearing the ship itself. The ship will be transmitting on a different channel and the signal will be rebroadcast through the marine operator's transmitter.

ALL THE SHIPS AT SEA

Radio room on Cunard's luxurious Queen Elizabeth is spacious in the grand manner—precisely what you'd expect to find on the world's heaviest liner.

These marine-operator stations have a range of several thousand miles so even if you live as far inland as Kansas you'll still be able to hear most of them. While these stations generally contact vessels within a hundred miles or so, ships in mid-ocean can place ship-to-shore calls through special marine telephone stations which operate on the bands above 2 mc. These stations are located on both coasts and frequently use single sideband (all ship stations will be using this method of transmission by 1970, according to law). CW transmissions also take place in the bands above 2 mc.

Tracking Down The Ships. Like all other radio stations, ships are assigned individual call signs by their respective governments. In the U.S., maritime radio transmitters are given call signs from several series of calls. For instance, ships having radiotelephone equipment alone are assigned the letter W, followed by another letter and then four numbers (such as WH3844, WL2400, etc.). Vessels equipped to use CW are given calls which begin with a W or a K and are followed by three additional letters. Ships of foreign nations, of course, have their own distinctive call signs.

When you hear a ship using phone, the station will almost always identify itself by giving both the name of the vessel and the call sign, thus greatly simplifying things. On CW you'll have only the call sign to work with and then it's up to you to try to figure out what you've heard. Best way to accom-

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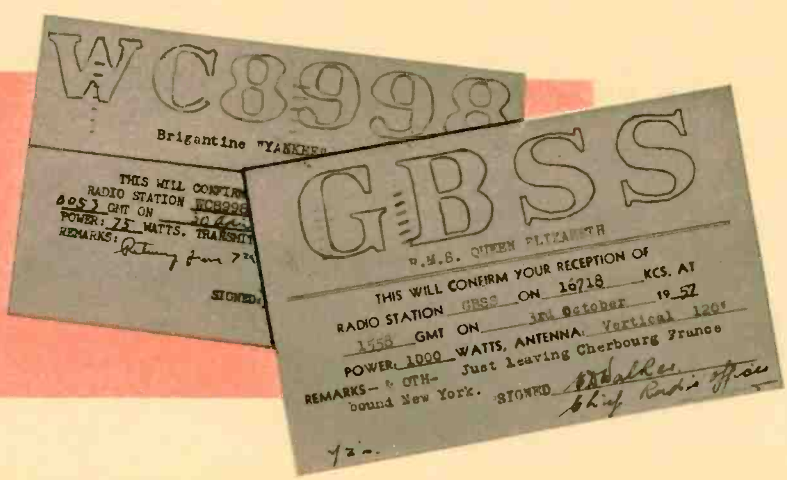
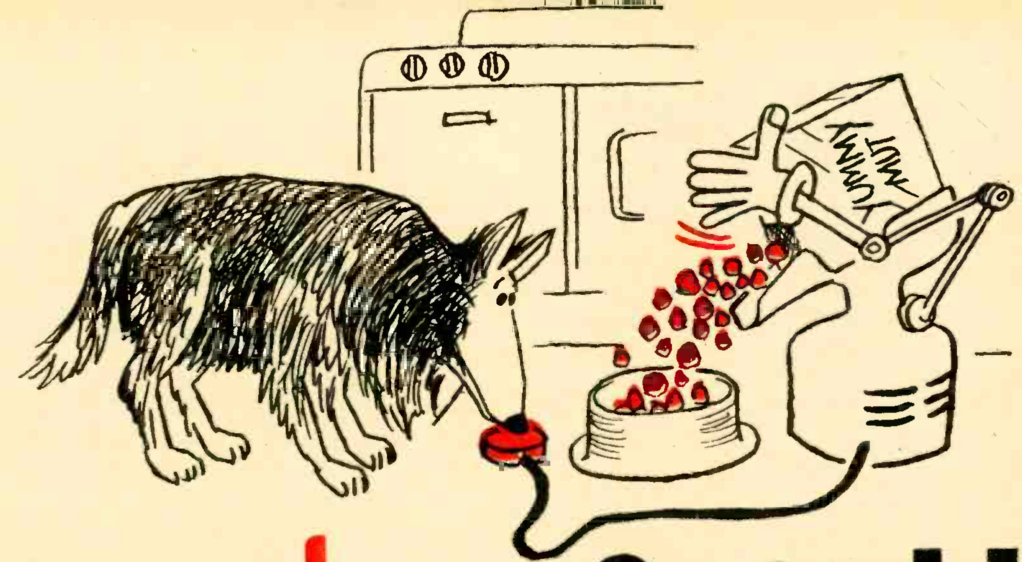


Ships seldom are provided with QSL cards, so the marine DXer should supply his own. Author included these cards with his reception reports of the Yankee and Queen Elizabeth. Ship officers verified reception by completing and returning the QSLs.



Touch to Switch!

Go modern! Instead of flipping switches, be lazy and just touch a plate.

By A. J. MOLINARA

PEOPLE get lazier every day. It seems whenever you turn around there's a new labor-saving device designed to make life easier. For example, did you know it's even possible to eliminate the strain of flipping a switch?

We got so exhausted from turning the lights on and off with a wall switch the other day that we built a gadget to spare ourselves even this exertion. Now, all we do is *touch* a small plate to control the lights.

Commonly known as a capacity switch, our gadget has many other practical applications. Amateurs, for instance, can put the sensing plate near the mike and use our touch switch as a transmit/receive switch. Install the switch's sensing plate at the front door and you have a light-touch doorbell button.

Put the sensing plate near the top of a tank or tub and when the water level gets too high a bell will ring. Install the plate near the ground at the back door and all Fido has to do is touch it with his nose to let you know he wants in.

You have an option when building our touch switch. Our design includes a latching relay (RY2) to keep, say, a light or bell on *after* you remove your finger from the sensing plate. To turn the light or bell off, you touch the sensing plate a second time.

If you are going to use the switch for a doorbell or a water-level alarm, eliminate RY2 and connect the bell circuit to contacts 3 and 4 on RY1. The doorbell then will stop ringing the instant you remove your finger from the sensing plate.

Construction. Our model is built on a 2⅞x5-in. piece of phenolic board. However, perforated board, plastic or bakelite will work just as well. If you expect to mount the circuit board inside a 4x6x2-in. chassis (Premier ACH-431), check the clearance before mounting the relays on the board.

Temporarily position the relays, terminal strips and transformer to determine where to drill mounting holes for them. Then mount these components. Install all wiring on the board before mounting components.

When installing diodes D1, D2, D3 and D4, hold the leads near the case with a pair of longnose pliers while bending them. If you simply hold the diode itself and bend a lead, the lead may break out of the diode's

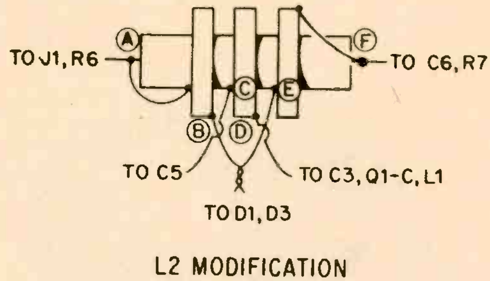
Touch to Switch!

body. Also, be sure to hold the pliers on the leads when soldering to dissipate heat.

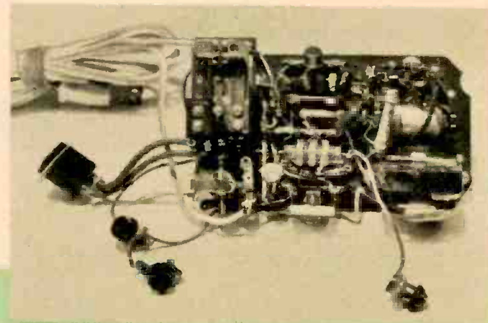
The cathode end of diodes D1, D2, D3 and D4 (marked with a + sign in our schematic and pictorial) is identified with a color band on the diode's body. Be sure to use 5 per cent resistors for R6 and R7 and the temperature-compensating capacitors specified for C3 and C4.

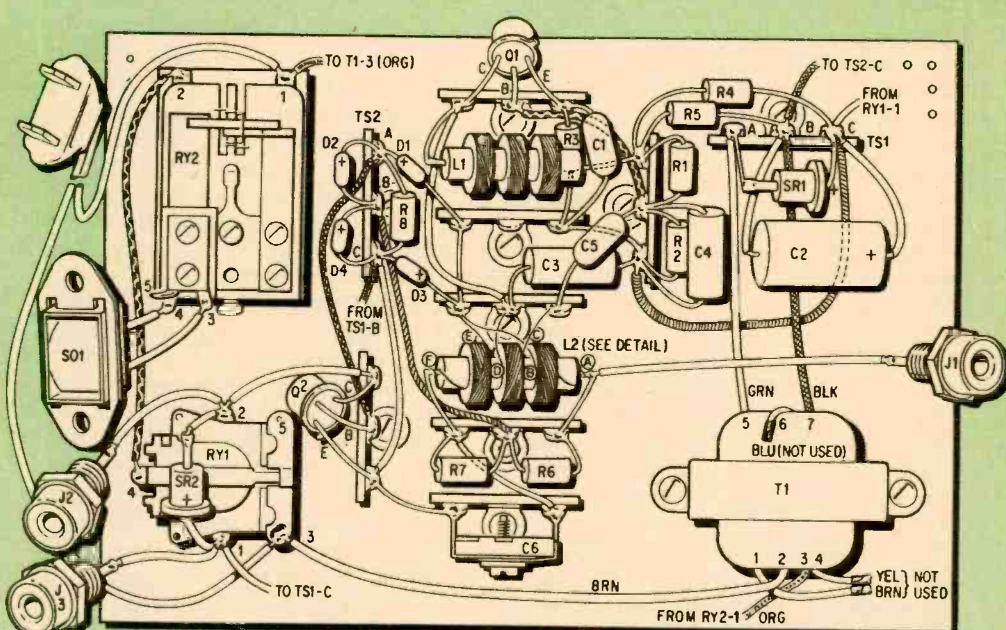
Coil L2 is a modified 3-section, 2.5-millihenry RF choke. The modification converts the choke into a transformer in which the center section becomes the primary and serves as the inductance in the RF oscillator circuit. The two outer sections become secondaries of the transformer and couple the RF from the oscillator to the four-diode bridge.

Take a look at the pictorial of the coil at the top of the second page of this article.

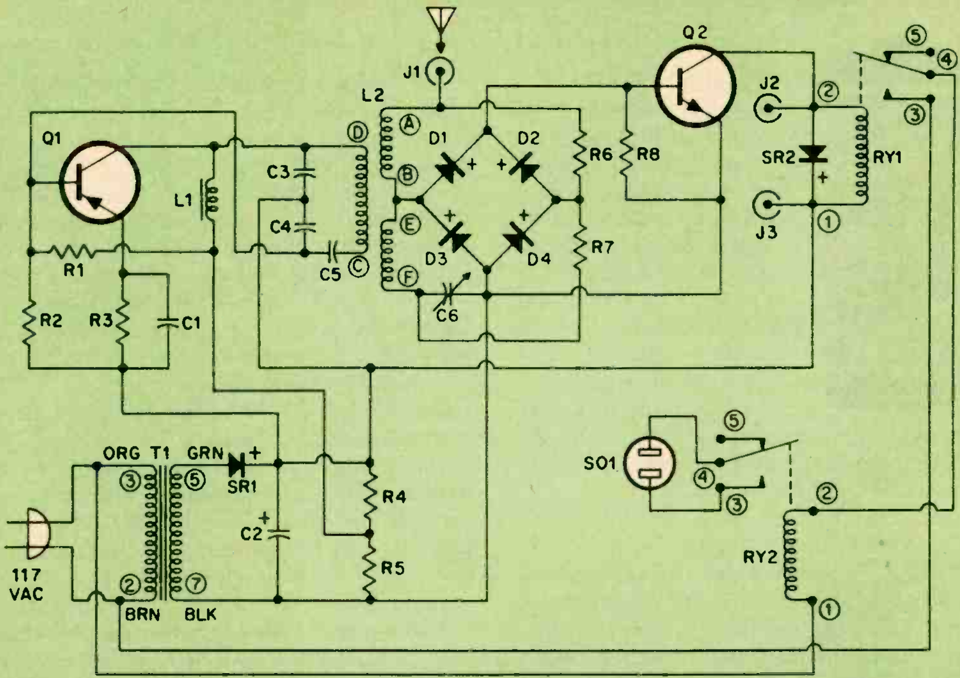


L2 must be a three-section, 2.5-millihenry RF choke. It is modified by breaking the wires between sections, unwinding them and soldering the wires from the left and right windings together.





Space is at a premium on the 2⅞x5-in. board shown in the photo above, so take care. Author used the brown and orange secondary leads of T1, across which the voltage was highest. Keep wires from L2 to D1-D4 and other parts short and mount capacitor C6 so it can be adjusted through hole in cabinet.



RF produced by Q1 is coupled to the two secondary windings of L2. If capacitances to ground at J1 and C6 are equal, voltage across diode bridge and Q2's base is zero. When J1 is touched, bridge is unbalanced and its output forward-biases Q2, causing it to conduct and energize, which then energizes RY2.

Break the wire between the sections and unwind a few turns from each section. Wires from the left and right sections are connected together. We have identified each wire with a letter and show circuit destinations.

Check-Out. First thing to do is determine if the RF oscillator is working. Plug in the touch switch and tune a broadcast radio placed nearby to around 800 kc. If the oscillator is working you'll hear it (the radio will go silent). The frequency isn't critical so long as you pick it up somewhere in the broadcast band.

If you are not going to mount the switch in a metal box, plug a 3-ft. wire with a 1-in. dia. plate on one end in J1. (If you *are* going to mount the switch in a metal box, hold off making the following adjustment until the board is installed in the box.) Connect a VTVM set to a low DC range to jacks J2 and J3. Using a plastic alignment tool, adjust C6 for the lowest voltage.

If you are going to mount the switch in the box, be sure to use spacers to keep the back of the circuit board away from the box. After mounting the board, mount jacks J1, J2 and J3 and SO1. Now, make the adjustment discussed in the preceding paragraph.

PARTS LIST

C1, C5—.01 mf, 100 V, 10% mylar capacitor
C2—50 mf, 50 V electrolytic capacitor
C3—240 mmf, 600 V temperature compensating (N750) tubular capacitor (Centralab TCN-220, Lafayette 33 G 2222)
C4—510 mmf, 600 V temperature compensating (N750) tubular capacitor (Centralab TCN-510, Lafayette 33 G 2231)
C6—9-180 mmf trimmer capacitor (Lafayette 34 G 6831 or equiv.)
D1, D2, D3, D4—1N34A diode
J1, J2, J3—Insulated pin jack or phono jack
L1—2.5 mh, 3-section RF choke (National R-50, Lafayette 32 G 5118)
L2—2.5 mh, 3-section RF choke (Modified National R-50; see text)
Q1—2N1305 transistor Q2—2N696 transistor
R1—22,000 ohm, ½ watt, 10% resistor
R2—2,700 ohm, ½ watt, 10% resistor
R3—100 ohm, ½ watt, 10% resistor
R4—3,900 ohm, ½ watt, 10% resistor
R5—1,500 ohm, ½ watt, 10% resistor
R6, R7—24,000 ohm, ½ watt, 5% resistor
R8—4,700 ohm, ½ watt, 10% resistor
RY1—SPDT relay, 2500-ohm coil (Potter & Brumfield RS5D, Lafayette 30 G 8599)
RY2—Latching relay; SPDT 5A contacts, 117 V, 60-cycle coil (Guardian IR-610L-C116. Available from Newark Electronics Corp., 223 W. Madison St., Chicago, Ill. 60606. Stock No. 24F098. $4.50 plus postage)
SO1—AC socket SR1, SR2—1N1692 diode
T1—Filament transformer, primary: 117 V secondary: 26 V @ .04 A, (UTC type FT-13, Lafayette 30 G 7129)

THE HAM SHACK

BY ROBERT HERTZBERG W2DJJ

EARLY BIRDS . . . Happy is the ham with a band gone dead —or somewhat dead, to to be more precise. The sort of deadness we're talking about has to do with relative quiet, and this you can have if you get up with the sun. The hisses, growls and clicks from neon signs, elevator controls and household appliances are miraculously absent. Ignition noise, if any, well may come from a solitary milk truck.

Anyone who thinks most hams are asleep at this hour is in for a surprise. Reason is that when it's 6 a.m. along the eastern seaboard, it's 11 a.m. in England and noon in France, Germany and the rest of central Europe. Fact is, the boys over there have been awake for hours. And do they roar in on 20!

One morning a few weeks back saw us part of a two-continent, three-way QSO. Other members of our triangle were F7GM, an American GI in Southern France, and a local lad who runs his kilowatt final early in the day before the neighbors turn on TV. F7GM was using one of those little Heath HW-32 transceivers with a simple wire antenna but his signals were as loud as those from the guy with the gallon.

Ancient History . . . Most fascinating document we've seen in some time is a copy of a 1909 Wireless Blue Book. Published by Hugo Gernsback, it lists several hundred U.S. and Canadian ship and shore stations and, more importantly, includes some 89 hams. Government regulation of wireless still was three years off so everybody, commercials and amateurs alike, picked their own call letters and wavelengths.

For instance, Neal Tate, of, Vacaville, Calif., simply was NT and operated on approximately 218 meters with a 2-in. spark coil. And Charles J. Meyers of Albany, N.Y., signed himself CJM and favored 175 meters with a modest 1-in. coil.

Interesting is the fact that we spotted the names of at least two chaps who still are active in the game. Come to think of it, they could be only in their early 70s, which really isn't old in this day and age.

Unwanted . . . More guys we can do without (THE HAM SHACK, May '65 EI) are those inconsiderate characters who plain don't respect directionals. Recently we heard G5TZ repeatedly call CQ Venezuela. Thing is, his carrier was hardly off before a couple of K2s and one W4 were hot after him. If he heard them, he did the only right thing and ignored them.

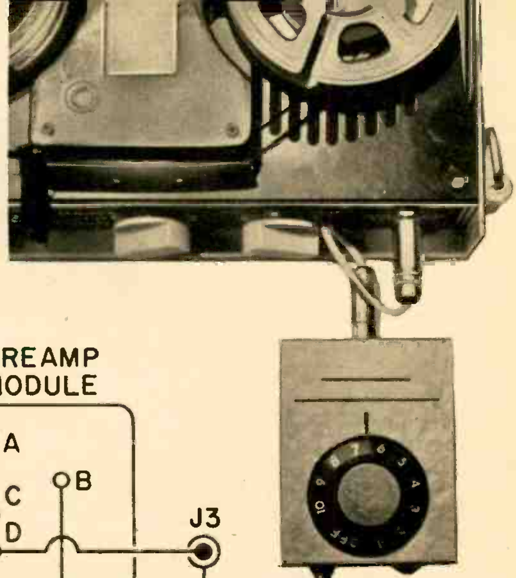
Who's A Ham? . . . Almost anybody, if our mail is reasonable indication. Typical letters that drift into The Ham Shack are from:

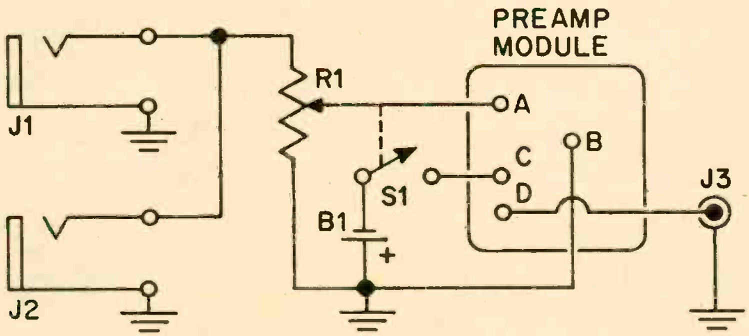
1) A busy physician who has a Technician license and can't seem to get his code

[*Continued on page* 110]

Known far and wide as the Skipper, Floyd Ziehl, W2RUI, of Lockport, N.Y., is what you might call a lazy op. To save himself the bother of switching frequencies, Floyd sports five separate and complete 1-kw transmitters — one for each major ham band. Skipper currently lays claim to more gear than many dealers carry in stock, though our photo shows only a fraction of the total.

PLUG-IN PREAMP





ONE big deficiency of many cheap tape recorders is low amplifier gain. This means that when the mike is located a distance from the source of the sound you end up wishing it were possible to turn the level control another 50 degrees clockwise. Since you can't you end up with a poor recording. And the amplifiers in these units often don't have enough gain for telephone pickup coils.

This modular preamp will solve the problem for low-Z (dynamic) mikes. Its cost is around \$6 and will at least double the input signal to the recorder. No modification to the tape recorder is required.

The wiring and parts placement in a 2¾x2⅛x1⅝-in. Minibox are not critical. The photo below shows the layout of our model. The instruction sheet furnished with the module shows an *inner switching lead* which should be ignored.

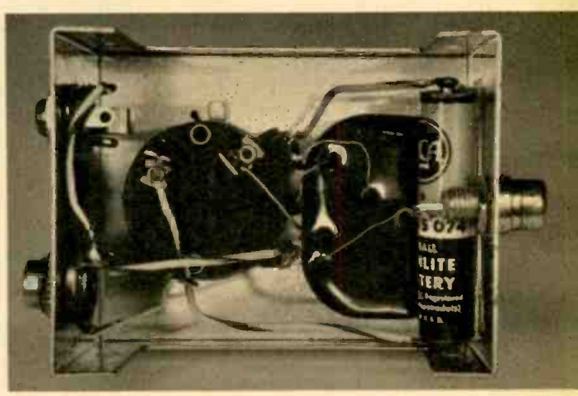
Two different size phone jacks (J1, J2) are provided to accommodate the most popular mike plugs. If your mike has a different plug, install a jack to mate with it. A phono jack (J3) is provided for output. However, you may connect a shielded output cable directly to lug D and ground. Put a plug on the other end of the cable to mate with your tape recorder's input jack.

All parts are installed in the main section of the Minibox. The preamp module and battery can be glued or taped in place.

Set the recorder volume control about halfway up and set the preamp's volume control all the way up. You'll make the best recording when the recorder's volume control and the preamp's control are in these positions.—*Fred Blechman, K6UGT*

PARTS LIST

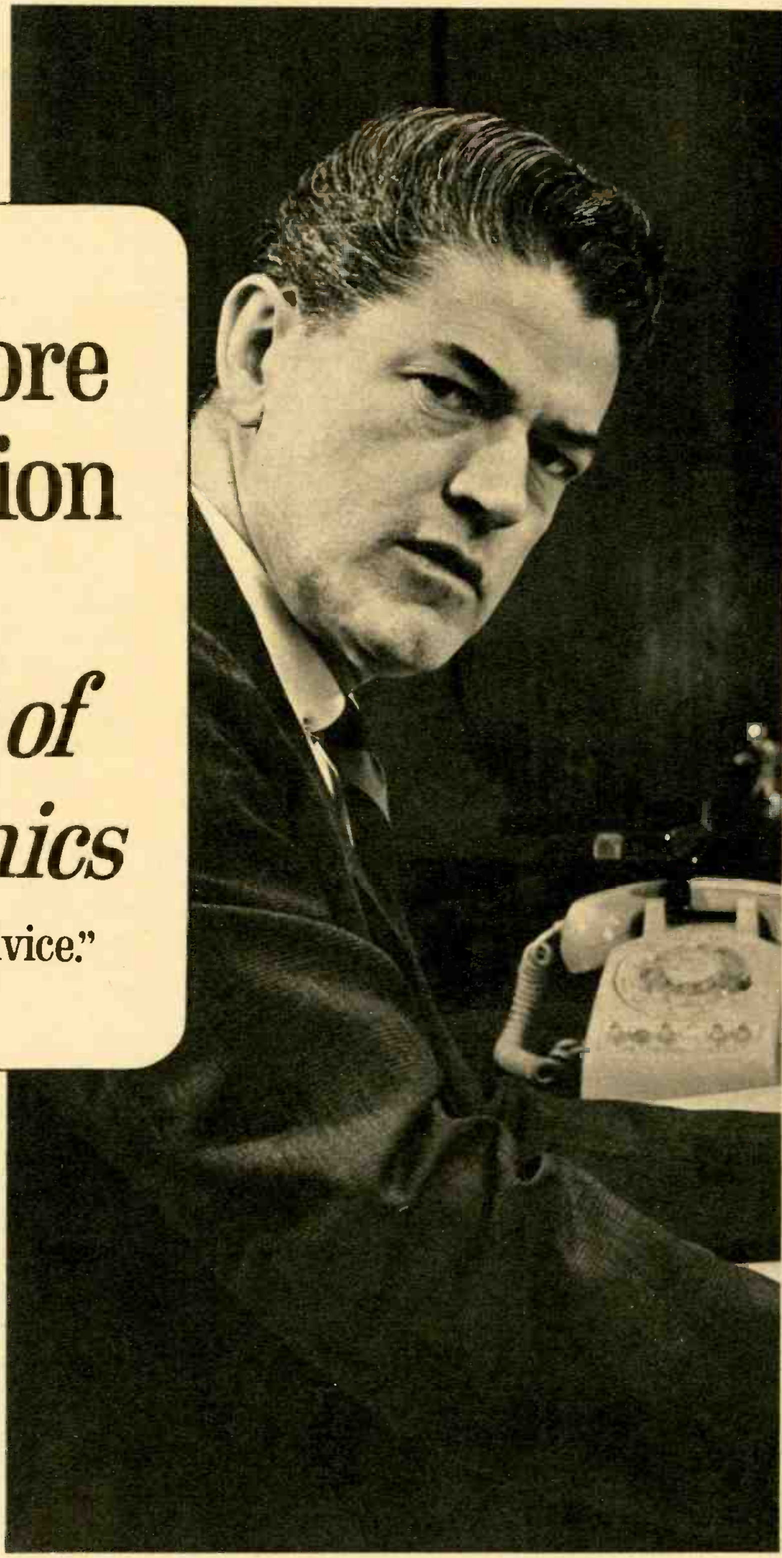
B1—1½ V size AAA penlite cell (RCA VS074 or equiv.)
J1—Phone jack
J2—Miniature phone jack
J3—Phono jack
R1—500,000 ohm audio-taper potentiometer
S1—SPST switch on R1
CB Microphone Preamp Module (Lafayette 19 G 1517)
Misc.—2¾x2⅛x1⅝-inch Minibox, knob, shielded microphone wire.



Standard phone jack is at lower left, miniature phone jack is above it. Output jack is at right.

"Get more education or *get out of electronics*

...that's my advice."



Ask any man who really knows the electronics industry. Opportunities are few for men without advanced technical education. If you stay on that level, you'll never make much money. And you'll be among the first to go in a layoff.

But, if you supplement your experience with more education in electronics, you can become a specialist. You'll enjoy good income and excellent security. You won't have to worry about automation or advances in technology putting you out of a job.

How can you get the additional education you must have to protect your future—and the future of those who depend on you? Going back to school isn't easy for a man with a job and family obligations.

CREI Home Study Programs offer you a practical way to get more education without going back to school. You study at home, at your own pace, on your own schedule. And you study with the assurance that what you learn can be applied on the job immediately to make you worth more money to your employer.

You're eligible for a CREI Program if you work in electronics and have a high school education. Our FREE book gives complete information. For your copy, airmail postpaid card or write: CREI, Dept. 1709C, 3224 Sixteenth Street, N.W., Washington, D.C. 20010

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GOOD READING

By Tim Cartwright

***MASTER ANTENNA TV SYSTEMS.** By Lon Cantor. John F. Rider, New York. 127 pages. $3.95*

Anyone looking for a bit of pocket money or perhaps for a small business of his own well might investigate the subject of master antenna systems. Judging from the mediocre pictures to be seen in motel rooms and even in TV showrooms these days, existing facilities offer opportunity for lots of improvement. And, of course, there are all kinds of likely places where no master systems exist (and where nobody gets decent reception with individual antennas).

Tightly written and effectively illustrated, this informative little volume crams a good deal of useful information into an easy-to-read format. Included are short chapters on background music and CCTV, as well as CATV. And if you have doubts that the field is lucrative enough to bother with, take a look at the opening chapter on the economics of master systems.

***TAPE RECORDING THE SOUNDS OF YOUR LIFE.** Robins Industries, Flushing, N. Y. 127 pages. $1.35*

Here's a pocket-size volume you ordinarily might skip over on a book rack because of its unimpressive, amateurish appearance. But amateurishness is this book's real value. The contributors all seem to be tape enthusiasts who have discovered for themselves the many things you can accomplish with a recorder. And chances are you'll find some of the suggestions brand-new—and fun in the bargain.

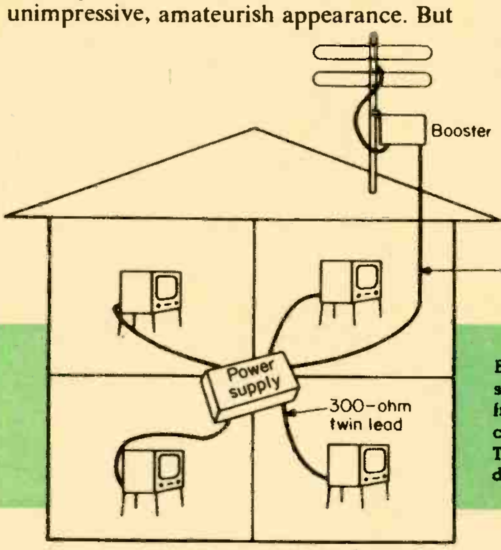
Included are sections on how to make use of a recorder on vacation, how to liven up a party with tape and how to pick out the ordinary day-to-day things in your life that well may be worth taping. Everything from writing to appearance is far from slick, but this still may be an enjoyable little book for a good many people.

***RADIO SERVICE TRAINING MANUAL.** By Edward F. Rice. Howard W. Sams & Bobbs-Merrill, New York & Indianapolis. 288 pages. $4.95*

This one comes through on most counts with flags flying. A practical guide that's not skimpy on necessary theory, it also is well-enough organized to steer a serviceman to the right diagnosis and cure in pretty short order.

On the whole, its material is neither obsolete (a welcome change) nor inaccurate. Fact is, the book even covers stereo FM—a subject avoided like the plague by most writers of service books—in reasonable detail. Illustrations, including programmed service charts, are good.

[*Continued on page* 111]



Best way to operate several TV sets off a single antenna is with a booster, since losses frequently are so great that a multiset coupler can't cope. Our illustration, taken from MASTER TV ANTENNA SYSTEMS, discussed above, depicts a typical four-set home installation.

A HANDBOOK OF AUTOMOTIVE ELECTRONICS

By PAUL HERTZBERG, K2DUX

LIFE blood of the automobile always has been the flow of electric current through the many circuits that enable the car to operate. But contrary to popular belief, the battery scarcely can be considered the most important component in this complex system of electrical veins and arteries. Rather, it is the generator or alternator that supplies the necessary power to keep both the car and its many accessories operating smoothly. The battery merely goes along for the ride and is pretty much dead weight while the car is running.

Nonetheless, because the battery is our electrical reservoir, it is deserving of at least passing inspection. The battery consists of sheets of lead hanging in a solution of sulphuric acid, which we call the electrolyte. Sending a flow of electric current into its leaden plates charges the battery.

Conversely, taking current from the battery discharges it. This action releases a flow of electrons to form what we call electricity. The battery's primary function is to start the engine; it is not needed during normal running of the car.

In actual fact, it matters little as to how we start the engine. One means always would be to park on a hill, then rely on gravity to set the car in motion. Mechanical linkage between wheels and engine then would turn the engine over and spin it to life.

Another way would be to use a hand crank (remember those antiquities?) which would rely on elbow grease rather than gravity to accomplish the

AUTOMOTIVE ELECTRONICS

same end. While both these techniques have been employed, each calls forth the ancient era when cars were competing with horses and Henry Ford was making his Model T. Modern way to start a car is electrically to crank the engine with a battery-powered motor.

Turning the ignition key in modern-day cars activates a heavy-duty switch called the starter solenoid that connects the battery to the starter motor. During the few moments while the starter is engaged, the battery is called upon to deliver a tremendous amount of energy. Current drain from the average 12-volt battery well may be as high as 75 amperes.

