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FCC Report

By ROBERT E. TALL
Washington Correspondent

WITH nineteen volumes of comments on the Federal Communications Commission's proposed Citizens Band rule changes undergoing analysis by the agency's staff, there is little likelihood that the Commission will take further action on these changes until after its customary August recess. Licensing of CB equipment, which fell off sharply when the Commission first released its proposals for drastic curbs and substantial rearrangement of the regulations for the service, soared to record figures again during the spring, and by the beginning of summer was rolling along as if CB'ers had never heard of the FCC's proposed cutbacks.

More than a few CB'ers, however, became aware that the Commission was not whistling in the dark, as the late spring and summer saw dozens of them get hit with the new "small forfeiture" authority of the agency. This permits the FCC to issue a "notice of apparent liability" to radio licensees for repeated or willful violations of its rules, and then collect fines ranging from $100 to $500 from the licensees.

Efforts To Band Users Together. Keeping pace with the increased tempo of FCC action were several major efforts around the country to mount stepped-up campaigns to get the Congress, the Commission, the nonbroadcast radio users as a whole, and the public generally, to wake up to the fact that mobile radio, including CB, needs more sympathetic treatment at the hands of the government than it has received in the past. FCC Commissioner Robert E. Lee, for one, took the bit in his teeth at a mid-June meeting of a radio user association by stating that "Everyone concerned is interested in some action that will spread the use of nonbroadcast radio to as many people and legitimate pursuits in our country as possible." He called for a meeting of all user organization representatives to sit down together and talk over the situation.

"Radio is a tool of industry as much as the shovel, the die and the crane," Mr. Lee declared, and the government must "give prompt attention" to its needs. According to the Commissioner, the main problem seems to be that under present conditions "we are party-lining the mobile radio users to the...
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FCC Report

(Continued from page 6)

extent that the radio systems are becoming nearly valueless in some services in some areas, and our growth indicators tell us that the situation is quickly worsening."

Commissioner Lee proposed that a government-industry advisory committee be formed for nonbroadcast radio, with functions similar to those of one the FCC sponsored to spur the development of UHF television, and he called for the assistance of all radio user organizations in its establishment. He suggested that a meeting be held in early fall, following preparatory work, and urged all radio organizations represented at the meeting "to be prepared to state the areas of possible scrutiny" which could lead to meaningful improvements for nonbroadcast radio.

"I would not expect that all of the problems of the land mobile radio field can be taken care of by the joint government-industry committee before it is dissolved," he noted. "However, I can certainly see—if the results of the committee's work are as worthwhile as I expect them to be—that the user groups would have become accustomed to working together more closely than has been the case in the past and would want to continue some form of central committee among themselves."

Henry Succeeds Minow. The nonbroadcast radio field as a whole took heart from President Kennedy's naming of Commissioner E. William Henry as chairman of the FCC following the resignation of Newton N. Minow. While Mr. Minow's two years at the helm of the Commission endeared him to the general public, even though his strong policies disturbed the broadcast station and network ranks at times, he had shown little interest in the land mobile communications field. Commissioner Henry, on the other hand, during the relatively few months he has been a member of the FCC, has stated several times that he considers the mobile radio field "one of the most important" areas faced by the Commission, and has pledged himself to work for improvements in it.

"Filing Fee" Situation At A Boil. No sooner had the FCC announced its "final" plan to charge people for filing applications for radio licenses, among other things, than work began among the various radio organizations—including those in the citizens and amateur radio fields—to have the plan scuttled either by Congress or by the courts.

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FCC Report
(Continued from page 8)

Each CB application filed with the Commission after Jan. 1, 1964, under the FCC’s announced plan, would have to be accompanied by a payment of $8.00; amateur applications would cost $4.00; and applications in other radio services administered by the Commission would range from $10.00 to $100.00—the latter for new TV broadcast stations. These figures would cover initial licenses only, with modifications in some cases costing less. The fees would be charged by the Commission at the time the applications were filed, whether the applications were eventually granted or not.

At this writing, formal petitions to the FCC for reconsideration of its action in adopting the “filing fee” plan were expected, followed by appeal to the courts if the agency refused to take such a step. Simultaneous efforts to have the appropriate Congressional committees look into the matter were also under way, and appeared to be the best possibility for stopping the Commission’s program. About ten years ago the Senate Commerce Committee stopped a similar plan of the FCC when it adopted a resolution asking the Commission to hold up on the matter.

THIS MONTH’S COVER

When it came time to photograph the August cover, we sent a few representative CB sets to the photography studio. Reading from the top, they are: (A) EICO 100-milliwatt Model 740; (B) Hallicrafters transistorized mobile Model CB-5; (C) Utica Model T&C II; (D) Pearce-Simpson “Companion”; (E) Sonar Model G; (F) Metrotek “Metrostar”; and (G) Regency “Range Gain.” Details on all of these sets, plus scores of others, start on page 66 of this issue.

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BCB DX'ers Speak Up

I enjoyed reading your article on "DX'ing the Broadcast Band" (February, 1962, page 69). I have been monitoring broadcast stations since the fall of 1961, and have logged 322 stations with QSL's from KFI, Los Angeles, and KOA, Denver. My biggest accomplishment is bagging every clear-channel station in the U.S. (32 states and also Canada, Cuba, Mexico, and the controversial Radio Americas). I would like to hear from fellow BCB DX'ers in the New Jersey area and in neighboring states.

RUSSELL EDMUNDS
Little Silver, N. J.

Of all the radio bands, I find the BCB the most interesting, and have logged 117 stations in North America and the Caribbean with my Hallicrafters S-120 receiver. The Medium-Wave report in the March, 1963, issue was very helpful ("Short-Wave Report," page 110). How about a regular column of information submitted by BCB DX'ers as to what time local stations and clear channel stations sign off, and what stations are audible when they do? When questions such as the location of Radio Americas come up, I am sure there would be many BCB DX'ers eager to report their findings.

LEONARD GOLDBERG
Brooklyn, N. Y.

Thank you for the letters. A column for broadcast band listeners may be considered if a substantial number of readers are interested.

Plaudits for Projects

I think P.E. gives a very complete and detailed description of each of its featured projects, and I'm sure that anything that goes into print is carefully examined. Everyone is human, and a few errors are bound to show up once in a while.

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RCA Victor

August, 1963
Letter Tray

(Continued from page 12)

but all of the P.E. projects I have built have worked well.

Randy Ajax, WV6ZSN
La Mirada, Calif.

Thanks, Randy. We'll continue to try to do the kind of job you and other P.E. readers expect.

Eliminating "Blinker Minder" Hash

Some readers have experienced difficulty with generator hash noise after construction and installation of "The Blinker Minder" (March, 1963, page 61). Some autos with worn commutators will cause a harsh, raspy note in the speaker when the engine is running. A remedy is to add two RC filters to the device to filter out such "hash" as shown in the diagram.

The Case of the Mystery Project?

What project do the three sentences behind the "Letter Tray" title refer to? One reads as follows: "... we changed L2 to 7 or 8 turns of #22..."

John Reid
Winchester, Mass.

The sentences, as far as we can determine, John, are nonsense, and were composed especially for the "Letter Tray" logo. You will note that this month's column sports a new head.

Operation "Assist" Gets Results

Thank you for helping me locate a copy of the schematic and operating instructions for my Silver Vomax vacuum-tube voltmeter through the "Operation "Assist" column. The response was most gratifying—I had replies from POP'tronics readers from British Columbia to Florida.

Paul E. Klein
River Edge, N. J.

(Continued on page 16)

Always say you saw it in—POPULAR ELECTRONICS
The new Cadre C-75 1.6-watt, 2-channel transceiver is 15 times too powerful for youngsters (under 18 years of age) to operate, according to FCC regulations. Clearly, it's not a toy. It's designed for serious CBers who need 'big set' performance that can be used conveniently anywhere.

The new C-75, weighing less than 2 lbs; provides clear, reliable 2-way communications up to 5 miles and more. All solid state design creates an extremely rugged transceiver to absorb rough handling, stays on frequency. Two crystal-controlled channels spell perfect communications contact everytime. Sensitive superhet receiver (1µv for 10 db S/N ratio) brings in signals in poor reception areas. Powerful transmitter has one watt output to the antenna. Adjustable squelch silences receiver during standby. AGC assures proper listening level. In a word, the C-75 has all the features you'd look for in a quality full size CB unit.

The C-75 has all the portable conveniences you'd want, too: operates on alkaline or mercury penlite cells (8-hour rechargeable nickel-cadmium battery available); earphone and antenna jacks; built-in retractable antenna; jack for base operation while recharging.

Use the Cadre C-75 anywhere in the field, for vehicle, office, boat or plane. Use it constantly too, because its all-transistor modular circuit (11 transistors and 2 diodes) is virtually maintenance free. $109.95. Recharger and 2 nickel-cadmium batteries $31.85.

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CADRE 515 Has a power supply for 110 volt AC and 12 volt DC. 5 crystal-controlled channels. $194.50
CADRE 520 For DC mobile operation and fleet use. $187.50
CADRE 525 In portable case with built in battery power supply, recharger, AC cord, telescoping antenna. $269.95

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August, 1963
Letter Tray

(Continued from page 14)

Within a month after my request for a schematic for a Belmont Model 525 receiver appeared in "Operation 'Assist," I had received 14 replies with the schematic or advice on where to get it. The letters came from all over the U.S. and Canada. I would like to take this opportunity to thank all those who offered assistance.

PAUL J. MONTLE
Arlington, Mass.

Electronics Correspondents Wanted

I would appreciate it if you would help me find pen friends in my field of interest—radio, television, and electronics. I will reply promptly to all letters received by me. Thank you for your help.

K. C. CHANDA
Electricity Department (Construction)
Damodar Valley Corporation
Anderson House, Alipore
Calcutta 27, India

Out of Tune

On the Beat Electronically (May, 1963, page 60). In the schematic diagram, the short bar for the negative plate of the last battery cell was left out. If you connected the negative terminal of the battery to ground, and the positive to Q6's emitter, the unit should operate properly.

Hi-Fi Shutoff (June, 1963, page 51). Substitute a s.p.d.t. toggle switch for S1 and rewire the unit as shown here. The original circuit causes constant recycling of K2 and K3 with the switch in manual position.

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August, 1963
Operation Assist

THIS column is the forum where our experimenter readers can meet to give or get information on those ancient or oddball pieces of electronic gear, when the regular sources of such data fail. Here’s how it works: Check the items below to see if you can help out a fellow reader with information on the set or gadget that's got him stumped. If you can help, write him directly and give him the information or advice he needs. On the other hand, if you need help, mail a postcard or letter to OPERATION "ASSIST," Popular Electronics, One Park Avenue, New York 16, N.Y. State the type of set (broadcast receiver, military surplus transmitter, etc.), the maker’s name, the model name or number, the serial number, approximate date of manufacture, and any other particulars that will help other readers identify the unit. It's better to give too much information than not enough. Also, carefully print or type your name and mailing address.

Because of your overwhelming response to the OPERATION "ASSIST" idea, it is impossible to print all the appeals for information we receive. The Editors therefore must reserve the right to select the more unusual and interesting requests, and those for which normal sources of technical information have failed.

Schematic Diagrams

G.E. Model A-75 superhet, chassis No. 7-12094, 510 to 19,500 kc. (Elmer J. Selbert, 5708 W. Greenfield Ave., West Allis 14, Wis.)
Atwater Kent Model 55C, 7-tube radio, type F-4 speaker. (L. J. Potter, 660 Union, N.E., Salem, Ore.)
RCA Radiola 20, floor model; also UX-199 and UX-120 tubes needed. (Lance Lee, Henridum, Minn.)
Philco Model 38-5 console radio. (Harry W. Bratton, 15311 E. 44th Terr., Independence, Mo.)
Beam Industries (Chicago) Mark 1 recorder; also recording head needed. (R. E. Howard, 604 S. Vernon St., Dallas 8, Texas.)
BC-312-N receiver, (part of SCR-193); also manual TM-11-550. (C. L. Bearndley, Rte. 2, Jackson, Tenn.)
Metz (German?) Type 402 KEP KW 5-tube superhet, 1600 kc. to 23 mc.; parts info also needed. (Gerald Smith, 216 Old Hope Rd., Kingston 8, Jamaica, W.I.)
McMurdo Silver Model 906 signal generator; operating instructions also needed. (Elmer H. Hummel, Box 182, Fernley, Nev.)
Stromberg Carlson (radio?), chassis No. 11292. (David Haas, 6232 Chickasaw Dr., Westminster, Calif.)
Navy TBY transmitter-receiver. Type CRI-13007, and power unit type CLG-20206, made by Westinghouse, 1911; operating and maintenance data also needed. (H. H. Halperin, 9712 South Merril Ave., Chicago 17, Ill.)

(Continued on page 22)
METROTEK has them all!

Power-packed citizens band equipment for every purse and purpose:

1. DeVille - the ultimate - 23 or 12 crystal controlled transceiver - only ONE crystal controls BOTH transmit and receive on each channel - 100% modulation - trunk mount and remote head available.

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5. Monocall - your individual selective squelch system - no personal channel monitoring - dependable unique dual tone operation - can be adapted to your present unit. Patent pending.

6. Metrotek 66 - new six meter transceiver - highly sensitive - double conversion - 25 watt unit input minimum 13 watt output with built in mobile power supply - crystal controlled or tunable functions.

METROTEK ELECTRONICS, INC.
205 W. Cabarrus St. Raleigh, N. C.
Operation Assist  
(Continued from page 20)

Majestic Model 50 screen grid superhet, and Pfanziel Model 10, 6-tube ('01A's) dating from 1920's. (V. E. Lingbloom, Elida, Neb.)

Crosley Showbox Model 706-60, 8-tube neutralyne receiver. (Fred Richardson, 600 Cypress St., Susanville, Calif.)

Telecraft Model 6 six-meter converter, No. 10035. (Harry Abel, 4405 Carlyle, Tampa, Fla.)

Navy surplus transmitter 7-350-XM; instruction manuals or any other information also requested. (Roger White, 428 West Sale Rd., Lake Charles, La.)

Army surplus BC 624 A, BC 966 A. Detrola Model 933 receiver; operating and service data also needed. (Larry Spann, 329 Flint St., Mobile, Ala.)

Army Signal Corps receiver BC 624 A, transmitter BC 625 A; modification data for amateur use also needed. (Edward Rymara, WSTVP, 5446 Chase Rd., Dearborn, Mich.)

Zenith Model 12ST 925-E, No. G-25283. (Lyle Johnson, 1461 Norman Ave., San Jose 25, Calif.)

Hallicrafters SX-28 receiver; tips to improve performance also needed. Jackson Model 652 audio oscillator; calibration data also needed. Precision Model 9120 tube tester; data for adding European 6-pin sidetube, and noval sockets also needed. (Ramesh B. Parikh, 10 Phirozehsh St., Santa Cruz West, Bombay 25, India)

Atwater Kent Model 447, about 1938; book also needed. (William J. Bender, 6613A Lucas St., Ft. Sill, Okla.)

Triumph Model 841 oscillograph ('scope?). (David Horn, 2400 Storey Ave., W. Middlet, Texas)

Sonora electric organ, Model 200-400; service information also needed. (Wm. C. Rivers, 8411 Pembroke Ave., Baltimore 7, Md.)

E. H. Scott Labs receiver, Model 8LR-M, a.c.-d.c. (G. H. Steffle, K4OIG, Box 1108, Lake Alfred, Fla.)

Philco Model 40-1203 radio-phonograph combination. (Scot Van Horn, Box 48, Delong, Ind.)

Sparton receiver, 6-tubes, BC and s.w. bands, about 1940. (A. A. Stephansky, 1069 Franklin Ave., Baden, Pa.)

Philco Model 37-630 receiver, BC and s.w., about 1940. (Mike Hintz, Rte. 1, Box 39, Grafton, Wis.)

Philco Model 40-180, radio with phono amp. Zenith Model 9-8-262, 8-tuber, motorized tuning. Hallicrafters Model ECT13, 6-tubes, BC and s.w., "Echophone." (Charles T. Huth, 146 Schonhardt St., Taft, Ohio)

Silvertone 3-band receiver, chassis No. J01, 853, about 1945. (E. E. Marz, Sr., 406 N. Schoenbeck Rd., Prospect Heights, Ill.)

Philco Model 826-62. (Larry Flagg, 404 W. 18th, Ft. Scott, Kan.)

Sparton phono oscillator and turntable, about 1939. (Mike Vanacore, 1211 36 Ave., Tampa 5, Fla.)

Triumph oscilloscope, Type CTU-8001, No. 1866; also Model 830 oscillograph wobbulator. (R. W. Walker, Rte. 1, Box 425C, Eureka, Calif.)

RCA marine receiver, Type RC 415-D1, issue 114-8T3B. (Pete Henricke, 200 Casserly Rd., Watsonville, Calif.)

Philco Model 38-8, coil 121, about 1938; also need alignment data. (Al Carmenini, 52 Davis Ave., White Plains, N.Y.)

Kolster Model K-22 receiver (by Brandes), made in 1928. (Clyde Douglas, 5017 Takoma Ave., Silver Spring, Md.)

Zenith Model 1005, 10-tuber, BC and s.w. (Leland Bunch, Route 2, Wilder, Idaho)

Philco Model 37-610 receiver. (Willis Barta. Brownlee B. R., Star Route, Homestead, Ore.)

Silvertone Model 110, 466-1 radio-phonewire recorder; also need recording wire and service data. (George Weber, 1105 E. Polk, Harlingen, Texas)

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Operation Assist

(Continued from page 22)

Dumont Type 20S-B oscilloscope, No. 5270. (Mariano E. Masimampo, 94752 Kauaia Pl., Waipahu, Hawaii)

Zenith Model 108666 BC and s.w. receiver, about 1937.

(L. J. Laurer, 405 Utica Rd., Utica, N.Y.)

Zenith Model 98211 BC and s.w. receiver, 8 tubes, 1935.

(Leo C. Simpson, K1005 F., 26 Lookout Ave., Natnick, Mass.)

RCA Radiola 17; also manual for BC-248-Q. (Erik J. Thorsen, K1095 F., 26 Lookout Ave., Natnick, Mass.)

Zenith BC and s.w. receiver, 7 tubes, serial No. 7916070 (model number unknown), about 1940. (David Aldock, 2512 Humble, Midland, Texas)

Fairchild Compacker kit, Model 510 (auto. sensing device). (S. Dowgialla, 141 Hopkins Ave., Jersey City, N.J.)

Howard Model 345, 7-tube communications receiver.

(Barry Craps, 23 Gillis Rd., Portsmouth, Va.)

Philco Model 18-1252 (console), and Model F-1510 (car) radio, also G.E. Model H-204. (Mike Zuhajewski, c/o Adam Zuhajewski, Paw Paw, Mich.)

Harvey Wells Model MTR-2532 marine radiotelephone, age unknown. (James Pate, 2401 Frances St., Oakland, Calif.)

RCA Radiola 18, Model AR-036. (Jim Perrin, Rue 1, Delphi, Ohio)

Philco Model 610 receiver. (Lloyd D. Kellys, Rue 2, Box 5, Flatonia, Texas)

Silvertone BC and s.w. to 17 mc., 8 tubes, 6K7G's. etc. (model unknown). (Carl Harriman, 8656 Beatty St., N.W., Washington, D.C.)

Millivac Model MV 25-8 d.c. millivoltmeter. (K. C. Britton, 43 Landers Rd., E. Hartford, Conn.)

Capehart-Farnsworth Model 3001. (Lester Lamborn, Jr., Box 204, Clay Creek Rd., Avondale, Pa.)

Hudson American Model 1-130-A signal generator.

(Larry A. Wheelock, Crane, Ind.)

RCA AUT-15 transmitter; also conversion data. (Steve Ray, WA4DBS. Rue 1, Box 133, Rockford, Ala.)

Atwater Kent Model 86F. BC superhet. (Wayne N. Lemcke, County Line Road, Hamlin, N.Y.)

E. H. Scott Model U-607 superhet. 25 tubes, about 1936. (C. W. Haussman, 1356 Brown St., Martinez, Calif.)

Supreme Model 570 signal generator; also manual. (J. G. Bonesteaux, 2921 Stumier Ave., S., Minneapolis 26, Minn.)

Philco Model 12-1011. radio-phonon combination, 1942. (Howard L. Stratil, 18603 Warrington, Detroit 26, Mich.)

Crosley Model 56, RCA 5992. (Leroy Humphries, 214 Cherry St., Bethel, Ohio)

Philco Model 70 superhetrdyn. (Edwin Smith, 102 Morewood Ave., Blairsville, Pa.)

Howard Communications Co. Model 335 receiver. (Donald Dresser, 927 Goulding St., Peekskill, N.Y.)


Military equipment made by Westinghouse. High-freq. xmitter (CAY-5223); intermediate-freq. xmitter (CAY-5225); and rectifier and modulator (CAY-2204), all of W.W. II vintage. (West Yankin High Electronics Club, c/o Mr. White, Hamiltonville, N.C.)

Supreme Model AE volt-ohm-milliammeter. (Robert Uechtmull, 21-21 66th St., Glendale 27, N.Y.)

Duvox 1-tube a.c.-d.c. radio using 12AU7, 12AT6, 505C, 305W, 1; no model or chassis no. (Alex Zeitlin, 88 Harriet St., Bridgeport, Conn.)

Triumph Chicago Model 811 oscilloscope used by the Army. (Wm. Freitag, 23823 Englehart, St. Clair Shores, Mich.)

RCA radio marine receiver (Model AR 4003 C.R.M. 16062, No. 91494, Serial No. 11-301), Preselector (Model AR 8503, Serial 333). (H. Williamson, 3915 Inlay, Toledo 12, Ohio)

"HR" Model AMM 1 modulation monitor. (Frank Privette, Box 53, Zebulon, N.C.)

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The three biggest names in CB microphones are

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The matched companion to the fine Turner mobile microphones. You get the same Turner quality, performance and dependability in a base-station mike. Same performance specifications as 350C, but with an on-off push-to-talk and lock switch and 7 foot cable, three conductor (one shielded), wired for relay operation.

THE TURNER MODEL 350C
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August, 1963

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Where the torque to be transmitted is small, you can improvise a universal joint quickly and easily with rubber suction cups. Use suction cups with holes in the ends so that they can be pushed over the ends of the shafts that you want to connect. Fasten the two suction faces together as shown by coating them with rubber cement, letting it dry thoroughly, and then pressing the two suction cups tightly together. Even shafts that are badly misaligned can be coupled with these quick universal joints.

—John A. Comstock

DRESS UP THAT SLOPPY WIRING WITH "TWIST-EMS"

Loose wires flopping around inside a chassis not only look messy, but can cause real trouble.

Tape used with modern recorders must be flawless—from one end of the reel to the other. Even the subtest defects (microscopic edge burrs, skew, cupping or curling) will prevent intimate contact between the tape's narrow tracks and the recording head. The result: unsatisfactory performance. Soundcraft Recording Tape is flawlessly made. Your guarantee that it has met the most painstaking magnetic and physical standards is the quality control number marked on every reel. It is your complete assurance of superior tape recordings. Note to our engineering-minded friends: Mail us the tab showing the quality control number of your reel of Soundcraft Tape. We'll send you its rigid specifications. Write for free Soundcraft Literature.

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August, 1963
NEW!

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BATTERY HOLDERS

Change batteries faster, easier
Positive, Jar-Proof, Spring-Loaded
Contact
Extremely Low Resistance
Applications Unlimited
Extra Power Source Protection
3 Diameters in 10 Lengths

ASK YOUR ELECTRONICS DISTRIBUTOR,
or write for complete specifications, sizes
and prices.

SECURITY DEVICES LABORATORY
Electronics Division of
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Increase your business efficiency,
safety and pleasure!

KAAR CB RADIO

Universal power supply / Snap-in, snap-out
mountings / Plug-in portability / Dust pro-
tection / Time-proven reliability.

TR327B—Tops for CB enthusiasts.
All 23 CB channels tuneable!
TR327—Ideal for Industrial Use.
Exclusive front panel loading control!
TR327A—Best for Boating, Sports Cars.
CB plus standard AM broadcast band!

Write for FREE Business and Citizens Compre-
hensive Frequency Chart.

KAAR ENGINEERING CORP.
2990 MIDDLEFIELD ROAD
PALO ALTO, CALIFORNIA

Tips

(Continued from page 26)

trouble if the equipment must withstand vi-
bration, or must work in several positions.
When dressing leads together to form
cables, you can save yourself the trouble of
doing a cord-lacing job, but still get many
of the benefits of such a job by using
the little wire-reinforced paper or plastic "Twist-
Ems" sold in dime stores and supermarkets.
These are meant for closing plastic bags,
tying plants to garden stakes, and the like,
but will hold wire bundles just as readily.
You can even color-code bundles if you wish.
Be sure not to tie shielded signal lines
with other wires, and never cable the input
and output leads of a stage or set together.

—Louis E. Garner, Jr.

BATTERY CLAMP SERVES
AS SELF-GRIPPING PLIERS

A large battery clamp can be a handy tool
for turning TV lead-in stand-off insulators;
as a bonus, it will hang onto the stand-off
if you have to let go. Such a clamp can
also help in turning wing-nuts and thumb-
screws, and in getting those pesky caps off
bottles of coil dope and speaker cement.
And as a "third hand" for holding together
two parts to be soldered, it's hard to beat.

—Jerome Cunningham

PANEL LABEL
FROM MAGAZINE COVER

Unable to find a decal for a completed con-
struction project? You can get around this
problem by cutting the name of the unit out
of the article title on the magazine cover,
and sticking it on the panel under a strip of
cellophane tape. Use a little rubber ce-
ment on the back of the trimmed "name

Always say you saw it in—POPULAR ELECTRONICS
RAD-TEL’S TUBE SALE!

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*RAD-TEL’S SPECIAL OFFER*

For every Rad-Tel quality Brand New Tube you buy, as advertised—Rad-Tel will give you your choice of a Brand New 5U4 or 6C6 tube for only 29¢ each!!

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Be your own TELEVISION REPAIRMAN

The Original NOW YOU CAN FIX YOUR OWN TV SET BOOK

You can fix your own TV if you have TV Flat Book — because 80% of troubles are caused by tubes. This book explains it, illustrates trouble and what tubes cause this trouble. Pinpoints in the over 3000 layouts by model number, position and type tube causing trouble.

No. 170

CHEATER CORD

6 ft., No. 154


RAD-TEL TUBE CO. TV, RADIO AND HI-FI

Dept. PE-8

55 CHAMBERS STREET, NEWARK, N. J.

*Terms: 25% deposit must accompany all orders, balance C.O.D. Orders under $5, add $1 handling charge plus postage. Orders over $5, plus postage. Approx. 8 tubes per 1 lb. subject to price sale, see C.O.D.'s outside continental U.S.A.

August, 1963
24 CHANNEL TRANSMITTER WITH TUNABLE RECEIVER AND RAZOR SHARP SELECTIVITY

- "Velvet-smooth" tunable receiver.
- "Q" multiplier at 455 KC IF input for razor-sharp selectivity with separate "peak" and "null" controls.
- Spotting/Public Address/Modulation control switch on front panel.
- Silicon diode power supply for improved regulation.
- Quality engineered 20 tube performance including 5 Nuvistors and 7 diodes.
- .1 µv for 6 db S/N sensitivity.

$269.50

WRITE FOR "SPEC" SHEET.

POLYTRONICS LABORATORIES, INC.
388 GETTY AVENUE, CLIFTON, N. J.

Tips

(Continued from page 28)

plate" and put it in position first; after it has dried, cover it with the tape. As a final touch, you can cover the tape edges with a thin coat of clear fingernail polish.

—P. C. Walton

CHANGING PANEL DECALS WITHOUT TEARS

Ever wish you could change some of those decals you put on the panels of your home-brewed electronic masterpieces? It happens to all of us when we modify a unit, or think of a better name. If this is your problem,

place a strip of fresh cellophane tape over the decal and stick it down well, leaving one end free. Then remove the old decal by pulling the tape directly out and away from the panel. It may take two or three pieces of tape to remove stubborn old decals completely.

—Stanley E. Bammel

EMERGENCY OR SPECIAL SCREWDRIVERS

If you carry a screwdriver to fit every width and length of screw-slot you encounter, you'll find that they can crowd other items out of the tool box. Here's a way to obtain those special sizes you need without having them bulge over the sides of your tool kit. Cut some short driver blades from ¼" steel and grind the opposite edges parallel so that each blade is a snug push-fit in one of your hex-nut drivers. Then grind the end to leave ¼" to 3/16" projecting. Finally, grind the tip to the thickness you need for those special narrow or broad screw-slots.

