3 ONE-EVENING PROJECTS

- Antique Phone Radio
- Universal AC Ammeter
- Perf-Board Phono Preamp

HOW BAD IS HIGHWAY HI-FI?

TEST REPORTS

- International C-12B Frequency Meter
- Heathkit/MagneCORD 1020 4-Track Stereo Recorder
- Knight-kit Safari III
- Portable CB Transceiver

HAM-CB RULES CHANGES!

FCC FIDDLES WHILE LICENSEES FUME!
Today's electro-technology makes possible near-perfect stereo at moderate manufacturing cost: that's the design concept behind the new EICO "Cortina" all solid-state stereo components. All are 100% professional, conveniently compact (3½"H, 12"W, 8"D), in an esthetically striking "low silhouette." Yes, you can pay more for high quality stereo. But now there's no need to. The refinements will be marginal and probably inaudible. Each is $39.95 kit, $119.95 wired.

Model 3070 All-Silicon Solid-State 70-Watt Stereo Amplifier: Distortionless, natural sound with unrestricted bass and perfect transient response (no inter-stage or output transformers); complete input, filter and control facilities; failure-proof rugged all-silicon transistor circuitry.

Model 3200 Solid-State FM/MPX Automatic Stereo Tuner: Driftless, noiseless performance; 2.4µV for 30db quieting; RF, IF, MX and AM bands; and printed circuit boards — you wire only non-critical power supply.

7 New Ways to make Electronics more Fun!

Save up to 50% with EICO Kits and Wired Equipment.

FREE 1967 CATALOG
EICO Electronic Instrument Co., Inc.
131-01 39th Ave., Flushing, N.Y. 11352
Send me FREE catalog describing the full EICO line of 200 best buys, and name of nearest dealer. I'm interested in:
- test equipment
- ham radio
- stereo/hi-fi
- automotive electronics

Name:
Address:
City:
State:
Zip:

Model 232 Peak-to-Peak VPM. A must for color or B&W TV and Industrial use. 7-ohm tan loss on all 4 functions, with exclusive Uni-Probe. $29.95 kit, $49.95 wired.


You hear all the action-packed capitals of the world with the NEW EICO 711 "Space Ranger" 4-Band Short Wave Communications Receiver plus ham operators, ship-to-shore, aircraft, Coast Guard, and the full 50 kHz band. 550KC to 30MC in four bands. Selective, sensitive superhet, modern printed circuit board construction. Easy, fast pinpoint tuning, illuminated slidebar dial, logging scale; 3" meter, electrical bandwidth tuning, variable BFO for CW and SSB reception, automatic noise limiter. 4" speaker. Headphone jack. Kit $49.95. Wired $69.95.

More "ham" for your dollar than ever — with the one and only $59/MCW 3-Band Transceiver Kit, new Model 752 — "the best ham transceiver buy for 1966" — Radio TV Experiment Magazine. 200-watts PEP on 80, 40 and 20 meters. Receiver offset tuning, built-in VFO, high level dynamic performance. Features and accessories generally priced at $189.95 kit, $299.95 wired.

NEW EICO 888 Solid-State Engine Analyzer
Now you can tune-up, trouble-shoot and test your own car or boat.

Keep your car or boat engine in tip-top shape with this completely portable, self-contained, self-powered universal engine analyzer. Completely tests your total ignition/electrical system. The first time you use it — just to tune for peak performance — it'll have paid for itself. (No tune-up charges, better gas consumption, longer wear.) 7 instruments in one, the EICO 888 does all these for 6V and 12V systems; 4, 6 & 8 cylinder engines.

The EICO 888 comes complete with a comprehensive Tune-Up and Trouble-Shooting Manual including RPM and Dwell angle for over 40 models of American and Foreign cars. The Model 888 is an outstanding value at $44.95 kit, $59.95 wired.

Model 460 Wideband Direct-Coupled 5° Oscilloscope, DC-5Mc for color and B&W TV service and lab use, Push-pull DC vertical arm, ball, or unball, input Automatic over limiter and amplifier. $109.95 kit, $149.95 wired.

Maneul 460 Wideband Direct-Coupled 5° Oscilloscope, DC-5Mc for color and B&W TV service and lab use, Push-pull DC vertical arm, ball, or unball, input Automatic over limiter and amplifier. $109.95 kit, $149.95 wired.
<table>
<thead>
<tr>
<th>Occupation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accounting</td>
<td>Accounting, Auditing, Business Law, Cost Accounting</td>
</tr>
<tr>
<td>Business Management</td>
<td>Business &amp; Tax Accounting, Executive Accounting, Federal Tax</td>
</tr>
<tr>
<td>Business Estimator</td>
<td>Business Estimator</td>
</tr>
<tr>
<td>Chemical Engineer</td>
<td>Chemical Engineer</td>
</tr>
<tr>
<td>Construction Engineer</td>
<td>Construction Engineer</td>
</tr>
<tr>
<td>Drafting</td>
<td>Drafting, Architectural Drafting</td>
</tr>
<tr>
<td>Drafting &amp; Designing</td>
<td>Drafting &amp; Designing</td>
</tr>
<tr>
<td>Electronics</td>
<td>Electronics</td>
</tr>
<tr>
<td>Electronics Engineering</td>
<td>Electronics Engineering</td>
</tr>
<tr>
<td>Electronics Technician</td>
<td>Electronics Technician</td>
</tr>
<tr>
<td>Engineering</td>
<td>Engineering</td>
</tr>
<tr>
<td>General Management</td>
<td>General Management</td>
</tr>
<tr>
<td>Graphic Design</td>
<td>Graphic Design</td>
</tr>
<tr>
<td>Interior Design</td>
<td>Interior Design</td>
</tr>
<tr>
<td>Industrial Engineering</td>
<td>Industrial Engineering</td>
</tr>
<tr>
<td>Industrial Electronics</td>
<td>Industrial Electronics</td>
</tr>
<tr>
<td>Mechanical Engineering</td>
<td>Mechanical Engineering</td>
</tr>
<tr>
<td>Mechanical Engineering Technician</td>
<td>Mechanical Engineering Technician</td>
</tr>
<tr>
<td>Mechanical Engineer</td>
<td>Mechanical Engineer</td>
</tr>
<tr>
<td>Medical Engineering</td>
<td>Medical Engineering</td>
</tr>
<tr>
<td>Mining Engineer</td>
<td>Mining Engineer</td>
</tr>
<tr>
<td>Power Engineer</td>
<td>Power Engineer</td>
</tr>
<tr>
<td>Power Engineering</td>
<td>Power Engineering</td>
</tr>
<tr>
<td>Plumbing</td>
<td>Plumbing</td>
</tr>
<tr>
<td>Printing</td>
<td>Printing</td>
</tr>
<tr>
<td>Printing &amp; Designing</td>
<td>Printing &amp; Designing</td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management</td>
</tr>
<tr>
<td>Project Management Engineer</td>
<td>Project Management Engineer</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Project Manager</td>
</tr>
<tr>
<td>Public Relations</td>
<td>Public Relations</td>
</tr>
<tr>
<td>Software Engineering</td>
<td>Software Engineering</td>
</tr>
<tr>
<td>Structural Engineer</td>
<td>Structural Engineer</td>
</tr>
<tr>
<td>Technical Writer</td>
<td>Technical Writer</td>
</tr>
<tr>
<td>Technical Writer (Software)</td>
<td>Technical Writer (Software)</td>
</tr>
<tr>
<td>Technical Writer (Technical)</td>
<td>Technical Writer (Technical)</td>
</tr>
<tr>
<td>Technical Writer (Writing)</td>
<td>Technical Writer (Writing)</td>
</tr>
<tr>
<td>Technical Writer (Design)</td>
<td>Technical Writer (Design)</td>
</tr>
<tr>
<td>Technical Writer (Engineering)</td>
<td>Technical Writer (Engineering)</td>
</tr>
<tr>
<td>Technical Writer (Analysis)</td>
<td>Technical Writer (Analysis)</td>
</tr>
<tr>
<td>Technical Writer (Programming)</td>
<td>Technical Writer (Programming)</td>
</tr>
<tr>
<td>Technical Writer (Development)</td>
<td>Technical Writer (Development)</td>
</tr>
<tr>
<td>Technical Writer (Support)</td>
<td>Technical Writer (Support)</td>
</tr>
<tr>
<td>Technical Writer (Testing)</td>
<td>Technical Writer (Testing)</td>
</tr>
<tr>
<td>Technical Writer (Testing &amp; Debugging)</td>
<td>Technical Writer (Testing &amp; Debugging)</td>
</tr>
</tbody>
</table>
### CONTENTS/INDEX

**Feb.–March 1967**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Facts</th>
<th>Theory/Tips</th>
<th>Construction</th>
<th>Ham CB SWL</th>
<th>Audio Hi-Fi</th>
<th>AM/FM TV</th>
<th>Test Bench</th>
<th>Related Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ham Station in a Needle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuning in on the Body’s Ills</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♠ Party Line Listening</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dim View on a Darkroom Subject</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♠ It’s War! FCC vs. CB/Hams</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spy in the Tie—FM Broadcaster</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal Hi-Fi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♠ Ceramic Pickup Preamp</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♠ Lab Check—International C-12B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instant BFO</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doorbell Silencer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;New Mod&quot; Soldier Goes Electronic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♠ Lab Check—Heathkit Tape Recorder</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♠ Lab Check—Knight-kit CB Rig</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♠ Universal AC Ammeter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desk Lamp Mike Stand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♠ Tape-Slide Synchronizer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Invasion!</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW Propagation Forecast</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>♠ Tape Sings the Song of the Open Road</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WHITE’S RADIO LOG, Vol. 47, No. 1—Page 93**

DEPARTMENTS
- Bookmark 6
- CB Column 12
- New Products 15
- Ask Me Another 23
- Literature Library 112

**ARIZONA**—Phoenix
**ARKANSAS**—Little Rock
**CALIFORNIA**—Anaheim, Bakersfield, Downey, Garden Grove, La Habra, Long Beach, Los Angeles, Mission Hills, Mountain View, Oakland, Rosedale, Sacramento, San Bruno, San Diego, San Francisco, Santa Ana, Santa Monica, Torrance, West Covina
**COLORADO**—Denver
**CONNECTICUT**—Hamden, Manchester, New Britain, New Haven, New London, Orange, Stamford, West Hartford
**FLORIDA**—Orlando
**GEORGIA**—Atlanta
**ILLINOIS**—Chicago
**KANSAS**—Wichita
**LOUISIANA**—New Orleans
**MAINE**—Portland
**MARYLAND**—Langley Park
**MASSACHUSETTS**—Boston, Braintree, Brockton, Brookline, Cambridge, Dedham, Framingham, Lowell, Medford, Natick, Quincy, Saugus, Springfield, Waltham, West Springfield, Worcester
**MICHIGAN**—Detroit
**MINNESOTA**—Minneapolis, St. Paul
**MISSOURI**—Kansas City, St. Joseph, St. Louis
**NEBRASKA**—Omaha
**NEW HAMPSHIRE**—Manchester
**NEW JERSEY**—Pennsauken
**NEW MEXICO**—Albuquerque
**NEW YORK**—Albany, Binghamton, Buffalo, New York, Schenectady, Syracuse
**OHIO**—Cincinnati, Cleveland
**OKLAHOMA**—Oklahoma City, Tulsa
**OREGON**—Portland
**PENNSYLVANIA**—Philadelphia, Pittsburgh
**RHODE ISLAND**—Providence, East Providence
**TENNESSEE**—Chattanooga, Memphis, Nashville
**TEXAS**—Abilene, Arlington, Austin, Brownsville, Corpus Christi, Dallas, Fort Worth, Houston, Lubbock, Midland, San Antonio, Sherman, Waco
**UTAH**—Salt Lake City
**VIRGINIA**—Arlington, Virginia Beach
**WASHINGTON**—Everett, Seattle
SPECIAL GET-ACQUAINTED OFFER FROM THE COUNTRY'S LEADING ELECTRONIC PARTS DISTRIBUTOR!

1,000 OHMS/VOLT POCKET AC/DC VOM

Thousands Sold at Our Regular Low Price: 5.95
YOU SAVE $2.00

- Measures a mere 3½” x 2½” x 1¼”
- Thumb-Set Zero Adjustment
- With Test Leads and Battery

Lowest price ever! 2-color scale; 5 ranges: AC/DC volts: 0-1000 in 3 ranges; 0-150 ma DC; 0-100 kΩ. 22-4027.

RADIO SHACK

TUNES AM BAND FROM THE COUNTRY'S LEADING ELECTRONIC PARTS DISTRIBUTOR!

1,000 OHMS/VOLT POCKET AC/DC VOM

Only 3.95

- Measures a mere 3½” x 2½” x 1¼”
- Thumb-Set Zero Adjustment
- With Test Leads and Battery

Lowest price ever! 2-color scale; 5 ranges: AC/DC volts: 0-1000 in 3 ranges; 0-150 ma DC; 0-100 kΩ. 22-4027.

HOBBYIST'S ONE TUBE RADIO KIT

- Tuned AM Band from 540-1600 KC
- Hi-Q Coil for Top Sensitivity

28-001

3.49

Fun to use; easy enough for anyone to build

2-TRANSISTOR AM RADIC KIT

- With Crystal Earphone
- Solid State Circuitry
- Ideal for Beginners or Do-It-Yourselves

28-002

3.95

Fine reception across the entire broadcast band!

WIRELESS MIKE/TRANSMITTER KIT

- Broadcasts into Any AM Radio at Ranges up to 20 Feet

28-003

2.98

Use as room-to-room intercom or “baby-sitter”!

ELECTRONIC ORGAN KIT

- Better than 1 Octave Range! Easy to Play!
- A Family Favorite!

28-004

5.95

Play songs on an organ you built yourself!

SAVE $1.00

Your Choice of Either $2 Book at Half Price!

50 easy-to-build solid state projects . . . from a simple radio to a 2-way intercom system. Each book entirely different: Book 1, 62-1050; Book 2, slightly more advanced, 62-2025.

FILL OUT COUPON AND MAIL TODAY TO:

RADIO SHACK

RADIO SHACK

EAST:
730 Commonwealth Ave. Boston, Mass. 02215

WEST:
1515 So. University Dr., Ft. Worth, Tex. 76107

Please rush me the item I've checked below.

[ ] VOM, 22-4027
[ ] Book 1, 62-1050
[ ] Book 2, 62-2025
[ ] Wireless Mike, 22-4027

Name (print)
Street
City
State Zip

RTVE-267

February-March, 1967
SCOTT’S NEW ONE-AFTERNOON TUNER KIT DELIVERS AMAZING FET PERFORMANCE

Now you can get factory-wired performance from a kit that takes only one afternoon to build! Scott’s new LT-112B is the only kit with Field Effect Transistor circuitry*, enabling you to enjoy more stations more clearly. Interstation Muting Control effects complete quiet between FM stations... oscilloscope output allows laboratory-precise correction for multipath distortion.

"Scott’s LT-112... is one of the finest FM stereo tuners we have tested and it is easily the best kit-built tuner we have checked... Because of its simple construction and trouble-free nature, it is a logical choice for anyone who wants the finest in FM reception at a most remarkable price." HiFi/Stereo Review.

LT-112B specifications: Usable sensitivity, 1.8 µV; Cross modulation, 90 dB; Stereo separation, 40 dB; Capture ratio, 2.5 dB; Price, $189.95.

For complete information on the Scott LT-112B, send for your free copy of Scott’s 16-page full-color illustrated Guide to Custom Stereo.

*Patents pending.

Scott... where innovation is a tradition.

Prices slightly higher west of Rockies. Subject to change without notice.
MAIL ORDER SHOPPING MART  UNUSUAL VALUES

A selection of products available by mail for readers of Radio-TV Experimenter. All merchandise sold on a money-back guarantee. Order Direct by Stock No. Send check or M.O.

3" ASTRONOMICAL TELESCOPE

See stars, moon, phases of Venus, planets close up, 60 to 180 power—famous Mt. Palomar reflecting type. Aluminized & overcoated 3" diameter f/10 primary mirror, ventilated cell. Equipped with 60X eyepiece and mounted on 3X finder scope, hardwood tripod. FREE: "STAR CHART"; 272-page "HANDBOOK OF HEAVENS"; "HOW TO USE YOUR TELESCOPE" book. $29.95 Ppd. Order Stock No. 85,050HP, Edmund Scientific Co., Barrington, NJ. 08007.

"FISH" WITH A MAGNET

Go treasure hunting on the bottom! Fishing fun & sometimes profitable! Tie a line to your 5-lb. Magnet—drop it overboard in bay, river, lake or ocean. Troll it along bottom—your "treasure" haul can be outboard motors, anchors, other metal valuables. 5-lb. Magnet is war surplus—Alnico V Type. Gov't cost $50, Lifts over 150 lbs. on land—much greater weights under water. $12.50 Ppd. Order Stock #70,571HP. Edmund Scientific, Barrington, N.J. 08007.

NEW BINOCULAR-TO-CAMERA HOLDER

Fits any camera for exciting telephoto pictures. 35-mm camera with 7x50 binocular brings distant objects 7 times nearer. Ideal for long-range photos of wild life, ships, people, planes, etc. Attaches easily. Use any binocular or monocular—and camera still or movie, color or black & white. Gray crinkle and bright chrome finish. 10" long. Full directions. $11.50 ppd. Order stock No. 70,223HP. Edmund Scientific Co., Barrington, N.J. 08007.

NEW MODEL DIGITAL COMPUTER


GIAN'T FREE CATALOG

Completely new 1967 Catalog, 148 pages packed with nearly 4,000 unusual bargains. Exciting new categories. Many new items. 100's of charts, illustrations. Many hard-to-get war surplus bargains. Enormous selection of telescopes, microscopes, binoculars, magnifiers, prisms, photo components, etc. For hobbyists, experimenters, workshops, factories. Shop by mail. No salesman will call. Write for Catalog "HP" to Edmund Scientific Co., Barrington, N.J.

SPACE-AGE NICKEL CADMIUM BATTERIES

Guaranteed rechargeable for 5 years. Use in flashlights, portable radios, toy or flash guns. Obsolete all older low-cost kit includes compact, highly efficient charger and 2 "D" size Ni-Cd batteries. Power output remains constant, 1 or 2 "D" or "C" size batteries charge in 16 hrs. $9.95 Ppd. Order Stock No. 60,591HP. Charger only, $5.98. Stock No. 60,592HP. Two "D" cells only, $5.98. Stock No. 60,593HP. Edmund Scientific Co., Barrington, New Jersey 08007.

GIANT SURPLUS BALLOONS

"Balloons of fun" for kids, traffic stoppers for stores, terrific for amateur meteorologists. Create a neighborhood sensation. Great backyard fun. Exciting beach attraction. Amateur meteorologists use to measure cloud heights, wind speed, and temp. Made of heavy black rubber, inflate with vacuum cleaner or auto air hose, or locally available helium for high rise. 8' diam. $2.00 Ppd. Order Stock No. 60,568HP. Edmund Scientific Co., Barrington, N.J. 08007.

ASTRONOMICAL TELESCOPE KITS

Grind your own mirror for powerful telescopes. Kit contains fine annealed pyrex mirror blank, tool, abrasives, diamond mirror, and eyepiece tubes. You build instruments valued from $25.00 up. Stock:

<table>
<thead>
<tr>
<th>Diam.</th>
<th>Thickness</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>70.003HP</td>
<td>4½&quot;</td>
<td>¾&quot;</td>
</tr>
<tr>
<td>70.004HP</td>
<td>6&quot;</td>
<td>1&quot;</td>
</tr>
<tr>
<td>70.005HP</td>
<td>8&quot;</td>
<td>1½&quot;</td>
</tr>
<tr>
<td>70.006HP</td>
<td>10&quot;</td>
<td>1¾&quot;</td>
</tr>
<tr>
<td>70.007HP</td>
<td>12½&quot;</td>
<td>2&quot;</td>
</tr>
</tbody>
</table>


COLLIMATOR—PARALLEL LIGHT SOURCE

Terrific bargain! Surplus gun sight orig. cost Gov't about $100. Was essentially a source of infinite light. Many uses for experimenters, research labs. Metal ring and dot reticle f/3.5, 2" achromatic lens, bulb 33½ x 2½" reflector glass plate. Bulb operates on 14V, can be converted to 110V—or inexpensive transformer available. 654 x 654 x 2½", $9.95 Ppd. Order #70,774HP. 110V transformer, $15.75 Ppd. Order #60,521HP. Edmund Scientific Company, Barrington, New Jersey 08007.

GIANT FREE CATALOG

Completely new 1967 Catalog, 148 pages packed with nearly 4,000 unusual bargains. Exciting new categories. Many new items. 100's of charts, illustrations. Many hard-to-get war surplus bargains. Enormous selection of telescopes, microscopes, binoculars, magnifiers, prisms, photo components, etc. For hobbyists, experimenters, workshops, factories. Shop by mail. No salesman will call. Write for Catalog "HP" to Edmund Scientific Co., Barrington, N.J.

FEBRUARY-MARCH, 1967
**STEP UP YOUR INCOME**

Learn at Home to Fix

**ELECTRICAL APPLIANCES**

If you have a business or job in Radio-TV Servicing or other home service, you'll find Electrical Appliance Repair a natural, profitable addition. NRI trains you quickly in spare time, shows you how to add to your income long before you finish training. NRI gives you parts to build your own Appliance Tester. Learn how to repair small and large appliances plus air conditioning, refrigeration, small gasoline engines, equipment used on farms and commercially. Cash in on this money-making side-line. Mail coupon for catalog. No obligation.

**NATIONAL RADIO INSTITUTE**
Washington, D.C. 20016

**Training Available Under New GI Bill**

---

**BOOKMARK**

BY BOOKWORM

- **Color TV.** The vast growth of color television activity has developed a pressing need for simplified, more useful color-TV troubleshooting guidance. *Color-TV Servicing Guide*, by Robert G. Middleton, is a quick, effective servicing tool, arranged by color-TV trouble symptoms. It shows how to apply proper troubleshooting procedures, based on an analysis of trouble symptoms. It includes many full-color illustrations of actual picture tube displays for the various troubles, plus clear, concise text explaining possible causes and diagnosing procedures.

The book goes through each section of the color-TV receiver, describing the symptoms of related troubles. The last chapter in the book explains in detail how to test and troubleshoot with color-bar generators. Without this helpful book at hand, many servicemen may be wasting time needlessly. It is written in a clear, concise manner by author Bob Middleton who is well-known for his down-to-earth books for practicing techniques. *Color-TV Servicing Guide* is available from electronic parts distributors and bookstores throughout the country, or from Howard W. Sams & Co., Inc., Dept. RTV, Indianapolis, Indiana 46206.

- **Data Book.** The fifth edition of the highly popular reference book *Allied Electronics Data Handbook* has been revised and enlarged to include new and up-dated material for use in electronics. Fundamental mathematical data covers math constants, math symbols and algebraic formulas. Complete mathematical tables are given for squares, cubes, square roots, cube roots, reciprocals, common logarithms, natural sines, cosines and tangents. Radio and electronic formulas are provided for 70-volt speaker matching systems, resistance, capacitance, in-
Now will trouble-shooting, using "breadboard" experiment, and set you interested in "Printed Circuit Signal Injector", with Printed Circuit Signa...
When a Pioneer Speaks... it's time to listen!

That's when you'll hear the optimum in tonal quality . . . sound reproduction at its faithful best.

You can always count on Pioneer speakers and speaker systems to deliver a quality performance. Every time. All the time.

Made by the world's largest manufacturer of speakers, this premium audio equipment is available at popular prices.

And you can select from many fine models—from the unique, handsome metal-grilled CS-24 Auxiliary Wall Speaker to the efficient, compact CS-20, CS-52 and the Ultimate 5-speaker CS-61 Bookshelf System. All carried only by franchised dealers.

A word from you and we'll send literature and the name of your nearest dealer.

(A) CS-62 Bookshelf 3-way speaker system (3 speakers). Oiled walnut enclosure. Meas. 25" x 15¾" x 11½", retail price: $142.00.

(B) CS-61 Bookshelf 3-way speaker system (5 speakers). Oiled walnut enclosure. Meas. 24¼" x 16½" x 13¼", retail price: $175.00.

(C) CS-20 Compact 2-way speaker system. Oiled walnut enclosure. Meas. 13¾" x 8" x 8½", retail price: $35.00.

(D) CS-24 Ultra-thin wall or bookshelf speaker system. Unique metal-grilled oiled walnut enclosure. Meas. 16¼" x 10¼" x 4½"; retail price: $27.75.

(E) CS-52 Compact 2-way speaker system. Oiled walnut enclosure with gold metal trim. Meas. 13½" x 8½" x 8½", retail price: $59.95.

PIONEER ELECTRONICS U.S.A. CORPORATION
146 SMITH AVENUE, FARMINGDALE, LONG ISLAND, N.Y. 11735
(516) 694-7720

Bookmark

ductance, reactance, resonance, frequency and wave-length, "Q" factor, impedance, conductance, susceptance, admittance, transmission lines, vacuum tubes. DC meters. trigonometric relationships, Ohm's Law for AC and DC circuits and others.

Basic formulas are given for tubes and transistors: also basic transistor symbols, circuits, and alpha-beta relationships. Included in engineering and servicing data are attenuator networks; RF coil winding formulas; wire table; RF coil winding data chart; charts for inductance, capacitance and resistance; metric relationships; how to use logarithms; tables on directly interchangeable tubes, both foreign and American; pilot lamp data; EIA and military codes for resistors and capacitors; Amateur Radio bands; TV channel and carrier band frequencies; recording tape playing times; schematic symbols and abbreviations; and Greek alphabet designations.

A giant amid its contemporaries, the handbook is available, postpaid in the U.S.A., from Allied Radio Corp., 100 N. Western, Chicago, Illinois 60680.

Good Buys. Some of the best books on electronics for experimenters as well as engineers are published by the government and are inexpensive. The Government Printing Office has just sent out a bulletin listing some of its electronics books. Of particular interest to our readers, I am sure, is Basic Theory And Application of Transistors which is filled with circuits, contains 263 pages and sells for only $1.25. Another good one is Selected Semiconductor Circuits, a 440-pager priced at $2.25. Theory and Use of Electronic Test Equipment is a 158-page book that every experimenter should have. It's only $0.75. Another one to have on the shelf for reference, and for learning the whys and wherefores, is Basic Electronics, a Navy training course covering 471 pages and priced at only $2.75.

These books can be ordered by mail from The Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. You can get a list of books on electricity and electronics.
**Tape Fans.** After the TV set and the radio/phono, the tape recorder is the most popular of home entertainment components. This text is widely used by students, teachers, actors, writers, private eyes, Beatle fans and other music and song collectors, for speech therapy or home speech improvement, for recording parties and special events like the baby's first sounds, for making tapes of selected broadcasts or prized records—the applications are endless.

The average tape recorder owner does not know a great deal about his machine and does not make full use of its capabilities. To help him, Allied Radio Corp., the Chicago-based electronics supply house for high fidelity and electronics components, has published a low-priced book, *Using Your Tape Recorder*, that explains the ABC's of tape recording to the non-professional user. Written by Harold D. Weiler, an old hand with audio and recording subjects, working with Allied's recording specialists, this new book treats all subjects in simple language directed to the recording hobbyist and non-technical operator. Priced at fifty cents, this paperback is available postpaid in the U.S.A. Send your four bits to Allied Radio Corp., 100 N. Western Ave., Chicago, Ill., 60680.

**Easy Does It Computer Lessons.** If you are fascinated by the seeming miracles performed by present-day computers, you probably would like to know how they operate. You can easily learn what actually happens in a computer...it's far simpler than you may have expected. Although computers contain a myriad of circuit complexes, they are actually combinations of a relatively few basic, simple circuits.

A new book, *Computers Self-Taught Through Experiments*, by Jack Brayton, helps you to learn about computers the easy way. It leads you through 28 simple, low-cost construction projects. The use of transistors in computers and describes the various individual computer operations in detail. Along the way it gives details for constructing actual working models of the computer circuits described.

While low-cost, easy-to-obtain parts are used, these circuits operate in the same manner as the ones in actual computers. At the end, construction details are given for a ten-stage adder/subtractor.
With H. G. Cisn's Copyrighted RAPID "TV TROUBLE SHOOTING METHOD"

Without experience or knowledge, this guaranteed new method of servicing TV sets enables you to DIAGNOSE TV troubles as rapidly as an expert. NO THEORY—NO MATH—you can locate all faults in record-breaking time regardless of make or model. "TV TROUBLE SHOOTING METHOD" is the most valuable aid to TV servicing ever written. Be a TV Trouble Diagnostician. Increase your present earnings, open your own Profitable Business or get that high-paying skilled job.

It's all in this book...

Nothing more to Pay—Nothing else to Buy

Alphabetically listed are 15 picture troubles, over 34 raster and 17 sound troubles. By this unique copyrighted method you know EXACTLY WHERE the trouble is, plus step-by-step instructions, including 40 RAPID CHECKS, help to find faulty parts.

1. IMPORTANT PRELIMINARY CHECKS NEED NO INSTRUMENTS! Of the 60 Rapid Checks, OVER 45 ALSO REQUIRE NO INSTRUMENTS! Rapid checks include emergency checks for distorted pictures, defective tubes including PIX tube, plus 57 others ALL EXPLAINED IN SIMPLE LANGUAGE. PERFORMED WITHOUT INSTRUMENTS. MANY CHECKS USE THE PICTURE TUBE AS A GUIDE.

H. G. Cisn, the author, is the Inventor of the ACT/DIAZI detergent radio. He invented the ACT/AC, ACT/TV, etc. He has also trained thousands of technicians now owning their own prosperous TV service organizations or holding highly paid TV positions. His years of experience are embodied in this remarkable new book.

Guaranteed Money Back in 5 Days If Not Satisfied!

ABSOLUTELY FREE with each order, your choice of Cisn's newest books: BASIC ELECTRICITY—Vol. 1 or TV/RADIO TUBE SUBSTITUTION GUIDE. These sell for $1.95 or ACT NOW and get a bonus postpaid at cost of only 50c.

RUSH COUPON NOW!

H. G. Cisn, Consulting Engineer—Dept. RE
Amagansett, N. Y.
Enclosed find $____ Rush Trouble Shooting Method and free book marked above (if not marked Basic Elec., will be sent).

Name ____________________________
Address ____________________________
City ____________________________ Zone _______ State _______

Jack Brayton is well known to the readers of this magazine as well as its sister publication Elementary Electronics. His basic computer theory pieces and construction projects have been in our reader's hands for almost two years.

Copies are available from electronics parts and distributors and bookstores throughout the country; or direct from the publisher, Howard W. Sams & Co., Inc., 4300 W. 62nd Street, Indianapolis, Indiana 46206.

 Bookmark

soft cover
192 pages
$4.25

"Is Ed still putting together that antenna tower in the cellar, Dear?"
How to get into one of today's hottest money-making fields — servicing 2-way radios!

More than 5 million two-way transmitters have skyrocketed the demand for service men and field, system, and R&D engineers. Top-notch licensed experts can earn $12,000 a year or more. You can be your own boss, build your own company. And you don't need a college education to break in.

How would you like to start collecting your share of the big money being made in electronics today? To start earning $5 to $7 an hour... $200 to $300 a week... $10,000 to $15,000 a year?

Your best bet today, especially if you don't have a college education, is probably in the field of two-way radio.

Two-way radio is booming. Today there are more than five million two-way transmitters used for police cars, fire trucks, taxis, planes, etc. and Citizen's Band uses—and the number is growing at the rate of 80,000 new transmitters per month.

This wildfire boom presents a solid gold opportunity for trained two-way radio service experts. Most of them are earning $5,000 to $10,000 a year more than the average radio-TV repair man.

Why You'll Earn Top Pay

One reason is that the U.S. doesn't permit anyone to service two-way radio systems unless he is licensed by the Federal Communications Commission. And there simply aren't enough licensed electronics experts to go around.

Another reason two-way radio men earn so much more than radio-TV service experts is that they are needed more often and more desperately. A home radio or TV set needs repair only occasionally, and there's no real emergency when it does. But a two-way radio user must keep those transmitters operating at all times, and must have them checked at regular intervals by licensed personnel to meet FCC requirements.

This means that the available licensed experts can "write their own ticket" when it comes to earnings. Some work by the hour and usually charge at least $5.00 per hour, $7.50 on evenings and Sundays, plus travel expenses. Others charge each customer a monthly retainee fee, such as $20 a month for a base station and $7.50 for each mobile station. A survey showed that one man can easily maintain at least 15 base stations and 85 mobiles. This would add up to at least $12,000 a year.

Be Your Own Boss

There are other advantages too. You can become your own boss—work by yourself or gradually build your own fully staffed service company. Instead of being chained to a workbench, machine or desk, you'll move around, see lots of action, rub shoulders with important police and fire officials and business executives who depend on two-way radio for their daily operations. You may even be tapped for a big job working for one of the two-way radio manufacturers in field service, factory quality control, or laboratory research and development.

How To Get Started

How do you break into the ranks of the big-money earners in two-way radio? This is probably the best way:

1. Without quitting your present job, learn enough about electronics fundamentals to pass the Government FCC Exam and get your Commercial FCC License.

2. Then get a job in a two-way radio service shop and "learn the ropes" of the business.

3. As soon as you've earned a reputation as an expert, there are several ways to earn more. You can move out and start signing up and servicing your own customers. You might become a franchised service representative of a big manufacturer and then start getting into two-way radio sales, where one sales contract might net you $5,000. Or you may be invited to move up into a high-prestige sales job with one of the major manufacturers.

The first step—mastering the fundamentals of electronics in your spare time and getting your FCC License—can be easier than you think.