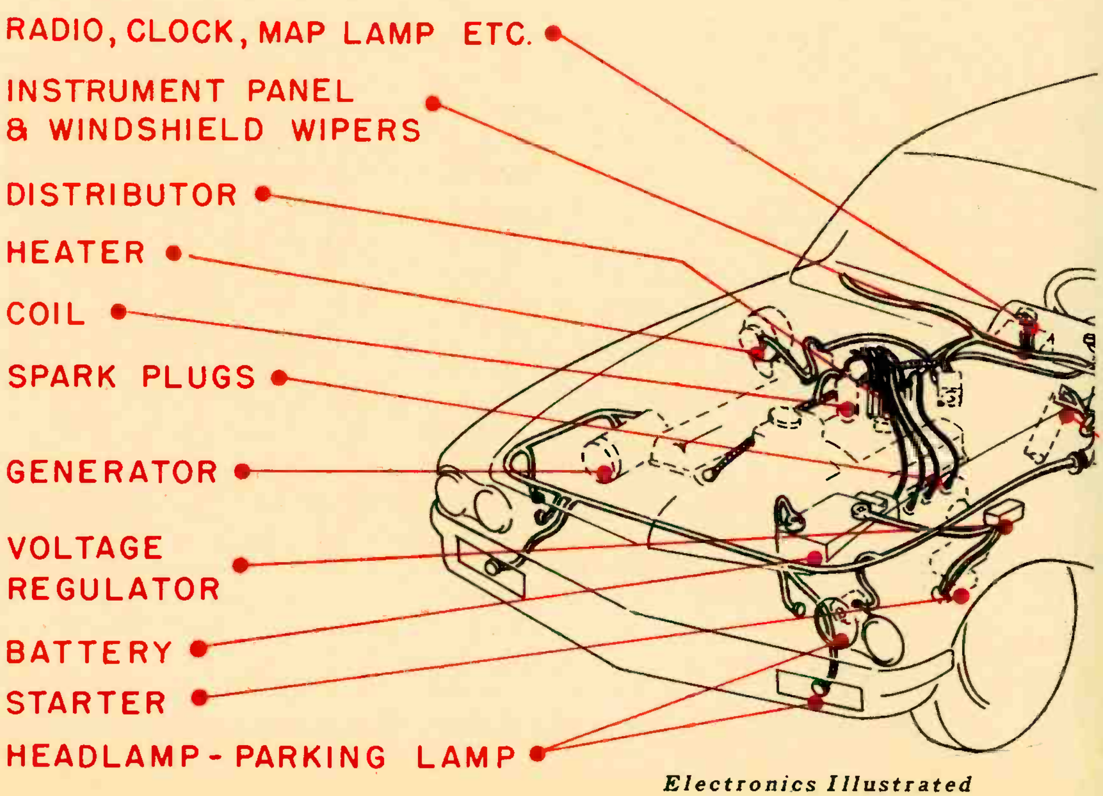
Cutaway view of a modern automobile reveals startling complexity of electrical system. Heart of the hookup, the battery, does little but start engine.

Stopping and starting the engine soon would drain the battery to the point where it no longer would supply electrons. In order to maintain the battery in a fully-charged condition, electric current must be put back in. A battery, in short, is nothing more than a reservoir of electro-chemical energy. The device that refurnishes its supply of electrons is the generator (or alternator).

Soon as the battery is charged fully, it is disconnected from the car's electrical system by a device known as a voltage regulator. The voltage regulator is the computer of the charging circuit; it compensates for the generator's characteristics which might cause damage to the battery and electrical circuits.

If the generator weren't running, its windings would appear as a dead short across the battery. Therefore, a cut-out relay is provided to disconnect the generator from the battery any time the engine is turning slowly—being started or idling, say.

Further, if the generator were connected directly to the battery when running, it conceivably could deliver charging current well in excess of 25 amperes—charging current being roughly proportional to engine speed.



And though the generator could be designed to deliver most any current, the battery well might overheat if fed too much current in too little time, either shortening its life or literally burning it up. Therefore, a current regulator is provided in order to limit the generator's output to a safe level both for the battery and the generator.

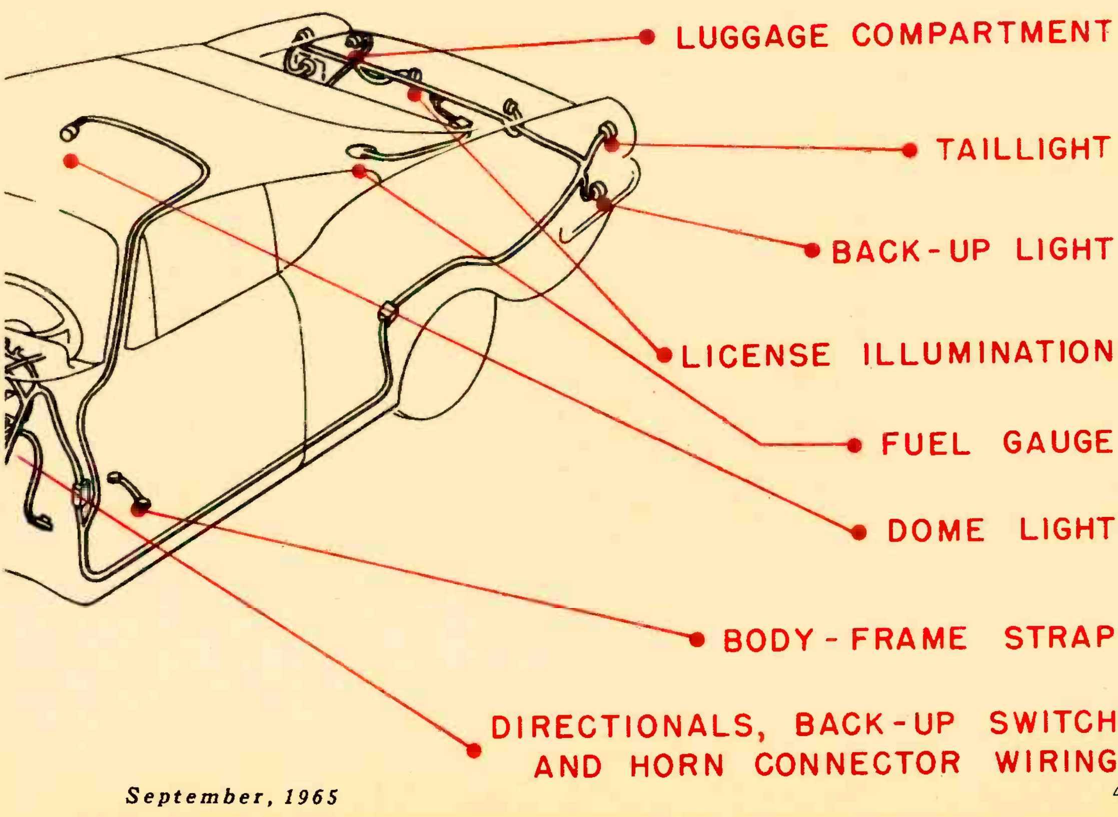
Still another aspect of a generator's operation which requires control is its output voltage. At high engine speeds the generator's output may exceed 20 volts, which is more than enough to burn out the ignition system, car radio and lights. Therefore, the voltage regulator includes a voltage-limiting circuit. Actually a resistor switched in and out of the generator's field winding, this device limits the generator's output to a safe value of about 14.4 volts (7.2 volts for 6-volt systems).

All generators, incidentally, produce electricity by passing wires through a magnetic field. This operation is based on the familiar principle of electromagnetic induction in which passing a conductor through a magnetic field causes electricity to flow in the conductor.

The generator rotor is coupled to the engine crankshaft by the fan belt. When the engine is running, a part of the generator called the armature (consisting of many windings of wire on a shaft) is spun inside a large magnet (the field coils affixed to the inside of the generator housing). Alternating current is produced in the armature, but only electrical pulses flowing in a given direction are collected. Result is that the output from the generator is DC.

This current is used to charge the battery and operate the car's electrical system. Only drawback is that the engine must be turning at greater than idling speed for the generator to produce usable output. Matter of fact, the generator begins to deliver output only after engine speed reaches about 1,000 rpm (roughly equivalent to a 10-mph road speed).

The increasing number of electrical gadgets (of which CB transceivers, tape players, cigarette lighters, even air conditioners form more than a small part) has served to intensify the generator's shortcomings. Fact is, it's more necessary than ever that cars have adequate sources of electrical power. A plethora of accessories frequently steal starting power from an already over-



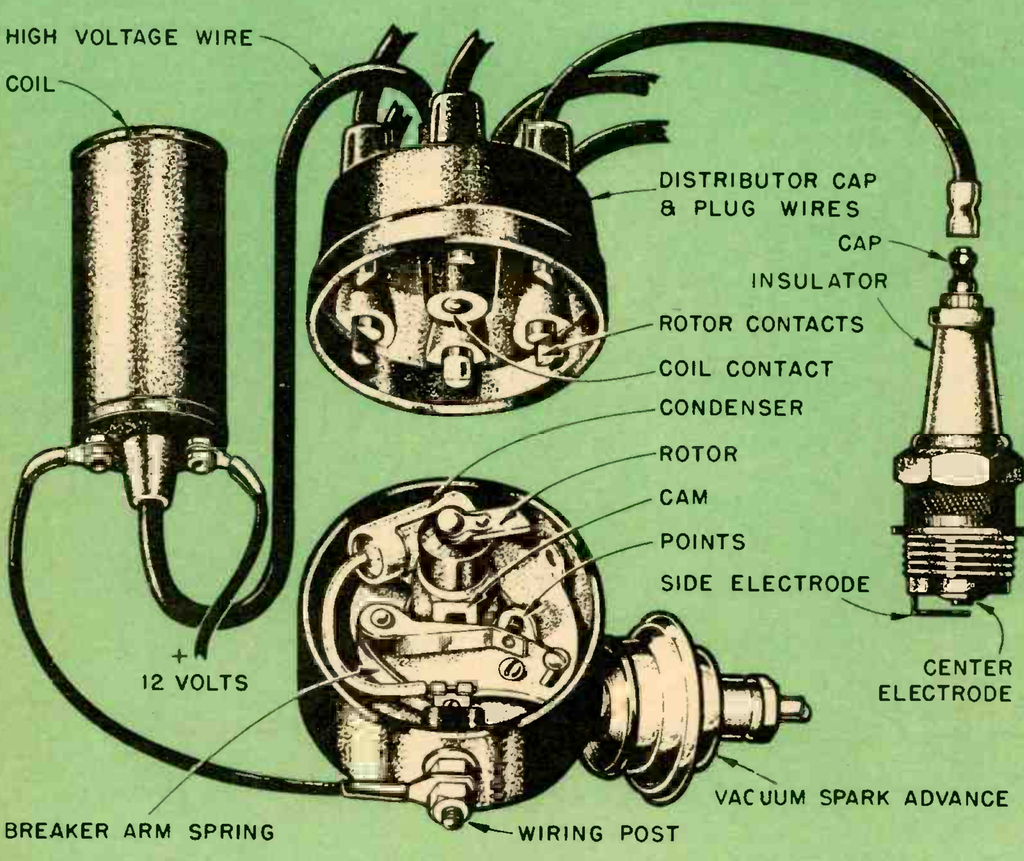
AUTOMOTIVE ELECTRONICS

taxed battery, especially at low idling speeds when generator output well may be non-existent.

In 1960, the Chrysler Corporation found the answer in an electrical device which had been around since the early days of power generation—the alternator. Reason no one had thought of using this device before stems from the fact that it generates AC and a car's electrical system operates on DC. This required that the AC be changed to DC (rectified) if the alternator were to replace the generator.

Modern high-current silicon diodes were able to solve this once-major problem nicely. Anyone with just a smattering of electronics knows how easily and efficiently these little wonders convert AC to DC. End result is a potent and reliable source of DC at most any engine speed. Some alternators can deliver 25 or more amperes at engine idling speeds and up to 100 amperes at engine speeds encountered in normal driving.

By using a rotating field and a stationary armature (called a rotor and a stator, respectively), an alternator can deliver much higher



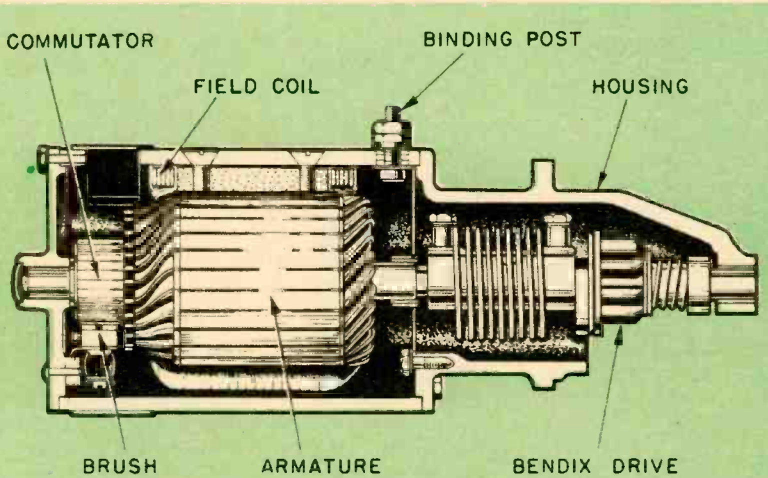
Conventional ignition system converts continuous low-voltage current into pulsating current in distributor (center). Current then is transformed in coil (left) to high voltage, only to be returned to distributor. Driven by cam, rotor in distributor acts as switchboard to fire proper spark plug (right) at proper time.

charging current than can a generator. Problem with the generator is the rotating armature in which its voltage is developed. Carbon brushes pressing against the commutator can collect only limited amounts of current.

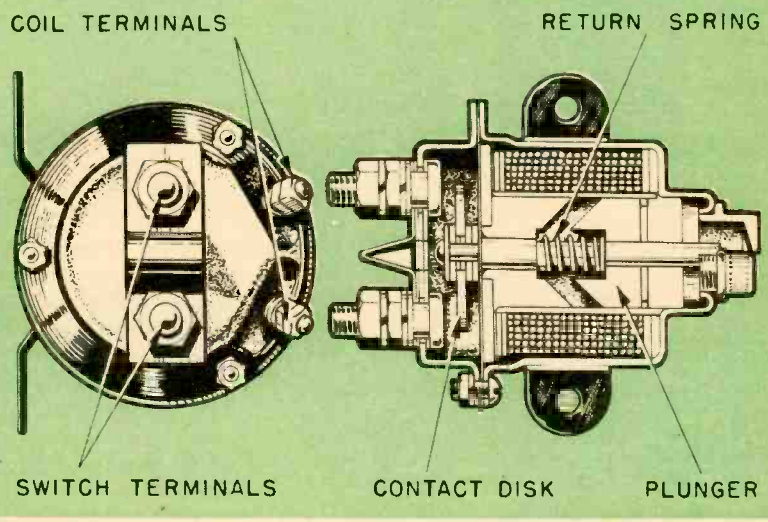
But an alternator induces the voltage it develops in the fixed stator windings which are wound in three phases. This permits much more current to be drawn because there is no electro-mechanical connection needed to collect the generated voltage. Further, the three-phase winding produces substantial current even when the engine is turning at idling speeds. Result is that batteries last longer and behave more dependably when it comes to doing what actually is their most important job—starting the engine of a car.

The alternator is relatively maintenance-free and has proven very reliable. Matter of fact, human error has been principle cause of its rare downfall. The protective diodes easily are destroyed should a garage mechanic connect battery-charger leads backwards (plus to minus and minus to plus). Same thing can happen when a battery is being used to start the engine on another car, should the jumper cables inadvertently be connected backwards. Touching the output lead or terminal to chassis ground also can burn out the diodes.

So far we've seen what's involved in starting the engine and recharging the battery.

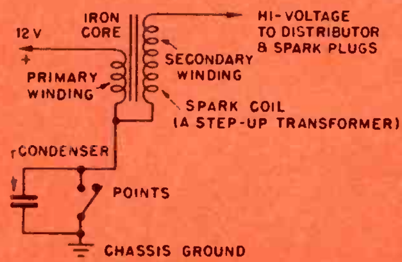


Starter motor makes heaviest demands on battery of any automotive electrical device, drawing currents as high as 75 amperes. When starter motor is energized, Bendix drive (see callout) engages teeth on engine flywheel and turns over engine until it starts.

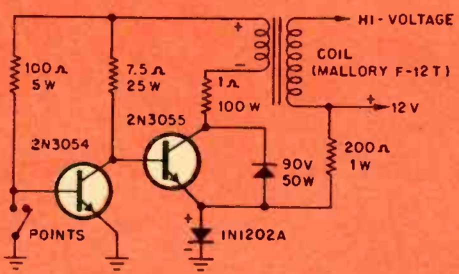


Starter solenoid is nothing more than a simple relay used to switch the large current flowing between starter motor and battery. A single key ordinarily turns on both the ignition system and the starter motor. However, the ignition switch itself operates the solenoid, and this, in turn, connects starter motor to the battery.

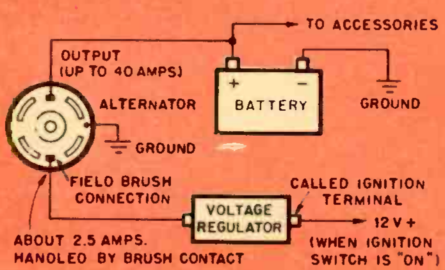
AUTOMOTIVE ELECTRONICS



Schematic diagram shows electrical hookup of coil, condenser and points. As diagram indicates, coil actually is a transformer. Condenser readies coil primary to accept next pulse.



Transistor ignitions substantially reduce current flow through points. Breaker points now control small current in transistor base circuit with transistor handling the heavy stuff.



Battery, alternator and voltage regulator work in harmony to keep circuit-voltage constant and battery charged. System is in balance only during periods when engine is running.

Now let's see how we keep the engine running by use of an ignition system. From the time of the Model A until very recently, ignition systems underwent almost no change. They consisted of spark plugs, a high-voltage coil, a distributor with its breaker points or contacts, a condenser and a source of current—the battery.

As readily can be appreciated, the breaker points always have been weakest link in the chain. At highway speeds, the contacts open and close over 200 times a second. Heavy currents through them cause bridging or building up of small metal deposits on the contact surfaces. Oxidizing also can result in the formation of insulated layers on the points. After a few thousand miles, wear and aging take their toll, performance drops off and the engine just may stop running.

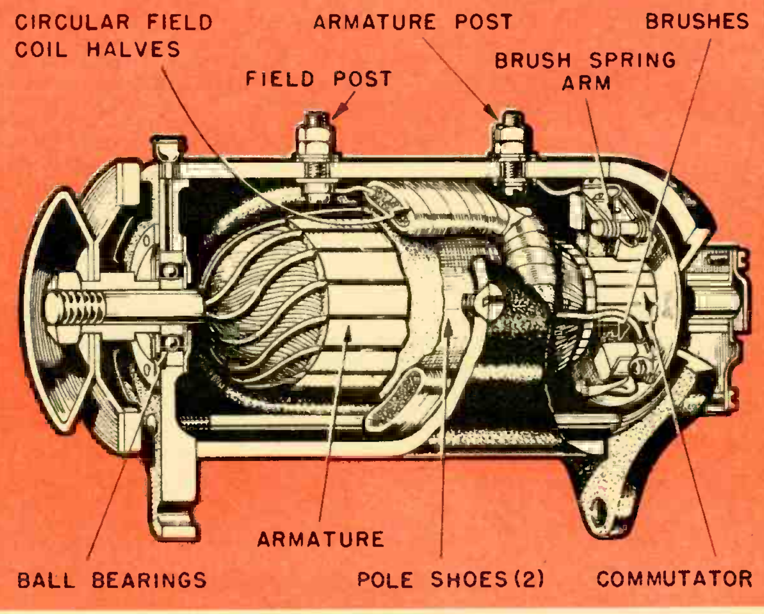
One answer has been the introduction of power transistors electronically to switch the high currents normally flowing through the points. In such a setup, the points handle a minute current that controls the transistors. Bonus is little oxidizing or metal transfer on the points. Wear and aging are minimal, and only slight adjustments may be necessary over a very long period of time.

Power transistors can switch large currents and this opens the door to using so-called hot coils with outputs of up to 40,000 volts. Voltages of this magnitude can fire spark plugs in ultra high-compression engines, in extremes of weather and temperature and even may make up for slight irregularities in timing.

Still another advantage is that the fast switching action of the transistor allows a greater build up of magnetism around the primary winding of the spark coil. This in turn results in greater output when the magnetic field collapses and induces a voltage in the secondary winding.

Transistor ignition dependably will give constant high output through all normal driving speeds. Race car drivers find it easier and safer to maintain high engine speeds because of the greater reliability transistor systems offer. Improved acceleration and increased engine RPM also may be counted among the advantages of transistor ignitions.

The small condenser located under the distributor cap in the conventional ignition system isn't used in a transistor system since it would serve no real purpose. However, the automotive role of a component familiar to



A generator and a starting motor are so similar that some auto manufacturer some day well may find a way of combining both functions in one unit. With drive arranged to engage flywheel teeth, unit would spin engine when power was applied and generate electrical power after engine was running.

all electronics hobbyists is interesting in itself, since this just might be one of the condenser's most unusual applications.

Perhaps the least understood part of the automotive ignition system, the condenser consists of two strips of tin foil separated by a sheet of waxed paper rolled up and encased in a small metal cylinder. One foil strip makes contact with the metal cylinder and the other is brought out as a single insulated wire lead. The case is connected to the car chassis (ground) and the lead wire is connected to the ungrounded terminal of the points.

When the primary current to the coil drops (points open), the magnetic field that collapses across the primary coil may generate as much as 150 volts. The condenser becomes charged, preventing any more magnetizing of the coil.

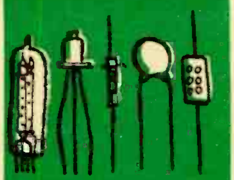
The magnetic field now can collapse very rapidly past the secondary winding, inducing a very high voltage (10,000 to 20,000 volts). The condenser then discharges through the primary circuit. All this tends to reduce point arcing and demagnetize or neutralize the coil to prepare it for the next build-up. The entire process takes about 1/10,000 of a second.

Speaking of capacitors, it is worth noting that a system called capacity discharge appears to be the coming thing for automotive ignitions. A direct development from the transistor ignition just described, capacity discharge puts capacitors back in the ignition driving seat and makes even transistors seem old-fashioned.

Also to be kept in mind is the fact that the electrically-operated accessories in the modern car actually are at cross purposes with an automotive electrical system's prime purpose of keeping the plugs sparking and the battery charged. For this reason, the alternator alone well may prove only temporary solution to the constantly increasing demand for automotive electrical power. Tomorrow's cars quite possibly will be equipped with auxiliary power plants whose sole function is to feed electrical accessories.

Thus, while the automobile still serves the same basic function it always has—to provide a means of transportation—the electrical side of the car is a far cry from what it was only yesterday. The engine still propels the car and the car still moves on wheels. Thing is, the electrical system has been restyled and refined, and its efficiency has increased many fold through use of modern materials and technology.

Next time you get into your car, pause and think about all the electrical devices you set in motion the second you turn the key in the ignition switch. A car truly is an electronic powerhouse on wheels.



BEGINNER'S PAGE

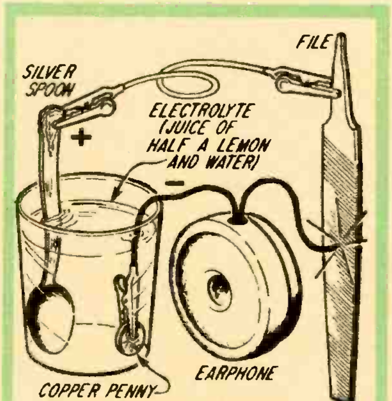
Lemonade Battery

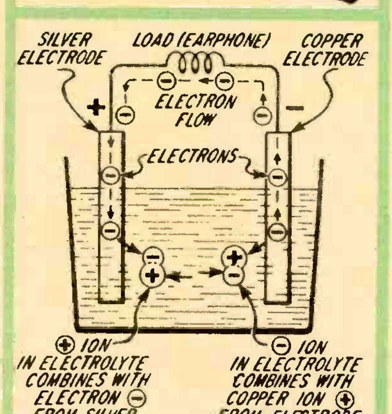
MANY people carry a hidden battery with them and can be made painfully aware of it by biting on a piece of aluminum foil. If your teeth have deep fillings there's a good chance you'll feel an uncomfortable twinge or a bitter taste. Reason for the sensation is that two dissimilar metals, aluminum and gold or silver, in an electrolyte (saliva) produce a chemical reaction which generates current.

You also can make a classically-simple battery with the juice of half a lemon, a glass of water, a copper penny and a polished silver-plated spoon. Squeeze the lemon into the glass of water, then immerse the spoon and penny with leads attached, as shown.

While listening with a high-impedance phone (2,000 ohms or greater), lift the spoon out of the solution and tap it on the surface. The clicks each time the spoon touches the solution indicate the presence of electricity. Clip one battery lead to the end of a file, then drag the other phone lead over the file. You should hear the same sound you'd hear directly from the file. Substitute an electrolytic capacitor (positive lead to spoon) for the phones. You'll hear a distinct click when you disconnect the charged capacitor and connect it to the phone leads.

Voltage is generated because of the interaction between electrolyte and the electrodes. Since copper is more active chemically than silver it puts more positive ions in the solution than silver. This leaves the copper with a surplus of electrons and that makes it into the negative terminal. The silver becomes the positive electrode because its lower level of chemical activity results in fewer of its ions going into solution.

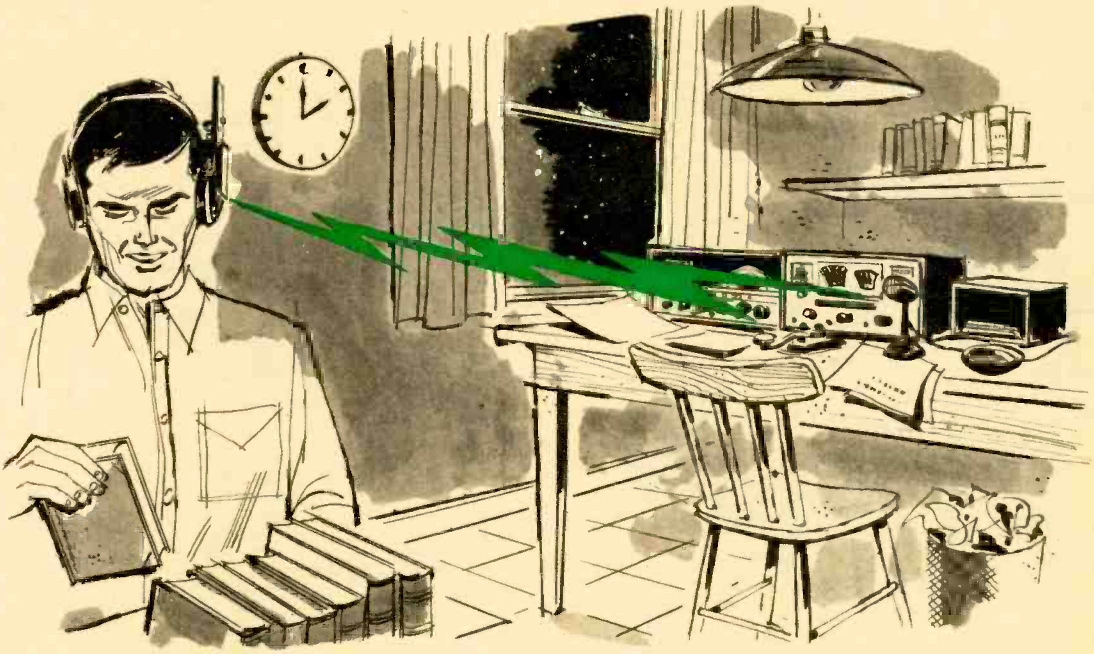




The lemon juice, which is about 6 per cent citric acid, becomes ionized when placed in water. That is, its molecules break apart and become a source of mobile positive and negative ions. An electron from the copper electrode travels through the external circuit, then down the silver electrode. The electron is snapped up by a positive electrolyte ion. At the other side of the cell, a negative electrolyte ion combines with positve copper ion that is dissolving into solution. This internal action causes a continuous electron flow in the external circuit.

A microammeter across the cell should indicate about a 60-microampere current. The voltage across the electrodes is about 0.3. Substitute a strip of clean aluminum for the spoon. Since the aluminum is more active chemically than copper, electrode polarity will reverse. That is, the aluminum will be the negative electrode.

Although home-made cells are primarily for experimentation, they can be put to practical use. The silver-copper cell develops enough power to operate a one-transistor audio oscillator with earphone output. Somewhat higher current capacity is possible by increasing the electrode surface area. The voltage can be increased by wiring several cells in series.—*H. B. Morris*



Wireless Headphones

Enjoy private listening with freedom to roam with no trailing cord.

By JIM KYLE, K5JKX

LATE-HOUR DXing keeping the family awake? Or maybe they hate jazz and you just can't hear enough of it? The best way to keep peace is to listen privately with headphones. But, convenient as they are, headphones literally tie you to the equipment. A long connecting cord, of course, will let you walk around while you listen, but then you're likely to get tangled or to go a bit too far and pull the receiver off the table.

The solution—wireless headphones. Just string a loop of wire around the room and hook it to the output of a radio or amplifier. Put on your wireless phones and start walking. You'll hear everything as you would with a direct connection.

The idea behind our wireless headphones is quite simple. The loop of wire around the room (under the carpet or behind molding) acts as a transformer primary. A high-inductance, ferrite-rod antenna on the receiver you carry on your headphones acts as the transformer secondary. The receiver's transistor amplifier boosts the signal level to drive the phones.

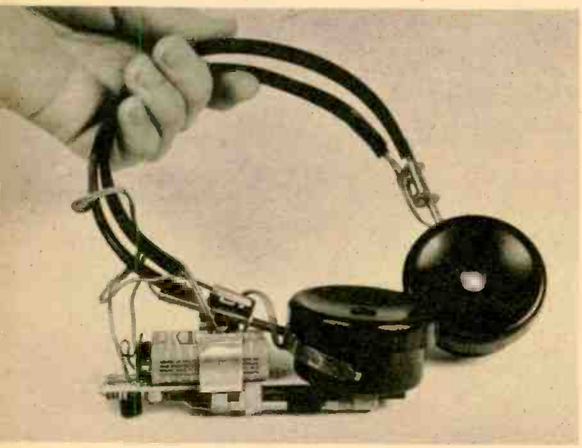
You might think you'd hear 60-cycle hum from house wiring but this doesn't happen. The reason is that the 60-cycle hum field is electrostatic. The headphone receiver picks up only the inductive field set up by the loop of wire.

Construction. We show plans for two receivers—one for high-impedance phones and one for a low-impedance earplug-type phone. But let's get the loop of wire out of the way first. It consists of ordinary enameled or insulated wire wound around the molding of the listening room or rooms.

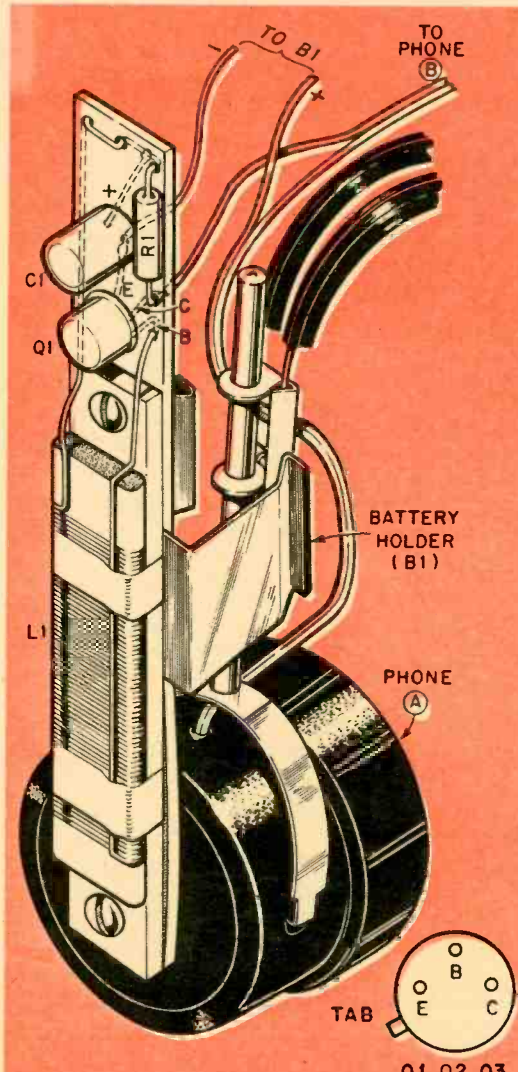
For best results, the resistance of the loop should be the same as that of the speaker now connected to your receiver. Our table shows wire and room sizes and the number of turns required for output impedances of 4, 8 and 16 ohms. For special applications, keep in mind that the resistance of No. 26 wire is 0.04081 ohm per foot and the resistance of No. 22 wire is 0.01614 ohm per foot.