—Ken Murray

Always say you saw it in—POPULAR ELECTRONICS
one way or the other, you gain the most with antenna specialists'

NEW

"Match-Maker"

MR 77 (27 Mc)

Vertical/Horizontal Beam Antenna

Now you can instantly match up your base antenna to work mobile and vertical bases or horizontal base beams by simply switching from vertical to horizontal polarization through separate coax feeders. The dual-direction versatility of the "Match-Maker" will give you a powerful 7 db. vertical forward gain. Switch to the horizontal beam and you get a 6 db. forward gain. Either way, you get a 15 db. front to back ratio.

Everything about the "Match-Maker" is rugged. Sturdy, heat-treated aluminum boom and elements plus oversize clamps to hold elements firmly in place give it the structural strength to withstand 100 mph winds. Only 12½' high with a boom length of 10', it weighs an easy-to-handle 24 lbs. If you're interested in VSWR, it's 1.5:1 or less, either horizontally or vertically. 50 ohms, gamma matched. All components are color-coded for simple, fast, accurate assembly.

Antenna Division,
12435 Euclid Ave., Cleveland 6, Ohio
Manufacturers of Antenna Specialists brand base and mobile antennas for amateur, professional and CB. Custom design broadcast and professional installations.

The portable power generator with only one moving part. Alternator principle. 1000, 1250, 3000 watt models. Write for complete information.
**NEW PRODUCTS**

**A)** UTICA'S DUO-BAND FM RECEIVER for low (30-50 Mc's) band and high (152-174 Mc's) band monitoring of police, fire and business mobile telephone frequencies. Xtal controlled positions for high and low bands, illuminated tuneable slide rule dial, dual conversion superhet receiver, squelch, tuned RF stage, xtal controlled 2nd oscillator and is temperature compensated for drift control.

110 V. AC only

Durable Chrome Steel Cabinet..........................$164.95
Accessory Speaker, Chrome Steel Cabinet............$ 12.95

**B)** For the ultimate in CB performance the T&C II features dual conversion 6 channel xtal controlled superhet transceiver with tunable receiver, S meter and signal strength output indicator, external xtal socket, auxiliary speaker terminal and universal power supply in a Deluxe Chrome Cabinet............................................. $199.95

C) The ruggedly handsome MC-27 is a dual conversion 6 channel xtal controlled superhet transceiver with superior squelch circuit, automatic volume control and universal power supply in a Deluxe Chrome Cabinet............................................. $179.50

---

**PORTABLE ANTENNA SYSTEM**

Vacationing hams and CB'ers now have a solution to the antenna problem thanks to "The Vacationer," a portable antenna recently introduced by D P Z Corporation. The antenna operates on six different bands—2, 6, 11, 10, 15, and 20 meters—by virtue of a shorting bar for 2 and 6 meters, and small interchangeable coils for the other bands. Rated at 175 watts PEP and 100 watts for AM, the antenna extends to 60 inches. Included in the package are 10 feet of RG-58A/U transmission line, heavy-duty plastic base, coils and shorting bar, 15 feet of counterpoise with alligator clip, and a special aluminum window mount. A low SWR is claimed on all frequencies. Price, $22.50. (D P Z Corporation, 30 Broad St., New York 4, N.Y.)

**COMPACT SCREWDRIVER KIT**

A compact, convertible all-screwdriver tool kit is currently being offered by Xcelite. The PS88 set includes five slot-tip screwdrivers (1/2" through 1/4"), three Phillips screwdrivers (#0, #1, and #2), and a special hollow "torque amplifier" handle. The tools are housed in a plastic pocket case. (Xcelite Inc., Orchard Park, N.Y.)

(Continued on page 34)
How can you be sure the speaker you own is really well-made?

Build it yourself!
(with the new KS-2 StrataKit)

Not content with developing the world's first true slim-line speaker system in kit form (the KS-1), Fisher now presents the KS-2, the newest, most advanced 3-way slim-line speaker system available in any form at anywhere near the price.

By simply installing the drivers, connecting the crossover network and completing the pre-assembled cabinet, you'll be well on your way to hearing why.

The KS-2 features a 12" free piston woofer with a half-roll cotton surround, massive 6 lb. magnet structure, and a free-air resonance of 25 cycles. The 5" mid-range has a butyl-coated surround and is sealed off in back to avoid interaction with the woofer and tweeter. The 3" cone-type tweeter is a hemispherical dome bonded directly to a 1" voice coil with a big 2 lb. magnet structure. Highs are silky smooth and widely dispersed.

The full 3-way inductance-capacitance network crosses over at 1200 and 2800 cycles and has a continuously variable tweeter level control to compensate for room acoustics and variations in pickup characteristics.

Measuring 20" wide x 25" high and only 6½" deep, the completely sealed, fiberglass-packed cabinet weighs 35 lbs. when assembled.

Response of the KS-2 is 35 cycles to well beyond audibility. It requires as little as 10 watts of power and will handle up to 60 watts. Price, in unfinished sanded birch. $89.50*.

Fisher Radio Corporation
21-52 44th Drive, Long Island City 1, N.Y.

Name_________________________________________________________________________
Address_____________________________________________________________________
City___________Zone__State__________


August, 1963
New Products

(Continued from page 32)

GENERAL-PURPOSE OSCILLOSCOPE

Kit builders who would like to put an oscilloscope together will be interested in EICO's general-purpose 3" unit, the Model 430. Vertical frequency response is flat from 2 cps to 500 kc., and horizontal response from 2 cps to 300 kc. Vertical sensitivity is 25 millivolts per centimeter; and the horizontal sensitivity is 25 volt r.m.s per centimeter. Synchronization is fully automatic on all ranges from 10 cps to 100 kc. Special features of the lightweight unit (11 pounds) include easy, direct connection to the vertical deflection plates (for modulation monitoring, for example) by simply plugging test leads into rear jacks and switching from "Amplifier" to "Direct Plates," and a regulated power supply for stable, drift-free operation. Price, $65.95 (kit); $99.95 (wired). (EICO Electronic Instrument Co., Inc., 33-00 Northern Blvd., L.I. City 1, N.Y.)

POLE-MOUNTED SPEAKER ENCLOSURE

A unique solution to the problem of "where to put the speaker" has been incorporated in the pole-mounted "Stereo Master" enclosure currently being manufactured by Wald, Inc. Internal capacity of the 10½" x 11" x 40" speaker enclosure is about 4620 cubic inches; acoustic lining is employed to prevent bass reverberation. Speaker hardware includes a Jensen 8" extended range woofer, 3½" tweeter, and precision crossover network. The spring-loaded top section of the pole keeps the enclosure, which is finished on all four sides, in place. Price, $86.90. (Wald, Inc., 119 Prospect Ave., Burbank, Calif.)
FEATURE FOR FEATURE — DOLLAR FOR DOLLAR
YOUR BEST BUY IN CB RADIO
THE NEW RCA
MARK VIII
27-Mc CITIZENS BAND 2-WAY RADIODPHONE

UP TO 9 FIXED, CRYSTAL-CONTROLLED
TRANSMIT-AND-RECEIVE CHANNELS.
PLUS ALL-CHANNEL TUNABLE RECEIVER.

CONVENIENT ACCESS TO CRYSTALS FOR QUICK CHANGING.

PUSH-TO-TALK CERAMIC MICROPHONE with coiled cord.

EXCELLENT TRANSMITTER
MODULATION CHARACTERISTICS

EXCELLENT VOICE REPRODUCTION—high intelligibility.

IMPROVED AUTOMATIC NOISE LIMITER
reduces effects of ignition and similar interference.

COMPACT AND LIGHTWEIGHT
3½” high, 9 pounds. Fits easily under any auto dashboard.

Continuously tunable receiver picks up any of the 23 C-B
channels. Tunes either by channel number or frequency.

Illuminated working channel. Pilot lamps behind the fixed-
channel dials show the channels being worked.

Separate mobile power supply. (Optional) 6- or 12-volt,
for car or boat. All units contain AC power supply.

Channel-marker kit. Select channels best for your area,
then mark them with the self-adhering labels included.

ONLY $149.50*
*OPTIONAL LIST PRICE

The Most Trusted Name
in Electronics

August, 1963
NEW-TRONICS
PHANTOM
TUNEABLE CB ANTENNA
COPPER-SHEATHED
FIBREGLASS

COPPER
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TUNEABLE
NEW-TRONICS

NEW-TRONICS

36

MOST DURABLE!

FIRST AND ONLY fibreglass antenna sheathed in copper braid and waterproofed with gray plastic sheath. Repeated striking of obstructions will not harm it. Bending of 90° will not crack or break it. Has all the electrical efficiency possible only with an all metal antenna.

MOST VERSATILE!


MOST ECONOMICAL!

With all its exclusive features, the PHANTOM is priced lower than similar purpose antennas with inferior performance.

Model FG-27 antenna with ¾-24 stud . . . . . . . . . . List $7.95
Model FGB-27 antenna, swivel base and lead . . . . . . . . . List $9.95

See the new PHANTOM at your dealer or write for literature describing our entire line of CB antennas and accessories.

Pat. Pend.

NEW-TRONICS CORP.
3455 Vega Ave., Cleveland 13, Ohio Dept. P.

Pop’tronics
Bookshelf

BASIC INDUSTRIAL ELECTRONICS COURSE
by Alfred Haas

This is another in a series of books put on paper by the Gernsback Library that might be characterized as a “state-of-the-art” report. (The objective in these course books is to offer the reader a how-and-why understanding of complex apparatus and techniques. The current contribution by author Alfred Haas is his second; the first, on “Oscilloscope Techniques,” was very well received, and this one should be equally successful. Although industrial electronics is an amazingly complicated and diversified field, it is part of tube and solid-state electronics at the hi-fi amplifier, ham transmitter, and power rectifier level of understanding. If you “savvy” these three categories, industrial electronics will be equally clear to you after you read this book.

Published by Gernsback Library, Inc., 154 West 14th St., New York 11, N.Y. Hard cover, $5.95; soft cover, $4.10.

BASIC SERVOMECHANISMS
by Ed Bukstein

Your reviewer particularly appreciated the very first sentence in this book: “The servomechanism is a self-correcting control system.” It was a statement that laid the foundation for what followed—the explanation of a somewhat difficult subject without the use of mathematics. Of course, author Bukstein’s magazine articles and other books on equally tacky topics have led us to expect a good job from him. This book is intended for the electronics technician who wants or needs an understanding of servos, amplidyynes, choppers, saturable reactors, etc. It covers the subject of basic servomechanisms thoroughly, is well illustrated, and logically arranged. To test the reader’s ability to absorb the subject, a

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BUILD 20 RADIO CIRCUITS AT HOME only $26.95

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12 RECEIVERS
3 TRANSMITTERS
1 OSCILLATOR GENERATOR
1 SIGNAL TRACER
1 AMPLIFIER
1 SIGNAL L. E. D.
1 CODE OSCILLATOR

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

The "EDU-KIT" offers you an outstanding PRACTICAL HOME RADIO COURSE at a rock-bottom price. The "EDU-KIT" is devised for professional and home radio & electronics technicians, making use of the most modern methods of home training. You will learn radio theory, construction principles, servicing techniques, this COMPLETE RADIO COURSE IN EVERY DETAIL. You will learn how to build radios, using regular schematics; how to wire and solder in a professional manner; how to service radios. You will work with the standard type of punched metal chassis as well as the latest development of Printed Circuit Chassis. You will learn the basic principles of electronic components. You will construct, study, and work with amplifiers, tubes, transistors, oscillators, detectors, rectifiers, test equipment. You will learn and practice code, printing the Progressive Code Oscillator, you will learn and practice trouble-shooting, building the Progressive Code Oscillator. You will learn and practice Oscillator, Square Wave Generator, and the accompanying servicing material.

You will receive training for the Novice, Technician and General Classes of F.C.C. Radio Amateur Licenses. The Progressive "EDU-KIT" has been in use for many years and is the most popular "EDU-KIT" of all time. The "EDU-KIT" will provide you with a basic education in Electronics and Radio, worth many times the complete price of $26.95. The Progressive "EDU-KIT" is well known for its outstanding material.

THE KIT FOR EVERYONE

You do not need the slightest background in radio or science. Whether you are interested in hobby electronics or you want an interesting hobby, a well paying business or a job with a future, you will find the "EDU-KIT" a worthwhile investment. Numerous people of all ages and backgrounds have successfully used the "EDU-KIT". In more than 79 countries of the world, the "EDU-KIT" has been carefully designed, step by step, so that you can make a mistake. The "EDU-KIT" allows you to teach yourself at your own pace. No instructor is necessary.

PROGRESSIVE TEACHING METHOD

The Progressive Radio "EDU-KIT" is the foremost educational radio kit in the world, and is universally accepted as the standard in the field of electronics training. The "EDU-KIT" uses the modern educational principle of "Learn by Doing." Therefore you construct, learn schematics, build equipment, do trouble shooting— all in a closely integrated program designed to provide an easily learned, thorough and interesting background in radio theory. You begin by examining the various radio circuits, learning the function, theory and wiring of these parts. Then you build a simple radio. With this first set you will learn the fundamentals of testing and trouble-shooting. Then you build a more advanced radio. The "EDU-KIT" has been carefully designed for service, and to help you work independently and learn to build and test all types of radios. You will find yourself constructing more advanced multi-tube radio circuits, and doing work like a professional radio technician.

Included in the "EDU-KIT" course are twenty Receiver, Transmitter, Code Oscillator, Signal Generator, Receiver, Transmitter, and Oscillator Kits. Each Kit has complete instructions and parts. You will learn the elements of electronic construction, and be able to use the "EDU-KIT" to build any of the radios you want to. You will also connect the Printed Circuit Chassis, constructed by means of professional wiring and soldering on metal chassis, plus the new method of professional wiring known as "Printed Circuit." These circuits operate on your regular AC or DC house current.

THE EDU-KIT IS COMPLETE

You will receive all necessary servicing material, instruction and parts. Each tube kit contains tubes, tube sockets, variable, electronic, inductors, capacitors, resistors, etc. The Printed Circuit Chassis are each custom designed to fit each different radio. You will receive Printed Circuit materials, including Printed Circuit chassises, special tube sockets, hardware and instructions. You also receive a useful set of tools, a professional electronic soldering iron, and a self-powered Dynamic Radio and Electronics Tester. The "EDU-KIT" also includes Code Instructions and the Progressive Code Oscillator. In addition to F.C.C.-type Questions and Answers for Radio Amateur License training, You will also receive lessons for service with the Progressive Signal Trace and the Progressive Code Oscillator, a High Fidelity Guide and a Quiz book. You receive Membership in Radio-Circuit-Clinic, a University of Electronics Privilege, a Certificate of Merit, a Certificate of Membership AND SERVICE, a Certificate of Membership FOR TV-AMATEUR LICENSE TRAINING AND PRINTED CIRCUITRY.

UNCONDITIONAL MONEY-BACK GUARANTEE

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ORDER DIRECT FROM AD—RECEIVE FREE BONUS RESISTOR AND CAPACITOR KITS WORTH $7

☑ Send "EDU-KIT" postpaid. I enclose full payment of $26.95.
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FREE EXTRAS

- SOLIDING IRON
- ELECTRICIAN'S WRENCH
- PLIERS-CUTTERS
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- WRENCH SET
- VALVE DISC CUTTER
- CERTIFICATE OF MERIT
- TECHNOIST INSTRUCTION MANUAL
- HIGH FIDELITY GUIDE & QUIZZES
- TELEVISION RADIO & TV
- MEMBERSHIP IN RADIO-TV CLUB:
  - AMATEUR LICENSE TRAINING
  - PRINTED CIRCUITRY

SERVICE LESSONS

You will learn trouble-shooting and servicing in a progressive manner. You will practice repairing the sections you construct. You will learn symptoms of faulty circuits in home and car radios. You will learn how to use the professional Signal Trace, the unique Signal Generator and the dynamic Radio & Electronics Tester. While you are learning in this practical way, you will be able to do more for your neighbors and friends, and charge fees which will far exceed the price of the "EDU-KIT," as well as help you with any technical problems you may have.

FROM OUR MAIL BAG

J. Statzik, Jr, of 25 Poplar Pl., Waterbury, Conn., writes: "I have repaired several sets for my friends, and made money for myself. I saved a lot of money. If I had not been able to afford the "EDU-KIT," I was ready to spend $240 for a course. But I found your ad and sent for your kit, and I got the "EDU-KIT." I send my friends the questions and also tell them I am a radio repair man. One man sends the questions and also tells my friends. You have made it easy for me to work as a radio repair man. The "EDU-KIT" has been in Radio for the last seven years, but like I am telling my friends, it is like to work with Radio Kits. As I like to build Radio Testing Equipment. I enjoy every minute I work with the different kits: the Signal Tester works fine. Also like to let you know the pride in being a member of your Radio-T.V. Club."

add this

to this

you'll be amazed at the improved performance*

**BLONDER-TONGUE**

**B-24c INDOOR BOOSTER**

Some people think a booster is only for use with outdoor antennas. Not so. In many cases, the new Blonder-Tongue B-24c indoor TV FM booster produces a dramatic improvement in reception when used with an indoor antenna. Simply add it to any garden variety indoor antenna, and you get up to 12 db gain in signal strength—enough to turn your indoor antenna into a powerful antenna system.

The Blonder-Tongue B-24c is easy to install anywhere in the home—patented, stripless screws eliminate the need to cut and twist twin lead. It can be used to amplify signals from any indoor or outdoor antenna. It's an excellent solution where you can't, or don't want to, utilize an outdoor antenna. Hook up a B-24c and see how much sharper and clearer it makes the picture. What's more, you can operate extra TV or FM sets from single indoor antennas—up to 4.

In very difficult reception areas an outdoor antenna is necessary because it delivers a better signal-to-noise ratio than an indoor antenna. In that case you still can use a B-24c indoor booster, or any one of the indoor or outdoor boosters in the Blonder-Tongue line. Blonder-Tongue boosters perform best. Try them today.

*especially effective in improving color TV

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Canadian Division: Benco Television Assoc., Ltd., Toronto, Ontario

home TV accessories • closed circuit TV • community TV • UHF converters • master TV

---

**Bookshelf**

(Continued from page 18)

number of questions appear at the end of each chapter.


**MICROWAVE SYSTEMS FUNDAMENTALS**

by F. Jonathan Mivec

To most electronics experimenters, the world of microwave techniques is shrouded in mystery. In this part of the spectrum, the everyday vacuum tube and transistor give way to klystrons, magnetrons, and wave guide plumbing. Septums, splash plates, and slots are a few of the terms one encounters in the discussion of antennas, for example. How can you find your way around this maze? Try reading *Microwave Systems Fundamentals* with its easy-to-understand, non-mathematical approach. It makes both a handy pocket guide and ready reference volume. It has our highest recommendation.

Published by Howard W. Sams & Co., 4800 West 62nd St., Indianapolis 6, Ind. Soft cover. 288 pages. $5.95.

**COMING NEXT MONTH**

Look what they're doing to electronic components! *POPULAR ELECTRONICS* goes behind the scenes to see how miniaturization will affect experimenters and do-it-yourself fans.

**ON SALE**

AUGUST 27

- **ELECTRONIC STOPWATCH**
  Reading down to tenths of a second, this stopwatch operates courtesy of the 60-cycle house current. It has varied uses, is easily constructed.

- **144-MC. SUPERHET**
  Remember the "Simple Superhet for 6" published in the April, 1963, issue? Take the identical chassis layout, change a few of the parts values, and it becomes—a superhet on 2! Always say you saw it in—*POPULAR ELECTRONICS*
A brand new compact control unit that permits the installation of transceivers in the automobile trunk or other out-of-the-way space. Unit mounts under auto dashboard and gives you complete remote control of transceiver.

- MOBILE OR BASE STATION OPERATION
- EASY INSTALLATION
- TURNS TRANSCEIVER ON AND OFF
- SWITCHES TRANSMIT AND RECEIVE CHANNELS
- ILLUMINATED DIAL
- DIMENSIONS: 2½" H x 7" W x 5" D
- RUGGED CONSTRUCTION

SPECIFICATIONS:
The International Executive Remote Console is designed as a companion accessory for remote operation of the Model 50 and Model 100 transceivers. The console contains the receiver/converter stages (uses the printed circuit board from your present Executive) plus a new transmitter oscillator. The attractive console blends with and compliments your auto instrument panel. Console panel includes illuminated dial, On-Off switch, volume control, squelch, transmit and receive indicator lights, push-to-talk microphone socket.

TWO MODELS TO CHOOSE FROM
Model RM0-9 . . . a deluxe unit with 9 transmit and 9 receive channels. Complete with channel switch, but less crystals. $57.50

Model RM0-1 . . . for single channel operation. Does not contain channel switch. Complete less crystal $42.50

SEE THE EXECUTIVE REMOTE CONSOLE AT YOUR INTERNATIONAL DEALER . . . TODAY!
Let's start with scopes—essential for the experimenter. EICO has an excellent variety to choose from. The new full performance 430 General Purpose compact with 3" flat-face CRT; the 427 General Purpose DC scope; and one of the best thought of scopes in the DC wide band field, the 5" CRT 460.

If you work with transistor circuits, EICO has the team for you: the 1020 Power and Bias Supply with 0.005% ripple; and the 680 Transistor & Circuit Tester which combines transistor parameter measurements with a 20kΩ/V multimeter for dc voltage (to 50v) and resistor measurements.

If you're interested in RF you'll need a good, wide coverage RF signal generator with built-in audio modulation such as the EICO 324 (150 kc-435 mc), and a good VTM such as the EICO 222 or peak-to-peak VTM the 232. Use either one with RF VTM probe PRF-11.

If you're interested in audio, EICO has an excellent Sine and Square Wave Audio Generator ranging from 20 cps to 200 kc, the 377. You'll also need an AC VTM. The 12-range EICO 250 (measures 100 μV to 300V) is an excellent choice. It has a panel switch that converts it to a broadband amplifier with 60 db gain and over 5V undistorted output. The EICO 261 AC VTM and Wattmeter has 11 ranges (measures 1 mv to 1000V) and it includes a tapped 4, 8, 16 and 600 ohms power resistor handling up to 80 watts as well as load compensated wattmeter ranges. In general you will need an EICO 222 or 232 VTM as well, for measuring up to 1500 VDC or AC, and for resistance measurements.

If you like to draw materials from a "junk" box, you'll need a Resistance-Capacitance Bridge, EICO 950R, which measures capacity from 10 μμf to 5000 μf, resistance from 0.5 ohm to 500 meg., and contains a continuously variable 0-500 VDC supply for a sensitive capacitor leakage test. Complementing it is the 935 for in-circuit capacitor short—open testing, and capacity measurements with unique shunt resistance balancing.

For trouble shooting audio, IF, and RF circuits, the 147A Multi-Signal Tracer has both RF & audio inputs with demod & direct probes, noise locator circuit, wattmeter, substitution test, & eye-tube and speaker monitors. And for testing tubes nothing beats the economical EICO 628 Emission Type Tube Tester. The new 667 Dynamic Conductance Tube and Transistor Tester is the best in the field. Both test all the new tube types including Nuvisor, Novar, 10-pin, Compacrons, etc.

Other handy items are EICO substitution and decade boxes: EICO 1100 covers EIA capacitance values from 15 ohms to 10 meg.; the 1120 EIA capacitance values from 100 mmf to 0.22 mmf. The 1140 combines both 1100 and 1120 in one box and permits series or parallel combinations as desired. The 1171, a Precision Decade Resistance Box, covers 1 to 99,999 ohms in 1-ohm steps; and EICO 1180, a precision Capacitance Decade Box, covers 100 mmf to 0.111 mmf in 100 mmf steps. If you want to know how a circuit performs with varying line voltage, or to correct for varying line voltage during an experiment, the EICO 1078 Metered Variable Auto-Transformer AC Bench Supply provides 0-140 VAC continuously variable, from 120 VAC line input with a 7½ amp. current rating. Output current and voltage are separately metered. If you're an experimenter or technician, you'll find that EICO test equipment can make any job easier. You can also be sure, that when you select EICO instruments, as a kit or factory-wired, you get the most performance for your dollar. See the most complete line of test instruments (kit and factory-wired) at your distributor.

A guide to what the well equipped experimenters' workbench looks like

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Always say you saw it in—POPULAR ELECTRONICS
Fiber optics—the transmission of optical images through thin glass fibers—is one of the most intriguing techniques used in modern electronics. This versatile new development has applications in just about every piece of equipment where optical images must be generated or processed. When a large number of fine glass fibers are properly
aligned in a bundle, they can be used to transfer an optical image—element by element—from one end to the other. If a glass fiber is coated with a thin layer of glass with a lower index of refraction, light entering into one end of the fiber travels down the length of it by means of a series of reflections from the walls.

Both flexible and inflexible fiber optic elements are being made. Small diameter flexible units for medical purposes may be used for viewing a patient’s stomach, or even—with a new technique—inside a patient’s heart! Flexible elements will permit engineers to observe the internal functioning of engines and other machines.

These versatile devices are made by enclosing a bundle of aligned fibers in a flexible plastic jacket and potting the ends in highly polished clear plastic for good light transmission.

For other applications, the aligned glass fibers are fused into a solid mass. Examples of dramatic new developments resulting from this technique are high-resolution, fiber optic cathode-ray tube face plates and various types of image pickup tubes—all with extremely high efficiencies. The image on a fiber optic face plate is about 40 times brighter than with a conventional cathode-ray tube since the image is formed on one surface and transmitted, with very little loss, to the other surface.

While the fiber optic element—a solid type—used in this experiment depends on a series of internal reflections to transmit light, suitably proportioned fibers perform in the visible spectrum exactly as do wave guides at microwave radio frequencies. In combination with laser beams with extremely wide usable bandwidths, fiber optic wave guides point to future communications systems with fantastic capacity. A single fiber optic "pipe" could easily carry a billion phone calls!

A Practical Experiment. Images can be transmitted through a fiber optic element by placing an illuminated object in direct contact with the polished ends of the fibers, or by optically focusing an image on this surface. The transmitted image can be directly viewed on the other end of the fiber optic element or may be projected—using conventional lenses—onto a viewing screen.

The setup used in this experiment is shown in detail in Fig. 1. The image from a 35-mm. photographic slide is

A 35-mm. slide projector is used to focus an image on the end of a 6" fiber optic element. Lens mounted on third panel projects the transmitted image on a small screen mounted at the end of the baseboard.
projected—in reduced size—onto the polished end of a glass rod fiber optic element. The image is transmitted through the 6” fiber optic path and then projected through an enlarging lens onto a small viewing screen.

The fiber optic element is "Image Conduit," made by the American Optical Company, and consists of 73,000 twelve-micron (.0005”) fibers fused together to form a hexagonal-shaped, ⅛”-diameter rigid rod. Image Conduit is available in 6” and 12” lengths from Allied Electronics, a subsidiary of Allied Radio, 100 North Western Ave., Chicago 80, Ill. The 6” length, Type 1C-1-6, is available under Allied catalog number 4E450 at $6.25. The 12” element, Type 1C-1-12, catalog number 4E451, sells for $11.00.

An Image Source. The image source used in this setup is an ordinary 35-mm. slide projector. Since projectors are designed to throw enlarged images on a screen some distance away, a different lens or lens-spacing system is necessary to get a reduced image which can be focused on the end of a fiber optic element.

The easiest way to modify the projector is to remove the lens and slide an 18” length of tight-fitting mailing tube over the lens barrel (see Fig. 1). Secure the mailing tube in place with friction tape; also use tape to build up the size of the projector lens so it fits snugly in the tube's other end.

Fire up the projector and insert a slide. Move a white card back and forth in front of the lens. At a distance of a few inches, depending on the focal length of the lens, a very small, intense,
in-focus image will be observed. Make a note of this distance; the end of the fiber optic element will later be mounted exactly at this point.

A second method of modifying a projector involves replacing the original long-focal-length projection lens with one of a shorter focal length (see Fig. 2). Suitable lenses can be obtained from junked 8-mm. movie cameras and projectors, and most camera dealers will sell them at a very low price. Alternately, a replacement 8-mm. projector lens can be purchased reasonably.

Two Lafayette Radio 8-mm. movie projector zoom lenses were used in the setup shown in the photos, one for the projector image-reducing lens and the other for projecting the fiber-transmitted image on a screen. Each has an adjustable focal length of 15 to 25 mm.

Mounting the replacement lens in the projector barrel (in reversed position) takes a little ingenuity. The author used a military surplus electrical connector clamp bushed out with electrical tape.