Cleveland Institute of Electronics has been successfully teaching electronics by mail for over thirty years. Right at home, in your spare time, you learn electronics step by step. Our AUTO-PROGRAMMED™ lessons and coaching by expert instructors make everything clear and easy, even for men who thought they were "poor learners." You'll learn not only the fundamentals that apply to all electronics design and servicing, but also the specific procedures for installing, troubleshooting, and maintaining two-way mobile equipment.

Get Your FCC License... or Your Money Back!

By the time you've finished your CIE course, you'll be able to pass the FCC License Exam with ease. Better than nine out of ten CIE-trained men pass the FCC Exam the first time they try, even though two out of three non-CIE men fail. This startling record of achievement makes possible the CIE Warranty: you'll pass the FCC Exam upon completion of your course or your tuition will be refunded in full.

Before Ed Dulaney studied with CIE, he was a crop duster. Today he owns the Dulance Communications Service, with seven people working for him repairing and manufacturing two-way equipment. Says Dulaney: "I found the CIE training thorough and the lessons easy to understand. No question about it—the CIE course was the best investment I ever made."

Find out more about how to get ahead in all fields of electronics, including two-way radio. Mail coupon for two FREE books, "How To Succeed In Electronics" and "How To Get A Commercial FCC License."

Cleveland Institute of Electronics
1776 E. 17th St., Dept. EX-18 Cleveland, Ohio 44114

Please send me without cost or obligation:

1. Your 40-page book "How To Succeed In Electronics" describing the job opportunities in Electronics today, and how your courses can prepare me for them.

2. Your book on "How To Get A Commercial FCC License."

Name: ___________________________ (please print)

Address: _________________________

City: __________ State: ______ Zip: ______

Occupation: ___________________________

☐ Check here for GI Bill Information.

Accredited Member National Home Study Council

EX-18
A Real Charmer. No, the Cobra V isn't some kind of late model snake, it's a glitzy new CB rig which just blew on the scene from the windy city. The Cobra is right in step with the latest trends in CB gear—little in size, all transistorized, low cost, efficient; and it claims to be the first rig on the market with a "special protective circuit for transmitter components."

In the performance department, the Cobra V has transistorized transmit/receive switching (that means no moving parts and therefore less chance for mechanical failure when a tired old relay drops dead of fatigue). There's also a clever new voltage filter to improve the clarity of the signals inhaled by the Cobra V.

Running a whopping 100% modulated 5-watt input on any five channels, the set puts up quite a showy front with a walnut grain finish ('neath that frilly walnut finish is an all steel housing). For those wise guys out there in the reading audience who come on strong with the fancy tech talk, we note that the Cobra V comes on strong with better than half a microvolt sensitivity (for 10 db S/N) and a selectivity of 6 db at ± 3 kc—O.K.?

You can get enough literature on the Cobra V to stuff a megacycle if you drop a card or letter to the manufacturer, B&K Division, Dynascan Corp., 1801 West Belle Plaine Ave., Chicago, Ill. 60613.

A Matchless Antenna? We've seen some wild looking things connected to the output of CB rigs but the Antenna Specialists MACH III makes the rest of them look like as tame as a tranquilized bunny rabbit.

Not knowing exactly how to describe it, the best we can do is simply parrot the description of the thing as stated by the manufacturer: "A spiral shaped, printed-circuit coil, waterproofed and shock-suspended inside a wing-shaped ornamental base."

This all boils down to the fact that this circuitry is a "involute transducer" (wha?).

Now that the engineering is clear to you (because it certainly isn't to us) we can get into the performance of the little devil. It's a 32 inch steel whip, basically, set into a futuristic cyco-lac plastic base containing all of the sophisticated jazz we just told you about (don't ask us to repeat it please).

Available in a variety of mounting types (with or without shock spring), the MACH III is DC grounded for optimum SWR across the band. The antenna may be peaked up to your particular rig by means of an adjustment in the base.

Prices (depending on mounting hardware) range from $12 to $25. The folk who figured this one out are at Antenna Specialists, 12435 Euclid Avenue, Cleveland, Ohio 44106.
Computers Self-Taught Through Experiments. Clearly explains the basic circuits used in computers and demonstrates the fundamentals of computer principles and operation through 28 simple, low-cost construction projects. CEI-1...

$4.25

Building Your Amateur Radio Novice Station. Provides complete, easy-to-follow construction details for building an inexpensive transmitter and receiver, plus several accessory items. ASP-1...

$3.50

Short-Wave Listener's Guide. 2nd Ed. Gives listings for over 300 short-wave stations by country, call letters, frequency, power, and broadcast time. Invaluable for the short-wave fan. SLG-2...

$1.75

99 Ways to Improve Your CB Radio. Provides invaluable tips on how to operate, service, and maintain CB radio equipment to achieve optimum performance. ICB-1...

$2.50

How to Build Speaker Enclosures. Provides a wealth of both practical and theoretical information for constructing high-performance speaker enclosures for music systems. SEB-1...

$3.25

Understanding Telemetry Circuits. Clearly explains the four basic telemetry systems in current use. Explains how they are used in space and research to monitor and record remote conditions. UTL-1...

$2.25

101 Questions & Answers About Transistors. Provides through pertinent questions and answers, a basic understanding of transistor theory and applications. QTS-1...

$2.50

Electronics in Oceanography. A full description of modern electronic systems and the basic instrumentation used for gathering, measuring, and interpreting oceanographic data. EOL-1...

$4.95

101 Ways to Use Your Color-TV Test Equipment. 2nd Ed. Explains practical application of test equipment to diagnose color-TV troubles. Describes setup, proper test procedures, how to evaluate results. TEM-9A...

$2.95

101 Ways to Use Your Oscilloscope. 2nd Ed. Provides latest information on the proper use of the oscilloscope for faster and better electronic servicing. TEM-2A...

$2.95

PHOTOFAC'T Guide to TV Troubles. 2nd Ed. Photos of actual TV picture defects indicate where to find the trouble source in minutes. PFG-2...

$3.95

Tube Substitution Handbook. 9th Ed. Includes hundreds of new substitutions; lists over 11,500 direct substitutions. Includes substitutions for receiving, picture tube, subminiature, industrial, and communications types. TUB-9...

$1.50

Color TV Servicing Made Easy. Full explanation of color principles, circuitry, setup adjustments, and servicing of color TV sets. Takes the mystery out of servicing color TV. CSL-1...

$3.25

Tape Recorders—How They Work. New 2nd edition. Fully explains principles of magnetic recording, various types of recorders, mechanisms and components, testing procedures, etc. Best reference on the subject. TRW-2...

$3.95

How to Read Schematic Diagrams. Not only shows you how to read and interpret diagrams, but analyzes each component, its construction, and its circuit purpose. RSD-1...

$2.25

Computer Dictionary. Defines over 5000 terms and concepts. Valuable appendices include information on computer systems, applications, COBOL, FORTRAN, ALGOL, QUIKTRAN, etc. CDS-1 (softbound).

$4.95

CDH-1 (hardbound).

$6.95

Color TV Trouble Clues. Vol. 2. Field-tested guide to procedures for fast color TV receiver repair. Describes symptoms, troubleshooting techniques, proper use of test instruments. COL-2...

$1.95

ABC's of Lasers and Masers. 2nd Ed. Clearly explains the operation and applications of the laser, the amazing device which produces light radiations capable of performing astounding feats. LAL-2...

$2.25

Second-Class Radiotelephone License Handbook. New 3rd edition; complete study course for elements I, II and III of the latest FCC exams. Helps you earn the license you need for two-way radio work. QAN-2...

$4.75

Color TV Training Manual. 2nd Ed. Best guide for technicians preparing to service color TV. Detailed explanation of color principles, circuitry, setup procedures, alignment, and troubleshooting; full-color illustrations. TVC-2...

$5.95

101 Ways to Use Your VOM & VTVM. Shows you how to get the most from these popular instruments, how to make required connections, how to test properly, how to evaluate results. TEM-3A...

$2.95

Citizens Band Radio Handbook. New enlarged edition. Covers latest CB equipment and circuits, antenna systems, fixed and mobile installations, maintenance and repairs, FCC rules, etc. CBH-2...

$3.50

Handbook of Electronic Tables & Formulas. New enlarged 2nd edition. Complete reference for all charts, math tables, formulas and laws, symbols, constants, and standards. Special color insert shows latest FCC frequency spectrum assignments. HTF-2...

$3.95

ABC's of Computers. Explains in simple terms how computers work and what they do. Covers analog and digital types, digital circuitry, memory devices, programming, etc. ABC-2...

$2.50

Transistor Radio Servicing Made Easy. 2nd Ed. The authoritative book on fast, accurate repair of transistor radios. Includes new FM models. TRE-2...

$2.95

Order from your Sams Distributor today, or mail to Howard W. Sams & Co., Inc., 4300 W. 62nd St., Indianapolis, Ind. 46268 Dept. RT-2

Send me the books I have circled at right. 

$ (check) (money order) enclosed.

Name:

Address:

City State Zip

Send FREE Sams Booklist

HOWARD W. SAMS & CO., INC.

February-March, 1967

13
ONLY CCTV CAMERA KIT ON THE MARKET

NEW IMPROVED MODEL

- Vidicon
- 25mm, f.1.9 Lens
- Cable
- Instructions

ASSEMBLED $259.50

$20 DOWN
$10 MONTH


All parts guaranteed one year. Vidicon guaranteed 90 days. Make check or money order to CONAR. Shipped REA collect.

SEND FOR FREE CONAR CATALOG

CONAR
Division of National Radio Institute, Dept. 8/P
3039 Wisconsin Ave., Washington, D.C. 20016

Get Your
F. C. C. LICENSE and
A. S. E. E. DEGREE

Move up. Make more money. Enjoy greater security. How? By having the knowledge, skills, and documents that industry needs and pays for. Grantham can train you—can prepare you for a successful career in electronics. Among the courses we offer are:

1. F.C.C. License Preparation (for first class Government license in communications electronics).
2. Electronics Engineering Technology (leading to the Associate in Science in Electronics Engineering degree).
3. Radio & Television Servicing (training you to be an expert radio-TV serviceman).

All of our courses are available in resident classes, and some of them are available also by correspondence. We are approved to offer training under the new G.I. Bill—both in resident classes and by correspondence. Write or phone any one of our locations listed below for free details. Specify the course you are interested in.

Grantham School of Electronics
Dept. R-6
1505 N. Western Ave., Hollywood, Cal. 90027
(Phone: 110 9-7578)
408 Marion Street, Seattle, Wash. 98104
(Phone: MA 2-7227)
818-18th St., NW, Washington, D.C. 20006
(Phone: 298-7460)

Palm Sized Yakker. Palm sized can mean the size of a palm tree, but in this case it's a miniature radio station offering 2 channel operation, superheterodyne receiving, push-pull audio, 9 transistor function circuitry, and it's all wrapped up under a $14.95 price tag.

This rig is called the Lafayette HA-62, transmitting in all its tiny glory from a die-cast chrome highlighted front panel via a telescoping whip antenna. Put in a 9 volt battery and you can plug in an earphone and make like Jack Daniel's (or James Bond, or whatever that fellow's name is). Signals from the HA-62 will carry for a mile or two under normal conditions, and no license is required (and no age limit either).

One Of Our Aircraft Is Missing. Not long ago we suggested that walkie-talkie users might make good use of the Class C radio control channels which lie between the Class D CB channels—thereby avoiding harmful interference from their more powerful 5-watt brothers. Unfortunately we forgot to consider the possible effects on the radio controlled aircraft using these channels. A number of model fliers quickly brought this to our attention—mentioning several instances when a walkie-talkie became the instrument of destruction to a prized model aircraft; knocked it right out of the sky.

The aircraft folks will be moving to their new 70 MHz mc channels and perhaps we might hold off on invading their 27 MHz channels until they're all moved out.

Radio-TV Experimenter
Retractable Slide Rule

Very small-pocket-sized (1 3/4 x 1 3/4 x 1 in.), this pocket slide rule extends to ten inches. The slide rule features A, B, C, and D scales with B and C scales folded in D°pi and D pi relationship to permit determination of circular areas and circumference by moving cursor only. Double-length sliding B and C scales provide an endless feature formerly found on circular slide rules. Reverse side measures to 20 in. or its metric equivalent and lists basic equivalents, fan laws, power, trig and geometric formulas. Cost, $8.50; manufacturer, Cal-Tape, 1095 Kingston Park, Roann, Ind. 46974.

5-Band CB Receiver/Direction Finder

This transistor portable tunes all 23 CB channels on two separate bands, as well as police/marine/shortwave band, 1.5-4.5 MHz; low frequency beacon/weather band, 200-400 kHz; standard AM broadcast band. The "Nova CB" has an accurately calibrated rotating antenna and null meter, and is also a precision radio direction finder for boats and light planes. Priced at $149.95. Nova CB comes with leather carrying case, chrome mounting brackets, 3 telescoping whip antennas, batteries.

Taut-Band VOM

Here in an easy-to-build kit, at a surprisingly-low price, is a 20,000 ohms-per-volt VOM with a burnout-proof movement. Covers 55 ranges for reading AC and DC volts, resistance, DC current, decibels—with a switch that virtually doubles the ranges. The perfect instrument for testing radio and TV sets, hi-fi components, appliances, motors, house wiring, etc. Compact 6 1/4 x 5 1/4 x 3 3/4" unit. Complete with batteries, test leads, assembly manual for only $39.95. And backed by this unique money-back guarantee... exclusive in the industry:

Build a Knight-Kit in accordance with our easy-to-follow instructions. When you have completely assembled the kit, you must be satisfied or we will return your money, less transportation charges, under the Allied guarantee of satisfaction.

ALLIED RADIO

Rush coupon today for full details and Special Introductory Offer.

ALLIED RADIO, Knight-Kit Div. Dept. 208B, P.O. Box 4398, Chicago, Ill. 60680

Please rush full details and Special Introductory Offer on the new Knight-Kit Taut-Band VOM.

Name

PLEASE PRINT

Address

City State Zip
New Products

Headphone jacks, miniature earpiece, pushbutton dial light, external power cord, house current adapter. Available at most stores or from Nova-Tech, Inc., 630 Meyer Lane, Redondo Beach, Calif.

Bass Guitar Speaker Systems

These speakers, PMC-1 and PMC-2, have been engineered to obtain maximum performance from bass guitar amplifiers. The 12-inch speakers have 2-inch diameter voice coils and 2-pound magnets. Both systems are about the size of a 2-suiter suitcase. The PMC-1 ($166.50) has a 12-inch woofer and handles 60 watts; the PMC-2 ($216.50) has two 12-inch woofers and handles 120 watts. Speakers made by Utah Electronics, 1124 E. Franklin St., Huntington, Ind.

For Hams What Am

The DR-30 Communications Receiver is a solid-state, dual conversion superhet unit using field-effect transistors. The use of FET's in the RF stages make for greater sensitivity, better image rejection and exceptional freedom from cross-modulation or overloading on strong signals. All the circuitry is on 9 plug-in, glass epoxy modules; chassis in 3/16-inch thick aluminum. Complete ham-band coverage, 80 through 10 meters plus a portion of six meters; 9.5-10.5 MHz for WWV and 31-meter SWL band plus provision for two optional crystals for additional frequency coverage. Selectivity positions 5.0, 2.1 and 0.5 kHz. Collins mechanical filter for SSB, operates on 12 VDC. Priced at $389.50 amateur net from Davco Electronics, Inc., PO Box 2677, Tallahassee, Fla. 32304.

Updated Second Op

Coincident with a rapid increase in good band conditions on most shortwave frequencies comes the revised, fourth edition of W91OP's Second Op. This is a simple DX computer on laminated card stock, giving beam headings to every country in the world from major geographic locations in the United States, immediate identification of prefixes including specific location of the prefix, time zone, continent, postage rates. Included on the periphery of the Second Op are provisions for logging contacts and receipt of confirmation. Send your name and address and $1.00 to Electro-Voice, Inc., Dept. PR-4, Buchanan, Mich. 49107 (or visit your local Electro-Voice distributor).

2—New Receivers—2

Both these new Hallicrafters receivers are AM/FM. The FM-66, shown on the right, has a hand-rubbed walnut cabinet, two built-in antennas, printed circuit chassis, and a 5-inch permanent
magnet speaker. It measures 14½ x 7½ x 5¼ inches, list price is $64.95.

And on the left, Model S-210 has 4 short wave bands as well as AM and FM. This one has 'spread' tuning, accomplished by electronically spreading apart distant stations to relieve congestion, permitting highly selective tuning on 49, 31, 25 and 19 meters. Power supply is the same as the FM-66—105-120 volt, 60 Hz AC. Has 3 dual-purpose and 3 single-purpose tubes. The vinyl-covered metal cabinet is 14½ x 7½ x 5¼ inches, and the unit lists for $89.95. If you don't have a Hallicrafters distributor near you, their address is Hallicrafters Co., 4401 W. 5th Ave., Chicago, Ill. 60624.

Lit-Up Base Antenna

The "Speakin' Beacon" Citizens Band base station antenna is a 27 MHz omnidirectional coaxial antenna with a permanent-circuit neon light built into its tip. Whenever the transmitter is keyed, the neon tube glows, visually verifying the RF power output and acting as a beacon to help guide mobiles. A Stati-Light ball surrounding the neon tube dissipates static electricity and helps eliminate noise. The ball, part of the neon light circuitry, provides proper capacity to ground to generate necessary voltage to light neon when RF energy is present. The Speakin' Beacon is 19 feet, 3 inches, aluminum, built to withstand winds up to 80 mph, has its own built-in lightning protection, and can be installed anywhere a vertical pipe would fit. Gamma matched, it has exceptionally low VSWR. Model is M-148, CB net price is $29.95, source is The Antenna Specialists Co., 12345 Euclid Ave., Cleveland, Ohio 44106.

Switch Hi-Fi All Over the Place

If you want simultaneous distribution of sound to more than one stereo speaker system—say family room, den, etc.—up to eight different areas in any combination at the same time, Model 642 Sound Control Center is for you. Offices, schools, would be other applications. Model 641, on the other hand, has a positive interlocking feature between switch stations which insures that only one system at a time can be selected. Frequency response through the internal switching network is
New Products

from DC to 30 kHz with negligible switching loss. No external power (other than audio power being distributed) is required for operation. Power handling capability is 100 watts maximum into a 4-ohm load. User net price for Model 642 or 641 is $49.50 from Switchcraft, Inc., 5555 Elston Ave., Chicago, Ill. 60630. Write for details and address of nearest distributor.

Hobbyists' Solid-State Kits

At popular prices, the do-it-yourselfer can now get hold of a wide variety of blister-packaged electronic kits as follows: EC-100 Siren Kit, $4.95; EC-101 Burglar Alarm Kit, $6.95; EC-102 Fire Alarm Kit, $6.95; EC-200 Intercom Kit, $3.95; EC-300 Audio Amplifier Kit, $4.95; EC-400 Metronome Kit, $3.95; EC-500 Tremolo Kit, $9.95; EC-600 Light Flasher Kit, $3.95; EC-700 "Mystifier" Kit, $4.95; EC-800 Photocell Nite Lite Kit, $4.95; EC-900 Power Supply Kit, $7.95; EC-1000 Code Oscillator Kit, $2.50. Shown is EC-1000. From EICO Electronic Instrument Co., Inc., 131-01 39th Ave., Flushing, N.Y. 11352. Each kit or group of kits may be the heart of your next home-brew project.

Be Your Own TV Producer

A new closed-circuit TV camera, model SS-310, using less space than a telephone, is priced in the hobbyist range. Resolution at center of picture is 350 horizontal lines or better with monitors, and 300 lines or better with conventional receivers. The camera circuit contains 19 silicon transistors, 2 germanium transistors, and 14 diodes. A clear picture can be obtained with a minimum amount of illumination, using f1.4 lens supplied with the camera. The SS-310 has an automatic electronic circuit that instantly compensates for wide and sudden lighting changes, assuring a clear picture under virtually all light conditions. Plug-in modular circuit boards facilitate replacements with a minimum of downtime. User price of the SS-310 with f1.4 lens, 25 feet of coaxial cable with connectors, is $289.95. Maker is Squires-Sanders, Inc., Martinsville Rd., Millington, N. J. 07946.

Transistorized Doorman

This pocket-sized garage-door controller, the Electro-Lift, opens, closes, locks the garage door...
and controls the garage light from 100 feet away. Meeting FCC rules, the Electro-Lift uses a new radio coding system called pulse-tone modulation. The 2¾ x 3¼ x 1-inch, 10 oz. transmitter can be carried in purse or pocket, clipped to the sun visor or under the dashboard. The receiver fastens to the wall of the garage; not overhead as in other versions. The Electro-Lift gives double protection against mishaps with both pushbutton and automatic stop features: handles single or double one-piece doors up to 20 feet wide and 8 feet high, sectional doors up to 10 feet wide. The complete Perma-Power Electro-Lift system sells for $179.95, and is friction-driven (the Perma-Power model G-670 is a chain-drive unit). Available nationally, or write to Perma-Power Co., 5740 N. Tripp Ave., Chicago, Ill. 60647.

Self-Service Technician

Mercury Electronics has dolled up their new self-service tube tester 204 Series in modern blue and grey cabinet designs. The new units have a panel designed to accommodate over 1,700 tube types including the latest nuvistors, novars, compactrons, magnovals and 10 pin types. They also test fuses, pilot lights, 6- and 12-volt auto radio vibrators. Only two settings are required to test any tube, and a flip tube chart lists over 1,700 tube types. For positive contacts there are 68 phosphor-bronze and beryllium tube sockets. The Lo-Boy Floor Model 204LB is dealer net $209.95, Counter Model 204C is $159.95. Mercury Electronics Corp., 315 Roslyn Rd., Mineola, N. Y. 11501.

Low-Cost 4-Track Recorder

At a nice price ($89.95) the Model RK-810, Stock No. 99-1527WX, has 3 speeds with 4-track monaural/record and 4-track playback stereo with 5-position selector control for rewind, stop, run, fast forward and pause for instant editing. It has a self-contained 5-inch speaker, 3-digit tape counter with

--------

**MESHNA SURPLUS BARGAINS**

**GEIGER COUNTER** chassis assembly, less probe tube, with 100 microamp indicating meter & 350 volt transistor power supply, which operates from 9 volt transistor radio battery. Unused, with schematic. **Stock #410** $4.00

**SUN CELL KIT** makes electricity from the sun. Package of 5 cells with book of experiments. **Stock #8OL-1** $1.50

**SNOOPERSCOPE TUBE** late style military like viewing tube, see in dark. With spec sheet. **#6002** $6.59

**ALNICO MAGNET**, lifts 50 lbs. **#4101** $4.00

**POWER SUPPLY KIT** output of 6-12-24 volts DC 6 amps from 115 volt house current. Use it for powering surplus gear, plating, experimentation. **#8002** $6.25

**IBM WIRED MEMORY PLANES** 160 core plane with spec sheet. (send for info on many larger types available) **#160** $4.00

**INFRA RED DETECTOR TUBE** sensitive IR detector. **#101** $1.00

**INFRA RED FILTER** use on your light for IR source **#412A** $1.75

**POLAROID FILTER** sheets, 5x5 inch **#255** 2/$1.00

**M-3 SNOOPERSCOPE** infra red viewer, complete operational, less battery. See in the dark. **#204** $22.50

**100 MICROAMP METER** new G.E. arbitrary scale **#134** $1.50

**PUSH BUTTON** assembly from auto radio, with ant., RF, osc. assembly, brand new. Experimenters delight. **#101** $1.00

The above listing show only a few bargains available from our 80 page catalog crammed with fantastic & unusual electronic & optical equipment purchased by us from Government & varied sources. For the experimenters, photo hgu, R & D lab we have a most unusual catalog. Send $5 handling & prod. cost for our latest listing of bargains. All material shipped Post Lynn, Mass., (you pay shipping). Min. order $5.00.

**JOHN MESHNA, JR.**

19 ALLERTON ST., LYNN, MASS. 01904

World Famed BREVETTATA TEAR GAS PISTOL

Appearance of this fine tear gas weapon is similar to real gun. It is ideal for people who work in lonely, dark locations, and require protection. Men give this gun to wives and daughters for night security. Many industrial applications. Shooting of gun stops aggressive without permanently injuring him. Neither permit nor license is needed, but it is not sold to minors. It is free six cartridges without reloading. Each gun comes with six tear gas shells and six blanks for practice and is shipped prepaid. Gun unit prices include, 12 shells and all shipping costs.

- 1 Gun-unit at $13.07
- 2 Gun-units at $22.86 (11.43 ea.)
- 3 Gun-units at $29.94 (9.98 ea.)
- 4 Gun-units at $35.16 (8.79 ea.)

Extra boxes of ten tear gas shells at $1.50 per box (prepaid with gun orders). Extra boxes of blanks at $1.25 per box.

**UNITED SAFETY SUPPLY CO.**

349 Manufacturers Exchange Kansas City SRT, Missouri

Tape this ad to the back of your TV or Radio Set

**ALL TV-RADIO RECEPTIVITY TUBES** $1.00

- ALL BRAND-NEW, First Quality. All Types Available. - Orders Shipped First Class Same Day Rec’d. - Unconditionally Guaranteed. - 24 Month Warranty. Send $1 for ea. tube + 50¢ postage & handling of entire order. FREE: Write for “do-it-yourself” TV Test Chart and Tube List to Dept. RTE-267.

**UNIVERSAL TUBE CO.** Ozone Park, N. Y. 11417

February-March, 1967
New Products

reset button, stereo tape head output jacks, 2 inputs for mike and auxiliary. Response is 40-15,000 Hz at 7½ ips; 40-10,000 Hz at 3¾ ips. Signal-to-noise ratio is 40 db or better; crosstalk 55 db or better. Size is 11½ x 1 ½ x 6½ inches. Takes 3- to 7-inch reels. Comes with dynamic microphone, 3 connecting cables, 2 rubber reel caps and 7-inch empty take-up reel. Textured vinyl case. Model RK-810 from Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, N.Y. 11791.

For Part 15'ers

With the Rangemaster 100 mW transceiver comes a guarantee stating that it will outperform in range and clarity any CB transceiver not requiring an operator's license. Reason for claim? An additional RF amplifier stage for long range reception. Pluses: extra sensitive superheterodyne receiver; crystal-controlled transmitter and receiver with separate microphone and speaker for telephone-like operation; switch controlled squelch, telescoping 60-inch antenna. The Rangemaster can be used with AC base station or AC adapter. Over 200 mW audio output; better than 30 db signal-to-noise ratio; 18 db selectivity. Uses 6 Penlite batteries. Size 8 x 2½ x 3 in., weight 1½ lbs., price $39.95. For information: Claricon, 663 Dowd Ave., Elizabeth, N. J.

Magnetizer Demagnetizer

This beautifully simple little tool eliminates the need for special magnetized tools. To magnetize a screwdriver just insert into one of the holes in the Sure-Nuf. The screwdriver retains its new magnetic properties until it is drawn across one of Sure-Nuf's outside metal plates. This breaks the magnetic field, and voila! it's back in its non-magnetic state. Smaller than a cigarette pack and weighing less than four ounces, the Sure-Nuf's permanent magnets never need recharging. Retail price is $2.89 from New Enterprises Inc., PO Box 338, Reno, Nevada 89504.

Go-Anywhere Antenna

The Trik Stik (Model TS-1) antenna can be mounted vertically or horizontally anywhere, under any conditions, for the following applications: Citizens Band, business radio (low and high band), SWL, monitor, aircraft, Civil Defense, amateur, experimenter, television, FM. Assembly is accomplished in minutes for permanent installations, temporary stations or test purposes and complete instructions are supplied with measurements for setting Trik Stik to the correct dimensions for any of the services listed. Price is $6.45 and it comes from Cush-Craft, 621 Hayward St., Manchester, N. H. 03103.

Cardioid Dynamic Mike

The cardioid pickup pattern of Olson's new mike sharply reduces feedback in PA and recording applications. Model M-216 has a moisture- and heat-resisting hermetically sealed cartridge, durable cast metal case. Will fit any stand with ⅛-27
thread. Impedance, 50K ohms; response 100-12,000 Hz. Comes with 20-ft. shielded cable, diameter 1%-in., 4½-in. long. $14.98 from Olson Electronics, Inc., 260 S. Forge St., Akron, Ohio 44308.

Bargain Regulated Power Supply

Here's a bargain for the experimenter or service technician who needs a low-cost variable source of ripple-free regulated DC power. Model PZ-121, available in factory assembled or kit form, delivers stable, continuously variable output from 0-15 volts DC and usable currents to 250 ma. from an AC line. This compact (6¹/₄ x 3¾ x 2 in.), solid-state unit provides regulation better than ± 0.2 volts and AC ripple of less than 5 mv for outputs to 100 ma. Zener-reference model PZ-121 features burn-out proof circuitry and transformer isolated output. Price—a mere $13.95 in kit form, $19.95 assembled, from Viking Engineering of Mpls., PO Box 9507, Minneapolis, Minn. 55440.

20,000 Ohms-per-Volt VOM

Knight-Kit has a new VOM, model KG-640, listed in complete detail in Allied’s 1967 catalog No. 260. The KG-640 has a total of 57 ranges starting as low as 0.8 VDC, covered by a positive-action range/function switch and range-doubler switch that virtually doubles the effective number of ranges. Repeatability of readings is promised by its rugged taut-band meter movement. No damage is possible to the protected movement, even with 1,000 times overload. The new Knight-Kit 20,000 ohms-per-volt VOM, with test leads, batteries and detailed instructions, is priced at $39.95 in kit form, $39.95 assembled. Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

---

**THOUSANDS OF BARGAINS TOP VALUES IN ELECTRONIC PARTS**

Transistors, Modules, Speakers, Stereo, Hi-Fi, Photo Cells and thousands of other Electronic Parts.

Send for FREE Catalogue

**ELECTRONIC DISTRIBUTORS INC.**

EDI

Dept. TA-2, 4900 Elston Chicago, Ill. 60630

PUSH CATALOGUE

Name

Address

City

State

Zip Code

---

**BIG CATALOG**

World’s “BEST BUYS” in GOVT. SURPLUS

Electronic Equipment

FULL OF TOP QUALITY ITEMS—

Transmitters, Receivers, Power Supplies, Inverters, Microphones, Filters, Meters, Cable, Keyers, Phones, Antennas, Chokes, Dynamotors, Blowers, Switches, Test Equipment, Headsets, Amplifiers, Converters, Control Boxes, Indicators, Handsets, etc., etc. SEND 25¢ (stamps or coin) for CATALOG and receive 50¢ CREDIT on your order. Address Dept. 34

---

**FAIR RADIO SALES**

P.O. Box 1105 • LIMA, OHIO • 45802

364 VHF RECEIVER

The 364B receiver provides the shortwave listener coverage from 26 to 54 and 55 to 174 MC in eight calibrated bands. It copies AM and FM signals. Completely self-contained. Ready to plug in.

$54.95

**LEARN Electronics Engineering AT HOME**

Fix TV, design automation systems, learn transistors, complete electronics. College level Home Study courses taught so you can understand them. Earn more in the highly paid electronics industry. Computers, Missiles, Theory and practical. Kits furnished. Over 30,000 graduates now employed Resident classes at our Chicago campus if desired. Founded 1934. Catalog.

**AMERICAN INSTITUTE OF ENGINEERING & TECHNOLOGY**

1139E West Fullerton Parkway Chicago, Illinois 60614

Write for information about GI Bill Training

---

**ALL BAND BATTERY SHORT WAVE RADIO KIT $12.95**


Send only $3.00

---

YOUR POSTMASTER SUGGESTS:

ZIP CODE NUMBERS TO HELP SPEED YOUR MAIL—USE THEM IN ALL ADDRESSES
Ham Station in a Needle

By DICK FLANAGAN

Many's the Ham longing for a super skyhook, but Bob Ryan, W7GWA, isn't one of them. For Bob numbers among the operators of what may very well be the highest Ham station in the world, which, because of its unusual location, also boasts a skyhook to top all skyhooks.

Installed on the observation deck of the Seattle Space Needle some 550 feet above the city's rooftops, station WA7GBD is operated by the Space Needle Amateur Radio Club. And Bob, who is one of the club's 75 members, takes turns working Hams around the world from this strange Ham-station-in-a-needle.

Bob generally works 20-meter SSB, using a Drake TR-4 transceiver and a companion RV-4 remote VFO. Currently, the station is heard as far away as Japan, Brazil, and Russian Siberia. Even greater range and reliability are expected when the present 300-watt transmitter is joined by a kilowatt linear, which is now on order from Drake. When it arrives, Seattle's Ham-station-in-a-needle will be as powerful as any amateur station going.

In spite of the Club's extraordinary offerings, there are no membership dues or other fees. The Space Needle organization simply issues free elevator passes to all members so they can have ready access to the station at any time. And since nearly a million people visit the observation deck annually, the public relations value of the station is thought to be excellent. Most of the visitors see the station in operation, frequently handling traffic from U.S. servicemen on ships and at bases overseas.
CW Monitor

"How can I add a code monitor to my CW transmitter?"

—C. C. S., Moody AFB, Ga.

While you could build an audio tone generator and key it simultaneously with your transmitter, you will not be actually monitoring your transmitted signal. To do so, all you need is a simple regenerative receiver, operated in an oscillating condition, a grid-dip meter or a heterodyne-type frequency meter, such as the BC-221 which is available at military surplus outlets.

You can build a monitor using a circuit such as shown in the diagram. (The coil can be a plug in type so you can change coils when switching your transmitter from one band to another.) Just place it near the transmitter and tune in its signal, with the key down, until you hear a beat note. You will then be able to
monitor your transmissions. The oscillator is tuned by adjusting its ferrite core. An antenna may be connected to the antenna binding post, but is usually not necessary when near a transmitter.