The high-impedance headphone receiver is built on a ¾-in.-wide by 5-in.-long piece

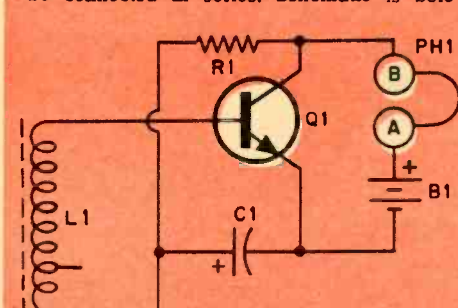
Wireless Headphones



Receiver for high-impedance headphones is built on perforated board which can be either bolted or cemented with epoxy to either of the phones.



One-transistor receiver is built on a ¾-in.-wide by 5-in.-long piece of perforated board. Examine inside of phone before drilling to find a clear area for mounting screw. Phones should be connected in series. Schematic is below.



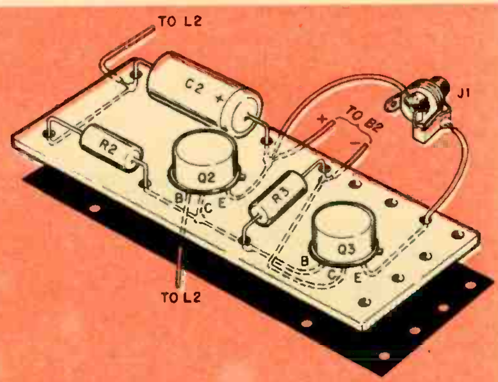
of perforated board. The board can be bolted directly to one of the phones as shown in our photo and pictorial. If you choose this mounting method, remove the phone's cover plate and diaphragm and look for a clear spot before you drill through the case.

Or you can glue the perforated board to the back of the phone with epoxy cement. After the board is attached, mount the ferrite-rod antenna (do not substitute a different antenna for the type we specify). Mount transistor Q1, resistor R1 and capacitor C1 by threading their leads through holes in the board.

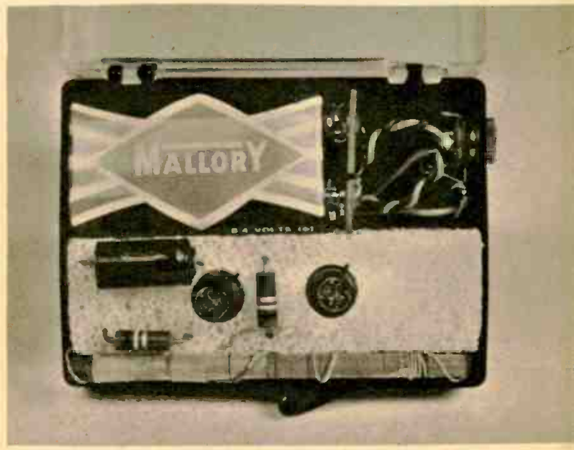
Do not cut the antenna's leads since they are litz wire, which is difficult to strip and solder to. Thread excess antenna wire through holes in the board to get it out of the way. Wrap the tap lead around the rod and tape it out of the way.

Remove the existing cord from the headphones and install a new one just long enough to reach over the headband from one phone to the other. Wire the two phones in *series* and connect one lead to Q1's collector and the other to the positive battery terminal. A switch is not included—just disconnect the battery clip to turn off the headphones.

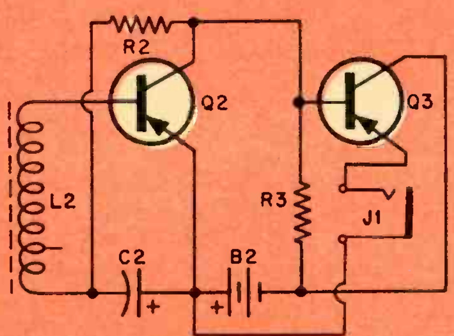
The receiver for a low-impedance (8-ohm) earplug phone has an extra transistor to provide additional gain. The receiver can be built in the 1x2x3-in. plastic box in which



Two-transistor receiver for low-impedance phones is shown built on a ¾x2⅞-in. piece of perforated board. Put spaghetti insulation on all leads that cross each other on back of the board.



Author built his two transistor receiver on a piece of Styrofoam. Leads pass through material easily but may come out in surprising places.



Schematic of two-transistor, low-impedance phone receiver. Because phone is less sensitive, Q2 is required to provide extra gain. Be sure to disconnect battery when receiver is not in use.

PARTS LIST

- B1, B2—9 V transistor radio battery (Eveready 216 or equiv.)
- C1—30 mf, 15 V electrolytic capacitor
- C2—50 mf, 15 V electrolytic capacitor
- J1—Miniature phone jack
- L1, L2—700 microhenry ferrite-rod antenna (J. W. Miller type 2005. Available from Newark Electronics Corp., 223 W. Madison St., Chicago, Ill. 60606. Stock No. 40F157. $1.80 plus postage. $2.50 minimum order.)
- Q1—2N1302 transistor
- Q2, Q3—General Electric type GE-2 transistor (Page 221, Allied Catalog No. 240; $1.20 plus postage.)
- R1—220,000 ohm, ½ watt resistor
- R2, R3—100,000 ohm, ½ watt resistor
- PH1—2,000 ohm, dual headphones (Allied 86 S 083 or equiv.)
- Misc.—No. 26 enameled wire (approx. 650 feet per ½ lb.) or No. 22 enameled wire (approx. 250 feet per ½ lb.), battery holder, battery clips, plastic box, perforated board, 8-ohm earplug phone.

the phone is packaged. Our receiver is built on a small piece of Styrofoam but you could use perforated board, as is shown in our pictorial. Again, wrap the excess-length antenna lead around the antenna.

Operation. Connect the loop to the output terminals of the equipment you'll want to listen to and adjust volume with the volume control. You probably will find the control has to be set a bit higher than it normally would be for speaker listening. The loop gives best results when about 1½ to 2 watts of power is fed into it.

Volume will be loudest when the antenna rod is at right angles to the plane of the loop —that is, when the rod is vertical. The closer the rod to the loop, (except when you're directly over or under the loop, when you won't hear anything), the louder the volume. Signal strength falls off rapidly as you move out of the room.

Number of Turns in Loop

Room Size (ft.)	Receiver Output Impedance		
	4 ohms	8 ohms	16 ohms
6 X 8	3	7	13
8 X 8	3	6	12
9 X 12 10 X 10	2	5	10
12 X 12	2	4	8
15 X 15	4*	8*	6
15 X 20	4*	8*	6
20 X 20	3*	6*	5
25 X 25	2*	4*	4

All wire No. 26 except (*) which is No. 22

The LISTENER

C. M. STANBURY II

PROBLEM QTHs . . . Most QSL cards give an SWL the full scoop on a station. Frequency, power, date and the like are spelled out as plainly as Yankee Go Home on a French wall. So, too, with QSLs from that center of Russian Redism, R. Moscow (we show the latest version in our illustration). An R. Moscow QSL definitely verifies reception, specifies frequency, time, date and at least implies that the location is Moscow. Thing is, it's this implication that can provide a few surprises.

In actual fact, most of R. Moscow's transmitters likely are located neither in Moscow nor even in the Russian S.S.R. itself. In DX circles, however, each Soviet Socialist Republic counts as a separate country. And location—QTH—can prove a real stumbling block for anyone who wishes to pin down R. Moscow's true whereabouts.

For example, one DXer we know came up with a verie from R. Moscow's 9720-kc beam to our Pacific coast. This done, he snagged a verie from R. Yerevan (Armenian S.S.R.) which, interestingly enough, was using the same channel—9720 kc. Truth is, both broadcasts almost certainly came from the same transmitter and the real location probably is Siberia.

This situation becomes still worse when you consider R. Moscow's regular North American Service (intended for the Eastern and Central parts of our continent). Transmitters for this service well may be located completely outside the U.S.S.R. The transmission on 9570 kc in this service most likely comes from Bucharest, Romania, and the one on 9560 from Sofia, Bulgaria.

To be sure, each Soviet city pretty well sticks to certain fixed channels on the lower frequencies. When it doesn't, the Reds usually divulge its actual location. For example, when R. Moscow rolled through on the broadcast band (935 kc) last winter, DXers were able to establish that the signal came from Lvov, Ukraine. Further, R. Moscow recently told one DXer that the Russian-language station on approximately 4600 kc actually is located in Vladivostok.

But when it comes to passing out information on its international broadcasts, about the only thing R. Moscow will tell you is whether it came from the European or Asiatic U.S.S.R. And this, as we've said, makes finding the true QTH a real problem.

Frequency Fixing . . . Most inexpensive SW receivers aren't accurate when it comes to frequency. Some sets are off by as much as 1 mc (1000 kc). Worse yet, many newcomers don't know their dials aren't giving them the correct picture. Thing to remember is that a low-price receiver isn't going to provide much fine calibration, no matter how skillful or experienced the operator. But with a few simple check points one at least can come close.

A check point can be any station which can be heard readily and which transmits on frequencies not subject to change. In North America, best bet is National Bureau of Standards station WWV and Canadian Do-

[*Continued on page* 111]

Though R. Moscow's current QSL card (this one was received early this year) gives date, time and wavelength of the transmission it is verifying, the actual location of the transmitter is anyone's guess. Broadcasts carrying the familiar R. Moscow identification actually may originate from points in the Soviet bloc as far west as Sofia and as far east as Vladivostok.

KIT EI REPORT

Electro-Voice Coronet

Bookshelf Speaker System

THE KIT: E-V Coronet I
THE MANUFACTURER: Electro-Voice, Inc., Buchanan, Mich.
THE PRICE: $47
THE CONSTRUCTION TIME: about 30 minutes

MOST stereo equipment nowadays is available in kit form, and speaker systems are no exception. For those considering a speaker kit, the question frequently asked is how much woodworking is required?

Electro-Voice anticipated this question by designing a system that requires next to no cabinet work. All panels are ¾-in. heat/pressure formed wood-chip composition that doesn't warp. And all panels come with an oiled-walnut veneer already applied to the outer surface. Even the grille cloth is supplied pre-mounted to the front panel. Result is that no tools are required for assembly.

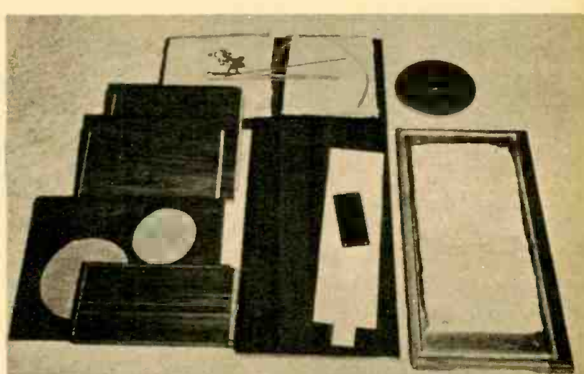
The manual's instructions and illustrations are very clear. Included is information about speaker placement and hookup as well as a pictorial showing connections for a tweeter, should you decide to add one later.

You start by mounting the 8-inch full-range speaker on the front panel. If you aren't going to use a tweeter, its cutout is covered with a supplied panel. Next, you screw four rods into captive nuts in the top panel. Then all panels, except the bottom, are fitted together. The speaker leads now are connected to the terminal screws on the rear panel and the bottom panel is fitted in place. Twist wing nuts on the rods that pass through the bottom and the entire assembly snaps together.

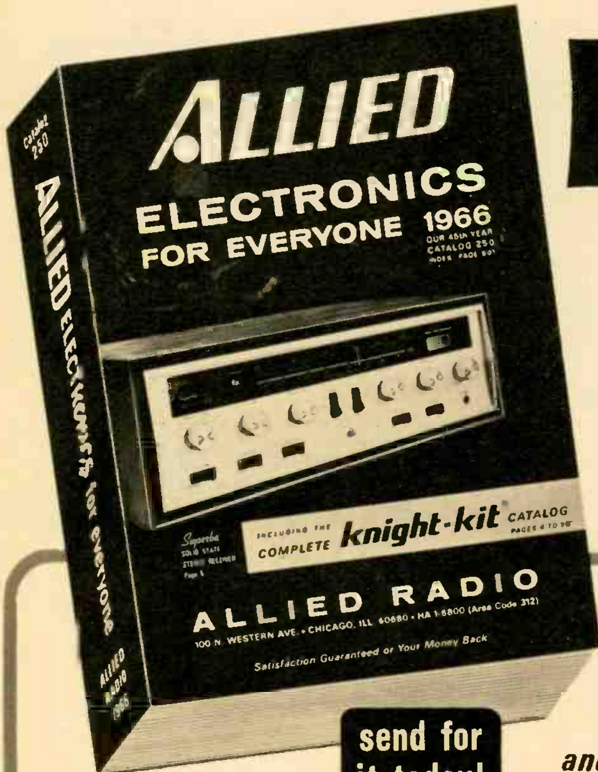
For added rigidity, a supplied gasket material is put in all joints prior to assembly. Unfortunately there wasn't enough of this material and it was difficult to obtain more locally. The finished enclosure looks handsome.

How does the Coronet I sound? Forty-seven dollars isn't going to give you real hi-fi sound but you do get your money's worth. E-V's claimed 50 to 13,000 cps response is conservative. Further, a slight rise in response above 12,000 cps isn't apparent on most program material.

While you won't hear knee-bending bass, there is no boom-boom common to low-cost ducted-port systems. As a better extension speaker or for budget systems, the Coronet I does a creditable job of sound reproduction.



The Coronet I enclosure before assembly. White strip in center is rolled to form ducted port and is installed in smaller hole at left in front panel.



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KIT
EI
REPORT

EI Tests a HOME TV TAPE RECORDER

World's first home TV tape recorder, in photo supplied by manufacturer, seemingly works like a breeze. Unit we assembled proved less able.

KIT: Wesgrove VKR 500 video recorder.
MANUFACTURER: Wesgrove Electrics Ltd., Nash Hse., New St., Worcester, England.
(In the U.S.: Wesgrove International, 3325 Fillmore St., San Francisco, Calif. 94123).
PRICE: $392

ONLY a few months back we at EI were saying we had heard about a lot more home TV tape recorders than we had seen and that we hadn't as yet been able to purchase even one (TELCAN, YOU SAY? July '65 EI). We also made mention of a British firm called Wesgrove which, like half a dozen other concerns, boldly had announced development of a home TV taper.

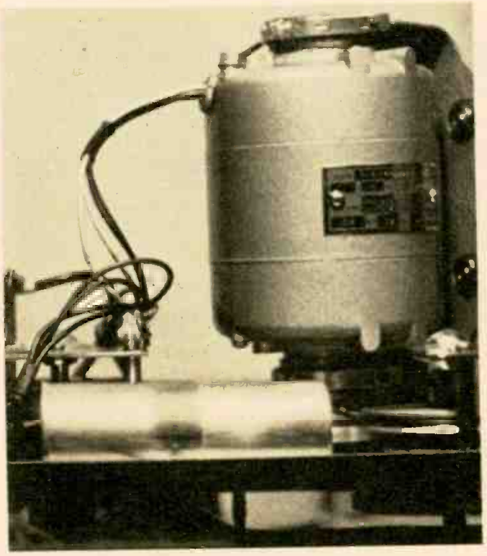
Thing is, this claim proved for real. Wesgrove *does* have a home TV recorder in both kit and wired versions. We know, because 1) we assembled the kit, 2) we inspected a factory-wired unit (what we don't know, of course, is how many more machines Wesgrove may have around in addition to the two just mentioned).

Though Wesgrove now has an American agent (see above), they had none at the time we purchased our kit, which came directly from company headquarters in Worcester, England. Packed in a big carton, the kit was accompanied by a 32-page instruction manual which, being typewritten and duplicated, suggests hasty preparation. It also allows conveniently for modifications, of which there already have been more than a few.

Our copy of the manual was marked *Issue 3* and contained 2½ pages of amendments and additional instructions, including six circuit modifications. Parts for four of the changes were contained with the kit, though those for the remaining two were not.

What It Is. What we had received, we were informed, was a low-cost TV tape recorder in kit form. The cost, considering the formidable performance the unit was alleged to be capable of, seemed fair enough—especially in view of what comparable commercial machines sell for. But the business of TV-taping was the thing that really held us spellbound, since here before us, though unbuilt, was the first home VTR (video tape recorder) to reach the marketplace. How, we wondered, had Wesgrove managed to turn the trick for the price we had paid?

The device, we soon found, best is described as a tape-transport equipped with record and play preamplifiers. With most components already mounted on the deck



Single motor in VKR 500 drives capstan, rewinds tape. Machine offers only play and fast-forward modes, so reels must be interchanged for rewind.

Kit consists of basic tape-transport mechanism and necessary record and replay electronics. Most components mount on single printed-circuit board.

plate, the transport struck us as looking much like most any tape deck. There is, for example, a feed spool with an associated tension device to keep the tape taut and prevent it from spilling. A single, 1/10-hp motor drives the capstan and also serves to drive the take-up spool when the machine is in the fast-forward position.

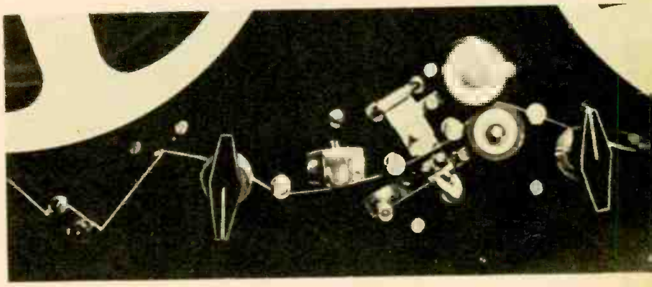
Interestingly enough, the unit has no rewind mode, which means that reels must be reversed and the machine placed in fast-forward in order to rewind the tape. This done, the reels again must be interchanged to play what has been recorded.

The deck has but two heads—one for audio record and play, one for video record and play. There's no erase head. A permanent magnet serves to erase the tape and also provides a kind of bias.

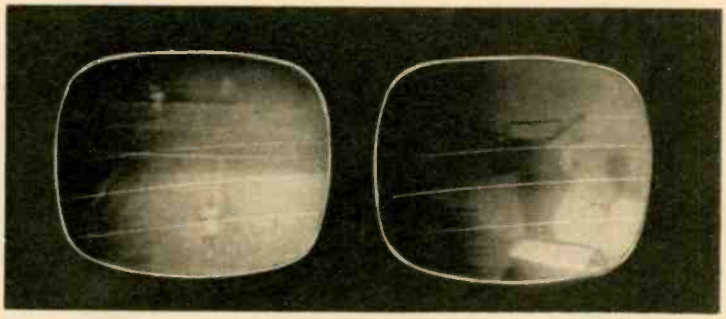
Digging a little further into the Wesgrove way of things, we discovered that the machine was intended to put both audio and video signals on triple-play (i.e., ½-mil) standard audio tape. To do so without resorting to rotating heads is impossible, of course, unless tape speeds are phenomenally high. And this they are in the Wesgrove unit, since the tape whips by at speeds up to 150 ips (roughly 40 times as fast as it does in a typical home recorder designed for audio use).

Putting It Together. Before starting assembly, we were advised to soak five spherical bearings in oil for an hour to allow the porous metal to drink enough lubricant for life. Three of these bearings were destined for the deck plate, one for the flywheel and one for the clutch spool.

We next began to work on the deck proper.



Deck view shows portion of feed and take-up reels and reveals path tape follows with machine in play mode. Transport is conventional in design, with tape issuing from feed reel (left), passing through tape guides, across a permanent-magnet erase head, on to sound head, video head, capstan drive and take-up reel. Interchangeable capstans give tape speeds of 90, 120 or 150 ips.



Tape of tennis tournament (left) and Yogi Bear cartoon was supplied by manufacturer and presented fair pictures on screen when played through completed kit. White traces are flyback lines which we could not significantly suppress.

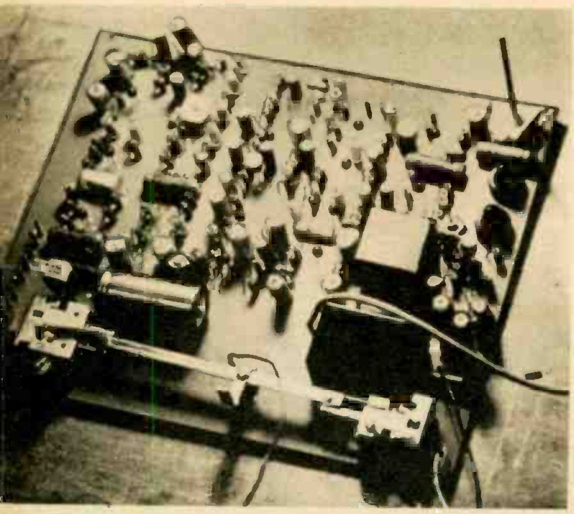
mounting supports, switches, cams and the like. Flywheel and capstan came next, with the motor eventually being connected according to the color code contained in the circuit diagram. An azimuth adjustment plate was assembled, whereupon the video and audio heads were mounted along with the erase magnet. Having adjusted clutch tension, we were advised to run the deck for two to three hours to seat the bearings.

With tape deck spinning away, we turned our attention to the single printed-circuit board on which are soldered the bulk of the VTR's 120-odd components. We encountered no trouble here, since both board and components are numbered and wiring primarily is a matter of matching numbers. The completed circuit board was mounted on the deck, the power transformer installed and all remaining wiring completed. The unit now was ready for testing.

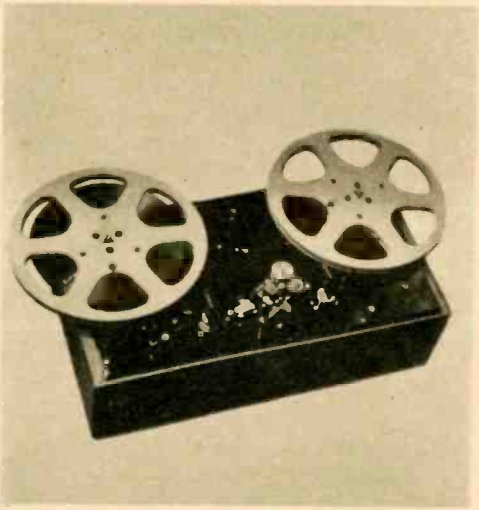
Connecting our TV set as instructed, we switched the recorder to record and watched for a picture on the TV screen (such a picture would come from a monitoring point in the recording amplifier and should show exactly what was going on the tape). But no picture appeared—only a confused pattern of lines.

When a stage-by-stage check of the circuit revealed no errors we decided to try one of the modifications Wesgrove had recommended but that we had decided to overlook in the course of wiring the kit. But this step still produced no usable picture on our screen, though the capstan supplied with our set gave the fastest of the three available tape

[*Continued on page* 114]



Circuit-board wiring is simplified by having both holes and corresponding components numbered. Schematic indicates voltages at key test points.



Completed VKR 500, ready for connection to TV set and audio amplifier. Unit's video bandwidth is roughly 2 mc, audio bandwidth about 10,000 cps.

Notes from EI's DX CLUB

HAM radio once again is legal in Lebanon (from which country, incidentally, EI's DX Club claims a few members). Prefix over Lebanon way is OD and 20 meters ordinarily is the most promising band for logging the Lebanese.

West Coasters looking for Polskie Radio (and Poland is a pretty tough country to hear in that portion of the continent) should try for R. Warsaw's English beam to Australia and New Zealand at 2330 PST. Frequencies for this service are 9675, 11840 and 15120 kc.

Earl MacKenzie of Nova Scotia notes that the CBC's low-power relay, CBNC in Stephenville, Nfld., operates with 40 watts on 1190 kc. BCBers should watch for this pipsqueak early Monday AM. The station will ID simply as R. Canada or CBC; reports go to the CBC's regional office at St. John's, Nfld.

Some regional DX from Australia that anyone can log, with some effort, is VLR6 (6150 kc) at Melbourne. Needless to say, VLR6 is a much better catch than any of the stations in R. Australia's overseas service. Best time to start watching for this one is around 0300 EST; reports go to the Australian Broadcasting Commission in Melbourne.

SWLs anxious to try for ham QSLs well might stick with 6 meters. Jerry Volkman, WA9KOB, points out that amateurs perhaps are more likely to QSL 6-meter reports from SWLs than those on any other band. Reason is that DX reception is fairly rare up on 50 mc.

R. Pyongyang in North Korea is received well (technically, at least) with English at 1900 and 2200 EST on a weirdo frequency of 14520 kc. This one reportedly again has started to verify; reports best are sent c/o R. Peking, China.

Leopoldville is back with an English transmission—a short newscast in our language is aired at 1755 EST (just prior to sign-off) on 11795 kc. As usual, station ordinarily provides reasonably good reception from coast to coast.

A new Cuban rebel, R. Libre (not to be confused with R. Libertad), reportedly is in operation on 6775 kc at 1700-1750 EST. Station is a rough catch at that hour and, of course, could change frequencies at any time. Interval signal is the letter *L* in Morse.

Kol Israel often is heard on 9009 kc, though Perry Brainin of New York City recently logged the station concluding an English broadcast at 1545 EST on the much rarer 9725 kc. Call on this channel is 4XB51.

VL9BR, R. Rabaul on New Britain Island (for DX purposes a part of Papua), may have increased power on 3385 kc. William Sparks of California reports hearing this one at 0030-0130 PST. Another DXer out California way, Paul R. Donegan, has come up with R. Pakistan on a seldom-reported channel—11920 kc, with English news at 0700 PST.

A clandestine much in the news these days is the Communist R. Espana Independiente. Bob LaRose of Binghamton, N.Y., has picked up this one on 17700 kc at 1300 EST. Station also has been heard on lower bands and easily is identified by its chime interval signal.

Tiny El Salvador may be hard to spot on maps but DXers should have no trouble picking it up on the SW bands. One offering is YSS, R. Nacional, now on 9550 kc. Station also is a regular visitor on the BCB (655 kc); best time to nab either outlet is during evening hours.

Radiodiffusion Nationale at Conakry, Guinea, is coming in well on its new 49-meter [*Continued on page* 114]

COPS, CROOKS, & COMPUTERS

By AL JURGENS

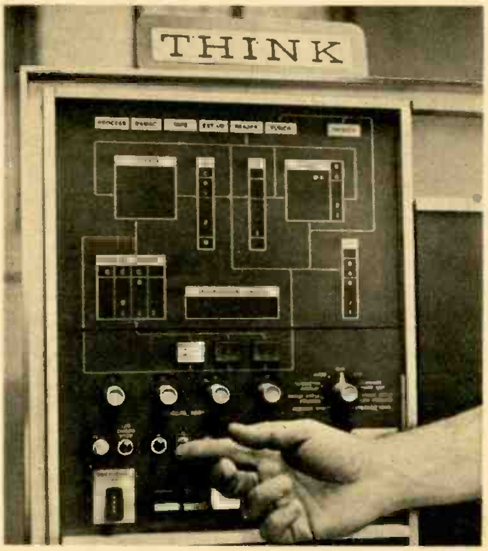
SOMEBODY once said an atlas puts the world at your fingertips, which sounds reasonable enough. Thing is, we suspect the New York Police Department had something of the same in mind when they purchased a $300,000 computer a few months back. Only the PD computer has an atlas beat on most every score. Reason is that this electronic sleuther places the entire crime world at the cops' fingertips with a speed and accuracy old Sherlock himself couldn't muster.

Because crime patterns forever are shifting throughout the greater New York area, no human ever has been able to retain the enormous amount of statistical evidence to understand fully the day-to-day crime situation. But the new electronic brain, properly programmed, can paint a most knowledgeable picture of crime in the mammoth metropolis. And, while scarcely broken in as yet, the computer already has paid off handsomely.

In one case, the computer trapped two crooks in about as much time as it takes to mention it. With the Police Department's entire fingerprint file transferred to IBM computer tape, prints can be matched in a matter of minutes. Two burglars were identified and seized almost immediately, thanks to the computer's front-line prowess. And in still another case, the computer immediately linked prints taken at one burglary with another committed months earlier. The suspect hadn't been caught at last report, but the police at least know exactly who they're looking for.

Though fingerprint matching seems accomplishment enough for the electronic crimebuster, this trick is but one of many the instrument has tucked up its semiconductor sleeve. Truth to tell, the computer feeds on facts supplied by every precinct—detailed information on every complaint, arrest, traffic accident and crime occurring in every 24-hour period. An electronic data processing section codes the info on IBM cards, then transfers the works to magnetic tape.

End result of the new setup is an electronic brain carefully tuned to law-enforcement needs. And thanks to Mr. Computer, the cops today well are prepared for a concentrated crackdown on crime.



Think, reads the sign above computer's control panel, which is precisely what every cop still must do. But the computer now stands ready to help.

A REASONABLE Guide to Medium-Fi

By FRED HOFFMAN A complete component stereo system for $50? Can it be any good at that price? EI's answer to both questions, after a lengthy study of component stereo now available to careful shoppers, is an emphatic yes. Matter of fact, our price actually is a bit better than 50 clams—$45.53, to be exact. But before we get into the meat of the matter, we just might talk a little about this thing called *medium-fi*.

No one, the story goes, wants to settle for less than the best. But some of us have to for one reason or another. We might like the best but our better judgment tells us we necessarily must be reasonable. And when it comes to stereo systems, legion is the man who either can't afford—or can't appreciate—the best in hi-fi. Even so, there's no reason why he should deny himself the hours of listening pleasure a modern stereo rig can give. His approach to the matter simply should be reasonable. He needs—or must settle for—what we term *medium-fi*. And all three of the systems EI is about to offer present reasonable solutions to the problem.

These days, $45.53 doesn't buy much in the way of a stereo console or phonograph. But with EI's rock-bottom component rig, you get a four-speed British-made record changer, complete with stereo cartridge; a 5-watt stereo amplifier which matches ideally to the phono cartridge and offers individual stereo volume and balance controls; and two midget speaker systems. The latter, using 4-in. speakers, are housed in nicely styled enclosures measuring 4⅞ x 8 x 4 in. In addition, they come equipped with their own volume controls which can be used to supplement those on the amplifier.

To the owner of a 100-watt amplifier and a pair of speaker systems costing $480, this may not sound like much of a component rig. But it offers substantial value over similarly priced phonographs.

For example: stereo sound quality depends in large part on the separation between channels. This, in turn, is determined by the amount of space between left and right speakers. Point is, EI hasn't found a stereo phonograph for under $60 which offers detachable speakers—and there are several selling at much higher prices in which speakers are separated by a little over a foot.

Most experts believe that speakers require a minimum separation of 5 ft. to produce acceptable stereo sound in the average living room. With components you soon can determine optimum speaker placement for your installation since you are under no restrictions as to how you set up your system. Matter of fact, besides allowing you to locate speakers so as to produce maximum stereo effect, a component system also leaves you free to install your changer and amplifier most anywhere you choose. Some

A REASONABLE Guide to Medium-Fi

stereo buffs have been known to hide all electronics by tucking the amplifier out of sight —in a closet, say. Others manage to arrange all components attractively (and conveniently) on book or wall shelves.

Components have another major advantage over phonographs or consoles. Sooner or later, you may decide to upgrade your system—to add larger speakers, a more powerful amplifier or a magnetic cartridge. And this you easily can do because of the flexibility of components. You clearly are free to replace any or all components as you decide you need better sound and have the money to spend. But the phonograph or console owner who wants to upgrade his rig ordinarily must buy a complete new system.