As described before, find the best position for the end of the fiber optic element by determining where a sharp image falls with the lens in place.

Construction. A permanent setup (not absolutely necessary) was constructed by the author, and consists of a baseboard and four panels. The slide projector was mounted at one end of a 40” x 8” x 1” white pine board; a 58” long board should be substituted if the original lens is used with an extension tube. Four 6” x 8” panels of 1/4” tempered Masonite were used to mount the fiber optic element, the projection lens, and the projection screen.

Using machine screws and nuts, mount two 1 1/2” brass angle brackets on one 6” side of each Masonite panel. Cement a 5” x 7” white card to the center of the mounting bracket side of one of the panels. Using wood screws, mount this panel in the center of one end of the board as shown in the photographs. Center the modified slide projector at the other end of the board and mount it.

Adjusting the Panels. Turn on the slide projector and adjust its mounting so that it projects a beam parallel with and down the center of the base. Center one of the Masonite panels on the board in front of the slide projector lens and mark the center of the projected image. Drill a 1/4” hole at exactly the same spot in each of the three remaining panels. Then install 1/4” rubber grommets in two of the panels to hold the fiber optic element. Mount one of the panels 1” farther from the lens than the optimum focus point which you found earlier and mount the second panel 4” beyond the first.

Now install the fiber optic element in the grommets, and adjust it so that a sharp image from the projector falls on its end.

The Projection Lens. The mounting position of the projection lens depends on its focal length. A short-focal-length lens such as one salvaged from an 8-mm. movie camera or projector should

(Continued on page 117)
This stable "front-end" BFO makes CW and SSB sets out of marginal receivers

By HARTLAND B. SMITH, W8VVD

Despite the well-deserved popularity of c.w. and single-sideband among radio amateurs, both modes of operation—and especially sideband (SSB)—can create some annoying problems on the receiving end. They can't be copied on a receiver which lacks a beat frequency oscillator (BFO). Without some means for generating a stable local carrier (the function of a BFO), the prospective Novice finds it impossible to practice code reception, and the curious SWL has a hard time deciphering sideband QSO's. Furthermore, many inexpensive or elderly ham receivers, even when equipped with BFO's, drift so badly that the operator must constantly retune to keep from losing the desired signal.

Luckily, there is now a simple answer to these problems—an amazingly stable, simple gadget called the "Code Bander." This easily constructed receiver accessory will enable you to copy code and sideband on any receiver.
prove frequency amplifier. Transistor to will the frequency stead, receiver's intermediate frequency. How easily understood C8 L1-22 C10 C4, C5-500-µµF. C3- C2 C1 B1-9-ol1 LI L1-22 turns of Barker and Williamson 3014 coil stock tapped 2 turns and 15 turns from the ground end.

Transistor Q1 is a highly stable oscillator, and Q2 acts as an r.f. amplifier. The unit's fundamental frequency range is 3.5 to 4 mc.

The Code Bander contains two inexpensive transistors: Q1, which serves as a highly stable oscillator, and Q2, which acts as an r.f. amplifier. The oscillator can be tuned to any frequency in the 3.5 to 4 mc. amateur band by adjusting the coarse tuning capacitor, C2. Vernier capacitor C1 provides the extreme bandspread required to accurately zero on a specific signal.

Both the fundamental and harmonics of the oscillator frequency are present at jack J1. Thus, the Code Bander can be used not only on 80 meters, but on 40,
The small parts are mounted under the chassis, and tuning capacitors and insertion control to the front panel. Solid support for L1 is provided by cementing pieces of polystyrene rod in the places shown.

This top and front view of the Code Bander shows the general mechanical arrangement with the small chassis mounted to the front panel. Note that the transistors and battery are mounted on top of the chassis.
20, and 15 as well. Control R9 adjusts the output so that optimum balance between the received signal and locally generated carrier can be achieved.

Oscillator stability is enhanced by tapping the base connection of Q1 down from the top of L1, and by using high capacity at C4 and C5 to swamp out capacitance changes in Q1. A very low value coupling capacitor, C8, minimizes instability resulting from amplifier loading.

Construction. Putting the Code Bander together will be easier if you install C1, C2, C3, L1, and R9 after wiring the other parts. A one-terminal tie strip supports the junction of R5, R6, and the r.f. choke (RFC). A two-terminal strip supports C4 and one end of C5.

Most chassis grounds are made to solder lugs located under the nuts which hold the chassis to the front panel. Exceptions are the grounded end of C5 which goes to the ground terminal of J1, and the cold ends of L1 and R9 which go to a lug bolted to the front panel midway between R9 and C1. (The head of this bolt is visible in the top photo on page 47 behind R9's knob.) Trim resistor and capacitor leads so they are just long enough to connect to the terminals.

The connector for B1 was salvaged from the top of a discarded 9-volt transistor battery. Solder one terminal of this connector to a ground lug and run a wire from the other terminal, through a hole in the chassis, to switch S1 (a part of R9). Since the drain is less than 2 ma., the battery will last indefinitely.

Mechanical Stability. A number of precautions must be observed to insure ruggedness. Beef up the 3" x 5" x 4" aluminum utility cabinet by installing extra sheet metal screws around the edges of both front and rear panels. Most components are mounted on a small aluminum chassis which is bolted to the front panel and, after installation in the cabinet, fastened to the rear panel with two sheet metal screws.

Solid support must be provided for L1. Cut three ½" lengths of ½"-diameter polystyrene rod and cement them between the coil and the bodies of C2 and R9. These plastic braces are visible in the bottom photo on page 47.

Code Bander Operation. To copy c.w., tune the receiver until you come across the familiar thump and hiss which denotes a code signal. Turn R9 to mid-range, and adjust C2 until the Code Bander's carrier beats against the signal to produce a whistle each time code is sent. You can vary the pitch of the beat note by tuning C1. Finally, adjust R9 for the best ratio between the signal and the locally generated carrier.

If R9 is set too high, the c.w. station will be smothered. On the other hand, too low a setting of the injection control will cause the beat note to weaken or disappear entirely.

Copying Sideband. For sideband reception, tune the receiver until the incoming garbled speech is loudest. If you're using a regenerative set, turn down its regeneration to drop the detector out of oscillation. Run C2 back and forth until the local carrier can be heard on top of the incoming signal. Slowly tune C1 for normal sounding speech. Set R9 just above the point where the signal tends to distort.

Although at first glance these instructions may appear complicated, once you're accustomed to operating the Code Bander, you'll find it easy to quickly tune in either a c.w. or sideband signal. If there is too much output with R9 at minimum, connect a twisted wire gimmick in the lead to the receiver (a gimmick is two short pieces of insulated wire twisted together to form a small capacitance). The gimmick arrangement may be needed with some receivers on 80 meters.

One final tip: if Q1 should refuse to oscillate, move the base tap on L1 up a turn or two.
When you took your original rabbit ears out of the box in which they came to you, it's almost certain that you did not find adequate instructions for their use. All of the manufacturers of rabbit ears, having built a very fine product, seem to have agreed that you must learn about it the hard way. So, they tell you nothing, or next to nothing, and your only recourse is to regard the adjustment of your ears as another of the "pleasant" mysteries of television.

Perhaps you have decided, after much experimenting, that you get best results with a long ear pointed at Chillicothe, Ohio, and a short ear pointed at the moon. Now this is all wrong—for several dull scientific reasons which can quickly be passed by. However, since the manipulation of rabbit ears is quite critical, producing either (and usually unexpectedly) a shocking improvement or degeneration in picture quality, a few helpful comments are in order.

As on the rabbit, the ears should be the same length, and if you need utmost sensitivity from your antenna, this length should be changed every time you switch channels.

In the chart on page 50 is the answer to TV's best guarded secret—the electronically right length for rabbit ears. Measurements to a small fraction of an inch may seem like lint-picking if you're entirely happy about the picture quality you are getting by adjusting your ears "esthetically." If, however, you're fighting to get a good picture out of a troublesome channel, exact-length rabbit ears will improve things. Measure with a steel tape or that cloth tape in the sewing basket, starting where the ears come out of the base. Small reference scratches can be made on each ear with a file so that you can quickly retune them for best results on any channel.

Wide or Narrow Ears? There's a catch to the problem of adjusting rabbit ears. They do not do their best when pointed up in a wide or tight V—they should be extended out to the sides! Unfortunately, this introduces a situation which is socially impractical, and one which has an element of danger. An unsuspecting guest may back into a rabbit ear point and impale himself upon it.

What happens, you ask, when rabbit ears are turned up into a V position? How long should they be? The arithmetic for this can get very complicated because everything changes a little every time you change the angle of the V.

In general, when using rabbit ears in this unscientific position, they should be slightly longer (maybe 10 percent) than the exact figures given for horizontal ears in the chart. They should be as

"TV'S BEST GUARDED SECRET—"
widely spread as possible, and, of course, they should be the same length as one another.

**Different Types of Ears.** In addition to the ordinary, garden-variety rabbit ears, other types available include exact replacements for those built into portable TV sets (sold through electronics supply houses), and at least a dozen models that include a switching arrangement in addition to the basic adjustment of the ears. These switches, which perform a variety of matching and orienting functions, may have as few as three positions or as many as twelve, depending, seemingly, upon whim.

If the switch positions correspond to Channels 2-13, fine. If, however, the positions are numbered 1-12 or, as in one case, 1-9 followed by A, B, and C, the contribution of the switch is far more subtle, and the best position can be found only by “cut-and-try.”

**Guaranteed Method.** Here is a three-step experiment that will guarantee absolute maximum performance with switches. Before starting, adjust the ears to exact length, and provide room to swing them around. It is necessary to carry out the steps in the order indicated, since you are dealing with three variables which are inter-related; if your method lacks scientific orderliness, your results will be confusing.

**Step One:** Set the rabbit ears selector switch to its lowest position.

**Step Two:** Swing the ears in a circle to get the best picture. You are trying to do two unrelated things—strengthen the incoming signal and, secondly, eliminate “ghosts.” If the main signal is strong enough so that the rabbit ears do not need to be positioned critically, the ears can then be set to reject ghosts. A compromise may be necessary.

**Step Three:** After obtaining the best possible results with the above steps, adjust the TV set's fine tuning control. Now move the selector switch on the rabbit ears to its next position, and repeat Steps Two and Three. And so on, ad nauseam.

**The Rabbit Ears Test.** Although rabbit ears tuning perfection is not recommended as standard practice, it is extremely useful in determining whether your present antenna and your use of it are as good as they could be. Rabbit ears can serve as a standard against which other antennas may be compared. By quickly connecting a pair of ears, you can determine if your roof antenna is pulling in a good signal or if it, or the TV lead-in, is defective.

Yours for the better picture.  

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**Table:**

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What about the future of the vacuum tube? Will designers continue to develop tubes based on new principles, and improve tubes employing already-known ones? The answer to this question is probably "yes," and a good look at the types discussed in this final portion of the tube "family tree" should convince anyone that the end is certainly not in sight. The family history of the cathode-ray tube alone ably illustrates how present-day tubes are built on past developments and discoveries. The first ancestor of the CRT was in actual operation in 1897, nine years before De Forest's triode put amplification into the hands of electronic researchers. Even so, practical television had to await development of more sophisticated CRT's, and particularly that much more unprecedented invention, the camera tube.
Camera Tubes. Used in television cameras, these tubes produce a video signal corresponding to the light image of a picture or scene which is to be televised, recorded on tape, or transmitted over a wired installation. In general, camera tubes consist of an electron gun assembly, a means for deflecting the electron beam in a regular pattern, and a photosensitive target assembly of some type which can convert light patterns into electrical charges or signals when struck by the electron beam. The electron guns and deflection techniques used with camera tubes are basically like those used with display-type CRT's.

The iconoscope was, for a number of years, the most practical type of camera tube. The heart of this device is a sensitized target on which the scene to be televised is focused by a lens system. The target is of sandwich-like construction and consists of a conductive coating or signal plate, a layer of insulation, usually mica, and a mosaic pattern of tiny photoemissive globules. Each globule acts somewhat like a miniature photocell.

When light strikes a globule, it emits electrons to a greater or lesser extent depending on the intensity of the light. These electrons are picked up by a collector ring in front of the photo-mosaic, leaving a greater or lesser positive charge on each globule. The globules and the insulated signal plate behind them thus act as a capacitor. As the beam from the iconoscope's electron gun strikes each globule, it restores the electrons lost by photoemission, and, in effect, discharges the capacitor, developing an output signal at the signal plate. The signal corresponds to the image of the scene being televised.

The Image Orthicon. Today, the most sensitive and widely used type of camera tube is the image orthicon. It is made up of three principal parts: an image section; a scanning section; and an electron multiplier. The image section of the tube contains a semitransparent photocathode on the inside of the glass faceplate, an accelerating grid (No. 6), and a target which consists of a thin glass disc with a fine mesh collector screen positioned very close to it on the photocathode (front) side. Focusing is accomplished by means of a magnetic field produced by an external coil and by the proper selection of photocathode and accelerating grid voltages.

In operation, the scene to be televised is focused on the photocathode, which emits electrons proportional to the intensity of the light striking each of its areas. The electron streams are focused on the target and cause secondary electrons to be emitted by the glass disc. These secondary electrons are collected by the adjacent wire mesh, leaving the photocathode side of the disc with a pattern of positive charges corresponding exactly to the image being televised. Since the glass is quite thin, a similar charge pattern is set up on its opposite side.

The glass is scanned by a low-velocity electron beam produced by an electron gun and deflected by external electromagnetic coils. This beam is made to decelerate and to approach the glass vertically at essentially zero velocity by the potentials applied to the decelerator grid (No. 5) and the field mesh. Some of the electrons are deposited on the glass to neutralize its positive charge while others are repelled to form a return beam. The return electron beam, then, is modulated by the positive
charge pattern on the target and hence in accordance with the original light image.

On coming back to the electron gun area, the return beam passes through a five-stage electron multiplier similar to that employed in photomultiplier tubes, developing an output video signal. The dynodes in the multiplier section may amplify the modulated beam by 500 times or more, with the result that the image orthicon is basically more sensitive than the human eye in picking up faint light images.

The monoscope is a special type of camera tube. Its basic principle of operation is similar to that of other CRT's, for it incorporates essentially the same type of electron gun and deflection systems. However, it is fitted with a permanently installed fixed pattern—such as a TV test pattern—and develops only a repetitive video signal.

Special CRT's. In addition to the cathode-ray tubes we've discussed, there are a number of special types which depend on electron beams for their operation. Among these are a variety of discharge and demonstration tubes used for classroom study and laboratory experiments, but by far the most common type is the X-ray tube.

The basic X-ray tube consists of two principal electrodes: an electron source (cathode), and a target anode. The anode is of dense metal and set at an angle with respect to the electron source. In operation, extremely high voltages are applied to the two electrodes, accelerating the electron stream to tremendous velocities. On striking the target anode, the electron beam excites the metal atoms, causing them to emit ultra-short electromagnetic radiation—X rays. Since the target is set at an angle, the X rays are radiated out through the side of the tube's glass envelope, where they can be photographed and used to trace in outline the interior make-up of solid matter.

**UHF Tubes.** Conventional receiving and transmitting electron tubes cannot be used effectively at ultra-high and super-high radio frequencies, that is, from five hundred to tens of thousands of megacycles. At these frequencies, short lead lengths begin to have considerable inductive reactance and act like coils or even r.f. chokes. Minute inter-electrode capacities become short circuits, and even the time required for an electron to move from a cathode to a plate may represent several cycles of the frequency to be handled. When even higher frequencies are considered, familiar tuned circuits cannot be used and are replaced by resonant cavities—essentially hollow, metal-enclosed spaces which behave like tuned circuits.

Tube manufacturers have designed a number of special tubes for use at extremely high frequencies. In general, these tubes have close electrode spacing to reduce electron transit time and, often, disc-shaped electrodes to reduce terminal lead inductance. Interelectrode capacities are minimized by keeping electrode supports small and shaping them for maximum spacing with respect to other tube elements. Due to their construction, many UHF tubes take on strange and unusual shapes, and are often named after their physical appearance. Thus, one firm may offer long,
slim "pencil" tubes, while others produce stepped tower-like "light-house" tubes, and so on. Quite frequently, the tubes are manufactured with resonant cavities as an integral part of their structure.

One pencil-type triode oscillator tube, the RCA 7533, is made with two built-in resonant cavities, one between grid and cathode and another between grid and plate. The tube looks very much like a small can. Designed for use as an oscillator in the 1660-1700 mc. band, the 7533 has a plate dissipation rating of 3.6 watts and can deliver approximately 500 milliwatts.

Another interesting UHF tube is the RCA 7457, a beam power type which can be used at frequencies up to 2000 mc. With a maximum plate dissipation rating of 115 watts, it can handle input powers as high as 180 watts up to 1215 mc. Used as a class C amplifier with 900 volts on its plate, it can deliver approximately 40 watts at 1215 mc. It is designed for forced-air cooling and has a built-in finned radiator. In general, the 7457 is used with external cavities, coaxial-cylinder, or parallel line circuits.

The GE GL-6299 is a co-planar triode suitable for use as an amplifier at frequencies as high as 3000 mc. Designed for use in receivers, it has an extremely low noise rating. As a rule, it is used with external cavities or coaxial circuits. Of ceramic construction, the GL-6299 generally resembles the "light-house" tube of a few years ago.

The UHF tubes we've just examined, as well as many similar types, operate on the same principles as more conventional electron tubes, except for their frequency of operation and the types of tuned circuits with which they are used. In addition, however, there is a group of high-frequency tubes which operate on entirely different principles: magnetrons, klystrons, traveling-wave tubes, and related types. We'll examine these next.

The Magnetron. Although used extensively since World War II as high-power oscillators in radar transmitters and other types of ultra-high frequency equipment, the magnetron is basically a diode. In its common form, it consists
of a coaxial cathode and a circular anode (or plate) which may, or may not, be split into two or more segments. This assembly is placed between the poles of a powerful permanent or electromagnet and aligned so that the magnetic field is coaxial with the cathode and plate.

In operation, a high positive voltage is applied to the magnetron's plate. If it were not for the magnetic field, the electrons emitted by the cathode would travel in a straight, radial line directly to the plate. The magnetic field, however, forces the electrons to travel in a spiral or circular path; and if the field is made strong enough, most of the electrons swing in complete circles, returning to the cathode. These high-speed electrons, whizzing by the plate structure, induce high-frequency currents. To obtain oscillation, then, a proper balance between anode voltage and magnetic field strength is needed, for the electron resonance must approximate that of the resonant cavity formed by the plate structure.

A split-anode magnetron can be made to oscillate at frequencies much below the natural electron resonant frequency by connecting the segments to a tuned circuit, such as a tuned line. In higher frequency types, the tuned circuit may be little more than a heavy bar of metal connecting the segments together to form a simple closed loop. Split-anode magnetrons need not be limited to two segments; four, six, eight, or more segments may be used.

A different type of magnetron employs a solid anode in which small resonant cavities have been formed. The high-speed electrons moving past the cavity openings shock the cavities into oscillation. The action is somewhat analogous to what happens when a person blows sharply across the open end of a small closed tube to produce a whistle.

Commercially available magnetrons operate at frequencies from a few hundred to as high as 30,000 mc. and can deliver peak output powers ranging up to 2000 kw. (2 megawatts!) when used as pulse generators, or hundreds of watts when used as c.w. sources.

The Klystron. In one sense a special type of cathode-ray tube, for it utilizes an electron gun and a stream of electrons for its operation, the klystron can be used as an ultra-high frequency oscillator or amplifier. When first invented, the device was originally dubbed a rhumbatron, for the electrons were said to be made to "dance the rhumba" within the tube, since they were velocity-modulated.

The components of the basic klystron tube include an electron gun assembly, a pair of closely spaced grids called a "buncher," another pair of grids called a "catcher," and an anode or plate called, in this case, a "collector," since it receives the electron stream sent down the tube by the gun assembly. There is a narrow "drift space" between the buncher and catcher grid assemblies.

In operation, the electron beam is aimed down the tube by the electron gun, and an r.f. voltage is applied to the buncher grid. As the electrons approach the buncher and pass through it, they...
**THE TUBE FAMILY TREE**

Bunching of groups of electrons as they move through tube is the basic principle of the klystron.

are alternately slowed and speeded up, that is, velocity-modulated. To visualize how this occurs, consider that the first buncher grid is momentarily negative and the second positive. Those electrons which are approaching the first grid are repelled and slowed down. Those which are between the first and second grids are repelled by the first and attracted to the second and hence speeded up. Those which have passed the second grid are attracted "backwards" and hence slowed down. On the next r.f. half-cycle, when the first grid is positive and the second negative, the action is reversed.

Thus, the net result is that the electron stream is separated into tiny bunches corresponding to the applied r.f. frequency. As the velocity-modulated stream moves along the drift space, the faster moving electrons in each bunch (or bundle, if you prefer) overtake the slower moving ones and the bunch, in one sense, becomes "stronger," for a greater number of electrons are compacted together. When these bunches pass the catcher grid assembly, they give up most of their energy, shock-exciting the tuned circuit into oscillation. Afterwards, the spent electrons are accumulated by the positive-charged collector.

In practice, klystrons are operated at such high frequencies that resonant cavities, rather than conventional tuned circuits, are used to tune the buncher and catcher grids. The electron stream is generally focused by a strong permanent magnet or electromagnet placed on the outside of the tube. A tunable klystron can be assembled by using a bellows-like arrangement for the cavities, permitting the cavity size to be reduced (to increase frequency) or expanded (to reduce frequency).

Since the output signal is much greater than the input signal applied to the buncher, due to the electron concentration which takes place in the drift space, the klystron may be used as an amplifier. It can also be used as an oscillator by coupling the catcher cavity back to the buncher.

While the two-cavity klystron is basic, it is not the only type produced. A single-cavity type, called a reflex klystron, uses the same cavity as both a buncher and catcher; here, a negative voltage is applied to the collector, repelling the electron stream back on itself so that it passes the double-grid assembly both "coming" and "going." More recently, a three-cavity electrostatically focused klystron has been developed.

Commercially available klystrons operate at frequencies from a few hundred to over 120,000 mc. (120 gigacycles), delivering output powers from less than a milliwatt (for receiver applications) to many watts (for transmitters).

**Traveling-Wave Tubes.** Utilizing some of the basic operating principles of both magnetrons and klystrons, traveling-

(Continued on page 110)
ELECTRONIC MENU QUIZ

By ROBERT P. BALIN

Many of the nicknames most technicians use for electronic parts, effects, or methods, are also names of common foodstuffs, such as those on the electronic menu below. Of course, any resemblance is purely a visual one! Nevertheless, see if you can match the electronic dishes (1-10) with the corresponding sketches (A-L).

(Answers on page 108)

1 Spaghetti
2 Ham
3 Link
4 Acorn
5 Prune
6 Banana
7 Honey
8 Pie
9 Cone
10 Salt

August, 1963
RADIO MARATHON BROADCASTS

Three trailers—one housing the operations room and the others a 50-kw. transmitter—mark the site of Radio Marathon just 100 miles from Cuban coast.

It is 0545 local time on Sombrero Isle, one of the small Florida keys. The sun, which is just rising above the ocean horizon, is a cool red, and glints dimly on the hood of the small car that slowly scrabbles along a rough coral road that winds near the water's edge. The car stops in a swirl of coral dust at a chain blocking the road. A sign suspended from the chain warns: KEEP OUT! U.S. GOVERNMENT PROPERTY. The driver leaves the car motor running while he gets out and unlocks
A way had to be found to get through.

This is the story of the unusual radio station that's doing it

By WILLIAM I. ORR

The chain barrier. Returning to his car, he carefully drives down the dusty, windswept road and draws to a halt in front of a group of three large trailers elevated off their wheels in the sandy soil at the roadside. Ahead of him and to the side is the ocean, normally a bright blue, but now a dull red from the increasing glare of the early sun. Outlined against the sky are three huge steel antenna towers, forming a line to the south like accusing fingers.

Now inside the first trailer, the man snaps on the lights and busies himself with the intricate electronic apparatus. He is adjusting a huge, portable radio transmitter, cleverly built into the two adjoining trailers. The transmitter is in stand-by condition, the mercury rectifiers humming a 120-cycle tune. Within a few moments the carrier is on the air, and at 1100 hours GMT, the powerful radio transmitter springs to life, transmitting across 100 miles of ocean a program to the island of Cuba that originates at a thousand miles away in Washington, D.C.

"This is the Voice of America station at Marathon, Florida. The following program is in the Spanish language..."

Birth of "Radio Marathon." Shortly after the U.S. blockade of Cuban waters and the subsequent removal of Soviet offensive missiles from that island, it was decided at the highest level in the United States Government that the whole story of the Soviet subversion of Cuba should be presented to the Cuban people in the Spanish language, and in depth. This task was assigned to the U.S. Information Agency, to be carried out by the facilities of the Voice of America.

The existing powerful short-wave transmitters of the far-flung VOA network did not adequately cover Cuba, mainly because of the close proximity of that island to the United States. The usual short-wave broadcast channels in use by the VOA, intended for long distance communication with far-off lands, did not offer maximum reliability in an all-out communication effort aimed at a point only 100 miles off the Florida coast. Therefore, the "Voice" engineers decided that an operation of this nature called for a clear-channel transmitter (Continued on page 125)
ONE OF THE MOST fascinating and useful electronic gadgets in existence consists, quite simply, of several thousand turns of fine wire enclosed in a small plastic shell. Its price is low—under $2. What is this miracle item? As the illustrations reveal, it's the telephone pickup.

This flexible pickup can be used to make "clean" tape recordings from your radio or phonograph without any wiring changes or other alterations, to construct an inexpensive meter-readout tachometer, or an audible code-practice oscillator.

Two types of pickups are shown in the photographs—one is the flat, rectangular type which can be placed on top of a unit or under a telephone (Lafayette Radio MS-16 at $1.95 is one of these). The other kind of pickup is in the form of a small cylinder with a suction cup attached to one end (Allied Radio 59R047 at $1.50).

Basic Uses. When a pickup is mounted on the receiver end of a telephone handset (or, if it's the flat type, placed underneath), it picks up the telephone signals by induction. The output of the pickup depends on the strength of the inductive field it is in, and is quite low when used to pick up telephone conversations. However, almost any amplifier or tape recorder has sufficient gain to produce a good output. (Be sure to check federal, state, and telephone company regulations before recording telephone conversations; in many cases, it is illegal.)

The impedance of the pickup is several thousand ohms, and it can be connected directly to a hi-fi amplifier or simple transistor amplifier for group listening to long-distance family calls or business "conference" calls. The Lafayette Radio PK-543 transistor amplifier ($4.95) will provide sufficient gain with the pickup (100 mw.) to drive a speaker. If you have a tape recorder with a "monitor" function, it can also be used.

Tape Recording Techniques. Since the pickup is really nothing more than an "inductive sensor," why not use it to "sense" the inductive field of a speaker coil? This is very easy to do: The speaker field is so strong that it's not even necessary for the pickup to be in close proximity—the speaker grille of a radio or phonograph is usually close enough.
A tachometer based on a pickup is easy to construct following the information in the text. Either the relative or—with calibration—actual rpm can be read.

Just place the pickup against the speaker grille. Plug the cable into the microphone jack of the recorder, and adjust speaker and recorder volume as desired. Unlike a microphone, the pickup will not record speaker distortion and room noise; this setup also allows you to monitor while recording.

The "Induc-Tach." It is very often desirable to know the speed of a motor or engine. "Go-Kart," quarter-midget racer, and hot-rod competitors, for example, need a means of determining whether a given engine modification results in higher engine speed or acceleration. The pickup, especially with magneto-operated engines, provides a simple, inexpensive way to read relative engine rpm, and, with a little extra trouble, can be calibrated to read actual rpm.

The photo above shows a pickup attached to a lawn mower magneto engine in such a position that the magnets on the flywheel pass by the pickup on each revolution. Relative rpm can be read by connecting a diode rectifier, potentiometer, and 0-1 ma. meter as shown in the schematic. The reading will depend on meter sensitivity, magnet strength, pickup proximity and orientation, rpm, and the value of the potentiometer ($R1$).

For slow speeds and small magnets, $R1$ may not be needed. If required, $R1$ should be adjusted to full scale at maximum rpm; it can be replaced with a fixed, 1/2-watt resistor if desired.

For spark engines or motors, it is necessary to place a magnet on the shaft

(Continued on page 113)
THIS IDEA can best be called a “space saver.” It all started when I began to wonder why an AM radio and a bedside lamp both had to take up valuable space on a night table. Wasn’t there some way they could be combined without destroying the usefulness of either object?