**Q-multiplier vs: Crystal Filter**

*My shortwave set employs a 1650-kHz IF. Would a Q-multiplier do any good, and where can I get one?*  
—R. N. K., Morton Grove, Ill.

A Q-multiplier is most effective at relatively low frequencies, 455 kHz and below. For 1650 kHz, a crystal filter can be used to improve selectivity. It is inserted at the input of the IF amplifier. They are made by several companies, primarily for equipment manufacturers. One company near you, Nieder- man-Sherold, Inc., 4302 Warren Avenue, Hillside, Illinois, makes a 1650-kc crystal bandpass filter.

**Add Noise Limiter**

*Can you give me a circuit for adding a noise limiter to my National SW-54 receiver?*  
—J. L., Seattle, Wash.

The original circuit of the detector and first-audio stage are shown in the upper diagram. Break the circuit at "X" and add five resistors, three capacitors and a diode as shown in the lower diagram.

---

**QSL a Satellite**

*Is it possible to receive satellite signals from outer space on a shortwave set? If so, on what frequencies?*  
—C. B., Seattle, Wash.

Russian satellites transmit on around 20 MHz within the tuning range of most shortwave sets which usually tune up to 30 MHz. American satellites transmit on frequencies around 100 MHz. A special VHF receiver or a converter ahead of a shortwave receiver is required.

**Mum's the Word**

*I have sent QSL cards to ship and marine coast stations I have heard, but have received no verification from them. Why don't they acknowledge my reports?*  
—A. R. T., Marysville, Wash.

You aren't supposed to send QSL cards to any but broadcast and amateur stations, un-
less you are requested to do so personally or by published invitation. An international treaty and the Communications Act make it unlawful for anyone to divulge the contents of any transmission, or even its very existence, from any class of station except broadcast or amateur.

Manufacturers' Radio Service

I recently read that 30 new low-power radio channels have been allocated in the 72- to 76-MHz band. Where can I get equipment for this band?

—R. K., Passaic, N. J.

It has been reported that Femco, Inc., Irwin, Penna., and Union Switch & Signal, Swissvale, Penna., will have equipment available for the 72- to 76-MHz band. However, these channels are restricted to those eligible in the Manufacturers Radio Service and may not be used for hobby or personal purposes.

Can or Will Earn?

How much can I earn as a radio-TV service technician? I have completed a correspondence course and have experience building kits.

—E. L., Edmonds, Wash.

In your part of the country, union scale for a technician is $3.60 per hour and is supposed to rise to $3.75 in 1967. Some non-unions shops pay less, some more for an experienced man. New York subway crews earn as much. But, electronics can be more fun.
Detector for FM, AM, CW and SSB

How can I modify a communications receiver to work on FM as well as AM, CW and SSB?

—R. H., Seattle, Wash.

You can replace the AM detector and first AF stage with a gated-beam tube (such as 6BN6) using the circuit shown in the schematic diagram. The existing IF transformer feeds the control grid of the tube. When S1 is set to AM and S2 is set to F (for fast AVC response) or S (slow AVC response), the grid and cathode function as a grid leak or diode detector and the rest of the tube functions as an AF amplifier. AVC voltage is developed across R2-R3 and is tapped off at their junction. Diode D1 prevents AVC action until the signal reaches a satisfactory level. With S3 open, the positive bias on the quadrature grid can be varied with R1 for minimum audio distortion.

When S1 is set to SSB/CW, the signal from the receiver's BFO (beat frequency oscillator) is fed to the quadrature grid to form a product detector. AVC attack time can be selected by setting S2 to F or S.

For FM narrow band reception, S1 is set to FM and C1-L1 are connected to the quadrature grid to form a gated-beam discriminator. By setting S2 to the None position, AVC is cut out and the tube also functions as a limiter. Closing S3 makes it possible to vary the cathode bias on both the control and quadrature grids with R1 for maximum sound recovery and best limiter action. The quadrature coil (L1) is tuned to the same frequency as the receiver IF and trimmed for maximum FM audio recovery.

High-Frequency Problem

I have a (Brand X) 4-tube superhet shortwave receiver which has good selectivity and sensitivity up to about 14 mc. But, from there up to 30 mc, it lacks the ability to pull in all but the very strongest signals. Would the addition of a preselector solve this problem?

—C. L., Brantford, Ontario

Have you had the tubes checked on a critical tube tester? Try new converter and IF-amplifier tubes. Also adjust the highest frequency band RF trimmer when tuned in to a CB or 10-meter ham station and again when receiving the weakest signal you can tune in. If you have or can borrow a signal generator, realign the IF transformers. Be sure to use a proper outdoor antenna. A preamplifier (preselector) would help, but it doesn't sound as if you were getting all of the performance that was designed into your receiver.

Sure Mike!

Can you give me the address of a company that produces a transceiver-type mike for ham transmitter use?

—L. Dec., Austin, Texas

Roanwell Corp., 180 Varick Street, New York, N. Y. 10014 makes mikes of this type. So do many others including Electro-Voice, Turner and Sonotone. Try your local electronics-parts distributors who should have them in stock.
A Hot Note

I recently read in Variety that a musician was killed as a result of electrocution while playing an electric guitar. How can this happen?

—H. H., Van Nuys, Calif.

He must have been in a bathtub or standing on a wet floor when it happened. Alvino Rey and others have been playing electric guitars for years with no ill effects. The danger of electric shock can be great under some conditions. For example, a skindiver, who was testing an underwater TV camera in Al Ogilvie’s swimming pool in California would have been electrocuted when he took the camera into the pool if it hadn’t been noted that the camera was “hot” to the touch when the camera was handled at poolside. Grounding the shield of the camera cable saved the skin diver’s life. The camera was “hot” because of the line-filter capacitors in its power supply which put the case about 60 volts above ground potential. The same hazard exists with TV sets and hi-fi devices. Moral: Don’t touch any appliance connected to the AC line when bathing.

Crystal vs. Mechanical

Would you please tell me how to connect a mechanical filter to my communications receiver (diagram enclosed)?

—J. B., Topeka, Kansas

Your set already has an adjustable crystal filter whose bandpass or selectivity can be varied. You don’t need a mechanical filter. Receiver design engineers are still arguing which is better, a crystal filter or a mechanical filter. They’re both good. If I were you, I’d keep what you have.

NOW AT YOUR NEWSSTAND!
New 1967
Electronics Hobbyist Annual

FOR A LIMITED TIME ONLY...

You can purchase the newest, most exciting magazine for those whose interest in electronics is on the hobby level. The Electronics Hobbyist contains easy to learn, tested and proven construction projects of every description, Literature Library and New Products sections as well as such new departments as CB News and Views, Hi Fi Trends and Communications for the Ham/SWL.

SOME CONSTRUCTION PROJECTS INCLUDE:

Audio Compressor
Ohms-Range Expander
Dial-An-Ohm
6-Meter Solid-State Walkie-Talkie
Transi-Match
A Go-Go Stereo Compact
100-kHz Calibrator
Build The Aero-Bander
SCR Slave Photoflash

Plus many more projects, gadgets and construction ideas enough to provide every experimenter with weekend fun for six months or more.

FOOLPROOF DESIGN!
EASY CONSTRUCTION!

Your favorite construction project has been carefully researched and tested by experts. Each article is complete with ‘how to’, construction tips, parts lists, diagrams, and photos to make construction easy and foolproof.

ACT NOW!

Don’t miss this opportunity to get your copy of The Electronics Hobbyist. Do not delay! The 1967 Edition is now on sale at your newsstand and will be available for a short time only.

FOR IMMEDIATE HOME DELIVERY
RETURN THIS COUPON TODAY!!
Does it Pay?

How can I boost the input power of my 5-watt, 2-meter transceiver to 75 watts?
—L.B., Morton Grove, Ill.

Get a linear amplifier. Connect its input to the output of your transceiver and the antenna to the output of the linear amplifier which should have internal antenna switching facilities. However, you can quadruple your effective radiated power by installing a 6 db gain antenna which costs less than a linear amplifier and won't increase your electric bill. Call AM 2-2903 in Chicago and ask for Griff. He's near you and can tell you what kind to use, where to get one and for how much.

Just a Minute

In one of your articles about building a novice antenna loader, a B & W Miniductor coil form was specified. Where can I get one?
—D. P., Cuyahoga Falls, Ohio.

It is made by Barker & Williamson in Bristol, Penna. If you can't find it at your local radio parts store, write to Mr. A. Consalvi at B & W.

Carrier for Frequency Standard

How can I recover the unmodulated carrier from an AM broadcast station so I can use it as a frequency standard?

Rig up an oscillator using a circuit such as the one shown in the diagram. Place it near an AM broadcast receiver and tune in a station at the desired frequency. Then tune the oscillator close to the broadcast-station frequency so you will hear an audio beat (whistle). Carefully tune the oscillator for zero beat, the point where no whistle is heard. You'll have it set right if you get a whistle when you turn the tuning capacitor either way. When set to zero beat with a signal of known frequency, your oscillator will be within a few cycles of that frequency.

Filter vs Crystal

Please don't make fun of the use of a mechanical filter with a "Q" multiplier. I have a Hammarlund HQ-100 with a Lafayette mechanical filter and the results are excellent. Adjacent channel QRM is much reduced and stability is considerably improved. For CW reception it cannot be beat for the price.
—R. C., Manchester, N. H.

Of course a mechanical filter is a good device. But, in a receiver which already has a crystal filter, why add another one? Since your receiver does not have a crystal filter, the addition of a mechanical filter makes sense.
SWL Skywire
I am a beginner SWL. What is the best antenna setup for 10-160 meters?
—M. B., Toronto, Ontario
Start out with a 50-foot wire antenna. Allied Radio in Chicago offers a complete antenna kit for 98 cents. You should be able to get one in Toronto for not much more. Later, as you get more experience, and if you have adequate space, you can use something more exotic.

Dig for Tunnel Diode
I can't find a TD-1 tunnel diode for use in the TD-FM radio described in a recent issue. What other type can I use?
Get a GE IN3712. It sells for $3.75.

Don't, If You Don't Know
I have 3-phase, 3-wire, 220-volt power. I have a machine which operates from a 220-volt, 2-wire circuit and ground. Can I connect it to two wires of the three-phase circuit and run a ground to the water main?
If the ground lead is used only for grounding the frame of the machine and is not actually connected to the 220-volt line, OK. Otherwise, you may need a star-to-wye transformer. Before you do anything, consult the power company.

Don't Miss
... what's new in electronics.
Begin your subscription to RADIO-TV EXPERIMENTER with the next issue. RADIO-TV EXPERIMENTER is dedicated to the hobbyist—the man who wants to obtain a fuller and broader knowledge of electronics through the applications of his hobby.

Get an early start in electronics with ELEMENTARY ELECTRONICS
The magazine that serves up electronic theory in pleasant spoonfuls and reinforces the knowledge you gain with exciting and useful projects.

Special Introductory Offer
12 issues for only $4.00. SAVE 50%
VFO or Crystal?
How can I install a crystal in my 30 to 50-MHz band FM receiver for receiving on 39.46 MHz?

—A reader, Someplace, USA

The first diagram is the circuit of the oscillator stage of your set, according to the schematic you sent. The second diagram is the modified circuit. Use the same oscillator coil tuned by a trimmer capacitor. Disconnect the oscillator section of the main tuning capacitor. You still use the tuning dial to tune the RF amplifier and mixer to 39.46 MHz. For that frequency, use a 28.76 MHz crystal.

OCR for ZIP
What is OCR and what is it used for?
—N. K., Philadelphia, Penna.

One meaning of OCR is optical character recognition, a technique for reading printing and written matter electronically. In one system, each character is looked at quickly by a flying-spot scanner, a kind of TV camera. What the scanner "sees" is sent in the form of electrical signals to logic circuits which identify the character and send a digital signal to a computer. For example, the logic circuitry can determine the difference between a handwritten lower-case e and a lower-case l. Both look alike but one is taller. OCR systems are used to read accounting forms and other documents as well as the ZIP code on letters.

Ceylon to a "T"
What make and model shortwave set might be capable of receiving Radio Ceylon on 11,800 kHz here in California?

—G. G., Davis, Calif.

Almost any sensitive superhet shortwave receiver that can be tuned to that frequency should be able to pickup the signal when it is bounced your way. However, the set should be equipped with a good outdoor antenna.

B-plus and Filament Power
Is it possible to build a AC-power supply furnishing 22.5 to 30 volts DC and 6.3 volts for a radio using a 3AU6 tube?

—T. L., Springfield, Ohio

You can use the circuit shown. The transformer furnishes 3.15 and 6.3 volts AC. Plate voltage is obtained from the AC line through a voltage divider composed of four No. 327 pilot lamps. According to the RCA Receiving Tube Manual, a 3AU6 tube requires 3.15 volts, not 6.3 volts, for its filament, as does a 6AU6.

It's a Boo Boo!
When watching TV commercials I have noticed that a commercial will come on for a second or two and then there is some kind of a switch. The commercial comes back on but at the beginning instead of at the point where it was interrupted. Do TV stations or networks run two films of the same program at the same time, with one as back-up?

—W. A. W., Huntington, West Va.

Checking with a major TV station in New York City, it was learned that no back-up film is used. In case of failure, the operator probably winds the film back up on the reel and reruns it. Thus, you will see it from the beginning. Even though film problems do sometimes arise, station and network executives often let operators know that "it will not happen here."... but it does—sometimes.
Solid-State S-Meter

Can you tell me how I can add an S-meter to a transistor shortwave receiver?

A. D., Utuado, Puerto Rico

If your receiver has AGC, you can use the circuit shown in the first diagram. You will have to reverse the meter leads, depending upon whether the set uses pnp or npn transistors. On the other hand, if your set does not have AGC, try the second circuit. Resistance values are approximate since it would be necessary to have a schematic of your set to determine exact values.

![Solid-State S-Meter Diagram]

Now You Know!

In your White's Radio Log, you don't list police, fire and other non-broadcast stations. Why not?

J. B., Avon Lake, Ohio

There are more than 1,500,000 police, fire and other radio communications stations plus countless mobile units. It would require several books to list them all. They are listed in the several volumes of The Radio Registry published by Radio Magazines, Inc., Box 629, Mineola, N. Y.

Skirling Got Ya' Whirling?

On my shortwave radio I hear tones which sound like bag pipes. What are they and what is their purpose?

M. E., Brooklyn, N. Y.

They are undoubtedly tones used for remote control or telemetering. In what is known as tone multiplexing, two or more tones may be transmitted simultaneously, producing unusual sounds.

How About That?

One of our local stations is on FM but still operates on AM even though it was told not to operate on the AM band by the FCC. Why doesn't its owner obey the FCC?

J. W., Cleveland, Ohio

Believe me, the station would not be operating in the AM band if it didn't have a license to do so. Many broadcasting companies use the same program material, simultaneously, on both AM and FM transmitters. The FCC now requires FM outlets to broadcast (a portion of their broadcast day) separate (different) programs.

Van de Graaf Measurements

How can I measure the amperage and wattage of my Van de Graaf electrostatic generator? The instructions list only the voltage.

T. T., Iselin, N. J.

The current is infinitesimal. Otherwise, the device would be dangerous. While it might be possible to measure the current, it wouldn't be worth the required investment in instruments. Why not ask the manufacturer who may have made the measurements in a laboratory?

Aero Bander Not for FM

How could I modify the Aero Bander to receive the FM broadcast band?

M. A. F., San Antonio, Texas

Your AM radio would not demodulate the FM signals.

That's an Ify Question

If a spacecraft could be built that could go faster than radio waves, it could overtake and intercept radio waves from the past. Right? What would happen if the radio signal and the
receiver were both traveling at the same speed?
—E. S., Garden City Park, N. Y.

I guess it would continue to receive the same thing like "Johnny One Note" or a pickup stylus stuck in a record groove.

Needle Sticks?
I have an Armaco AR4 VOM with a 95-microamp meter movement. Whenever the test leads are shorted (for the resistance test), the needle moves to only a point somewhere between one-quarter and one-half scale position. Battery voltage and all resistors seem to be OK. What could be the problem?
—W. J. L., Toronto, Canada

Still sounds like resistor or battery trouble. Even if the resistors pass current and look OK, they could have changed in resistance value.

TV or Not TV
How can I convert an old TV set into an oscilloscope?
—M. S., Amherst, N. Y.

It wouldn't be worth the trouble. You can buy a scope kit for about $80 and you will get much more benefit from it.

Swing It
I have an old 0-1 milliammeter. The needle swings quite some time before it comes to rest. What can I do about it?
—H. W. B., Bonarlaw, Ontario

Sounds like it needs mechanical repair and adjustment, which could be expensive at today's skilled labor rates. Since a new meter costs so little, why don't you get a new one?

RF Amplifier Doesn't
I recently built a class-C RF amplifier which does not amplify. Diagram is enclosed. When I feed 10 watts into it, I get about 5 watts out. Also, I get RF output at the input but not at the output of the pi network. Yet, the pi network still has a tuning effect. What is wrong?
—J. P., Ogden, Utah

Looking at your diagram, it appears that C6 is connected to the wrong side of RF choke L4. If actually connected as shown, the plate of the tube is bypassed to ground for RF. Connect C6 to the B+ side of L4.

Try, Try Again
How can I identify kind and rating of an assortment of semiconductors and transistors of assorted shapes and no marking?
—G. W. B., Lancaster, Calif.

Is it going to be a boy, girl or an it? That's the way it is with transistors. When they reach the end of the production line, they're tested and marked to indicate what they turned out to be. You could spend hours running tests on your diodes and transistors and trying to match them up with the specs on umpteen thousand types. Just try them in circuits. If one doesn't do what you expect, try another one.

Brand X Does It Again
I have a noise problem with my two identical (Brand X, Model Y) CB transceivers. It is so bad that it is almost impossible to receive anything except over very short distances. I have tried using them both as a mobile unit and a base station, but both are just as noisy in either application. Can you give me a circuit for a noise limiter I can add?
—P. L. McG., Knoxville, Tenn.

Looking up the circuit of your sets we find that a noise limiter is included and the sets should be very sensitive, the latter accounting for the noise. You probably live near a busy street and pick up ignition noise from passing cars. Try moving your base antenna away from the street and, in your car, suppress the noise at the source with adequate suppression devices.

Canadian Ham
Can you tell me where I can get a radio amateur license in Canada?
—R. M., Lacombe, Alberta

Write to the Department of Transport in Ottawa. They can furnish you the address of their nearest field office.

(Continued on page 35)
ALLIEd 1967 CATALOG

NEW 514-PAGE

ALLIED CATALOG

TOP SAVINGS ON THE BEST IN ELECTRONICS FOR EVERYONE . . .

NO MONEY DOWN—24 MONTHS TO PAY!
Low Monthly Payments to fit your budget.

CHOOSE FROM THE WORLD'S LARGEST SELECTION IN ELECTRONICS . . . AND SAVE!
Buy from the world's largest electronics supplier. Use the Allied Credit Fund Plan to enjoy what you want NOW—no money down, 24 months to pay.

RUSH THIS CARD NOW!

NAME—PLEASE PRINT
ADDRESS
CITY
STATE 20B ZIP

TO:
ALLIED RADIO
P. O. BOX 4398
CHICAGO, ILLINOIS 60660

IMPORTANT!
PRIORITY CATALOG REQUEST

PLACE STAMP HERE
CHOOSE FROM THE WORLD'S LARGEST SELECTION IN ELECTRONICS ... AND SAVE!

Buy from the world's largest electronics supplier. Use the Allied Credit Fund Plan to enjoy what you want NOW - no money down, 24 months to pay.

RUSH THIS CARD NOW!
Using SCR's
Can you tell me where I can get a schematic and parts list for a 1500-watt light dimmer using two SCR's back-to-back and for operation from a 115-volt 60-cycle AC source?

—J. A. W., Ridgeway, Ont.

Write to either General Electric, Rectifier Components Dept., Auburn, N. Y. or Westinghouse Electric Corp., Semiconductor Division, Youngwood, Penna. Their application engineering departments should be able to suggest a circuit. Also you might get a copy of the GE SCR Manual or the Westinghouse SCR Designers Handbook. Both are available from the respective firms at $2.00 each.

Knee-High to a Brass-Pounder
What is the age limit for an amateur radio operator license?
—C. S. C., Queens Village, N. Y.

There is no age limit. There are quite a few young hams. I got my general class ticket when I was 14, which was a long time ago.

Brass-Pounders Delight
Can you tell me who, if anyone, is interested in old Morse telegraph equipment?
—C. A. N., New York City

The Toledo Morse Chapter is collecting antique telegraph equipment. Leon C. W. Kettring, 1118 Clymema Drive, Toledo, Ohio, is head of the organization's procurement committee.

Biggest KW?
What is a California kilowatt?
—D. W., Palo Alto, Calif.

A California kilowatt is a ham expression for transmitters allegedly employed by some hams in California that operate at much higher power than the legal one-kilowatt limit. Such operation is illegal, but it is said that it is practiced by some. Since everything is supposed to be bigger in California than elsewhere, so are some ham rigs, they say.

Now at your newsstand!
In the February Issue of SCIENCE & MECHANICS

Noted author and automotive expert Joe Gutts reveals the results of the extensive tests he gave the 1967 Volkswagens in the February issue of S & M. Also read "The Remarkable Gunstra Rotating Engine"... a new engine (not yet in production) invented by a New Jersey designer... only 12 moving parts; completely inclosed; a very low weight—high h.p. ratio.

SAVE $2.00... a fabulous 50% savings!

What better way to keep up-to-date on the most dramatic events shaping our ever-changing world than through the pages of SCIENCE & MECHANICS—now at a special low introductory price.

12 MONTHS—ONLY $2

You save a whopping 50% from the regular subscription price. Don't pass this up. Great reading at a great price. Use the coupon to subscribe.
If You Service Citizens Radio Transceivers...

you should have

AN INTERNATIONAL

C-12B

FREQUENCY METER

Four Instruments In One

The C-12B is more than a frequency standard—it measures power output, measures AM modulation, and is a signal generator... all self contained in one convenient unit.

check these features!

- **Frequency Measurement** — Range 26.965 mc to 27.255 mc. Frequency stability ±.0025% 32°F to 125°F; ±.0015% 50°F to 100°F.

- **Power Measurement** — 0 to 5 watts, accuracy ± ¼ watt.

- **Counter Circuit** — Frequency range 0 to 3 kc. Residual error 100 CPS @ zero beat.

- **AM Modulation Measurement** — Range 0 to 100%. Accuracy 3% @ 400 CPS @ 80% modulation.

- **Signal Generator** — Frequency range 26.965 mc to 27.255 mc. Low output 1 microvolt through special pick-off box furnished with meter. High output 100 microvolts through output jack.

- **Panel Controls** — Channel selector, 24 positions • "Hi-Lo" frequency adjust • RF level control • Modulation set • Power • Meter calibration adjust • Function selector, 7 positions • Modulation • RF • Deviation • Calibration • Battery Test "A" • Battery Test "B" • Battery Test "C".

- **Battery Power Required** — 1½ vdc @ 60 ma, 67½ vdc @ 5 ma, 9 vdc.

The C-12B is capable of holding 24 crystals and comes with 23 crystals installed. Everything you need including connecting cable, PK box, dummy load, and batteries.

**Cat. No. 620-101** ........................................ $300.00

Manufacturers of precision electronic products for home, industry and aerospace needs.

WRITE FOR COMPLETE CATALOG

INTERNATIONAL

CRYSTAL MFG. CO., INC.

113 No. Lee, Okla. City, Okla. 73102

36
It all started with a pill, a pill that was a radio station, a radio station that could transmit "news" direct from a human stomach. The pill was followed by a camera, a camera so small it could be swallowed and photograph a man's stomach in living color.

At first, no one took these tiny pioneers very seriously. For at the time medicine appeared to be in one corner, electronics in another, and the two weren't going to pull off any full-fledged marriage for a long time—if ever. But that was before man began to seriously consider the fact that his brain, nervous, and muscular systems are all electrical. And if man himself is electrical, why not his repair and diagnostic systems?

(Continued overleaf)
Tuning in on the body's ills

This realization led to a new science called biomedical engineering, a discipline that combines electronic with medical techniques, sometimes borrowing from space and military research to create new diagnostic wonders. One day soon such marvels may rule out the hit-or-miss human error that has characterized medicine up to our time. Come that happy hour and current medical techniques may seem as medieval as when man applied leeches to cure his aches and pains.

All One. Now being introduced in major hospitals is a master six-unit electronic medical internist built by Honeywell. Its big claim to fame is the fact that it can instantaneously record eight types of information about a patient and show them on a 17-in. screen.

ECG, EEG, EMG, PCG, and other electrodes sensing surface and below-skin changes show heart, brain action, and skin temperatures on a television screen to a doctor as he operates. This new system's sharp-focus screen is so bright it can be seen 20 feet away. And the device promises to eliminate much of the hazard in surgery as well as store vital information for later consultation and record.

Life Savers. Not as comprehensive but already a veteran of 250 neurological operations is an IBM-Mayo Clinic system on duty at St. Mary's Hospital in Rochester, Minnesota.

To monitor patients, electrical detector signals are converted to digital coding, processed and printed out on a special typewriter to be scanned by a closed-circuit TV camera. The machine will show a patient's heart and breathing rates, arterial pressures, and body temperatures on a 14-in. screen while an operation is in progress. Meanwhile, a 5-in. satellite oscillograph set up near the patient will give automatic electrocardiograph readings.

Warnings. Another team of Advanced Systems engineers borrow techniques used to analyze missile status before test firing. Their purpose: to have "early warning" of changes in a patient's condition before clinical signs appear.

Sensors relay information to an IBM 1800 computer, report on an operating room screen warning of changes that could bring on an emergency in the seriously ill.

Nuclear. Still another biomedical life-
Some advances in medical electronics fall in the evolutionary (rather than revolutionary) category, with recent improvements in X-ray equipment a prime example. X-ray installation at right dates from the late '20s and consists of a vertical fluoroscope in conjunction with a radiographic table, with the same power source being used for each.

Note that over-table tube is still of the non-shockproof type, with exposed high-tension leads.

Modern X-ray installation (at left) conceals X-ray tube in rayproof body of enclosed table, while image is now made thousands of times brighter by means of image intensifier on deck extending across table. Further, over-table X-ray tube is supported on telescoping column, in turn suspended from overhead carriage traveling on ceiling racks. Resulting arrangement permits rapid positioning and angulation of X-ray tube.

saver supplying emergency information is nuclear. A surgeon may need to know before an operation if a patient needs a transfusion, what kind of anesthetic may be best, and whether or not the heart is getting enough blood.

To answer these questions, Picker X-Ray built a machine it calls a "Hemolitre." This unit shows just how much blood is circulating in a patient, information that can mean the difference between life and death in heart cases, serious surgery, or an automobile accident emergency.

Picker does it by tagging a small amount of serum with a radioactive substance such as Iodine 131 which is then injected into a patient's bloodstream. A few minutes later, a small sample of blood is withdrawn. The Hemolitre then calculates the radioactive potency of the blood before and after the injection, as well as the radioactivity of the serum itself.

This information is then fed into a computer which spins its electronic gears and ultimately reveals what the doctors want to know on its front panel.

Chair Is Examiner. Philco isn't that formal. Their engineers at Western Development Laboratories division at Palo Alto, California, have developed a diagnostic chair. Once a patient is comfortably seated, the chair picks up respiration rate, pulse rate, heart sounds, and electrocardiograph readings, then records the data on graph paper—all without the patient's knowledge!

While the Philco sensor chair borrows its tricks from space research, a new development at RCA was once in the Army. The image amplifier, adding amplification and TV skills to the already powerful electron microscope, is a direct descendant of the World War II "Snooperscope." Combined with an image orthicon, it gives 50,000 times the light gain of the conventional studio camera.

The very intense intensifier can now see and record images too faint to be seen by an electron microscope alone, and it will even record them for TV tape or film playback. Honorary RCA Vice President Dr. Alfred N. Goldsmith calls the new amplifier "among the most powerful and useful electronic de-
Tuning in on the body's ills

Electronic medical system devised by Honeywell (right) can simultaneously measure, record, and display a wide range of functional changes that can occur in any patient. Main elements of system are KP-731 multi-channel oscilloscope (top right), 1508 Visicorder (middle right), and 8100-II FM portable tape recorder/reproducer (top left). Also recording data for later playback is the Mayo Clinic-IBM radiation scanner (below, right). Unlike ordinary scanners which produce a paper chart or film image, the Mayo-IBM system records all data on magnetic tape for computer processing, thus giving doctors a clearer view of images painted by radioactivity.

Dr. Goldsmith is so enthusiastic about the amplifier he hopes we will one day improve electron-optical powers to the point where sequences of nucleic acids will be seen, classified, and their significance visually decoded.

Living Color. Probing even more deeply into human body secrets is the Picker Magna-Scanner, a new machine that will scan inner organs and glands in both black-and-white and color. Mounted on the end of a beam on a scanner that can be rolled across the room and wheeled right up to a patient's bedside, the machine scans radioactive material inside the body.

A photorecorder picks up a black-and-white picture of the organ or gland involved at the same time a multicolor dot recorder pictures the same areas in eight colors. The two systems, black-and-white and color, are designed to supplement each other, showing different versions of the same organ to the diagnosing doctor.

Already in use at Cedars of Lebanon Hospital in Los Angeles, the scanner pictures a patient's liver, spleen, pancreas, parathyroid, brain, heart, lungs, thyroid, kidneys or spine.

Sound Tells. Sound waves can diagnose, too. Doctors at the Albert Einstein Medical Center in Philadelphia say a good many elderly patients cannot take prolonged X-ray examination, so a medical-engineering team built a machine that scans people with sound waves. High-frequency sound cites vascular disease, particularly hardening of the arteries, by photographing an artery blocked by deposits or harmed by an aneurysm.

Ultrasonic waves at a frequency of about 2 MHz reflect from body tissues, register an image on an oscilloscope, and are then photographed for future records.

Skin Changes. Even a more revolutionary diagnostic tool is one that spots disease by skin-temperature changes. Called thermography, the technique hinges
on the theory that the average internal temperature of the body remains pretty much unchanged if a person is healthy. Skin temperature, in contrast, fluctuates, depending on both internal and external factors.

At the Einstein Medical Center, physicians scan skin surfaces with infrared radiometers to cite internal disturbances. The method calls for rapid, high-resolution infrared scanners and very basic scientific know-how to be able to accurately analyze. But in spite of the revolutionary aspects of the new technique, it has already won its colors by early detection of some types of cancer and vascular troubles.

**Model Organs.** For the new electronic internists to completely rule out diagnostic error, the modern doctor applying the techniques must know more about the workings of the human body, still enigmatic in many respects. This information IBM and University of Mississippi School of Medicine engineers and physicians try to supply. Borrowing from space science they successfully simulate body organs with a computer.

Feeding all known information along with mathematical descriptions of body organs and systems into analog and digital computers, they simulate such organs as the human lung, kidney, and heart.

One model of a kidney has already afforded doctors a clearer comprehension of the relationship between kidney function and high blood pressure. And they hope to learn more about arterial blood pressure, blood flow, and blood composition through a mathematical model of the circulatory system.

For years, doctors have tried to discover how kidneys control rates at which substances are eliminated or reabsorbed into the body. To date, they have only theories, but they now hope to solve their problem by building a mathematical model. The computer can then show which theory best simulates actual function.

**The Body A System.** Dr. Arthur C. Buyton of the Mississippi School explains the work by saying he believes the body the best engineered and most complicated system known. Since it is controlled by several hundred patterns, only a computer, he thinks, can aid in understanding its workings.

To discover why elderly women fall and break a hip more often than men, Moss Rehabilitation Hospital in Philadelphia has carried out another study. Two hundred women clad in shorts and wired to an electronic machine, walk across a "copper" carpet. Six muscular movements are recorded: the angle of each hip, knee, and ankle joint, plus muscular potentials during five walking positions.

Each of the motions is then measured electronically with the thought that if the doctors can find why the women fall they may discover a preventive.

**Pain Cure.** For the study, analysis, and diagnosis of the human body and its complaints, the new biomedical engineering has already proved revolutionary in its promise to rule out human error. But so far it has come up with few cures.

One, however, seems so extraordinary it may well eclipse any medical process yet known! While not exactly a cure, it promises to relieve severe pain, the kind associated with diseases such as cancer and serious injury to the nervous system.

**A Dime Helps.** Smaller than a dime, the miniature device can be implanted near the spinal cord. Here, a mild, non-painful stim-

(Continued on page 116)
It takes only a few hours to install a modern radio in the case of an antique telephone, but you'll end

Time was when telephones came in wooden boxes with cranks and earpieces. Mounted on the wall at some level or other, the then new-fangled creations could be utilized only with a preposterous amount of stretching or stooping—and only if the party line wasn't engaged.

Today, most of these phones have gone the way of the Stanley Steamer, though a few still lurk in attics and antique shops (the one in the photos was picked up at a country sale for a five-dollar bill). And though their days as telephones are over, such oldies can be returned to service in a way grandpop would never have dreamed of—as a conversation-inspiring cabinet for a table radio.

Strip Treatment. The old oak wall telephone in the photos took its first steps toward its new role when it was dusted, then given the strip treatment. All of the old wiring and small parts were removed from the inside of the main case, leaving only the box and the exterior paraphernalia.

The front-hinged lid of the telephone came off when we removed the screws from one side of the three brass hinges. We then cleaned up the main cabinet and the wooden back, removing a variety of grease, pencil marks, and stains. What we didn't touch, of course, were the dents and scratches (remember, we wanted this to be an antique!).

Almost any long and narrow radio chassis could have gone into the telephone cabinet. The type or age of the radio really made precious little difference as long as the radio worked and would fit in the main compartment. Though we were tempted at one point to use a small, battery-powered transistor job, we eventually settled on a new G-E T1220A AM/FM table model (which, incidentally, uses an AC/DC circuit).