To find the $45.53 stereo component system, EI scoured leading electronic parts houses in search of the lowest-priced, generally-available merchandise capable of producing satisfactory stereo sound. Though we found some closeouts which constituted really good buys, we rejected these in favor of components in more general distribution. Equipment obtainable only through smaller outlets also was bypassed for merchandise freely available in larger cities or from firms doing business by mail.

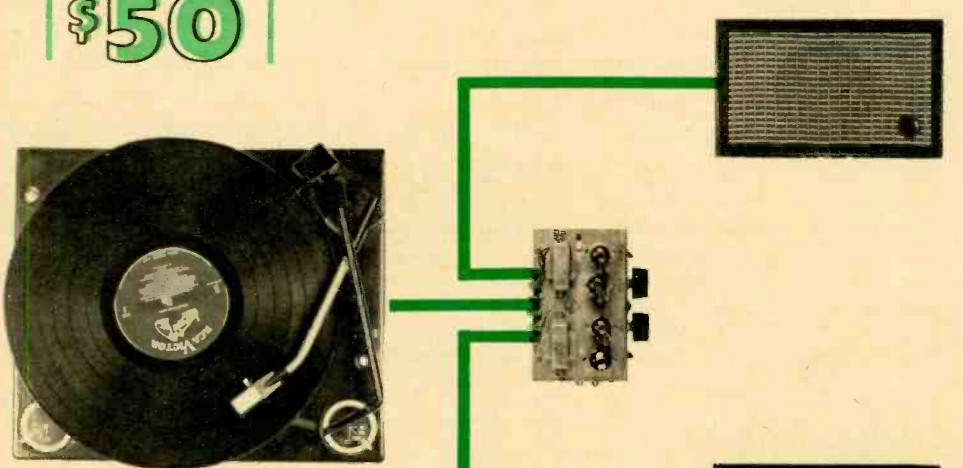
Some prices we quote, incidentally, are those at which we generally found the components for sale. It's entirely possible that your radio supply house may offer an even better buy on some items. Then, too, its price on a specific item may be a few cents higher than our figure.

Our rock-bottom choice for amplifier was the Trutest Stereo/5, offered by Lafayette Radio Electronics for $10.95. Though its terminals are marked for 4-ohm output, the unit works well with most small speaker systems. The speaker we chose was the Philmore WC4, which lists for $4.85. A virtually identical unit is available from Calrad Electronics at a price which varies, depending on the dealer selling it. Calrad's model number is PMB-5 and it, like the Philmore, is made in Japan.

To round out our rock-bottom system, we found a British-built BSR four-speed record changer with cartridge for under $20. Price on this item varies from store to store, so you may have to do some shopping to equal our figure. Further, you also likely will have to make up your own base, though some stores offer one for $4.88 (a figure we included in our total).

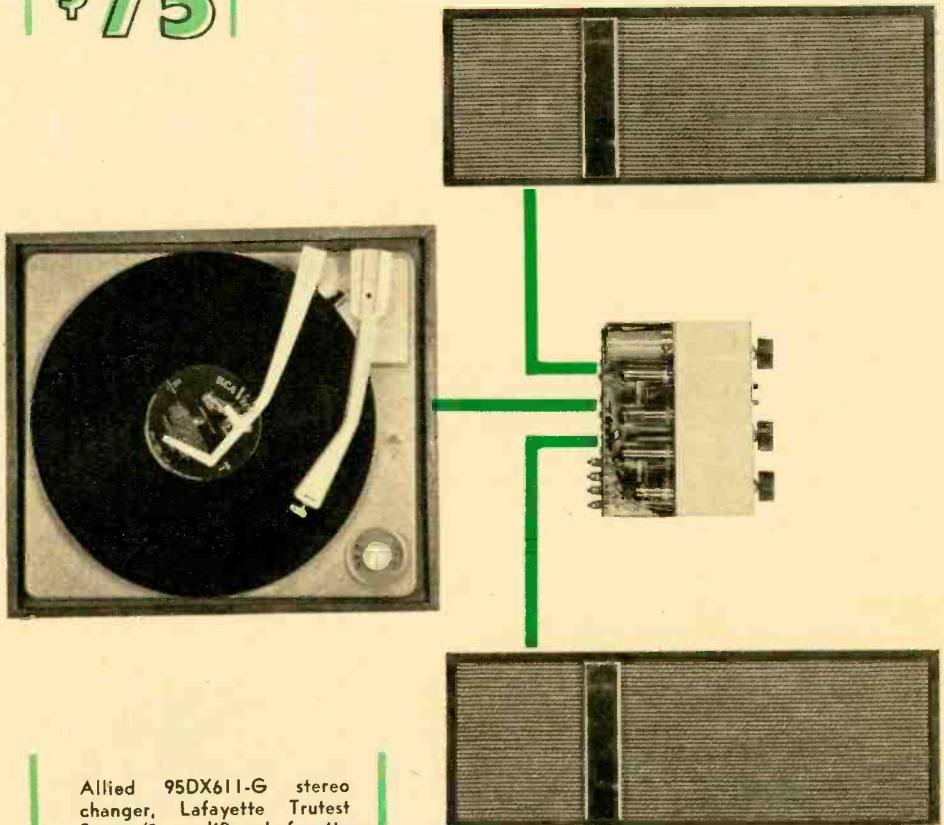
Assuming you can't locate the BSR at what

$50



BSR UA-25 stereo changer (or equivalent), Lafayette Trutest Stereo/5 amplifier, Philmore WC4 or Calrad PMB-5 speakers.

$75



Allied 95DX611-G stereo changer, Lafayette Trutest Stereo/8 amplifier, Lafayette SK-181 Minuette speakers.

you think is a reasonable price, you always can choose an American-made changer instead. Fortunately, both Allied Radio and Lafayette Radio Electronics offer one for $19.95. Like the BSR, these units come with a stereo cartridge, though the base is extra ($3.95).

The provision for upgrading that a component system offers is one of the biggest points in favor of component hi-fi. For example, a somewhat better system can be had by switching to a more powerful amplifier and bigger speakers without buying a new changer or cartridge. And this, as you already may have guessed, is precisely what we did to assemble our under-$75 system.

For $65.35 you can have an 8-watt stereo amplifier (the Trutest Stereo/8 from Lafayette Radio Electronics priced at $17.95), Allied's 95DX611-G changer ($19.95 plus $3.95 for the base) and a pair of Lafayette's SK-181 Minuette speaker systems ($23.50 the pair). These use a 5 x 7 in. oval speaker in a rear-loaded, reflex-type enclosure measuring 5⅞ x 15¾ x 8¼ in. The speakers require the extra amplifier power to produce fuller bass and generally more satisfactory frequency response than is possible with the smaller, less expensive Philmore or Calrad speakers.

This interrelation of parts, by the way—the need for smaller, less expensive amplifiers to be fed by high-output pickups (usually with ceramic or crystal elements) and to drive speakers which require relatively little power to produce sound—is a prime secret behind the design of any sound-reproducing system. Matter of fact, this requirement holds whether the setup is an inexpensive stereo portable, a $500 console or a $1,000 component rig. And it means that your choice of amplifier largely determines the kind of cartridge or speakers you can use.

For example, simply adding a larger, less

A REASONABLE Guide to Medium-Fi

efficient speaker system to your Trutone Stereo/8 may result in poorer sound—unless the amplifier has at least the power output the speaker manufacturer recommends for his equipment. All of EI's systems contain suitably matched components which can be expected to function well with one another. However, it would be unwise to attempt to substitute a component from one system for that from another since this likely only would upset the stereo apple-cart.

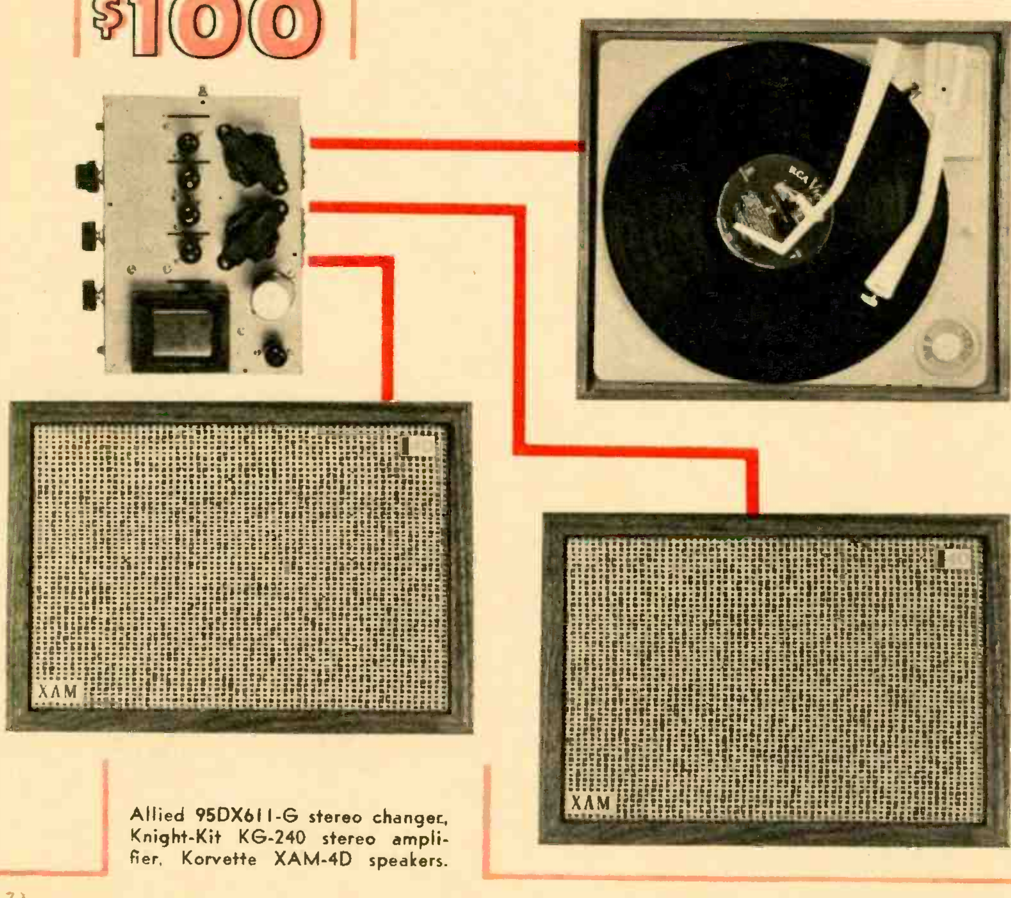
Our $100 stereo component system is a logical upgrading from EI's $75 system and costs $98.63. It includes the Knight KG-240 20-watt stereo amplifier ($26.95 in kit form from Allied Radio), two XAM-4D speaker systems sold by E. J. Korvette for $47.78 a pair; and the Allied changer and base used in our $50 system. Result is a system with adequate amplifier power to drive really good speakers (the KG-240 produces 10 watts per channel, and has screw terminals for 8- and 16-ohm speakers). The speakers in turn produce a more solid bass and a more brilliant treble than is possible with the smaller units used in EI's less expensive systems.

When you've spent $98.63 for this system (or less for the others), you have achieved component stereo at a reasonable price. But once the component bug has bitten, you likely will want to step up to something bigger and better later on—perhaps to a record changer free of rumble or with a variety of elaborate features; to a magnetic cartridge, which can cut record wear in half as well as produce smoother stereo sound; or to be a more powerful amplifier.

In our systems what we've done is steadily to upgrade the power and quality of the amplifier and the size and quality of the speakers. The record reproducer has remained much

[*Continued on page* 115]

$100



Allied 95DX611-G stereo changer, Knight-Kit KG-240 stereo amplifier, Korvette XAM-4D speakers.

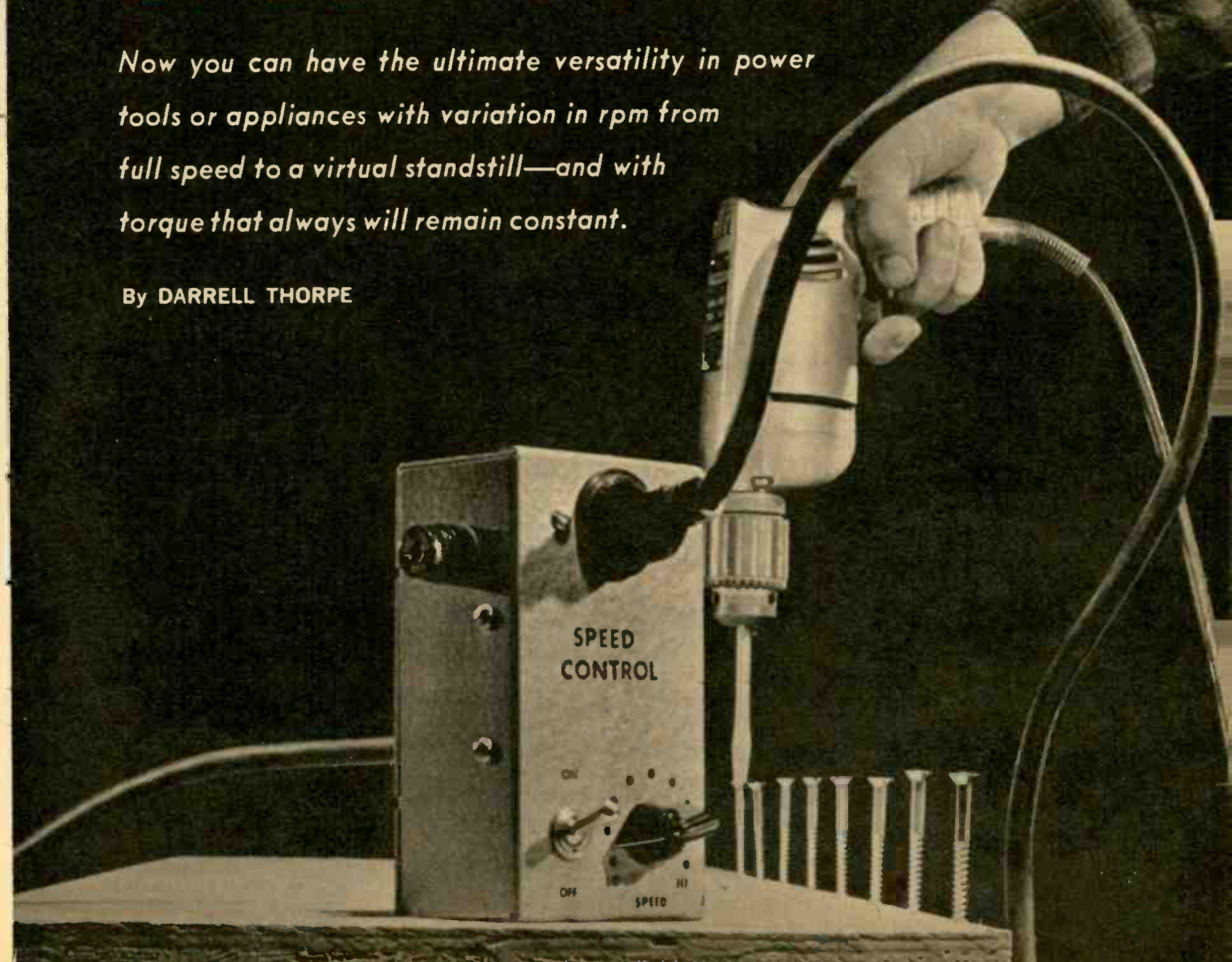
MANY is the hobbyist who has put together, say, a speaker cabinet requiring a couple of dozen screws. By the time the last one was in, he would have given his numb right arm for a power screwdriver. But there's no need to run out and buy one when you own a common electric drill. True, the speed of the drill is much too high to drive screws. But EI's Full-Range Speed Control can solve this problem easily. Plug the drill into the controller, turn the knob counterclockwise to get the speed way down and that second cabinet will go together in half the time.

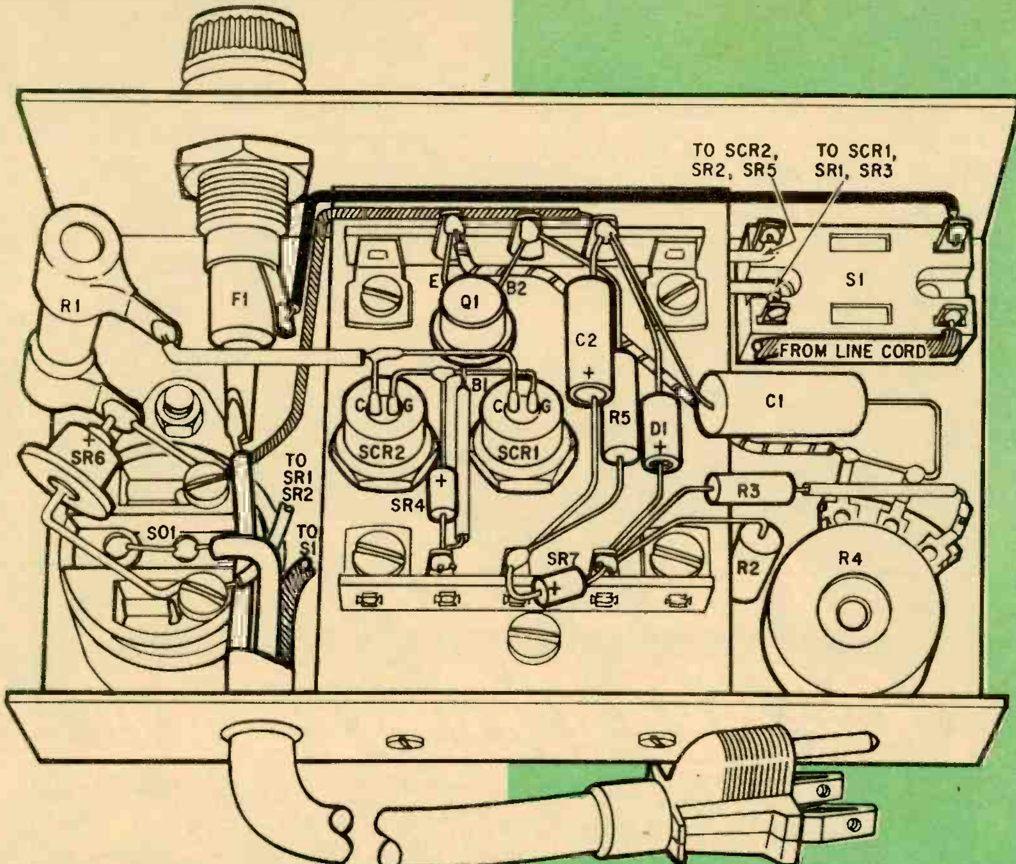
Speed controls are becoming both popular and plentiful but they're not all alike. Most are half-wave jobs with limited control range and fading torque. EI's controller is a full-wave design that permits you to vary the speed of any universal motor from full speed to a virtual standstill—and the torque (or twisting power) remains constant

FULL-RANGE SPEED CONTROL

Now you can have the ultimate versatility in power tools or appliances with variation in rpm from full speed to a virtual standstill—and with torque that always will remain constant.

By DARRELL THORPE





SPEED CONTROL

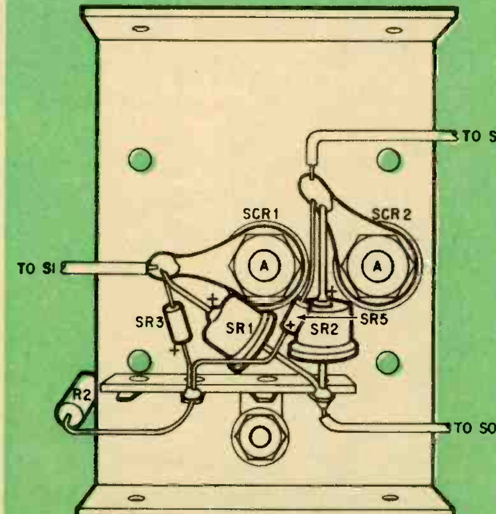
throughout the range. As the work load increases so does the power supplied to the tool to maintain torque.

There are many applications for the controller. When using a saber saw to cut metal or hard wood you must slow the motor to keep the blade from overheating. When cutting plastic the speed of the saw also will have to be reduced or the heat build-up will melt the cut edges of the plastic, causing them to fuse.

Or suppose you have to drill a ½-in. diameter hole in a thick piece of steel. Run the drill at full speed and the bit will burn up, lose its cutting efficiency and the hole will be filled with burrs. Not so at slow speed, though, and you'll be able to start the hole without a center punch because the bit won't creep.

Besides being able to reduce the speed of shop tools, the controller will work with fans, movie projectors, sewing machines, food blenders, sanders, lathes, vibrators or almost any tool or appliance that has a series or universal (brush) motor that does not draw

Fig. 1—Inside of controller. Mount SO1, F1, S1 and R4 near the edges of the cabinet to allow room for the heat-sink chassis in the center. Lead from B1 on Q1 goes only to anode of SR4. Underside of heat-sink chassis, below. Mount SCR1 and SCR2 as shown in the detail diagram at the right. Be careful when installing the chassis that SR1 and SR2 do not touch the cabinet or get pushed against SCR1 and SCR2.



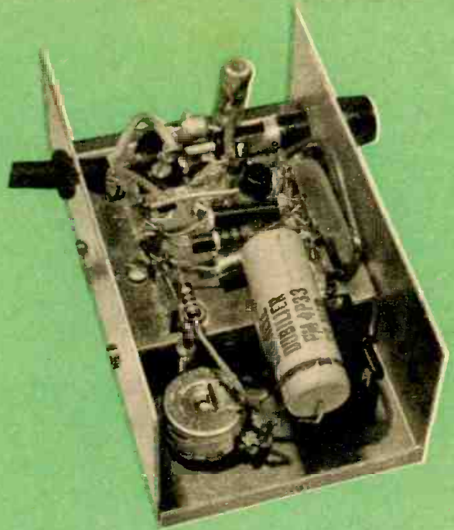


Fig. 2—Put tape on the inside of the other half of Minibox so that R1's (top) and C1's (bottom) leads do not short to the cabinet.

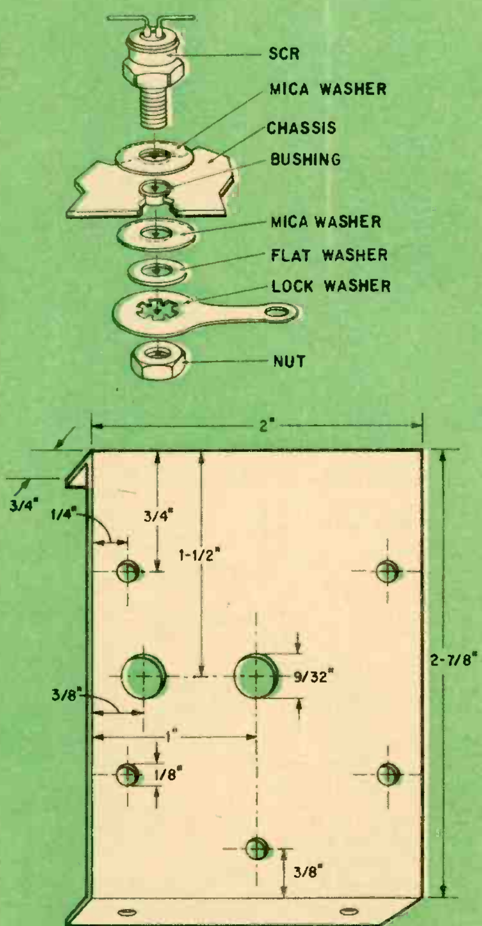


Fig. 3—Detail diagram above shows how SCRs are mounted with hardware supplied with them. Heat-sink chassis dimensions are shown below.

more than 6½ amps. Although some of the aforementioned appliances have built-in speed controls, the speed range and torque characteristics will be improved greatly by our controller. How does the controller achieve all this?

Many early-design speed-control devices had only one controlled rectifier. Hence, they were able to supply only half-wave power to the motor. This meant that the maximum speed was only about half the normal full speed. And at less than full speed many motors can't develop sufficient torque to keep turning as the work load increases.

Our controller overcomes these disadvantages because it provides full-wave power to the motor. It has a unique feedback circuit that furnishes extra power to maintain torque as the work load increases. To test this characteristic after you've built the controller, plug a drill into it and set potentiometer R4 for a speed of about 100 rpm. Then hold the chuck with your hand and turn the drill on. You'll be pleasantly surprised at the high starting and running torque.

Construction. Because many of the semiconductors used in the controller may be difficult to obtain locally, we have arranged with Allied Radio to supply a package of all parts except the fuse, resistor R1, the AC plug and other small hardware. However, our Parts List has sufficient information for you to purchase all parts on your own if you choose to do so. The Parts List includes Allied's special stock number and price for the parts package.

Our model is built in a 3x5¼x2⅛-in. Minibox. Silicon-controlled rectifiers SCR1 and SCR2 must be mounted on a 1/16-in.-thick aluminum (or copper) chassis. It is important that the chassis be this thick since it serves as a heat sink. A thinner piece of metal will not conduct the heat away quickly enough to prevent damage to the SCRs.

The SCRs also must be electrically insulated from the chassis, as shown in Fig. 3, with two mica washers, a bushing and hardware supplied with them. It is important that the holes for the SCRs be free of burrs or the mica washers may be punctured and there will be a short. This will create a shock hazard because the cabinet would have one side of the AC line connected to it. After the SCRs are mounted, install diodes SR1, SR2, SR3 and SR5 on the underside of the plate as shown in Fig. 1.

SPEED CONTROL

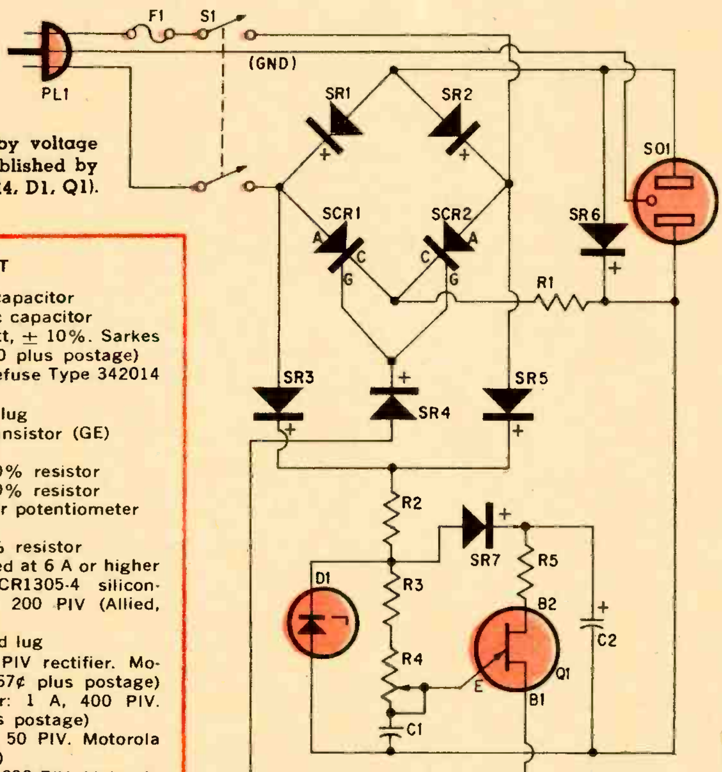
Drill the necessary mounting holes in the cabinet for mounting the SCR chassis, speed-control potentiometer R4, *on/off* switch S1 and the fuse holder. However, do not mount R4, S1 and the fuse holder in the cabinet until the SCR chassis has been installed. After all major parts are mounted, complete the interconnecting wiring. Where wiring must carry the load current, use heavy wire.

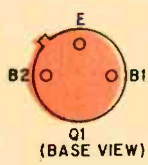
If the motor requires between 2 and 3 amps, R1 should be a 1-ohm, 5-watt wirewound resistor. For a 5 to 6 amp motor, R1 should be a ½-ohm, 10-watt wirewound resistor. If you want to be exact about it, compute R1 with this formula: $R1=2/Im$, where Im is the maximum rated current of the appliance's motor in amperes.

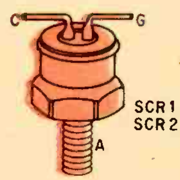
Operation. Plug the appliance into SO1 and plug PL1 into an AC outlet. Set switch S1 to *on*. With the speed-control knob fully clockwise, the tool's motor will operate at full speed. Turning the knob counterclockwise will reduce speed until the motor runs at only a few rpm.

Most tools and kitchen appliances have a universal motor. However, if you are not sure of the type of motor, look for brush holders, or brushes, which are characteristic of this type of motor. Also, if the label on the appliance indicates that it can be operated on either AC or DC, you can assume that it has a universal motor.

Fig. 4—Amount of power full-wave bridge (SR1, SR2, SCR1, SCR2) furnishes to motor (at SO1) is a function of the point in each half of the AC cycle at which the SCRs are caused to conduct by voltage applied to gates. This is established by phase-control circuit (C1, R3, R4, D1, Q1).







PARTS LIST

- C1—.33 mf, 200 V tubular capacitor
- C2—10 mf, 25 V electrolytic capacitor
- D1—Zener diode: 7 V, 1 watt, ± 10%. Sarkes Tarzian VR7 (Allied, $1.50 plus postage)
- F1—6 A, 3AG fuse and Littlefuse Type 342014 holder
- PL1—AC plug with ground lug
- Q1—2N2160 unijunction transistor (GE)
- R1—Resistor (see text)
- R2—15,000 ohm, 2 watt, 10% resistor
- R3—3,300 ohm, ½ watt, 10% resistor
- R4—25,000 ohm linear taper potentiometer (Mallory U-29 or equiv.)
- R5—220 ohm, ½ watt, 10% resistor
- S1—DPST toggle switch rated at 6 A or higher
- SCR1, SCR2—Motorola MCR1305-4 silicon-controlled rectifier: 8 A, 200 PIV (Allied, $2.15 plus postage)
- SO1—AC socket with ground lug
- SR1, SR2, SR6—3 A, 200 PIV rectifier. Motorola MR1032A (Allied, 67¢ plus postage)
- SR3, SR5—1N4004 rectifier: 1 A, 400 PIV. Motorola (Allied, 67¢ plus postage)
- SR4—1N4001 rectifier 1 A, 50 PIV. Motorola (Allied, 45¢ plus postage)
- SR7—1N4003 rectifier: 1 A, 200 PIV. Motorola (Allied, 60¢ plus postage)
- Misc.—3x5¼x2⅛-in. Minibox (Bud CU 2106-A or equiv.), 1/16-in. thick aluminum.

NOTE. A package of parts including the fuseholder (but not F1, PL1, R1, terminal strips, 1/16-in. aluminum, the line cord and small hardware) is available from Allied Radio Corp., 100 N. Western Avenue, Chicago, Ill., 60680. The price is $14.95 plus postage. Specify special stock No. 39 AX 820.

THE SEARCH FOR SMOKEY JOE

By LEN BUCKWALTER, KBA4480

Every day some 20 CBers find themselves with the most provocative QSL of all—a violation notice from the FCC. Most licensees, faced with an official warning, submit quietly and mend their ways. Some, of course, also must shell out hard currency in the form of fines. Others must appear at an FCC office for a verbal twice-over-heavily.

But hidden under such raw statistics are cases which prove that the CB population, like any group, counts among its number a few who seemingly relish a set-to with Uncle Sam. The FCC tells of busted-down doors, confiscated equipment and lengthy jail sentences.

The offenders in such cases don't go to five-and-dime courts, of course. Their offenses are serious and the penalties are major. The evidence to prove that an offense was committed and who committed it is assembled carefully. A tape recording, a transcript of spoken remarks or engineering testimony—they're all part of the procedure.

But a court case requires that the offender has been located, which in a few instances proves to be the rub. Some offenders flaunt the law under the protective cover of an alias or three. And it's this gambit—false identification—that has led to some of the most colorful cases on the docket.

These masquerading Citizens Bandits read like a roster of legendary folk-heroes—Smokey Joe . . . Big John . . . the Ol' Cotton Picker . . . Mush Mouth . . . the Night Raider. All are flesh-and-blood characters who have ridden roughshod through CB, laughed at the law through a microphone and left their names imprinted on FCC dossiers.

