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kit (p. 65)

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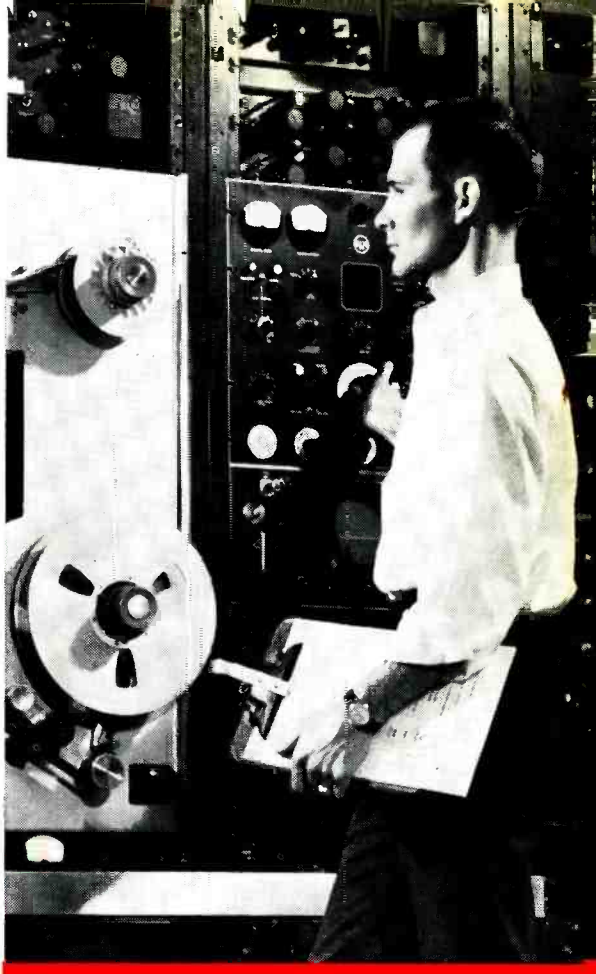

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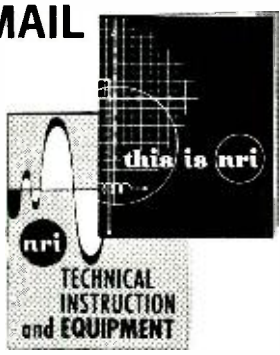

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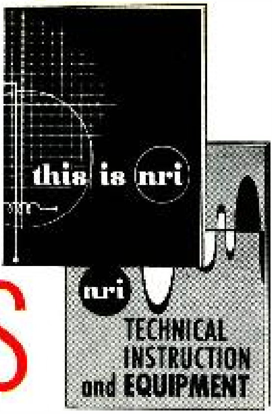

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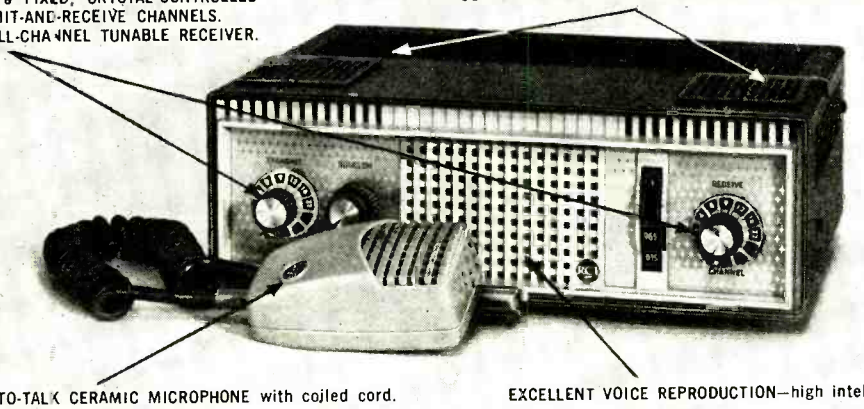

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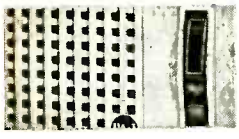

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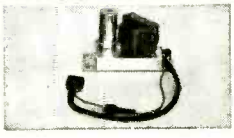

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CIRCLE NO. 21 ON READER SERVICE PAGE

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This month's cover photo by Bruce Pendleton