Trial Run. Once the etched circuit board had been removed from the radio's plastic case, we temporarily lined up the chassis and marked the mounting holes for its controls. Since we wanted to mount the dial plate separately, we cut it free from the cabinet with a hacksaw blade. Having smoothed off the rough edges, we laid the dial on the side of the telephone case, carefully traced around it, then slid the radio chassis into
Slide-rule dial in radio author used was permanently affixed to plastic cabinet, so author carefully sawed it out with hacksaw blade. Dial could then be fitted into cutout in telephone box.

Photos above show how radio was positioned in telephone box; view at left shows 3/6-in. holes in one end of box for speaker grille and line cord. Varnish was later applied to telephone box to spruce up its appearance.

up with plenty to talk about and a lot to listen to.

position. Fortunately, we found there would be plenty of room to mount the chassis in the telephone compartment and also to fasten it to the dial.

Masking tape was placed on the marked edge of the antique cabinet to serve as a guide line for the dial cutout and to protect the case against possible mars and scratches. We then drilled two 1/2-in. holes on opposite ends of the masked area to start a small saber saw. Since the oak case was very hard, we were careful not to feed the powersaw too fast.

**Plastic Grille.** We mounted a 4-in. speaker at the bottom of the telephone case, having first drilled several 3/6-in. holes and then covered them with a small piece of plastic screening. The line cord was passed through another 3/6-in. hole at the speaker end of the cabinet, and a knot was tied in the cord at a point just inside the cabinet to secure it against accidental stress.

Next, we replaced the circuit board in the cabinet and marked the chassis mounting holes on the wooden base. This done, we removed the chassis and drilled two 1/6-in. mounting holes. Wood screws and spacers were used to fasten the chassis to the telephone base.

With the plastic dial in the new opening, we drilled two mounting holes at either end so the dial could be fastened to the telephone cabinet. The dial was mounted in place and the radio chassis was then bolted to the dial itself.

**Finishing Touches.** With the project almost completed, we then soldered the wires from the output transformer to the speaker voice-coil terminals and taped the FM antenna wire to the inside of the telephone cabinet. After the radio had been mounted and tested, we sealed the dial in place by squirting rubber seal around the dial.

Later, we removed the telephone bells, front mouthpiece, and hand phone hanger from the cabinet and spray-painted them with black enamel. When they were dry, we remounted them in position, then touched up the telephone cabinet proper with two coats of varnish. And last of all, we sat back for some real modern-time Party Line Listening!
Dim View On A Dark Subject
You won't have to grope around blindly in your darkroom after you install this miniature safe-lighting system.
by Robert Hertzberg, W2DJJ

Why fumble around in your photo darkroom trying to read the markings on an enlarger lens or a print timer? The time you spend in your darkroom will be much pleasanter if you install a very simple lighting system using a few inexpensive parts, most of which can be salvaged from an experimenter's "junk box." Even if bought new they cost little.

The actual sources of illumination are a couple of pilot-light assemblies with red jewels and No. 47 miniature bayonet-base lamps. These fit neatly inside 35-mm film cans. The holes for them are made in the can with an ordinary penknife, the metal being very soft aluminum. One can is mounted on the pivoted safe-light arm of the enlarger by a short piece of brass or aluminum, which is bent to throw the light upward to the rim of the lens. The usefulness of the filter is not impaired at all; the whole assembly swings back and forth smoothly. The other can is mounted over the face of the print timer, pointing downward.
The lamps are powered by a 6.3-volt filament transformer which is enclosed in a small wooden box at one end of a board used for a base—the front portion of the base supports the timer itself. The various dimensions of the box are adjusted to suit the size of the timer. The top of the box holds a line switch and four binding posts; the right side, a single AC outlet—for the timer’s AC plug.

The light for the timer dial connects to one pair of binding posts, the enlarger-lens light to the other. Lamp cord is fine for the purpose. A single pair of posts would serve just as well, since the lamps are in parallel, but the extra pair is handy if still another light is wanted, perhaps to illuminate a clock face or a paper safe. There is absolutely no shock danger from the low-voltage wiring powered by the filament transformer.

Placed next to the enlarger, the timer-transformer unit is very convenient to operate. The bright red jewels end all squinting, yet do not fog the fastest black-and-white enlarging papers.

Parts List

J1—Outlet (Female power receptacle)
J2-J5—Binding posts, insulated
S1—Toggle switch, s.p.d.t.
T1—6.3-volt, 1-amp. sec; 117-volt pri filament transformer (Lafayette 33R3702 or equiv.)
2—Pilot lamp assemblies—red jewel (Lafayette 33R6109 or equiv.)
2—#47 pilot lamps
Misc.—Film cans, wire, solder, wood stock, glue and nails, machine screws, etc.

Estimated cost: $2.50
Construction time: 1 hour
The shocking truth about the bitter battles that may determine the future of every Ham and CB operator in the United States

"It's war!" The words of a militant professional protest leader? Hardly. Fact is, they were grumbled only recently by a fellow radio operator—a normally quiet and bookwormish chap who probably thinks twice before he swats a fly. But this time he had good reason to be infuriated. And his sentiments are typical of those being muttered in radio circles throughout the country.

Several factors precipitated his declaration: first, the seemingly hostile attitude towards Hams and CBers by the Federal Communications Commission; second, the strained relations between the American Radio Relay League and Hams; third, the growing realization among operators that they might well have to fight to defend their operating rights and privileges.

The battle lines are most definitely drawn; wits are being sharpened right this minute! But what are the issues? What is at stake, and what brought on this unusual battle royal? Many of the facts have never been revealed—until now, that is.

Down The River. It is believed by some that the Ham radio situation began at a private meeting in New York between the FCC and the executives of the ARRL and QST (the ARRL's official publication). With a major international radio frequency allocation conference looming on the horizon, the FCC regretfully reported that some of the new African nations were complaining about the lack of radio frequencies for their use: possibly they would try to steal the Ham frequencies. If such a thing actually came to pass, Hams throughout the world would blame the FCC because it permits U.S. citizens to get Ham licenses with a minimum of red tape, exams, and waiting time. As a result the U.S. has amassed a tremendous number of Hams per capita—many of them rotten operators who have earned (for American Hams in general) an international reputation as obnoxious loudmouths running far more power than is necessary.

The FCC was on a spot and felt that something would have to be done to show the rest of the world that U.S. Hams weren't so bad as to cause the loss of Ham radio frequencies. The ARRL was quick to accept the challenge of coming up with some sort of
solution to save face for the Commission. The ARRL brass itself had long been unhappy with many of the new breed of Hams and said it had "increasing concern . . . as to whether the basic purposes and objectives of the amateur radio service, particularly those relating to technical qualifications and proficiency," were being achieved. The League claimed that many Hams "just go out and buy their equipment, plug it into the light socket, connect an antenna and operate."

All of this was far below the dignity of the pompous and tradition-steeped League executives, many of whom still live in the days when operators wound their coils on oatmeal boxes and put India ink on crystals to change frequency. It seemed to them that this would be the right time to weed out these new rascals by either kicking them off the air altogether or at least openly branding them as second-class operators.

The Plan. Back the ARRL folks went to Connecticut and into the conference room for secret talks. The result of the brain-picking session was a mish-mash of ideas which had been previously rejected by the ARRL and the FCC, only now the plan was rearranged and dubbed with the new title of "Incentive Licensing." Worded in fancy legal terms, it was rushed down to the FCC on a silver platter for prompt approval. QST, having the uneasy feeling that the plan might not sit too well with some ARRL members, gingerly tried to explain Incentive Licensing to its 105,000 reader/members. The result was an upbeat explanation intended to sell an idea which had few selling points (no mention was made of the FCC's inspirational role in its creation).

Stripped of the fancy frills, the plan suggests creation of a new "elite" class of Ham license to be called the "Amateur First Class License." This license would be available only to those Hams who had held an Advanced, General, or Conditional Class License for at least one year.

To get the new license, the Ham would have to take a new written exam which would be harder than his previously taken test; he would also have to pass a 16-wpm code test (existing General Class tests call for 13 wpm). Only operators of this new license class (or those who held the coveted "Extra Class" license, which is harder to obtain) would be allowed to operate a phone station on the prime DX frequencies below 50 MHz (160 through 10 meters). Those Hams who couldn't pass the exam would be forced to jam into a small band of phone frequencies or use CW (which, for all practical purposes, is now obsolete).

In addition, all phone privileges, for Novice operators (the 2-meter band) would be withdrawn. To round the plan off, the FCC was asked by the ARRL to devise "distinctive" call-signs for each particular class of license so that Hams would immediately be able to ascertain the prowess of fellow amateur operators.

The Prospects. The FCC's acceptance of these ideas would see thousands of long-time DX phone operators unceremoniously evicted from their operating haunts until (and un-
It's War!

less) they could pass a rougher exam than they had ever before taken. (Fact of the matter is that many Hams couldn't pass the very exam they took to get their original license if a year or so had elapsed.) Their only hope would be to cram for the new exam and, failing that, squeeze onto the few remaining frequencies or pack their DX gear in mothballs and migrate to the local-coverage VHF bands—where the FCC was to reserve them some "exclusive" frequencies.

The regular VHF operator, already plagued with split-up bands and class distinction between General, Technician and Novice class operators, would then be faced with the prospect of slicing up the pie for yet another group. For new immigrants from the lower bands would be now joining the VHF fraternity by taking away the regular VHF operators' best frequencies. The idea, of course, was to force the Technician class VHF operator to get the incentive to step up his code speed and pass a General Class license which would permit him to again operate on his old frequencies.

Not On Your Life. The grass roots reaction was instantaneous and rather violent. Enraged Hams flooded both the ARRL and FCC offices with highly impassioned messages, all carrying the same theme, namely, that they weren't buying even one little bit of this proposal. *CQ* magazine, an independent Ham publication, offered its own plan for upgrading the American Ham, but the damage had already been done. The ARRL plan had been formally submitted to the FCC. And Wayne Green, Ham radio's angry young man (and publisher of another Ham publication, 73, promptly sailed into the ARRL with one of his famous tirades over that one.

With cannon bombarding it from all sides, the ARRL found itself in a rather embarrassing situation, especially since the FCC unexpectedly decided to play it cool and not rubber-stamp Incentive Licensing into the law of the land. The League was simply left to hang by its thumbs while the folks in Washington pigeon-holed the idea and announced that they were "thinking over" the plan's alleged merits.

The League landed out in the cold with many Hams, too. In fact, when mid-1965 membership stood at 105,000, the League had confidently predicted that mid-1966 rolls would fatten up to about 108,000 to 110,000 members. In actuality, membership had shriveled to less than 80,000 by mid-1966!

Panic Button. Not only had Hams stopped renewing their memberships in the League, but the proposal had triggered one of the most horrendous business slumps Ham radio had ever known. The proposal was also the best explanation for one of the most severe drops in license applications for years.

The ARRL hastily engaged a public relations firm to find out what had gone wrong and what had happened to its membership. The poll-takers in turn announced that the "crux of the situation" was that "if the people are indeed representative, then too many Hams just do not feel the sense of personal relationship with the League they want to feel." In other words, most Hams just couldn't understand why their good Ham buddies at the League would have officially proposed Incentive Licensing without having taken the minor courtesy of asking members for their opinion beforehand.

Meanwhile, the League itself explained causes of non-renewal thisaway: that the League was "out-of-touch" with the operators' interests; the operator simply "had not gotten around to renewing," and the operator was "just not active" any longer.

By the fall of 1966, things had gotten so desperate at the League that *QST* announced what appeared to many to be an almost pathetic last-gap measure to recapture the badly fumbled ball; a panacea for regaining its composure, lost prestige, and members. The new idea, "Ham Quest 67," had the League pleading (in *QST*), "Strength through unity—that's what is needed."

Carefully skirting any mention of the dreaded Incentive Licensing plan, the ARRL rehashed all of the reasons why it's really pretty wonderful to have the kindly ARRL folks lending their prestige to Ham radio and watching out for the interests of the operators. Part of "Ham Quest 67" included sending out "ammunition to be used in convincing non-members that they ought to join the League...," offering prizes for the member or affiliated local club bringing in the largest number of new members.

The FCC? Yes, it's still thinking over the proposal. But it also offers no inkling as to when (if ever) a decision will issue forth.
The way things stand now, Ham radio has been shaken to its foundations. Operators are angry and confused. The industry is pulling in its belt a few notches. And the FCC (still meditating the Incentive Licensing plan and seemingly unaware that Ham radio has been hurt badly) has managed to find the time to turn its helping hand towards yet another radio service.

**The CB Scene.** In September of 1966, the FCC sent a letter to all CB manufacturers expressing the FCC's unhappiness with the CB service. The letter innocently hoped that the manufacturers (who have a $50-million per year thing going in CB) "will assuredly agree . . . that . . . a healthy state of affairs" hardly exists. Manufacturers were told that unless things got better the FCC might consider putting a temporary freeze on new CB licenses.

Established with the best of intentions and the worst of planning, the CB service was created by the FCC on a frequency band long regarded as useless for communications because of the fantastic noises generated there by industrial, scientific, and medical electronic gadgets. Even Hams, some of whom can turn almost anything into a useful communications tool, had precious little use for it. The band was "given" to CBers much as a useless scrap of meat is tossed to a dog, except that the FCC made it clear that the meat could be eaten only in certain ways, and only *without* enjoyment. The Commission announced that CB communications could not consist of "hobby type communications" or "idle chit chat."

**Biting The Hand.** As had been feared, the CB operator picked up on the CB service as a great way to be a "sort of" ham operator, using CB sets as telephones in a gigantic party-line gossip and bull-throwing festival. This sent the FCC into apoplectic convulsions and brought forth upon the users a number of purges which saw new rules added, old ones strengthened, fines invoked, licenses revoked, and even the old ogre of the Federal Trade Commission trotted out to frighten manufacturers. Despite these efforts some 20,000 new license applications still arrive at the FCC each month, and the present license records show about 800,000 citizens licensed and using about 2½-million transceivers (most of them incorrectly, one can presume).

But what gives? Wasn't the FCC created to control radio communications in the United States—a task that includes issuing licenses and making and enforcing laws in the public "interest, convenience and necessity"? True. But to enforce those laws it receives a grubby little pittance with which it must also run a huge monitoring network to tune in on hams, CBers, commercial broadcasters, business-band operators, police, ships, aircraft, and dozens of other radio stations.

Although the FCC doesn't admit it openly, some officials have privately confessed that the money available for enforcement purposes simply isn't enough to adequately foot its monitoring network. Nor is it sufficient for the Commission to even attempt to enforce most of the rules which it grinds out in an almost endless procession. And therein lies the rub.

CB is not only a newcomer to the family of radio services, it's a difficult one to handle at best. Worse yet, it's considered to be non-essential (for the protection of life or property or for informing the public, that is). The FCC perhaps feels that if it can't get more money, maybe it would be better off with less radio services—and guess which is at the uppermost tip of the totem?

It's a pity that the FCC can't keep some of the money it takes in on fines and licenses. CBers alone toss Uncle Sam about $160,000 per month in license fees. The money comes into the FCC alright, but it goes right out for placement in the government's kitty where it is doled out in support of European junkets for VIPs, insect research, and programs to lull farmers into *not* growing wheat. Maybe a little of this money pumped into anemic FCC veins would give it stomach enough to carry on in the traditions of the Great Society.

The most ludicrous thing about the whole CB "dilemma" has yet to be mentioned. For in spite of all the FCC's bellyaching, nobody would be any the worse if CBers were simply left alone to talk themselves blue.

February-March, 1967
It's War!

wouldn't this be in the public "interest, convenience and necessity"?

Holding The Bag. Yet the FCC, staffed by political appointees and public servants, insists that it is acting in the best interests of the American public. And despite the abject poverty under which the FCC must exist, when the COMSAT communications satellite arrived on the scene an Act of Congress was rushed through to establish a new FCC division just to handle the single satellite. (They probably haven't been too busy in the new division since the rates are so high that even the TV networks don't use it very often.)

In the meantime, the American public has watched the FCC give token interest to the rigged quiz shows which duped 190-million citizens (threats to put a freeze on broadcast station licenses were not heard). Users of essential communications services are crowding each other off the air due to lack of sufficient channels, yet the FCC insists on reserving 470 MHz worth of UHF-TV space for a mere 250 broadcasters. And on the marine bands, casual listening discloses opulent yachtsmen broadcasting language so salty it would bring a blush to the face of even the crustiest old navy Chief.

Are these problems of a lesser nature than those facing CB or Ham radio? Are the broadcasters truly the "darlings" of the FCC (as has been suggested for years)? Or is it that the FCC is so understaffed that they just haven't seen these problems or so underfinanced that they can't afford to do anything about them?

Regardless of the answer, one gets the impression that the FCC might perhaps have had a master plan right along which would explain some of its activities. A hint of this was perhaps dropped when FCC Commissioner Kenneth A. Cox recently stated that if all other alternatives fail to sufficiently relieve the present congestion, additional frequencies would have to be given to needy services. This, he said, would be accomplished by a complete reorganization of the frequency spectrum (Cox likened it to "unscrambling an egg"). Obviously, new frequencies can't be created by a wave of the FCC's magic wand. They would necessarily have to be taken away from "non-essential" radio service.

It's War! Yes, it really is a war, still a cold one at this point but warming up by the minute! Hams are thoroughly disgusted at being made fools of by the ARRL, and even more annoyed with the FCC which (for reasons unknown to the operators) is still fumbling with the Incentive Licensing scheme. The ARRL is wobbling around on a shaky pair of legs. Ham and CB manufacturers are wondering where they go from here, and CB operators are still trying to figure out the justice in their paying $8 for a CB license only to be divested of their rights to freedom of speech and the pursuit of happiness.

One guess is as good as another as to where the next battle will be fought. If the FCC would ever attempt to shut down these services, it would undoubtedly be faced with the specter of three million bootleg operators jamming the reallocated frequencies. And could the rumor be true that three million CBers and Hams intend marching on Washington, right up to the FCC's Ham/CB office (above a supermarket, by the way) to sing "We Shall Over-modulate"?

Bushings for TV Line

To bring TV twin-leads into the house with low-loss and without letting cold air in, make sealed feed-through bushings from polystyrene tubing. For 300-ohm line, bore a ½ in. dia. hole through window frame and push a length of ½-in. O.D. polystyrene tubing through the hole, allowing about 1½ in. of tubing to project on each side of frame. Push line through tubing. Seal tube ends by heating with matches or a cigarette lighter, and, wearing a glove to protect the fingers, pinch the tube ends firmly together. Hold until plastic sets. Works fine for long-wire antenna lead-ins.
Privacy is almost a thing of the past. Nearly every day the papers detail some new horizons in eavesdropping, from the phone company listening in to subscriber's conversations to executives hugging the rank-and-file employee's washroom. And of course, in this modern era of recording tape and the scissors, even the most innocuous of conversations can be rearranged into the most damning of evidence. What to do? Nothing. You can scream and the most you'll get is a few sympathetic words from your Congressman, but not much else: for the polizzi you complain to are up to their ears in wiretaps and bugs, the Feds have a sorry record of eavesdropping prosecutions, the phone company has been getting away with it for at least 30 years, and your Congressman's indignation dies with yesterday's headlines.

About the only thing you can do is fight to protect the truth; make certain that what's used against you isn't the result of some brilliant tape editing. Make certain that when you tell your neighbor "I need some money for termite poison" it doesn't come out "I poison for money."

And you can easily protect yourself with the Tie-Spy—known in the trade as an 007 FM mike. Just clip on the Tie-Spy and your words are broadcast to a nearby FM receiver, by Lars Jorgensen
while it can be transferred to tape in an unedited version of what was said.

As shown in the photographs, the Tie-Spy consists of an miniature, very-short-range FM transmitter and a microphone that appears to be a high-class diamond-studded tie-pin. You simply clip the mike to your tie (naturally you're out of luck if you wear bow ties), place a battery in the transmitter, and you're on the air. A nearby confederate can monitor your conversation on an FM portable and handle the recording.

Construction. The unit shown is housed in a plastic case approximately 2 1/4 x 1 1/4 x 1 3/4 inches. Actually it can be made smaller by using subminiature components. But to keep the price down to rock bottom, we have used standard components available from Allied and Lafayette Radio (among others). If you want to squeeze it into an olive by all means do so, just use the equivalent miniature values—nothing is really critical except the coil.

In a similar vein, the sound quality is exceptionally "tinny"—readable but "tinny." This is due to the low-impedance loading of the high-impedance crystal tie-clip mike we used to keep costs down. If you want to go for a few extra bucks get a better mike, a low impedance job—say a dynamic type from 500 to 500 ohms. You can even try a small transistor radio speaker, or might even add a matching transformer. As we said, nothing is really critical.

The electronics is assembled on a 1 1/4 x 2 1/2 inch section of perf-board. If you slightly round-off the corners the perf-board will just fit into the plastic case.

Start assembly by mounting tuning capacitor C5 and oscillator/antenna loading coil L1. L1 is made as follows: Cut off a three foot section of AWG-18 solid enameled wire and tensilize it by clamping one end in a vise and pulling on the free end until the wire goes "dead slack"—unless this is done the coil will unwind when you release tension.

Using a 3/8-inch drill bit as the form, wind seven closewound, tight turns. Remove the coil from the form and stretch the first three turns so the distance from the "start" to the third turn is exactly 3 3/4 inch. Scrape a small bit of insulation from the start of the third turn (actually what we call the second turn), and solder about an inch of wire to this tap. As shown in the schematic, the tap connects to the "top" of C5 while the "start" of the coil connects to Q2's collector. The free end of the coil will be connected later to the antenna.

Flea clips or Vector T28 push-in terminals are used for tie points and supports. To mount the C5-L1 assembly, push in a set of terminals directly under C5's solder tabs and install a very short support lead from C5's tabs to the terminals.

To insure frequency stability C6 should be the silver mica type or its equivalent. Space gets a little tight on top of the board so miniature resistors (1/8 or 1/2 watt) and capacitors are suggested. The components on the bottom of the board can be "standard" size (1/4-watt resistors, etc.).

We can only be certain the project will work with the transistors specified in the parts list, do not substitute another type for the specified Q1 and Q2.

Battery Power. The power supply has no

While the tie-bar may not be the most in men's jewelry it does the job—it's the microphone that counts the most right here.
on-off switch. To start the transmitter you simply clip in the battery. To turn the unit off you remove the battery. The specified battery will give an average of 35 hours service, depending on the “freshness” and frequency of use. Since there is no standard battery holder you have to make your own. The battery holder is simply two L-brackets fashioned from scrap aluminum (an old Minibox) or copper. The L-brackets are mounted to the board with 2–56 machine screws. Connection is made to the clips by soldering directly to the head and nut. Note that the negative clip has a hook at the end. The battery’s negative terminal is slightly recessed into its case, so to insure connection you must form an ⅛-inch “hook” which will bite into the negative battery terminal.

The Mike and Antenna. The mike is supplied with a mini-plug. Cut off the plug, unbraid the shield—forming a tinned twisted lead with no free strands—and solder the mike cable directly to a ground terminal and the input to C1. The antenna consists of 12 inches of very-thin stranded wire—AWG-22 or thinner—soldered to L1’s free end.

Drop the unit into the plastic case, leaving the hinged cover open. Mark the points where the mike and antenna leads will pass through the case. Remove the transmitter and quickly press a hot soldering tip into the edge of the case at marks for the mike and antenna leads. The case will melt under the iron, forming the openings for the two leads. Don’t press down hard or you’ll go (Continued on page 114)

Circuit is simple but you must remember that wiring at 100 MHz is critical—all leads to Q2 and L1-C5 must be kept short to get proper operation on the FM band.

Estimated cost: $7.00
Construction time: 2 hours

Tight-wound portion of L1 is a loading coil for the short antenna—the spread portion tunes with C5. Leads that connect to the base, emitter and collector of Q2 should be kept as short as possible (a normal VHF wiring technique). Those to Q1 aren’t as critical. Transparent plastic box protects delicate parts—specially L1 and C5—from damage.

**PARTS LIST**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>7-volt mercury battery, Mallory (Allied 553886 or equiv.)</td>
</tr>
<tr>
<td>C1</td>
<td>2-mf, @ 6-volt DC</td>
</tr>
<tr>
<td>C2</td>
<td>10-mf, @ 12-volt DC</td>
</tr>
<tr>
<td>C3, C4</td>
<td>500-mmf ceramic disc</td>
</tr>
<tr>
<td>C5</td>
<td>2.7-30 mmf, trimmer capacitor (Arco 461 or equiv.)</td>
</tr>
<tr>
<td>C6</td>
<td>5-mmf silver mica</td>
</tr>
<tr>
<td>L1</td>
<td>see text</td>
</tr>
<tr>
<td>M1</td>
<td>Tie-Clasp Microphone, (Lafayette 99C-4567 or equiv.)</td>
</tr>
<tr>
<td>Q1</td>
<td>Transistor, Motorola HEP 251 (from Allied)</td>
</tr>
<tr>
<td>Q2</td>
<td>Transistor, Motorola HEP 52 (from Allied)</td>
</tr>
<tr>
<td>R1</td>
<td>4700-ohm, 1/10-watt resistor</td>
</tr>
<tr>
<td>R2</td>
<td>330,000-ohm, 1/10-watt resistor</td>
</tr>
<tr>
<td>R3</td>
<td>10,000-ohm, 1/10-watt resistor</td>
</tr>
<tr>
<td>R4</td>
<td>47-ohm, 1/10-watt resistor</td>
</tr>
<tr>
<td>R5</td>
<td>100,000-ohm, 1/10-watt resistor</td>
</tr>
<tr>
<td>R6</td>
<td>470-ohm, 1/10-watt resistor</td>
</tr>
<tr>
<td>Misc</td>
<td>Plastic cabinet, (Lafayette 13C3801); perf-board; terminals, wire, solder, L-brackets, machine screws, nuts, etc.</td>
</tr>
</tbody>
</table>

Motorola HEP52
Personal Hi-Fi

A complete tonearm, preamp, earphone-amp combo, this setup is ideal for stereo on the private side.

By Art Trauffer

Build this novel amplifier-in-miniature and you’ll no longer have to fire up a high-powered stereo amplifier just to drive a pair of headphones. This little stereo-headphone driver will cost under $3.00, entail less than an hour’s work, and yet give you beautiful, clean, wide-range headphone reproduction. Utilizing the Euphonics Miniconic semiconductor stereo phono cartridge, the TA-15 tonearm and the PS-15 power source, this simple setup is perfect for personal hi-fi.

The photo below gives some idea of how easy this little amplifier is to put together, and the schematic diagram reveals how few parts are involved. No volume controls are used because headphone volume is just right for persons with normal hearing, and the stereo balance is good.

Construction. Note that the two aluminum panels, screw-fastened to the wooden base, act as a battery holder for the size-D flashlight cell and automatically connect the cell to the circuit. Phono-input jacks J1 and J2—Phono jacks (single-hole mount)
J3—Stereo headphone jack (two-circuit type)
Q1, Q2—2N217, GE-2, or SK3003 transistor or equivalent
R1, R2—2200 ohms, 1/2-watt resistor
Misc.—Wood stock, aluminum stock (.037-in. 20-gauge), wood screws, lockwashers, solder, stereo headphones (low impedance)

Estimated cost: $3.00
Construction time: 1 hour

PARTS LIST

Aluminum panels attached to wooden base form sides of unit and also serve as battery holder. Jacks need not be insulated.
Flat amplifiers are great but you must have a flat input signal. Here's how to match that pickup.

One of the problems with home-made phono amplifiers is that they are invariably flat—good circuit design can make even the cheapest transistor audio amplifier flat to within ±3 dB throughout the usable portion of its frequency curve. You would think this feature would be desirable, but it's not necessarily so when you take a hard look at the signal supplied by the phono pickup. The unequalized output voltage curve for a typical ceramic cartridge extends from 50 to 10,000 cps. peaks at about 300 cps, and falls about 6 db per octave at 50 cps and 15 db per octave at 10,000 cps. Also, the impedance of a ceramic pickup decreases as the frequency is increased. On top of this non-linear characteristic the signal is further complicated by the record manufacturers. Recordings are deliberately made with reduced amplitudes at low frequencies, a relatively flat middle frequency range, and increased amplitudes at high frequencies due to manufacturing difficulties in the preparation of plastic platters. Therefore, a carefully designed preamplifier circuit is needed to boost the low-frequency signals, reduce the highs and match the ceramic pickup's impedance before passing an equalized audio signal to the frequency-flat amplifier.

Fortunately, the recording industry had decided on a recording equalization standard (R.I.A.A.) and the characteristics of ceramic pickups are almost universally identical with respect to frequency response and im-

**CERAMIC PICKUP EQUALIZING PREAMP**

by Jay Copeland

**PARTS LIST FOR EQUALIZING PREAMP**

- C1—.01-mf. disc capacitor (voltage not critical)
- C2—.0033-mf. disc capacitor (voltage not critical)
- C3—10-mf., 6-WVDC electrolytic capacitor
- Q1—2N1091 npn transistor, RCA (Alternates are 2N440, 440A, 635, 636, 636A, 1005, 1006)
- R1—220,000-ohm, ½-watt resistor 5 %
- R2—33,000-ohm, ½-watt resistor 5 %
- R3—10,000-ohm, ½-watt resistor 5 %
- R4—4,700-ohm, ½-watt resistor 10 %
- 1—Perf-board cut to 2⅛” x 2½” approx.
- Misc.—Flea clips, bare and insulated wire, solder, etc.

Estimated cost: $3.50
Construction time: 1½ hours.

Equalized output is taken across C3 and the negative lead of the DC power input.
Layout of the components on the perforated circuit board is not at all critical—but watch ground connections if you take power from amplifier.

pedance output. Now, a preamplifier can be designed to *straighten* the frequency-output curve from a ceramic pickup's signal prior to being fed to a *flat* amplifier.

**How it works.** The schematic diagram for the ceramic-pickup preamplifier appears to be a basic common-emitter type using an *n*-type small-signal transistor—except for the collector-base network (resistor R2 and capacitors C1 and C2). Resistors R1 and R3 provide fixed base bias. The amplifier's input impedance is made smaller than the pickup's impedance and Q1's current gain is made to vary inversely to the velocity response of the R.I.A.A. recording characteristics.

The negative feedback characteristics of the collector-base network does the equalizing—C1 is the effective circuit element for frequencies between 30 and 500 Hz (cps); R2 between 500 and 2000 Hz; and C2 above 2000 Hz. The large amount of negative feedback reduces distortion and permits the use of low operating current in the collector circuit. This is essential for a low-noise output signal. The fact that no equalizing network is connected in series with the base also helps reduce noise.

The low input impedance of the preamplifier permits hookup to all available ceramic pickups on the market today. Remember, unlike a vacuum-tube amplifier circuit, this transistor preamplifier depends on the apparent input impedance mismatch for proper audio equalization.

**Putting it Together.** Parts layout, shown in photo, closely matches the schematic diagram. All resistor, capacitor and transistor leads terminate at flea clips. If you prefer not to use flea clips, make all connections by passing leads through perf-board holes and soldering underneath perf-board. Twisted wire leads can be used to connect to ceramic pickup and amplifier input terminals. Shielded cables should be substituted if hum level is high. Also, it may be necessary to connect a 10-mf. 6-volt electrolytic capacitor across the power supply leads (watch polarity) if preamp taps power from phono's power supply.

Installation is not critical. Keep leads short and locate perf-board away from heat. A classical recording (with violins) can serve as a test record. Play the recording before and after modification—use your amp's *AUX* input.

**A Safe Connection**

- When making a wire connection for your projects, cut two one-inch pieces from a half-inch rubber tube. Split these and put one around each wire at the connection point. Then wrap some plastic electrical tape over all, and it makes a neat, safe job. This idea is not suitable for power or lamp cords.

**Polystyrene Tubing Insulates Chokes**

- To protect the metal ends of an RF choke from accidental contacts in a crowded radio chassis saw a lengthwise slot on one side of a length of polystyrene tubing, and slip it over the RF choke. For straight-wound chokes, ½ in. O.D. tubing is about right, but for pie-wound chokes use larger tubing. Coil-dope or speaker-cement applied to wire leads where they enter tubing keeps tubing from slipping off choke. Or, heat the ends of the tubing and pinch them shut. Use color code to indicate value.
INTERNATIONAL CRYSTAL MODEL C-12B
CB Frequency Meter

It should be evident to every CBer that the FCC is bent on a real crackdown, for the monthly list of fines and forfeitures now runs several pages rather than several lines. And a quick perusal of the list shows that next to transmitted obscenities, off-frequency operation ranks near the top of the pink-ticket list.

But there is really no reason why any CBer should risk losing his license because of off-frequency operation. For the truth of the matter is that any communications service shop or CB club shop should be equipped with a frequency meter.

A frequency check is difficult? Nonsense. With a frequency meter specifically designed for CB, such as International Crystal’s model C-12B, it takes but ten seconds to check each channel. Equally important, operation is so simple the check could be performed by a child.

Twenty-three Plus. The C-12B is a hybrid (tube and transistor), battery-powered frequency meter specifically designed for CB, such as International Crystal’s model C-12B, it takes but ten seconds to check each channel. Equally important, operation is so simple the check could be performed by a child.

The meter is supplied with a separate pick-up box (called the PK) that provides a dummy load for the transmitter and acts as an attenuator when the frequency meter is used as a precision signal generator. The meter’s direct output provides an unmodulated signal (for alignment, say) of 100 microvolts; with the PK box in the circuit, the output at the end of the PK’s test cable is one microvolt.