The answer turned out to be quite simple, as the photo shows. I took a 6½” length of a square walnut wood post that I had lying around my workshop, drilled a hole through the center, and pushed a threaded brass rod into the hole so that portions of it extended from either end. (This brass tubing—cut to certain lengths and already threaded—is available from practically any electrical supply house, and at a very reasonable price.) Then I cut a square of “Non-Skid” (an “under-the-rug” rubbery material) for use as a “washer” between the bottom of the post and the top of the plastic radio cabinet.

Before you “top” your radio with a lamp, check the thickness of the cabinet. If it’s quite thin, it might be advisable to put a piece of Masonite under the metal washer inside the cabinet. This will relieve the strain on the cabinet in case someone should bump into the lamp.

The lamp is wired to the a.c. input of the radio and controlled by its own on/off switch. To eliminate a possible shock hazard, there should be no contact between the “harp” of the lamp and the radio chassis.

—Art Trauffer

Drill a hole through a wood post to hold the lamp the desired distance above the radio cabinet. Buy the brass pipe first, since every length may not be stocked at your local electrical supply house. The pipe is already threaded to fit the lamp socket, so you will only need one extra nut and metal washer.
A NEW instrument, which combines the sensitivity of a VTVM with the operational advantages of a conventional VOM, has been introduced by the Product Research Division of DeVry Technical Institute (4141 Belmont Ave., Chicago 41, Ill.). Known as a TRVM (transistorized voltmeter), the unit features compact size, complete portability and freedom from 117-volt a.c. lines, and an input resistance close to 10 megohms. Weighing only 4½ pounds, the TRVM is small (7¾" x 5½" x 4½") and will operate from its self-contained battery pack up to 1000 hours.

When used as an a.c. voltmeter, the TRVM has a response within 1.5 db from 10 cycles to 500 kilocycles. The a.c. ranges include 0-5, 0-50, 0-500, and 0-1000 volts; d.c. full-scale ranges are 1, 10, 100, and 1000 volts. Current-measuring (d.c.) capabilities are 0-50, 0-500, 0-5000, and 0-50,000 microamperes. External accessory shunts permit full-scale current readings of 500 milliamperes and 5 amperes.

On the a.c. voltage scale the input impedance is 650,000 ohms (5-volt scale) and 2.0 megohms (all other scales).

In wiring kit, the transistor mounting board comes first, then the Range and Battery Off switches.

The d.c. input resistance is about 10 megohms on all scales except the 1-volt range where it is 920,000 ohms.

As an ohmmeter, the TRVM has ranges of 0-10,000 and 0-100,000 ohms, and 0-1 megohm and 0-10 megohms.

The Circuit. The TRVM has a unique circuit that provides burn-out protection for the meter movement. High-quality silicon transistors are used in a temperature-compensated differential
Although this behind-the-panel view makes the TRVM look like a hodgepodge, the kit goes together smoothly, with no problems.

If you have a Dymo tape imprinter, you can put it to work keeping track of the rear panel calibration adjustment holes.

The small size of the DeVry TRVM can be realized by comparing it with an ordinary wrist watch. Test lead input jacks are mounted just below the Function and Zero Adjust knobs.

amplifier arrangement. Each "side" of the amplifier utilizes two transistors—a common-emitter stage direct-coupled to, and driving, an emitter-follower. Adequate inverse feedback insures stable operation and good frequency response. Precision resistors are used in the voltage divider and calibration networks.

Kit or Wired. The TRVM is sold completely wired and tested for $89.50, but those who like to build equipment can save themselves $25.00 by investing in the kit version at $64.50. Two manuals accompany the kit: a carefully detailed "Assembly Manual," and a very useful "Operational Manual."

The kit is easily assembled in about six hours. Calibration is particularly important, and the builder should expect to spend at least an hour double-checking each step in the calibration procedure to insure accuracy. A TRVM built in the POPULAR ELECTRONICS lab was assembled in 5½ hours while 45 minutes were spent in calibration. Its accuracy was comparable to a factory-wired VTVM selling at the kit price.

Applications. From the experimenter's viewpoint, the TRVM is ideal for general bench and service work. The meter is large, while the instrument itself is remarkably small. Complete freedom from 117-volt a.c. lines means operation in field, including on-the-spot tests of mobile radio equipment (CB or ham); shipboard installations, including marine radios, depth finders, etc.; and ordinary AM and FM auto radios.

Ease of operation is assured by only four front panel controls. The "Ohms Adjust" is coaxially mounted with the "Range" switch. The "Zero Adjust" control is coaxially mounted with the "Function" switch. A single pair of color-coded leads is used for all measurements, permitting switching of mode of operation with an absolute minimum of bother.

If you're thinking of replacing that VOM, or looking for a portable VTVM, the DeVry TRVM is worthy of your serious consideration.

POPULAR ELECTRONICS
SEVERAL years ago, POPULAR ELECTRONICS' Editors decided to devote a part of each August issue to a directory of CB equipment. Throughout the intervening years, it has been fascinating to watch the rapid succession of technical improvement in CB gear. Despite the criticism leveled at CB today (sour grapes variety), its radio gear is somewhat more advanced technically than that of most other communications services. Since our last directory was published, great strides have been made in the use of selective calling, double-sideband with reduced carrier, and even single-sideband suppressed carrier. Receiver selectivity is being improved and antennas are more efficient. Cost has been held down and in some areas slightly reduced. In the following pages is a product-by-product listing of every item of interest to a CB'er—we hope you find it of value.
Knight KN-2550

$99.95

6-channel crystal-controlled transmit and receive plus panel-mounted crystal socket for extra transmit channel plus tunable receiver; 117-volt power supply; 10-tube performance superhet with 3 i.f. stages; NuVistor r.f. stage; series noise limiter; adjustable squelch; ceramic mike; no relays—electronic switching; combination 5-meter and output indicator; $111/2 x 14 1/8 lb.; mobile 12- or 6-volt power supplies available for $111.95 (each).

ALLIED RADIO CORPORATION

100 N. Western Ave., Chicago 80, III.

Model C-22 (Knight-Kit) $69.95 (kit, less crystals)

5-channel crystal-controlled transmit and receive plus tunable receiver; universal power supply (117- and 12-volt); 9-tube performance superhet (no r.f. stage, 2 150-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output; 10 1/2 x 10 1/2 x 4 1/2; 12 lb.; available with only 117-volt power supply for $64.95; numerous accessories available.

Model KG-4000 (Knight-Kit) $59.95 (kit)

1-channel crystal-controlled transmit and receive; 1-watt input; transistorized (9 transistors and 3 diodes); battery operated with 8 easily obtainable "C" cells (or rechargeable substitutions); superhet receiver (1 r.f. and 2 455-kc. i.f. stages); noise limiter; adjustable squelch; receiver has 'Local-Distance' switching to adjust sensitivity; 10 1/2 x 3 3/4 x 4 1/2; about 1 1/2 lb. Accessories: additional plug-in crystals and rechargeable batteries.

KNIGHT KN-2560 (not illustrated) $219.95

23-channel, crystal-controlled (frequency synthesis) transmit and receive; universal power supply (either 117- and 12-volt, or 117- and 6-volt); double-conversion superhet with crystal filter to achieve maximum selectivity; adjustable squelch; noise limiter; noise cancelling ceramic mike; transmitter is double-sideband with reduced carrier radiating equivalent of 10 watts PEP (peak-envelope-power); 5-meter and switching to read voltage and current to final amplifier in transmitter; 5 1/2 x 11 1/2 x 9 3/4; 15 lb.

APELCO COMPANY

213 E. Grand Ave., So. San Francisco, Calif.

Model AR-10 $219.50

10-channel, crystal-controlled (frequency synthesis) transmit and receive plus tunable receiver; universal power supply (117- and 12-volt); 11-tube performance double-conversion superhet (1 r.f. stage, 1650-kc. conversion, 250-kc. conversion plus 1 i.f. stage); adjustable squelch (called "gate"); noise limiter; 5-meter and modulation indicator; pi-network output ceramic mike; 9 1/2 x 5 1/4 x 11 1/2; 18 lb.

B & K/MARK

1801 W. Belle Plaine, Chicago 13, III.

Model SSB-27 ("Sidewinder") price n.a.

This is a single-sideband suppressed-carrier transmitter; up to 5 of the 46 possible SSB channels may be selected; all frequency-controlling crystals are in a temperature-regulated oven—long term stability better than 0.00015%; undesired sideband is more than 40 db down; crystal lattice filter for 35 db carrier suppression; receiver has 3-kc. selectivity; "Voice Lock" control on panel allows plus or minus 200-cycle variation for precise SSB netting; 117- or 12-volt power supply.

BIGGS ELECTRONICS, INC.

1328 Pulaski St., Peru, III.

La Salle Model LA-101-AN $164.95 (net)

5-channel, crystal-controlled transmit and receive; universal power supply; adjustable sensitivity; "Voice Lock" control on panel allows plus or minus 200-cycle variation for precise SSB netting; 117- or 12-volt power supply.
(117-, 12-, or 6-volt) power supply; 13-tube performance superhet (2 r.f. and 2 455-kc. i.f. stages) with NuVision front end; series noise limiter; adjustable squelch; ceramic mike; link-coupled output; 6 x 13 x 6.

LA-101-AN

A. J. BRISKIN, INC.
3252 F Street, San Diego 2, Calif.

Tele-Mate 500

5-channel, crystal-controlled transmit and receive; 12-volt power supply (117-volt supply available as Model Tele-Mate 500P); completely transistorized receiver and transmitter; receiver has r.f. stage and 3 455-kc ceramic-filter i.f. stages; adjustable squelch; noise limiter always in circuit; pi-network output; ceramic mike.

BROWNING LABORATORIES, INC.
100 Union Ave., Laconia, N. H.

Compact (transmitter only)

$84.50 (net)

11 crystal-controlled channels including special crystal socket on front panel permitting easy crystal change; 4 tubes; pi-network output; neon output indicator; ceramic mike; may only be used with units having "transmit" switching facilities; 7 x 5 3/4 x 9 1/2; 15 lb.

Model M-523 ("Drake")

$260.00 (net)

23-channel, frequency-synthesis transmit and receive, also available as Model M-506 with 6 channels for $109.50; separate unit (not shown) 12-volt power supply for mobile use, buyer may substitute 117-volt base station supply, or buy as extra unit for $20.00; 13-tube performance double conversion superhet (cascade r.f. stage; 4.2-mc. conversion, 455-kc. conversion and 2 455-kc. i.f. stages); adjustable squelch; noise limiter always in circuit; tone control on speaker box (separate unit, not shown); pi-network output; TVI trap; ceramic mike; 3 x 3 5/8 x 9 1/2.

August, 1963

Model R-2700A (receiver only)

$149.00 (net)

All-channel bandspread receiver calibrated in frequencies and channel numbers plus 5 crystal-controlled channels; 117 volts only; 15-tube performance double-conversion superhet; adjustable series noise limiter; adjustable squelch; 5-meter; delayed a.v.c.; antenna tuning adjustment on front panel; 7 x 15 1/2 x 9 3/4; 25 lb.

Model 23 Over S9 (transmitter only) $144.00 with 1 crystal to $189.00 with all 23 crystals (net)

Provisions for 23-channel operation; 5 tubes, plus silicon rectifiers; metered for modulation percentage and SWR; "squelching" switch; speech clipper and splatter filter; ceramic mike; "on-the-air" indicator; 7 x 9 3/4 x 9 1/2; 20 lb.

CADRE INDUSTRIES CORP.
20 Valley St., Eatontown, N. J.

Model C-75

$109.95 (suggested retail)

2-channel, crystal-controlled transmit and receive; rechargeable battery power supply; 1.0-watt output; 11 transistors and 2 diodes; noise limiter; adjustable squelch; 2 lb.; numerous accessories available including carrying strap, battery charger, special earphones, etc.

Model 510

$219.95 (suggested retail)

5-channel, crystal-controlled transmit and receive, plus tunable receiver (also available as Model 515 without tunable receiver feature for $199.50); solid-state 117- and 12-volt power supply (2 watts drain on receive and 8 watts drain on transmit); also available as Model 520 (12-volt power supply only at $187.50); NO tubes; 19 transistors and 8 diodes; double-conversion superhet; series noise limiter; adjustable squelch; pi-network output; TVI trap; ceramic mike; 4 x 12 x 6 l b; accessory power pack with recharging network and carrying handle available as Model 5700-1 ($34.95); batteries are $21.90, extra.
This company manufactures and distributes a wide variety of moderately-priced items. Included in their most recent product announcements were noise suppressors, channel selectors, antennas, body mounts, etc. Write the address above for details.

DAVIS MANUFACTURING CO.
2072 La Jolla Drive, Stockton, Calif.

Model 5W6
$229.50 (list)
6-channel, crystal-controlled transmit and receive; universal power supply (either 117-, 12-, or 6-volt); 10-tube performance superhet; series gate noise limiter; adjustable squelch; carbon mike; pi-network output; modulation clipper and filter built-in; 5½ x 9½ x 10¾.

DEMCO ELECTRONICS, INC.
Bristol, Ind.

Echo 880
$139.00 (list)
12-channel crystal-controlled transmit (including 1 externally-mounted crystal socket); tunable receiver with "spotting" circuit; universal power supply (117- volt, 12- and 6-volt); 13-tube performance double-conversion superhet; 1 r.f. stage, 3.5-kc. conversion, 595-kc. conversion and 2 i.f. stages; adjustable squelch; 5-meter; noise clipper always in circuit; ceramic mike; link-coupled output; modulation indicator; 5 x 7 x 12; 9 lb.
EICO (Electronic Instrument Co., Inc.)
33-00 Northern Blvd., Long Island City 1, N. Y.

Model 770/771/772
Model 770: $79.95 (kit) and $109.95 (wired). Others: $89.95 (kit) and $119.95 (wired).

4-channel, crystal-controlled transmit; 1-channel crystal-controlled receive, plus tunable receiver; 117-volt power supply; 10-tube performance superhet (1 r.f. and 2 1750-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; neon output indicator; pi-network output; 6 x 8½ x 9; 10 lb. Model 771 has 117- and 6-volt power supply. Model 772 has 117- and 12-volt power supply.

Model 777
4-channel, crystal-controlled transmit and receive plus tunable receiver with spotting switch; universal power supply (117-, 12- and 6-volt); 10-tube performance double-conversion (1 r.f. stage, 1750-kc. conversion, plus 262-kc. conversion) superhet; series noise limiter; adjustable squelch; pi-network output; 5-meter; ceramic mike.

ELECTRONICS COMMUNICATIONS INC. [e.c.i.]
325 No. Macquesten Pkwy., Mt. Vernon, N. Y.

Courier 1M
$229.50

12-channel, crystal controlled transmit; 4-channel fixed receive (no crystals) plus tunable receiver; 117- and 12-volt power supply; 15-tube performance triple-conversion superhet (1 r.f. stage, 10.4-mc. conversion, 1505-kc. conversion, 2 262-kc. i.f. stages); r.f. gain control; series noise limiter; adjustable squelch; 5-meter and output indicator; ceramic mike; 4¾ x 14½ x 7½; 14 lb. Accessories: 23 position crystal switch for transmit, base station mike.

Fleet Courier
$159.50

5-channel, crystal-controlled transmit and receive; 11-tube performance superhet (2 r.f. stages and 2 455-kc. i.f. stages); universal power supply (117- and 12-volt); noise clipper; adjustable squelch; ceramic mike; 4½ x 8½ x 11.

August, 1963

GC ELECTRONICS CO.
400 South Wyman St., Rockford, Ill.

Globe Master
$229.95 (net)

11-channel, crystal-controlled transmit and receive plus tunable receiver; “spotting” switch; universal power supply (either 117- and 12-volt, or 117- and 6-volt available at the same price); 14-tube performance double-conversion superhet; series noise limiter; adjustable squelch; ceramic mike; speech clipping and filtering for effective modulation; pi-network output; S-meter; 11½ x 4½ x 10; 16 lb.

Globe Star
$159.95 (net)

5-channel, crystal-controlled transmit and receive; universal power supply (either 117- and 12-volt, or 117- and 6-volt available at the same price); 11-tube performance double-conversion superhet (1 r.f. stage, 1680-kc. conversion, and 1 262-kc. i.f. stage); series gate noise limiter; adjustable squelch; ceramic mike; pi-network output; 4½ x 9 x 9½; 13½ lb.

GENERAL RADIOTELEPHONE CO.
3501 Burbank Blvd., Burbank, Calif.

Model MC-5
$199.95 (net)

6-channel transmit plus front panel connection for 7th crystal; 4 crystal-controlled receive channels plus tunable receiver; universal (117-, 12- and 6-volt) power supply; 10-tube performance superhet (2 r.f. and 2 452-kc. i.f. stages) including special crystal mixer; series noise limiter; adjustable squelch; ceramic mike; pi-network output, metered output indicator; output jack to remote speaker; sliding variable tone generator for “calling”; “Local-Dist” switch reduces receiver sensitivity; 4½ x 8¼ x 10½; 15 lb. Accessories: 12- or 6-volt power cables ($4.95).

Model MC5-5B
$229.95 (net)

Similar to above, but capable of receiving SSB signals; no transmitting facilities other than regular AM; squelch control replaced by r.f. gain control; separate switch on front panel re-inserts carrier for SSB reception.

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CB DIRECTORY

GEM ELECTRONICS
34 Hempstead Take., Farmingdale, L.I., N.Y.
Manhattan $124.95
Identical to Echo Model 880.

GONSET
801 South Main St., Burbank, Calif.

Model G-14
$149.50 (net)
4-channel, crystal-controlled transmit and receive; universal power supply (117 and 12 volts, but may be internally modified for 6-volt operation); 11-tube performance double-conversion superhet (1 r.f. stage, 1650-kc. conversion, and 2 455-kc. i.f. stages); series gate noise limiter; adjustable squelch; ceramic mike; pi-network output; TVI filter; output indicator; 4 x 7 x 11 1/4; 11 lb.

Model G-15
$199.50 (net)
4-channel, crystal-controlled transmit and receive, plus tunable receiver; built-in "spotting" switch; universal power supply (117 and 12 volts, but may be internally modified for 6-volt operation); 12-tube performance double-conversion superhet (1 r.f. stage, 1650-kc. conversion, and 2 455-kc. i.f. stages); series gate noise limiter; adjustable squelch; voltage regulator tube; ceramic mike; pi-network output; TVI filter; S-meter and output indicator; 4 x 7 x 11 1/4; 11 lb.

HALLICRAFTERS CO.
5th and Kostner Avenues, Chicago 24, Ill.

Model CB-3A
$159.50
8-channel, crystal-controlled transmit and receive; universal power supply (either 117- and 12-volt, or 117- and 6-volt); 10-tube performance double conversion superhet (1 r.f. stage, 1650-kc. conversion, 1 262-kc. i.f. stage); series noise limiter, adjustable squelch; ceramic mike; S-meter is optional extra at $8.95; pi-network output; TVI filter; neon bulb output indicator; 5 x 12 x 8; 13 lb.

Model CB-5
$199.95
6-channel, crystal-controlled transmit and receive; 12-volt d.c. power supply only (optional a.c. power supply and base station pedestal is $49.95); 15-transistors in receiver section; 3 low drain tubes in transmitter section; double-conversion superhet (1650-kc. and 455-kc. i.f. stages); automatic noise limiter; adjustable squelch; ceramic mike, pi-network output; accessories include portable battery pack and tone-coded squelch; 10 1/4 x 3 1/4 x 8 1/4; 6 1/4 lb.

HALLMARK INSTRUMENTS
6612 Denton Drive, Dallas, Texas
Hallmark 512
$149.50 (list)
12-channel, crystal-controlled transmit and receive; universal power supply (117- and 12-volt); 10-tube performance superhet (1 r.f. stage and 1 455-kc. i.f. stage); noise limiter, adjustable squelch; ceramic mike; pi-network output; S-meter; 12 x 7 x 5 3/4; 15 lb.

HAMMARLUND MFG. CO.
53 West 23rd St., New York 10, N. Y.

Model CB-Six
$179.50
6-channel, crystal-controlled transmit and receive; superhet receiver with plus or minus 3-kc. vernier tuning adjustment on front panel; other details not released at press time.

Model CB-23
$249.50
23-channel, crystal-controlled transmit and receive using special crystal-fixed circuitry; universal power supply (117 and 12 volts); 11-tube performance double-conversion superhet (1 r.f. stage, 1650-kc. conversion, 1 262-kc. i.f. stage); series noise limiter; adjustable squelch; ceramic mike; S-meter and output indicator; headphone jack on front panel; plus or minus 3-kc. vernier tuning control on receive.

POPULAR ELECTRONICS
Model HQ-105 TRS
$224.50 (built-in speaker)
1-channel transmit (see below); tunable communications-style receiver covering 540 kc. to 30.0 mc. (identical to standard receivers in the Hammarlund line), including bandspread, O-multiplier, 5-meter, noise limiter, etc. This model has built-in speaker (also available without); $13.75; 9 7/16 x 16 1/4 x 9 3/8; 30 lb. Accessories: see separate listing for OCT-X 8-channel crystal selector ($15.95), external speaker ($14.95), clock timer ($9.95).

Model GW-11A
$69.95 (kit)
3-channel transmit and 1-channel crystal-control receive plus tunable receiver; 117-volt power supply (available for either 12- or 6-volts at same price); 9-tube performance superhet (no r.f. stage, 1 455-kg. i.f. stage); series noise limiter; adjustable squelch; ceramic mike; link-coupled output; S-meter; 4 1/2 x 13 1/2 x 5 3/4; 7 1/4 lb.; available completely wired for $99.95 (117-volt power supply) or $104.95 (12- or 6-volt power supply).

Model GW-12A
$39.95 (kit)
1-channel, crystal-controlled transmit and receive; 117-volt power supply (available for 117-volts only at this price; 117-, 12- and 6-volt version costs $44.95—unassembled kit); superhet receiver; series gate noise limiter; adjustable squelch; ceramic mike; 5% x 8 x 8; 7 1/4 lb.; available completely wired for $79.95 (117-volt power supply) and $84.95 (12- or 6-volt power supply).

Model GW-22A
$59.95 (kit)
$99.95 (assembled)
5-channel, crystal-controlled transmit and receive; 117-volt power supply (available for either 12- or 6-volts at $89.95); 10-tube performance superhet (1 r.f. stage and 1 455-kc. i.f. stage); adjustable squelch; noise limiter always in circuit; link-coupled output; ceramic mike; 9 3/4 x 6 1/2 x 9 3/8; 10 lb.; available with built-in selective calling for $84.95 (kit); or $136.95 (assembled). Appearance similar to GW-12A.

Model GW-42A
$119.95 (kit)
$189.95 (assembled)
5-channel, crystal-controlled transmit and receive, plus tunable receiver; universal power supply (117-, 12-, and 6-volt); 11-tube performance superhet (1 r.f. stage and 2 455-kc. i.f. stages); built-in tone squelch system with 4 front-panel selected tones; noise limiter; adjustable squelch; ceramic mike; link-coupled output; S-meter and modulation indicator; 5 1/8 x 17 1/2 x 10 1/2; 22 lb.

Model GW-52 $74.95 (kit)
1-channel, crystal-controlled transmit and receive; rechargeable battery power supply; superhet receiver (transistorized); adjustable squelch; 1-watt input to transmitter; earphone jack; TVI trap; 10 15/16 x 3 1/4 x 1 11/16; 2 1/2 lb.

Model MW-33 ("Marine")
$89.95 (kit)
5-channel transmit and receive plus tunable receiver; universal power supply (117-, 12-, or 6-volt); 9-tube performance superhet (1 r.f. and 1 455-kc i.f. stage); series noise limiter; adjustable squelch; 5-meter or modulation indicator; link-coupled output; 4 1/4 x 11 3/4 x 11; 14 1/2 lb.

August, 1963
Cipher 1000
2-channel, crystal-controlled transmit and receive; battery power supply (12 "D" cells—life about 120 hours); superhet receiver; adjustable squelch; noise limiter; 1-watt input to transmitter; ceramic mike; 5½ x 9 x 3¾; 7 lb.

INTERNATIONAL CRYSTAL MFG. CO., INC.
18 North Lee, Oklahoma City, Okla.

Model 10
3-channel, crystal-controlled transmit, plus tunable receiver; power supply sold separately for $19.50 (specify 117, 12 or 6 volts when ordering); 10-tube performance superhet; series noise limiter; squelch attachment sold separately for $4.95; ceramic mike; external speaker; 3½ x 8 x 7; 5 lb. Accessories: see text above, plus crystals, antennas, mounts, etc.

Model 50
$19.50 (net)
3-channel, crystal-controlled transmit and 2-channel, crystal-controlled receive, plus tunable receiver; universal power supply (117, 12 and 6 volts); 12-tube performance double-conversion superhet; series noise limiter; adjustable squelch; ceramic mike; pi-network output; modulation indicator; 5½ x 8½ x 9; 12 lb. Accessories: crystals, antennas, mounts, etc.

Model 100-C
$209.50 (net)
12-channel, crystal-controlled transmit and 2-channel, crystal-controlled receive, plus tunable receiver; universal solid-state power supply (117-, 12- and 6-volt); 13-tube performance double-conversion superhet (1 r.f. stage, 10-kc. conversion, 455-kc. conversion, 1 455-kc. i.f. stage); special a.v.c. circuit (coiled A.S.C.); crystal filter on receive; audila filter; series noise limiter; adjustable squelch; ceramic mike; pi-network output; built-in "calibrate" circuit; 5½ x 8½ x 9; 12 lb.; numerous accessories.

Model 100-D
$239.50 (net) Similar in most respects to Model 100-C, except for speech filtering and clipping on transmit; illuminated dial for ease of channel identification.

INTERNATIONAL TELEPHONE AND TELEGRAPH CORP.
Box 99, Lodi, New Jersey

Model 320
$199.95 (list)
5-channel, crystal-controlled transmit and receive; universal power supply (117- and 12-volt); NO tubes, 17 transistors and 8 diodes; double-conversion superhet (1 r.f. stage, 1680-kc. conversion, 455-kc. conversion and 3 455-kc. i.f. stages); adjustable squelch; noise clipper in circuit at all times; ceramic mike; pi-network output; TVI trap; 11¾ x 3½ x 5¾; 6 lb.

E. F. JOHNSON CO.
Waseca, Minn.

Viking Messenger
$139.95
5-channel, crystal-controlled transmit and receive; available in a variety of power supply arrangements for 230, 117, 24, 12, or 6 volts; 9-tube performance superhet (1 r.f. and 1 455-kc. i.f. stage); series noise limiter; adjustable squelch; ceramic mike; pi-network output; modulation indicator; 5½ x 7 x 11½; 12 lb.; numerous accessories available.

Messenger Two
$169.95
10-channel, crystal-controlled transmit and receive; available with either 117- and 12-volt; or 117- and 6-volt power supply; 9-tube performance superhet (1 r.f. and 1 455-kc. i.f. stage); series noise limiter; adjustable squelch; ceramic mike; pi-network output; modulation indicator; 5½ x 7 x 11½; 12 lb.; numerous accessories available.

Personal Messenger
$129.50
1-channel, crystal-controlled transmit and receive; battery power supply (penlight cells)
Model 500 $249.95 (list)

August, 1963

5-channel, crystal-controlled transmit and receive; 12-volt power supply (only); all transistor, superhet receiver (1 r.f. stage and 3 i.f. stages); adjustable squelch, 5-meter; noise limiter always in circuit; pi-network output; ceramic mike; electronic switching—no relays; 2½ x 6 x 5½; 4½ lb.; same unit, but with built-in batteries and battery charger available for $299.95 (list).

KAAR ENGINEERING CORP.
2995 Middlefield Rd., Palo Alto, Calif.

Model TR-327 $179.00 (FOB, Palo Alto)
4-channel, crystal-controlled transmit and receive, universal (117-, 12- or 6-volt) power supply; 14-tube performance superhet (1 r.f. and 2 455-kc, i.f., stages); series noise limiter; adjustable squelch, ceramic mike; pi-network output; TVI trap; "Power" tuning control on front panel used to tune transmitter to maximum output; 5-meter; special 2-tube o.v.c. circuit varies gain of receiver to minimize effects of noise and interference; 5½ x 10¼ x 8½; 16 lb. Accessories: mounting hood ($3.90) and various antennas.

Model TR-327A & B $199.00 (FOB, Palo Alto)
Similar to above, but Model A will tune standard AM broadcast in addition to 4-channel crystal-controlled transmit and receive. Model B (sold for $189.00) has 5-channel, crystal-controlled transmit and 2-channel, crystal-controlled receive, plus tunable receiver.