VOLUME 20 APRIL, 1964 NUMBER 4

Special CB Construction Section

Construction Projects

Amateur, CB, and SWL

Electronic Features and New Developments

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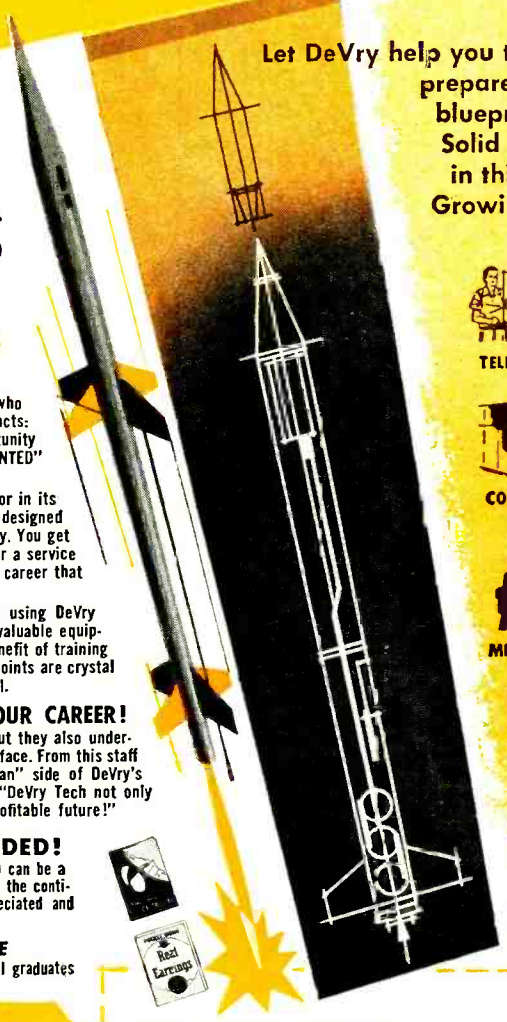

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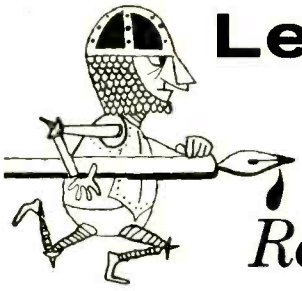


Letters *from our Readers*

Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS One Park Avenue, New York 16, N. Y.

Picture Tube Radiation

■ Could you settle an argument between my brother and myself? He claims that a TV picture tube emits dangerous amounts of nuclear radiation. I disagree. Which one of us is right?

STEPHEN A. MAAS
Drexel Hill, Pa.

It all depends, Stephen. It is quite true that a TV picture tube is a source of spurious radiation, mostly "soft" X rays. However, with a tube which is operated at its normal voltages—as is the case with all home TV sets—almost all of the X rays are absorbed by the tube's glass face-plate and, in most cases, cannot even be detected further than an inch or two from the screen. On the other hand, precautions are often taken to protect industry technicians who continually work close to exposed picture tubes.

Amplifier Modification Praised

■ Thank you for "Bigger Bass From Broadcast Sets" (December, 1961). I tried this simple modification on a guitar amplifier I constructed, and the result was outstanding. I'd recommend this idea to anyone who wants more bass from a small radio or amplifier. Another project I'd like to see in P.E. is a tube-type tremolo utilizing two or three single-purpose tubes.

MICKEY FERGUSON, WPE4FWI, KAI1712
Mineral Bluff, Ga.

Broadcast-Band Propagation

■ Finding much of the short-wave spectrum dead one evening, I tried some broadcast-band DX'ing, and was surprised to hear stations from Wisconsin, Minnesota, and Arizona. What's the reason for this BCB DX?

PAUL PLAKOSH, JR.
Coraopolis, Pa.

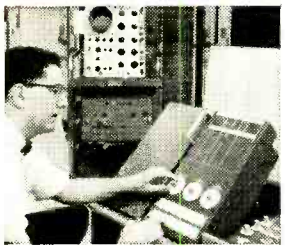
Reflection from the ionosphere, Paul, especially from the F layer. Skip reception of BCB signals is currently at an all-time high due to decreased ionization of the upper atmosphere which usually tends to absorb these frequencies to a greater or lesser degree, depending on time of day or night, season, etc. This decreased ionization is a function of the sunspot cycle.