On The Beat. Block diagram shows how the frequency tests are performed. The output of a precise crystal-controlled oscillator is mixed (beat) with the transceiver’s output signal. The difference signal below is first amplified, then rectified, and the resultant DC passed to a calibrated meter. The greater the difference frequency, the higher the meter reading. This, in turn, is interpolated into deviation from center-frequency.

Let’s look at a practical example. Suppose you wanted to check out a channel-9 crystal. Setting the frequency meter to channel 9 produces an internal 27,065 MHz signal. If the signal from the transceiver were off-frequency by 100 Hz, its output would be 27,065,100 MHz. And when 27,065,000 Hz is beat against 27,065,100 Hz, the output from the mixer will be the difference between the two frequencies—a 100-Hz beat note.

This is then amplified, rectified and the resultant DC displayed on the meter as 100-Hz deviation. A special switch is provided that tells you whether the deviation is above or below center channel. If the signal from the transmitter were exactly 27,065 MHz, there would be no (zero) beat note and the meter would therefore indicate “0”—no deviation from center channel. The meter is calibrated from 0 to 3000 Hz deviation, with
a special mark at the maximum permitted deviation of 1350 Hz.

**The Acid Test.** Is the C-12B reliable? Is it really a secondary frequency standard the CBer and the service shop can depend on? To find out, we checked the C-12B against a Hewlett-Packard counter with a known accuracy of 1 Hz. The results are shown in the table. Column 1 shows the channel, column 2 the assigned frequency, column 3 the actual reference frequency of the C-12B, and column 4 the C-12B's error in Hz. Note that the error is less than the specified 100 Hz and in many instances less than 10 Hz.

Allowing for interpolation of the meter scale (which is calibrated in units of 60 Hz), the maximum error of the model we obtained would be considerably less than 100 Hz. Frequency drift from the moment of throwing the power switch to the moment of measurement (a few seconds) was less than 10 Hz, again keeping total error well within the claimed 100 Hz.

As far as the mechanical operation is concerned, things couldn't be easier. You feed in the transmitter's signal, set the mode switch to RF, adjust the level control until the meter pointer lines up with a scale mark, then switch to deviation. The meter then indicates frequency deviation instantly; total measurement time is less than 10 seconds.

**Other Functions.** To use the C-12B as a power meter, you simply set the mode switch to RF and turn the level control full clockwise. The C-12B then indicates the transmitter's output power, and in the unit we tested it does so with an accuracy better than the claimed 1/4 watt. For example, when the actual power fed into the unit was 3.0 watts, the C-12B indicated an input of 3.2 watts.

Since the C-12B's meter is damped, a sustained word rather than a string of words must be used for modulation tests in order to permit the meter to rise to peak value. For example, when the speech input was a long

(Continued on page 118)
Exclusive with RCA...

AUTOTEXT
faster, easier way
toward a career
in electronics

EXCLUSIVE WITH RCA. "AUTOTEXT," developed by RCA and introduced by RCA Institutes, Inc., is a system of programmed instruction, accurately planned so that as you read a series of statements, questions, and answers, you learn almost without realizing it! It's fast! It's easy! It's fun!

NEW TREND IN EDUCATION! Programmed instruction has been proved with thousands of students. People who have had trouble with conventional home training methods in the past can now master the fundamentals of electronics almost automatically!

PROVE IT TO YOURSELF NOW! An interest or inclination in electronics is all you need. RCA "AUTOTEXT" will help you do the rest. And the future is unlimited; the jobs are available! The important thing is to get started now!

COMPLETE COURSE AVAILABLE. RCA Institutes now offers you a complete Home Training Course ("Introduction to Electronics") using the "AUTOTEXT" method. You get a complete set of theory lessons, service practice lessons, experiment lessons, and all the kits you need. You'll learn faster with less effort!

ATTENTION VETERANS!
All RCA Institutes Courses available under new G.I. Bill

CLASSROOM TRAINING AVAILABLE IN NEW YORK CITY, AND CHERRY HILL (NEAR CAMDEN) NEW JERSEY.

Send postcard for free illustrated book today! Specify home training or classroom training!

RCA INSTITUTES, INC.,
A Service of Radio Corporation of America
350 West 4th St., New York, N.Y. 10014

THE MOST TRUSTED NAME IN ELECTRONICS

THE MOST TRUSTED NAME IN ELECTRONICS

FEBRUARY-MARCH, 1967
You can add a Beat-Frequency Oscillator to just about any all-band receiver without digging into the chassis. All connections are external but you can get better shortwave reception with a direct connection.

Many receivers for the general public have a shortwave band but no BFO (beat-frequency oscillator). Most hams today use either Morse code (CW) or single-sideband (SSB) voice (both of which require a BFO), and cannot be tuned in on receivers without a BFO circuit. But there is a solution. Go to a war-surplus dealer, purchase the lowest priced longwave receiver he has at hand, and you’re in business.

**Here’s How.** Just about all modern receivers, especially those that are intended for the general public, are put together using a superheterodyne circuit (not that there is anything necessarily “super” about the home-entertainment version of it). The signal from the antenna is picked up by the RF stage of the receiver—at the station’s actual frequency. In the type of set we’re dealing with here, little amplification takes place in the RF (radio frequency) stage. Instead it is immediately converted to a fixed intermediate frequency (IF), and usually centers on 455 kHz (kc). Because this narrow band of frequencies is fixed, tuned-amplifier circuits can be built much more economically.

Now if you had a receiver intended for amateur or communications listening, it would have a beat-frequency oscillator operating very near the intermediate frequency. The BFO is actually a miniature transmitter (oscillator) built into the receiver and putting out a microvolt signal. For example, in Lafayette’s brand new HA-700 the BFO operates at either 452.5 or 457.5 kHz (and if necessary can be adjusted for any value in between). When a CW carrier is tuned dead on, it appears in the IF stage at exactly 455 kHz, beats with that BFO just 2.5 kHz away and in turn produces an audio note of 2500 Hz (cps). (1 kHz equals 1000 Hz, of course.) The dots and dashes are then easily readable (heard as dots and dashes).

**What To Do?** But we’re forgetting—you’ve inherited a SW receiver without a beat-frequency oscillator. So obviously what you must do is **add** a BFO to your present receiver. And because you are just a beginner, this must be accomplished in the simplest way possible. Which brings us back to that war-surplus longwave receiver. Most of these are blessed with a BFO which operates at the LW sets’ own IF (somewhere below 200 kHz) and all will tune the SW rigs’ IF. (Be careful—some were regenerative circuits not superhets.) By now I’m sure the idea is beginning to dawn on you. If not then consider this little experiment.
Put the two receivers side by side on a table. Pick out a station on the SW dial, then turn the set's volume down to nil but not far enough to turn the power off. Now tune the LW receiver to 455. Lo and behold—there is your SW station.

Why? Well, because every inexpensive shortwave rig radiates slightly at its intermediate frequency. Whatever it picks up is rebroadcast at 455 kHz and your longwave receiver will pick this up. Of course you'll want maximum IF pickup. To obtain this, the two receivers should be connected to a common antenna. And if this still doesn't provide enough pickup, have a qualified technician hitch the SW IF's output directly into the LW's RF circuit. But we emphasize the person who does this must be fully qualified. If you try it yourself, the results could be "shocking." Anyway, in most cases the common antenna will do the trick.

Pitfalls. Now in setting up this system there are a few pitfalls to avoid. First be sure the LW receiver does tune to the IF—that is, it must have a band covering the 400 through 500 kHz range. Next, be sure the LW rig you buy is war surplus and not a new one, otherwise you could wind up paying more than a regular Ham receiver would have cost. Sometimes the hand switches on these old rigs act up, however, for amateur purposes. once the receiver is on that 455 kHz band, you shouldn't care less. On the other hand, this should knock down that price still further. For more exact details on price, pick out the appropriate dealers from their ads in this issue (and Literature Library), then write them.

There is one more thing to look out for. We said that the two receivers should be connected to a common antenna. But sometimes connecting the SW receiver on the hookup will badly detune the LW antenna circuit. If this does happen, simply place a very small capacitor (not bigger than 50 µF but the value is not critical) between the longwave lead and main antenna which in turn is attached directly to the SW rig. This effectively isolates the two tuning circuits. This is a must if you decide to connect into the IF amplifier directly.

All Set. So now you're all set for CW reception. You're also ready to receive single-sideband transmissions but these will require much more careful tuning. A SSB signal is just like one using standard AM (amplitude modulation) except that one sideband (which you won't miss) and the carrier have been removed. In order to hear single-sideband voice transmissions in an intelligible manner you must produce your own carrier within the IF. The BFO, of course, makes this possible. (Turn page)
Using The BFO. However, in order for your BFO to act successfully as a substitute carrier two conditions must be met. First, it must appear in the IF, frequency-wise, exactly where the station’s own carrier, if it had one, would be. Second, strength of modulation and artificial carrier must be the same in that IF stage. Both problems are considerably simplified in this instance because the living-room type of all-band (SW) receiver you are now being forced to use is not very selective, which means a range of signals at least 10 kHz wide (5 kHz on each side of the tuned frequency) will be passed on to the LW receiver with their comparative strengths unaltered. Then because just about all superheterodyne sets are blessed with AVC (automatic volume control), you merely have to tune the LW receiver up and down those IF signals until the desired modulation becomes readable. However, because of the military rig’s own high degree of selectivity, the amateur station’s modulation level will probably be weaker than normal. To compensate for this, push the LW’s audio gain (volume) well up.

How Good? Now before anybody gets delusions of grandeur, we’ll level with you. This system will not work as well as a regular Ham receiver. It is intended strictly for those who have inherited (gratis) one of those highly polished, so-called hi-fi sets, or even one of the many transistorized portables whose shortwave band has been added just “for luck.” On the other hand, when you consider that such rare amateur loggings as FK8AB New Caledonia, CR5SP Sao Tome, a number of Antarctic stations, etc. (who use almost nothing but single-sideband), we think you’ll agree that the effort involved in using this inexpensive converter combination is well spent.

Doorbell Silencer

Here’s a simple way of silencing that doorbell or buzzer so that it won’t wake Junior taking his afternoon nap.

Pick up a small twist switch with threaded shaft and nut for panel mounting from your hardware store or “five-and-dime.” Remove the cover or housing from your doorbell and drill a hole through it large enough to pass the threaded shaft on the switch. Make sure the switch body inside the housing won’t interfere with the bell mechanism.

Remove the wire coming from the bell transformer from its terminal and connect one of the pigtail wires on the switch to the transformer terminal. Then connect the transformer wire to the other pigtail wire on the switch by twisting them together and taping.

You don’t have to turn off the house current for this job—house bell circuits carry only 6 volts. However, it is wise to do so if you must stand on a chair or stepladder.

Replace bell housing, and have someone press doorbell button so you will know if the switch is in the “on” or “off” position.
Come a day soon the lowly foot-slogger will become a one-man division, complete with his own missile and missile launcher, landing apparatus, communications equipment. And he'll carry his gear wherever he goes.

A soldier turned packhorse? Hardly. For much of the new weaponry emerging from major research today rivals tiny Alice for wonder. Fantastic though it seems, the foot soldier of tomorrow will carry whole systems on his back, weapons that draw from astronomy and space and molecular electronics, and shame the crude armaments of the past.

Was a time man warred with sticks and stones, bows and arrows, and lances and swords. He rode off to battle resplendent on a white horse, with metal vest and gleaming sword and flowing cape. But for all his splendid beauty he was a pretty vulnerable target for the guy who didn't like him. So as time went on and he sharpened up a bit he fashioned more skillful weapons: the rifle, the machine-gun, the grenade. But never in his history, with all his advancing technology, has man designed instruments of war as sophisticated as the ones he tests today.

World's First. Using advanced radar techniques, RCA engineers have built a canny system that will mount on the barrel of a rifle, an M-79 grenade launcher, or an M-60 automatic. Its function: to spot moving enemy targets, whether walking or running, man or animal, large or small, jeep or ten-ton truck. (Continued Overleaf)
When tomorrow's soldier wants to spot a target in an area, he will simply switch a control on the back of his weapon. The world's smallest radar will then look over the situation, let its soldier boss know when it spots a target by emitting a series of eerie sounds. Ranging all the way from a low groan to a high-pitching squeal, such noises will reveal whether the radar has spotted a walking man, a crawling man, a man who is running, or a speeding vehicle.

**Doppler Squeals.** In essence, the radar —like any other—is simply applying Doppler know-how, the principle that says a sound or radio wave shortens as the emitting object moves toward the listener, lengthens as the object moves away. And the Doppler effect in this 2-lb. radar wonder results from the frequency- or pitch-change in the radar’s 9-GHz signals, which, converted to sound frequencies in a headset, can tell the soldier which type of target he has spotted and where it is.

In battlefield operation, the Doppler return will sound much like an off-key siren winding up when the vehicle it spots is moving away. Since the up and down and lateral vibrations of a truck all show different rates from those of a small vehicle such as a jeep, the characteristic differences between targets are distinctly discernible—even when pickup targets are traveling at the same rate of speed over a particular terrain.

The new radar spots almost anything that moves and at almost any speed—from 2 feet per second to over 45 miles per hour. And while performing its duties it puts up with no nonsense from the enemy. In fact, it is virtually immune to jamming, and a scrambler turns the radar beam into radio noise for enemy detectors.

**Over Yonder.** Should Mr. Radar miss the enemy lurking over the horizon, Lockheed's clever "Ping Pong" will spot him. For Lockheed engineers have just tested the world’s first round-trip missile, a lightweight fellow that scouts the enemy, takes his picture, and return-trips on its own.

All the future soldier will have to do is aim and shoot, then wait for "Ping Pong" to return, guided by its programmed sensors and sliding fins. Already flight-tested near Lockheed's Burbank plant in California, the first-of-its-kind carries a rocket on each end. And in spite of all its propulsion power, Ping Pong makes little noise except for a brief "sput" when fired. After that it is as mum as any other cloak-and-dagger agent.

**Spot The Sneak.** But what if the enemy hides his tank or jeep under a camouflage net? Fairchild Space and Defense Systems has built a see-through-everything camera that will spot the sneak in its hiding place. Applying spectograph technique, the camera...
filters densities of light by wavelength, detects minute differences in living, dying, and dead foliage by chlorophyll content so that a photointerpreter can see tiny shadows that may reveal a tank's hiding place.

Four rotating lenses of 3-in. focal length record images of the target through filters of different wavelengths side by side on 9½-in. infrared roll film. The blue, green, red, and near-infrared filters show up as black-and-white densities proportioned to the brightness of the filtered light.

To the person inexperienced in interpreting the finer points of photos, these gradations indicate changes in terrain unspottable in conventional photography. When advanced color techniques are added, the Fairchild picture may show the terrain in blue, the hiding tank in shocking pink.

Calling Centers. With all these electronic aids, tomorrow's soldier won't need worry too much about enemy surprise attack. But speeding information to command centers will call for split-second communications.

To this end, Litton Industries has built a microminiature radio transmitter that weighs only four pounds, complete with batteries. Formally named the "Digital Message Entry Device," it will send messages in digital form in less than half a second. The sender-soldier need only set one of 22 "thumbwheel" switches in position and press the transmitting switch. Instantly, the digital message will burst over the airwaves to be picked up at a command center by a standard receiver.

Each of the 22 numbers represent a prearranged message. And when the sender hears a responsive hum in his helmet he knows his message has been decoded. Immune to jamming, the "entry" will be especially valuable for future allied soldiers who speak different languages, since they will be able to communicate in code.

Tiny TV. Though digital messages cannot show tactical situations as they happen on the battlefield, the television picture can. To send pictures to field commanders behind the front lines, Westinghouse has devised the world's tiniest TV camera. Even today the smallest space camera weighs up to four pounds, calls for 100 to 200 cubic inches of space and 9 to 30 watts of power. But not this tiny viewer.

The Westinghouse molecularized wonder weighs only 1 lb., 7 oz., and is believed to be the lightest and smallest TV camera ever built. With a 1-in. vidicon camera tube, the unit is about as long as a two-cell flashlight. Without lens, it measures 7⅛ in. long, 2 in. wide, 3¼ in. deep, occupies only 50 cu. in. and runs on 4 watts of power.

Asked how they can make a camera that dainty, Westinghouse engineers say they owe
THE "NEW MOD" SOLDIER

all to a special electrostatic tube that includes a binary countdown synchronizing generator capsule of producing standard interlaced 525-line scanning at 30 frames per second. Its 197 miniature components—-compared to 582 in conventional circuitry—-include 36 molecular blocks, giving the camera its sync generation, amplification, and scanning. And the midget even manages picture quality comparable to its grown-up TV-studio sisters.

To match the tiny camera, Westinghouse offers a receiver mate, 3½ in. high, 1½ in. wide, 4½ in. deep, adding up to 21 cu. in. in all. Truly microelectronic, the VHF receiver midget gets its gumption from rechargeable silver-cadmium batteries.

Soft Touchdowns. As important to the New Mod soldier as intelligence and communications will be the ability to land on his feet in the new helicopter warfare. To fashion "shoes" for the foot soldier forced to parachute-land or drop onto a tree-top landing mat from a helicopter, Lockheed borrowed from its moon-landing know-how.

Originally designed to cushion the lunar excursion modules (LEM) when they land on the moon, the DynaSorb "shoes" are fashioned of metal tubing slotted at one end. Under stress the metal curls in upon itself, much in the manner of a party noisemaker. In this way, the new shoes will absorb energy impact on landing.

In Lockheed's design, a cylindrical tube is notched at measured intervals around its base. On impact a cone rises within the tube and extends the splits which have a natural tendency to coil. A control ring on the outside of the tube will govern the splitting rate and the tightness of the coils which bear the impact. The "shoes" come in a variety of hardy metals that can withstand Superman stresses.

Red-Eye. But probably the most amazing of all the new-day small-wonder weaponry is an anti-aircraft missile a soldier can fire from his shoulder, giving him for the first time an effective weapon to protect himself against low-flying aircraft. General Dynamics has already tested a 4-ft., solid-fuel, infrared-nosed weapon weighing only 28 lbs. Not only will it fire from the shoulder, but the device also is designed to home onto any low-flying craft and blast it with a high-explosive warhead.

Tomorrow's soldier will simply point the fiber-glass launcher toward the target. And when the missile signals audibly or visually that it's sighted the target, the gunner will uncage the seeker, let the red-nosed wonder soar toward the heat of the enemy's engine.

A two-stage job, the first stage will thrust 20 ft. after firing, sufficient distance to safeguard the soldier. The second stage will then soar on target, with the missile's control taking in continuous target information and signalling the fin wings just what to do to speed toward enemy rendezvous.

With its microelectronic circuits all on tiny silicon chips, the amazing small-wonder missile will form part of the harness tomorrow's soldier will carry. Significantly, a pack including all the new weapons systems just described will weigh no more than a portable television set. But it will give tomorrow's soldier the most sophisticated weaponry man has ever known.
It's not uncommon these days to run into people who automatically assume that anything offered as professional equipment is pure junk. And they do have a point, since anyone exposed to "professional recorders" at $29.95 and "professional amplifiers" at $19.95 could hardly believe otherwise.

This makes it all the more unusual to find a really professional recorder that isn't touted as such. Yet the Heath AD-16 is just that—a professional recorder of the type you could very well find in a broadcast or recording studio. What makes the Heath a professional recorder is that it originally started out as a professional machine—a Magnecord.

It appears that Heath took an already existing "professional" recorder, reduced it to its component parts, and eliminated some tricky equalization adjustments that could give the nontechnical user some headaches.

Heath then added a construction manual, packed the unit in a shipping carton, and offered it at a savings of almost $200 below the wired (Magnecord) price. As far as we can determine, the major difference between the Heath AD-16 and the original Magnecord lies in the elimination of the adjustable frequency equalization—the Heath model provides only fixed equalization for a basic "flat" response.

Sound interesting? You bet it is. And there are some other surprises. Unlike some other recorders that are jam-packed with almost useless features and accessories, the Heath is as straightforward as a sunny day in June. There are no slide-projector control circuits, no automatic echo, no automatic sound-on-sound; in fact, no automatic anything to run up the cost. The price of the Heath AD-16 represents only the transport

---

Fig. 1. Record-play response of Heath AD-16 at 3 3/4 ips was in keeping with company's claim of ± 3 db, 30 to 10,000 Hz. Note that both channels offer approximately the same response.

Fig. 2. Overall record-play response of Heath AD-16 at 7 1/2 ips again was generally in line with manufacturer's specifications. Two channels differ by factor of only 1 db.
and electronics necessary for straight four-track stereo recording.

**Focus On Features.** Among the many features of the AD-16 are three heads—for simultaneous playback (monitoring) while recording; an L-Stereo-R mode switch that permits recording on either the L or R track or both; pilot lamps to indicate the track(s) in the record mode; a built-in mixer that permits mixing the signals from the microphone and auxiliary input jacks; independent, friction-clutched controls for microphone, auxiliary, and output level; two stereo (or mono) headphone jacks that can accommodate any headphone impedance; two amplified VU meters that monitor the input and playback levels. In short, the AD-16 boasts every feature you would expect to find in any truly professional (broadcast-quality) recorder.

The tape transport is a three-motor affair, with one for the capstan, one for the supply reel, and one for the take-up reel. Pushbutton-operated solenoids, rather than complex mechanical levers, activate the appropriate drive mechanisms. In addition to the usual play, fast forward, fast rewind, record, and interlock buttons, there is a cue button that is perfect for locating a specific spot on a recording and for doing professional-style editing.

**Putting It Together.** Except for the head assembly, the entire AD-16 is user-assembled. Building the electronic side of the AD-16 consists primarily of pushing components into a printed circuit board and soldering. And putting the transport together is not notably difficult since solenoid operation sharply reduces the number of mechanical components and simplifies adjustment of those which remain. The all-important head assembly is pre-mounted at the factory to insure that tracks are properly positioned on the tape, although the builder must make final head-azimuth alignments. A full set of height and positioning adjustments is provided for each head should the need arise for head replacement or repair. The instruction manual goes into detail on this.

Pushbutton controls are part of the transport deck, as is a belt-driven, resettable revolutions counter. A “tape gate” is also part of the transport and is pulled in by a solenoid in the play, record, and cue modes. A built-in tape-break switch (auto-stop) doubles as a supply-reel compliance arm, and a compliance arm is also provided for the take-up reel.

The deck is completely operative upon completion of assembly except for the minor spring tension adjustments. Only setting the bias current and aligning the heads remain, and Heath provides a special tape for these two adjustments. The tape provides

(Continued on page 114)
The latest addition to Knight's line of CB transceivers really offers something different and unusual, which, although it may not appeal to all, will certainly find a home with some.

The Safari III looks much the same as any other solid-state rig, with the usual PTT microphone. But the difference is that the mike is in reality a speaker/mike; release the PTT switch, and the sound is right out there in front of your face. Ambient noise too high? Just move the mike next to your ear and literally pour the sound down the canal.

Priced at $84.50, the Safari III is available only as a semi-kit. To insure that the transmitter meets FCC regulations, the entire transmitter section is factory-wired, tuned, and adjusted. The builder makes absolutely no adjustments to the transmitter section during or after construction. Building the kit consists, essentially, of mounting the receiver and modulator components on the printed circuit board (the transmitter and receiver utilize the same board). And with the exception of the front panel controls and power-cord socket, there are few components which are not mounted on the PC board.

**Push And Solder.** Construction is not difficult since most of the work consists of pushing the components through the matching holes and soldering. Typical of Knight-kits utilizing printed-circuit wiring, the printed wiring in this unit has an "anti-run" coating that exposes the copper foil only at the point to be soldered. Even if you use excessive heat or solder, the solder will be confined to the exposed copper (a good feature for beginners and oldtimers alike).

The only point at which extreme care must be taken is with the crystal-socket-to-selector-switch wiring. Although the transceiver is normally supplied with but one set of crystals, there are sockets for full 23-channel operation. That means 46 crystals, and, therefore, 46 leads running to the selector switch. While the selector switch wires are color-coded, the same color is used several times. As a result, extra care must be used to insure that the right socket lead goes to the right selector terminal (yep, we goofed).

**Ready To Go.** When the kit assembly is completed you're in for a real surprise. For with the exception of the three second-oscillator coil adjustments, all receive coils are pre-aligned. Even a careful instrument alignment made absolutely no improvement in performance!

The finished transceiver line-up is one stage of RF, two stages of overload-protected 1F amplification, a noise limiter, an S-meter amplifier, and the usual audio section. The transmitter uses three transistors.

Performance is just about what you would expect from this line-up. Power output at
Although it looks like any other microphone, this one doubles as the Safari III's speaker. Sound quality is quite good.

13.6 V (battery supply) was 4.6 watts into a 50-ohm load. Modulation, under the best conditions, peaked at 80%, running about 50% on an average voice level (if there is such a thing as an average voice level).

Receiver sensitivity checked out at 1.8 μv for a 10 db S + N/N (signal plus noise to noise) ratio. AGC action, that is, the variation in audio output for a 94 db variation in RF input signal, was 23 db. Adjacent channel rejection was slightly better than 35 db—not super-selective by any means but adequate in all but the most heavily congested CB areas and certainly adequate for straight family and business communications.

Talk And Listen. Because of the speaker arrangement we could not use the standard test for audio power output as it would be meaningless. Subjectively, the signal reproduction is quite good if you favor having the speaker in the microphone. Unlike very early CB transceivers which utilized speaker/mikes and delivered a muffled, "hollow" sound, the Safari III delivers a notably intelligible signal from the speaker/mike.

To us, response appeared devoid of all highs and lows—it was all mid-range, such as you'd expect from a very good quality intercom. While it was a bit unusual to have the sound coming from the mike, under high ambient noise levels it proved advantageous to be able to direct the sound directly into the ear. But it might prove a bit cumbersome to utilize this system in a quiet office.

Many options are available for the Safari III. You may purchase individual crystals at $2.50 each, or a full set at $69.95. There is a portable battery pack that accepts D cells or rechargeable alkalines, and an AC power pack that also doubles as a battery charger. For field use there is a canvas carrying bag and a portable antenna specially designed to be used with the battery pack.

For additional information on the Safari III, write Dept. 20, Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680.

**Shrunken Antenna for Expanded DX**

- Limited in antenna space? Here is a low-cost three-band system that will fit the average backyard and is ideal for the novice amateur operator since it's designed for 80, 40 and 15 meters.

  The system is constructed with 300-ohm television twin lead and consists of a 40- and 80-meter dipole with the same feed line at the center. The entire system is "shrunk" to 100 ft. by bending the 80-meter section back 12 ft. at each end. There is no noticeable sacrifice in performance.

  Construct the antenna to the dimensions in the diagram, using copper-clad steel TV twin lead. Start by cutting two 50-ft. lengths of twin lead and attaching an egg insulator to a single insulator to form the center feed point.

  From each outer end, measure back 12 ft. toward the center, then remove a 5-ft. section of conductor from one side of the twin lead. Attach the feed line and the system is ready to go on the air.

Either 72-ohm coax or twin lead may be used for feeding the system. A 72-ohm twin lead reduces the weight which the antenna must support and keeps the system electrically balanced.

You should obtain adequate results with this antenna system of 80, 40, and 15, and it will also work fairly well on 20 and 10 meters. But for the best overall performance, use an antenna tuner, if available.
Measuring the current drawn by an AC-powered circuit will often pinpoint those obscure defects in power transformers and other parts.

One of the benchmarks that separates the tinkerer from the serious electronic experimenter is an AC ammeter. Everyone has a VOM or a VTVM, but very few tinkerers ever measure AC amperes. There are many times when the ability to measure current will save the day on a repair job or an electronic design project.

To keep from draining the bank account an ammeter should be a multi-range job. I started with a 0-50 AC milliammeter simply because I had acquired one in a trade. You can usually pick up a good used one from Bigelow Electronics, P. O. Box 71, Bluffton, Ohio 45817 or buy an inexpensive new one. There are two general types of AC milliammeters in use today. One is called an iron vane type while the other is simply a DC movement with a rectifier to change the AC-circuit current to DC-meter current. The second is referred to as a rectifier-type ammeter. For the experimenters the inexpensive iron-vane type is preferred and is the one used here.

Since the meter has a full-scale reading of 50 ma it is best to make it read three different values of current beginning with a five.

The selected ranges were: 0-50 AC ma., 0-500 AC ma., and 0.5 AC amperes.

*It's The Shunt.* You can make any range current meter that you need by following these directions. To make a milliammeter read higher values of current it is necessary to put a shunt across the meter—you put a lower value resistance in parallel with the meter-coil resistance. To make the 0-50 ma meter indicate 500 ma select the shunt so that 50 ma goes through the meter and 450 ma goes through the shunt. On the 5 ampere range there will be 50 ma flowing through the meter and 4,950 amperes through the shunt.

*Internal Resistance.* To find the resistance of the shunt you must know the internal resistance of the meter. To find this value connect the unknown meter in series with a battery and a rheostat. Adjust the series rheostat until the meter reads full scale. Connect a second rheostat in shunt (across the meter) and adjust the shunt until the meter reads half scale. See the drawing for this circuit. Disconnect the rheostat from across the meter and carefully measure its resistance. This value of resistance is equal to the resistance of the meter.
Shunt-Resistance Value. Using the following formula with the meter resistance just found you can determine the values of the shunt resistors.

\[ R = Rm \times (n-1) \]

In this formula, \( R \) equals the shunt resistance, \( Rm \) is the meter resistance and \( n \) is the scale multiplication factor. For example let's convert the 0-50 mA meter to read 0-5 amperes. The scale multiplying factor is 100. If the meter resistance is 100 ohms then:

\[ R = (100 - 1) = 101 \text{ ohms}. \]

The 1.01-ohm shunt will have to carry 4.950 amperes at the full scale reading. By using the power equation

\[ P = I^2 R \]

we find that we need a 27-watt resistor. A 50-watt adjustable resistor will work nicely here—if you actually intend to measure 5 amperes. (If all your work will be in the 2 ampere neighborhood a 25-watt, 1-ohm resistor will be adequate.) If the shunt resistance figures out to less than one ohm it may be necessary to make it from copper or nichrome wire. Remember it will be necessary to multiply the scale readings by 100 when using this shunt. You can use the same formula to figure other values of shunts.

Calibration. When you get ready to check the calibration of your meter it would be wise to have another meter to use as a standard. Connect the standard ammeter, your meter, and a load of the proper size in series. (See the circuit diagram for this step.) Adjust the load for 2.5 amperes through the standard meter and adjust the shunt's resistance until your meter reads 2.5 amperes. Recheck the meter with a 5-ampere load. A four-position single-pole switch is wired, as shown, to select the different meter ranges. A meter short-circuit position is included because it is good practice to always short out the meter until you are sure of your circuit. A phenolic board is used to mount the switch and resistor. The meter is mounted first in the aluminum box and then the phenolic board is mounted to the meter by the meter studs. The photographs show how everything goes together.

Easier Testing. Not only is an ammeter useful to an electronics experimenter, but many radio-TV repairmen are finding set

---

**PARTS LIST FOR AC AMMETER**

J1, J2—5-way binding posts; 1 red, 1 black (Lafayette 99C6233 or equiv.)

J3, J4—banana jack (to attach ammeter to adapter—optional)

M1—AC milliammeter (see text)

R1, R2—wirewound shunt resistors (see text)

S1—Selector switch (Mallory 1313L; Allied 56A4253 or equiv.)

1—Chassis box, 5 x 4 x 3-in. (Bud CU2105A; Allied 42D7621 or equiv.)

**PARTS LIST FOR AMMETER ADAPTER**

F1—Fuse of proper rating for range in use (see text)

J5, J6—5-way binding posts; 1 red, 1 black (Lafayette 99C6233 or equiv.)

J7—Chassis-mount AC receptacle (Amphenol 61-F; Allied 40H677 or equiv.)

P1, P2—Banana plug (to attach adapter to ammeter—optional)

P3—Chassis-mount AC plug (Amphenol 61-M; Allied 40H675 or equiv.)

1—Recessed steel shell for P3 (Amphenol 61-61; Allied 40H086 or equiv.)

1—Chassis box, 4 x 2 x 2 3/4-in. (Bud CU-2115A; Allied 42D7631 or equiv.)

Misc.—machine screws, nuts, wire, solder, phenolic board, wire, etc.

Estimated cost: $14.00

Construction time: 2 hours
troubles with an AC ammeter. The ammeter described above will work on most radios, audio amplifiers, and TV sets. Do not use it on irons, toasters, or other high current devices. To make this meter more useful in checking line-cord powered devices an adapter (shown in the photographs) was developed.

Since there was no room in the meter box for an AC receptacle or fuse holder I decided to make an additional box that could be easily fastened to the meter box. The end dimension of the meter box was 4-inches wide by 3-inches high. A box 2-inches deep that would match this would be great, but none are available. The nearest standard-size box is 4 x 2 3/4 x 2-inches or you could cut down a 3 x 4 x 5-inch box to match the meter case. An AC socket and plug are mounted on the front of the box—on the top is a fuse holder and two 5-way binding posts. The back of this box has two banana plugs that mate with two banana jacks mounted in the meter box. These banana plugs and jacks just hold the two boxes together and do not carry the meter current. Be sure and use an instrument fuse to protect the meter—they are faster than a conventional fuse.

How It Works. The device to be tested is plugged into the AC socket. A jumper cord, with banana plugs, connects the adapter and ammeter through the 5-way binding posts on each box. This connection puts the meter circuitry in series with the fuse and AC plug. An AC cord with a male plug on one end is plugged into the AC plug on the adapter.

You don't need to resort to a lot of figuring if you use the cut-and-try method of shunt design. Just connect the two meters in series and increase the resistance of the shunt until meters indicate the same. Refer to the text.