KELTNER ELECTRONICS, INC.
1045 W. Hampden, Englewood, Colo.

Model HE-15B $54.50 (net)
8-channel transmit; 117-volt supply; 8-tube performance superhet (1 r.f. and 1 1750-kc, i.f., stage); adjustable series noise limiter; no squelch; ceramic mike (no push-to-talk); link-coupled output; neon tube output indicator; TVI trap; cathode current of transmitter metered from front panel jack; 5½ x 10½ x 6½; 9 lb. Accessories: mobile power supplies for either 6 or 12 volts ($10.95) and various antennas.

Model HE-20C $109.50 (net)
8-channel transmit; universal (117- and 12-volt) power supply; 10-tube performance superhet (1 r.f. and 2 1650-kc, i.f., stages); series noise limiter; adjustable squelch; built-in selective call circuitry; "spotting" switch; ceramic mike; link-coupled output; TVI trap; output indicator; 5-meter, 5½ x 12½ x 8; 14 lb.; numerous accessories available.

Model HE-75 $66.50 (net)
1-channel, crystal-controlled transmit and receive; battery power supply (penlight cells may be replaced with nickel-cadmium battery at extra charge); superhet receiver; 1-watt input to transmitter; has "Local-Distance" switch to conserve power; noise limiter; adjustable squelch; earphone jack, 3 x 8 x 2; sold with earphone and carrying case.

Model HE-90 (photo overleaf) $94.50 (net)
6-channel, crystal-controlled transmit and receive plus tunable receiver; 117-volt power supply (12-volt power supply available for $11.50); superhet receiver with 2 i.f. stages; Nuvistor r.f. stage; noise limiter; adjustable squelch; 5-meter; "spotting" switch on front panel; pi-network output; TVI trap; panel jack for plate current metering; ceramic mike; 11½ x 5 x 6½; 14 lb.; numerous accessories available.

LAFAYETTE RADIO ELECTRONICS CORP.
111 Jericho Turnpike, Syosset, L. I., N. Y.

Model HE-75 $66.50 (net)
1-channel, crystal-controlled transmit and receive; battery power supply (penlight cells may be replaced with nickel-cadmium battery at extra charge); superhet receiver; 1-watt input to transmitter; has "Local-Distance" switch to conserve power; noise limiter; adjustable squelch; earphone jack, 3 x 8 x 2; sold with earphone and carrying case.

Model HE-90 (photo overleaf) $94.50 (net)
6-channel, crystal-controlled transmit and receive plus tunable receiver; 117-volt power supply (12-volt power supply available for $11.50); superhet receiver with 2 i.f. stages; Nuvistor r.f. stage; noise limiter; adjustable squelch; 5-meter; "spotting" switch on front panel; pi-network output; TVI trap; panel jack for plate current metering; ceramic mike; 11½ x 5 x 6½; 14 lb.; numerous accessories available.
MAXWELL ELECTRONICS CORP.
229 Garvon St., Garland, Texas

Model 27 C-3 $159.50 (net) or $149.50 (net)
for single-channel model

3-channel, crystal-controlled transmit and receive; 117-volt power supply (other models available for 12 or 6 volts at same price); 13-tube performance superhet (2 high-gain r.f. and 1 455-kc. i.f. stage); noise clipper and series noise limiter; adjustable squelch; dynamic mike; link-coupled output; 13 3/4 x 7 1/2 x 6 lb. Accessories: battery eliminator converting 12-volt model to 117 volts ($29.95) and various antennas.

MESUR-MATIC ELECTRONICS CORP.
Warner, New Hampshire

Saturn CBX 15 $229.99
3-channel, crystal-controlled transmit and receive plus tunable receiver; universal power supply (117-, 12- and 6-volt); 11-tube performance double-conversion superhet (1 r.f. stage, 1650-kc. conversion, 1 262-kc. i.f. stage); r.f. gain control; noise limiter; adjustable squelch; "spotting" control; earphone jack on front panel; 5-meter; modulation meter; power output meter; pi-network output; ceramic mike.

METROTEK ELECTRONICS, INC.
205 W. Cabarrus St., Raleigh, N C.

Metrostar $169.95
8-channel, crystal-controlled transmit and receive plus tunable receiver; universal power supply (117- and 12-volt); 9-tube performance double-conversion superhet (1 r.f. stage, 1650-kc. conversion, 455-kc. conversion and i.f. stage); crystal-controlled second oscillator; gated-audio noise-limiting squelch system; 5-meter; ceramic mike; pi-network output; no relays—electronic switching; 12 3/16 x 5 1/4 x 9 7/16; 13 lb.

Space Station Price n.a.
5-channel, crystal-controlled transmit and receive, plus tunable receiver; 117-volt power supply; superhet receiver; 5-meter; accessory socket for plug-in Monocall Selective Call System; adjustable squelch; electronic switching—no relays; ceramic desk mike; 12 lb.

Starfire $124.95
5-channel, crystal-controlled transmit and receive plus tunable receiver; 117-volt power supply (12-volt mobile supply is available for $18.00; 6- and 12-volt supply is $22.70); 9-tube performance superhet (1 r.f. and 1 455-kc. i.f. stage); series noise limiter; adjustable squelch; pi-network output; ceramic mike; no relays—electronic switching; 11 3/16 x 6 3/4 x 8 3/4; 8 1/4 lb.

MIRATEL, INC.
Richardson St., New Brighton 12, Minn.

Model C/R-117 $198.50 (suggested retail)
5-channel, crystal-controlled transmit and receive; universal solid-state power supply (117-, 12-, or 6-volt); 12-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output with TVI trap; metered to read percentage of modulation and carrier output; 5-meter; 5 3/4 x 10 1/4 x 10; 18 lb.
Model CD-5 ("Citi-fone")  $134.50 (suggested retail)
5-channel, crystal-controlled transmit and receive; universal (117- and 12-volt) power supply; 10-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; adjustable "noise immune" squelch; ceramic mike; pi-network output; TVI trap; 4½ x 8 x 11½; 15 lb. Accessories: various antennas.

Model CD-7 ("Citi-fone")  $189.50 (suggested retail)
5-channel, crystal-controlled transmit and receive, plus tunable receiver; universal power supply (117- and 12-volt) superhet receiver; series noise limiter; adjustable "noise immune" squelch; ceramic mike; pi-network output; TVI trap; jack for external speaker or headphones; S-meter and output indicator.

OLSON ELECTRONICS, INC.
840 S. Forge St., Akron 8, Ohio

Audio-Visual Spotter (Model RA-520)  $119.95
12-channel crystal-controlled transmit (including 1 panel-mounted crystal socket); 23-channel tunable receive featuring special "spotting" circuitry; universal power supply (117- and 12- and 6-volt); 13-tube performance double-conversion superhet (1 r.f. stage, 3.5-mc. conversion, 595-kc. conversion and 2 i.f. stages); adjustable squelch; S-meter; noise clipper always in circuit; ceramic mike; link-coupled output; modulation indicator; 12- or 6-volt battery cables are $2.95 extras; 5 x 7 x 12; 9 lb.

PEARCE-SIMPSON, INC.
1385 N.W. 27th Ave., Miami 35, Fla.

MULTI-ELMAC
21470 Coolidge Highway, Oak Park 37, Mich.

Companion  $189.50 (FOB, Miami)
5-channel, crystal-controlled transmit with extra crystal socket on front panel for 6th channel; 5-channel, crystal-controlled receive, plus tunable receiver; universal transistorized power supply (117 and 12 volts); 11-tube performance superhet (1 r.f. stage and 2 455-kc. i.f. stages); preset noise limiter; adjustable squelch; carbon mike, transmit indicator light; link-coupled with reactance "tune-out" adjustment; durable plastic cabinet; 5 x 8½ x 12¼; 8½ lb.

Escort  $229.95 (tentative)
8-channel, crystal-controlled transmit and receive plus tunable receiver; universal power supply (117- and 12-volt); 11-tube performance superhet; adjustable squelch; noise limiter; "spotting" switch; S-meter; pi-network output; ceramic mike; 11½ x 4½ x 9½; 15 lb.

POLYTRONICS LAB, INC.
388 Getty Ave., Clifton, N. J.

Poly-Compact  $149.95 (net)
4-channel, crystal-controlled transmit and receive; universal power supply; superhet receiver; noise limiter; adjustable squelch; S-meter; electronic switching—no relays; 5 x 6½ x 11.

Poly-Comm "N"  $189.50 (net)
4-channel, crystal-controlled transmit and receive; universal power supply (117, 12 and 6 volts); 12-tube performance double-conversion superhet (1 Nuvistor r.f. stage, 6.0-mc. conversion, 3 455-kc. i.f. stages); series gate noise limiter; adjustable squelch; ceramic mike; pi-network output; pilot bulb output indicator; TVI trap; extra rugged construction; 5 x 11 x 7½; 12½ lb.; also available with S-channel, crystal-controlled transmit and receive for $199.50.

Poly-Comm "Pro"  $269.50 (net)
24-channel (1 channel for CAP), crystal-controlled transmit and receive; universal power supply; double-conversion superhet (1 r.f. stage, 6.0-mc. conversion, 455-kc. conversion, plus i.f. stages); built-in Q-Multiplier; adjustable squelch; noise limiter; S-meter and output indicator; pi-network output; ceramic mike; may be used for public address.

August, 1963
Poly-Comm Senior "23" $349.50 (net)
23-channel, crystal-controlled frequency-synthesis transmit and receive; vernier tuning on receive; universal power supply (117- and 12-volt); 14-tube double-conversion superhet (1 r.f. stage, 6.0-mc. conversion, 455-kc. conversion and 2 i.f. stages); series gate noise limiter; adjustable squelch; ceramic mike; pi-network output; Accessories: field strength meter ($6.95) and various antennas.

Model TRC-27A $69.95 (net)
3-channel, crystal-controlled transmit and receive; universal (117- and 12-volt) transistorized power supply; 11-tube performance superhet (1 r.f. and 2 455-kc. i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output. Accessories: field strength meter ($6.95) and various antennas.

Model TRC-5 $69.95 (net)
5-channel, crystal-controlled transmit; 1-channel crystal-controlled receive, plus tunable receiver; 117-volt power supply (see below); superhet receiver; noise limiter; adjustable squelch; ceramic mike; no relays—electronic switching; 10 lb.; 12-volt power supply available for $14.95.

Model TRC-8 $109.95 (kit net)
8-channel, crystal-controlled transmit and receive, plus tunable receiver; universal power supply (117- and 12-volt); 9-tube performance double-conversion superhet (1 r.f. stage, 1650-kc. conversion, 455-kc. conversion, plus 1 i.f. stage); adjustable squelch; noise limiter always in circuit; S-meter and power input meter; pi-network output, ceramic mike; 4 1/2 x 12 x 8 1/4; 12 lb.; available as a completely wired unit for $139.95.

RAYTHEON COMPANY
213 East Grand Ave., So. San Francisco, Calif.

Mark VIII $149.50 (list)
9-channel, crystal-controlled transmit and receive plus tunable receiver; 117-volt power supply (12- and 6-volt power supplies available as separate units for $19.95); 9-tube performance superhet (1 r.f. and 2 i.f. stages); series noise limiter; adjustable squelch; TVI trap; ceramic mike; no relays—electronic switching; 3 1/2 x 11 1/4 x 8; 9 lb.

RADIO CORPORATION OF AMERICA
Harrison, N. J.

Model TRC-27A $89.95 (net)
4 1/2 x 12 x 8 1/2; 14 lb.

POPULAR ELECTRONICS
RayCom II
$220.00 (list)
10-channel, crystal-controlled (frequency synthesis) transmit and receive, plus tunable receiver; universal power supply (117- or 12-volt); double-conversion superhet (1 r.f. stage, 1650-kc. conversion, 250-kc. conversion plus 1 i.f. stage); noise limiter; \textit{adjustable} squelch; carbon mike; pi-network output; 5-meter and modulation indicator; 10 1/2 x 5 1/2 x 10 1/2; 18 lb.

RAYTHEON COMPANY
Westwood, Mass.

Roy-Tel TWR-3 (appearance same as RayCom II)
$219.95 (list)
10-channel, crystal-controlled (frequency synthesis) transmit and receive, plus tunable receiver; universal power supply superhet (1 r.f. stage, 1650-kc. conversion, 250-kc. conversion (117- and 12-volt)); 11-tube performance double-conversion superhet (1 i.f. stage); adjustable squelch; noise limiter; 5-meter and modulation indicator; pi-network output; ceramic mike; 12 x 6 x 10 1/2; 18 lb.

Ray-Tel TWR-2
$159.95 (list)
5-channel, crystal-controlled transmit and receive; universal power supply (117 and 12 volts); 10-tube performance double-conversion superhet; series noise limiter; adjustable squelch; special carbon mike; pi-network output; pilot-bulb output indicator; transmitter filaments may be switched off at front panel during "standby" periods; adjustable squelch; electronic switching; auxiliary speaker connections; 9 1/2 x 8 1/4; 12 1/2 lb.

REGENCY ELECTRONICS, INC.
7900 Pendleton Pike, Indianapolis 26, Ind.

Model CB-27
$124.95 (12- and 6-volt units available at same price)
2-channel transmit; tunable receiver; 117-volt power supply (other models available); 9-tube performance double-conversion superhet; series noise limiter; adjustable squelch; ceramic mike; pi-network output; neon-bulb output indicator; 4 1/2 x 6 1/2 x 8 1/4; 8 1/2 lb. Accessory: Model CS-6 crystal switch adds 3 more channels ($119.95, list).

Range Gain
$269.95
23-channel, crystal-controlled (frequency synthesis) transmit and receive with 3.5-kc. vernier tuning control on front panel; universal power supply (117- and 12-volt, or 117- and 6-volt); double-conversion superhet (1 r.f. stage; 7.5-mc. conversion; 260-kc. conversion, plus 2 i.f. stages, plus crystal filter in first conversion stage); adjustable squelch; adjustable noise limiter; S-meter; double-sideband reduced carrier transmitter (approximately 6 db down); voltage and current to final amplifier read from panel meter, final tuning control of transmitter on front panel; pi-L network output; about 10 watts peak-envelope power (P.E.P.) output; ceramic mike; 11 1/2 x 5 3/4 x 9 3/4; 15 lb.

ROSS LABORATORIES, INC.
124 Lakeside Ave., Seattle 22, Wash.

Model 400
$164.50 (net)
1-channel, crystal-controlled transmit and receive; hand-held battery-operated transceiver with 1.5 watts input; superhet receiver; automatic noise limiter; adjustable squelch; may be used with penlight cells; 9 1/2 x 3 1/2 x 1 1/2; under 2 lb. Accessories: rechargeable nickel-cadmium batteries and built-in charger ($45.00); alkaline battery pack ($4.00).

SAMPSON COMPANY
2244 S. Western Ave., Chicago 8, Ill.

Receiver, S-meter and Speaker

Model CB1A
$377.80 (complete station)
Base station; transmitter is 23-channel, crystal-controlled; 117-volt power supply; external crystal socket for test purposes; pi-network output; plate current and voltage meter; modulation indicator; 6 x 1 1/2 x 7 1/4; (may be purchased separately for $159.95). Receiver (separate unit) has 5-channel, crystal-controlled plus tunable receive; 117-volt power supply; 14-channel performance double-conversion superhet (2 r.f. stages, 10.7-mc. conversion, 2 455-kc. i.f. stages); series gate noise limiter; adjustable squelch; "Local-Distant" sensitivity switch; 6 x 11 x 7 1/4 (may be purchased separately for $159.95). Power-VSWR meter sits atop separate speaker ($15.95); measures power output into dummy load; measures VSWR (directly); available for $41.95.

August, 1963
1 channel, crystal-controlled transmit and receive; battery power supply (6 penlight cells); superhet receiver; battery life indicator; earphone jack; 240 milliwatts input to transmitter; sold with carrying case and strap; 19 oz.

SONAR RADIO CORP.
3050 West 21st St., Brooklyn 24, N. Y.

Model "E" $179.50 (net)
8-channel, crystal-controlled transmit and receive plus tunable receiver; universal (117-, 12- and 6-volt) power supply; 11-tube performance superhet (1 r.f. and 2 455-kc., i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output; pilot-bulb output indicator; 4¾ x 9½ x 11¼; 9 lb. Accessories: 5-meter ($17.95) and various antennas.

Model "G" $229.50 (net)
8-channel, crystal-controlled transmit and receive, plus tunable receiver; universal power supply (either 117 and 12, or 117 and 6 volts); 10-tube performance double-conversion superhet; series noise limiter; adjustable squelch; transmit "spotting" switch on front panel; 5-meter and output indicator; ceramic mike, pi-network output; TVI filtered; 4¾ x 9½ x 11¼; 9 lb. Accessories: antennas, noise suppression kits and mounts.

TECRAFT SALES CORP.
Box 84, South Hackensack, N. J.

Falcon Radiophone Mk V $169.95
5-channel transceiver with tunable receiver, plus 1 crystal-controlled receive channel; universal (117-, 12- and 6-volt) power supply; 13-tube performance double-conversion superhet; series noise limiter; adjustable squelch; ceramic mike; pi-network output; plate current metered in transmitter; r.f. gain control may be purchased with special "TNS" noise-eliminating and squelch circuit built in ($20.00); 5⅞ x 11⅞ x 9½; 12 lb.

TRAM ELECTRONICS, INC.
Box 187, Winnisquam, N. H.

Model TR-27B $265.00
8-channel, crystal-controlled transmit and receive, plus tunable receiver; 117-volt power supply; 14-tube performance double-conversion superhet (2 r.f. stages, 4.5-mc. conversion, 2 455-kc., i.f. stages); series noise limiter; adjustable squelch; ceramic mike; pi-network output; S-meter and modulation indicator; TVI trap; "spotting" switch; built-in speech compression; external speaker connections; 7½ x 15½ x 9¼; 23 lb.

Model TR-27C $320.00
23-channel, crystal-controlled transmit; 1-channel crystal-controlled receive using panel-mounted socket; otherwise same as Model TR-27B.

Model TR-70B $246.50
8-channel, crystal-controlled transmit including 1 channel through panel mounted external socket; 8-channel crystal-controlled receive plus tunable receiver; solid-state power supply for either 12 or 6 volts, positive or negative ground; 14-tube performance double-conversion superhet (2 r.f. stages, 4.5-mc. conversion, 2 455-kc., i.f. stages); noise limiter; adjustable squelch; ceramic microphone; pi-network output; S-meter; modulation indicator; TVI trap; 5⅞ x 11 x 9½; 17 lb.

Model TR-70C $288.00
23-channel, crystal-controlled transmit, 1-channel crystal-controlled receive using panel-mounted socket, otherwise same as Model TR-70B.
UTICA COMMUNICATIONS CORP.
2917 W. Irving Park Rd., Chicago 18, Ill.

August, 1963

Model MC-27
$179.50
6-channel, crystal-controlled transmit and receive; universal power supply (117, 12, and 6 volts); 10-tube performance double-conversion superhet (1 r.f. stage, 1680-kc. conversion, 1 266-kc. i.f. stage); noise limiter; adjustable squelch; ceramic mike; link-coupled output; 4 x 11 1/4 x 7; 11 lb. Accessories: antennas (see separate listing), mounting brackets ($4.95) and power cables ($4.80, each).

VOCALINE COMPANY OF AMERICA, INC.
Old Saybrook, Conn.

Model T&C II
$199.95
6-channel, crystal-controlled transmit (1 channel is a spare socket on the front panel) and receive, plus tunable receiver; universal power supply (117, 12 and 6 volts); 13-tube-and-transistor performance double-conversion superhet (1 r.f. stage, 1680-kc. conversion, 1 266-kc. i.f. stage); noise limiter; adjustable squelch; 5-meter and output indicator; link-coupled output; 4 x 13 x 7; 12 lb.

WEBSTER MANUFACTURING
317 Roebling Rd., South San Francisco, Calif.

Model "411"
$169.95 (list)
4-channel, crystal-controlled transmit and receive; universal (117- and 12-volt) power supply; 9-tube performance superhet (1 r.f. and 1 455-kc. i.f. stage); series noise limiter; adjustable squelch; carbon mike; pi-network output; pilot-bulb output indicator; 5 x 9 1/2 x 8 1/2; 12 1/2 lb. Accessories: various antennas.

Model 412
$174.50 (list)
6-channel, crystal-controlled transmit and receive, including 1 channel crystal socket (transmit and receive) on front panel; universal power supply (117- and 12-volt); superhet receiver; noise limiter; adjustable squelch; pre-wired to accept manufacturers selective calling system; 5-meter; restricted audio response on transmit; pi-network output; 9 1/8 x 5 1/4 x 11 1/2; 12 1/2 lb.

Model "440"
$219.50 (list)
10-channel, crystal-controlled transmit and receive, plus tunable receiver; universal (117- and 12-volt) power supply; double-conversion superhet (1 r.f. stage, 1650-kc. conversion, 1 250-kc. i.f. stage); noise limiter; adjustable squelch; carbon

Model ED-276
$249.95 (list)
6-channel, crystal-controlled transmit (1 channel is a socket on the front panel) and receive, plus tunable receiver; universal solid-state power supply (117 and 12 volts); transistorized double-conversion receiver; noise limiter and combined adjustable squelch and sensitivity; receiver has fine-tuning front-panel adjustment when used for "Crystal Receive"; tubes used in transmitter section: 3 5/8 x 9 5/8 x 9 1/2; 14 1/2 lb.

Model ED-27M
$189.50 (list)
4-channel, crystal-controlled transmit and receive; universal transistorized power supply (117, 12, and 6 volts); 12-tube performance double-conversion superhet (1 r.f. stage, 4.0-mc. conversion, 1 455-kc. i.f. stage); noise pulse suppressor; patented "Vocatron" noise-immune adjustable squelch; ceramic mike; pi-network output; pilot-bulb output indicator; 5 1/4 x 9 1/4 x 8 1/4; 11 lb.

Model PT-27 ("Comraire")
$199.95 (list)
4-channel, crystal-controlled transmit and receive—plus tunable CB receiver—plus standard broadcast-band AM reception; rechargeable dry-battery power supply; transistorized double-conversion superhet receiver; 2-tube transmitter with about 1-watt input; noise limiter; squelch switched "in" or "out"; ceramic mike; pi-network output; crystal diode rectifier operates special power meter attached to antenna circuit; built-in flashlight; 9 x 4 x 11; 11 1/2 lb.
mike; pi-network output; S-meter and power output indicator; requires only 1 crystal per channel since unit has built-in "frequency synthesizing" circuit.

CB STATION ACCESSORIES

Included in this section of the Buyer's Guide are test instruments, selective-calling attachments, speech filters and compressors, etc. All product descriptions are necessarily short and the reader is urged to write the manufacturer for more detailed specifications.

ALLIED RADIO
100 N. Western Ave., Chicago 80, Ill.

Model Ten-2 (Knight-Kit) $29.95 (kit)
Measures true power output to 5 watts (direct readings) with 50-ohm load; measures VSWR (direct readings); measures percentages of positive and negative modulation; with built-in antenna can be used as relative field strength meter; checks crystal activity; can be used as signal monitor, audio generator and code practice oscillator.

AQUASPACE DEVELOPMENT
Box 586, Canoga Park, Calif.
Citizen Converter (Model 6c) $19.95

For mobile use; converts CB band to AM auto radio band (840-1100 kc.); self-contained mercury battery power supply; uses auto radio antenna.

BIGGS ELECTRONICS, INC.
1328 Pulaski St., Peru, Ill.

Standing Wave-Power-Meter $24.95 (net)
Measures VSWR (direct readings) and when terminated with non-inductive load will read power output in watts. Must be connected to transmitter with very short (not over 1 foot) piece of coax cable. May be left in transmission line at all times without ill effects.

BUSINESS RADIO CO., INC.
P.O. Box 5652, Minneapolis 17, Minn.

Noistop (Model 612) $16.95 (net)
Special noise-eliminating and squelch circuit mounted in 1 1/2 x 2 1/2 x 4 box; may be attached to any single- or double-conversion superhet (wiring instructions supplied for 18 different CB sets); ideal for mobile use; printed-circuit board, circuit is variation of famous TNS (Twin Noise Squelcher).

Patch-a-Call $74.95 (net)
Automatic, transistorized voice-operated phone patch; powered by 117-volt line; incoming voice activates transmitter—pauses make base station go back to receive; auxiliary speaker permits phone monitoring by base station operator; sold with complete wiring and installation instructions.

POPULAR ELECTRONICS
**S-Master**  $11.95
Transistorized outboard meter to be connected to o.v.c. bus in transceiver; gives accurate proportional reading of incoming signal strength; internal battery (NEDA-1064) has 9-12 month operational life.

**COMMAND ELECTRONICS MFG. CO.**
3256 N. Pulaski Road, Chicago 41, Ill.
This company manufactures and distributes a wide variety of moderately-priced items. Included in their most recent product announcements were noise suppressors, channel selectors, antennas, body mounts, etc. Write the address above for details.

**COMTRAN ASSOCIATES INC.**
2847 Cropsey Ave., Brooklyn 14, N.Y.

**COMPRESSION AMPLIFIER**

**CESCO CB-52-C**  $19.95
Measures power output to 52-ohm load; may be used to approximate antenna feedline mismatch; this model sold with coaxial connectors, Model CB-52-S available for $18.95 has Motorola-type spade connectors.

**CESCO CB-52-T**  $24.95
Measures VSWR (direct readings) at power levels up to 5 watts output; reads output power in watts; may be used as field strength meter; Model CB-75-T available at same price for 75-ohm coax lines; coaxial connectors.

August, 1963
Model 65-419 ("Speech Booster") $24.95 (net)
Low-gain compressor amplifier with limited bandpass characteristics (300-2500 cycles); clips and filters speech frequencies exceeding preset amplitude level; must be adapted to CB equipment; requires 400-volt d.c. supply at 5 ma. and 6.3 volts a.c. at 0.6 ampere.

Model 65-512 ("Tenna-Meter") $15.95 (net)
Inserted in coax line to measure relative power output and to assist in tune-up of transmitter.

Model 65-518 ("Signal Optimizer") $47.50 (net)
Measures VSWR (direct readings); measures power output in watts (direct readings); checks crystal activity; can be used as field strength meter (built-in telescoping antenna); plug-in headphones permit check on modulation quality.

Model CB-T $9.95 (net)
TVI filter; inserted in coax transmission line; provides 30 db attenuation above 28 mc.; only 1 db insertion loss; eliminates TV channel 2 interference.

Model SBT-3 ("Sideband Generator") $99.95 (net)
Converts AM output of 5-watt input transceiver to double sideband with suppressed carrier; 117-volt power supply only; no connection to modulator required; effectively increases "talk power."

Model 615 ("SWR Bridge") $39.95 (net)
Measures VSWR (direct readings) up to 54 mc.; measures true power output to 52-ohm load (self-contained) in two ranges—0-5.0 and 0-25.0 watts; measures relative field strength using attachable telescoping antenna; may be left permanently in coax line; adapter cables for connecting to Motorola plugs available at $1.95 each.

Model HA-12 ("Encoder/Decoder") $79.95
Selective calling system using 2-tone signalling; designed for use with manufacturers model CB-3A, but may be adapted to other transceivers; no power supply; requires high voltage from transceiver; automatically resets after 10 seconds; 6 possible codes; has call light feature; use on both transmit and receive; 2 3/4 x 3 3/4 x 3 1/2; 1 1/4 lb.

Model HA-12A ("Encoder") $44.95
Selective calling system using 2-tone signalling; designed for
mobile use; transmitting only (no receiving features); 6 possible tone codes; 2 3/8 x 3 3/4 x 4 1/2; 1 lb.

HAMMARLUND MFG. CO.
53 West 23rd St., New York 10, N. Y.

OCT-X Selector (8 channel) $15.95 (net, less crystals)
Push-button switch designed for use with Hammarlund HQ-105 TRS transmitter/communications receiver; plugs into existing crystal socket—8 new crystals plug into back of selector.

HEATH COMPANY
Benton Harbor, Mich.

Tone Squelch (Kit GD-162A) $33.95 (kit only)
Selective calling system; one of 4 different audio tones chosen by front panel switch; variable "hold" adjustment; 117-volt, self-contained power supply; incoming call indicator; external connections to alarm devices provided at rear of chassis; each unit is complete tone generator as well as monitor with resonant-reed relay; 12-volt d.c. kit available ($37.95).

HOLSTROM ASSOCIATES
P.O. Box 8640, Sacramento 22, Calif.