Tach Draws Comments

■ The procedure given for calibrating the "X-Line Tachometer" (January, 1964) is correct, but only for an eight-cylinder, four-cycle engine. Since the tach is basically a pulse counter, the first step in using it

Pick the course for your career...

Electronics Technology



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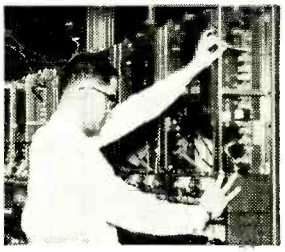

Mobile Radio, Microwave and 2nd Class FCC Preparation are just a few of the topics covered in this "compact" program . . . Carrier Telephony too, if you so desire.

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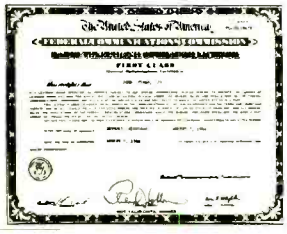

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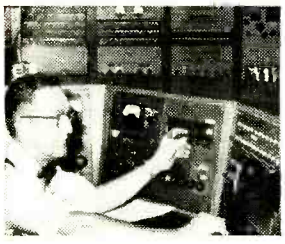

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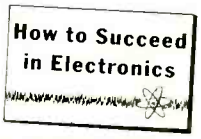

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Letters

(*Continued from page 6*)

is to compute the number of breaker point openings per rpm (i.e., for a two-cycle engine there will be one opening for every cylinder: for a four-cycle engine there will be one-half the total number of cylinders.) The tach can be calibrated for any engine using the following formula:

$$\frac{\text{Calibrating frequency (cps)}}{\text{Point openings per rpm}} \times 60 = \text{Indicated rpm}$$

I have used my tach for several months and find that it works equally well with any type of ignition system. Some electronic ignition systems, however, use less than 12 volts on the points; in this case, the tach can be connected across the ignition coil if the coil grounds the negative terminal. I wholeheartedly recommend the circuit to all.

I. M. Senia, WB2DHM
Hoboken, N.J.

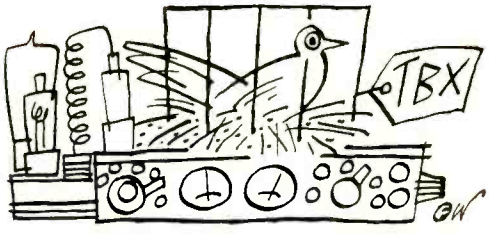
■ I would like to install the "X-Line Tachometer" in a positive-ground car. Is the circuit suitable for such installation?

John Spiegler
Bradford, Pa.

The "X-Line Tachometer," as illustrated in the article mentioned above, can be used only with negative-ground cars. This is because of the reversal of signal polarity in positive-ground vehicles.

Pigeon, Ground Transportable . . .

■ Just finished reading Ken Greenberg's brief article on "How To Identify Surplus Gear" (January, 1964). Trying to decipher the codes in the title, I came up with the startling observation that according to the



joint "AN" system a TBX would be a Ground Transportable Pigeon for Identification and Recognition. Quite a while since I've seen one of those offered by a military surplus dealer!