All circuitry inside meter case (left) is on phenolic board that mounts directly on meter terminals. Tapered end of phenolic board is to give better clearance for leads to J1 and J2. If you start with a larger case, adapter can be built in, eliminating J3, J4, J5 and J6 as well as P1 and P2. The 5-amp fuse will not protect M1 if shunt resistor should open up.
end and a female socket on the other end is used to connect the ammeter adapter to a wall outlet.

**One Use.** I had no sooner finished the ammeter adapter than an opportunity came to use it. A two-cabinet stereo set came into my shop with the complaint that it was popping fuses. When I checked the units I found both fuses popped. I connected each unit to the ammeter adapter and found that each unit alone drew approximately one ampere. Tapping the tubes in the changer cabinet showed up a bad 5Y3GT tube that caused the ammeter to read 3 amperes. Since each unit should have had a 1.5 ampere fuse to start with, it was easy to figure why the fuse had gone. Further examination showed that the blown fuse in the other cabinet was only a ¾ ampere size. Proper (1½ ampere) fuses were put into both amplifiers along with a new 5Y3GT tube and no more trouble was found. Monitoring the current for short intervals over a period of several days showed no change.

Many defects in electronic equipment can be detected with an AC ammeter. Some of these are: shorted or partially shorted power transformers, bad tubes, and bad or leaky filter capacitors. It also makes it easy to decide what size fuse to put into newly designed (and built) electronic equipment. A safe rule-of-thumb is to install a fuse rated about one and a half times higher than the operating current.

**Desk Lamp Mike Stand**

**Record that tall story using the desk lamp reflector to increase pickup range**

A microphone stand for hand mikes (such as those that come with less expensive tape recorders) can be improvised from a flexible neck desk lamp with its cord removed (or at least disconnected), a plug to fit the lamp's socket, and a ½ x ¾ in. metal strip. Bend the metal strip to the size necessary for the mike in question, and use as shown. To pick up faint sounds attach the lamp's bowl-type reflector to the lamp's socket to "funnel" or focus the sound into the mike. Face the mike toward the inside of the reflector. Position mike closer or further from the bowl for best pickup.
Constructing a unit with no springs to adjust and no relay contacts to pit or stick is possible if you switch with a regular unilateral SCR wired across a diode bridge.

Just think about it! The next time you show color slides of your last vacation you can sit on your duff and enjoy a cool, mixed drink while your tape recorder does the work. A rich, clear narration prepared in advance patters out in step with changing slides without any effort on your part. Your guests will be entertained as well as curious about that gadget you call the Tape-Slide Synchronizer.

The Tape-Slide Synchronizer is an electromechanical device which automatically actuates the slide-changer mechanism at the exact instant dictated by the commentary on the magnetic recording tape—thus assuring perfect synchronization of commentary and slides at all times. A taped slide-show commentary has a number of advantages over live, off-the-cuff commentary. One advantage is that important facts (that are hard to come by) will not be forgotten on successive showings as time goes by. Another advantage is that the show need not be postponed if your voice goes before the night of the performance. You can sit back, relax and enjoy yourself. (Don't forget that drink!)

Early units were difficult to use. Some required conductive marks to be placed on the tape, others used a high-level audio signal in the sound track (which was objectionable as it could be heard). In order to overcome the objection of the noise from the sync signal, one unit operated on the complete absence of sound on the tape. A four-second (or longer) silent period would activate the slide-changer mechanism. This system was workable with monaural tapes but it was difficult to record the commentary without pausing, thus causing unwanted slide changes. Some success was also had using inaudible (ultrasonic) sync signals.

For Stereo Tape Recorders. With the advent of the two- and four-track stereo-tape record and playback equipment the disadvantages of the early units were automatically eliminated as the commentary could be recorded on one channel and the sync signal on the other. On playback the sync signal would operate the slide changer via the switch in the synchronizer. But even with this there were relay contact problems.

A Unique Circuit. This Tape-Slide Synchronizer is solid state. Using the unilateral SCR (silicon-controlled rectifier) alone will pass only one half of the AC (sine wave) power—still requiring a relay to switch on
and off the AC to the shaded-pole induction motor—which normally powers the semiautomatic slide changers. By using the SCR with a diode bridge circuit both halves of the 60-cycle (Hz) power are passed and the relay can be eliminated. Another way to eliminate the relay is to use two SCRs in inverse parallel but this is more expensive.

Originally this Tape-Slide Synchronizer was used with a stereo record-playback tape deck with only one power amplifier and speaker—for the commentary channel.

The three-stage transistor amplifier operates the SCR circuit. It provides plenty of gain for use with the tape deck and even a small crystal microphone can be used to operate the slide changer and put a sync signal on the tape.

**SCR-Diode Bridge Switch.** The heart of this unit is the SCR-diode bridge switch—the basic switch circuit is shown top right. The SCR has high resistance between anode (A) and cathode (C) when there is no signal on the gate (G), and no AC can flow through the diode bridge to power the motor—it is off.

When the gate of SCR1 is made positive (by a positive-going signal between gate and cathode) the resistance of SCR1 becomes very low between anode and cathode (it conducts) and the motor runs.

Conduction of both halves of the AC-power sine wave is brought about as follows: when the AC cycle is positive at W, current flows through motor M1, then through D5 from A to B, through SCR1 to D2 (from D to C) back to the other side of the line (Y).

When the positive cycle of the AC line is at Y, current flows through D3 (from C to B), through SCR1 to D4 (from D to A), then back through motor M1 to the other side of the line (W).

In like manner, the sync signal from the output of the tape recorder, when rectified and applied as a positive (+) pulse to the gate of the SCR-diode bridge, switches the slide-changer motor.

**Solid-State Synchronizer.** The complete schematic wiring diagram, including that for the slide changer, is shown below. Remote pushbutton S2 is used to operate the slide changer. An Airquist (model Y) semiautomatic slide changer is used here. However, practically any remote-pushbutton operated unit could be used. The slide changer is shown attached to a TDC.
Complete setup, ready for an automated slide show, has Tape-Slide Synchronizer between slide projector and tape machine. Use any automatic projector, stereo unit.

(model D) slide projector.

Current flows through the motor when S3 is pressed. (Numbers 1 through 4 shown on the slide-changer portion of the schematic are the actual contact numbers molded into the Cinch-Jones 4-contact chassis socket in the slide changer.)

When the motor starts it operates the motor-driven cam switch (S4—wired in parallel with S3) keeping current flowing when S3 is released. After the changer has completed its cycle the cam switch opens, the motor stops—and everything is ready for another slide change when S3 is pressed again.

The Tape-Slide Synchronizer is connected electrically to the slide changer through the 4-contact plug and operates as follows:

Depressing S1 connects the collector of the last stage of the three-transistor audio amplifier (through C1) to the input of the previous (second) stage converting it into a 1000-Hz feedback oscillator. The 1000-Hz signal from the ungrounded secondary of the output transformer is rectified by D1, passed through the RC filter (R2 and C4) to the gate of SCR1. The 1000-Hz signal appears at the gate of SCR1 as a positive-going pulse—activating the solid-state switch which in turn powers the slide-changer motor as

---

**PARTS LIST**

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>.01-mf, 200 volt, capacitor (miniature)</td>
</tr>
<tr>
<td>C2</td>
<td>.002-mf, 200 volt, capacitor (miniature)</td>
</tr>
<tr>
<td>C3</td>
<td>1000-mf, 15-volt, electrolytic capacitor</td>
</tr>
<tr>
<td>C4</td>
<td>15-mf, 15-volt, electrolytic capacitor</td>
</tr>
<tr>
<td>D1</td>
<td>1N540 silicon diode</td>
</tr>
<tr>
<td>F1</td>
<td>2-amp 3AG fuse</td>
</tr>
<tr>
<td>F2</td>
<td>6.3-volt miniature pilot lamp</td>
</tr>
<tr>
<td>J1</td>
<td>Phone jack, miniature open circuit</td>
</tr>
<tr>
<td>J2</td>
<td>Phone jack, miniature closed-circuit</td>
</tr>
<tr>
<td>P1</td>
<td>4-contact plug (Cinch-Jones P-304-CCT to fit slide-changer socket)</td>
</tr>
<tr>
<td>R1</td>
<td>5000-ohm miniature potentiometer</td>
</tr>
<tr>
<td>R2</td>
<td>50-ohm 147-ohm, 1-watt resistor</td>
</tr>
<tr>
<td>S1</td>
<td>5-p.s.t. normally-open pushbutton (Grayhill 30-1 s.p.s.t. or equiv.)</td>
</tr>
<tr>
<td>S2</td>
<td>5-p.s.t. slide switch (Wirt or equiv.)</td>
</tr>
<tr>
<td>SCR1</td>
<td>117-volt, 4.7-amp silicon controlled rectifier (GE-Z1 or equiv.)</td>
</tr>
<tr>
<td>T1</td>
<td>Filament transformer, 117-volt to 6.3-volt, 0.6 amp Stancor P-6465 or equiv.</td>
</tr>
<tr>
<td>Z1</td>
<td>500-volt, 1-amp (Mallory FW-500 full-wave silicon bridge or equiv.)</td>
</tr>
<tr>
<td>Z2</td>
<td>200-volt, 1-amp (Mallory FW-200 full-wave silicon bridge or equiv.)</td>
</tr>
<tr>
<td>T2</td>
<td>3-transistor, miniature audio amplifier (Lafoyette PK-522 99C9039 or equiv.)</td>
</tr>
<tr>
<td>C1</td>
<td>Chassis box, 6x5x2½-in. (cut down from 9½x5x2½); Bud AC403 or equiv.</td>
</tr>
<tr>
<td>Misc.</td>
<td>Phenolic board, terminals, machine screws, nuts, wire, solder, fuse holder, plastic (spaghetti) tubing, plugs, etc.</td>
</tr>
</tbody>
</table>

**Estimated cost:** $14.00

**Construction time:** 3 hours

---

Large shaded areas show original circuitry of prewired units used in Tape-Slide Synchronizer. Added circuitry is outside of shaded boxes.

---

**February-March, 1967**

79
TAPE-SLIDE SYNCHRONIZER

previously explained. R2 limits the current through the gate circuit of SCR1 to a safe value. C4 is the filter capacitor.

The output of the oscillator is also fed to the stereo-recorder input (from J3) and it is recorded as the sync signal on the control channel of the tape. The commentary is recorded in the usual manner on the other channel of the tape at the same time.

During playback the output of the control channel of the recorder is connected (via J2) to the input of the second stage of the audio amplifier where it is amplified, rectified by D1 and applied to the gate of SCR1—the solid-state switch powers the slide-changer motor.

Microphone Sync. A small crystal microphone can be plugged into J1 and when the word “change” is spoken into the mike there is adequate amplification to operate the slide changer mechanism and record a sync signal on the control channel of the tape.

Tape Deck. If only a stereo tape deck (without power amplifier) is available, there is ample amplification for both recording and playback of the sync signal on the control channel using either the microphone or S1. On playback, the output of the tape-deck preamp (which contains the sync signal) should be connected to J1 for the necessary amplification. During recording the sync signal from jack J3 is connected to the input of the tape-deck preamp.

Using Stereo Recorder. Extremely smooth operation has been obtained using the Tape-Slide Synchronizer with a Wollensak T 1580 stereo recorder. With this recorder the sync signal can be taken off at J2 (instead of J3) and applied to the input of the control channel to record the sync signal. On playback the output of the control channel can be taken from the external speaker jack and fed to J2 where it is amplified and operates the solid-state switch.

With this setup, output jack J3 is never used and the recorder cable need not be changed from J3 to J2 (in the Tape-Slide Synchronizer) when going from record to playback. (Continued on page 118)
We all shared the same license. Me, my girl Ora and my sometimes buddy, Nat. And tonight, the big night, I (Unit 1) had a date with Ora (Unit 2) at 8:00 sharp. And I was late, already a half hour late. Traffic being light, I'd taken the ocean drive (to pick out a parking place in advance) and no sooner was I committed to this route than fog commenced to roll in. At 8:30 I crawled along at 10 per, still a good 15 minutes from Ora's beach house. I tried to find some jazz on FM, which is scarce along this coast. Nearest station is on the island, 50 miles away, and it wasn't making it through the fog.

I switched over to CB just as Ora put her carrier on and pinned my needle. "This is Unit 2," she said softly. "Unit 1, where are you?" A sweat trickled down my spine.

I came back, "Crawling along in this darn fog. I'll be there by 8:45." I speeded up a little.

"That's nice, because at 8:50 I lock the doors—", a bit of dead carrier indicated Ora considered her next thought, "—and call Nat."

Nat and I both have a thing for her but so far the competition had been more or less polite. Anyway Unit 3 must have heard Ora because on the air he came. Darn it!

"Unit 1, CQ Unit 1." His carrier cut out briefly. "This is Unit 3 with emergency traffic." He sounded breathless and all that.

I pretended not to hear and speeded up a little more.
“Unit 1, come back. We’ve been invaded. I’m driving from Cometland toward Ora’s. They’re only a mile or so behind me on the highway.” Nat paused for breath and assumed his most desperate tone. “Do you read me?”

Cometland is a resort about 20 miles up the coast. With one hand on the wheel and the other on my transceiver, I decided to play along. I put myself on the air. “Unit 1 to Unit 3, invaded by what? Dragons from Mercury or gnomes from who knows where?”

“Giants in spaceships. A whole army of them. They’ve completely taken over Cometland.” His signal inched up a little on the S-meter.

Ora broke in. “With this fog, how can you tell?”

Unit 3, undaunted. “Unit 1, you’d better turn back. I’ll pick up Ora and meet you further south.”

Yours truly pushed a little harder on that accelerator. “Sure you will.”

She, sweetly, “Whoever gets here first...”

Nat kept it up. “I’m not fooling, Unit 1. They’ve turned Cometland into a base and more spaceships are landing right now. You can hear them coming in from here.” There was a loud hum in the background.

I yawned a little. “So you brought your shaver with you. And don’t forget the last CB’er who sent a phony distress got two years in the pen.”

It was her turn. “Maybe he’s not worried because the license is in your name. Anyway, man, you’d better make it here within five minutes.”

“Just passed the lighthouse, Ora. That makes it less than a mile.” The fog horn was really blowing up a storm and now the visibility had dropped to absolute zero. I slowed down, thought about that license bit, and began to sweat a little. “Unit 3, this is Unit 1. As licensee I’ve just cancelled your operating privileges.”

A moment of quiet and then he returned. But now that hum was really tremendous. “One of their ships is right overhead. I think it’s after me. The thing is draining power from my batteries.” His signal dipped appropriately. “Now my car has stalled and I can’t move.” With the most tremendous panic you ever heard come out of a CB receiver, “They’re landing on the road in front of me.” He faded out completely.

Ora took over the channel. “Hey, Unit 1, it’s now 8:45. Do you figure those astronauts out there in the fog would treat me better than you guys do?”

I inched around a final curve by following the shoulder of the road. “Wouldn’t bet on it.”

“Well, I may get the chance to find out because there’s a big bright light coming up over the northern horizon.”

I put myself back on the air quick. “If Nat’s arrived there first, both your operating privileges are cancelled.”

Thirty seconds of dead air.

“Nobody here except me, yet. But if he’s kidding, how come we’re the only two people on the air?” She laughed ever so slightly, almost nervous. “Anywhere, any band.”

Enough! Between the fog and Nat’s phony distress, I was really hung up. “All right, girl, if you really want to play, standby.” I switched on my general coverage converter and began working down through the international SWBC bands. 16 and 19 meters were absolutely dead but on 15,016 kHz some bird with a phony accent and a made-up language was sending messages. I returned to CB and hit the airwaves again.

“Nat, it’s also illegal to transmit off the Citizen’s Band. Do you read me?”

Silence.

On 15,016 those weird messages continued to flow. I moved on down through 25 and 31 meters which were also blank. Static showed up around 6 MHz but still no stations. A funny feeling crept into the pit of my stomach.

The AM broadcast band was also silent.

I put my CB transmitter on in a hurry. “Ora, do you read me?”

Her signals were so weak I couldn’t make out what she said but now I was close enough to see her house through the fog. In front of it—a spaceship and astronauts. Giants, most of them six feet tall, well over 175 pounds, no tails at all. And that’s how in the year X/4000 Venus was conquered by invaders from the planet Earth.
Regardless Of What You Pay For A Color TV...

It Can’t Perform As Well As This New Heathkit® “180” For Only $379.95*

Here’s Why!

Exclusive Features That Can’t Be Bought In Ready-Made Sets At Any Price! All color TV sets require periodic convergence and color purity adjustments. This new Heathkit GR-180 has exclusive built-in servicing aids so you can perform these adjustments anytime... without any special skills or knowledge. Simple-to-follow instructions and detailed color photos in the GR-180 manual show you exactly what to look for, what to do and how to do it. Results? Beautifully clean and sharp color pictures day in and day out... and up to $200 savings in service calls during the life of your set!

Exclusive Heath Magna-Shield... surrounds the entire tube to keep out stray magnetic fields and improve color purity. In addition, Automatic Degaussing demagnetizes and “cleans” the picture everytime you turn the set on from a “cold” start.

Choice Of Installation... Another Exclusive! The GR-180 is designed for mounting in a wall or your own custom cabinet. Or you can install it in either optional Heath factory-built Contemporary or Early American styled cabinets.

From Parts To Programs In Just 25 Hours. All critical circuits are preassembled, aligned and tested at the factory. The GR-180 manual guides you the rest of the way with simple, non-technical instructions and giant pictorials. You can’t miss!

Plus A Host Of Advanced Features... like the hi-fi 180 sq. inch rectangular tube with “rare earth phosphors”; smaller dot size and 24,000 volt picture power for brighter, livelier colors and sharper definition... Automatic Color Control and gated Automatic Gain Control to reduce color fading and insure jitter-free pictures at all times... deluxe VHF Turret Tuner with “memory” fine tuning... 2-Speed Transistor UHF Tuner... Two Hi-Fi Sound Outputs for play through your hi-fi system or connection to the GR-180’s 4” X 6” speaker... Two VHF Antenna Inputs — a 300 ohm balanced and a 75 ohm coax... 1-Year Warranty on the picture tube, 90 days on other parts. For full details mail coupon on the following page. Better yet, use it to order the best 19” Color TV buy... it’s available now in limited quantities.

*Kit GR-180, everything except cabinet, 102 lbs. .......................... $379.95
GRA-180-1, walnut cabinet (shown above), 30 lbs... 18¼” D X 25” W X 29” H... $49.95
GRA-180-2, Early American cabinet, 37 lbs... 18¼” D X 25¼” W X 31¾” H... Available February... $75.00

NEW 12” Transistor Portable TV — First Kit With Integrated Circuit

Unusually sensitive performance. Plays anywhere... runs on household 117 v. AC, any 12 v. battery, or optional rechargeable battery pack ($39.95); receives all channels; new integrated sound circuit replaces 39 components; preassembled, prealigned tuners; high gain IF strip; Gated AGC for steady, jitter-free pictures; front-panel mounted speaker; assemblies in only 10 hours. Rugged high impact plastic cabinet measures a compact 11⅞” H X 15½” W X 9¾” D. 27 lbs.

Kit GR-104 $119.95

Turn Page For More New Kits From HEATH

February-March, 1967
9 Kit-Giving Ideas From Heath...

Harmony-by-Heathkit® Electric Guitars & Heathkit Guitar Amplifier

NEW Heathkit Transistor Guitar Amplifier
60 watts peak power; two channels — one for accompaniment, accordion, organ, or mike; — the other for special effects... with both variable reverb and tremolo; 2 inputs each channel; two foot switches for reverb & tremolo; two 12" heavy-duty speakers; line bypass reversing switch for hum reduction; one easy-to-build circuit board with 13 transistors, 6 diodes; 28" W. x 9" D. x 19" H. leather-textured black vinyl cabinet of 3/4" stock; 120 v. or 240 v. AC operation; extruded aluminum front panel. 44 lbs.

American Made Harmony-By-Heathkit Guitars
All guitars include instruction book, tuning record, pick, connecting cord, deluxe red leather cushioned neck strap and chipboard carrying case. All wood parts assembled and factory finished — you just mount metal parts, pickups & controls in pre-drilled holes and install strings.

Deluxe Guitar... 3 Pickups... Hollow Body
Double-cutaway for easy fingering of 16 frets; ultra-slim fingerboard — 241/2" scale; ultra-slim "uniform feel" neck with adjustable Torque-Lok reinforcing rod; 3 pickups with individually adjustable pole-pieces under each string for emphasis and balance; 3 silent switches select 7 pickup combinations; 6 controls for pickup tone and volume; professional Bigsby vibrato tail-piece; curly maple arched body — 2" rim — shaded cherry red. 17 lbs.

Silhouette Solid-Body Guitar... 2 Pickups
Modified double cutaway leaves 15 frets clear of body; ultra-slim fingerboard — 241/2" scale; ultra-slim neck for "uniform feel"; Torque-Lok adjustable reinforcing rod; 2 pickups with individually adjustable pole-pieces under each string; 4 controls for tone and volume; Harmony type 'W' vibrato tail-piece; curved maple arched body, 1 1/2" rim, shaded cherry red. 13 lbs.

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

NEW! Deluxe Solid-State FM/FM Stereo Table Radio

Tuner and IF section same as used in deluxe Heathkit transistor stereo components. Other features include automatic switching to stereo; fixed AFC; adjustable phase for best stereo; two 51/2" PM speakers; clutched volume control for individual channel adjustment; compact 19" W x 61/2" D x 91/4" H size; preassembled, prealigned "front-end"; walnut cabinet; simple 10-hour assembly. 17 lbs.
Something For Everyone

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

Save $170 by doing the easy assembly yourself. Features solid-state circuitry; 4-track stereo or mono playback and record at 7½ & 3½ ips; sound-on-sound, sound-with-sound and echo capabilities; 3 separate motors; solenoid operation; die-cast top-plate, flywheel and capstan shaft housing; all push-button controls; automatic shut-off; plus a host of other professional features. 45 lbs. Optional walnut base $19.95, adapter ring $4.75

Kit AD-18
$399.50
(less cabinet)

NEW Deluxe SB-301 Amateur Receiver Kit

New SB-301 receiver for 80 thru 10 meters with all crystals furnished, plus 15 to 15.5 MHz coverage for WWV; full RTTY capability; switch-selected ANL; front-paneling switching for control of 6 and 2 meter plug-in converters; crystal-controlled front-end for same rate tuning on all bands; 1 kHz dial calibrations, 100 kHz per revolution. 23 lbs. Matching SB-401 Transmitter, now with front-panel selection of independent or transceive operation...$285.00

Kit SB-301
$260.00
(less speaker)

2-Watt Walkie-Talkie

Assembled
GRS-65A
$99.95
New ... Factory Assembled. Up to 6 mile range; rechargeable battery; 9 silicon transistors, 2 diodes; superhet receiver; squelch; ANL; aluminum case. 3 lbs. 117 v. AC battery charger & cigarette lighter charging cord $9.95. Crystals $1.99 ea.

NEW Portable Phonograph Kit

All Transistor. Assembles in 1 to 2 hours. Preassembled 4-speed automatic mono changer; 4" x 6" speaker; dual Sapphire stylus; 45 rpm adaptor; olive & beige preassembled cabinet; 117 v. AC. 23 lbs.

Kit GD-16
$39.95

FREE

World’s Largest Electronic Kit Catalog!

108 pages ... many in full color ... describe these and over 250 easy-to-build Heathkits for color TV, stereo/hi-fi, CB, ham, marine, shortwave, test, educational, home and hobby items. Mail coupon for your free copy.

HEATH COMPANY, Dept. 19-2
Benton Harbor, Michigan 49022

□ Enclosed is $________________, plus shipping.
Please send model (s)________________.

□ Please send FREE 1967 Heathkit Catalog

Name ____________________________
Address ____________________________
City __________________ State _______ Zip ______

Prices & specifications subject to change without notice. CL-265

February-March, 1967
Starting this issue we have made our propagation forecasts even easier for shortwave listeners to use. If you are DXing at a certain hour, simply run down the left-hand column in the Forecast table until you find the appropriate time slot, then look across to the right and determine what is available on which bands for each major area in the world. Bands in brackets are promising second choices. Time intervals are for your local standard time. If you live in the Central Standard Time (CST) zone then use the Eastern column but deduct 1 hour.

### Peak DX Periods

<table>
<thead>
<tr>
<th>Area</th>
<th>Eastern (EST)</th>
<th>Western (PST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia (except Near East)</td>
<td>0000-0900</td>
<td>1800-0900</td>
</tr>
<tr>
<td>Europe, Near East &amp; Africa (N. of the Sahara)</td>
<td>1200-2400</td>
<td>1200-2400</td>
</tr>
<tr>
<td>Africa (S. of the Sahara)</td>
<td>1500-1800</td>
<td>1900-2300</td>
</tr>
<tr>
<td>South Pacific</td>
<td>0800-1200</td>
<td>1600-2000</td>
</tr>
<tr>
<td>Latin America</td>
<td>1800-2200</td>
<td>0400-0800</td>
</tr>
</tbody>
</table>

To use the table put your finger on the region you want to hear and log, move your finger down until it is along side the local standard time at which you will be listening and lift your finger. Underneath your pointing digit will be the shortwave band or bands that will give the best DX results. The time in the above propagation prediction table is given in standard time at the listener's location which effectively compensates for differences in propagation characteristics between the east and west coasts of North America. However, Asia and the South Pacific stations will generally be received stronger in the West while Europe and Africa will be easier to tune on the east coast. The shortwave bands in brackets are given as second choices. Refer to White's Radio Log for World-Wide Shortwave Broadcast Stations list.
Like peas and pods, tapes and cars are pretty much inseparable these days. For the cartridge player has at last found a home for itself—on countless highways and byways throughout the nation.

If there’s a Ford in your future, you may well find a stereo tape-cartridge system in it. And Ford’s not alone. For today’s boom in car-cartridge players is so big it’s second only to the craze for color TV. Some industry optimists even see highway hi-fi as the greatest thing to hit the recording industry since the LP.

But what’s the big deal about car-cartridge players? (They have, after all, been around for more than a decade.) And given four tracks (and often eight) at a tape speed of $3\frac{3}{4}$ ips (sometimes $1\frac{3}{8}$), the question is whether such players produce any stereo worth having. In short, just how bad is highway hi-fi?

The answer, as we’ll see shortly, depends on what we define as hi-fi and which particular highway hi-fi is under discussion. For the fact is that at the moment, there’s not one but three major and several minor systems for putting stereo tape in your car. The majors include the Fidelipac system, developed in 1956 by George Eash: the Lear-Jet system, introduced in 1965 and espoused by Ford and RCA Victor; and the Norelco system, introduced in 1964 but only recently adapted for automotive use.

Also clouding the picture is a major battle-of-the-systems. At the moment, the industry is going through a set-to reminiscent of the one between RCA Victor (with its 45s) and Columbia (with its then-new LPs) over a decade ago. Significantly enough, no system
t...
cars will have stereo tape playing systems."

Norelco. With all this activity, another cartridge system would seem to have little chance of gaining a foothold. Nevertheless, Norelco last year introduced a dashboard harness for its battery-operated portable tape-cartridge recorder and thus made a bid to capture part of the growing market. And the real breakthrough came when Norelco managed to persuade Mercury Records, Minnesota Mining, General Electric, Sony, Aiwa, Concord, Panasonic, and 31 other firms to adopt its system. Norelco-type players now cost from $70 to $100 and, unlike the others, are powered by self-contained flashlight batteries.

The Norelco system centers around a two-hub cartridge roughly a fifth the size of the other two. Similar to a design that was introduced by RCA in 1959, the Norelco model utilizes ¼-in. tape recorded at 1½ ips. At the moment, recording is twin-track mono only—but the developers plan to introduce compatible four-track stereo soon. Blank cartridges, which cost from $2.65 to $3.25, hold 45 minutes of uninterrupted recording and are available from Norelco, Mercury, and Minnesota Mining. Prerecorded cartridges will cost about $4.95 for 32 minutes (about the same price as a stereo LP).

Among the machines which now fill the Norelco car harness are the Norelco Carry-Corder ($89.95), the Mercury TS8000 ($89.95), the Wollensak 4100 ($89.95), and the General Electric M8300 Lively Set (about $90). Both Norelco and Mercury project four-track stereo models using ¼-in. tape at prices around $150.

The versatility of a 3-lb. recorder that operates equally well in a living room, at the beach, or under the dashboard—plus the fact that the owner can record his own fare—are the major assets of the Norelco system. Of course, given the know-how, it is possible to record Fidelipac tapes on a conventional four-track recorder, then load the tape into a cartridge. And Soundex now offers a Lear-Jet record/playback deck, while Roberts has introduced eight-track cartridge record/playback as an extra feature on its model 1725-8L recorder.

But for the most part, Fidelipac and Lear users are limited to commercially-recorded cartridges. At press time, there were only 50 prerecorded Norelco-type cartridges—all monaural, and all from the Mercury, Philips, Smash, Wing, and Limelight catalogs. But more were promised.

SJB, Tenna. For those who can't make up their minds as to which of the three major systems they prefer, there are a number of hybrid compatible units on the market. SJB's line, for example, includes six models, ranging in price from $100 to $170. The model ST308, at the bottom of the scale, comes with indicator light. For $130 you have a choice of model ST408, with indicator light and automatic light or model 603M/48, an all-chrome unit with speakers, adjustable bracket, cigarette lighter plug, and carrying handle. Another $10 adds FM radio to the ST308. Shell out $170, and you have a choice of two compatible tape-FM units, models ST408/FM and 603M/48/FM.

Still another compatible unit comes from Tenna Corporation. Said to be the least expensive on the market, it sells for $69.95 and features automatic sensing of cartridge.

Mark 8 player by RCA Victor permits use of 8-track car-cartridge tapes anywhere in the home. Device comes in two models: unit at left contains built-in speakers, while model below must be attached to stereo system.
taped sings
the song of the
open road

automatic switch-on, a reject bar, and optional foot switch control.

Homeward Bound. With most of the cartridge problems licked, manufacturers are beginning to design players for the living room (and a few models which can be connected directly to a component hi-fi system). Accepting Lear-Jet cartridges are Soundex's $80 player, RCA's Mark 8, and models from Lear-Jet, Roberts, and General Electric. Fidelipac units are available from Muntz Stereo-Pak, Telepro, SJB, and others.

Among the four-track home players are Telepro's Satellite II; and Muntz's A-HW-1, AR-300 and AR-400. The latter two are complete home-entertainment centers with record changer, amplifier and tape-cartridge handler. The AR-400, mounted in a cabinet, also contains two speaker systems, while the AR-300 is the heart of a stereo compact system.

Installation. In theory, some of the prices quoted by manufacturers include installation of the player in your car. In practice, you can save money on virtually any model by installing the unit yourself. Just how much work is involved depends on the type of unit you buy. The Norelco models, for example, simply slip into their harness with no additional work required. Those which operate through an existing car radio fit in a bracket mounted below the dashboard. (You'll also have to connect the player output to the radio amplifier—often merely a matter of inserting a jack.)

The most complicated to mount are the stereo models with speakers, since you'll have to cut holes for the speakers in your door panels. Which tools you'll need depends on the type of padding your car has inside the door. Speaker brackets and protectors usually are supplied with the do-it-yourself kits. Wiring from the player to the speakers is fairly simple, and consists of tucking the wire up under the dash, then running it through the panelling to the point where it meets the door frame.

Sound-Box-On-Wheels. Where does it all lead? Surely eight-track tape must have a significantly higher tape hiss than four-track? And isn't it logical to expect 3 3/4-ips or 1 1/2-ips recordings to sound inferior to 7 1/2 ips? Actually, there's an aural trick involved. Tapes that sound very ordinary in a living room sound very good (if not excellent) in a car. The trick is similar to the one which permits 3 1/2-in. speakers in stereo headphones to produce such startling bass tones.

In short, much of the system's success stems from the setup itself; you're enclosed in a relatively small space with two speakers and are in effect smack in the middle of a veritable sound-box-on-wheels. At the same time, road and traffic noises mask any imperfections in the recording or the equipment so that you hear—or think you hear—strikingly good sound.

In the living room, however, it can be (Continued on page 115)

Unlike both Fidelipac and Lear-Jet systems, Norelco's cartridge contains two separate reel hubs that unwind and wind in standard fashion. Cassette (seen in hand in photo at right) can be used with car-player (below) or even AM/FM/SW portable.
An up-to-date Broadcasting Directory of North American AM, FM and TV Stations. Including a Special Section on World-Wide Shortwave Stations.

In this issue of White's Radio Log we have included the following listings: U.S. AM Stations by Frequency, Canadian AM Stations by Frequency, U.S. Commercial Television Stations by States, U.S. Educational Television Stations by States, Canadian Television Stations by Cities, and the World-Wide Shortwave Stations.

In Our Next Issue, April-May, 1967, the Log will contain the following listings: U.S. AM Stations by Location, U.S. FM Stations by States, Canadian AM Stations by Location, Canadian FM Stations by Location, and the expanded Shortwave Section. The shortwave listings will always be completely revised in each issue of Log to insure 100 percent up-to-date information.

In the June-July, 1967, issue of Radio-TV Experimenter, the Log will contain the following listings: U.S. AM Stations by Call Letters, U.S. FM Stations by Call Letters, Canadian AM Stations by Call Letters, Canadian FM Stations by Call Letters, and the expanded World-Wide Shortwave Section.