Smokey Joe wasn't the Jesse James of CB but his crime, operating without legal identification, is considered among the worst. At least this is the opinion of the man who can pick up a phone and tighten a nationwide net of electronic cops around anyone's antenna. He's Frank M. Kratokvil — the J. Edgar Hoover of the FCC—who has the title of chief of the Commission's monitoring and enforcement arm.

Kratokvil recalls the story of Smokey Joe with special relish. Smokey, you see, set his own trap, then stumbled into it. On a quiet night in Florida you still can hear the echo of the clank.

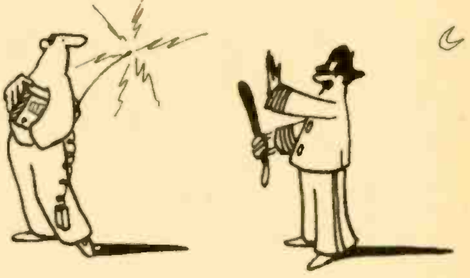
At least three FCC stations had been monitoring Smokey Joe as he committed a running series of violations. The big one was the smoke-screen identity designed to conceal his whereabouts. Sure, the FCC is equipped to cope with this kind of outlaw operation, what with direction-finding and other electronic devices. But before the direction-finding boys got into the act an astounding coincidence took place.

About the time Smokey Joe was having his fraudulent fun, an FCC engineer out of Atlanta was checking a report of antenna overheight. At one point the investigation took him into the CBer's shack. And quite naturally his official eye roamed over the walls. He spotted nothing save some innocent QSL cards until—clank—one card popped out from the rest. It read:

S-M-O-K-E-Y J-O-E

On it appeared Smokey's real name and real address.

Yes, Ol' Smokey had outwitted himself, never having dreamed he'd be caught in *someone else's* shack. The jig was up and



SMOKEY JOE

Smokey soon faded. But the Smokey Joe saga was to contain yet another bit of irony. The CBer whose shack sported Smokey's card also was found to have an assumed name. His on-the-air moniker: Sluggo. Appropriate, considering what he did to Smokey.

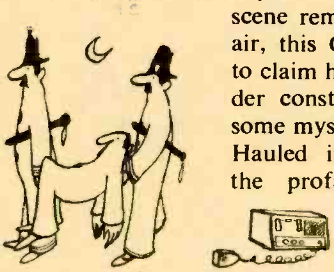
Further up along the East Coast, the CBer who called himself Big John also got trapped by a telltale QSL card. Only this time the card wasn't tacked on some other CBer's wall. An FCC engineer had made his way to the scene by DF & Intercept—direction-finding techniques which zero in on the signal. Big John's weakness? He loved big signals, the kind officially described as outside groundwave coverage (working skip, in everyday parlance). When the FCC engineer entered the shack he spotted QSLs addressed to Big John. The search was over and Big John quietly turned in his license.

Not all cases end so serenely. In a coal-mining section of the country, one operator was identified and turned in by neighboring CBers. Rat-finks, you say? Not when you consider the circumstances. The offender had been using the band as a medium for profanity.

When FCC officials arrived at his shack they were well-prepared, since the man had threatened violence. A couple of U.S. marshals overpowered him and carried him out. Two casualties were suffered in this case. One of the marshals was bitten by the struggling CBer. And the offender himself received a two-year jail sentence in federal court.

Again, there's a touch of irony. The two-year period now is about over. Hope at FCC offices is that he's decided to go straight—because he's just applied to the Commission for a new license!

Another case of profanity on the CB airwaves—this one in Chicago—ended on a sadder note. Not content just with making obscene remarks over the air, this CBer went on to claim his life was under constant threat by some mysterious forces. Hauled into court on the profanity charge,



the man ultimately was declared mentally incompetent.

Search for Smokey Joes, whoever and wherever they may be, is improving all the time (though the Ol' Cotton Picker, Mush Mouth and the Night Raider still are at large at this writing). The FCC Field Engineering Bureau, which seeks out Smokey Joes of one sort or another, now is the Commission's biggest division. And it has ploys all its own. For example, the 120 mobile units that roam the country well-nigh are impossible to spot. One might be a station wagon, another a six-wheel truck, a sedan, a coupe or most any other vehicle.

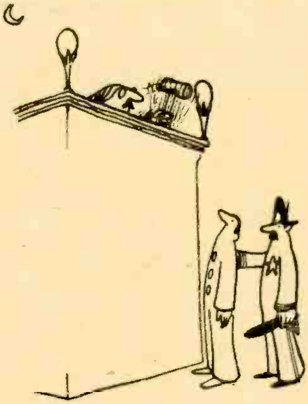
But it's direct confrontation between FCC investigator and CBer that produces the sparks. Consider cases of what officially is called overpower. It usually means a big linear amplifier added to the rig to beef up output.

So unwelcome was one souped-up Indiana station that local CBers got together and complained to Commission officials. The FCC, in turn, dispatched an inspector to look over the offending station. The agent was greeted at the door by the lady of the house — who either was a split-second thinker or had intimations of what was up.

"Will you wait a moment?" she asked. "I have a dog here who doesn't take to strangers." As she withdrew into the house the inspector peered through the door. It was a judicious piece of snooping; he saw the woman pushing a linear amplifier under a bed.

In another case of overpower, the FCC investigator had to wait a bit longer for the payoff. It was worth it. Here, too, the official was met by the little woman. She tried to beg out gracefuly, claiming that her husband had locked the CB equipment in the basement and that he himself was out of town. The sharp-eyed inspector, however, caught sight of a 30-watt linear amplifier sitting on a nearby desk.

But there's more to this one. The wife was telling at least part of the truth. Her husband *was* out of town. What she didn't mention



was that hubby was pursuing a dubious occupation. At the moment, it was learned, he was robbing a store. Police found his car full of stolen radio equipment. (Three guesses as to how this one turned out.)

Not so notorious was the owner of a lunchroom in Brooklyn, also suspected of overpower. But he wasn't turned in by irate neighbors: a cigar box proved his demise. When the FCC inspector attempted to investigate, the man refused him entry to the premises. And to exclude the investigator completely, he dropped the window blinds. His motive: to hide a linear amplifier from view. But one blind got hung up on a cigar box and thus afforded the investigator a peek at what really was happening. Result: license revoked.

Let's say that lunchroom owner had succeeded in covering up the evidence. What then? Truth to tell, the FCC is far from powerless. In serious cases, a complaint is filed with the U.S. Department of Justice, warrants are issued and U.S. marshals are sent out to make a pinch. Most of the time it's simply a matter of knocking on the door and gaining what's called friendly entry. Any resistance at this point and the roughhouse begins. Down goes the door, out goes the equipment, and, if necessary, the violator with it.

Yet in some instances of radio law-breaking (a federal offense) the Commission is content to bow out and let local authorities take over. This happened in a case which could go down in history as Calling All Girls. In a large Midwestern city, CB radio was being used to expedite operation of a call-girl ring. Did it violate FCC law? It was, after all, a business use—and CB was created expressly for business and personal activity.

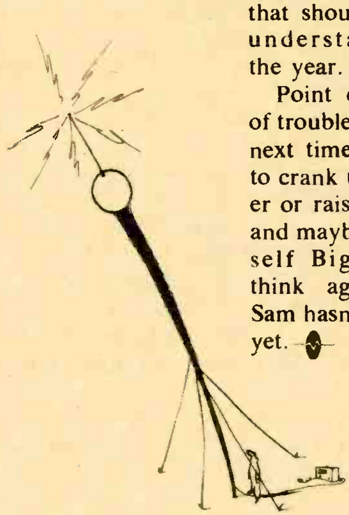
One official said the ring could be nabbed for secret code words which had been used in exchanging vital bits of information. It finally was decided, however, that since the activity ran contrary to local law, local authorities would prosecute. So the FCC simply extended technical assistance and kept the ring under radio surveillance. It led to the arrest of more than a half-dozen persons. At this writing they await trial for violating local, not federal, law.

There's one instance where conventional authority isn't always the force that punishes the violator. The perpetrator here is the type who attempts to transmit information out of a race track after the ponies start running. The angle is simple: an informed accomplice on the outside then can place a bet with a bookmaker and win every time.

In one laughable case, the transmitter by accident was operated on the frequency used by the track's photo-finish facility. Hearing peculiar signals on his channel, the operator reported it to the FCC. The Commission did the predictable—in court, of course.

If that sounds like one for the money, listen to the exploits of a Maryland CBer. He got nabbed, but not by the FCC. In a zany scheme, he flushed out the U.S. Secret Service. The crime: photographing a dollar bill, making a thousand enlargements, then sending them out as QSL cards.

Dramatic? Sure. But the Treasury Department soon learned of it and sent a special agent to the engineer in charge of the FCC's Baltimore office. The CBer was investigated, and the result of the case described in a report. It states that such activity "is not expected to be a continuing problem"— a line that should place as understatement of the year.



Point of our tale of troubles? Just this: next time you yearn to crank up the power or raise the tower and maybe call yourself Big Skipper, think again. Uncle Sam hasn't lost a war yet.

Pin-Money Phone Amp

By MARTIN H. PATRICK

Less than $1 worth of parts will boost phone conversations to room volume.

CONFUSION inevitably follows when a long-distance call comes in from a relative or a friend. Before you get a chance to find out who's paying for the call, every member of the family is trying to get a grip on the handset to join the conversation. Upshot of all this is that tempers are likely to get frayed and the caller has to repeat the same message to every person who got only part of it the first time.

Before you know it that three-minute time limit turns out to be 15 minutes—most of which is just repetition. For a pretty good fee the telephone company will swap your phone for a special instrument which has a built-in speaker. In addition, there will be an extra monthly billing for the instrument.

In this electronic age this is extravagance. True, there are plenty of telephone amplifiers on the market. But they aren't cheap — at least not as cheap as ours which will set you back only about $1.

When you think about it, it's a shame to buy a telephone amplifier when you have a pretty good amplifier in any tube or transistor radio. Only problem is to couple the radio to the telephone. We've solved that problem with our Pin-Money Phone Amp which is a low-power broadcast-band oscillator. It picks up inductively both sides of a phone conversation and transmits them to a clear spot on the radio's dial. The volume is limited only by the size of the radio.

Best of all the Pin-Money Amp is cheap. It uses a total of six parts, one of which is a transistor that costs 25¢ to 30¢. The rest of the parts are probably off in a corner of your workbench. To save money, you wind both simple coils yourself.

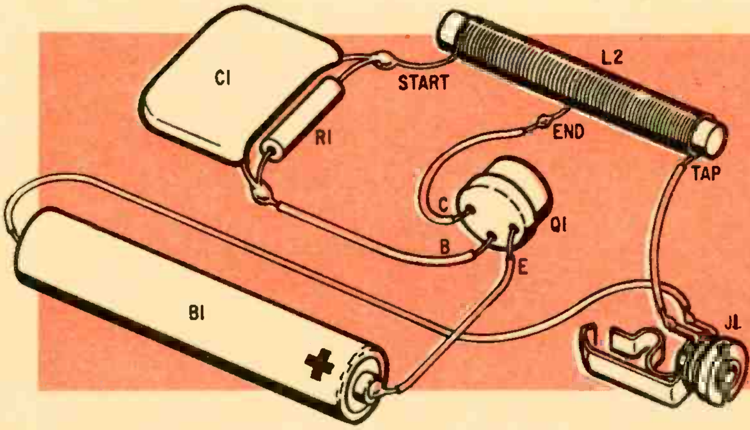
Oscillator coil L2 should be wound on a non-metallic material such as a wood candy (lollypop) stick whose diameter is 3/16 inch and whose length about $1\frac{1}{4}$ inches. Fasten one end of a length of No. 32 enameled wire to either end of the stick and close-wind 100 turns covering a one-inch length of the stick. Then make the tap by twisting a loop in the wire. Continue winding 200 more turns in the *same direction* over the first 100 turns.

Pick-up coil L1 is made with two pieces of wood that are $2\frac{1}{4}$x$2\frac{1}{4}$x$\frac{1}{8}$-inch thick. In the center of one piece glue a 1-inch diameter disc made from a few pieces of flexible magnetic material (Lafayette stock No. 14 G 3307). Then glue the other piece of wood to the other side of the magnetic material (as shown in the pictorial) taking care that the edges of the wood are lined up.

After the glue has dried, fill the space between the end pieces with as many turns of No. 32 enameled wire as possible.

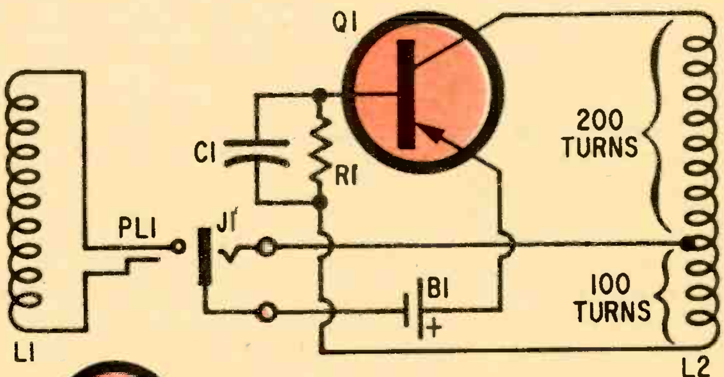
To operate the Amp, place the oscillator coil near the radio's loop antenna. Mount the pick-up coil near the base of the telephone. Lift off the phone's handset and tune the radio until you hear a loud dial tone from the radio. If the signal from the Amp interferes with a station, add or remove a few of L2's turns to change the oscillation frequency.

Move L1 under the phone until you find a spot where the volume is loudest. If you get feedback, move the radio away from the phone's handset.



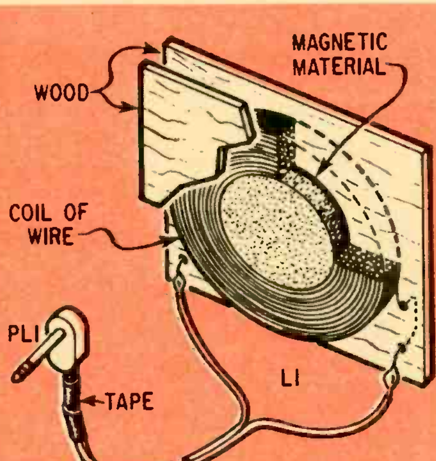
Start L2 at one end of the stick and wind 100 turns. Bring out a loop for the tap then wind 200 more turns in the same direction. The last turn should be near the middle of the coil. Cover the leads of Q1 with spaghetti and solder them directly to the other parts taking care not to use excess heat.

Oscillator is a Hartley type that is put into operation when pick-up coil L1 is plugged into J1. You could add a small switch in one of the battery leads for more convenient operation. If operating frequency interferes with a strong station, tune the radio to a quiet spot on the dial and add or remove a few of L2's turns to change the frequency of oscillation.

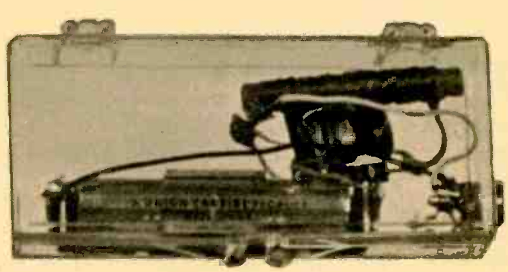


PARTS LIST

B1—1.5 volt penlite cell
C1—.1 mf, 75 V (or higher) capacitor
J1—Miniature phone jack
L1—Pickup coil (see text)
L2—Oscillator coil: 300 turns No. 32 enameled wire wound on a 3/16-inch diameter x 1¼-inch long wood form. Tapped at 100 turns
PL1—Miniature phone plug
Q1—PNP transistor (RF/IF) Allied No. 39 A642G (four for 88¢ plus postage). Or, Lafayette 19 G 1504 (two for 59¢ plus postage)
R1—22,000 ohm, ½ watt resistor



Pick-up coil. Sandwich 1-in. dia. magnetic material disc between square pieces of wood. Wind No. 32 enameled wire to edges.



The amplifier can be built in a 3x1½x¾-in. plastic box if size AAA cell is used. Parts can be glued in box. Battery holder is a Keystone No. 137.

HI-FI TODAY

By John Milder

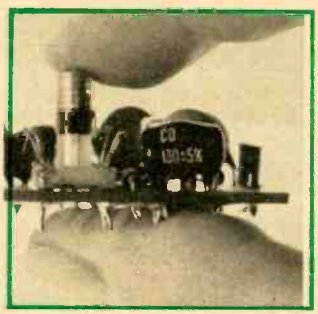
They shrunk yer tuner

Music to motor by

THOUGH practically everyone has argued the pros and cons of transistor amplifiers, little is said about transistor tuners. The scuttlebutt for a while, of course, was that transistor front-ends were prone to overloading and cross-modulation. Thing is, that situation largely has been laid to rest by 1) new transistor designs, 2) sophisticated circuitry specifically aimed at solving the problem.

To put the frosting on the cake, some of the latest FM tuners pair space-age transistors with other space-age components. Makers of the KLH model 18 tuner, for example, currently are asking, Who Shrunk Yer Tuner? Answer, of course, is that they did, having tucked a novel bit of stereo-FM circuitry into a cigar-box-like enclosure scarcely 9 in. long.

How did they do it? Well, for one thing, IF transformers in the unit are about the size of its transistors, as our photo suggests. Composed of two plastic-core windings mounted side by side, the IFs sport ferrite slugs in both primary and secondary. So small are the transformers and so low the current they handle that separate shields no longer are called for. Gone is the old-fashioned IF strip where transformers are much as they've always been and the only real change is that transistors have replaced tubes. In its stead is a miniature, fully shielded strip that is solid-state all the way through.



Tiny as the transistors they couple, IF transformers in the KLH model 18 stereo-FM tuner are designed specially for solid-state circuitry. Fingers grip input IF on unit's tiny IF strip.

The long and the short of it is that KLH has come up with perhaps the first truly transistor tuner. And if things are as they seem, other manufacturers are certain to devise similar miniature tuners to take advantage of all the transistor has to offer. You might say it looks as though the transistor is beginning to deliver on its promises.

Having just traded my ancient Volkswagen in on a Peugeot, I have automotive matters on the mind more than usual. One thing I've been noticing is the increasing emphasis on highway hi-fi. FM car radios, of course, are multiplying and Motorola now is on the auto-FM bandwagon with such foreign manufacturers as Becker and Blaupunkt. But even more striking is the swing to tape for cars.

The big impetus—and it's no surprise—is the tape cartridge. It's ideal for the kind of casual handling it's certain to get in a car. Cartridges also actually are easier to fiddle with in many cases than the tuning knob on a car radio. Both mono and stereo systems are available.

Add the fact that a cartridge is equally at home under the dash or in the living room and it's easy to see why more and more recorder manufacturers are getting into the act. Latest entries are by TelePro and RCA (the latter with an eight-track system developed by Lear Jet). And some auto makers (Ford, for one) will be offering stereo tape systems as an option with next year's cars.

Only catch is that we already are getting into muddy water. If we wind up with a dozen different cartridge systems for autos, the whole car-tape trend easily could go the way of 3-D movies. What we need is some standardization—and quick!

You may remember my mentioning some new low-noise tapes a while back that I'd seen being used in recording studios. Well, they now are available for home taping—from manufacturers like American, Kodak, Reeves-Soundcraft and 3M. More are on the way. In addition to low noise, most of the new tapes also feature improved formulations capable of capturing those elusive highs at slow speeds. Progress, it's wonderful.

QRP SPECIAL

If hamming has lost its challenge for you, try a half watt smack in the middle of the packed 80-meter band.

By CLARE GREEN, W3IKI

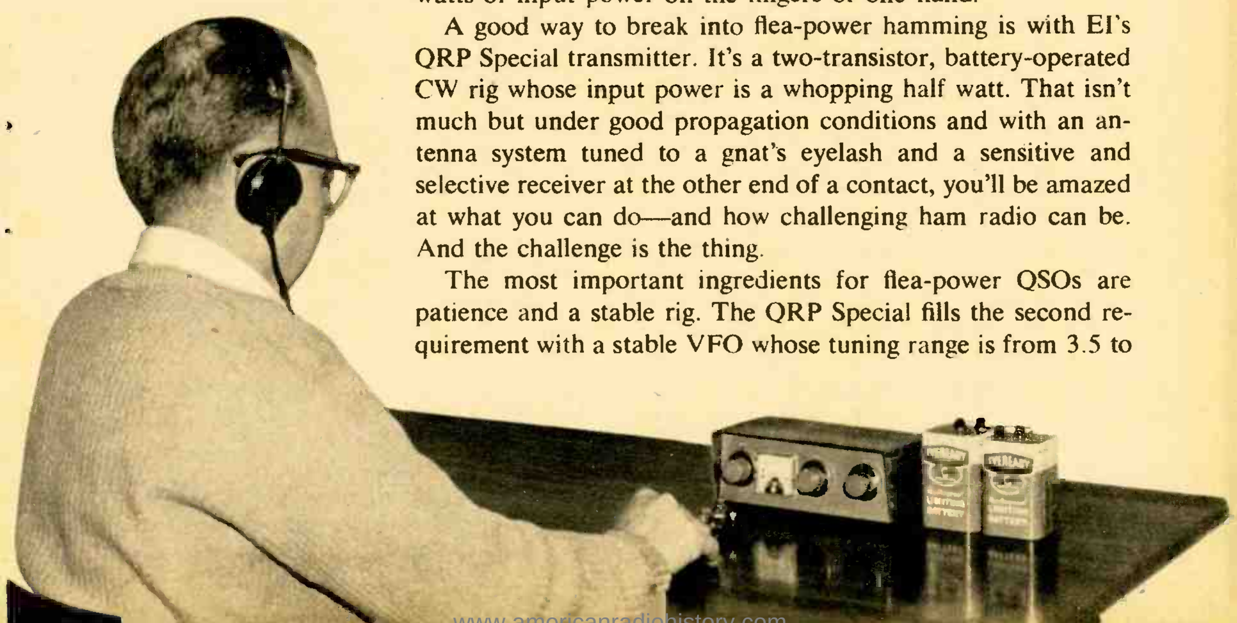
WHAT's happened to the old-time fun and challenge that was ham radio's keynote? Nowadays you go out and purchase all the equipment, hook it together, turn it on and you're in business. Anyone with a couple of hundred watts to play around with can send a string of CQs and come up with QSOs. If this doesn't do the trick you simply can boost your input power to a full gallon. If you can't stir up someone on the band with this blast you might as well use the telephone or the U.S. mail.

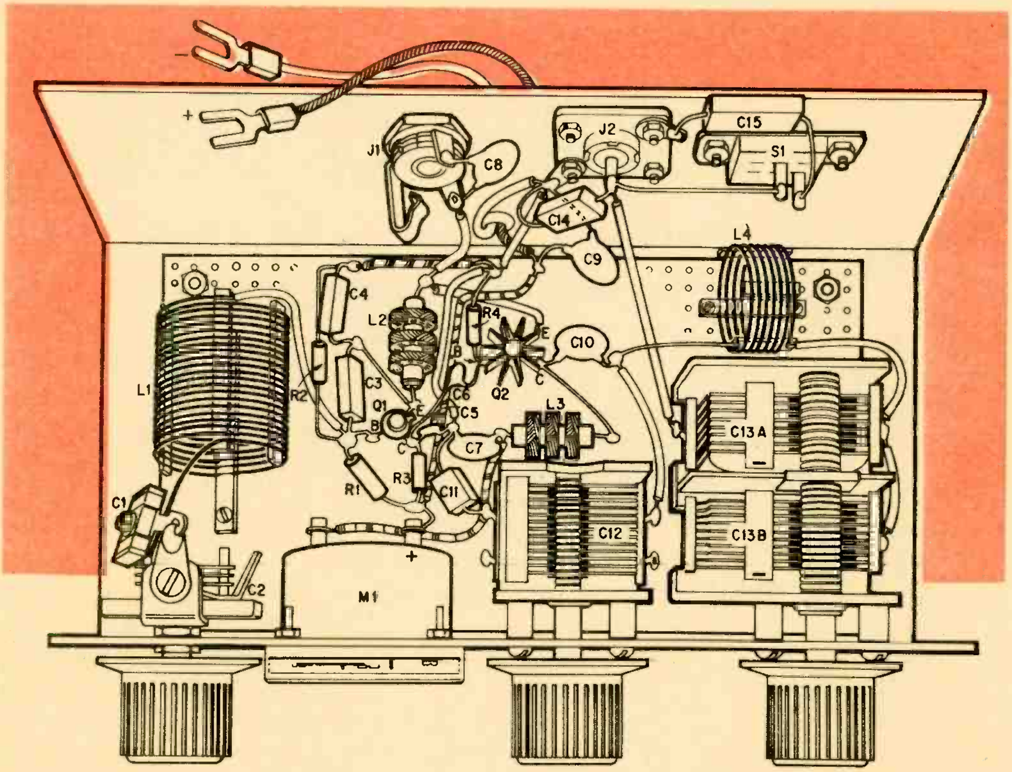
For many operators, high-power hamming has turned out to be dull stuff. Some say the contest is gone for good. But it hasn't yet—not by a long shot.

There's a group of amateurs who feel the lower the power, the greater the test of real hamming skill. They call themselves flea-power operators and their objective is to see how many contacts can be made with hardly any power at all. Although the QRP Amateur Radio Club (see THE DAVIDS IN GOLIATH LAND, July '65 EI) considers everything up to 100 watts flea power, the real fun begins when you can count the watts of input power on the fingers of one hand.

A good way to break into flea-power hamming is with EI's QRP Special transmitter. It's a two-transistor, battery-operated CW rig whose input power is a whopping half watt. That isn't much but under good propagation conditions and with an antenna system tuned to a gnat's eyelash and a sensitive and selective receiver at the other end of a contact, you'll be amazed at what you can do—and how challenging ham radio can be. And the challenge is the thing.

The most important ingredients for flea-power QSOs are patience and a stable rig. The QRP Special fills the second requirement with a stable VFO whose tuning range is from 3.5 to





Placement of parts is important for proper operation. Scrape the inside of the front panel to be sure good electrical contact is made between the panel and the frames of C2, C12 and C13A/C13B. Coils L1 and L4 are supported by machine screws through the strips extending a quarter-inch beyond the turns.

QRP SPECIAL

3.8 mc. The rig is built in a 3x8x5-in. cowl-type Minibox. The power supply is a 12-volt lantern battery. All the controls, including a 100-ma meter for tuning up the final, are on the front panel or what would be considered the U-section of the Minibox.

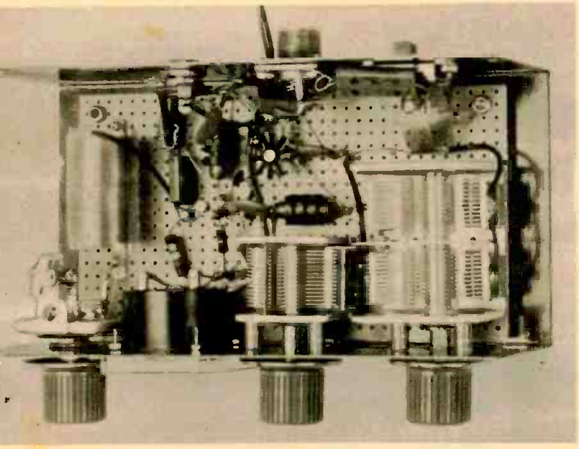
Naturally, with a low-power rig you just can't bulldoze your way through the crowded portions of the band. Low-power operation demands patient listening for clear spots in the QRM.

Your location and the time of day will determine the best operating technique. The author, who lives in a well-populated area of the East Coast, made his first tests of the QRP Special by trying for contacts around the middle of the day.

As a rule of thumb, the better the antenna, the less power will be needed for a QSO. The author used a coax-fed half-wave dipole cut for the 80-meter band. We recommend that you use such an antenna, the construction details of which are shown on the last page of this article. You should cut the antenna for the particular part of the band you want to operate on. More information on antennas can be found in the Radio Amateur's Handbook.

The Circuit. Take a look at the QRP Special's schematic. Q1 is connected as a Clapp oscillator that is coarse-tuned by L1/C1. C2 actually is a bandspread control that tunes the oscillator over the 3.5-3.8 mc portion of the 80-meter band. Q1's base current is established by R1 and R2. C3 and C4 (with L2) provide RF feedback in the emitter circuit.

The RF at Q1's collector is fed via C6 to the class C RF (final) stage, Q2. The amplified RF is coupled from Q2's collector circuit by C10 to the pi-network tank consisting of C12 and L4. Antenna and transmission-



Coil L1, left, has 51 turns—more than actually appear in the pictorial. Use the 96-turn coil specified in the Parts List for both L1 and L4.

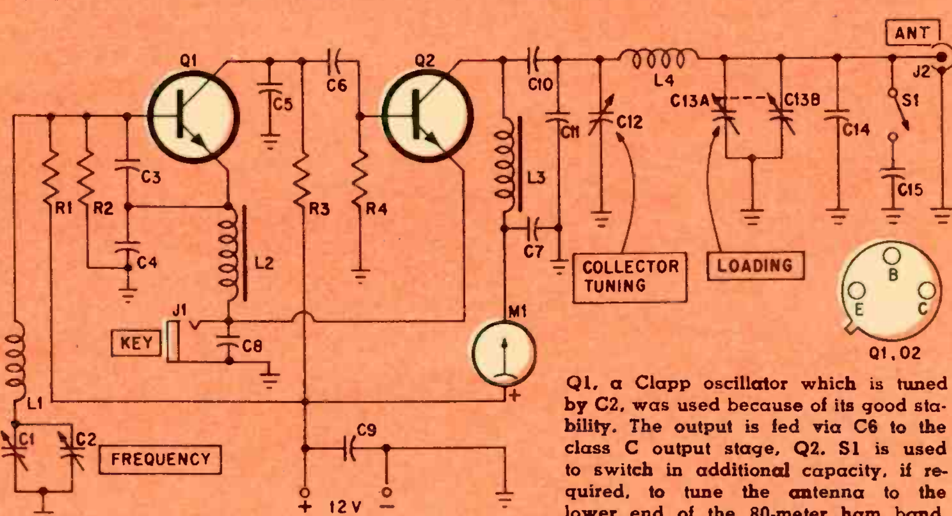
line loading are controlled by C13A/B, C14 and C15. To tune a particular antenna over the lower end of the 80-meter band, S1 is used (if necessary) to switch in additional capacitance (C14). The exact amount required should be determined experimentally for your antenna. The pi-net is designed to match 52-to-72-ohm antennas.

The key, which is plugged in J1, grounds the emitter circuits of both stages. Meter M1 indicates resonance of the pi-net. Capacitor C8 is an RF bypass across the key and C9 acts as an RF bypass across the battery.

Construction. Drill all holes and mount the front and rear panel components as shown in our pictorial and photos. The component board we used is a standard size (Lafayette 19 G 3606) that fits into the cabinet without having to be cut. Drill four holes

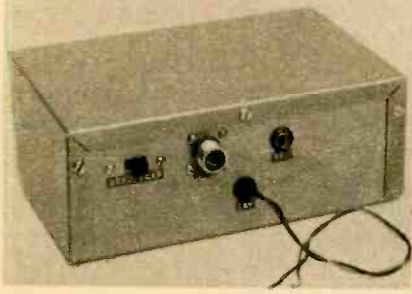
PARTS LIST

C1—5-80 mmf trimmer capacitor (Allied 13 L 512 or equiv.)
C2—2.8-17.5 mmf variable capacitor (Hammarlund HF-15, Allied 13 L 590)
C3—470 mmf, 500 V mica capacitor
C4, C14—1,000 mmf, 500 V mica capacitor
C5—50 mmf, 600 V ceramic disc capacitor
C6—500 mmf, 600 V ceramic disc capacitor
C7, C8, C9, C10—.005 mf, 600 V ceramic disc capacitor
C11—220 mmf, 500 V mica capacitor
C12—10-365 mmf variable capacitor (Lafayette 32 G 1103 or equiv.)
C13A, C13B—2-gang TRF variable capacitor: 10.3-365.7 mmf per section (Lafayette 32 G 1102 or equiv.)
C15—620 mmf, 500 V mica capacitor
J1—Open-circuit phone jack
J2—SO-239 coax connector (Amphenol 83-1R)
L1—51 turns Barker & Williamson Miniductor No. 3016 (Lafayette 40 G 1625)
L2, L3—2.4 millihenry RF choke (J. W. Miller No. 4666, Newark 59F304. 75c plus postage. Newark Electronics Corp., 223 W. Madison St., Chicago, Ill., 60606. Minimum order $2.50.)
L4—13 turns Barker & Williamson No. 3016 Miniductor (use leftover from L1)
M1—0-100 ma DC meter (Lafayette 99 G 5055 or equiv.)
Q1, Q2—2N706 transistor (GE)
Resistors: ½ watt, 10%
R1—25,000 ohms
R2—33,000 ohms
R3—330 ohms
R4—1,000 ohms
S1—SPST slide switch
Misc.—3x8x6-inch gray aluminum cowl-type Minibox (Bud 2132, Allied 88 P 686), transistor heat sink (Wakefield Engineering NF201, Allied 6 E 527), perforated board, flea clips, 12-V battery (Burgess TW2 or equiv.), National HRS-4 and HRS-5 knobs.