Michael D. Shapiro
Marion, Iowa

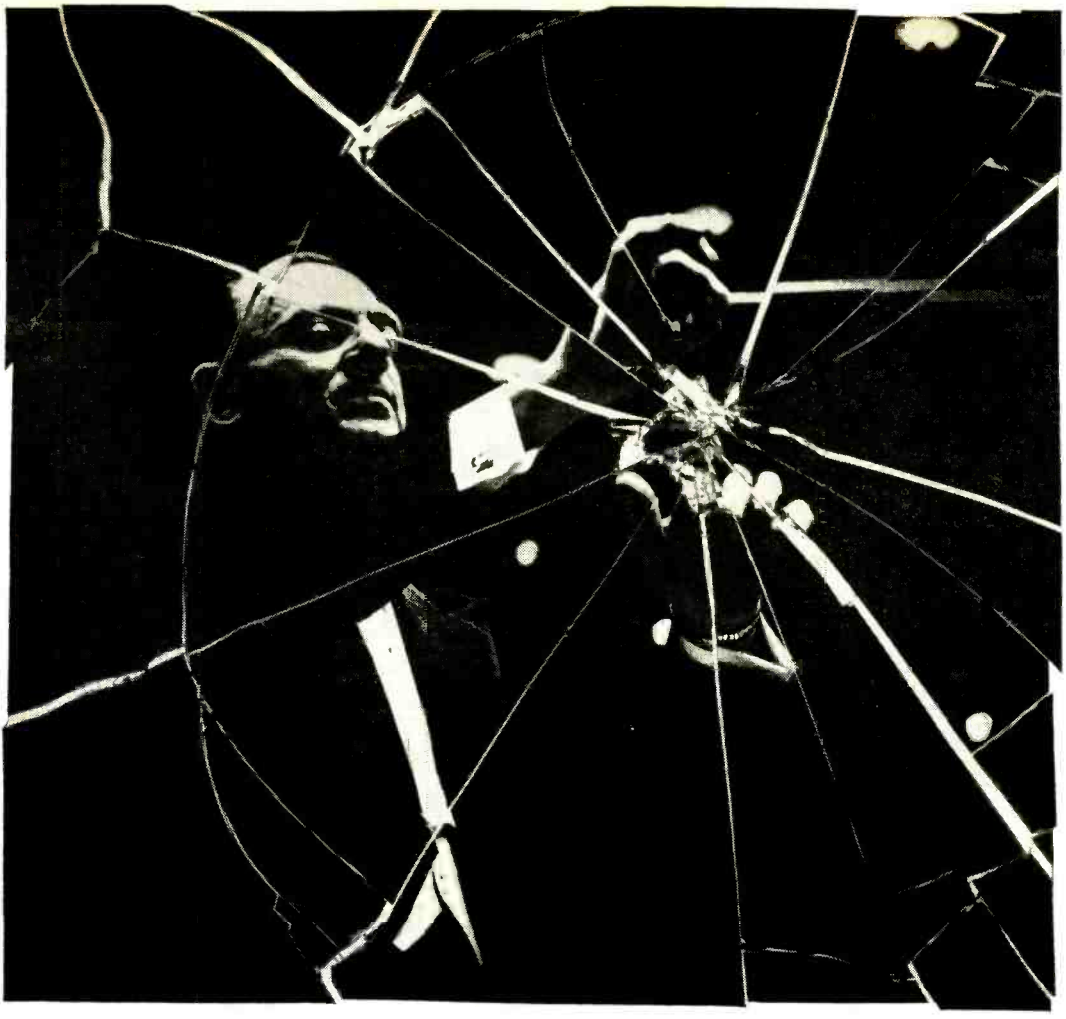
Anyway, Mike, who'd want to buy one?

Plans for "The Lightning Bug"?

■ I would like to construct "The Lightning Bug" described in the Carl and Jerry story (November, 1963). Could you possibly furnish me with a wiring diagram and parts list? Also, the story mentioned the new LDR-25 power photocell. Where can I get it and how much does it cost?

Jim Liess
Detroit, Mich.

Sorry, Jim. "The Lightning Bug" exists only in author John Frye's story—not in actuality. However, it would certainly be possible to build such a device. One source for the Delco Type LDR-25 power photocell is



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CIRCLE NO. 18 ON READER SERVICE PAGE

Letters

(Continued from page 8)

Harvey Radio Co., Inc., 103 W. 43 St., New York, N.Y., 10036. The price is $1.50. Let us know how you make out.

Apartment Antennas

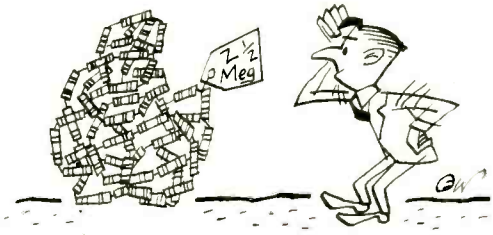
■ My Heath GR-91 receiver and 25 feet of wire draped around the window used to pull in plenty of DX on 49, 25, 21, and 19 meters, as well as on the broadcast band. Recently I moved to the fourth floor of a steel and concrete apartment building where the lease prohibits an outdoor antenna, and the only signals that move the S-meter now are two 50,000-watt locals. Is there anything I can do to improve the situation, or should I start looking for a new place to live?