Model AAA-1 ("Audio-Aid-All") $10.99 (kit)
Speech clipper and filter; restricts audio passband to 500-2500 cycles; uses zener diodes; must be connected internally to modulation circuit of transceiver; derives power from transceiver; improves "talk power" and percentage of modulation.

INSTRUMENTS & COMMUNICATIONS, INC.
33 Danbury Road, Wilton, Conn.

Model DP-2 (Coupler-Duplexer) $4.99 (kit)
Coupling network permitting use of CB antenna for regular AM broadcast reception through auto radio; complete with coax connectors; tuned circuit isolates BC receiver from CB transceiver.

INTERNATIONAL CRYSTAL MFG. CO., INC.
18 North Lee, Oklahoma City, Okla.

Executive S/Meter Speaker $49.50 (net)
Designed especially for use with manufacturers Model 100 transceiver; VTVM circuit (3 ranges) for accurate S-meter readings; audio passband of speaker restricted to most useful voice frequencies.

HOLSTROM ASSOCIATES
P.O. Box 8640, Sacramento 22, Calif.

International Speech Clipper/Filter $17.95 (net)
Audio filter restricts voice range to 300-2500 cycles; limits modulation peaks; increases percentage of modulation; designed for internal wiring to most CB transceivers, or specifically to all of manufacturers models except 100-D (has this circuit built-in).

August, 1963
Executive Speech Filter

$36.50 (net)

Designed especially for use with manufacturers Model 100 transceiver; speech compressor and filter; limits voice range to 300-2500 cycles; increases percentage of modulation; increases "talk power."

E.F. JOHNSON COMPANY

Waseca, Minn.

Eliminoise (not illustrated)

$11.50

Kit of parts to suppress interference created by automotive generator-regulator, or alternator-regulator; includes spark plug shielding, distributor cap shielding, etc.

Tone Alert

$59.95 (net)

Selective calling system: may be attached to most CB transceivers; self-contained power supply; each unit is both tone generator and monitor with resonant reed relay; indicator call light stays on after proper incoming tone signal is received; 37 possible tones available; either 117- or 12-volt, or 117- and 6-volt models.

KAVIN ENGINEERING CO.

89 West Main St., Penacook, N. H.

23-Channel Switch

$32.50 (FOB)

Rotary switch with bank of crystal sockets around perimeter; double-pole switching for crystal isolation; dial markings can be applied as crystals are purchased and installed; simple connection to most transceivers not using frequency synthesis.

LAFAYETTE RADIO ELECTRONICS CORP.

111 Jericho Turnpike, Syosset, L. I., N. Y.

Field Strength Meter (Model TM-16A)

$15.95 (net)

Transistorized design permits sensitive tune-up of CB equipment; battery operated (1.5-volt flashlight cell); has earphone jack for monitoring output modulation quality of transmitter, available with 3 ranges; external telescoping antenna.

LAMPKIN LABORATORIES, INC.

Bradenton, Fla.

Frequency Meter (Model 105-B)

$260.00

Professional-style frequency meter; conservatively guaranteed to be better than 0.0025% in accuracy; available without built-in crystal calibrator for $215.00; may be used to determine any transmitter frequency between 100 kc. and 175 mc.; higher range multipliers to 450 mc. are avaiable as accessory items.
CB-AM Radio Coupler (Model CBC-1) $8.95 (net)
Signal splitter enabling use of cowl-type CB antenna for regular AM auto radio reception; minimum signal loss; uses coax connector to transceiver; Motorola-type connector to auto radio.

Monocall
$79.95
Selective calling system using 2-tone method; mechanical reeds with 6 possible code combinations; used both on transmit and receive; has 10-second "hold"; requires B-plus voltage only from transceiver; 2½ x 3½ x 5½; 12 oz; also available as "encoder" for $39.95 (no receiving functions).

Model 290 ("Micro-Match") $26.50
Measures VSWR (direct readings); measures true power output to 52-ohm load up to 4 watts; may be left in coax line; r.f. load resistor available ($2.95) and cable assembly for connecting to transceiver ($2.45).

Selectro $29.50 (Model "C") and $59.50 (Model "D")
Selective calling system; transistorized in 2 separate packages; Model "C" Coder has 9 tone channel possibilities; Model "D" is decoder for base station use (also requires 12 volts a.c. or d.c.); system operates by pressing "Call" button or "C" Coder for 3 seconds.

Poly-Call Price n.a.
Selective calling system; plugs into manufacturers models N, N-8, Pro, or Compact; spare relay contacts to control external devices; no wiring required by installer.

Poly-Tuner $34.95 (net)
Outboard accessory to provide 22-channel reception to owners of manufacturers' Poly-Comm N or Poly-Comm 11G CB transceivers; also contains S-meter (illuminated model S-meter available at slightly extra cost).

August, 1963
Antenna Tester (Model 520A) $49.95 (net)
Measures VSWR (direct readings) up to 180 mc.; measures true power output to 50-ohm load up to 1000 watts—reads on 3 scales (0-10, 0-100, and 0-1000); may be left in coax line; scale especially divided in Good-Poor ranges to assist novice in obtaining peak results with equipment; does not require external shunts or correction charts.

C/B Transmitter Tester (Model 510B) $48.95 (net)
Measures power output to 5 watts (direct readings with 50-ohm load); measures relative power output of 100 milliwatt handheld transceivers; measures percentage of modulation (positive and negative); may also be used as field strength meter and remote r.f. indicator; optional accessory is attenuator to enable measurements with transmitters up to 50 watts output ($15.95).

CRYStalignMETER (Model 500) $36.95 (net)
Valuable instrument for checking crystal activity; checks all crystal oscillating modes; transistorized with self-contained battery supply; can be used as crystal-controlled signal generator with tone modulation; built-in loop will detect r.f. fields near base of antenna; cable connections permit use as remote r.f. indicator; may also be used to check modulation; plate current, etc.

Crystal Test Set (Model 500A) Price n.a.
Improved version of the above; may be used to compare activity of low frequency crystals; when used with r.f. probe (Model 502) this set will measure r.f. volts and power output (separate meter scales); does not have built-in loop.

"S" Meter (Model 540) $15.88 (net)
Transistorized meter circuit easily connected to a.v.c. bus in any superhet; self-contained; battery-operated (standard 9 volts); 2 controls—sensitivity and zero set; size matches that of Model 540 Signal Filter.
Signal Filter (Model 530) $15.88 (net)
Pulse and ignition noise eliminator; adjustable squelch control; seems to be based on famous TNS circuit; requires filament and B-plus voltage connections to transceiver; easily wired into most superhet receivers; instructions supplied by manufacturer; 2 tubes; very rugged design.

SIMPSON ELECTRONICS, INC.
4212 Ponce de Leon, Coral Gables 46, Fla.

ELDECO Part-O-Gen $14.95
Transistorized battery-operated oscillator for checking crystal activity; may be used for "spotting" and alignment; tone modulated; accepts large and small pin crystals.

SMEA ENGINEERING
123 East Washington, Tipton, Ind.

Pow-R-Mike $39.95 (net)
Speech compressor to increase so-called "Talk Power"; 117-volt power supply built in; ceramic microphone mounted in front panel; can be made extremely sensitive and will pick up voices 25-50 feet away from mike; variable compression; 3½ x 8 x 5; 2½ lb.

Mobileer (Model R) $39.95 (net)
Similar circuit to above; sold with noise cancelling mike (or Model R) for $29.95 without microphone; powered from 12-volt car battery, no other connections but mike cable to transceiver; manufacturer claims 30% increase in modulation.

SPRAGUE PRODUCTS CO.
Suppressikit SK-1 (not illustrated) $17.85 (net)
Easily installed kit of 5 basic parts to suppress radio interference from generator, distributor, voltage regulator and high-voltage coil; uses well-known "Thru-Pass" Sprague capacitors; liberal use of shielded cabling.

STONER ELECTRONICS
Box 7388, Alto Loma, Calif.
Auto-Patch (Model SE-104) $14.95 (net)
Connects telephone line to CB transceiver; requires connections to microphone, speaker, and telephone lines—can be done in about 5 minutes; fully automatic once installed; modulation level setting on rear apron of Auto-Patch.

Audio Ram (Model SE-100) $34.95 (net)
Transistorized low-gain audio amplifier/compressor/speech clipper; operates from self-contained battery supply; deluxe model has YU meter and level control; also available in economy version (Model SE-101) without metering and level control for $24.95; also available as kit (Model SE-101K) for $14.95; provides about 12 db compression; increases so-called "talk power."

WORLD RADIO LABORATORIES
Council Bluffs, Iowa

CB Preomplifier (Model NA-27) $11.95
R.f. preomplifier fixed-tuned (but sufficiently broad-banded) to 27-mc.; uses 2 Nuvistor tubes; printed-circuit wiring; easily installed—requires filament and row B-plus voltage; manufacturer claims gain of 20 db; usable with either superhet or superregen receivers; manufacturer supplies wiring instructions.

Editor's Note
In preparing the above catalog section, every possible effort has been made to itemize representative CB products, or accessories especially designed for the CB operator. There are obviously a number of products in the ham radio field that can also be used for CB. The equipment above does not include such things as signal generators, tube testers, etc., that are of equal importance to the CB'er, the ham, SWL, and radio serviceman. Nor does it include crystals; CB crystals of uniform tolerance and quality are being supplied to almost every radio parts jobber and distributor throughout the country, and a listing of the crystal manufacturers would be superfluous.

August, 1963

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<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Webster Ward Products Corp.</td>
<td>317 Roebling Rd. S. San Francisco, Calif.</td>
</tr>
<tr>
<td>Utica Communications Corp.</td>
<td>2917 W. Irving Park Rd. Chicago 18, Ill.</td>
</tr>
<tr>
<td>Telrex Laboratories</td>
<td>3465 Vega Ave. Cleveland 13, Ohio</td>
</tr>
<tr>
<td>New-Tronics Corp.</td>
<td>4510 N. Lindbergh Blvd. Bridgeton, Mo.</td>
</tr>
<tr>
<td>Master Mobile Mounts, Inc.</td>
<td>1801 W. Belle Plaine Ave. Chicago 13, Ill.</td>
</tr>
<tr>
<td>Mark Heliwhip</td>
<td>8450 N.E. Highway 6 Lincoln, Nebr.</td>
</tr>
<tr>
<td>Hy-Gain Antenna Products</td>
<td>317 Roebling Rd. S. San Francisco, Calif.</td>
</tr>
<tr>
<td>Herb Kreckman Co.</td>
<td>317 Roebling Rd. S. San Francisco, Calif.</td>
</tr>
<tr>
<td>Master Mobile Mounts, Inc.</td>
<td>4125 W. Jefferson Blvd. Los Angeles 16, Calif.</td>
</tr>
<tr>
<td>Mosley Electronics, Inc.</td>
<td>4510 N. Lindbergh Blvd. Bridgeton, Mo.</td>
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</table>
Although microphones now supplied with transceivers have improved in quality, many CB'ers require different features—noise cancellation, base station with pedestal, more or less frequency response, etc. This listing should enable the CB'er to determine the characteristics of the microphones that are available.

### AMERICAN MICROPHONE CO.
Galien, Mich.

Model B208S $13.95 (list)
Ceramic element; rated output level —58 db; 50-8000 cycle response; 5' coiled cord; available without coiled cord for $1.45 less; has 'Slide-Lock' d.p.s.t. switch; molded case.

Model B213S $16.75 (list)
Ceramic element; rated output at —58 db; 50-8000 cycle response; 5' coiled neoprene cord; available with or without d.p.s.t. switch; also available with crystal element for $2.50 less; sold with dash bracket; hi-impact Impexx case.

### ASTATIC CORP.
Conneaut, Ohio

Model 511 $19.95 (list)
Ceramic element; rated output level —50 db; 200-4000 response not given; 5½' coiled cord; press-to-talk leaf-type d.p.s.t. switch; plastic case with spun-aluminum grill.

Model 513 $34.50 (list)
Dynamic element; rated output level—50 db; 200-9000 response not given; 5½' coiled cord; press-to-talk leaf-type d.p.s.t. switch; plastic case with spun-aluminum grill.

### ELECTRO-VOICE, INC.
Buchanan, Mich.

Model 600E/602E
Model 600E: $39.00 (list)
Model 602E: $57.50 (list)
Dynamic element; rated output level —55 db; 100-7000 cycle response; 6' coiled cord; available in hi-Z or lo-Z; d.p.s.t. switch; gray plastic finish; mounting bracket. Model 602E has the same response, but incorporates a noise-reducing aperture to permit close-talking where high ambient noise is encountered.

Model 641
Ceramic element; rated output level —57 db; 70-10,000 cycle response; 6' coiled cord (base station mike); hi-Z or balanced 150 ohms; chrome case; Model 634 is furnished without fixed-tilt stand coupler; both models have on-off switch. Model pictured above is the 641 with 418-5 stand ($15.00 list, extra).

Model 634 $31.50 (list)
Model 641 $35.00 (list)
Model 634 $31.50 (list)
Dynamic element; rated output level —57 db; 70-10,000 cycle response; 6' coiled cord; available with or without d.p.d.t. switch; gray finish with Cycolac plastic body; supplied with hang-up bracket.

Model 714SR $16.50 (list)
Ceramic element; rated output level —55 db; 60-7000 cycle response; 5' coiled cord; d.p.d.t. switch; gray finish with Cycolac plastic body; supplied with hang-up bracket.

Model 717 $19.50 (list)
Ceramic element; rated output level —55 db; 100-7000 cycle response; 5' coiled cord; cardioid pattern; noise cancellation as high as 67% from back of microphone; d.p.d.t. switch; blue-gray finish with Cycolac plastic body; supplied with hang-up bracket.

Model 727
Model 727: $18.00 (list)
Model 727SR: $20.00 (list)
Model 729: $24.50 (list)
Model 729SR: $26.50 (list)
Ceramic element, rated output level —55 db; 60-8000 cycle response; 8½' cord (base station mike); supplied with slip-in die-cast desk stand plus floor stand adapter. Model 727SR has d.p.d.t. leaf-type switch, gray finish; some models with cardioid pattern called Model 729.
Model C47 ("Hothead") $16.00 (list)
Ceramic element; rated output -48 db; 300-4000 cycle response; 6' coiled cord; press-to-talk d.p.d.t. switch; Model C47D available for some price has differential to 600 cycles and cardiod pattern to 4000 cycles supplied with hang-up bracket.

Model C470 available for some price has differential to 600 cycles and cardiod pattern to 4000 cycles supplied with hang-up bracket.

Mark I "Big Mike" $33.50 (net)
Dynamic element with built-in transistor amplifier (mercury battery power supply); rated output level adjustable from zero to -39 db; variable frequency response; 5' coiled cord; d.p.d.t. switch; hangup bracket.

Model 201/401
Model 201: $18.00 (list)
Model 401: $22.00 (list)
Ceramic element; rated output level -55 db; 40-10,000 cycle response; 5' coiled cord; s.p.d.t. switch; supplied with mounting bracket; black finish, plastic "Armo-Dur" case; Model 401 is similar, but has dynamic element and -49 db response.

Model 275SK
Ceramic element; rated output level -59.5 db; 40-10,000 cycle response; 7' coiled cord; s.p.d.t. switch; supplied with mounting bracket; black finish, plastic "Armo-Dur" case; desk stand optional accessory.

Model 444
Dynamic element; rated output -52.5 db; 300-3000 cycle response; 7' cord (uncoiled); base station microphone with adjustable height stand; d.p.d.t. switch with locking feature; gray finish; Model 460 "Dispatcher" similar in appearance, but has 100-9000 cycle response, available after August 1.

Model 488 Sonabor $57.50 (list)
Controlled reluctance with noise cancelling features; rated output level -58 db; 200-4000 cycle response; 5½' coiled cord; d.p.d.t. switch; hi-Z or lo-Z models available; gray finish with lip guard; plastic "Armo-Dur" case.

Model 254C $23.50 (list)
Ceramic element; rated output level -54 db; 80-7000 cycle response; base station mike with fixed desk stand; touch on-off switch and lever-lock switch; 7' cable; also available with a dynamic or crystal element.

Model 350C $12.50 (list)
Ceramic element; rated output level -54 db; 80-7000 cycle response; d.p.s.t. switch; 5' coiled cord; gray finish, polystyrene case; supplied mounting bracket. A special combination of the 254C and 350C are sold in one package for $40.30 (list).

Model 355C $12.50 (list)
Ceramic element; rated output level -50 db; 80-7000 cycle response; d.p.s.t. switch; 5' coiled cord; heavy-duty plastic case; mounting bracket supplied.

(Continued overleaf)
DIRECTORY
UNIVERSITY LOUDSPEAKERS, INC.
80 S. Kensico Ave., White Plains, N. Y.

Model 61/61HF
Model 61: $24.95 (net)
Model 61HF: $27.95 (net)

Dynamic element; rated output level -55 db; 95-9500 cycle response (Model 61HF has a response of 70-14,000 cycles); 6' coiled cord; d.p.s.t. switch; gray finish; heavy-duty plastic.

HAND-HELD TRANSCEIVERS

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>MODEL</th>
<th>TYPE</th>
<th>WEIGHT</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allied Radio Corp.</td>
<td>Knight-Kit C-100</td>
<td>Superregen</td>
<td>9 oz.</td>
<td>$9.95</td>
</tr>
<tr>
<td>100 North Western Ave.</td>
<td>Knight-Kit C-555</td>
<td>Superhet</td>
<td>16 oz.</td>
<td>$19.95</td>
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<tr>
<td>Chicago 80, Ill.</td>
<td>Lincoln Walkie-Talkie</td>
<td>Superhet</td>
<td>24 oz.</td>
<td>$32.50</td>
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<tr>
<td>J. Briskin Inc.</td>
<td>Tele-Mate 200</td>
<td>Superhet</td>
<td>14 oz.</td>
<td>$99.50 (list per pair)</td>
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<tr>
<td>14827 Ventura Blvd.</td>
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<tr>
<td>Sherman Oaks, Calif.</td>
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<tr>
<td>Concord Electronics Corp.</td>
<td>TG-093</td>
<td>Superhet</td>
<td>15 oz.</td>
<td>under $60</td>
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<tr>
<td>809 North Cahuenga Blvd.</td>
<td></td>
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<tr>
<td>Los Angeles 38, Calif.</td>
<td></td>
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<tr>
<td>E I C O</td>
<td>740</td>
<td>Superhet</td>
<td>19 oz.</td>
<td>$54.95 (kit)</td>
</tr>
<tr>
<td>33-00 Northern Blvd.</td>
<td></td>
<td></td>
<td></td>
<td>$79.95 (wired)</td>
</tr>
<tr>
<td>Long Island City, N.Y.</td>
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</tr>
<tr>
<td>Electra International</td>
<td>Miniphone 100</td>
<td>Superhet</td>
<td>10 oz.</td>
<td>$39.95 (pair)</td>
</tr>
<tr>
<td>1348 Foothill Blvd.</td>
<td>Miniphone 400 Mk. 1A</td>
<td>Superhet</td>
<td>10 oz.</td>
<td>$69.95 (pair)</td>
</tr>
<tr>
<td>LaCanada, Calif.</td>
<td>Miniphone 400 Mk. II</td>
<td>Superhet</td>
<td>12 oz.</td>
<td>$149.95 (pair)</td>
</tr>
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<td></td>
<td>Miniphone 600</td>
<td>Superhet</td>
<td>12 oz.</td>
<td>$99.50 (net)</td>
</tr>
<tr>
<td>Electrosolids Corp.</td>
<td>S-2100</td>
<td>Superregen</td>
<td>8 oz.</td>
<td>$9.95 (list)</td>
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<tr>
<td>12740 San Fernando Rd.No.</td>
<td>S-2200</td>
<td>Superhet</td>
<td>12 oz.</td>
<td>$32.95 (list)</td>
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<tr>
<td>Sylmar, Calif.</td>
<td>S-2300</td>
<td>Superregen</td>
<td>6 oz.</td>
<td>$19.95 (Retail)</td>
</tr>
<tr>
<td>Fanon-Electronic Industries, Inc.</td>
<td>Fanon-Masco FCB-9A</td>
<td>Superhet</td>
<td>14 oz.</td>
<td>$67.40 (list)</td>
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<tr>
<td>439 Frelinghuysen Ave.</td>
<td>Fanon-Masco RCB-10</td>
<td>Superhet</td>
<td>16 oz.</td>
<td>$74.95 (list)</td>
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<tr>
<td>Newark 14, N. J.</td>
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<tr>
<td>GC Electronics Co.</td>
<td>Pocketphone</td>
<td>Superhet</td>
<td>14 oz.</td>
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<tr>
<td>Rockford, Ill.</td>
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<tr>
<td>General Radiotelephone Co.</td>
<td>Fieldmaster</td>
<td>Superhet</td>
<td>24 oz.</td>
<td>$39.95</td>
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<tr>
<td>3501 Burbank Blvd.</td>
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<td>Burbank, Calif.</td>
<td></td>
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</tr>
<tr>
<td>Hallicrafters Co.</td>
<td>CB-6</td>
<td>Superhet</td>
<td>20 oz.</td>
<td>$59.95</td>
</tr>
<tr>
<td>4401 West Fifth Ave.</td>
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<tr>
<td>Chicago 24, Ill.</td>
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</table>

(Continued on page 116)
SAFETY IN THE HAM STATION

WHAT'S WRONG with this little episode?

One of my friends marched proudly into my shack the other day carrying a new communications receiver. "Hi, Herb," he said. "Give a listen to my new receiver." Carefully placing it on the table, he unwound its power cord and inserted the plug in a nearby 117-volt, a.c. socket. Then he transferred the antenna lead-in from my receiver to his. Next, he connected the loudspeaker. "I don't think we'll need your ground wire," he said as he turned the receiver power switch on. In a half minute, signals began pouring out of the speaker.

Nothing wrong? Think again. The flaw in the above story is that my friend carelessly violated two elementary safety rules when he hooked up his receiver, just as many licensed amateurs, SWL's, and CB operators do every day.

Let's take a real hard look at the dangerous habit of working on electrical apparatus with the power plug inserted in the wall socket. Obviously when you do so, you may be betting your life on a bit of insulation and a small spring in a switch—even if the power switch is in the off position. Also, while leaning over gear to work on it, your clothing could hook the switch and turn it on accidentally, maybe when your hands are in firm contact with a high-voltage point. These possibilities present no danger if you make sure that the power plug is out of the socket before you start to work.

Good Ground Connections. In modern electronic equipment, the 117-volt primary circuit is almost always bypassed to the metal chassis with capacitors of values between .001 and .01 µf. rated at 400 to 600 volts. This is done to prevent

Novice Station of the Month

We are pleased to award a one-year subscription to Don Hutchins, of West Point, N.Y., (WN2CDV), for submitting the winning photo in our August contest. A Heathkit DX-35 transmitter, long-wire antenna, and Lafayette KT-320 receiver are Don's ham tools; with them, he has contacted 20 states, 3 Canadian provinces, and the Panama Canal, all on 80 meters. If you want to try for a similar award, send us a picture of your station—preferably showing you at the controls—with some information about yourself, your equipment and activities. All entries should go to Herb S. Brier, POPULAR ELECTRONICS, P. O. Box 678, in Gary, Indiana.
or

Run a heavy copper wire ing installed too your

but this directly one to poor perhaps, to lightning surge piece former capacitors annoying at transmitter, any metal rent flows unwanted 350 contacts mostly John Sanders, TRONICS, Publishing Company, Dept. CH3, One Park Avenue, New York 16, N.Y. If you order by mail, add 25 cents extra for postage.

PLUG-IN TRANSMITTER CRYSTAL SWITCH

A sharp Novice operator soon recognizes the advantages of changing his
Two crystal jacks were left out of the unit shown to clarify the construction details.

transmitter crystal to get out from under a strong interfering signal, or to move closer in frequency to a station he wishes to work. Unfortunately, even when the crystal socket is mounted on the transmitter front panel, it is not always easy to change crystals in a hurry, and when the crystal socket is recessed inside the transmitter, it is practically impossible. But by adding crystal switching to your transmitter, you can change crystals effortlessly.

The plug-in unit in the photograph will accommodate up to eight crystals, and by using the larger box specified in the Parts List and adding four more crystal sockets, 12 crystals can be accommodated.

Construction. Clearances are quite limited (unless you decide to mount the crystal sockets externally); therefore, be extra careful to mount the switch \( S_1 \) in the exact center of the box. Position the crystal sockets flush with the rear of the box, and space them approximately \( \frac{1}{16}'' \) apart, center to center. The \( \frac{1}{8}'' \) mounting holes are \( \frac{1}{16}'' \) apart, and the \( \frac{3}{16}'' \) holes to accommodate the crystal holder prongs are centered \( \frac{1}{16}'' \) from the adjacent mounting hole. Place an extra panel nut on the switch bushing before mounting the selector switch; adjust this nut to position the switch wafer between the terminals on the crystal sockets.

Wiring. Connect together the front terminals of all crystal sockets, and connect the rear terminal of each socket to the corresponding fixed terminal of the selector switch. Use a length of standard 300-ohm TV lead-in for the (Continued on page 114)
TODAY, with transistor radio receivers in the hands of nearly every teenager, with transistorized ignition about to become a standard feature in many new cars, and with transistorized controls used throughout industry, it is interesting to pause and look back over the developments of the past fifteen years.

If you're under twenty, chances are you don't remember the announcement of a new kind of amplifying device—the transistor—invented by scientists of the Bell Telephone Laboratories, Doctors Shockley, Brattain and Bardeen. That announcement was made in the summer of 1948 and was received, at the time, with mixed emotions. Some engineers and scientists considered the new device little more than a laboratory curiosity—interesting, but not to be taken seriously. Others woefully predicted that the transistor would "kill" both the vacuum tube and vast industry based on it. Still others looked on it as a device that would supplement, rather than supplant, the tube.

In actual fact, all three predictions came true to some extent: The transistor was a laboratory curiosity for some time, it has "killed" some sections of the vacuum tube market, and, today, it does supplement the tube in many applications.

The first transistors were point-contact devices, and it was from these that the basic electrode names were taken. Each consisted of a small cube-like "base" of semiconductor material upon which rested two fine cat-whisker wire electrodes, one of which was said to "emit" current carriers into the base, while the other "collected" them. Three electrode names, base, emitter, and collector, were derived from this terminology.

These early devices had tremendously high gain, so high, in fact, that they were stable as amplifiers only when used in the grounded-base (or common-base) configuration (see Fig. 1). With this arrangement, the unit was not a current amplifier in the generally accepted sense. Rather, it amplified signals by virtue of the difference between its low input and high output impedances (or resistances), and it was from this fact that the transistor derived its name—a coined word from the expression "trans-
fer resistor." At the time, many engineers considered the transistor as simply a special version of such resistor-like devices as the thermistor and varistor.

Old-timers and those who have been interested in radio for a number of years will remember the first stir that the transistor caused among hobbyists, and may even recall when "low-cost" experimenter's transistors sold for fifty dollars each, and when Raytheon announced its first truly low-cost unit, the now famous CK722, at only $7.50.

The photographs shown here are of historical significance, and you may wish to save them for your scrapbook, for they were sent out with the very first news releases which announced the invention of the transistor.

Readers' Circuits. Many readers are fascinated by direct-coupled circuits. There are probably several reasons for this popularity. Such circuits are quite simple when compared to corresponding vacuum tube designs, and relatively few components are needed for multi-stage, direct-coupled projects. Direct-coupled circuits offer a means for achieving the experimenter's ultimate goal—maximum performance with minimum complexity and cost. This month we are featuring two direct-coupled projects which are based on a basic circuit described in this column some time ago.

The high gain audio amplifier illustrated in Fig. 2 was submitted by Edmund J. Burke (354 Darwin Drive, Snyder, N. Y.). He constructed the device by simply combining a basic direct-coupled circuit described several years ago (January, 1959) with a booster amplifier described in the December, 1962 issue.

Referring to the schematic diagram, a crystal microphone cartridge (XTAL MIC) serves as the primary signal source. The signal from the microphone is applied to the 100,000-ohm gain control (R1) and, from there, to a three-stage direct-coupled complementary amplifier, Q1-Q2-Q3. The amplified output signal from Q3 is transformer-coupled to the power amplifier, Q4, by T1. Capacitor C1 serves as a d.c. blocking capacitor to prevent a short of Q4's bias (furnished through R2) by T1's secondary winding, while C2 provides inverse coupling.
feedback to minimize harmonic distortion in the output stage. A loudspeaker voice coil serves as Q4's collector load. Operating power is supplied by B1, controlled by single-throw, single-throw switch S1.