Q1, a Clapp oscillator which is tuned by C2, was used because of its good stability. The output is fed via C6 to the class C output stage, Q2. S1 is used to switch in additional capacity, if required, to tune the antenna to the lower end of the 80-meter ham band.

QRP SPECIAL



Front view of transmitter, above. Left control is VFO, meter indicates final's collector current, center control is final's collector tuning, right control is loading. At the left is a photo of the rear of the transmitter.

in the bottom of the cabinet and mount the board at its corners, using machine screws and spacers to prevent the flea clips from shorting to the case.

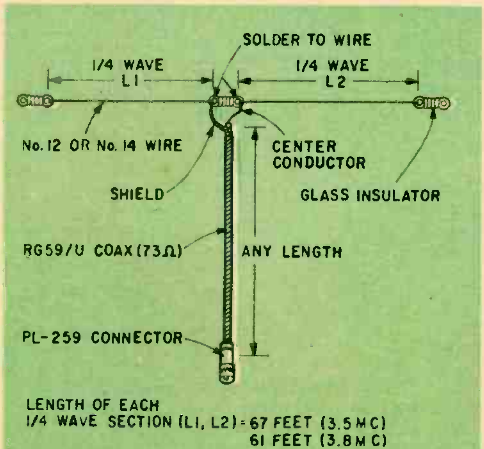
Count the number of turns required for L1 and L4, then carefully cut the plastic strips that hold the wire. Leave a ¼- to ½-in. length of plastic strip extending at each end in order to mount the coils to the board. The author used small brass wood screws but sheet-metal screws could be used as well. Make sure that you use short, direct leads between all components for best operation.

Before installing the heat sink on transistor Q2, expand the center of it with a pencil. Also check coils L1 and L4 after finishing construction to make sure that there are no shorted turns or metal chips in them.

Tune-Up and Operation. After wiring is completed, set C2, C12 and C13A/B to full capacity (do not install the knob on C2 at this time). Warm up your receiver, set it to 3.5 mc and turn on its BFO. Connect a 12-V battery, making sure that the polarity is not reversed since this could damage the transistors, and plug a key in J1. Temporarily connect a 51- or 75-ohm carbon resistor to J2 for a dummy load.

Depress the key and adjust trimmer capacitor C1 for a beat note in the receiver. Tune C12 for maximum dip, then tune C13 until the meter indicates 40 ma. Temporarily install the cover on the cabinet and check the frequency of the signal in the receiver. Keep adjusting C1 until the output frequency is exactly 3.5 mc with the cabinet cover on.

Install the cabinet cover permanently and [*Continued on page* 111]



Half-watt input power means you must have a good antenna. A half-wave dipole is best.

TRANSISTOR VOLTAGES

Transistor		Base	Emitter	Collector
Q1	*	+7½	+7½	+12
	**	−3½	0	+ 9
Q2	*	0	+7½	+12
	**	−1	0	+11

* Key up ** Key down

All measurements made with a VTVM. ±20%. C2 set to mid-range. 51-ohm dummy antenna at J2. C12 and C13 tuned to resonance at 40 ma.

CB CORNER

BY LEN BUCKWALTER KBA4480

Color It Busy

HELP's arriving! That was the phrase most on the tongues of CB makers at an electronics show we visited recently. And rightly so, for HELP (Detroit's *H*ighway *E*mergency *L*ocating *P*lan) already is making its mark on CB gear.

One manufacturer quick to turn the hullabaloo into hardware is Raytheon. Its new TWR-7 (the rig in our photo), for example, looks like most any piece of CB gear until you take away the mike. Its front panel then bears striking resemblance to a regular car radio—knob at each end, dial in the middle. Consensus was that Raytheon had shown some shrewd thinking, for several reasons.

If CB is to get into 80 million cars, it can't look like a jet set. Instead, it must appear friendly and familiar, something Grandma might find appealing. And that's precisely the guise the neat little TWR-7, obviously aimed at the big market, presents. Its channel selector is easy to operate, even without looking. And hippy features—S-meter, tunable receive—have been dropped in favor of simplicity.

First CB set specifically designed for the proposed HELP service, Raytheon's TWR-7 deliberately is on the simple side and largely goof-proof.

Even price and size have been streamlined. The entire rig is only about as big as Goldfinger in the pocket edition and tagged at about \$130—a fair figure for a solid-state 5-watter.

Another manufacturer responsive to recent CB developments is Squires-Sanders. Channel window on this company's new 23er shows all channels in black, save for No. 9. It comes up red and thus points to the suggested HELP frequency. (As our title indicates, they also might have colored it busy, since if HELP comes channel 9 will be mighty busy indeed.) A spokesman for the company said that newer versions will bow to the recent CB rules change which limits inter-station chit-chat to seven channels. Such equipment will have Channels 9 through 14 inked in red, along with No. 23.

Coming Up Rosy. With plenty of CB makers under one roof, we decided to finger the industry's pulse. "Where's CB going, now that rules are tighter?" we asked. Responses to our question naturally were varied, though the bulk offered more optimism than you'd find on the first day of spring. Some even had convincing arguments to back up the back-slapping.

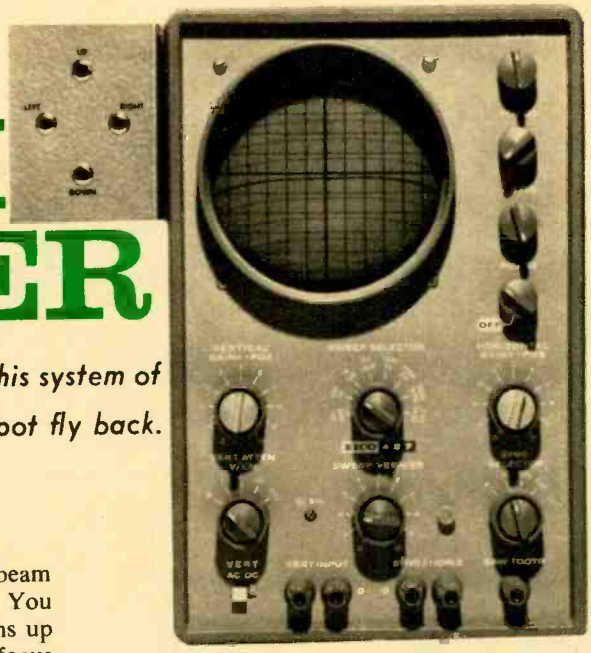
Many, for instance, feel that the business user finally will come into his own. Not that the rules will squelch personal users or even the outright hobbyists. With well-defined channels, the two camps will be kept separate. Result, summed up by one company manager, is that "everybody'll be happy."

A CB distributor from Nebraska told of a farmer who came into his store after learning of the new rules. "It's about time," beamed the soil-tiller. "Now I'll be able to call home and get through." Mildly confused, the distributor was set straight with the explanation that channels in the area had been clobbered by ladies exchanging pickle recipes.

Another promising report from the same distributor tells how the new rules altered the plans of an industrial operator fed up with pre-rules-change CB. Instead of switching to the more costly business bands, he decided to wait and see. Needless to say, he's glad he did.

[*Continued on page* 112]

BEAM FINDER



Which way did that beam go? This system of 4 lamps tells how to make the spot fly back.

By BERT MANN

LOCATING an oscilloscope's missing beam often can be a test of patience. You know the routine: after the scope warms up you turn the positioning, brightness and focus controls back and forth—but nothing appears. After dozens of twists on each knob, the spot finally shows up.

Maybe yours is a DC scope that takes a while to settle down. After carefully centering the beam you turn your back for a second. Turn around and the beam's gone. Where to? You can find out by jockeying the controls all over again. But a faster way is to look at the Beam Finder.

The Finder is a four-lamp indicator that is connected to the horizontal and vertical plates of the scope's CRT. The four lamps represent the top, bottom, right and left sides of the CRT. When the beam is off the CRT's face, the appropriate lamp (or lamps) tells you where it is.

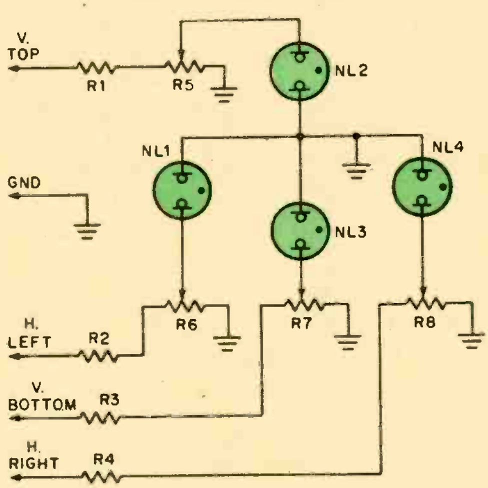
For example, if the top and right lamps are lit the beam is out in space around the 2 o'clock position on the CRT. Therefore, you'd move the beam down with the vertical-positioning control, then to the left with the horizontal-positioning control. When the beam is around the center of the CRT all lights will be off.

Our model was built in a 3x4x5-in. Minibox but you could build the Finder in the scope itself if there's room. Further construction details are covered in the captions.

The schematic at the bottom of the last page of this article is typical of the deflection circuits in scopes that employ what is called balanced beam positioning. The points to which the Finder is connected are identified with the letter *X*.

The schematic at right is typical of general-purpose scopes that have unbalanced positioning circuits. That is, only one vertical and one horizontal plate are used for beam positioning. The other vertical and horizontal plates are connected together and to B+. You connect two leads from the Finder to the B+ point and the other two leads to the points marked *Y*.

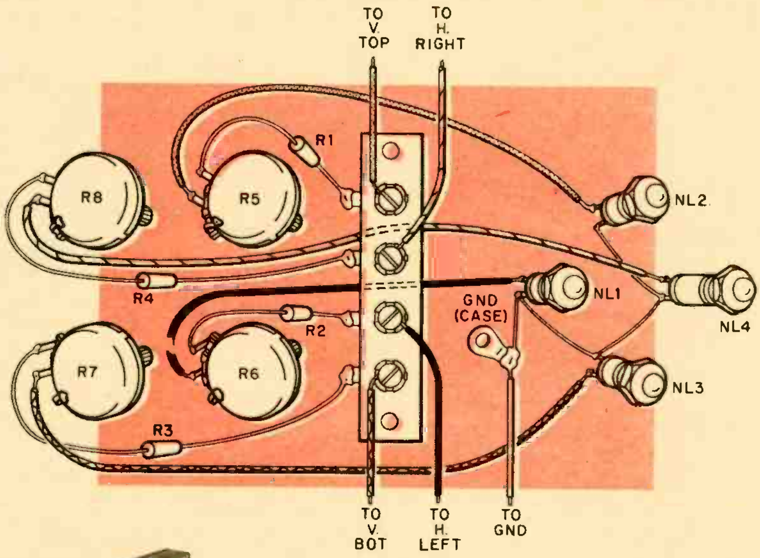
Setup and Operation. If the scope has balanced positioning, position the beam so it is centered horizontally (equidistant from the left and right sides of the CRT). Then adjust

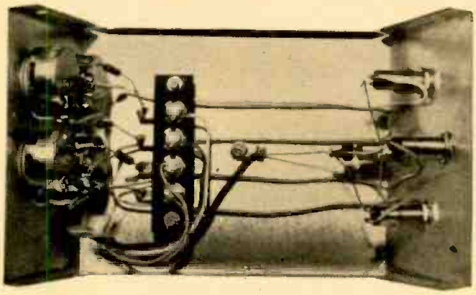


R5 is adjusted so that when beam is at top edge of CRT, voltage at V. TOP will cause NL2 to light. Operation is same for other directions.

BEAM FINDER

For convenience, we used a screw-type terminal strip in our model to which connecting leads from scope are soldered. Circuit could be built in smaller cabinet or installed in scope. One lug on each pot is grounded by being soldered directly to the case of the control.





PARTS LIST

NL1-NL4—NE-2 neon lamp or Lafayette 99 G 6226 neon lamp assembly

R1-R4—220,000 ohm, ½ watt, 10% resistor

R5-R8—1-megohm, linear-taper potentiometer (IRC Q11-137 or equiv.)

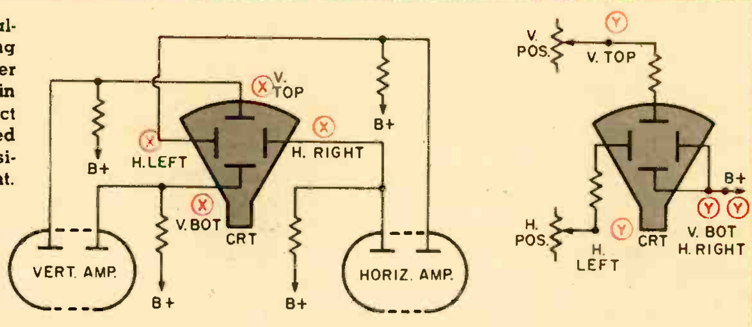
Misc.—3x4x5-inch Minibox, 4-terminal, screw-type terminal strip.

the scope's vertical-positioning control to put the beam at the top edge of the CRT. Now adjust R5 to the point where NL2 just lights. Then move the spot to the bottom of the CRT and adjust R7 until NL3 just lights. Similarly, adjust R6 and R8 with the beam located at the left and right sides of the CRT.

For scopes with unbalanced positioning, determine which plates are at B+ potential. If it's the bottom and right plates, adjust R7 and R8 until NL3 and NL4 light. Center the beam vertically, then move it to the CRT's left edge. Now adjust R6 until NL1 lights. Center the beam horizontally and move it to the top of the CRT and adjust R5 until NL2 lights.

With the bottom and right plates at B+ potential, the Finders' bottom and right lamps always will be lit. If the left lamp lights, the beam is off the left side of the CRT. If the top lamp lights, the beam is off the top of the CRT. If, say, the top lamp is *out* and the beam is *not* on the face of the CRT, the beam is beyond the bottom of the CRT.

In scopes with balanced beam-positioning circuits, connect Finder to points marked X in left schematic. Connect Finder to points marked Y in unbalanced positioning circuit at right.



Build This Sensitive 3-Tube ALL-BANDER

By CHARLES GREEN, W3IKH

BUILD an all-band receiver from scratch? Even old hands are likely to give you a wry look when you tell them what you're going to do.

Behind the expression are apprehensions about winding a dozen coils, complicated bandswitch wiring, critical front-end layout and a difficult alignment procedure.

Such fears often are groundless and the 3-Tube All-Bander can prove it. For one thing, you don't have to wind a single coil. The eight coils are standard catalog items that you mount in old tube bases. This eliminates the bandswitch-wiring problem since you simply plug in a different pair of coils for each band. The benefits of this are simplified construction and a chassis free from rat's-nest wiring.

Parts layout *is* important but it will not be difficult to duplicate that of our model. Alignment using a standard RF signal generation with a range from 550 kc to 36 mc, will go smoothly. And in terms of performance, the All-Bander can easily hold its own with most budget four- and five-tube general-coverage receivers now on the market.

Take a look at some of the other features of the All-Bander. Its frequency coverage is continuous from 550 kc to 36 mc in four bands. Though it has only three tubes it sports a superhet front-end followed by a regenerative detector. The detector is followed by two stages of audio, which provide sufficient power to drive the speaker to room volume.

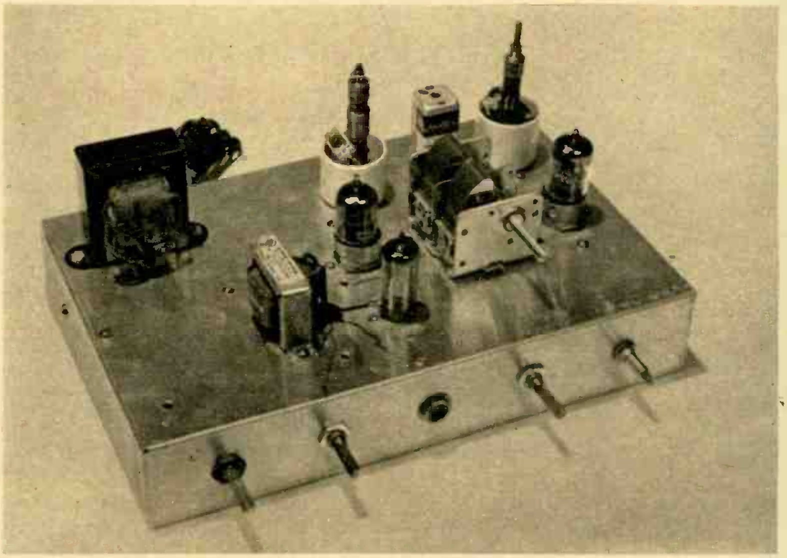
The combination of the superhet front-end and the regenerative detector give the All-Bander a high degree of sensitivity and selectivity. In addition, the circuit includes bandspread to open up those crowded portions of the dial when you're trying to pull a weak station out of the QRM.

The Circuit

Look at the schematic in Fig. 3. Signals from the antenna appearing at J1 are tuned by L1 (or L2, L3, or L4, depending on the band) and C2A at the input of mixer V1A. Variable capacitor C2B (ganged with C2A) tunes oscillator V1B so its output is always 456 kc above the frequency of the incoming signal. The output of the oscillator is coupled to the mixer by a gimmick capacitor. Bandspread is produced by dual-section variable capacitor C3A/C3B.

The resultant 456-kc IF signal at V1A's plate is fed to the regenerative detector stage, V2A. Regenerative feedback is pro-

3-Tube ALL-BANDER



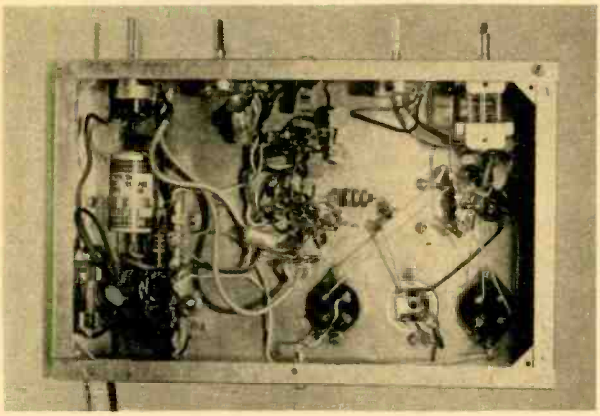


Fig. 1—Power transformer is in upper left corner; output transformer is below it and to right. Antenna coil is near the rear edge of the chassis in the center and oscillator coil is in the upper right corner. If you don't want to put the receiver in a cabinet, mount the speaker and the dial on the front of the chassis with angle brackets. In underside of chassis (left), tight areas are around V2's socket (center) and V1's socket (upper right). Bandspread capacitor C3A/C3B is in the upper right corner of chassis.

duced in this stage by C13, C14 and L9. *Regen* potentiometer R10 controls the stage's gain and, consequently, the amount of regeneration. The greater the regeneration the higher the sensitivity and selectivity.

The audio signal is coupled by C17 to *AF gain* control R11. The signal is then fed to V2B and V3, where it is amplified further. Transformer T3 couples the signal to the speaker. Phone jack J2 disconnects the speaker automatically when the earphones (preferably high impedance) are plugged in. B+ and heater voltages are furnished by T2, SR1, SR2 and the filter circuit consisting of R17, R18 and C22A, B and C.

Construction

To avoid crowding, build the All-Bander on a 7x11x2-in. aluminum chassis. Using the pictorial in Fig. 2 as a guide, mount all parts in the locations shown. But before installing tuning capacitor C2A/C2B, mount V1's socket and a three-lug terminal strip to the left of it. Drill two large holes in the chassis for wires from the terminal strip to C2A/C2B. (In our pictorial C2A/C2B is shown mounted slightly to the left so connections can be seen. It should be mounted so its lugs are directly over the terminal strip lugs.) Ground the braid of the shielded wires to R11 at each end.

Because of the frequencies at which the All-Bander operates, wiring and component placement are important—particularly around V1 and V2. The connections to C2A/C2B and C3A/C3B and coil sockets SO1 and SO2 are made with No. 16 tinned

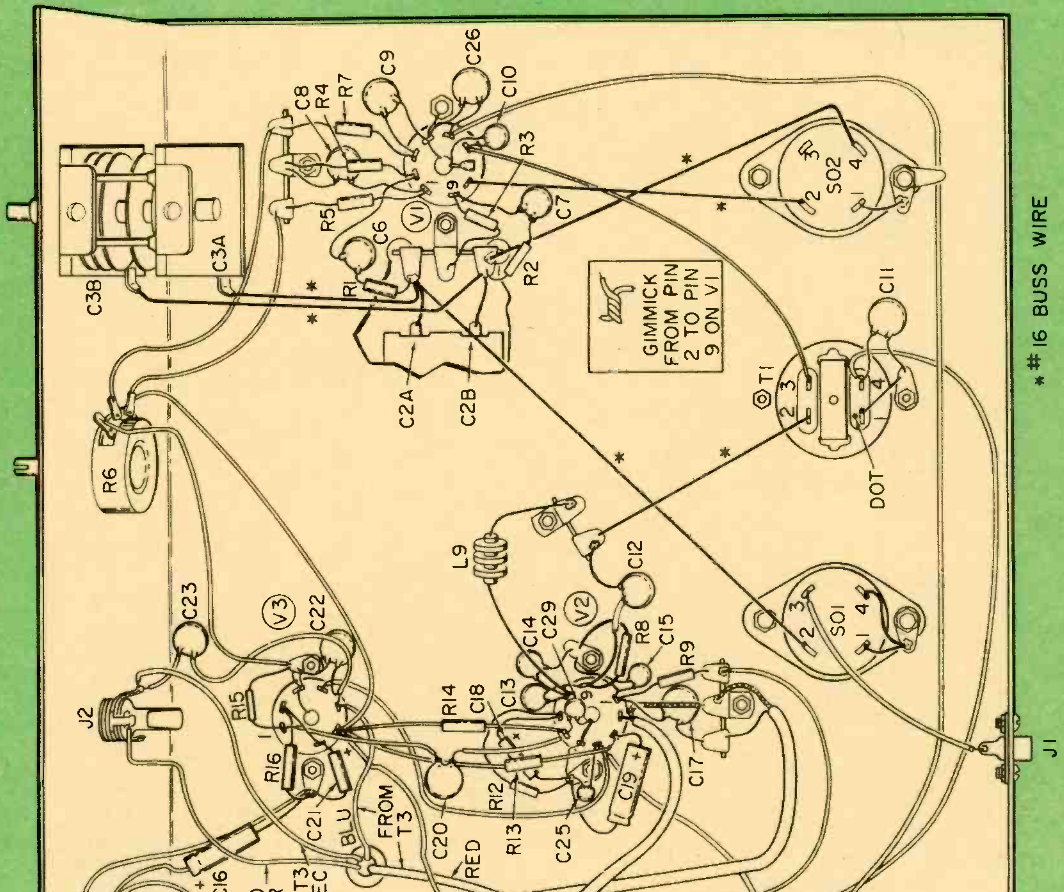


Fig. 2—Duplicate our layout and you won't have problems in getting the receiver to work. Take dimensions from this diagram and multiply them by 1.5 to lay out your chassis. For purposes of clarity, tuning capacitor C2A/C2B is shown moved out from V1 slightly. It should be mounted so its lugs are directly over the terminal strip that is near V1's socket. The holes for SO1, SO2 and T1 are 1⅛-in. dia.

3-Tube ALL-BANDER

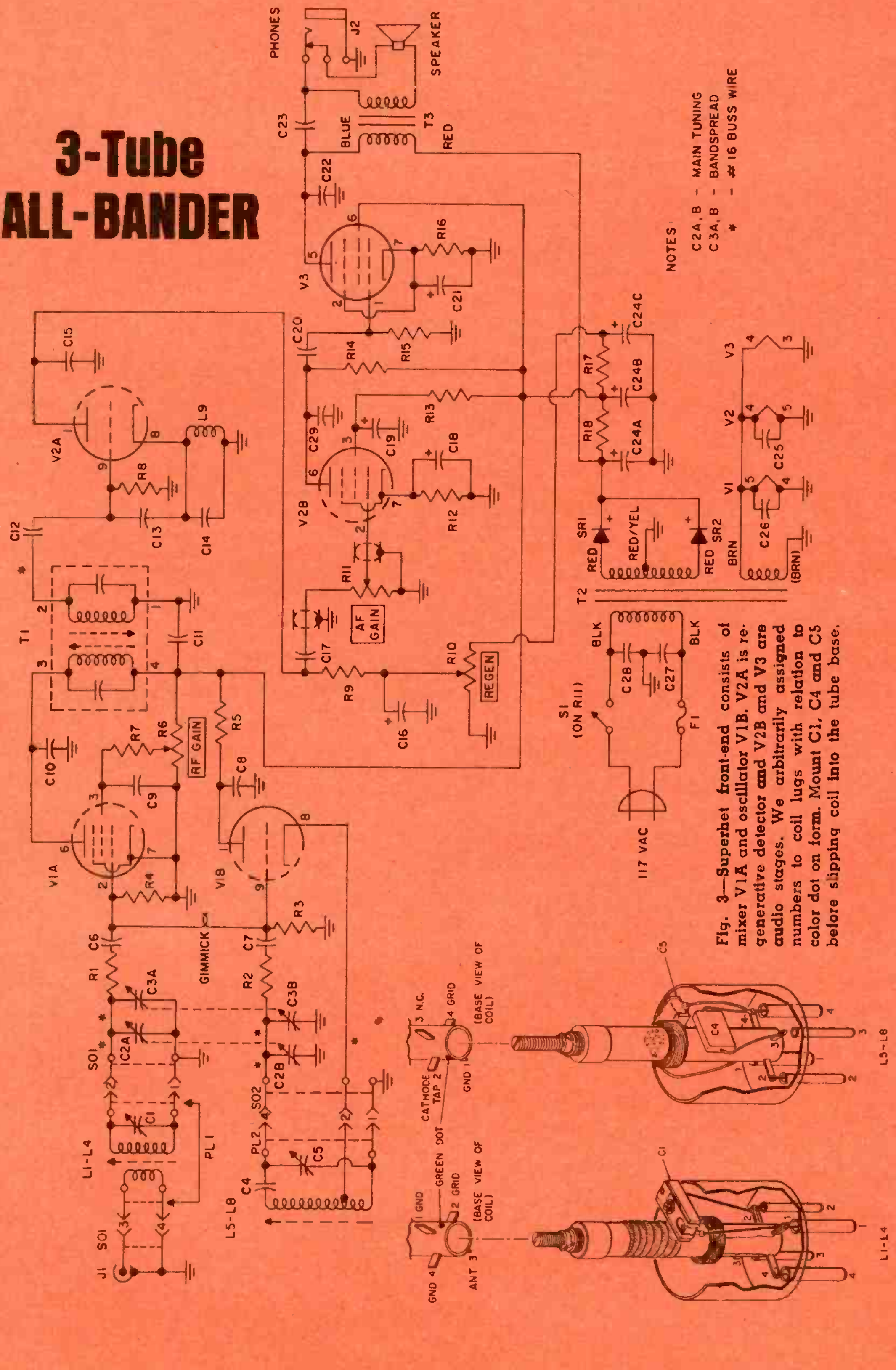


Fig. 3—Superhet front-end consists of mixer V1A and oscillator V1B. V2A is regenerative detector and V2B and V3 are audio stages. We arbitrarily assigned numbers to coil lugs with relation to color dot on form. Mount C1, C4 and C5 before slipping coil into the tube base.

PARTS LIST

Capacitors: 500 V ceramic disc unless otherwise specified
C1, C5—4-25 mmf midget trimmer capacitor (Arco-Elmenco type 422. Newark Electronics Corp., 223 W. Madison St., Chicago, Ill. 60606. Stock No. 14F962. 30¢ plus postage. $2.50 minimum order) Total of 8 required, 1 per coil.
C2A, C2B—10.3-365.7 mmf, 2-gang, TRF variable capacitor (Lafayette 32 G 1102)
C3A, C3B—3-15 mmf, 2-gang variable capacitor (Bud LC-1660. Allied Stock No. 13L555. $3.30 Plus postage; not listed in catalog.)
C4—Padder capacitors (see coil chart)
C6, C7, C12—100 mmf
C8, C9, C23, C26—.005 mf   C10, C13—10 mmf
C11, C17, C20, C22, C27, C28—.01 mf
C14, C25—.001 mf   C15, C29—500 mmf
C16, C19—5 mf, 150 V electrolytic
C18, C21—8 mf, 12 V electrolytic
C24A, B, C—20/20/20 mf, 150 V electrolytic (Mallory TCT-3112)
F1—1 A fuse and holder
Gimmick—See pictorial and text
J1—Phono jack
J2—Closed-circuit phone jack
L1, L2, L3, L4—Antenna coil, J. W. Miller (see coil chart)
L5, L6, L7, L8—Tapped oscillator coil, J. W. Miller (see coil chart)
L9—.55 mh RF choke (J. W. Miller No. 4649. Lafayette 34 G 8828)
PL1, PL2—4- or 8-pin tube base

Resistors: ½ watt, 10% unless otherwise specified
R1, R2—33 ohms   R3—47,000 ohms
R4, R15—1 megohm   R5, R7, R17—15,000 ohms
R6, R10—100,000 ohm, linear-taper potentiometer
R8—3.3 megohms   R9—120,000 ohms
R11—1 megohm, audio-taper potentiometer with SPST switch
R12—1,600 ohms   R13—680,000 ohms
R14—180,000 ohms
R16—680 ohms, 1 watt
R18—1,800 ohms, 2 watts
S1—SPST switch on R11
SO1, SO2—4- or 8-pin tube socket
SR1, SR2—Silicon rectifier, minimum ratings: 500 ma, 400 PIV (Lafayette 19 G 4204 or equiv.)
SPKR—4 in., 4 ohm speaker
T1—455 kc miniature IF transformer (J. W. Miller 12-C1. Lafayette 34 G 8727)
T2—Power transformer: 250 V center tapped @ 25 ma, 6.3 V @ 1 A (Allied 62 G 008 or equiv.)
T3—Output transformer; primary: 10,000 ohms, secondary: 4 ohms (Allied 61 G 448 or equiv.)
V1, V2—6U8A tube
V3—6AK6 tube (see page 214, Allied Catalog No. 240)
Misc.—7x11x2-in. aluminum chassis, 7- and 9-pin tube sockets, Eddystone No. 598 dial (available for $8 plus postage from Harrison Radio Corp., 225 Greenwich St., New York, N. Y. 10007), National TX-10 shaft coupling (Allied 42 H 009, 67¢ plus postage. Not listed in catalog.), terminal strips, knobs.

copper buss wire. Mike sure that you position these wires away from the chassis and other components. Use short, direct connections everywhere.

The gimmick capacitor is made by soldering two lengths of plastic-insulated wire to pins 2 and 9 on V1's socket. Then, tightly twist the wires together four turns. Cut off the excess wire and position the gimmick vertically (perpendicular to the chassis surface).

Make sure that you run the wire between pin 6 of V1 and pin 3 of T1 right against the chassis. After mounting C3A/C3B, install a three-lug terminal strip behind it, making sure there is sufficient space for the nearby components and leads. Connect a lead from V1's heater (pin 4) to a solder lug under V1's socket-mounting screw.