Therefore, in any three consecutive 1967 issues of Radio-TV Experimenter magazines, you will have a complete cross-reference listings of White's Radio Log that is always up-to-date. The three consecutive issues are a complete volume of White's Radio Log that offers up to the minute listings that can not be offered in any other magazine or book. If you are a broadcast band DX'er, FM station logger, like to photograph distant TV test patterns, or tune the short-wave bands, you will find the new White's Radio Log format an unbeatable reference.
<table>
<thead>
<tr>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>540—555.5</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>560—575.5</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>580—585.5</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>590—605.5</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>610—625.5</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>630—645.5</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>650—665.5</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>670—685.5</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>690—705.5</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>710—725.5</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
</tbody>
</table>

**U.S. AM Stations by Frequency**

<table>
<thead>
<tr>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>540</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>560</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>580</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>590</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>610</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>630</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>650</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>670</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>690</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
<tr>
<td>710</td>
<td>WP</td>
<td>WBAF, Portland, Ore.</td>
</tr>
</tbody>
</table>

**Every effort has been made to ensure accuracy of the information listed in this publication, but absolute accuracy is not guaranteed and, of course, only information available up to press-time could be included. Copyright 1966 by Science & Mechanics Publishing Co., a subsidiary of Davies Publications, Inc., 505 Park Avenue, New York, New York 10022.**

---

**Radio-TV EXPERIMENTER**
<table>
<thead>
<tr>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>740</td>
<td>405.2</td>
<td>500</td>
<td>750</td>
<td>398.0</td>
<td>500</td>
<td>760</td>
<td>395.4</td>
<td>500</td>
<td>770</td>
<td>393.9</td>
<td>500</td>
</tr>
<tr>
<td>WBAM Montgomery, Ala.</td>
<td>5000</td>
<td>KGED Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WBAMU Montgomery, Ala.</td>
<td>1000</td>
<td>KGDC Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WMCY San Francisco, Calif.</td>
<td>5000</td>
<td>KCBM Burlington, Vt.</td>
<td>1000</td>
<td>KGDF Anchorage, Alaska</td>
<td>1000</td>
<td>KOGU Phoenix, Ariz.</td>
<td>1000</td>
<td>KGDO Anchorage, Alaska</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Radio-TV Experimenter
<table>
<thead>
<tr>
<th>Call Letters</th>
<th>Frequency (kHz)</th>
<th>City, State</th>
</tr>
</thead>
<tbody>
<tr>
<td>KDWB</td>
<td>1230</td>
<td>St. Paul, Minn.</td>
</tr>
<tr>
<td>KFWY</td>
<td>1230</td>
<td>El Paso, Texas</td>
</tr>
<tr>
<td>KGGM</td>
<td>1230</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Dallas, Texas</td>
</tr>
<tr>
<td>KMCO</td>
<td>1230</td>
<td>Madison, Wis.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Indianapolis, Ind.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Des Moines, Iowa</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Nashville, Tenn.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Buffalo, N.Y.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Washington, D.C.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>St. Louis, Mo.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Boston, Mass.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Detroit, Mich.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>New York, N.Y.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>New Orleans, La.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Boston, Mass.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Detroit, Mich.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>New York, N.Y.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>New Orleans, La.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Boston, Mass.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Detroit, Mich.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>New York, N.Y.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>New Orleans, La.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Boston, Mass.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Detroit, Mich.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>New York, N.Y.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>New Orleans, La.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Boston, Mass.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Detroit, Mich.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>New York, N.Y.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>New Orleans, La.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Boston, Mass.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Detroit, Mich.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>New York, N.Y.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>New Orleans, La.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Boston, Mass.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Detroit, Mich.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>New York, N.Y.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>New Orleans, La.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Boston, Mass.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Detroit, Mich.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>New York, N.Y.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Los Angeles, Calif.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>Chicago, Ill.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>New Orleans, La.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>San Francisco, Calif.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Boston, Mass.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Detroit, Mich.</td>
</tr>
<tr>
<td>KMAC</td>
<td>1230</td>
<td>New York, N.Y.</td>
</tr>
<tr>
<td>KMAI</td>
<td>1230</td>
<td>Los Angeles, Calif.</td>
</tr>
</tbody>
</table>
WLEL Batesville, Miss.
KBGS Bismark, N.D.
KGO Missoula, Mont.
KOIL Omaha, Neb.
WRG New York, N.Y.
KSRD Socorro, N.M.
KWSO Binghamton, N.Y.
KONO Alexandria, Va.
WEYE San Francisco, Cal.
WOMPI Bellefonte, Ohio
WIPD Rapid City, S.D.
KUAND Duluth, Minn.
KAPY Altoona, Pa.
WFBG Altona, Pa.
WFEG Sunbury, Pa.
WFIG Sumter, S.C.
WATO Oakland, Cal.
KBMC Kalamazoo, Mich.
KIVY Crockett, Tex.
KTRM Wichita Falls, Tex.
KMRD Atlanta, Ga.
WAGE Lebanon, Pa.
KUMA Pendleton, Ore.
KGSJ Woodbridge, Va.
KMYZ Winsted, Minn.
KAPF Farmville, Va.
KWEJ Grand Forks, N.D.
KAPW Laredo, Tex.
KOMI Lewiston, Idaho
WOSC Memphis, Tenn.
KANB St. Louis, Mo.
WERI Cleveland, Ohio
WRRC Spring Valley, N.Y.
WYSC Athens, Ga.
WRES Elizabethton, Tenn.
WWSL Lake Wales, Fla.
KWHI Kershaw, S.C.
WWSN Oneida, Tenn.
WZOK Jacksonville, Fla.
KABK Knoxville, Tenn.
KFMN Panama City, Fla.
KZMX Laramie, Wyo.
KSKY Nashville, Tenn.
WBRT Rensselaer, N.Y.
KINX St. Petersburg, Fla.
WPXW Winton, Cal.
KAPA Albuquerque, N.M.
KCAR Chatham, Mass.
WCCW Traverse City, Mich.
KBIA Iowa City, Iowa
WJNO New Haven, Conn.
KCIJ Pocatello, Idaho
WZCB Truro, Mass.
KGBV Traverse City, Mich.
KSGM St. Genevieve, Mo.
KZAM Altus, Okla.
KSLB Ashland, Ky.
Kobra Frankfort, Ill.
WHKI Hammond, Ind.
WACU Alhambra, Calif.
KGIL Elgin, Ill.
KQBR Westfield, Mass.
KVGX Iola, Wis.
KSKY Aiken, S.C.
WABW Pottsville, Pa.
WRDR Lake City, Fla.
WJAF Grinnell, Iowa
WRTR Oneida, Tenn.
WJWJ Des Moines, Iowa
KARX Boone, Iowa
KQSD Kiel, Wis.
KOCN Kankakee, Ill.
KQX Savannah, Ga.
KQSK Evarsvllle, Wash.
KDME Gridley, Calif.
WEUN Altoona, Pa.
KCEC Jefferson, Wis.
KQTX St. Joseph, Mo.
KGMX San Luis Obispo, Calif.
KQTV Wallingford, Conn.
KQWM Pullman, Wash.
KQDL Mc Allen, Tex.
KQFB Laramie, Wyo.
KQLV Oklahoma City, Okla.
KQRL Shreveport, La.
KQNL Charlotte, N.C.
KQVD Battle Creek, Mich.
KQRS Kansas City, Kans.
WMSI Bangor, Maine
WMAI Ashland, Ky.
WBOB Murray, Ky.
KVOK Baton Rouge, La.
KRMX Okmulgee, Okla.
WHWT Shreveport, La.
WBER Bakersfield, Calif.
WCBU Corpus Christi, Tex.
WMKF Hickory, N.C.
WWNE New Bedford, Mass.
W2CW Bad Axe, Mich.
WAVP Grand Rapids, Mich.
KAPM Waukesha, Wisc.
KAPW San Antonio, Tex.
KAPM Brownsville, Tex.
WHEP Cleveland, Ohio
WYGB Carbondale, Ill.
KWHH Allentown, Pa.
KDFR Morristown, N.J.
WYOM Kirtland, N.M.
WYSH Greenville, Miss.
WNSM Newberry, S.C.
WYEX Detroit, Mich.
WYAN Alto, Pa.
KAMW Punta Gorda, Fla.
WYAM Little Rock, Ark.
WYO Waco, Tex.
WYKI Orlando, Fla.
KAMCO Decatur, Ill.
WYLA Boyd, Tex.
KAMQR Garden City, Kans.
KAOM Louisville, Ky.
WYLL Charleston, W.Va.
KAMZ Oklahoma City, Okla.
<table>
<thead>
<tr>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1400-211.1</td>
<td>WACI Tuculosa, Ala.</td>
<td>3000d</td>
<td>1400-208.2</td>
<td>WHBY Montgomery, Ala.</td>
<td>3000d</td>
</tr>
<tr>
<td>1420</td>
<td>WACT Tuscaloosa, Ala.</td>
<td>3000d</td>
<td>1420</td>
<td>WACO Temple, Tex.</td>
<td>3000d</td>
</tr>
<tr>
<td>1450</td>
<td>WDCE Washington, D.C.</td>
<td>3000d</td>
<td>1450</td>
<td>WDGC Washington, D.C.</td>
<td>3000d</td>
</tr>
<tr>
<td>1500</td>
<td>WAAL Laurel, Miss.</td>
<td>5000d</td>
<td>1500</td>
<td>WFTY Muckaloosa, Miss.</td>
<td>5000d</td>
</tr>
<tr>
<td>1550</td>
<td>WBOB New York, N.Y.</td>
<td>5000d</td>
<td>1550</td>
<td>WAPA Rochester, N.Y.</td>
<td>5000d</td>
</tr>
<tr>
<td>1600</td>
<td>WHTF Buffalo, N.Y.</td>
<td>5000d</td>
<td>1600</td>
<td>WHTN Des Moines, Iowa</td>
<td>5000d</td>
</tr>
<tr>
<td>1650</td>
<td>WTVG Chicago, Ill.</td>
<td>5000d</td>
<td>1650</td>
<td>WVBQ Scranton, Pa.</td>
<td>5000d</td>
</tr>
<tr>
<td>1700</td>
<td>WBBM Chicago, Ill.</td>
<td>5000d</td>
<td>1700</td>
<td>WBBN Chicago, Ill.</td>
<td>5000d</td>
</tr>
<tr>
<td>1750</td>
<td>WBBM Chicago, Ill.</td>
<td>5000d</td>
<td>1750</td>
<td>WBBN Chicago, Ill.</td>
<td>5000d</td>
</tr>
<tr>
<td>1800</td>
<td>WXLW Columbus, Ohio</td>
<td>5000d</td>
<td>1800</td>
<td>WXLW Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>1850</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>1850</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>1900</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>1900</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>1950</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>1950</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2000</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2000</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2050</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2050</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2100</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2100</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2150</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2150</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2200</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2200</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2250</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2250</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2300</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2300</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2350</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2350</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2400</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2400</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2450</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2450</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
<tr>
<td>2500</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
<td>2500</td>
<td>WOUB Columbus, Ohio</td>
<td>5000d</td>
</tr>
</tbody>
</table>

**February-March, 1967**

---

**Note:** The table above contains a list of radio stations and their wave lengths, along with additional information such as city names and states. The data is presented in a clear and organized manner, making it easy to read and understand.
<table>
<thead>
<tr>
<th>kHz</th>
<th>Wave Length</th>
<th>W.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>540</td>
<td>555.5</td>
<td>CBK Regina, Sask. 50,000</td>
</tr>
<tr>
<td>550</td>
<td>545.1</td>
<td>CFB Sudbury, Ont. 1,000</td>
</tr>
<tr>
<td>560</td>
<td>525.4</td>
<td>CFOS Owen Sound, Ont. 1,000</td>
</tr>
<tr>
<td>570</td>
<td>526.0</td>
<td>CJFK Corner Brook, Nfld. 1,000</td>
</tr>
<tr>
<td>580</td>
<td>516.9</td>
<td>CFRA Ottawa, Ont. 50,000</td>
</tr>
<tr>
<td>590</td>
<td>508.2</td>
<td>CHLC Hau terve, Que. 5,000</td>
</tr>
<tr>
<td>600</td>
<td>499.7</td>
<td>CFAR Flin Flon, Man. 10,000</td>
</tr>
<tr>
<td>610</td>
<td>491.7</td>
<td>CHNC New Carlisle, Que. 10,000</td>
</tr>
<tr>
<td>620</td>
<td>483.6</td>
<td>CFCL Timmins, Ont. 10,000</td>
</tr>
<tr>
<td>630</td>
<td>475.9</td>
<td>CKCK Regina, Sask. 10,000</td>
</tr>
<tr>
<td>640</td>
<td>468.5</td>
<td>CBM St. John's, Nfld. 10,000</td>
</tr>
<tr>
<td>650</td>
<td>459.0</td>
<td>CHF A Edmonton, Alta. 10,000</td>
</tr>
<tr>
<td>660</td>
<td>450.2</td>
<td>CBS Radio, Ont. 10,000</td>
</tr>
<tr>
<td>670</td>
<td>440.2</td>
<td>CHD Hamilton, Ont. 10,000</td>
</tr>
<tr>
<td>680</td>
<td>434.5</td>
<td>CFRG Montreal, Que. 10,000</td>
</tr>
<tr>
<td>690</td>
<td>425.7</td>
<td>CIJR Blind River, Ont. 10,000</td>
</tr>
<tr>
<td>700</td>
<td>422.3</td>
<td>CIJS Marcelin, Ont. 10,000</td>
</tr>
<tr>
<td>710</td>
<td>410.7</td>
<td>CIK Grand Bank, Nfld. 10,000</td>
</tr>
<tr>
<td>720</td>
<td>407.0</td>
<td>CIK North Vancouver, B.C. 10,000</td>
</tr>
<tr>
<td>730</td>
<td>402.3</td>
<td>CIJN Lethbridge, Alta. 10,000</td>
</tr>
<tr>
<td>740</td>
<td>393.3</td>
<td>CIJN Medicine Hat, Alta. 10,000</td>
</tr>
<tr>
<td>750</td>
<td>384.6</td>
<td>CIJN Edmonton, Alta. 10,000</td>
</tr>
<tr>
<td>760</td>
<td>375.9</td>
<td>CIJN Red Deer, Alta. 10,000</td>
</tr>
<tr>
<td>770</td>
<td>366.2</td>
<td>CIJN Calgary, Alta. 10,000</td>
</tr>
<tr>
<td>780</td>
<td>356.3</td>
<td>CIJN Kelowna, B.C. 10,000</td>
</tr>
<tr>
<td>790</td>
<td>346.6</td>
<td>CIJN Vancouver, B.C. 10,000</td>
</tr>
<tr>
<td>800</td>
<td>336.9</td>
<td>CIJN Victoria, B.C. 10,000</td>
</tr>
<tr>
<td>810</td>
<td>326.2</td>
<td>CIJN Prince Albert, Sask. 10,000</td>
</tr>
<tr>
<td>820</td>
<td>316.5</td>
<td>CIJN Dryden, Ont. 10,000</td>
</tr>
<tr>
<td>830</td>
<td>306.8</td>
<td>CIJN Moncton, N.B. 10,000</td>
</tr>
<tr>
<td>840</td>
<td>296.1</td>
<td>CIJN Fredericton, N.B. 10,000</td>
</tr>
<tr>
<td>850</td>
<td>286.4</td>
<td>CIJN Saint John, N.B. 10,000</td>
</tr>
<tr>
<td>860</td>
<td>276.7</td>
<td>CIJN Sydney, N.S. 10,000</td>
</tr>
<tr>
<td>870</td>
<td>267.0</td>
<td>CIJN Charlottetown, P.E.I. 10,000</td>
</tr>
<tr>
<td>880</td>
<td>257.3</td>
<td>CIJN Moncton, N.B. 10,000</td>
</tr>
<tr>
<td>890</td>
<td>247.6</td>
<td>CIJN Fredericton, N.B. 10,000</td>
</tr>
<tr>
<td>900</td>
<td>237.9</td>
<td>CIJN Saint John, N.B. 10,000</td>
</tr>
<tr>
<td>910</td>
<td>228.2</td>
<td>CIJN Sydney, N.S. 10,000</td>
</tr>
<tr>
<td>920</td>
<td>218.5</td>
<td>CIJN Charlottetown, P.E.I. 10,000</td>
</tr>
<tr>
<td>930</td>
<td>208.8</td>
<td>CIJN Moncton, N.B. 10,000</td>
</tr>
<tr>
<td>940</td>
<td>199.1</td>
<td>CIJN Fredericton, N.B. 10,000</td>
</tr>
<tr>
<td>950</td>
<td>189.4</td>
<td>CIJN Saint John, N.B. 10,000</td>
</tr>
<tr>
<td>960</td>
<td>179.7</td>
<td>CIJN Sydney, N.S. 10,000</td>
</tr>
<tr>
<td>970</td>
<td>169.9</td>
<td>CIJN Charlottetown, P.E.I. 10,000</td>
</tr>
<tr>
<td>980</td>
<td>159.2</td>
<td>CIJN Moncton, N.B. 10,000</td>
</tr>
<tr>
<td>990</td>
<td>149.5</td>
<td>CIJN Fredericton, N.B. 10,000</td>
</tr>
</tbody>
</table>

**Canadian AM Stations by Frequency**

Canadian stations listed alphabetically by call letters within groups. Abbreviations: kHz, frequency in kilocycles; W.P., power in watts; d, operates daytime only; n, operates nighttime only. Wave length is given in meters.
U. S. Commercial Television Stations by States

U. S. stations listed alphabetically within state groupings. Territories and possessions follow states.

Channel; C.L. = call letters.
World-Wide Shortwave Stations

With this copy of White's Radio Log at your operating desk you will be able to quickly identify and spot over 300 international broadcasting stations—the majority of the currently active stations being monitored by our readers and by the RADIO-TV EXPERIMENTER monitoring station, DX Central.

Each issue brings you a completely revised and updated version of the shortwave section which reflects new frequencies and schedule changes by the broadcasters. Our list may lack only one thing, that is your personal listening experiences.

Yes, we find that the best way to compile a listing of active shortwave stations is to rely upon the latest reception loggings of our readers and, although we know that thousands of our readers make use of White's, only a handful of readers take the trouble to send us a copy of their loggings. Naturally we don't expect to hear from each and every reader for each and every issue, but we would like to hear from you at least once in a while. Why not let us know when you stumble upon particularly difficult station to log, or when you come upon a revised broadcast schedule, you might even tell us if a regularly heard station has left the air.

In your report to us please indicate the name and/or call of the station, the location, the approximate frequency, and the time (in GMT) monitored. Send as many as you like. We will use as many as we can.


<table>
<thead>
<tr>
<th>kHz</th>
<th>Call</th>
<th>Name</th>
<th>Location</th>
<th>GMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2410</td>
<td>4VU</td>
<td>R. Lumiere</td>
<td>Port au Prince,</td>
<td>0140</td>
</tr>
<tr>
<td>2455</td>
<td>3910</td>
<td>R. Zambia</td>
<td>Lusaka, Zambia</td>
<td>0455</td>
</tr>
</tbody>
</table>

31 Meter Band—9500 to 9775 Kc/s

<table>
<thead>
<tr>
<th>kHz</th>
<th>Call</th>
<th>Name</th>
<th>Location</th>
<th>GMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3215</td>
<td>BED59</td>
<td>V. of Free China</td>
<td>Taipeh, Formosa</td>
<td>1245</td>
</tr>
<tr>
<td>3225</td>
<td>ELWA</td>
<td>R. Village</td>
<td>Monrovia, Liberia</td>
<td>0815</td>
</tr>
<tr>
<td>3230</td>
<td>VRH8</td>
<td>Fiji BC</td>
<td>Suva, Fiji Is.</td>
<td>0945</td>
</tr>
<tr>
<td>3240</td>
<td>BC</td>
<td>Service Rep. Iraq</td>
<td>Baghdad, Iraq</td>
<td>1930</td>
</tr>
<tr>
<td>3245</td>
<td>YYKT</td>
<td>R. Libertador</td>
<td>Caracas, Venezuela</td>
<td>2325</td>
</tr>
<tr>
<td>3275</td>
<td>ZYR31</td>
<td>Bauru R. Club</td>
<td>Bauru Brazil</td>
<td>0530</td>
</tr>
<tr>
<td>3394</td>
<td>VRH1</td>
<td>Fiji BC</td>
<td>Suva, Fiji Is.</td>
<td>0930</td>
</tr>
<tr>
<td>3400</td>
<td>BC</td>
<td>Brazil, Mtd. BC</td>
<td>Belize, Brit.</td>
<td>0920</td>
</tr>
<tr>
<td>3400</td>
<td>BC</td>
<td>Brazil, Mtd. BC</td>
<td>Honduras</td>
<td>0240</td>
</tr>
<tr>
<td>3005</td>
<td>VYKK</td>
<td>V. de la Patria</td>
<td>Caracas Venezuela</td>
<td>0240</td>
</tr>
<tr>
<td>3315</td>
<td>RC</td>
<td>Martinique</td>
<td>Ft. de France, Martigny</td>
<td>0100</td>
</tr>
<tr>
<td>3316</td>
<td>SIERRA</td>
<td>Leonne BC</td>
<td>Freetown, Sierra</td>
<td>0100</td>
</tr>
<tr>
<td>3325</td>
<td>YGRA</td>
<td>R. Monagas</td>
<td>Maturin Venezuela</td>
<td>0240</td>
</tr>
<tr>
<td>3335</td>
<td>VLYCD</td>
<td>R. Wewak</td>
<td>Wewak Paua</td>
<td>1000</td>
</tr>
<tr>
<td>3346</td>
<td>RZ</td>
<td>R. Zambila</td>
<td>Luwaka Zambia</td>
<td>2000</td>
</tr>
<tr>
<td>3350</td>
<td>GHANA</td>
<td>Ghana BC</td>
<td>Accra, Ghana</td>
<td>0605</td>
</tr>
<tr>
<td>3375</td>
<td>YM1</td>
<td>V. de la Fe</td>
<td>Maracaibo, Venezuela</td>
<td>0245</td>
</tr>
<tr>
<td>3385</td>
<td>HIDA</td>
<td>R. Hit Musical</td>
<td>Santo Domingo, Dom. Rep.</td>
<td>1100</td>
</tr>
<tr>
<td>3395</td>
<td>HIAZ</td>
<td>R. Santiago</td>
<td>Santo Domingo, Dom. Rep.</td>
<td>1100</td>
</tr>
</tbody>
</table>

60-Meter Band—4750-5060 kHz

<table>
<thead>
<tr>
<th>kHz</th>
<th>Call</th>
<th>Name</th>
<th>Location</th>
<th>GMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4770</td>
<td>ELWA</td>
<td>R. Village</td>
<td>Monrovia Lberia</td>
<td>0615</td>
</tr>
<tr>
<td>4795</td>
<td>RY</td>
<td>R. Commercial</td>
<td>Sa da Bandeira, Angola</td>
<td>2330</td>
</tr>
<tr>
<td>4815</td>
<td>HRV</td>
<td>R. Rodrigues</td>
<td>Osagadaouqua, Angola</td>
<td>0600</td>
</tr>
<tr>
<td>4820</td>
<td>HRV</td>
<td>R. Evangelica</td>
<td>Tupacapanca, Peru</td>
<td>0600</td>
</tr>
<tr>
<td>4860</td>
<td>VYQ</td>
<td>R. Muhammad</td>
<td>Mauritius BC</td>
<td>1300</td>
</tr>
<tr>
<td>4856</td>
<td>CS67</td>
<td>E. Regional</td>
<td>Cuma, Venezula</td>
<td>0030</td>
</tr>
<tr>
<td>4872</td>
<td>RY</td>
<td>R. Dahaney</td>
<td>Ponta Delgada, Azores</td>
<td>2230</td>
</tr>
<tr>
<td>4875</td>
<td>RZ</td>
<td>R. Dahaney</td>
<td>Ponta Delgada, Azores</td>
<td>2230</td>
</tr>
<tr>
<td>4885</td>
<td>ZYG26</td>
<td>R. Pioneira de Teresina</td>
<td>Teresina, Brazil</td>
<td>0230</td>
</tr>
<tr>
<td>4914</td>
<td>HRSY</td>
<td>V. del Pacifico</td>
<td>San Lorenzo, Honduras</td>
<td>0315</td>
</tr>
<tr>
<td>4915</td>
<td>HGA</td>
<td>Ghana BC</td>
<td>Accra, Ghana</td>
<td>0330</td>
</tr>
<tr>
<td>4920</td>
<td>RY</td>
<td>R. Cordace</td>
<td>Bujumbura, Burundi</td>
<td>0400</td>
</tr>
</tbody>
</table>

February-March, 1967
<table>
<thead>
<tr>
<th>kHz</th>
<th>Call</th>
<th>Name</th>
<th>Location</th>
<th>GMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4926</td>
<td>EAJ206</td>
<td>R. Equatorial</td>
<td>Bate, Spanish</td>
<td>2130</td>
</tr>
<tr>
<td>4940</td>
<td></td>
<td>R. Abidjan</td>
<td>Abidjan, Ivory Coast</td>
<td>2300</td>
</tr>
<tr>
<td>4950</td>
<td></td>
<td>R. du Senegal</td>
<td>Dakar, Senegal</td>
<td>0630</td>
</tr>
<tr>
<td>4955</td>
<td>PRF7</td>
<td>R. Cultura de Campos</td>
<td>Campos, Brazil</td>
<td>1030</td>
</tr>
<tr>
<td>4965</td>
<td></td>
<td>R. Zambila</td>
<td>Lusaka, Zambia</td>
<td>1830</td>
</tr>
<tr>
<td>4970</td>
<td>YVLK</td>
<td>R. Rumbos</td>
<td>Caracas, Venezuela</td>
<td>2430</td>
</tr>
<tr>
<td>4985</td>
<td>ZYTV</td>
<td>R. Brazil Central</td>
<td>Goiana, Brazil</td>
<td>0900</td>
</tr>
<tr>
<td>5010</td>
<td></td>
<td>R. Geroua</td>
<td>Georgia, Cameroon 2115</td>
<td></td>
</tr>
<tr>
<td>5041</td>
<td></td>
<td>E. de Guine</td>
<td>Bissau, Port.</td>
<td>2230</td>
</tr>
<tr>
<td>5047</td>
<td></td>
<td>R. du Togo</td>
<td>Lome, Togo</td>
<td>2200</td>
</tr>
<tr>
<td>5050</td>
<td></td>
<td>R. Tanzania</td>
<td>Dar es Salaam, Tanzania</td>
<td>1830</td>
</tr>
<tr>
<td>5250</td>
<td>HCP55</td>
<td>Ondas Canarias</td>
<td>Atogues, Ecuador</td>
<td>0250</td>
</tr>
<tr>
<td>5260</td>
<td></td>
<td>R. Alma Ata</td>
<td>Alma Ata, USSR</td>
<td>0410</td>
</tr>
<tr>
<td>5285</td>
<td>HRN</td>
<td>V. de Honduras</td>
<td>Tegucigalpa, Honduras</td>
<td>1130</td>
</tr>
<tr>
<td>5390</td>
<td></td>
<td>R. Prague</td>
<td>Prague, Czech</td>
<td>0100</td>
</tr>
</tbody>
</table>

### 49 Meter Band—5950 to 6200 kHz

<table>
<thead>
<tr>
<th>kHz</th>
<th>Call</th>
<th>Name</th>
<th>Location</th>
<th>GMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5950</td>
<td></td>
<td>R. Warsaw</td>
<td>Warsaw, Poland</td>
<td>1530</td>
</tr>
<tr>
<td>5955</td>
<td></td>
<td>R. Zelveya</td>
<td>Bluefields, Nicaragua</td>
<td>1100</td>
</tr>
<tr>
<td>5960</td>
<td></td>
<td>R. Casino</td>
<td>Puerto Lomín, Costa Rica</td>
<td>1100</td>
</tr>
<tr>
<td>5970</td>
<td></td>
<td>Trans World R.</td>
<td>Bonaire, Neth.</td>
<td></td>
</tr>
<tr>
<td>5970</td>
<td></td>
<td>R. Alma Ata</td>
<td>Alme Ata, USSR</td>
<td>0410</td>
</tr>
<tr>
<td>5980</td>
<td></td>
<td>Gronlands R.</td>
<td>Godthab, Greenland</td>
<td></td>
</tr>
<tr>
<td>5990</td>
<td></td>
<td>R. Demerara</td>
<td>Georgetown, Guyana</td>
<td>0950</td>
</tr>
<tr>
<td>6010</td>
<td>VUD</td>
<td>All India R.</td>
<td>Stockholm, Sweden</td>
<td>0230</td>
</tr>
<tr>
<td>6020</td>
<td></td>
<td>PCJ</td>
<td>N. of West</td>
<td>Lisbon, Portugal</td>
</tr>
<tr>
<td>6040</td>
<td>CFVP</td>
<td>V. of Praries</td>
<td>Lagos, Nigeria</td>
<td>0520</td>
</tr>
<tr>
<td>6040</td>
<td>JHCB</td>
<td>V. del Tolima</td>
<td>Ibagu, Colombia</td>
<td>0215</td>
</tr>
<tr>
<td>6055</td>
<td></td>
<td>R. Prague</td>
<td>Prague, Czech</td>
<td>0700</td>
</tr>
<tr>
<td>6060</td>
<td></td>
<td>R. Habana</td>
<td>Havana, Cuba</td>
<td>0100</td>
</tr>
<tr>
<td>6075</td>
<td>HIBD</td>
<td>R. Lieberdom</td>
<td>Santiago, Dom.</td>
<td>1100</td>
</tr>
<tr>
<td>6082</td>
<td>OAX2</td>
<td>R. Nacional</td>
<td>Lima, Peru</td>
<td>0200</td>
</tr>
<tr>
<td>6085</td>
<td>PCJ</td>
<td>R. Nederland</td>
<td>Hilversum, Netherlands</td>
<td>1500</td>
</tr>
<tr>
<td>6090</td>
<td></td>
<td>R. Kaduna</td>
<td>Caduha, Nigeria</td>
<td>0520</td>
</tr>
<tr>
<td>6095</td>
<td>LRY1</td>
<td>R. Belgrano</td>
<td>Buenos Aires, Argentina</td>
<td>0600</td>
</tr>
<tr>
<td>6100</td>
<td></td>
<td>BC Service Rep.</td>
<td>Baghdad, Iraq</td>
<td>1930</td>
</tr>
<tr>
<td>6110</td>
<td></td>
<td>R. Habana</td>
<td>Havana, Cuba</td>
<td>0100</td>
</tr>
<tr>
<td>6135</td>
<td></td>
<td>R. Habana</td>
<td>Havana, Cuba</td>
<td>0100</td>
</tr>
<tr>
<td>6145</td>
<td></td>
<td>R. Malaysia</td>
<td>Kuala Lumpur, Malaysia</td>
<td>1130</td>
</tr>
<tr>
<td>6160</td>
<td>OIX7</td>
<td>Finnish BC</td>
<td>Accra, Ghana</td>
<td>0330</td>
</tr>
<tr>
<td>6170</td>
<td></td>
<td>R. Warsaw</td>
<td>Helsinki, Finland</td>
<td>2100</td>
</tr>
<tr>
<td>6175</td>
<td></td>
<td>R. Habana</td>
<td>Nicosia, Cyprus</td>
<td>0257</td>
</tr>
<tr>
<td>6180</td>
<td>ETLF</td>
<td>R. V. Gospel</td>
<td>Warsaw, Poland</td>
<td>1530</td>
</tr>
<tr>
<td>6155</td>
<td>OE212</td>
<td>Australian R.</td>
<td>Havana, Cuba</td>
<td>0330</td>
</tr>
<tr>
<td>6160</td>
<td>HSK4</td>
<td>R. Thailand</td>
<td>Bangkok, Thailand</td>
<td>0415</td>
</tr>
<tr>
<td>6170</td>
<td></td>
<td>R. Habana</td>
<td>Bangkok, Thailand</td>
<td>0415</td>
</tr>
<tr>
<td>6185</td>
<td>CSA29</td>
<td>V. of West</td>
<td>Havana, Cuba</td>
<td>0210</td>
</tr>
</tbody>
</table>

### 31-Meter Band—5900-9775 kHz

CB—BUSINESS RADIO

SHORTWAVE RADIO

*93* Heath Co. has a new 23-channel all-transistor 5-watt CB rig at the lowest cost on the market, plus a full line of CB gear. See their new 10-band AM/FM/Shortwave portable and line of shortwave radios.

*101* If it's a CB product, chances are International Crystal has it listed in their colorful catalog. What can be wired or wired, accessory or test gear, this CB oriented company can be relied on fill that bill.

48. *Hy-Gain's* new CB antenna catalog is packed full of useful information and product data that every CB'er should know. Get a copy.

107. Get with the mobile set with Tram's XL'100. The new Titan CB base station, another Tram great, is worth knowing about.

111. Get the scoop on Versa-Transonic's Versa-Tenna with instant magnetic mounting. Antenna models available for CB'er's, hams and mobile units from 27 MHz to 1000 MHz.

49. Want to see the latest in communication receivers? National Radio Co. puts out a line of mighty fine components and their catalog will tell you all about them!

45. Catering to two-way radio buffs for 30 years, World Radio Laboratories has a new free catalog which includes the latest CB transceivers, etc. Quarterly fliers chock-full of bargains are also available.

50. Make your connection with Amphenol—the tune in to the latest on CB product news with specs and pics on new gear. Keep informed on Amphenol's new products.

100. You can get increased CB range and clarity using the "Cobra" transceiver with speech compressor—receiver sensitivity is excellent. Catalog sheet will be mailed by B & K Division of Dynascan Corporation.

54. A catalog for CB'er's, hams and experimenters, with outstanding values. Technics lists their latest CB transceivers, etc. Quarterly fliers chock-full of bargains are also available.

46. If a rugged low cost business/industrial (two-way radio is what you've been looking for, be sure to send for the brochure on E. F. Johnson Co.'s brand new Messenger "202."

102. Sentry Mfg. Co. has some interesting poop sheets on speechippers, converters, talk power kits and the like for Interested CB'er's, hams and SWL'er's, too.