Standard, readily available parts are used. Both Q1 and Q3 are type 2N107's, Q2 a type 2N170, and Q4 a Lafayette type SP-147 (although any standard power transistor should work here with R2's value readjusted accordingly). Resistor R1 is a conventional volume control with on-off switch (S1) attached, while R2 is a half-watt resistor. Capacitor C1 is a 30- to 50-µf., 20-volt electrolytic, and C2 a 0.2 µf. paper or ceramic capacitor. The coupling transformer, T1, may be any output type with a 1000- to 4000-ohm primary and a 3.2- to 8-ohm secondary. A 6-volt battery (B1) is used, and may be made up of four flashlight cells connected in series.

The loudspeaker should have a voice coil impedance of from 3.2 to 8 ohms. For lower distortion at the same or greater output, insert an output transformer between Q4 and the speaker voice coil. Connect the center tap and one end of the primary winding of the transformer (Lafayette AR-503 or AR-167 can be used) at the points marked "X" in the schematic. Connect the speaker voice coil to the transformer secondary, matching impedances.

The receiver circuit illustrated in Fig. 3 is basically similar to Edmund's audio amplifier, except that the microphone has been replaced by a tuned circuit (L1-C2), coupling coil (L2), and diode detector (D1), while the transformer-coupled power output stage has been replaced by a pair of moderate-impedance (2000-ohm) headphones. The reader who submitted the circuit, Paul Fischer, was inspired by a Carl and Jerry story which appeared in a recent issue of POPULAR ELECTRONICS.

In operation, signals picked up by the antenna (ANT) are coupled through C1 to the selective tuned circuit L1-C2. The selected signal is picked up by L2 and applied to the diode detector (D1), and then to the three-stage, direct-coupled amplifier, Q1-Q2-Q3. Resistor R1 provides an adjustable bias for optimum performance, and serves a secondary role as a gain control, while R2, bypassed by C5, provides a stabilizing bias for the output stage. Capacitor C4 is an optional component, serving to provide feedback around the last two stages.

Again, inexpensive, readily available components are used. Transistors Q1 and Q3 are 2N170's, while Q2 is type 2N107. Capacitor C1 is a small ceramic, C2 a 365 µf. variable, C3 a 0.5 µf. ceramic or paper unit, and C5 a 10-µf., 10-volt electrolytic. Capacitor C4's value is determined experimentally. Start with a .001 µf. ceramic, and try smaller values if oscillation occurs. Resistor R1 is a 50,000-ohm volume control, and R2 a half-watt resistor. The tuning coil is a Superex ferrite loopstick (L1), while the coupling coil (L2) consists of four turns of #26 double cotton-covered wire wound over L1 in the same direction as the original coil. Diode D1 may be type 1N54 or 1N60. Operating power is supplied by a 3-volt battery (B1), controlled by a single-pole, single-throw toggle or slide switch (S1).

Either project may be assembled in (Continued on page 118)
ALTHOUGH much has been written from time to time on the subject of reporting to stations for verification purposes, little mention has been made of one important point: the return address.

There is an increasing tendency among many reporters, especially amateur radio monitors, to include the notation “QSL via ARRL” in their reports. For the uninitiated, this term simply means that the foreign station is asked to send a verification to WPE such-and-such in care of the American Radio Relay League, West Hartford, Conn.

The ARRL is the headquarters of the amateur fraternity in the United States, and, with the help of hams in all districts, acts as a clearing house for QSL’s from foreign lands. Many American ham operators ask foreign stations to “QSL via ARRL” for the sake of convenience, especially if poor conditions are making reception difficult. The term “QSL via ARRL” is readily understood the world over, and is far simpler to send over the air than an address.

American hams who are members of the ARRL and who take advantage of the QSL Bureau are expected to comply with certain rules, such as keeping the Bureau supplied with a number of “SASE’s” (self-addressed, stamped envelopes). When cards arrive, they are forwarded to the addressee in one of the SASE’s.

WPE registration holders who have been including the “QSL via ARRL” notation in their reports should realize that they may not be complying with ARRL rules, especially that one covering SASE’s. Many WPE monitors are not even ARRL members.
are available to anyone holding a WPE registration, and to other SWL's as well. He operates his bureau on a strictly nonprofit basis, and we know from personal contact with Roy that he often digs into his own pocket to keep the cards going out.

From time to time Roy publishes a list of WPE registrations for whom he has cards but no addresses. Many readers keep a few SASE's on hand at the

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### ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

All of the stations below specifically beam English-language newscasts to the U.S.A. The times may vary a few minutes from day to day.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>STATION</th>
<th>FREQUENCY (kc.)</th>
<th>TIMES (EST)</th>
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<td>Australia</td>
<td>Melbourne</td>
<td>17,840, 15,315, 9580</td>
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<td>Sofia</td>
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<td>1900, 2000, 2300</td>
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<td>Montreal</td>
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<td>Leopoldville</td>
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<td>1630, 2100, 2230</td>
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<td>West Congo</td>
<td>Brazzaville</td>
<td>11,725</td>
<td>2015</td>
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<td>Prague</td>
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<td>2030, 2330</td>
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<td>U.S.S.R.</td>
<td>Moscow</td>
<td>(announced) 9650, 9570, 7320, 7250, 7150, 7130; (also monitored on 7230, 7200, 7110, 7070, 7030)</td>
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<td>Vatican City</td>
<td>Vatican City</td>
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</table>
Short-wave monitor card (below) is that of WPE4EDV. It’s owner, Jim Phillips, of Waverly, Va., DX’ers with two receivers: a Heath GR-91 and a General Electric J-620 (right).

QSL-SWL bureau in the event that cards come in for them.

It might be a good move on the part of WPE monitors, especially those who may have requested foreign stations to “QSL via ARRL,” to check and see if Roy is holding any QSL cards. We would suggest that you include return postage in order to keep his expenses to a minimum. Write directly to him at the Ballston Spa, N. Y., address given above. And if you are a ham radio monitor and in the habit of sending reports to foreign hams, you might send an SASE or two to Roy to expedite the forwarding of cards to you in the future.

Please bear in mind that Roy Waite is doing this work on his own—a little help and cooperation on your end of the line will go a long way toward improving the SWL-QSL service.

Obituary. Just as we went to press we learned of the death of one of our veteran DX’ers, Anson Boice, WPE1BD, New Britain, Conn. “Ans” was an expert in DX’ing before yours truly even heard of it. Those who knew him will miss him—those who didn’t know him will no longer be able to profit by his periodic reports: 30, Anson.

(Continued on page 121)
A Short-Wave Broadcast Predictions

**AUGUST 1963**

**By STANLEY LEINWOLL**
Radio Propagation Editor

An ENGLISH-language program of particular interest to hams and SWL's, "The VOA Amateur Radio Program" is still popular. If it's new to you, it consists of 15-minute segments featuring interviews, propagation forecasts, general gossip, and news of recent developments. A special QSL card is available to listeners of the program which is written and announced by Bill Leonard, W2SKE, who is also a prominent news-caster for CBS. Broadcast times (GMT) include: Sunday at 0730, 0845, 2230, and Monday at 0330. Since the program is carried on a world-wide basis, frequencies range from 49 to 13 meters, depending on time and transmitter site. In general, the 0330 GMT (1130 EDST) program is most likely to be heard by domestic listeners from transmitters in the U.S. on the 49-, 31-, and 25-meter bands. Specific frequencies can be obtained by writing Amateur Radio, Box 922, Washington 4, D.C.

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To determine the frequencies and times for best short-wave reception in the United States, select the table for the area you are located in, read down the left-hand column to the region you want to hear, then follow the line to the right until you are under the figures indicating your approximate local time. The boxed numbers will tell you the frequency band (in megacycles) to listen to during any 2-hour interval. Asterisk (*) indicates that signals will probably not be heard.
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*Under present rules part 19.32 the FCC does not provide for more than 5 (5) watt input in the Citizens Radio Service (26.965-27.225 MC Band)

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August, 1963
"UP PERISCOPE!" Jerry called to Carl, and the latter released the large cylindrical object he had been holding on the bottom of Jerry's full bathtub and watched it slowly rise to the surface.

The youths were checking out their latest "invention," a hand-held portable sonar unit for use in scuba diving. Actually it was just a crude copy of the Hydro Probe manufactured and sold by the Raymond Development Company of Watertown, Massachusetts. While the unit the boys had made was much larger and clumsier than the commercial version, it operated on the same general principle.

They had simply installed inside a large paint bucket a flashing-light type transistorized depth-finder. The depth-finder was the same kind they had used at Parvoo University to locate a metal plaque at the bottom of the river. A five-inch diameter circle had been cut from the center of the airtight lid, and a heavy sheet of Plexiglass had been cemented over this opening so that the depth-finder dial mounted just behind it could be seen. The transducer had been fastened to the outside bottom of the can, and the cable from it led inside through a waterproof seal.

Finally, the on-off/sensitivity control was connected through a speed-reducing gear train to a tiny permanent magnet reversible electric motor. The motor, in turn, was controlled by a spring-loaded, normally-off, double-pole, double-throw toggle switch mounted on the side of the paint bucket. An unpierced nursing bottle nipple, with its rim cemented to the bucket, slipped over the bat handle of this switch, and permitted control of the sonar device inside its waterproof seal.

"That does it," Carl said, lifting the dripping unit from the bathtub and holding it in front of his face by means of the two strong handles soldered to the sides of the can. "It barely floats, so it should be easy to maneuver under water, and it doesn't leak a drop. Let's take it to the old quarry and try it out."

"O. K.," Jerry agreed. "You load the scuba gear in the car while I dry this thing off. Mom'll kill us if we drip water on her floors."

A HALF HOUR LATER the boys left the highway and traveled a short distance along a side road until they reached the abandoned quarry. They were just getting out of their car when they were surprised by the voice of the county sheriff.

"Over here, fellows," he called, emerging from the undergrowth. They could
see the sheriff’s car parked behind some bushes growing between the road and the edge of the steep-sided quarry.

He was an old friend, and Carl did not hesitate to ask, “Hey, what are you hiding from?”

“Remember that branch-bank holdup at the shopping center a little over a year ago?” he asked. “The two men we think did the job ran through a roadblock and came out on the highway with the state troopers on their tail. They took off on this road and lost the state police for a few minutes—about fifteen. The police closed in from both ends of this short road and took them not a quarter of a mile from here, but none of the bank loot was on them.”

“We searched every inch of the road and a hundred yards either side,” the sheriff continued. “The prosecutor didn’t have enough on them to try them for the bank job, but they both did a year in the pen for possession of a stolen car. Their sentences were up last week, and I’m staked out here on a hunch those two birds stashed the dough away, and will try to come back for it.”

“Maybe they threw the money in the quarry,” Carl suggested.

“We thought of that, and state police divers spent two whole days exploring the bottom, yard by yard. They had to do most of their searching by touch because working of the sand pits along the little creek feeding into the quarry keeps the water riled up so you can’t see more than a foot or so in front of you. The divers found old tires, empty beer cans, rolls of rusty fence wire, baby buggies—everything but money. But what devilment are you two . . . .”

Before he could finish his question, an emergency call tripped the squeal of the radio installed in his car. The city police had just received a telephoned tip that a supermarket on the other side of town was to be held up, and the dispatcher relayed the information along with the message that all mobile units in the county were ordered to converge on the spot.

“Stick around, I’ll be back,” the sheriff said as he headed for the highway.

CARL AND JERRY walked down a slope to the edge of the quarry. Across and to the right, the sheer walls of the large pit went almost straight down to the surface of the muddy water some thirty feet below. Where they were standing, a thick curtain of vines grew over the edge and cascaded down until the vine ends trailed in the water. Over to the left, however, a steep path zigzagged down to a narrow ledge running around the quarry a foot or so above the water.

They lugged their gear down this path, and Carl helped Jerry put on the scuba outfit. In practically every other physical endeavor, Carl was easily Jerry’s superior; but in swimming, the chubby youth was as much at home in the water as an otter. “Blubber floats better than muscle,” was Carl’s succinct and disparaging explanation.

With the diving equipment in place and checked out, Jerry picked up the portable sonar and slid beneath the murky water. Going down a few feet, he worked the rubber-covered switch handle to turn the unit on and adjust the sensitivity.

The two glowing spots of neon light on the dial of the depth-sounder were easily seen when the Plexiglass disk was held close to his eyes, and he was delighted to find the crude affair working exactly as anticipated. Not only did it indicate how far the bottom was beneath him, but the stone walls of the quarry also returned sharp echoes to indicate their distance from his location. Moreover, when he turned on his back and pointed the instrument straight up, an echo was returned from the air-water.
interface that indicated how deep he was swimming.

He played with the instrument for several minutes, trying it out at different depths and "swimming blind" with only the sonar ranging indication of the instrument to tell him how deep he was swimming and to warn him when he approached the bottom or sides of the quarry. While he was swimming some fifteen feet below the surface toward the vine-covered wall of the pit, the distance-indicating spot of light suddenly jumped counterclockwise from the ten-foot to the five-foot position. Swinging the instrument slightly to either side or up or down returned the spot of light to the more distant indication.

Keeping his depth, Jerry inched slowly forward until the front end of his paint bucket bumped into something suspended in the water. Inspection with his hands revealed it was a large metal container of the kind pressure-gun grease is kept in at a filling station. A thin wire led straight up from the ball, and Jerry followed this upward with his hands until he came to the surface.

He discovered he was behind the screen of vines and that the thin strand of steel piano wire ran up through these vines to the top of the quarry. He was about to call to Carl, whom he could see through the leaves, when he was stopped by the sound of a man's voice above him yelling at Carl.

"Just stay where you are and keep your mouth shut, buddy, and you won't get hurt. My friend, Chauncey, and I just want to pick up something we left here a while back. When we get it, we'll go our way and you can go yours."

"Go on and pull up that grease bucket, Bert." Jerry heard another voice say. "I'll keep the gun on him. I can't wait to get my hands into that lovely green grease. You know, I'll bet that tricky sheriff was hiding out, waiting on us. Man, he was really flying low when we met him on the highway. That phony tip of yours was a real smart idea."

Very quietly Jerry eased himself up on the rock ledge. Then, after a short search, he picked up a piece of broken broom handle floating near his feet and twisted it in the piano wire so that a couple of turns went around it. A few seconds later he felt the man above fumbling and tugging at the wire.

"Come here and help me, Chauncey. The wire must be tangled in the leaves or something, and the footing ain't very good on this slope. I sure don't want to drop the end of the wire. That kid can't go anywhere with us watching him. Take hold of that side of the stick and help me pull."

A stronger tug came on the wire, and Jerry slowly rose to his feet, giving slack. Then, grasping the piece of broom handle with both hands, he leaped from the ledge throwing his full weight onto the wire. The result was startling. Two bodies came hurtling down from above and hit the water with great splashes. A third smaller splash was made by the revolver.

When Jerry surfaced, he saw Carl leaping up the steep path as if he were a mountain goat. Listening to the men behind him spluttering and cursing as they clawed their way up on the ledge, Jerry decided Carl had a good idea; he swam quickly to the foot of the path and climbed out of the water.

The two men were starting toward him along the ledge, and he didn't even take time to remove his air tanks or swimming fins as he started a clumsy ascent up the path. Carl said afterward, that, as he watched Jerry frantically slipping and floundering on the path, all he could think of was a circus seal climbing up a stepladder to get a fish.

When the two men started to follow Jerry, Carl pelted them with stones. Jerry struggled out of the diving equipment and joined the fight at the top of the path. Using only jagged chunks of rock for weapons, the two of them easily held the men at bay until the sheriff came back a half hour later.

After the boys had explained the situation and the law officer had Chauncey and Bert safely handcuffed to the steering wheel of his car, Jerry dove down and brought up both the revolver and the end of the piano wire. The grease bucket was hauled to the surface and opened. Inside, lying on sand used for ballast, were several neat packages of currency.

"Every dollar is here," the sheriff announced when he finished counting it. "All the time those police divers were
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August, 1963
Menu Quiz Answers
(Quiz on page 57)

1 - J SPAGHETTI is the slip-on sleeve used to insulate bare wiring.

2 - C A HAM is a radio operator who has been granted an FCC amateur radio license and call letters.

3 - G The part of a fuse that melts when the rated current is exceeded is the LINK.

4 - A The ACORN is a type of vacuum tube for UHF applications, which has no base, and has its pins brought out through the sides of the glass envelope.

5 - H To PRUNE a coil means to adjust the spacing between turns or to remove turns to alter its inductance.

6 - F A BANANA plug has a segmented springy metal prong that maintains a low-resistance contact in the mating socket.

7 - I A HONEYcomb coil has a pattern in which the position of adjacent turns is continuously shifted to minimize distributed capacitance.

8 - D The PI Ecrust effect is a kind of TV picture distortion due to a hunting action in the horizontal automatic frequency control circuit.

9 - B A CONE is the conical paper diaphragm in a loudspeaker.

10 - E Rochelle SALT crystals having the chemical name sodium potassium tartrate are used in phonograph cartridges.
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HEATH COMPANY
Benton Harbor 10, Michigan

August, 1963
THE TUBE FAMILY TREE

(Continued from page 56)

wave tubes (or, simply TWT's) may be used both as amplifiers and oscillators. Like the magnetron, these tubes depend on the interaction between moving electrons and a magnetic field, and, like the klystron, they employ the principle of velocity-modulation.

The traveling-wave magnetron is one type. Consider the multi-cavity magnetron in the drawing on page 55. Suppose the circular anode were split at one point and "straightened out." The result would be a multi-cavity anode similar to the tube shown on this page (top). To this we add a plane electrode to serve as a cathode plate, an electron gun, and a collector, plus a focusing magnetic field (not shown) to keep the electron stream projected by the gun from actually touching either the anode or cathode. The anode and plane cathode form a wave guide. If an r.f. signal is introduced at one end, it will travel to the other end. Now, if the velocity of the electron stream is adjusted to match the phase velocity (speed at which a constant phase progresses) of the electromagnetic wave moving down the tuned wave guide, the electron stream will be velocity-modulated and will transfer some of its energy to the traveling wave. The result, then, is that the output wave collected at the far end is stronger than the input signal, thus fulfilling the basic condition for amplification.

A different type of TWT consists of an electron gun, a wire helix, and a collector. A tube connects the input and output wave guides at each end of the helix. In operation, a stream of electrons is sent down the axis of the helix and the input signal is fed in. The helix, acting as a coiled transmission line, transmits the input signal to its far end at an axial velocity determined by the ratio of the pitch to the circumference of the helix. If the electron stream velocity matches the traveling wave's axial velocity, there is an interaction between the wave and electrons, transferring energy from the electron stream to the wave and thus amplifying it. Since the currents induced in the helix are displacement currents, the electron stream need not actually touch the helix and hence a strong magnetic field is generally used to focus the electron stream and to keep it from diverging over its relatively long path.

The backward-wave oscillator tube (or BWO) operates on general principles similar to those employed in conventional TWT's except that the traveling wave moves in a direction opposite to that of the electron stream (hence the name). In one sense, the tube serves to supply its own "input" signal. Sometimes, a strong transverse magnetic field is used to bend the electron stream in a
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August, 1963

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PE 83
atomic particles. The gas ionization of the two electrodes. If an ionizing particle enters, the tube delivers another pulse. These pulses can be amplified and used to drive a loudspeaker or headphones, or, if preferred, fed to an electronic counting circuit. The number of pulses in a given period of time (that is, the pulse rate) is proportional to the number of radioactive particles or rays which enter the tube, and hence to the intensity of the radioactivity measured.

There are a variety of indicator tubes, with the simple neon bulb being a prime example. Another type is the Nixie tube. A cold-cathode gas-filled type, this tube is equipped with a number of cathodes, each shaped to represent a numeral from 0 to 9. When an ionizing voltage is applied between one of the cathodes and the common plate, that cathode glows, rendering the numeral visible. Nixies are used as read-out devices in computers and counters.

The famous tuning-eye tube is another type of indicator tube. In its basic form, it consists of a cathode, control electrode, and fluorescent screen to which a positive voltage is applied. The electrons leaving the cathode are attracted to the fluorescent target, causing it to glow. When a negative voltage is applied to the control electrode, it repels these electrons, leaving a "shadow" on the target, with the shadow area proportional to the amplitude of the applied d.c. voltage. Sometimes, a tuning-eye type indicator tube and triode are combined in one envelope.

Used in computers, counters and similar equipment, the beam-switching tube is made up of a cathode, beam forming and holding spades, shield grids, switching grids, output (target) electrodes, and rod-type permanent magnets. In operation, the electrons emitted by the cathode are formed into a narrow beam
by a combination of magnetic and electrostatic fields. This beam is held in a fixed position by the potentials applied to the various electrodes, but can be switched from one target electrode to another, in rotation, by applying suitable voltages to the switching grids.

Other special-purpose tubes include ionization and thermocouple-type vac-

uum-gauge tubes; tubes in which one of the control elements is mechanically linked to an external pressure button so that the tube can be used as a mechano-electronic transducer; types with built-in fixed resistors used as ballast tubes; special T-R (transmit-receive) tubes to prevent the application of transmitter power to a receiver when both units share the same antenna system; and many, many other kinds.

The Future. Electron tube manufacturers are constantly seeking ways to improve their tubes and to develop new types to meet the needs of equipment designers and manufacturers. Great efforts are being expended in the development of UHF and microwave tubes. Several firms are working on tubes requiring low operating voltages which will be competitive with the transistor. One firm has developed a tube without a filament—it's designed to be used in an environment so hot that the cathode requires no additional heating. And an envelope-less tube has been developed for use in the vacuum of outer space.

How will the tube "family tree" branch out in the future? Even an educated guess is likely to be wrong. Only two things are certain: There will be many new types of tubes introduced in the next several years, and the "tree" will keep right on growing.

or other rotating member that can be reached with the pickup. The magnet need not be large—a more sensitive meter can be used if the signal is low. Care should be taken to anchor the magnet firmly as near as practical to the axis of rotation, since the centrifugal force developed at high speed could cause the magnet to break loose with consequent damage. Any clamps used to hold the magnet or pickup should be made from nonmagnetic aluminum.

Calibration. If you're interested in actual rpm rather than relative speed, calibration can be accomplished with an oscilloscope and audio generator hooked up as indicated on page 61. With the motor running at low speed, adjust the frequency of the audio generator until a single trace appears on the oscilloscope screen. Read the generator frequency and multiply by 60 to convert to rpm.

Increase engine speed and repeat for several readings: plotting the results should give you a "scatter" of points that fall on both sides of a straight line. The graph thus plotted may be used to convert any meter reading to rpm, or a new meter scale may be made to overlay the existing scale.

Code Practice Oscillator. Oscillation requires positive feedback. By placing the pickup in the inductive field of its own amplifier, oscillation will result and can clearly be heard through the speaker. By putting a key in series with the pickup, dots and dashes can be made. Here again, the transistor amplifier with its relatively low impedance requirement does a better job than a typical radio audio amplifier. It may be necessary to couple to the back of the speaker for better sensitivity. Also, changing the position of the pickup will very often change the pitch of the oscillation.

A pickup can also be used as a hum-finder. Simply connect it to a high-gain amplifier and use it to trace a.c.-carrying circuits.

There are, no doubt, many other practical applications for this simple inductive coil, and the price is low!
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CINCINNATI 17, OHIO

Across the Ham Bands
(Continued from page 95)

connection to plug P1. Solder one conductor to the common crystal socket terminals, and connect the other conductor to the terminal for the switch rotor. Make the lead long enough to permit you to insert plug P1 into the transmitter crystal socket when the unit is conveniently placed near the transmitter. Don't make the lead excessively long, however. Although length is not critical, too long a lead might make the transmitter operate erratically.

Operation. Transmitter operation should remain essentially the same except for the added convenience of crystal switching. In addition, if you tune the transmitter to a frequency near the center of the 80-, 40-, or 15-meter Novice bands, it probably won't be necessary to retune the buffer and final stages of the transmitter to operate on any other frequency within that Novice band. However, for best keying with some crystals, you may wish to touch up the oscillator tuning.

Warning. The distributed capacitances, etc., of the crystal switch may change the actual oscillating frequency of some crystals as much as 100 cycles or so from their marked values. This possibility is of no importance for normal Novice operation, but it is illegal for a CB operator to make any changes that will affect the output frequency. Therefore, the switch is not suitable for CB use.

News and Views

Roger B. Hallen, WN6BOW/WB6BOW, 7738 Day St., Tujunga, Calif., has his radio shack located in a guest house in the back yard—most convenient for cutting down on XYL interference. Rog works 80 meters with a Knight-Kit T-60 transmitter, R-55 receiver, and a Gotham vertical antenna; he has a total of 12 states. Rog also works 6-meter phone with his Technician license, but didn't mention his equipment . . . Ray Thornton, RFD #2, Lisbon, Conn., started his radio career as WPE1CYR, advanced to KN1YFF, and is now K1YFF. As a Novice, Ray racked up 34 confirmed states using an EICO 723 transmitter and Lafayette KT-320 receiver. As a General, he works phone and c.w. on 80 through 10 meters with the same equipment, plus the modulator described in "Across the Ham Bands" some time ago. His states total.

Always say you saw it in—POPULAR ELECTRONICS
is up to 40; he has also worked England, Puerto Rico, and Canada . . . Gary Boyles, WN4MCY, 331 Lindsey St., Fayette, Alabama, runs 15 watts to an AMECO AC-1 transmitter feeding a three-band doublet antenna 30' high; he receives with a Hallicrafters S-38. Gary worked five states his first week on the air.

Marvin Born, WA8CKN, Reedsville, W. Va., worked 25 states as a Novice on 80 meters using a 75-watt, home-built transmitter to feed an inverted-V antenna. A Hammarlund HQ-145X receiver did the rest. Marv now works SSB with a Johnson Invader-200 . . . Tom Hall, WAOYYQ, 2020 Yosemite St., Seaside, Calif., celebrated the arrival of his hard-earned Conditional license by writing us a letter. Tom feeds a dipole antenna with a Knight-Kit T-60 transmitter and receives on a Knight-Kit R-55 receiver. This equipment, plus several of the items described in our construction projects, has given him 32 states, Canada, and Japan.

Keith Moe, KN7VRS, 2038 W. Monte Vista, Phoenix 9, Ariz., has a word of warning to prospective hams. Don't do as he did and neglect your code practice after passing your examination and while waiting for your license to come. As a result, Keith had to relearn the code before he could get on the air and work anyone. But now his Heathkit DX-60 transmitter, Heathkit GR-91 receiver, and the shortened vertical antenna, described in the October, 1962 column, keep him on 80 meters almost every night, where he likes to ragchew rather than chase DX . . . S. Sgt. Frank W. Lewis, Co. B, 10th Special Svc. Group, APO 108, New York, N. Y., is K1QFA when he is home in Springfield, Mass., but for the past three years he has been DL4HN stationed in Germany. His receiver is a German "lightweight," the Blaupunkt FE-52, which totals up to a mere 350 pounds! His transmitter is a homemade SSB 50-watter for 80 and 20 meters built mostly from scrounged parts; it feeds a 300' end-fed antenna, which puts a strong signal into the States. He has also worked all continents. . . . Harold King, WN4JOB, 288 Rockyford Rd., N.E., Atlanta 17, Ga., has two horizontal 40-meter dipoles and a vertical on his antenna farm. He drives them with an EICO-723 transmitter and receives on a Hallicrafters

Keith Moe, KN7VRS, has something valuable to say to would-be amateurs in text at left.

SX-99 aided with a Heathkit Q-Multiplier. Twenty-seven states (25 confirmed) and Canada are listed in Hal's log; he QSL's 100 percent and averages an 80 percent return. Hal pays for his equipment with the proceeds of his paper route.

Richard Alter, WN2REE/WPE2KCO, 178 Main St., Fort Plain, N.Y., runs 50 watts input to a Heathkit DX-20 transmitter to feed an 80-meter dipole antenna 55' high. Rich uses a Hammarlund HQ-129X receiver for ham work and SWL's with a Heathkit AR-3. Besides having 20 states confirmed out of 20 worked, Rich lists a 10-wpm code certificate, being the net control station for a net, and working a YL in Delaware on his "brag" list . . . Terry Hackworth, WNOODOR, 115 West Rogers St., Clinton, Mo., figures he wasted four months of his Novice time; he ordered a certain transmitter, and, after waiting four months for delivery, he canceled the order and got a WRL SB-175. With it, an RME-4300 receiver, and a Hornet vertical antenna, Terry has worked 34 states and several Canadians, mostly on 40 meters, his favorite band.