Coils L1 through L8 are mounted in old four-pin tube bases as shown in the sketch in the left corner of Fig. 2. Solder 2-in. lengths of No. 14 tinned wire to the four lugs of coils L1 to L4 and to the three indicated lugs on coils L5 to L8. Also solder the same size wire to lugs 1 and 2 on L1 to L4 to support trimmer capacitor C1.

On coils L5 to L8, trimmer capacitor C5 is connected from lug 1 to lug 4. Padder capacitor C4 is connected from lug 3 to lug 4. (Notice that there is no wire from lug 3 on coils L5 to L8 to pin 3 of the tube base.)

Position the capacitors right up against the body of the coil, then carefully slip the coil into the tube base, making sure the wire goes into the pins easily. Solder the wire in the socket pins. If you find it difficult to locate four-pin tube bases, you may use octal tube bases instead.

In keeping with its electrical design, the All-Bander deserves a good-looking cabinet,

COIL CHART

Band (mc)	Desig	C4	J. W. Miller No.	Lafayette stock No.
.55-1.7	L1	—	A-5495-A	34 G 8710
.55-1.7	L5	390 mmf*	A-5496-C	34 G 8713
1.7-5.5	L2	—	B-5495-A	34 G 8714
1.7-5.5	L6	2,000 mmf*	B-5496-C	34 G 8818
5.5-18	L3	—	C-5495-A	34 G 8751
5.5-18	L7	5,100 mmf*	C-5496-C	34 G 8719
12-36	L4	—	D-5495-A	34 G 8720
12-36	L8	.01 mf**	D-5496-C	34 G 8723

*5% mica capacitor   **ceramic disc capacitor

Fig. 4. Use this chart to determine the value of capacitor C4 and manufacturer's and distributor's stock Nos. for all coils. Coils should all be wired like units at left, for each of the bands.

3-Tube ALL-BANDER

such as the one it is shown in on the first page of this article. The cabinet is made of half-inch walnut veneer and is glued together. Nails are not used anywhere. While the glue is drying, the cabinet should be held together with rope tied around it. Cabinet construction details are shown in Fig. 5. The photo indicates how the speaker is mounted.

If you're not handy at woodworking you could install the All-Bander in a commercially made metal cabinet. Or you simply could mount the dial and speaker on the top of the chassis with ordinary angle brackets and let it go at that. The Eddystone dial on our model gives the All-Bander a professional appearance. If you want to trim the cost of the receiver you could use an Olson Electronics No. RA-635 five-scale vernier dial. It sells for $3.99 plus postage.

Alignment

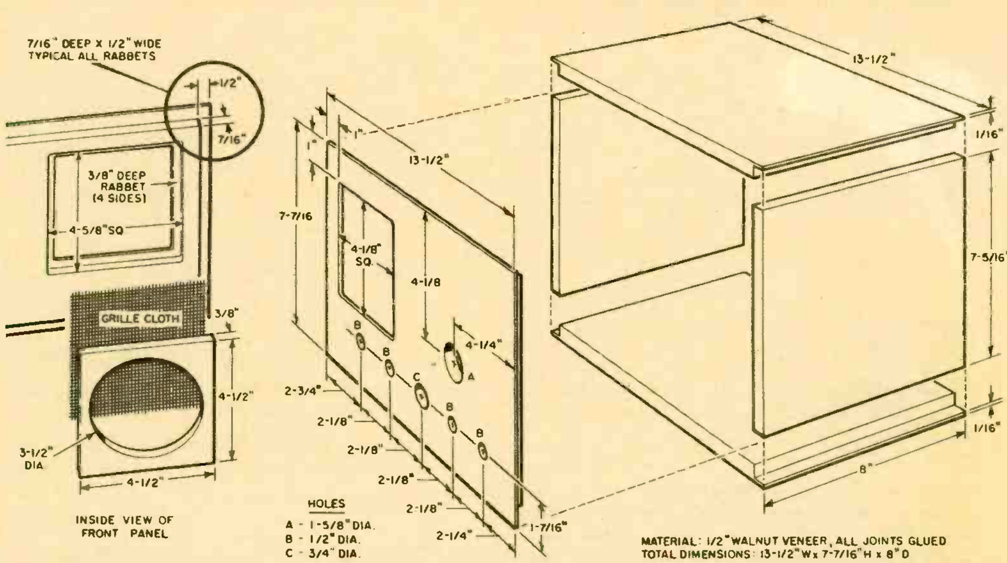
Turn on power and let the All-Bander warm up for about 15 minutes. Do not plug in any coils yet.

Connect the hot lead of a signal generator to pin 2 of V1 and the ground lead to V1's socket-mounting screw. Set C2A/C2B and C3A/C3B to minimum capacity—that is, plates fully open. Set R6 and R11 to mid-rotation and turn R10 clockwise to a point just below where the receiver breaks into oscillation. Set up the signal generator for a 456-kc modulated output and adjust the slugs (top and bottom of the can) of T1 with a plastic alignment tool for maximum audio output.

Disconnect the signal generator and connect its hot lead through a 300-ohm, ½-watt carbon resistor to J1. Connect the generator's ground lead to the chassis. Then carefully perform each of the 24 steps in the alignment table.

Note. The oscillator stage operates 456 kc

Fig. 5—Details and dimensions for a ½-in. walnut-veneer cabinet. Speaker is attached to a piece of ⅜-in.-thick plywood which is mounted in front panel. Tie rope around the cabinet to hold joints together while the glue dries.



above the frequency of the incoming signal. Make sure you don't align the receiver on an image frequency. For example, if you tune the receiver to 1000 kc the oscillator will be operating at 1456 kc. Mix this signal with a 1000-kc input signal and you get a 456-kc IF signal.

But suppose when the receiver is tuned to 1000 kc, a 1912-kc signal is fed to J1. The oscillator still would be operating at 1456 kc and when its output is mixed with a 1912-kc signal you'll also get a 456-kc IF signal. Remember that in the All-Bander the image frequency is always twice the IF frequency plus the frequency to which the receiver is tuned.

To allow for oscillator shift as the mixer circuit is aligned do not completely open or close C2A/-C2B for the minimum- or maximum-capacity positions indicated in the Alignment Table.

Upon completing alignment, coat the tuning-slug screws on each of the coils and the trimmer-capacitor screw heads with just a drop of coil dope or clear nail polish. This will prevent misalignment caused by accidental movement of loose screws.

Operation

For a good antenna see the ALL-BAND SWL ANTENNA article in the September 1964 EI. If you don't want to go to the trouble of constructing this antenna, a 25-ft. length of insulated wire will work well for broadcast and higher-power short-wave stations. But for best results, a good outside antenna and ground are required for digging those weaker stations out of the QRM.

Normally the *RF gain* control should be kept about halfway up and adjusted to keep the strong stations from overloading the detector stage. The *regen* control should be kept below the point of oscillation for AM stations and adjusted for oscillation to provide a beat note for CW reception. With care, sideband can be tuned in by adjusting the *regen* control carefully.

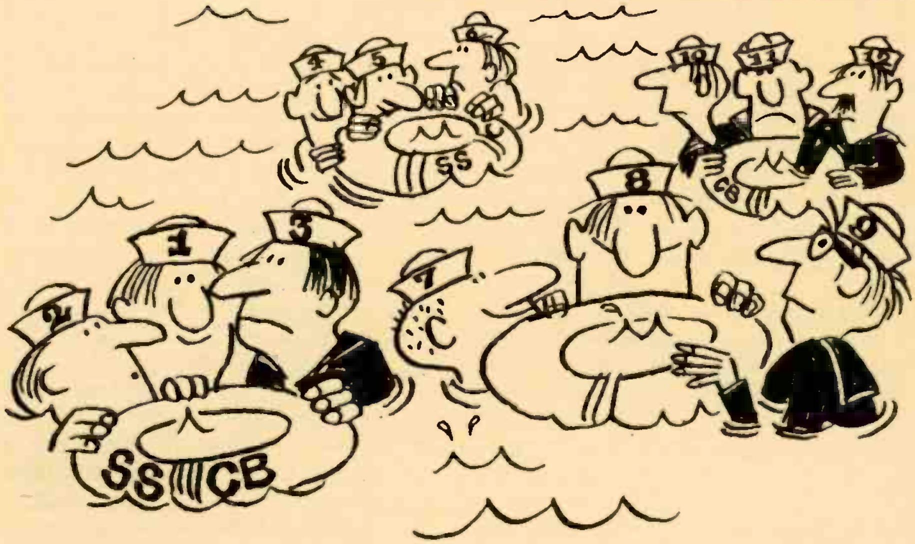
The best way to use the bandspread capacitor (C3A/C3B) is to adjust it so its plates are fully open. Set the main tuning capacitor to the highest frequency of a particular segment of the band you wish to tune. Then tune with the bandspread capacitor. As the plates close, you will tune lower frequencies. Good listening!

ALIGNMENT TABLE

Step	Coils	Signal generator frequency (mc)	C2A/C2B setting	Adjust for max. signal
1	L1, L5	.55	maximum capacitance	L5
2	L1, L5	1.70	minimum capacitance	C5
3	L1, L5	.60	tune for signal	L1
4	L1, L5	1.50	tune for signal	C1
5	repeat steps 3 and 4			
6	calibrate dial with signal generator			
7	L2, L6	1.70	maximum capacitance	L6
8	L2, L6	5.50	minimum capacitance	C5
9	L2, L6	1.80	tune for signal	L2
10	L2, L6	5.00	tune for signal	C1
11	repeat steps 9 and 10			
12	calibrate dial with signal generator			
13	L3, L7	5.50	maximum capacitance	L7
14	L3, L7	18.00	minimum capacitance	C5
15	L3, L7	6.00	tune for signal	L3
16	L3, L7	16.00	tune for signal	C1
17	repeat steps 15 and 16			
18	calibrate dial with signal generator			
19	L4, L8	12.00	maximum capacitance	L8
20	L4, L8	36.00	minimum capacitance	C5
21	L4, L8	13.00	tune for signal	L4
22	L4, L8	30.00	tune for signal	C1
23	repeat steps 21 and 22			
24	calibrate dial with signal generator			

Fig. 6—After completing the preliminary alignment described in the text, continue to this alignment procedure. Be sure bandspread capacitor C3A/C3B is set to minimum capacity (plates fully open) while performing these steps.

SURVIVAL COURSE



With most CB licensees dumped into seven channels, it's easy to sink but

DANIEL BOONE had reasons to push on into the wilderness. "Soon as I gits a neighbor close as seven mile," Dan would level, "I mosies to where there's elbow room. Fact is, I jes' cain't stand crowds."

With the new rules limiting interstation Citizens Band communications to a mere seven channels, CBers would like to follow Daniel's lead and move to choicer territories. But they can't—not and stay CBers. The average licensee is in deep water looking for a way out. But there aren't enough life preservers to go around. The Sorry Seven simply offer too few frequencies and too much QRM.

The rules that became effective last April took a high percentage of the stations then on 23 channels and squeezed them into the seven. Now there's almost no avoiding the jokers, the loudmouths, the 16-year-olds rattling on about their love life. In short, the seven general-purpose CB channels are a mess and surviving on them calls for front-line strategy so sharp even the Pentagon might take notice.

First tactic is to reduce received QRM. If you can't hear 'em you can't work 'em, the old axiom of pre-rules-change CB, now roars home with all the impact of a kilowatt linear driving a rhombic. Received QRM stems from three sources: local stations on the same channel, skip stations on the same channel and signals on adjacent channels.

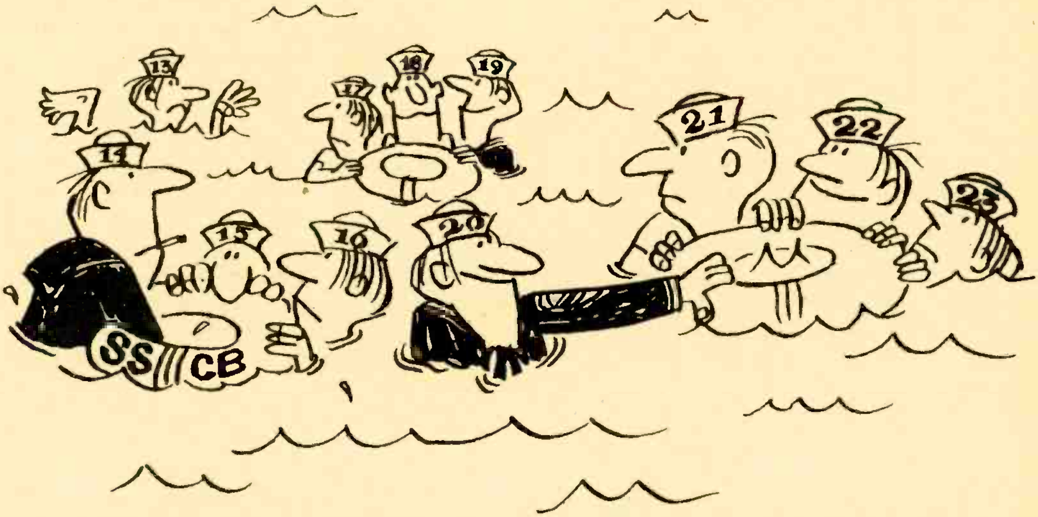
Adjacent-channel interference is determined by receiver selectivity, which in turn largely is a function of IF bandpass. Most modern budget transceivers are sufficiently selective to reject adjacent-channel interference from all but the strongest signals. And when operations were spread over 23 channels the odds were in your favor that a local station would be either in your group or on a channel at the other end of the band.

Unfortunately, the local powerhouse now has been moved right next to your favorite channel and his sideband hash all but jams your receiver. So you must start off by eliminating adjacent-channel QRM.

If you're contemplating new equipment the answer is simple: buy a de luxe transceiver, one with a crystal or mechanical filter or multiple low-frequency IF amplifiers (note the plural). Their selectivity (IF bandpass) is so sharp that adjacent-channel interference virtually is non-existent. Assuming you don't feel like spending a couple hundred bucks

FOR CBers

BY HERB FRIEDMAN, KBI1957



hard to swim. Here's how the smart CBer can keep his head above water.

for new gear, next best bet is to upgrade your transceiver with an adaptor that sharpens selectivity, such as EI's DOUBLE-CONVERSION ADAPTOR (Nov. '62 EI) or CB CHANNEL SLICER (Jan. '65 EI).

Once you've eliminated QRM from adjacent channels it's time to work on co-channel interference. And here some major improvements can be made, enough to make it look as though the seven-channel squeeze never happened. The co-channel QRM cutter is the directional beam. To understand the strengths of this one, let's say we have five stations in operation, all using non-directional antennas—ground planes, perhaps. Their radiation patterns overlap so that in monitoring station A, station B hears A—plus C, D and E.

But give these same stations directional antennas and station B will receive A far better and at the same time his pickup of the other stations is reduced. Reason is that directional antennas by definition transmit and receive signals primarily from one direction.

If the antennas at both stations (A and B) had a receive and transmit gain of 10db, the effect at station B would be equivalent to station A's running 500 watts input (5 watts boosted 10db, or 50 watts, for transmitting; and 10db more, or 500 watts, for receiving). Simultaneously, the other stations are beaming their signals away from station B, so B gets reduced co-channel interference plus extra effective power from station A.

Complicated? Not at all. Each station utilizing a directional antenna not only reduces his own received QRM but the QRM he causes other stations. And don't forget the extra punch a directional puts into your signal.

As for skip QRM, we just are beginning to emerge from a sunspot valley and skip interference virtually is nil. But in the next year or two sunspot activity will increase and skip reception naturally will follow suit. Unfortunately, there is little that can be done about skip interference and a station 3,000 miles away always can come barreling in as though it were in the next room. Sole protection against skip is a directional antenna, oriented (when possible) so skip signals arrive at points where the antenna's sensitivity is minimal.

Of course, optimum modulation characteristics are just as important as QRM reduction. The advantages of speech clipping or compression have been stressed again and again for old-fashioned 23-channel CB. Thing is, a modulation booster is an absolute necessity on the Sorry Seven.

Of utmost importance, too, is that a modulation booster be adjusted critically, which in most cases is to its design limit. For example, if a compressor is rated for 6db compression, don't push for 12db by shouting into the mike. The distortion might appear to be more talk power but it ultimately will reduce intelligence.

Intelligence also can be improved by eliminating room echo. To be sure, it really doesn't matter on a free and clear channel whether you like to sit back and run the mike gain wide open. Armchair copy is armchair copy so long as the signal has no interference. But QRM-plus-echo is a sure way to fend off solid copy.

SURVIVAL COURSE

Best bet is to use close miking to prevent echo and to insure that the all-important voice sibilants (which carry the intelligence) go into the mike, not into the air. Keep in mind that the most intelligible signal is crisp (lots of highs and echo-free). End result may have little in common with the sound of a broadcast station but it will cut through QRM.

After you've done your all to put out your most powerful signal (not to mention souping up your receiver to the point of picking up a flea's whisper clean across town), it's time to modify operating procedure. Really sharp operating procedure puts you one up on the lids—the characters with the dead carriers and the incessant break-breaks even when you're calling for an ambulance.

The military has a good technique which well can do wonders on the Sorry Seven. They keep transmissions short, with each consisting of a single thought. This way, if the channel suddenly is hit with severe QRM it's necessary only to repeat a single idea.

Short transmissions also let you hear what's on a channel. If you switch to receive and find ten layers of QRM you have only to wait for another hole and then slip in with your message. On the other hand, if you drone on and on you might get QRMed on the first sentence. Two minutes and six subjects later you release the push-to-talk switch only to find no one's heard a word you said.

Another sharp trick is to use the holes in between the QRM. Thing is, the receiving station must be just as sharp as you are if this technique is to prove efficacious. Wait for the QRM to subside and then get in with a quick transmission which you cleverly cut to the bone.

For example, if you're stuck on the road and are calling for assistance, say no more than necessary. Don't go on and on about where you are, the color of your car and the nature of the breakdown. Start by getting someone's ear with a short "I need assistance." And when you get a response keep to the point, like, "Tow truck needed at Sixth and Main."

Even if your transmission is smeared by QRM the receiving operator frequently will get part of the idea the first time, the whole idea the next time. Suppose, for example, he gets only tow truck on your first transmission. In this case, he might say, "Repeat after tow truck." You reply, "Send to Sixth and Main." Total time needed for each transmission is less than three seconds.

Note that call letters are not given continuously. Repeating call letters, over to you, unit 1 to unit 2 and like jazz might sound professional but it's not. When you have an emergency, you're fighting to get a message through. Who is working who is unimportant, and it's sufficient to give the sequence only at the beginning and end of contact (the FCC says).

Of course, contacts on the Sorry Seven aren't limited to emergencies. You might have messages for buddies both old and new. Unfortunately, so does everyone else. Result is that the only way you can get a clear channel long enough to hold an intelligent conversation is to operate at 4 o'clock in the morning.

However, don't overlook the chance to get real QRM-free channels. The 16 so-called business channels—the ones where you may talk only to stations under your own license —are used about as often as a coal stove in a luxury apartment house. Typical business radio transmissions are short and far between and there always is room for you. Since you don't have to use one of the Sorry Seven to

[*Continued on page* 115]

EI AT LARGE

The Once Over

ERSTWHILE economists see the 60s as the age of automation, but we electronics hobbyists know it's really the age of plans. Fact is, the do-it-yourselfer never has had happier days (though we do spot a less than gleeful countenance now and again). Plans he can procure for Mercury mapping, flip-flop fracturing or chefing in an I-hate-to-chef fashion.

We in electronics frequently are more fortunate than others, and some of the plans we are offered really pan out. But so grandiose are a few of the plans making their rounds these days that we only could take a closer look.

Grand Plan No. 1 came to us in better

form than most TV dinners in that it was neither frozen nor in need of heat. A wrist-radio of the sort Dick Tracy allegedly devised, it also sported a built-in compass (though weather-vane it had not).

And while the radio did pick up a local station, it spread the signal across the band in the best of bread-buttering fashion. Volume, we found, could be controlled only by a cantilevering wrist movement, and the whole gadget made us long for a crystal-and-catswhisker affair we parted with 20 odd years ago. Dick Tracy, we decided, was putting profit over performance, and he also just might be perpetrating some kind of fraud.

Next Grand Design we uncovered was a true two-buck goldmine, though perhaps of no value to beleaguered Fort Knox. For a mere 200 pennies, we picked up a set of plans, by Relco, for converting an old TV receiver into a big-screen oscilloscope, looking, we suppose, like the large jobs the mad scientists use in the horror movies.

Opening the envelope, we were astounded by the project's stark simplicity: three sheets of mimeographed paper detailed the complete conversion. And since one page contained the schematic of the amplifier we were to build (and the second page the pictorial of that same amplifier), we sensed no fear of becoming bogged down in details.

But now for the crippler. As most any electronics-minded soul is aware, all useful scopes incorporate an adjustable sweep (horizontal) oscillator and a vertical amplifier which amplifies minute test signals. But a TV receiver offers neither. Instead, it has a fixed horizontal sweep of 15,750 cps and a vertical sweep of 60 cps.

Relco gets around this little problem by having the user rotate the picture tube 90 degrees. This way, the 60-cps sweep becomes the horizontal sweep. Since the 60-cps sweep easily can be varied to about 100 cps, the converted TV set could display at least two cycles of a 120- to 200-cps signal. By squinting, we might push that figure up to 1,000 cps. But even the cheapest commercial scope lets you see up to at least 100 kc, which puts that 1,000-cps figure somewhat on the low side.

Major part of the Relco conversion is construction of a high-gain amplifier which becomes the scope's vertical amplifier. Nothing wrong here (it obviously doesn't take outstanding engineering to pass 1,000 cps). And Relco didn't claim we'd wind up with a wide-band scope, anyway. They even admitted we wouldn't have some of the refinements of a commercial scope—if you call a horizontal amplifier, adjustable sweep frequencies and convenient centering and focus controls *refinements*.

Our third Grand Design was a set of plans from Colordaptor for a "Color TV Converter." And unlike Relco's three mimeographed pages, the Colordaptor instructions are printed and they are quite thorough. Basic color theory, detailed construction steps and quite good pictorials and schematics are all there.

The Colordaptor system basically is the one CBS came up with decades ago. This, old timers will remember, utilized a big motor-driven spinning disc holding red, green and blue filters in front of the kinescope. The spinning color disc was synchronized to the transmitted picture. As each filter came in

[*Continued on page* 116]

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FCC Form 756 A

The United States of America

NUMBER P1-20-6490

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PLACE AND DATE OF ISSUANCE BUFFALO, NEW YORK SEPTEMBER 11, 1963

DATE AND TIME OF EXPIRATION SEPTEMBER 11, 1968 AT THREE O'CLOCK A. M., EASTERN STANDARD TIME.

SPECIAL ENDORSEMENT: SHIP RADAR ENDORSEMENT - SEPTEMBER 11, 1963 - BUFFALO, NEW YORK

ISSUING OFFICER

Federal Communications Commission.

Tommy Willis Duffy (Licensee)

(Issuing Officer)

Ben F. Waple (Secretary)

NOT VALID UNTIL SIGNED

SPECIMEN

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These CIE men have good jobs
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Matt Stuczynski, Senior Transmitter Operator, Radio Station WBOE. "I give Cleveland Institute credit for my First Class Commercial FCC License. Even though I had only 6 weeks of high school algebra, CIE's AUTO-PROGRAMMING teaching method makes electronics theory and fundamentals easy. After completing the CIE course, I took and passed the 1st Class Exam. I now have a good job in studio operation, transmitting, proof of performance, equipment servicing. Believe me, CIE lives up to its promises!"

Ted Barger, Electronic Technician, Smith Electronics Co. "I've been interested in electronics ever since I started operating my own Ham rig (K8ANF). But now I've turned a hobby into a real interesting career. Cleveland Institute of Electronics prepared me for my Commercial FCC License exam . . . and I passed it on the first try. I'm now designing, building and testing all kinds of electronic equipment . . . do a lot of traveling, too. It's a great job . . . and thanks to CIE and my FCC License, I'm on my way up."

Chuck Hawkins, Chief Radio Technician, Division 12, Ohio Dept. of Highways. "Cleveland Institute Training enabled me to pass *both* the 2nd and 1st Class License Exams on my *first* attempt . . . even though I'd had no other electronics training. (Many of the others who took the exam with me were trying to pass for the eighth or ninth time!) I'm now in charge of Division Communications and we service 119 mobile units and six base stations. It's an interesting, challenging and extremely rewarding job. And incidentally, I got it through CIE's Job Placement Service . . . a free lifetime service for CIE graduates."

Glenn Horning, Local Equipment Supervisor, Western Reserve Telephone Company (subsidiary of Mid-Continent Telephone Company). "There's no doubt about it. I owe my 2nd Class FCC License to Cleveland Institute. Their FCC License Program really teaches you theory and fundamentals and is particularly strong on transistors, mobile radio, troubleshooting and math. Do I use this knowledge? You bet. We're installing more sophisticated electronic gear all the time and what I learned from CIE sure helps. Our Company has 10 other men enrolled with CIE and take my word for it, it's going to help every one of them just like it helped me."

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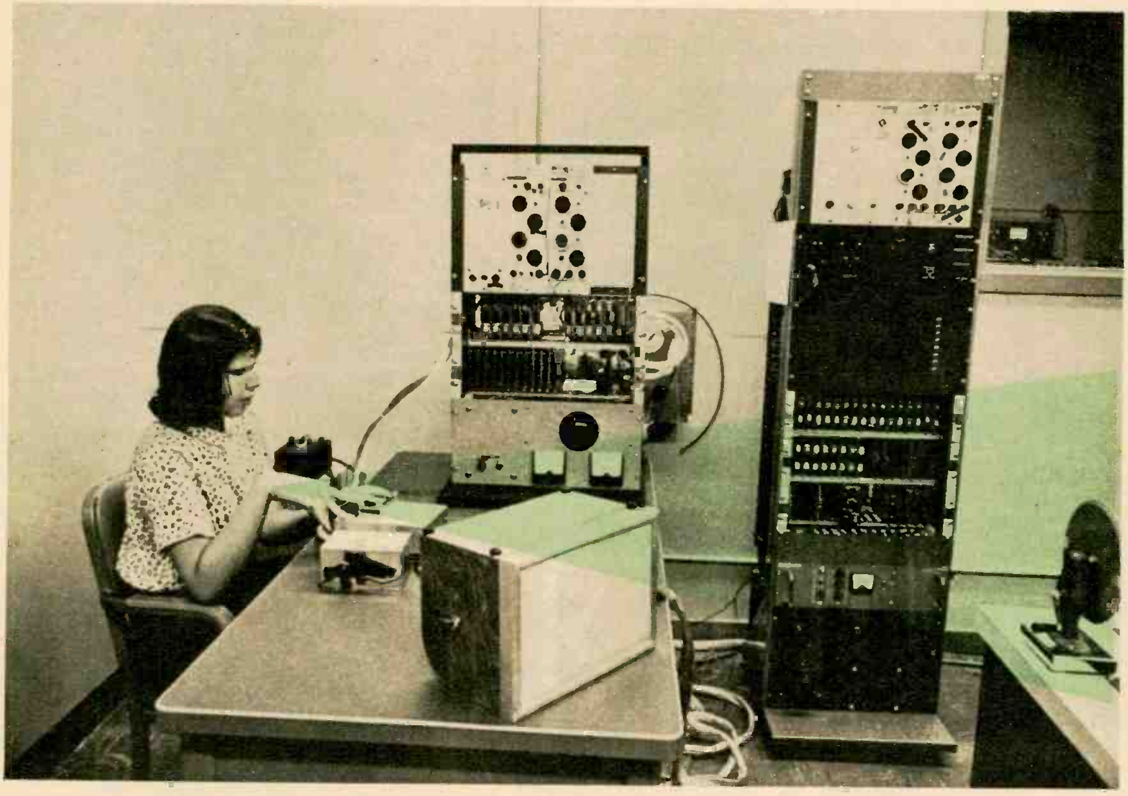


ELECTRONIC BRAILLE

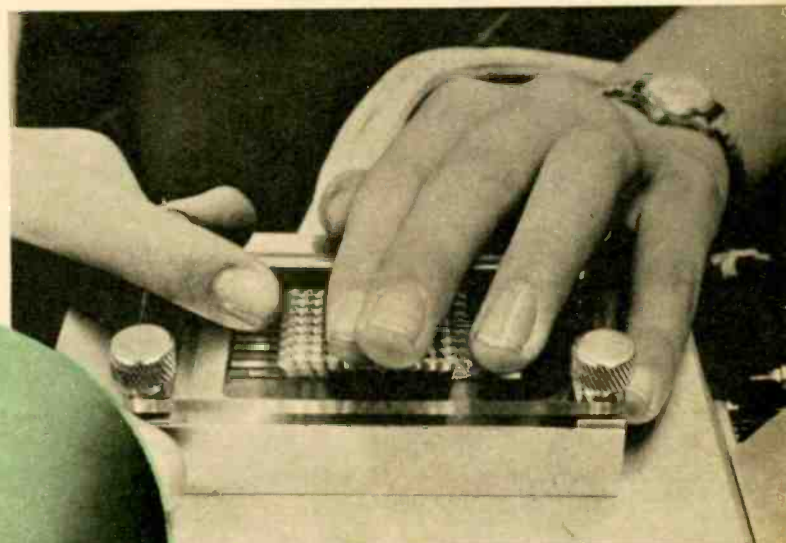
THOUGH the machines in our photo above would have caught the attention of most any 12-year-old, Candy Linvill paid them no mind. Candy, like some 400,000 others in the U.S., is blind. And while she long has been able to read books printed in the system Louis Braille devised a century ago, hope is that she someday may read the same books and magazines everyone else does.

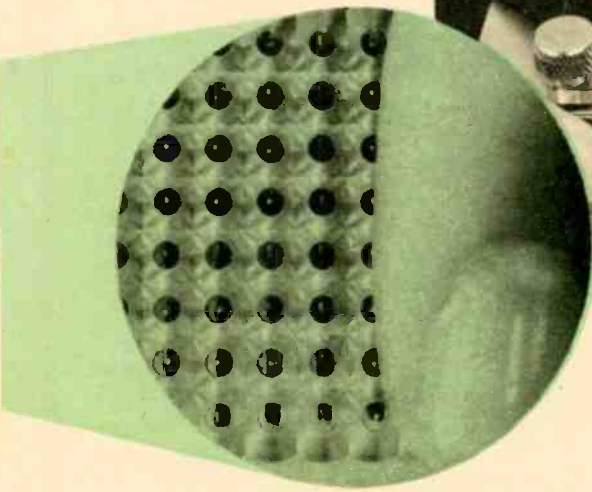
Professor John G. Linvill, head of the Electrical Engineering Department at Stanford University, is Candy's father. Working in conjunction with the staff of the Stanford Research Institute, he already is well on the way toward developing a pocket-size reading machine that will translate a printed page directly into a kind of electronic braille. Big advantage of such a device would be elimination of the need for reproducing books and papers in braille.

In its initial form, the device existed in a purely experimental version put together by Gerald Alonzo, a graduate student at Stanford. Since then, the more elaborate instrument shown in our photos has been built. But Prof. Linvill envisions a final microelectronic model made of plastic and about the size of a blackboard eraser.

"It would roll freely over the page on plastic rollers," Prof. Linvill explains, "while tiny photoelectric cells on the bottom scanned the words. The photocells would be connected to fine reeds whose tips protrude through small holes in a reading panel at the top of the device.

"When a photocell saw black, the reed connected to it would vibrate. By moving the device over the page, a blind person would feel the vibrating outline of each letter as his fingertips touched the reeds. In time he might recognize whole words by touch."



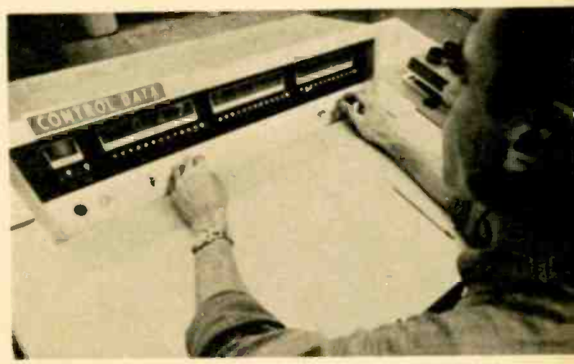


Experimental electronic-braille setup at Stanford University employs reading surface consisting of 96 piezoelectric bimorph reeds (see detail at left). Blind reader places index finger on surface of reeds, eventually learns to identify letter machine is scanning by sensation imparted to fingertip. Hope is that more sophisticated versions of the device ultimately may enable blind persons to sense complete words rather than single letters.