103. Squires-Sanders would like you to know about their CB transceivers, the "23'er" and the new "555." Also, CB accessories that add versatility to their 5-watters.

ELECTRONIC PRODUCTS

66. Try instant lettering to mark control panels and component parts. Daka's booklets and sample show this easy dry transfer method.

108. Get the facts on Mercury's line of test equipment kits—designed to make troubleshooting easier, faster and more profitable.

67. "Get the most measurement value per dollar," says Electronics Measurements Corp. Send for their catalog and see today! 92. How about installing a transistorized electronic ignition system in your current car? AEC Laboratories will mail their brochure giving you specifications, schematics.

90. Seco offers a line of specialized and standard test equipment that's ideal for the home experimenter and pro. Get specs and prices today.

HI-FI/AUDIO


110. Get the latest facts on sound columns, American Gelozen Electronics Inc. offers a ten-page booklet giving the hows and why's plus method of installation and arrangement of sound columns.

15. A name well-known in audio circles is Acoustic Research. Here's its booklet of the famous AR speakers and the newly AR turnable.

16. Discover how Curing Control, anti-salting and other Garrard features in the Lab 80 offer top in audio listening. 32-page Garrard Compara-

119. Empire Scientific's new 8-page, full color catalog is now available to our readers. Don't miss the sparkling decorating-with-sound ideas.

24. Need a hi-fi or PA mike? University Sound has an interesting microphone booklet audio fans should read before making a purchase.

27. An assemblage of high fidelity components and cabinets are described in the Sherwood brochure. The cabinets can almost be designed to your requirements, as they use modules.

95. Confused about stereo? Want to beat the high cost of hi-fi without compromising on the results? Then you need the new 24-page catalog by Jensen Manufacturing.

99. Interested in learning about amplifier specifications as well as what's available in kit and wired form from Acoustech? Then get your copy of Acoustech's 8-page colorful brochure.

34. You can't pick the tape recorder you need without a program—and Sony Superscope has one. Full color 16-page booklet is at your dealer's showcase. Includes accessories.

TAPE RECORDERS AND TAPE

113. Scotch is the product and it's made by Minnesota Mining and Mfg. Co. (3M). Get a packet full of facts and tape data from 3M and learn all about your tape recorder and the tape it needs.

31. All the facts about Concord Electo-

32. "Everybody's Tape Recording Handbook" is the title of a booklet that Sorbes-Tarsian will send you. It's 24-pages jam-packed with info for the home recording enthusiast, in-cludes a valuable table of recording times for various tapes.

33. Become the first to learn about Kovelco's complete Carry-Corder 150 portable tape recorder outfit. Four-color booklet describes this new car-

35. If you are a serious tape audio-

91. Sound begins and ends with an Uher tape recorder. Write for this new 20 page catalog showing the entire line of Uher recorders and acces-

39. A 12-page catalog describing the audio accessories that make hi-fi liv-

HI-FI ACCESSORIES

112. Telex would like you to know about their improved Serenata Head-

90. Want to know about your improved Serenata Head-

111. Get the latest facts on sound columns, American Gelozen Electronics Inc. offers a ten-page booklet giving the hows and why's plus method of installation and arrangement of sound columns.

15. A name well-known in audio circles is Acoustic Research. Here's its booklet of the famous AR speakers and the newly AR turnable.

16. Discover how Curing Control, anti-salting and other Garrard features in the Lab 80 offer top in audio listening. 32-page Garrard Compara-

119. Empire Scientific's new 8-page, full color catalog is now available to our readers. Don't miss the sparkling decorating-with-sound ideas.

24. Need a hi-fi or PA mike? University Sound has an interesting microphone booklet audio fans should read before making a purchase.

27. An assemblage of high fidelity components and cabinets are described in the Sherwood brochure. The cabinets can almost be designed to your requirements, as they use modules.

95. Confused about stereo? Want to beat the high cost of hi-fi without compromising on the results? Then you need the new 24-page catalog by Jensen Manufacturing.

99. Interested in learning about amplifier specifications as well as what's available in kit and wired form from Acoustech? Then get your copy of Acoustech's 8-page colorful brochure.

34. You can't pick the tape recorder you need without a program—and Sony Superscope has one. Full color 16-page booklet is at your dealer's showcase. Includes accessories.

TAPE RECORDERS AND TAPE

113. Scotch is the product and it's made by Minnesota Mining and Mfg. Co. (3M). Get a packet full of facts and tape data from 3M and learn all about your tape recorder and the tape it needs.

31. All the facts about Concord Electo-

32. "Everybody's Tape Recording Handbook" is the title of a booklet that Sorbes-Tarsian will send you. It's 24-pages jam-packed with info for the home recording enthusiast, in-cludes a valuable table of recording times for various tapes.

33. Become the first to learn about Kovelco's complete Carry-Corder 150 portable tape recorder outfit. Four-color booklet describes this new car-

35. If you are a serious tape audio-

91. Sound begins and ends with an Uher tape recorder. Write for this new 20 page catalog showing the entire line of Uher recorders and acces-

39. A 12-page catalog describing the audio accessories that make hi-fi liv-

HI-FI ACCESSORIES

112. Telex would like you to know about their improved Serenata Head-

90. Want to know about your improved Serenata Head-

111. Get the latest facts on sound columns, American Gelozen Electronics Inc. offers a ten-page booklet giving the hows and why's plus method of installation and arrangement of sound columns.

15. A name well-known in audio circles is Acoustic Research. Here's its booklet of the famous AR speakers and the newly AR turnable.

16. Discover how Curing Control, anti-salting and other Garrard features in the Lab 80 offer top in audio listening. 32-page Garrard Compara-

119. Empire Scientific's new 8-page, full color catalog is now available to our readers. Don't miss the sparkling decorating-with-sound ideas.

24. Need a hi-fi or PA mike? University Sound has an interesting microphone booklet audio fans should read before making a purchase.

27. An assemblage of high fidelity components and cabinets are described in the Sherwood brochure. The cabinets can almost be designed to your requirements, as they use modules.

95. Confused about stereo? Want to beat the high cost of hi-fi without compromising on the results? Then you need the new 24-page catalog by Jensen Manufacturing.

99. Interested in learning about amplifier specifications as well as what's available in kit and wired form from Acoustech? Then get your copy of Acoustech's 8-page colorful brochure.

34. You can't pick the tape recorder you need without a program—and Sony Superscope has one. Full color 16-page booklet is at your dealer's showcase. Includes accessories.
98. Swinging to hi-fi stereo headsets? Then get your copy of Superex Electronics’ 16-page catalog featuring a large selection of quality headsets.

104. You can’t hear FM stereo unless your FM antenna can pull ‘em in. Learn more and discover what’s available from Eico’s 6-pager “Third Dimensional Sound.”

KITS

*42. Here’s a colorful 108-page catalog containing a wide assortment of electronic kits. You’ll find something for any interest, any budget. And Heath Co. will happily send you a copy.

*44. EICO’s new 48-page 2-color pocket-size short copy. For alog pioneer a copy.

AMATEUR RADIO

46. A long-time builder of ham equipment, Hallicrafters will send you lots of info on the ham, CB and commercial radio-equipment.

SCHOOLS AND EDUCATIONAL

*57. National Radio Institute, a pioneer in home-study technical training, has a new book describing your opportunities in all branches of electronics. Unique training methods make learning as close to being fun as any school can make it.

*59. For a complete rundown on curriculum, lesson outlines, and full details from a leading electronic school, ask for this brochure from the Indiana Home Study Institute.

61. ICS (International Correspondence Schools) offers 236 courses including many in the fields of radio, TV, and electronics. Send for free booklet “It’s Your Future.”

74. How to get an F.C.C. license, plus a description of the complete electronic courses offered by Cleveland Institute of Electronics are in their free catalog.

105. Get the low-down on the latest in educational electronic kits from Trans-Tek. Build light dimmers, amplifiers, metronomes, and many more. Trans-Tek helps you to learn while building.

TOOLS

*76. Learn about Xcelite’s line of pliers and snips, specialized for radio, TV and electronic work. Xcelite’s hand tools offer many advantages worth looking into. Bulletin N464 and N664.

TELEVISION

*70. The Heath Co. now has a 19" color TV to complement their 21" and 25" models. A new B&W portable model will be a hot seller for the mobile set. Get the facts today!

72. Get your 1967 catalog of Citron’s TV, radio, and hi-fi service books. Bonus—TV tube substitution guide and trouble-chaser chart is yours for the asking.

29. Install your own TV or FM antenna! Jefferson-King’s exclusive free booklet reveals secrets of installation, orientation; how to get TV-FM transmission data.

97. Interesting, helpful brochures describing the TV antenna discovery of the decade—the log periodic antenna for UHF and UHF-TV, and FM stereo. From JFD Electronics Corporation.

ELECTRONIC PARTS

*1. Allied’s catalog is so widely used as a reference book, that it’s regarded as a standard by people in the electronics industry. Don’t you have the latest Allied Radio catalog? The surprising thing is that it’s free!


*4. Olson’s catalog is a multi-colored newspaper that’s packed with more bargains than a phone book has names. Don’t believe us? Get a copy.

*23. No electronics bargain hunter should be caught without the 1967 copy of Radio Shack’s catalog. Some equipment and kit offers are so low, they look like misprints. Buying is believing.

5. Edmund Scientific’s new catalog contains over 4000 products that embrace many interests and fields. It’s the Buyers’ Guide for Science Fair fans.

*106. With 70 million TV’s and 240 million radios somebody somewhere will need a vacuum tube replacement at the rate of one a second! Get Universal Tube Co.’s Troubleshooting Chart and facts on their $1 flat rate per tube.

*7. Whether you buy surplus or new, you will be interested in Fair Radio Sales Co.’s latest catalog—chuck full of surplus buys for every experimenter.

*8. Want a colorful catalog of goodies? John Meshna, Jr. has one that covers everything from assemblies to zener diodes. Listed are government surplus radio, radar, parts, etc. All at unbelievable prices.

*6. Bargains galore, that’s what’s in store! Poly-Paks Co. will send you their latest eight-page flyer listing the latest in merchandise available, including a giant $1 special sale.

10. Busstein-Applebee offers a new giant catalog containing 100’s of big pages crammed with savings including hundreds of bargains on hi-fi kits, power tools, tubes, and parts.

11. Now available from EDI (Electronic Distributors, Inc.) a catalog containing hundreds of electronic items, EDI will be happy to place you on their mailing list.

12. VHF listeners will want the latest catalog from Kuhn Electronics. All types and forms of complete receivers and converters.

RADIO-TV EXPERIMENTER, Dept. 267
505 Park Avenue, New York, N. Y. 10022

Please have literature whose numbers I have encircled sent to me as soon as possible. I am enclosing 25¢ (no stamps) to cover handling charges.

NAME (Print clearly)______________________________

ADDRESS______________________________

CITY________________________ STATE____ ZIP CODE________

I am a subscriber

Indicate total number of booklets requested

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113

February-March, 1967
Heath AD-16 Recorder
Continued from page 70

sustained 400 Hz and 15 kHz tones for both azimuth and bias adjustments, using the built-in VU meters as indicators. For those who prefer it, an instrument alignment procedure is described, although it is neither easier nor better than that with the test tape.

How It Performed. The actual frequency response of the AD-16 is shown in Figs. 1 and 2. Although the response "wavers," it is well within Heath's specs which are given in the table. (The "waver," by the way, is normal with professional recorders that don't attempt to get a "ruler flat" frequency response by excess equalization at the expense of substantially higher high-frequency distortion.)

The 1 kHz THD (total harmonic distortion) was right on the button of Heath's claims. In fact, a record input level that exceeded 0 VU did not noticeably increase the reference distortion of 1.5% THD, even

with the pointer full into the "red region" at +3 VU. The noise level was a shade poorer than Heath's claims—at 7 1/2 ips it measured —49 db on the right channel and —45 db on the left channel (referenced to 3% THD).

The AD-16's price of $399.50 represents only the recorder; the walnut base is an optional extra at $19.95. For additional information write to Dept. EB, Heath Co., Benton Harbor, Mich. 49023.

Spy in the Tie
Continued from page 53

right through the case... If desired, melt a hole opposite the adjusting screw of C5—so you can change frequency without removing the transmitter from the case.

Checkout. Insert the battery into the clips —get the polarity right—close the case, place an FM receiver near the transmitter, and place the mike near the receiver's speaker. As you tune the receiver you can't miss the transmitter's frequency, the feedback will be unbearable. To change the transmitter's frequency, adjust C5 until there is no interference from strong FM-broadcast stations.

Protecting yourself. To use the Tie-Spy, clip the mike to your tie, place the transmitter in your trouser's side pocket, and run the antenna around your waist under your belt or under the back of your shirt, or wherever you prefer. The effective transmitter range will be about 25 to 50 feet. Don't try to speak directly into the mike as the gain is very high and the modulation will severely "pop"—the gain is designed to pick up voices from one to three feet. Naturally, the better the mike the better the reproduction.

A Note of Warning. The transmitter

must operate between 88 and 108 MHz (mc) and it must not interfere with a commercial broadcast signal. And the transmitter must be certified by an electronics technician that it has no spurious emissions and conforms to FCC requirements. For more details concerning wireless-mike FM transmitters we suggest you write to the FCC, Washington, D.C. 20554 and request Bulletins 11 and 12 concerning FCC rules pertaining to license-free, low-power transmitters.
Tape Sings
Continued from page 92

another story. Played through their own speakers most cartridge systems sound like table-model FM radios. Bass is not really adequate by audiophile standards, and treble has been boosted to provide a slightly unnatural sound. Played through a component system, Fidelipac, Lear, and Norelco cartridges all sound somewhat better—though none is the equal of a good 7½-ips reel-to-reel tape.

The best sound comes from Fidelipac (we sampled some of International Tape Cartridge Corp.'s Command titles), which provides generally good and full bass response through a big speaker system. Mid-range is accurately reproduced, as is treble. We found only a slight mellowing of the upper ranges, compared with a disc copy of the same music. The Lear-Jet system produces a similar frequency response (on the basis of RCA Victor recordings by Morton Gould, the Boston Pops, and Peter Nero), but there is a definite increase in tape hiss and a slight accentuation of treble response compared to Fidelipac.

White's Radio Log
Continued from page 111

17805 — Deutsche Welle
17810 PCJ R. Nederland
17815 — R. de Sao Paulo
17820 TAV R. Ankara
17825 LLN R. Norway
17845 — R. Sweden
17850 — United Arab BC
17860 ORU V. Friendship
17885 — BBC Relay
17900 — R. Budapest
17910 — Ghana BC

13-Meter Band—21450-21750 kHz

21450 — R. Prague
21495 CSA67 R. Nacional
21540 — R. Australia
21545 — Ghana BC
21600 — R. Tanzania
21665 — R. Budapest
21670 LLP R. Norway
21685 — R. Budapest
21700 LLO R. Norway
21790 — V. Denmark

"Check the side window, Boss! There's a blond, about 23, 5'9", 120 lbs...."

This table-model player also accepts Norelco cassette. Lid exposes speaker grille.

Norelco's 1½-ips tape has slightly less audible tape hiss than Lear-Jet, but a slightly less natural treble sound as well. At the same time, Norelco's bass tones are not as clear or crisp as Fidelipac's (tests were made with cartridges recorded from Command discs).

Wow and flutter, however, which used to bedevil reel-to-reel slow-speed recordings, are inaudible on all these systems. And while none of these systems offers a hi-fi alternative to a good component disc- or tape-reproducing system, one significant fact remains. For the truth of the matter is that all can produce excellent results on the road.
J2 are mounted directly on one metal panel, and the stereo headphone jack (J3) is mounted directly on the other metal panel—no insulating washers are necessary. Resistors R1 and R2, and transistors Q1 and Q2, are all mounted by their own leads, and no spaghetti (insulating tubing) is needed if you keep all leads well apart. When soldering the transistor leads, use a pair of long-nose pliers as a heat sink.

How It Works. The PS-15 low-voltage DC source feeds a current through the piezoresistive elements in the phonograph cartridge. As the stylus rides in the stereo record grooves, the piezoresistive elements are flexed and stretched and act as rapidly varying resistances. The varying currents from the cartridge are given one stage of transistor AF amplification in the PS-15 unit.

The output from the PS-15 is fed into the input of our little headphone driver and given another stage of transistor AF amplification to drive the stereo headphones. The two 2.2K (2200 ohms) resistors (R1, R2) provide base bias for Q1 and Q2; you might experiment with other values for best results with your particular transistors.

The amplifier is turned off simply by pulling the headphone plug out of the jack.

The Body's Ills
Continued from page 41

Injury blocks pain stimuli coming from other parts of the body and prevents their traveling on to the brain. Still experimental, it promises to ease suffering now relieved only by narcotics or dangerous operations.

Another remedial operation that can be ruled out is the one often necessitated by accidental swallowing of a ferrous object. General Electric engineers have come up with a gadget that has already removed a padlock, a coffee-can key, coins, pins, dental burrs, hypodermic needles, and metal toys from innocent human tummies.

About 30 in. long and ¼-in. in diameter, the new wizard consists of a stainless steel cable in a plastic tube and ends with an iron tip. When the magnet at the end of the control cable is slid forward until it touches the iron tip, the tip magnetizes. When the permanent magnet is retracted into a magnetic shield, the tip loses its magnetism.

An important breakthrough, the new instrument can retrieve foreign objects in a matter of two to three minutes. No anaesthesia is needed, and a general practitioner requires the help of only a fluoroscope.
ADDITIONAL INCOME

MAKE Your Classified Ad Pay. Get "How to Write a Classified Ad That Pulls." Includes certificate worth $2.00 towards classified ad in S & M. Send $1.00 to C. D. Wilson, Science & Mechanics, 505 Park Ave., New York, N. Y. 10022.

AUTO PARTS & ACCESSORIES

CAR REPAIR: Dedicated to mechanically minded readers. Send $1.00 (includes postage & handling) to Car Repair 505 Park Ave., New York, N. Y. 10022.

BOATS, MOTORS & MARINE SUPPLIES

Full size, cut-to-shape boat patterns, blueprints. Send $1.00 for big new illustrated "Build a Boat" catalog includes Fishing Boats, Carvers, Cruisers, Catamarans, Houseboats—Outboards, Inboards, Sailboats—12 to 30', "How to Build a Boat" booklets 25c. Cleveland Boat Blueprint Co., Box 18252, Cleveland, Ohio.


BOATING Journal is the best! Don't be without this magazine. Order now. $4.50 for one year. Boating Journal, 505 Park Ave., New York, N. Y. 10022.

BOOKS & PERIODICALS


BUSINESS OPPORTUNITIES

I MADE $40,000.00 a year by Mailorder! Helped others make money! Start with $10.00—Free Profit! Torrey, Box 318-T, Ypsilanti, Michigan. 48197.


MONEYMAKING Mail-Order Opportunities, $200.00 weekly possible. Litton, 533C, Randallstown, Maryland.


EARTHWORMS


EDUCATION & INSTRUCTION

BUILD Your Own Test Equipment and a Stereo AM-FM Radio! Practice Home Study Courses in Electronics in Theory, Practice and Servicing with complete kits and tools included in price. Write for free booklet with no obligation to: Inesco, Intercontinental Electronics School, Dept. 16B, 9100 St. Lawrence Blvd., Montreal 11, Quebec, Canada.

ENGINES, MOTORS, DYNAMOS

STEAM Boat & Steam Automobile Brochure Send Only Two Dollars, Shaw, Box 21204, Concord, Calif. 94521.

FOR INVENTORS

PATENT Searches—48 hour airmail service. $6.00, including nearest patent copies. More than 200 patent attorneys have used our service. Free Invention Protection Forms. Write Miss Ann Hartings, Patent Searcher, P. O. Box 176, Washington, D. C. 20004.

FOR SALE—MISCELLANEOUS

1,000 GUMMED Address Labels, 50c. Mart's, Box 434, Mackinaw, Ill. 61755.

PRACTICAL tips for home, garden and workshop are in "1001 How-To Ideas." A high value reference for all craftsmen. Send $1.00 for your copy, includes Postage, to 1001 How-To Ideas, 505 Park Ave., New York, N. Y. 10022.

HYPNOTISM

NEW concept teaches you self-hypnosis quickly! Free literature. Smith-McKinley, Box 3038 San Bernardino, Calif.

INVENTIONS WANTED

WE either sell your invention or pay cash bonus. Write for details. Universal Inventors, 228-5, Marion, Ohio.

LEATHERCRAFT

FREE "Do-it-yourself!" Leathercraft Manual. Tandy Leather Company, 1001 Foch, N03, Fort Worth, Texas.

MODELS & MODEL SUPPLIES


MONEYMAKING OPPORTUNITIES

HOW To Make A Home Operated Mail Business Pay!! Details—Carpenter, 2007- J West High Place, Chicago, Ill. 60637.

START Profitable Business in spare time. Investigate many money-making agency and franchise opportunities. Send 50c for sample Money-Making Opportunities Magazine, 505 Park Avenue, New York, 10022. Dept. 5.

OF INTEREST TO WOMEN

$100.00 WEEKLY Possible Lacing, Assembling our products! Write: Cuties, Warsaw 64, Indiana 46580.

PATENT SERVICE

PATENT Searches—48 hour airmail service, $6.00, including nearest patent copies. More than 200 registered patent attorneys have used my service. Free Invention Protection Forms. Write Patents Jones, Patent Searcher, P. O. Box 176, Washington 4, D. C.

PERSONAL

BILLS Problems? Poor credit no trouble. Not a loan company. Send for free publication, Automatic Acceptance. 318D Broadway Blvd., Reno, Nevada or 307DC Fosseau Ave., Providence, R. I.

PETS—DOGS, BIRDS, RABBITS, HAMSTERS, ETC.

MAKE big money raising rabbits for us. Information, Keeney Brothers, New Freedom, Penna.

RADIO & TELEVISION


POLICE-Aircraft—Emergency Calls on your broadcast, radio with Tunavert! Economical!—Practical! Tune the Band! $29.95! Free Catalog. Mart's, Box 94521, N. Y. 10022.

CANADIAN—Giant Electronics Cat- logs. Hi-Fi. Shortwave, Ham, CB. Rush $1.00, ETOG, Dept. EX, Box 741, Montreal, Canada.


SCIENCE EXPERIMENTS

SCIENCE Experimenter—the magazine dedicated to the youth who is interested in experimentation, construction and Science Fair entries. Send $1.00, includes Publication, to Science Experimenter, 505 Park Ave., New York, N. Y. 10022.

SONGWriters

POEMS Wanted for musical setting and recording. Send poems, Free examination. Crown Music, 45-65 West 37, New York 1, N. Y.

TREASURE FINDERS—PROSPECTING EQUIPMENT

"NEW" Scientific Instrument detects buried gold, silver, coins, treasure. $9.95 up. Send registration form, ETOG, Box 10583, Houston, Texas 77018.

Tape-Slide Synchronizer

Continued from page 80

R1 and J2 are added to the PK-522 amplifier to make this simplification of operation possible. Volume control R1 is set to about its mid-range position for this setup.

Shock Hazard and Grounding. The yellow lead of the output transformer was grounded to the positive (+) battery terminal in the original PK-522 circuit. To completely eliminate shock hazard the printed-circuit foil was cut leaving the secondary ungrounded as shown at X in Fig. 2.

A separate transformer power supply (T2-R2 and C3) provides DC for the amplifier—eliminating possible shock hazards from this source. To prolong its life, R3 is used to reduce the light output of the pilot lamp. The value of C3 must be at least 1000 mf as it holds the power supply voltage on the amplifier for good operation, after the AC supply to T2 has been cut off by the motor-driven cam switch (S4) in the slide changer.

Construction Details. Placement of parts is not critical. And using subassemblies for the amplifier, SCR switch and the amplifier power supply makes for a neat and compact unit which should be easy to service if this should ever be necessary.

The photo of the under side of the chassis (Fig. 3) shows the location of parts. The PK-522 amplifier is shown fastened to the right side of the chassis box on ⅛-inch stand-off insulators. These can easily be made from test-lead handles or banana-plug insulators.

The SCR-diode bridge switch (SCR1, Z1, D1, R2 and C4) is mounted on a phenolic panel and fastened to the left side of the cabinet with ½-inch spacers. The power supply (Z2 and R3) is mounted on another small phenolic panel which is then attached to the bottom side of the chassis box with ½-inch spacers. T2 is mounted direct to the lower side of chassis as shown.

Fig. 4 is a photograph of the Tape-Slide Synchronizer and shows, in conjunction with Fig. 3, the location of the other components.

Cables. The two-wire power cable which connects the slide-changer unit to the Tape-Slide Synchronizer has a 4-contact plug number Jones P-304-CCT on one end which mates with the original Jones 4-contact socket S-304-AB on the slide changer. The other end of the power cable has a female Jones cable socket S-304-CCT which mates with a male chassis plug P-304-AB on the Tape-Slide Synchronizer.

The female Cinch-Jones chassis socket S-304-AB shown on the chassis is not essential unless the original remote pushbutton cable operation is desired.

The shielded wire connecting the synchronizer unit with the recorder has a miniature phone plug on one end and whatever type fittings needed (on the other end) to mate with the input and output of the particular recorder used.

Conclusion. The Tape-Slide Synchronizer can be used with any stereo-tape record/playback unit and practically any remote-pushbutton-operated semiautomatic slide changer. Adequate gain is available from the 3-transistor amplifier to operate with the preamps of most stereo tape decks. Furthermore, if desired, a small crystal microphone can be plugged into the synchronizer’s input for voice operation of the slide changer and simultaneous recording of the sync signal on the tape.

Since the Tape-Slide Synchronizer is all solid state there are no relays, contacts or moving parts to wear out. This unit has been in service for nearly a year and has required no service of any kind to date.

Perfect synchronization of commentary and slides is assured at all times because the sync pulse and commentary are recorded on a single 2-track tape.

International Crystal C-12B

Continued from page 58

"wo-o-of," or "hello-o-o-o," the C-12B indicated somewhat in excess of 90% modulation. The actual scope value under these conditions was 100%.

Summing Up. The C-12B frequency meter, functioning as a frequency meter, precision signal generator, RF power output meter, and modulation meter, essentially performs all the tests required to insure a CB set is completely legal in its operation and that it is performing at optimum efficiency. We therefore recommend it as a must-have item for any shop doing CB servicing.

The C-12B is priced at $300.00. Additional information is available from Dept. RF, International Crystal Mfg. Co., 18 N. Lee, Oklahoma City, Okla. 73102.
FREE!

LAFAYETTE
1967 Catalog 670

Now BETTER THAN EVER

Over 500 Pages

Featuring Everything in Electronics for
- HOME - INDUSTRY - LABORATORY
from the
"World's Hi-Fi & Electronics Center"

Use Lafayette's Easy-Pay Budget Plan
No Money Down... Up to 24 Months to Pay
Satisfaction Guaranteed or Money Refunded

STORE LOCATIONS

NEW YORK
Bronx
Brooklyn
Jamaica
Manhattan
Scarsdale
Syosset

NEW JERSEY
Newark
Paramus
Plainfield
MASSACHUSETTS
Boston
Natick
Saugus
MONTGOMERY
MT. RAINIER, MD.
CONNECTICUT
Hamden
W. Hartford
PENNSYLVANIA
Pittsburgh

Mail This Card Today for Your Friend's
FREE
1967 Lafayette Catalog 670

Mail the Coupon Today for Your FREE 1967 Lafayette Catalog 670

LAFAYETTE Radio ELECTRONICS
Dept. EXB-7  P.O. Box 10
Syosset, L.I., N.Y. 11791
Send me the Free 1967 Lafayette Catalog 670

Name ____________________________
Address __________________________
City ___________________ State ______
Zip ____________________________

(Please Give Your Zip Code No.)
Live Better Electronically With
LAFAYETTE
RADIO ELECTRONICS
Mail The Card Today for Your
FREE!
1967 Catalog 670

Shop At The
"World's Hi-Fi &
Electronics Center"
For Widest Selection,
Low Prices
Stereo Hi-Fi • Citizens
Band • Ham Gear •
Tape Recorders • Test
Equipment • TV and
Radio Tubes and Parts •
Cameras • Auto Access-
ories • Musical Instru-
ments • Tools • Books

Everything In Electronics For
Home • Industry • Laboratory

Exclusively Yours at Lafayette

A Complete Assort-
ment of Musical
Instruments

25-Channel,
Solid-State C.B.
Transceiver
Model HB-600

New! Criterion Hi-Fi
Bookshelf Speakers

No Money Down • Up to 24 Months to Pay

New 65-Watt AM-
FM Solid-State
Stereo Receiver,
Model LR-900T

New! 2-Channel
6-Transistor
Walkie-Talkie
Model HA-62

New! All Solid-State
Tape Recorders and
Decks—Model RK-830

Satisfaction Guaranteed or Money Refunded

Lafayette
Mobil-Ade™ 12-
Channel Solid-State
CB Transceiver,
Model HB-555

50-Watt Solid-State
Stereo Amplifier,
Model LA-248

New Complete Line
of Lafayette
TV Antennas

Do A Friend A Favor...

Have a friend interested in hi-fi or electronics?
Send us his name and address and we will send
him his own personal copy of the 1967 Lafayette
Catalog 670.

FREE! MAIL THE CARD TODAY!
NOW 12 EASY, EXCITING WAYS TO LEARN ELECTRONICS, TV-RADIO WITH NRI

NRI has a training plan to fit your interest, your need, your education... from Color TV Servicing to Electronics for Printers. Pick the field of your choice and mail postage-free card now.

TELEVISION-RADIO SERVICING
Learn to fix home entertainment equipment like radio, hi-fi and stereo sets, all kinds of TV sets. Training kits include choice of black-and-white or color TV set you build. A profitable field full or part-time.

INDUSTRIAL-MILITARY ELECTRONICS
From basic principles to computers. Comprehensive training teaches fundamentals, then takes you into such modern-day miracles as servos, telemetry, multi-plexing, phase circuitry, others.

COMPLETE COMMUNICATIONS*
Teaches and provides actual practice in operation, service, maintenance of AM, FM, and TV broadcasting stations. Also covers marine, aviation, mobile radio, facsimile, microwave, radar.

FCC LICENSE*
Prepares you for First Class FCC Radiotelephone License exams. You begin with fundamentals, advance to required subjects covering equipment, procedures.

MATH FOR ELECTRONICS
A brief course for engineers and technicians who need a quick review of essential math used in industry, communications, government. Basic arithmetic review, short cut formulas, modern digital number systems, much more.

BASIC ELECTRONICS
A concise course in Electronic terminology and components. A wealth of useful information to help you better understand the field. For anyone who wants a basic understanding of Radio TV Electronics.

ELECTRONICS FOR AUTOMATION
Not for beginners, but for men with some knowledge of Electronics who want an understanding of process control, ultrasonics, telemetering and remote control, electronic medical measurements, other subjects.

AVIATION COMMUNICATIONS*
Prepares you to install, maintain, service direction finders, ranges, markers, Loran, Shoran, Radar, landing systems. Earn your FCC License with Radar Endorsement.

MARINE COMMUNICATIONS*
Covers transmitters, direction finders, depth indicators. Radar, Sonar, other equipment on commercial ships, pleasure boats. Prepares for FCC License with Radar Endorsement.

MOBILE COMMUNICATIONS*
Learn to install and maintain mobile transmitters and receivers used by police and fire departments, public utilities, construction firms, taxis, etc. Prepares for FCC License.

ELECTRICAL APPLIANCE REPAIR
Prepares you quickly to repair all types of appliances, including air conditioning, refrigeration, small gasoline engines. An easy, practical course leading to profitable part-time or full-time business of your own.

ELECTRONICS FOR PRINTERS
Designed to teach operation and maintenance of Electronic equipment which controls the latest devices developed for the graphic arts industry. From basic principles to computer circuits. Approved by major manufacturers.

SEE OTHER SIDE

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

FILL OUT AND MAIL POSTAGE-FREE CARD

TRAIN UNDER NEW GI BILL.
If you served since Jan. 31, 1955, or are in service now, check GI line in postage-free card.

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS WILL BE PAID BY
NATIONAL RADIO INSTITUTE
3939 Wisconsin Avenue
Washington, D.C. 20016

FIRST CLASS PERMIT
NO. 20-R
Washington, D.C.
Discover the Ease and Excitement of Learning TV-Radio, Electronics at Home with NRI

Begin now an exciting adventure. NRI—the home-study school that pioneered learn-by-doing training kits is now first to bring you COLOR TV training equipment. Learn Color TV Servicing by building your own high-quality Color set. You get "on-the-job" experience as you train. Your family enjoys the thrills of vibrant color shows for years to come. And, thanks to NRI training, you can do your own servicing—no costly service contract.

Earn $4 to $6 an Hour Extra Spare Time
Color TV is booming. Set sales exceed 5,000,000 a year now. 10-million-color-set years are predicted soon. And 60% of color set owners also own black-and-white sets. TV Technicians are in demand now to serve this giant, money-making, growing market. NRI shows you how to cash in on Color TV: how to earn $4 to $6 an hour extra in spare time while learning; how to be your own boss in a full-time Radio-TV Servicing business, or qualify quickly for jobs in the fascinating fields of broadcasting/communications, industrial electronics, automation and space projects.

Act Now to Move Ahead
NRI offers you a choice of 12 different training plans, designed for people with all kinds of interests, all levels of education. Courses are described briefly on the other side of this page. To find out how you can be a part of the Electronics Age, mail postage-free card for free NRI color catalog. Don't delay. Electronics and Color TV need you now.

NATIONAL RADIO INSTITUTE, Electronics Div., Washington, D.C. 20016. No salesman will call.

PICK YOUR FIELD and mail postage-free card for free color catalog

SEE OTHER SIDE