Will we soon see your "News and Views" or picture in this space? The first step is up to you, you know. Send your letters, etc., to Herb S. Brier, W9EGQ. Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Indiana, 73,
HAND-HELD TRANSCEIVERS  (Continued from page 92)

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>MODEL</th>
<th>TYPE</th>
<th>WEIGHT</th>
<th>PRICE</th>
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<tbody>
<tr>
<td>Heath Co.  Benton Harbor, Mich.</td>
<td>GW-21</td>
<td>Superhet</td>
<td>32 oz.</td>
<td>$44.95 kit</td>
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<td></td>
<td>GW-31</td>
<td>Superhet</td>
<td>32 oz.</td>
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<td>$19.95 kit</td>
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<td></td>
<td></td>
<td>$29.95 wired</td>
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<tr>
<td>International Crystal</td>
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<tr>
<td>18 North Lee  Oklahoma City, Okla.</td>
<td></td>
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<tr>
<td>This is a special unit described in POPULAR ELECTRONICS, JULY, 1963, Page 70.</td>
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<tr>
<td>Keltner Electronics</td>
<td>HT-2</td>
<td>Superregen</td>
<td>12 oz.</td>
<td>$59.95 list</td>
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<tr>
<td>1045 W. Hampden Englewood, Calif.</td>
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<tr>
<td>Lafayette Electronics Corp.</td>
<td>HA-60</td>
<td>Superhet</td>
<td>20 oz.</td>
<td>$33.95</td>
</tr>
<tr>
<td>111 Jericho Turnpike, Syosset, L.I., N.Y.</td>
<td>HE-82</td>
<td>Superhet</td>
<td>12 oz.</td>
<td>$19.95</td>
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<td></td>
<td>HE-100</td>
<td>Superhet</td>
<td>21 oz.</td>
<td>$39.95</td>
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<tr>
<td>Monarch Electronics, Inc.</td>
<td>TC-900B</td>
<td>Superhet</td>
<td>14 oz.</td>
<td>$39.95</td>
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<td>North Hollywood, Calif.</td>
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<tr>
<td>Radio Shack Corp.</td>
<td>TRC-2</td>
<td>Superhet</td>
<td>32 oz.</td>
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<td>730 Commonwealth Ave.</td>
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<tr>
<td>Boston 17, Mass.</td>
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<tr>
<td>R. C. A. Electron Tube Div.</td>
<td>Personal-Com 300</td>
<td>Superhet</td>
<td>16 oz.</td>
<td>$99.50 list</td>
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<td>Harrison, N. J.</td>
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<tr>
<td>The Sampson Company</td>
<td>Fonet 101</td>
<td>Superhet</td>
<td>19 oz.</td>
<td>$63.50 per pair</td>
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<tr>
<td>Communications Equip. Div.</td>
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<tr>
<td>Chicago 8, Ill.</td>
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<tr>
<td>Sony Corp. of America</td>
<td>Sony 9</td>
<td>Superhet</td>
<td>16 oz.</td>
<td>$149.95 list per pair</td>
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<tr>
<td>580 Fifth Ave.</td>
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<tr>
<td>New York 36, N.Y.</td>
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<tr>
<td>Standard Radio Corp.</td>
<td>SR-Q10X</td>
<td>Superhet</td>
<td>28 oz.</td>
<td>$149.95 per pair</td>
</tr>
<tr>
<td>350 Broadway</td>
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<tr>
<td>New York 13, N.Y.</td>
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</tr>
<tr>
<td>Vanguard Electronic Labs.</td>
<td>Mark I</td>
<td>Superregen</td>
<td>48 oz.</td>
<td>$59.98 net</td>
</tr>
<tr>
<td>190-48 99th Ave.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hollis 23, N.Y.</td>
<td>Mark II</td>
<td>Superhet</td>
<td>52 oz.</td>
<td>$79.98 net</td>
</tr>
</tbody>
</table>

ALL TAPE HEADS WEAR OUT! HERE'S HOW AND WHY!

Magnetic tape itself is the real cause of head wear—its abrasive action as it passes over the head face gradually wears away the depth of metal (see at right). Wear is nearly always uneven with craters or ripples forming on the face making it impossible to achieve good contact between the head gap and signal recorded on the tape! Severe high frequency losses and erratic output result from such poor tape-to-gap contact—the outstanding fidelity of tape reproduction is lost!

Head wear should not be permitted to reach this point—much less go beyond it to the limit where the gap actually begins to open up.

Examine your heads for wear or have your Hi Fi dealer, Radio/TV serviceman or camera store check them. Insist on Nortronics replacement heads and "Quik-Kit" mounting hardware; both correctly matched to your recorder.

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Fiber Optics
(Continued from page 44)

be used to get a reasonably large image on the screen. The Lafayette Radio zoom lens described previously is ideal since it allows adjustment of the size of the projected image.

How you mount the projection lens in its Masonite panel will depend on its dimensions, but the mounting used should both support it firmly and allow for easy focus adjustment. Enlarge the ¼” hole in the panel as necessary.

In the author's unit, the Lafayette lens was mounted in a 1” plastic-to-standard pipe adapter. The inside of the adapter was filed out slightly to accept the barrel of the lens.

When the lens is mounted, set the focus adjustment in the center, and position the assembled panel between the end of the fiber optic element and the viewing screen. Move the panel back and forth for optimum focus of the projected image and mount it in the best position.

Making a Bent Element. Although this basic unit (which uses a straight 6” fiber optic element) gives a dramatic demonstration of the principles of fiber optics, an even more startling show can be put on by replacing the straight element with a formed one like that in the photo on page 44.

To keep its end-to-end length the same as that of a 6” element, a 12” element is bent at four points to form a square 1½” on a side. By keeping the ends aligned, the formed 12” element can be substituted directly for the 6” element.

Mark points on the 12” rod for bending with a pencil, and very carefully heat it at these points, and carefully make the required 90-degree bends. Heat the rod only as much as is absolutely necessary to avoid complete fusing of the fiber bundle.

The project described here is relatively simple, and many variations are possible. Whether you are a serious experimenter, a science fair entrant, or just a tinkerer, you’ll find these fiber optic elements fascinating to work with.
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Transistor Topics
(Continued from page 98)

a small plastic, metal, or wooden case. Neither lead dress nor layout are critical, but good wiring practice should be followed with all signal leads kept short and direct. As is common with direct-coupled circuits, transistor leakage is important, and it may be necessary to experimentally select transistors for optimum performance.

Transitips. Push-pull amplifiers are extremely popular for audio output applications. Although simple and efficient, they can still present problems, even to experienced hobbyists.

A typical push-pull circuit is illustrated in Fig. 4. The stage is driven by $T_1$. Base bias for the push-pull transistors, $Q_1-Q_2$, is supplied by voltage divider $R_1-R_2$, with the stage matched to its load (typically, a loudspeaker) by output transformer $T_2$. Capacitor $C_1$, an optional component, is used as a high frequency bypass and thus serves to reduce the effects of harmonic distortion.

Perhaps the most critical single factor in push-pull amplifier performance is the class of operation. Three principal classes are used: Class A, where a moderate bias is applied and the entire input signal is amplified by both transistors; Class AB, where a small bias is used, and where slightly more than half the applied signal is amplified by each transistor (one handles positive half-cycles, the other negative half-cycles); and, finally, Class B, where cut-off bias is used and where each transistor responds to only half the input signal.

Fig. 4. Typical push-pull amplifier stage.
Of these, Class A delivers the "cleanest" signal (least distortion) but is the least efficient and most easily overloaded. Class B is the most efficient, can deliver greater power output, but tends to introduce more distortion. Class B is also the most critical as far as transistor characteristics are concerned. Class AB operation has performance characteristics falling between those of Class A and Class B and, in general, is the most popular class.

When the stage is operated Class A, R1 and R2 are chosen to deliver a moderate base bias. Since both transistors amplify the entire signal, they need not be matched closely, and either will deliver a fairly "clean" output even if the other transistor opens—although at reduced power. The stage has a fairly low input impedance.

With either Class AB or Class B operation, the stage has a much higher input impedance, and T1 must be chosen accordingly to provide a proper match. Resistors R1 and R2 are chosen to deliver a small (or zero) bias. And, for best performance, the two transistors must be matched as far as both leakage and gain are concerned. If either transistor fails, the output signal will become weak and distorted.

If, for one reason or another, it is impossible to obtain matched pairs for use in Class AB or B stages, several alternate techniques may be employed. The most common is to connect small resistors in series with each emitter lead. These may range in value from a fraction of an ohm for power transistors to 100 ohms or more for small-signal types. The best values to use in a particular case can be determined experimentally.

Inverse feedback will help improve the performance of a Class AB or B stage in many cases. This can be introduced by using a resistor and coupling capacitor in series between T2's secondary and T1's primary or by changing the bias method, removing R2 and using resistors between each transistor's collector and base electrodes—but don't cross-couple. Again, determine the best values to use by experimenting.

If trouble is encountered with a push-pull stage, first check base bias (as well
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Two new products: Astro-Dynamics' Model 27C4 heat sink (top), and Motorola's low-cost silicon controlled rectifier, both of which are discussed in text.

as collector voltage). Then make sure that the two transistors are matched with respect to gain and leakage. Finally, check the remaining components: C1, T1 and T2.

Product News. Our news this month is concerned primarily with new components and semiconductor devices. Here's a quick review.

- Astro Dynamics, Inc. (Second Ave., Northwest Industrial Park, Burlington, Mass.) has introduced a new printed circuit board transistor heat sink. Identified as Model 2704, the unit will accommodate both TO-5 and TO-9 cases.
- General Electric (West Genesee St., Auburn, N.Y.) is now producing a series of 300-ampere silicon controlled rectifiers. Known as the 6RW71 series, the new units are available with peak reverse ratings from 50 to 400 volts.
- Motorola, Inc. (5005 East McDowell Rd., Phoenix 8, Ariz.) has introduced a series of low-cost SCR's intended for consumer applications; type numbers range from MCR 808-1 to MCR 808-6, depending on voltage ratings. Also from Motorola comes news of a new power transistor specifically designed for use in low-voltage, high-current power converters: type number 2N2728.
- Siliconix, Inc. (1140 West Evelyn Ave., Sunnyvale, Calif.) has developed a line of unipolar field-effect transistors suitable for 3- to 6-volt battery operation (in contrast to earlier units, which required relatively high voltages). Types numbers range from U-106 to U-109. All are P-channel planar diffused types.

That closes the book for now, fellows—back next month.

—Lou

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Current Station Reports

The following is a résumé of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 254, Haddonfield, N.J., in time to reach your Short-Wave Editor by the eighth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Algeria—According to a verification letter, the current schedule of the Radio-Tele Algérienne is as follows: 0130-0430, 0630-0930, and 1230-1600 on 9685 and 11,835 kc., and 0130-0400, 0700-1000, and 1300-1600 on 6160 kc.

Angola—Stations noted in Brazil: CR6RD, R. Clube do Huambo, Nova Lisboa, 5060 kc., at 1615-1632 s/off; CR6RI, R. Diamang, Dundo, 9612 kc., at 1401-1431 closing with nonstop music; CR6RN, R. Clube do Angola, Luanda, 4869 kc., at 1640-1702 s/off; and CR6RV, R. Clube do Marico, Luco, 5137 kc., at 1500-1604 s/off and from 0029 s/on. Portuguese is noted on all stations.

Australia—Melbourne has made some changes: 11,740 kc. replaces 11,835 kc. for transmissions to Indonesia at 0430-0600 and for the Chinese program that follows; Eng. to Africa at 1200-1400 has moved up to 9600 kc. The dual 11,855 kc. outlet remains as is. Eng. to S. E. Asia on 11,880 kc. has been extended one hour and now is heard at 0330-0900. Other xmsns noted: to N.A. at 0714-0815 on 9580 kc. and 1955-2300 on 17,840 and 15,220 kc.

Austria—Vienna has an xmsn to Japan on Mondays, Wednesdays and Fridays only at 0700-0730 on 15,155 kc. The N.A. xmsn is aired at 1700-2300 on 6155 kc. and 1900-2100 on 9770 kc., the S. A. xmsn at 1800-2100 on 11,785 kc.

Bolivia—CP75, La Cruz del Sur, La Paz, 4985 kc., reportedly has an Eng. xmsn daily at 2130 parallel to CP99, 11,765 kc.

R. Nacional Lab, Cochabamba, 5025 kc., has been testing in Spanish around 2100 with closing at 2120 or later. CP38, R. Altiplano, La Paz, 9505 kc., opened last March and can be heard at times around 2000 when R. Record is off.

Brazil—PRL7, R. Nacional, Rio de Janeiro, 9720 kc., has been tuned at 0215-0330 with continuous music. The normal s/on time is 0250; whether this earlier xmsn is a s/on schedule change or a test xmsn is not yet known.

Cambodia—According to R. Australia, R. Phnom-Penh operates at 1800-2100 and 2300-0300 on 3241 kc. (1 kw.) and 1900-1915 on 4907 kc.

Canada—CKFX, Vancouver, 6080 kc., with only ten watts is noted in Alaska from 0300-
If you send a weak to fair signal and recorded music and commercials.

Ceylon—The Commercial Service of R. Ceylon, Colombo, can be heard on 9560 kc. from 0740 to past 0930 in all Eng. A London news relay is given at 0800; otherwise mostly pop music.

China—Here is a listing of Chinese native language stations: Amoy, 4835 kc. (5 kw.), Canton, 2380, 3205, and 5050 kc. (all 50 kw.), Changsha, 2420 kc. (5 kw.), Chungking, 2330 kc. (10 kw.) and 3250 kc. (5 kw.), Foochow, 3375 kc. (1 kw.), Kiangshan, 3315 kc. (5 kw.), Kunming, 2390, 3232, and 4770 kc. (all 20 kw.), Kweiyang, 3385 kc. (5 kw.), Nanchang, 2460 kc. (1 kw.), Nanning, 5030 kc. (20 kw.), Si-chang, 2480 kc. (1 kw.), and Yungning, 2310 and 3268 kc. (both 20 kw.). Possible new channels for Peking include 5320 kc. noted in Eng. to 0730, and 5265 kc. (dual to 7480 kc.) with Eng. news at 0700-0721.

Dahomey—A recent verification lists this schedule for R. Cotonou: Monday to Friday at 0015-0145, 0615-0730 (Thursdays to 0800) and 1200-1700; Saturdays 0015-0145 and 0700-1800; Sundays 0200-1700; all on 4870 kc.

Ecuador—HCJB, Quito, is on air after a recent storm in which lightning reportedly destroyed its antennas.

England—The first commercial station in England, R. Mann, has been granted a license to operate on either 980 or 1180 kc. Operations may already have commenced.

Ethiopia—Addis Ababa has been noted on two new channels: 11,765 kc. at 1510-1520 with Eng. news; to 1530 with native music; to 1540 with pop music and French announcements; to 1550 s/off with French news; and on 15,228 kc. with apparently the same programming. The latter is a move from 15,240 kc.

Federation of Rhodesia and Nyasaland—The Gwelo station is scheduled as follows: 2425 kc. (2.5 kw.) in Commercial and General Service Monday thru Friday at 1120-1605 (Saturdays to 1700, Sundays to 1515); 3396 kc. (20 kw.) Monday through Fridays at 2255-0045 and 1000-1605 (Saturdays to 1700, Sundays 0900-1515; on 6020 kc. (20 kw.) Monday through Friday at 0045-0700 (Saturdays to 1000). Sundays 0055-0700 (to 0900 on the first Sunday of each month); 9506 kc. (2.5 kw.) Monday through Friday at 0045-0700 and 1000-1115, Saturdays 0045-1115. Sundays 0055-0700 and 0900-1115 (0055-1115 on the first Sunday of each month); 3306 kc. (10 kw.) with the African "C" program Monday through Saturday at 2300-0110 and 1035-1500 (Sundays 1035-1500 only); and on 5975 kc. (10 kw.) Monday through Saturday at 0500-1030 (Sundays 0557-1030). The Zomba station is listed for 3865 kc. (10 kw.) for the African "D" program broadcast to Nyasaland daily at 0900-1500.

Formosa—Voice of Free China, New Park, Taipei, has Eng. daily at 0510-0555; Japanese from 0555; Eng. again noted 0720-0800 on 11,860, 9720, 7130, and 6095 kc.

Germany (East)—R. Berlin International has Eng. to Africa daily at 0730-0800 with a mailbag on Sunday; on 11,785 kc. at 0430-0450 in Eng. to Africa; on 6060 and 9730 kc. from 1700-1745 in Eng.; on 9560 kc. at 2030 and 2100 in Eng.; and to N.A. at 2000-2100 in Eng. on 6080 kc.

Always say you saw it in—POPULAR ELECTRONICS
SHORT-WAVE ABBREVIATIONS

Announced
Eng.-English
ID-Identification
kc.-Kilocycles
kw.-Kilowatts
N.A.-North America
R.-Radio
S.A.-South America
S/off-Sign-off
S/on-Sign-on
VOA-Voice of America
xmsn-Transmission

Germany (West)—Deutsche Welle has a new xmsn to Indonesia daily at 0745-0825 on 17,815 and 15,405 kc.

Greece—We have just received this schedule from one of the men aboard the U.S. Coast Guard Cutter Courier; the VOA station located at Rhodes: 0100-0230 on 6185 and 7130 kc., 0900-0930 on 9530 and 7130 kc., 1100-1130 and 1600-1745 on 6015 and 7130 kc. The “Amateur Notebook” program is aired Sundays only at 1730-1745.

Honduras—Radio 1 de Mayq, Tela, a new station, has been found on 4790 kc. at 1920 with news. R. Jucutud, Tela, was noted in the 11-megacycle band (frequency not otherwise given) with tests at 2020-2028. Apparently a low-powered xmr, it quickly faded out. This one has a dual outlet on 4995 kc., rated at 500 watts. Further details requested.

Hong Kong—ZEN41, Cable and Wireless, Ltd., will verify correct reports by letter for their 9244 kc. outlet.

Italy—Rome has an Italian xmsn beamed to the Near East and Africa at 0735-0755 on 17,800 kc. Eng. xmsns, mostly unchanged, remain as follows: to N.A. at 1930-1950 and to United Kingdom and Ireland at 1420-1440, both on 9575 and 5960 kc.

Korea (North)—R. Pionyemyg is scheduled to broadcast to the Near East at 1500-1600 on 7225 and 9752 kc., to Europe at 2200-2300 on 15,240 and 9725 kc., and to S.E. Asia at 0700-0900 on 9752 and 5044 kc. The latter xmsn (0700-0800, at least) is in Eng. and heard well on the West Coast on 5044 kc.

Luxembourg—The Station of the Sports. R. Luxembourg, is noted from 1645-1730 with pop music, ads, and ID’s each 15 minutes on 6090 kc.

Malaysia—Kuala Lumpur, 7142 kc., s/on in Malayan at 1830 with ID and a world news bulletin, Eng. is given from 1930.

Morocco—Rabat has been found on 15,408 kc. from 1540-1556 with Eng. ID and music.

Nepal—R. Nepal, Kathmandu, broadcasts in the Home Service three xmsns in Hindi and Gorkhali on 4800 kc. at 2120-2320 0220-0420, and 0820-1020. There is an Eng. newscast at 2200.

Netherlands—The current schedule from R. Nederland, Hilversum, to N.A. in Eng. reads: 1030-1045 on 15,445 and 11,950 kc. (Tuesdays and Fridays only), 1415-1430 on 17,810 and 15,445 kc. (Tuesdays and Fridays only), 1625-1720 on 15,445 and 9715 kc. (excluding Sundays), and 2025-2120 on 9590 and 5985 kc. (excluding Sundays). R. Nederland recently used the article “Look How They’re Packaging Power” which appeared in the Dec., 1962 POPtronics.

New Guinea—VLT9, Port Moresby, operates on 9520 kc. at 1815-0245; VLT6, 6180 kc., is noted from 0315-0415 with ship and weather
reports, time checks, sports, and, at 0400, a London news relay. This is all in Eng.

**Norway**—R. Norway, Oslo, has a new xmn on N.A. and the Caribbean area at 1000-1130 on 15,175, 11,850 and 9610 kc. The remainder of the summer schedule reads thusly: 0100-0135 (replacing 0045-0050) to Europe, Africa, and Middle East on 17,855, 15,175, 11,850, and 6130 kc.; 0525-0535 weekdays to North and South Atlantic on 17,825, 15,175, 11,850, and 9610 kc.; 0600-0730 to Far East; N.Z., E. Australia, and Europe, 0800-0930 to India, Indonesia, W. Australia, and Europe, both on 16,750, 17,855, 15,175, 11,850, and 6130 kc.; at 1800-1930 to S. A., Middle and S. Atlantic on 15,175, 11,850, and 6130 kc.; 2000-2130 to N.A., North Atlantic, and 2300-0030 to N.A. (West Coast), Pacific areas, and E. Africa, both on 11,850, 6130 kc. and 1300-1430 to Middle and S. Atlantic, and Europe, both on 17,855, 15,175, 11,850, and 6130 kc.; at 1800-1930 to S. A., Middle and S. Atlantic on 15,175, 11,850, and 6130 kc.; 2000-2130 to N.A., North Atlantic, and 2300-0030 to N.A. (West Coast), Pacific areas, and E. Africa, both on 11,850, 6130 kc.

**Spain**—Madrid is well heard on 9360 kc. at 2215-2300 to Atlantic Coast, 2315-0000 to Pacific Coast, and 0015-0100 in General service. A Spanish xmn to the Canary Islands is noted at 1525-1550 on 9370 kc.

**Sweden**—Stockholm’s summer schedule includes these changes: to the Far East at 0730-0845 on 9620 kc. (replacing 11,850 kc.), and 17,855 kc. to Europe in French at 1530-1600, Spanish, French, and Portuguese at 1715-1845 on 5990 kc. (replacing 6095 kc.); at 1715 the Americas at 2000-2115, 2130-2245, and 2300-2330 on 11,805 kc. (replacing 7270 kc.).

**Turkey**—DX’ers needing this country should try for VSI on 4560 kc. They operate daily (excluding Sunday) at 1600 with local news, shipping and weather information. Reports are welcomed and should be sent to British Cable & Wireless Co., Ltd., Grand Turk.

**U.S.A.**—The RCA point to point telephone station at Kahu Point, Hawaii, specifically states that they are not interested in reception reports and will not verify. This one is noted afternoons on approximately 16,050 kc.

**USSR**—Here is a list of definitely identified Siberian stations: Khabarovsk on 9750, 9377, 7210, 6195, and 4090 kc. The 4010 kc. channel seems to be inactive. Magadan is on 9500, 5940, and 4995 kc. Vladivostok is on 5015 kc. Blagoveschensk is on 6005, 6115, and 4050 kc. Moscow (Via Komsomolsk) is on 6020 and 6050 kc. Relays from Khabarovsk, Blagoveschensk, and Magadan are heard mostly between 0300 and 0700. Ulan Bator, 5067 kc., is noted with native music to 0815; from 0815 to 0855 with a Moscow relay dual to 5960 kc. Kiev reports a change in their Eng. to N.A. with the schedule now reading Monday, Thursday, and Saturday at 2150 on 9650, 9710, 11,790, and 11,960 kc., and 0450 on 9710, 11,790, and 11,960 kc. Alma Ata, 10,530 kc., can be heard at 1930-2030 in Russian and Kazakh.

**Vatican City**—The Vatican’s N.A. xmn at 1950-2010 on 9645 and 7250 kc. is also reported as being on 8450 kc., although this is unconfirmed. The 9645 kc. outlet, according to a late report, has moved up to 9675 kc. The Eng. xmn to Australia and N.Z. can be well heard at 1700-1718 on 11,740 and 9645 kc., on Mondays, Wednesdays, and Fridays only.

**Yemen**—R. Sana is operating on 15,725 kc. (15,560 kc. had disappeared) at 2300-0100, 0600-1000, and 1100-1530. The power seems to be in the 100 kw. range. Noted on 15,720 kc. at 11,700, 755 kc. dual to 5955 kc. at 1100; and 15,780 kc. at 1310 in Arabic to 1602 s/off.

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Radio Australia, Melbourne, Australia
Swedish Calling DX’ers Bulletin, Stockholm, Sweden
Radio Marathon
(Continued from page 59)

operating in the standard broadcast band which would be located at a suitable site in Southern Florida and equipped with a highly directional antenna array. Once the necessary formalities had been completed and a suitable site located, the brand-new portable "Voice" transmitter, operating on a frequency of 1180 kc., was placed on the air in the record-breaking time of 12 days.

The portable VOA Marathon relay station consists of a Gates Radio 50,000-watt transmitter suitably modified for portable operation and built into air-conditioned trailers. Power is obtained from a temporary power line, with two 250-kilowatt stand-by generators at hand. A three-element vertical directional antenna array fed by an open wire coaxial line beams the signal at the "Pearl of the Antilles."

Goal for BCB DX'ers. And here is your challenge! Can you hear "Radio Marathon"? This DX catch of the year is on the air daily, from 6 a.m. to 9 a.m., and from 5:30 p.m. to 11:30 p.m. EST. By special arrangement with the Federal Communications Commission, "Radio Marathon" operates on the same channel as WHAM in Rochester, N.Y., and protects the coverage of that station by virtue of the highly directional antenna array which aims over 99 percent of the radiated power at Cuba. As a result of the extremely high concentration of "fire power," the signal of "Radio Marathon" is very weak in the continental United States.

Another rare catch for the DX'er is provided by a second VOA station operating on 1040 kc. and located on a Florida key in the same area as "Radio Marathon." Also radiating 50,000 watts into a directional antenna, the second station operates in parallel with the Marathon installation.

Transmitting entirely in the Spanish language except for "station break" announcements in English, these two unusual portable stations are an example of modern technology used to carry the message of freedom and democracy.

August, 1963
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TV Tuners—Rebuilt or Exchanged $9.95 complete—all types—fast, guaranteed service. Send tuner with all parts to: L.A. Tunexchange, 4611 West Jefferson Blvd., Los Angeles 16, California.


CB QWE QSL Cards, Samples Free. Radio Press, Box 24, Hollywood, Calif.

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SAVE dollars on radio, TV-tubes, parts at less than manufacturer’s cost. 100% guaranteed! No rebrands, pulls. Request Bargain Bulletin. United Radio, 1000-E, Newark, N.J.

TRANSISTORIZED Products Importers catalog, $1.00, Intercontinental, CPO, 1717, Tokyo, Japan.

INVESTIGATORS! free brochure, latest subminiature electronic listening devices. Ace Electronics, 11500 L.W. NW 7th Ave., Miami 50, Fla.

CANADIANS—GIANT Surplus Bargain Packed Catalogs. Electronics, Hi-Fi, Shortwave, Amateur, Citizens Radio. Rush $1.00 (Refunded). ETCO, Dept. Z., Box 741, Montreal, CANADA.


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CB-QSL Cards—45 Designs; Free Brochure, Woody, 2611 Shenandoah St., St. Louis 4, Mo.

GOVERNMENT Sells Surplus: Electronics; Oscilloscopes; Transceivers; Test Equipment; Radar; Sonar; Walkie-Talkies; Boats; Jeeps; Aircrafts; M'sc.—Send for "U.S. Depot Directory & Procedures" $1.00—Brody, Box 425(PE), Nanuet, New York.

INVESTIGATORS! Do your own sound work. Send $1.00 for brochure of electric, latest electronic equipment. WJS Electronics, 1525 No. Hudson. Hollywood 28, Calif.


TRANSISTORIZED treasure finder kits, assembled models from $19.95. Free catalog. Relico, Box 10563, Houston 18, Texas.

12 Weather instrument Plans $1.00. Saco, Box 2513B, South Bend, Indiana.


FREE literature keeping you informed on the latest work-saving, money-making test equipment. Learn how Easy Budget Payment Plan lets you pay out of increased earnings. Top engineered test instruments are priced for tremendous value. Write today. Century Electronics, 352 Maple Ave., Westbury, N.Y.

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TRANSISTORS—brand new, NPN units that can be used as the basis for many experiments and transistorized projects. Similar in specifications to the 2NJ29, these transistors are not seconds or pulls but fully tested and guaranteed units fresh from the factory. Will replace any general purpose NPN or PNP transistor. Order several at five for only $1. Baker Electronics, R.R. 1, Greencastle, Indiana.

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15 Distance One tube plans—25¢; One-tube Handbook—50¢. Includes Transistor experiments catalog. Laboratories, 1131 L Valota, Redwood City, California.

CB-QSL SWL cards. Samples 10¢. Free catalogue. Longbrook, Box 393, Quakertown, New Jersey.


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August, 1963

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