In short, the kind of device Prof. Linvill envisions would consist of an optical probe small enough to be held in the hand and scanned across a page of a book or magazine. Variations in the amount of light reflected from black printing on white paper would generate signals in an array of tiny piezoelectric bimorph reeds under the reader's fingertips. These reeds, in turn, would vibrate in a pattern shaped like the letter being scanned.

Before trying to develop the complicated electronic circuitry required for such a device, SRI researchers devised tests to see if the reading method was practical. A computer was programmed to simulate the output of an array of photocells moving across a line of print and signals were sent to a group of reeds under the reader's fingertips. Blind persons soon were responding to the reeds much as they would to old-fashioned braille.

The device currently in operation at SRI, while a far cry from the sort of instrument ultimately envisioned, already has given encouragement. Candy Linvill, who has played guinea pig in the experiments, could read about 25 words per minute after just a few weeks of daily hour-long practice sessions. And though she can do much better with ordinary braille (165 words per minute), Prof. Linville is confident her reading speed will increase with practice and further improvement in the device.—*Robert Levine*



Technician controls input to reed array in experiments. Scanning eventually will be automatic.

HOW TO LOSE YOUR LICENSE

MOST mailings we receive from the Federal Communications Commission read as though they had been written by a Philadelphia lawyer. FCC handouts fairly reek with above-entitled, procedural due process, initial eligibility and other such legalese. They also ordinarily are as much fun to wade through as a creek in January. But we registered surprise if not outright astonishment when our eyes chanced upon an appendix tacked on to what the FCC calls a Memorandum Opinion And Order in the matter of Docket No. 14843.

This MOAO itself serves to deny certain petitions for changes in the new changes (try to follow that one) in the CB rules. The Commission first states why it is denying these petitions.

But it doesn't stop there. An appendix spells out exactly what the Commission means by Prohibited Uses (Section 95.83 of Docket No. 14843). The language in the appendix is so clear no CBer could mistake what he need do to lose his license. Just take your pick.

"The following," says the FCC, "are typical but not all inclusive, examples of the types of communications evidencing a use of Citizens radio as a hobby or diversion which are prohibited under this rule":

"You want to give me your handle and I'll ship you out a card the first thing in the morning"; or, "Give me your 10-20 so I can ship you some wallpaper." (Communications to other licensees for the purpose of exchanging so-called 'QSL' cards.)

"I'm just checking to see who is on the air."

"Just calling to see if you can hear me. I'm at Main and Broadway."

"Just heard your call signs and thought I'd like to get acquainted"; or, "Just passing through and heard your call signs so I thought I'd give you a shout."

"Just sitting here copying the mail and thought I'd give you a call to see how you were doing." (Referring to an intent to communicate based solely on hearing another person engaged in the use of his radio.)

"My 10-20 is Main and Broad Streets. Thought I'd call so I can see how well this new rig is getting out."

"Got a new mike on this rig and thought I'd give you a call to find out how my modulation is."

"Just thought I would give you a shout and let you know I am still around. Thanks for coming back."

"Clear with Venezuela. Just thought I'd let you know I was copying you up here."

"Thought I'd give you a shout and see if you knew where the unmodulated carrier was coming from."

"Just thought I'd give you a call to find out how the skip is coming in over at your location."

"Go ahead breaker. What kind of a rig are you using? Come back with your 10-20."

One wonders whether the FCC really believes this sort of thing can be heard on CB channels. Or did someone just tell them?

The Ham Shack

Continued from page 40

speed up to 13 wpm. Prescription: ignore the phone for 15 minutes a day and concentrate on copying CW.

2) A 15-year-old Novice who lives in a big apartment house and isn't permitted a roof antenna. Suggestion: tape a dipole of TV twin-lead along a hallway or around the ceiling of a room. We know a ham who lives on the seventh floor of a 25-story building and works around the world with just such a skyhook. He uses low-power SSB and never bothers his TV neighbors.

3) An 80-year-old pre-World War I ham who didn't renew his ticket after the armistice and is now all het up about returning to the game since listening on his grandson's receiver. Advice: get a copy of So You Want To Be a Ham, published by Howard W. Sams & Co., Indianapolis. (I'd have to admit that there are other good books on the subject—but I didn't write them.)

Time Will Tell . . . Many hams who obtained their tickets during the 1960s are under the impression that the 10-meter band is worthless. And, to be sure, about the only thing you hear on it nowadays is ignition noise. But when it does open up, these lads are in for a pleasant surprise.

For the record, we had a low-power mobile rig on 10 during the late 1950s. And our experiences on 10 during those sun-spot heydays were no less than fantastic. Like parking in the middle of Times Square in New York City and working North Africa, Alaska, Germany and the Canal Zone, all in a single hour. Needless to say, we hope for return of those days—and soon.

Good Reading

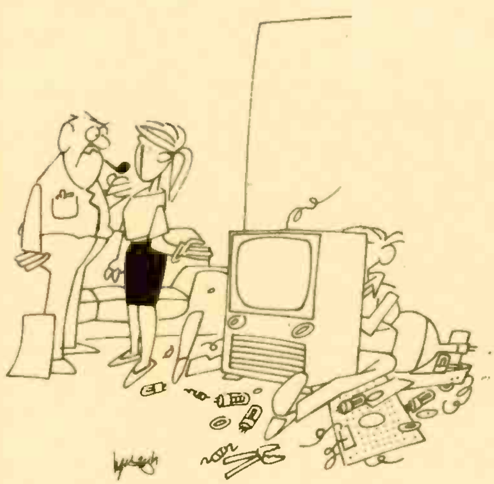
Continued from page 46

WORLD RADIO TV HANDBOOK, 19th (1965) Edition. Distributed by Gilfer Associates, Park Ridge, N. J. 302 pages. $4.95

Did you know that ABC International Television will sell you, for only $1,081,000, sponsorship of a half-hour TV show reaching more than 16,000,000 homes in 23 countries? That's one of the tidbits in the latest edition of WRTH, the cosmopolitan publication which lists frequencies, stations—even times—for the world's public-minded broadcasters, country by country. Complete QSL data are included, even down to mailing addresses. Only question due an SWL who hasn't gotten this year's copy is what is he waiting for?

PHOTOCELL APPLICATIONS. By Rufus P. Turner. Lafayette Radio Electronics Corp., Syosset, N. Y. 80 pages. $1.50

This is one of those occasional worthwhile by-products of commerce. It naturally is designed in part to help sell photocells and other components but this doesn't reflect on its usefulness. There are a lot of worthwhile photoelectric projects here, including test instruments, relays, control gadgets and communications devices. Most of them can be tackled by the beginning hobbyist and there's plenty to keep most anyone busy.



"Dad, this is Ted. He's studying electronics."

QRP Special

Continued from page 86

install C2's knob. We used a National type HRS-5 knob numbered 0 to 10 as a logging dial. Tune your receiver and simultaneously adjust C2 to several points up to 3.8 mc. Then write down the frequency that corresponds to the knob's logging number.

Remove the dummy load and connect an 80-meter antenna (52 to 72 ohms). Make sure that your key's contacts are clean because a little oxide can cause trouble with the low voltages used in this rig. No warm-up time is required for the transmitter. It is ready for use instantly.

Close or open S1 as required for best loading of the antenna. The value of C15 may have to be changed to suit your particular antenna so experiment with different values for best loading.

The Listener

Continued from page 58

minion Observatory station CHU. WWV operates on 2500, 5000, 10000, 15000, 20000 and 25000 kc. CHU uses 3330, 7335 and 14670 kc.

If, for example, WWV's signal on 10000 kc actually comes in at 10500, you know your dial registers 500 kc too high in that portion of the spectrum. Remedy is either to have your receiver aligned properly (assuming an alignment would help) or simply interpolate your frequency findings.

Another problem with inexpensive receivers (and sometimes expensive ones, too) is an image signal approximately 900 kc above or below the station's true frequency. Bear in mind that an image is produced only on superheterodyne receivers. And take care not to mistake images for harmonics, which are real transmissions coming from the stations themselves.

If you hear an SWBC station on a band where you think it shouldn't be—one populated mostly with CW and other utility stations, say—check 900 kc above or below for similar programming (you soon will learn in which direction your receiver's images lie). The real signal always will be stronger than its image. It's the real signal you should endeavor to tune to, of course.

All The Ships At Sea

Continued from page 36

plish this is to obtain a copy of the book called Alphabetical List of Call Signs from the International Telecommunications Union in Geneva, Switzerland.

This huge volume lists every call sign assigned by each nation (except ham, CB, aircraft, land-mobile and experimental stations), together with the location of each station. If the station is aboard a ship, the name of the ship is given as the location. Price for this book changes with each edition, so check with the ITU before ordering.

Another ITU publication you'll find handy is the List of Coast and Ship Stations. This one has complete details on all marine operators, as well as marine telephone and telegraph stations (calls, frequencies, schedules, addresses, owners, power and so on). It also contains similar information on several thousand ships of all nations. But for some unknown reason, this book is rather foggy when it comes to U.S. ships.

Best and latest word on U.S. ships is contained in the latest edition of Merchant Vessels of the United States, published by the U.S. Government Printing Office in Washington, D.C. This book gives the complete story on well over 40,000 ships flying the U.S. flag. While it is not intended to be a guide to small private vessels, it's the cat's meow for running down all types of commercial vessels such as tugs, tankers, freighters, fishing vessels and passenger liners. This book varies in price, too, so check with Washington before you order.

The QSL. Once you have logged your ship and tracked it down to the point where you have the name and address of the owners, it's time to start thinking about how you're going to get a QSL. Naturally, your report should contain all the information necessary to support your request for a QSL—date, time, frequency, signal strength and other technical comments, plus the call or name of the station being called or worked.

Never include in your report any actual details of transmissions you have heard (such as: "The Captain was talking to his wife." Not only will this kill your chances for a QSL, it's also against the law to divulge the contents of radio transmissions.

To insure a QSL in reply to your report, make up a prepared (and stamped) QSL card which the radio operator or captain can fill in, sign and return to you. Address your reception report to the Chief Radio Operator (on ships with four-letter calls) or to the captain (on ships with the letter-number combination calls).

Now just sit back and relax and in a short time those juicy QSLs will start rolling in. While you're waiting, why not see how many more ships you can log? One sunny summer Sunday while sitting at the set I managed to log 107 different ships during a one-hour period. Can you beat my record?

WHERE THE SHIPS ARE

BAND (kc)	REGION	SERVICE*
415-490	Worldwide	MM-CW
2000-2107	N. and S. America, Greenland	F/M, MM-CW
4063-4438	Worldwide	MM-CW, Phone, Facsimile
6200-6525	Worldwide	MM-CW, Phone, Facsimile
8195-8815	Worldwide	MM-CW, Phone (DSB, SSB), Facsimile
12330-13220	Worldwide	F/M, MM-CW, Phone (DSB, SSB), Facsimile
16460-17360	Worldwide	F/M, MM-CW, Phone (DSB, SSB), Facsimile
22000-22720	Worldwide	F/M, MM-CW, Phone (DSB, SSB), Facsimile

**MM—Maritime Mobile, F/M—Fixed/Mobile, CW—Radiotelegraphy, DSB—Double Sideband, SSB—Single Sideband*

CB Corner

Continued from page 90

The dollar sign still tells the best story. One chief engineer used the word hysteria to describe industry's first reaction to the proposed rules changes. On top of this came the $8 license fee. Sales slumped noticeably and morale was about as low as the ground rung on a ladder.

But came the FCC announcement turning those proposed rules into law and the expected drop simply didn't materialize. Fact is, CB makers now look for plenty more bloom on the boom.

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☐ Please send my Free 1965 Heathkit Catalog.

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(Please Print)
Address __________
City __________ State __________ Zip __________
Prices & specifications subject to change without notice. CL-207

Home TV Tape Recorder

Continued from page 66

speeds—150 ips—and, therefore, should have produced the best picture quality. We finally found the video head itself to be faulty and replaced it. But the picture was no better than before.

Unfortunately, setting the record level is a matter of trial and error on the Wesgrove, since no visual indicator is provided. No amount of adjustment produced an acceptable picture, so Wesgrove suggested we send them one of our recorded tapes for examination. Their verdict was that our signal had been recorded at too low a level.

When our tape was returned, Wesgrove had recorded a tennis match and part of a Yogi Bear cartoon on it. Played back through our recorder, both subjects came through as reasonable pictures on the screen, though with a certain amount of flashing and flyback lines (see our illustration). Attempts to increase our own recording level only made pictures white, indicating overloading, and we still were unable to record a picture of a quality equal to that given on the tape from Wesgrove. We accordingly asked them to check our set over for us. They're still checking.

Summing Up. Though Wesgrove has distinguished itself by being the first maker to market a true home VTR, the rush to reach the marketplace is evident from circuit board to instruction manual. The VKR 500 clearly is not a kit for the builder who is not prepared to experiment as only a technically qualified hobbyist can. Putting the kit together scarcely is more than half the battle, since it still must be connected to a TV set and made to operate properly.

The unit's recording head, incidentally, is said to have a life of approximately 100 hours. In view of the machine's 150-ips tape speed, this seems a somewhat optimistic figure. Even so, replacement heads reportedly sell for about $8 at the Wesgrove factory and the hobbyist who has assembled the kit obviously will have no trouble replacing a head.

Given its maximum reel size (11½ in.) and playing time (30 minutes per side at 90 ips), the Wesgrove VKR 500 would seem to offer the enterprising and technically knowledgeable hobbyist plenty of room for experimentation. But much more experimentation will be required by Wesgrove itself before its VTR can make a bid as a serious electronic product for the consumer.

Notes From El's DX Club

Continued from page 67

spot—6115 kc. Watch for this one at 0100 EST sign-on.

Propagation: The end of August should see a noticeable decrease in the number of TV and FM DX openings and this trend will continue through the fall. As the angle of the sun in the sky begins to decrease, heating in the upper atmosphere also will drop. Sporadic-E regions, therefore, will form less frequently in the ionosphere than during peak summer conditions, and result will be a reduction in the amount of VHF reflected. Openings in the 10-meter amateur band and the Citizens Band also will drop off sharply.

In the bands between 3 and 30 mc, trend during the day will be toward higher useful frequencies, with 21 mc utilized more frequently for SWBC services during the day. Best daytime DX reception will be in the 15- and 17-mc bands.

At night, 6 and 7 mc will continue to offer most DX promise, though 9 mc also should be satisfactory.

"And I have to have it by Friday."

Continued from page 72

the same, which means it's likely to be the first component you'll change at some later date.

The cartridge, too, fundamentally is identical throughout the three systems, so it, too, might be upgraded. You may wish, for example, to take the jump to a magnetic cartridge. If so, a number of mail-order specialists, including Rabson's, Airex Radio and Packard Electronics in New York City, offer the ADC, Shure M3D and other good magnetics at prices from \$8.77 to \$10. To make this step, however, you'll need a stereo preamp for your Knight-Kit or an amplifier equipped with low-level phono inputs.

Speakers in our \$100 system, on the other hand, are the best EI could find in the price range. They can be relied on to produce the best possible results with the signal you feed into them. They're quite adequate for the \$100 system and they can be expected to produce even better sound with a more powerful amplifier and magnetic cartridge.

Continued from page 102

talk with your home, why not keep your family network on a business channel?

Similarly, if you belong to an auto or boating club get one license (in one person's name) to cover all units. This done, you again can avoid the Sorry Seven.

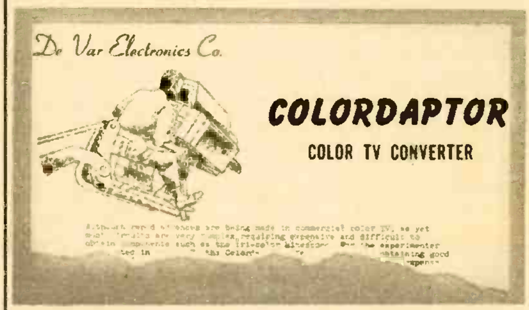
But remember, chatter really is ixnayed on the business channels. It's okay to say, "Let's get a cup of coffee after the show." But don't start discussing your rig or what your wife thinks of the Beatles. Such subjects aren't allowed on the business channels.

Also keep in mind that the business channels virtually are clear channels. This means even the most basic equipment—a groundplane antenna and a so-called broad receiver—will give better performance than the best of equipment on the Sorry Seven. If you can avoid the Sorry Seven by limiting your operations to substantive messages between stations under the same license, by all means do so. The savings in equipment costs easily can total \$250.

Continued from page 103

front of the black-and-white screen, the kinescope would display only picture information which represented the color components for that particular filter. Then the retentive characteristics of the eye got into the act by blending the three individual filtered pictures into the one color picture.

Chuckling at the thought of a big, BIG flywheel whizzing around the TV set, we



later recalled that the matter isn't for laughing. We once had the pleasure of seeing one of those old CBS color sets and, if our memory serves us well, the color was really good.

Even so, 'twas the flywheel that was the CBS system's downfall. A 21-in. screen would require a color disc half the height of the room, which fact just doesn't make for practicality. But practical or no, it's a CBS-type color set the Colordaptor plans would have us build.

Construction of the Colordaptor electronics presumably is within a hobbyist's capabilities, since the company will supply a kit of parts right down to the punched chassis, complete with motor and color filters. But we still would have to construct the color disc ourselves. We passed up this happy prospect, though we suppose a master metalworker who also happens to be an experienced electronics experimenter would have no trouble with the Colordaptor conversion.

But don't let us scare you off. If your veins flow with the spirit of the early pioneers, the Colordaptor system well might provide a pathway to new adventures in electronics. After all—as with the Dick Tracy radio and the horror-movie scope—the Grand Plan is there.

Pursuing The Pirates

Continued from page 10

operates from an abandoned U.S. minesweeper anchored in the Thames Estuary. The vessel, by the way, is registered in Honduras.

Most recent of the latecomers, R. Invicta first was heard about a year ago on 1126 kc, broadcasting from the Thames Estuary about midway between Southend and Sheerness (No. 4 on our map). Several days after its air debut, R. Invicta moved to 980 kc. R. Sutch, meanwhile, climbed to 1535 kc. Later, it moved to 1540 kc and began announcing itself as R. City on 197 meters (1523 kc). And R. City it remained for a bit, in time transmitting exactly on its 1523-kc frequency. Shortly thereafter R. City moved up to 1534 kc, promising a second, 50-kw transmitter on 755 kc. But when it came, the new transmitter appeared on 1284 kc—not the 755 kc R. City had announced.

This bizarre game of musical frequencies has continued to the time of this writing. Pirates R. Caroline North, R. Caroline South and R. Invicta have stabilized on 1520, 1495 and 980 kc, respectively. R. City, however, continues to cavort, interfering with R. Caroline North and several other stations in the process. It also had changed names again and when heard last was calling itself R. London.

Though the Dutch succeeded in silencing their pirate TV station by direct dismantling (and the Swedes their offshore AM outlet by lengthy legislating), the Britons had much more trouble with their pirates. Even a law making it illegal to supply the floating freebooters failed to take them off the air. U.S. DXers desirous of snagging any or all of this forbidden foursome best had tune late at night or early in the morning due to the time difference between the U.S. and the British Isles. For DXers wishing to try for QSLs, mailing addresses are as follows:

1) R. Caroline South, c/o Ronan O'Rahilly, 54-62 Regent St., London, W.1, England.

2) R. Caroline North, Box 3, Ramsey, Isle of Man.

3) R. London, 7 Denmark St., London, W.C. 2, England.

4) R. Invicta, 35 Bouverie Sq., Folkstone, Kent, England.

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ELECTRONIC SWAP SHOP

Continued from page 16

ATWATER KENT model 40. Need test equipment. Charles D. Yelverton, Rte. 1, Box 63, Louin, Miss. 39338.

ZENITH AM/SW receiver. Will trade for Hallicrafters S-118 or Knight R55A. Charles Bugdin III, 130 Maple Ave., Riverhead, N.Y. 11901.

LAFAYETTE HA-150 walkie-talkie. Will trade for Johnson Personal Messenger or other CB walkie-talkie. Fred Ziegler, 1635 Popham Ave., Bronx, N.Y. 10453.

RCA WR-64A crosshatch generator and an antenna rotor. Want RCA WO-91A oscilloscope and Millen 90662 grid-dip meter. Bill Novcaski, Box 198, Shiocton, Wis. 54170.

GO-CART, less engine. Will swap for Hallicrafters SX-99 or similar receiver. Leonard Swiderski, Box 756, Timmins, Ont.

HALLICRAFTERS HT-17 transmitter converted to 6 meters. Will swap for Novice transmitter or tape recorder. J. & G. Cruddas, 43 Warren St., Peabody, Mass. 01960.

HEATHKIT Q-multiplier. Need Hallicrafters S-meter, 24-hour clock and signal tracer. Rickie Prindle, 810 Amherst Dr., Abilene, Tex.

MAYFAIR tape recorder. Will trade for Lafayette HA-85 walkie-talkie. Nick Bernier, 11532 Lafayette, Chicago, Ill. 60628.

COMPONENTS—transistors, resistors, tubes, etc. Will trade for Knight 5-watt CB transceiver. Steven Szambaris, 14343 University, Dolton, Ill. 60419.

CROSLEY SW/BC receiver and components. Will exchange for ham or SWL equipment. Jack Neal, 1596 Johns Rd., Clinton, Ohio 44216.

RCA and Silvertone broadcast radios. Want Heathkit GR-91 or Knight Star Roamer receiver. Phillip Kelly, Rte. 1, Box 638, Camas, Wash. 98607.

LAFAYETTE HE-82 CB walkie-talkie and Knight 12-watt hi-fi amplifier. Will swap for mobile CB transceiver. Paul E. Knupke, 1225 Cass Rd., Maumee, Ohio 43537.

AZURE binoculars and voltmeter. Will trade for oscilloscope, ham transmitter or CB transceiver. Larry Whitten, 128 Alfred St., Biddesford, Me. 04005.

GLOBE SCOUT ham transmitter and RCA WV38A VOM. Want Heathkit MW-34 or other CB equipment. Milton McGee, Jr., Box 389, Coushatta, La.

SHORT-WAVE crystal receiver with headphones. Will exchange for typewriter. Steve Reynolds, 2718 1721 St., E. Omaha, Neb. 68110.

PACO S-50 oscilloscope. Will trade for R/C transmitter and receiver. Ed Schraut, 3406 Dawes St., Madison, Wis. 53714.

HALLICRAFTERS SX 24, Webcor tape recorder and Knight T-60 transmitter. Will trade for equipment of equal value. David Johnson, 8263 E. Mansfield, Denver, Colo. 80237.

LAFAYETTE HA-60 walkie-talkies. Will swap for short-wave receiver. Don Hobbs, 212 Railroad St., Milton, Fla. 32570.

KNIGHT Span Master. Will exchange for CB crystals or walkie-talkie. Lawrence Kumjian, 44 Amethyst St., Elmont, N.Y. 11003.

ELECTRO-SOLIDS Spacephone walkie-talkie, components and hardware. Will swap for Novice transmitter. Steve Morgan, 2415 Suffolk Ct., Dayton, Ohio 45420.

ZENITH Transoceanic SW portable. Looking for CB gear or ham receiver. David Noel, Box 488, Glasco, Kans. 67445.

KNIGHT Star Roamer and Heath Q-multiplier. Want Lafayette HE-80 or other CB gear. Ron Prater, Rte. 3, Willard, Ohio 44890.

ZENITH Transoceanic receiver. Will swap for Heath MW-33 or other CB equipment. Eric B. Olsen, Rte. 1, Box 4, Kingsville, Ohio 44048.

REGENCY receiver. Need Knight CB transceiver. Bob Armstrong, 707 Cascade Ave., Atlanta, Ga. 30310.

HAMMARLUND HQ-100A receiver. Will swap for other ham equipment. Paul F. Arutt, 1200 Harbor Rd., Hewlett, N.Y.

OLD TUBES. Will swap for FM radio. Bob Hawkins, 1515 Marlowe Ave., Cincinnati, Ohio 45224.

NOVICE transmitter (homebrew). Will swap for CB gear. Reed Valleau, WN8PHD, Box 195, Michiana, New Buffalo, Mich., 49117.

HEATHKIT GW-22A CB transceivers and Cipher V tape recorder. Will exchange for stereo recorder or receiver. Daryl Bietila, Rte. 1, Box 790, Ishpeming, Mich. 49849.

EMERSON P1924 receiver/phono combination. Will swap for ham or CB gear. Larry Scott, 2530 40th Ave., San Francisco, Calif. 94116.

HEATHKIT CB-1. Will exchange for Lafayette HA-150 or HE-75. Marshall A. Shelsy, 1630 Undercliff Ave., Bronx, N.Y. 10453.

HALLICRAFTERS S-119 receiver, Lionel HO model-train set, other radio and model equipment. Want International Crystal CB transceiver. Ronnie Beaver, 973 N. Church St., Spartanburg, S.C.

LAFAYETTE HE-29C walkie-talkie. Make swap offer. Danny Quinn, 1007 S. 17½ St., Corsicana, Tex. 75110.

BRUMBERGER reel chest. Want compact table radio. Cecil Mills, Rte. 3, Box 258, Winnsboro, Tex. 75494.

HEATHKIT GW-31 and Panasonic walkie-talkie. Will swap for communications receiver or test equipment. Bruce Potterton, 221 Dunham Ave., Madera, Calif. 93637.

KNIGHT-KIT Span Master receiver. Will trade for ham gear, Richard Stahl, 2058 Parkview Ave., Abington, Pa. 19001.

HALLICRAFTERS S38E communications receiver. Will trade for Heath HR-10 receiver. Rick Goebbel, 719 Ellen Dr., Mt. Pleasant, S.C.

ADMIRAL 10-in. TV. Will swap for Lafayette HB 115 CB transceiver or equivalent. Eric Olsen, Rte. 1, Box 4, Kingsville, Ohio 44048.

HALLICRAFTERS S-119 receiver. Need Heath IM-13 VTVM or equivalent. Herbert Gibson, 312 N. Grant St., Three Rivers, Mich. 49093.

ELECTRO-VOICE 664 and Lafayette dynamic microphones. Want Lafayette HE-30 receiver. Bill Zuckowski, 11-16 154th St., Beechurst, N.Y. 11357.

HEATHKIT HR-10 receiver. Will trade for communications receiver or CB transceiver. C. Koenderman, Milford, Pa. 18337.

HY-GAIN 18V vertical antenna. Make swap offer. Tom Hartmann, WA8MWL, 4907 Allison Dr., Lansing, Mich. 48910.

PRI 107C Geiger counter. Will swap for Johnson CB or 30- to 50-mc mobile receiver. J. H. Walton, 4801 Midway Dr. N.W., Cedar Rapids, Iowa 52405.

HEATH GW-12 CB transceiver. Want 6- and 2-meter ham gear. Jerry Berquist, WAØLCF, 307 First Ave. N.W., Chisolm, Minn. 55719.

HAM TRANSMITTER, 80 through 10 meters. Will trade for CB transceiver. Robert France, 16247 Denley St., Haciendo Hts., Calif. 91745.

RCA model 100 speaker. Make swap offer. Leo E. Smith, Rte. 1, Box 375B, Sandy, Utah 84070.

HALLICRAFTERS SW-500 receiver and Trutone FM receiver. Will trade for ham, CB or test equipment. Elliott Farrell, Jr., Box 994, Walterboro, S.C. 29488.

WRL Globe Chief 90. Will exchange for CB transceiver. D. Covert, 19 College Cts., Barbourville, Ky.

CREI engineering course. Will trade for tape recorder. H. L. Bumbaugh, 724 N. Crescent Hts. Blvd., Hollywood, Calif. 90046.

RCA Radiola 18. Will swap for anything of equal value. James Dewery, 9105 53rd Ave., Oak Lawn, Ill.

EICO 710 grid dip meter. Will swap for small transmitter or transceiver. Paul Dujmich, 1104 Prescott St., McKeesport, Pa. 15131.

KNIGHT Star Roamer receiver. Need Knight R-55A or R-100A. Alan Marote, 355 Court St., New Bedford, Mass. 02740.

STEREO TAPE heads, FM tuner, 400-cycle AC power supply and electroluminescent boards. Will exchange for tape recorder or record changer. M. Morrow, 31 Puritan, Detroit, Mich. 48203.

HALLICRAFTERS S-77A receiver, and other equipment. Make swap offer. Bob Wood, Box 67, Tilbury, Ont.

HALLICRAFTERS S-38D receiver; BC-459A/ARC5, BC-457A/ARC5 and T-67/ARC3 transmitters. Want communications receiver, CB rig or VHF/UHF gear. Brian Harper, 218 22nd St., Dunbar, W. Va. 25064.

WILLIAMSON-type 30-watt stereo amplifier and Knight AM/FM/stereo-FM tuner. Will exchange for Lafayette RK-650 tape deck. Arnold D. Bishop, 2866 Falls Rd., Marcellus, N.Y. 13108.

HOMEBREW SCOPE and 1625 tubes. Want CB transceiver. Gary Piper, WA8GBO, 1220 Ward St., Port Huron, Mich. 48060.

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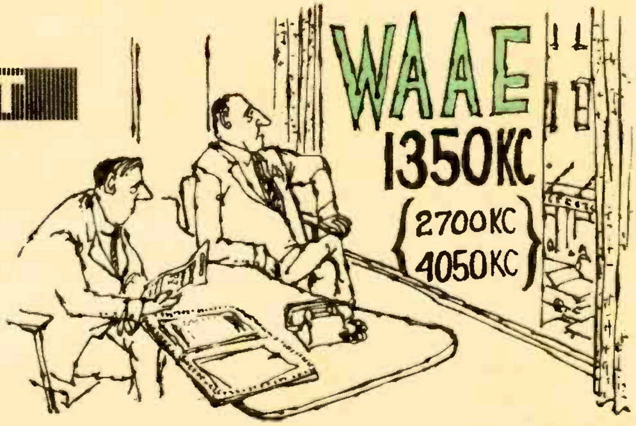
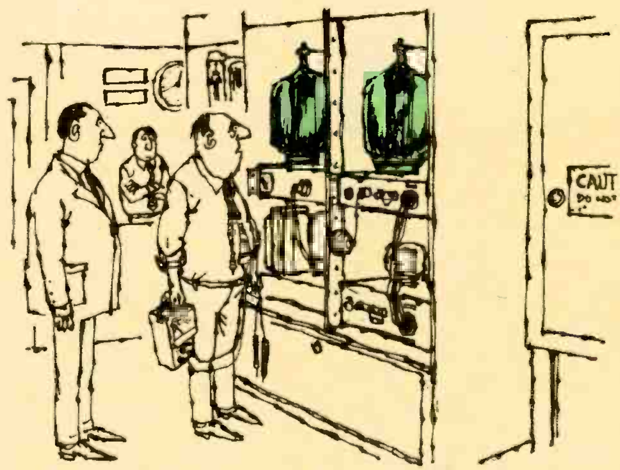
OVER AND OUT

by

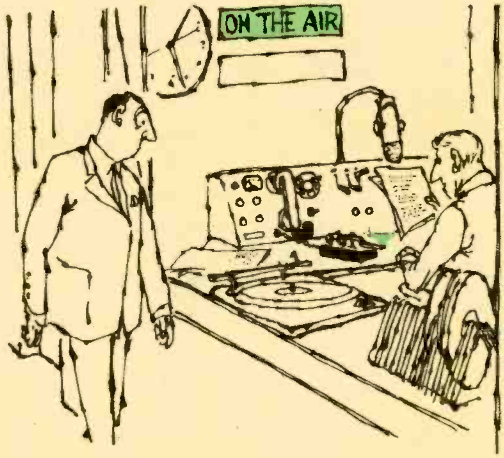
Rodrigues



"Well, yes, we ARE having a little trouble with harmonics."



"Are you SURE there's something wrong? The tubes all light up."



55 RADIO SHACKS COAST TO COAST

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LOWELL — Central Shop. Plaza, 455-5469
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