RON BROWNSBERGER
Toronto, Ontario

Your problem is a common one, Ron. The best bet, if you can get away with it, is to put up an "invisible" outside antenna, or a window-mounted "flagpole." For an invisible job, use very fine wire—#24 to #28—and fasten it between a window and fire escape, between two windows, the window and the roof, etc. You can make tiny, lightweight, transparent antenna insulators with ¼" polystyrene rod or tubing cut to 3" lengths and drilled at each end to take the wire. Alternately, you might be able to mount an aluminum "flagpole" to a windowsill—make an insulating wood base and cover it with several coats of varnish. "Guy" wires insulated at the building will improve performance. Finally, if all else fails, try the "Power Line Antenna Adapter" (POPULAR ELECTRONICS, September, 1963).

Those 220-Ohm Resistors

■ I read with great interest and profit "Bargains by the Bagful" (February, 1964), and was especially intrigued by the "assortment" of 481 half-watt, 220-ohm resistors for 99 cents. Although Euclid never had 220-ohm resistors in mind, his theory of continued



fractions, expounded about 400 B.C., could be used in emergencies to make a varied assortment indeed. For 500 ohms, for example, you could just parallel five of the resistors and then open one leg of the circuit following the first two resistors and insert a series string of eight resistors!

DAVID E. Y. SARNA
New York, N.Y.

Radio-In-a-Bottle Contest?

■ For that informal "radio-in-a-bottle" contest (Letters column, July and September, 1963) we need rules and definitions. I suppose "bottle" means a *glass* bottle (not a hot-water bottle, for example)? Does the radio have to play or just look like a radio? (After all, a ship in a bottle doesn't float.) Just what constitutes a radio? In past issues we've seen fountain-pen radios, pie-case radios, soap-dish radios,

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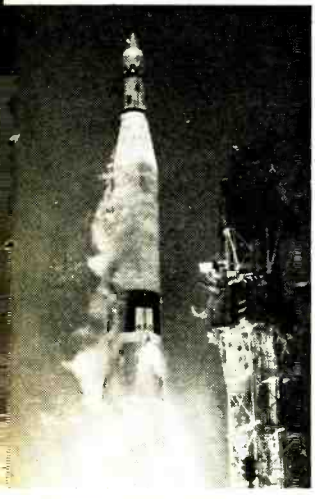

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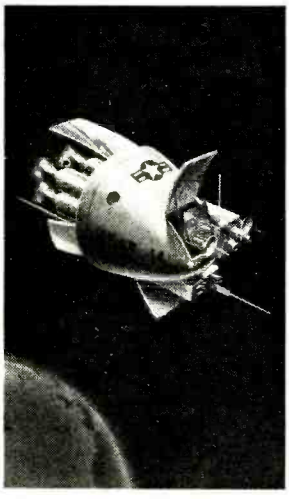

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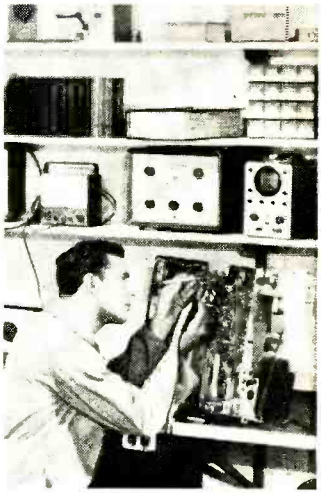

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Letters

(*Continued from page* 10)

radios in hats, even one you could mail in a letter. But in a bottle? Maybe someone could contribute a ship in a bottle with ship-to-shore radio!

ARTHUR F. MILES
San Diego, Calif.

Well, to keep it sporting, Art, we feel that a bottled radio should definitely be built in a narrow-necked (the size of a Coke bottle) glass bottle, should incorporate at least two or three battery-powered transistors, an antenna, and reproducing mechanism (all inside the bottle). It should play audibly, of course. While no prizes have been announced, we are considering all-expense-paid tours of Lilliput.

Trunk-Mounting CB Rigs

■ Concerning the letter on "Improved Mobile Rigs?" ("Letters From Our Readers," February, 1964), you will be interested to learn that International Crystal's new Executive Models 500, 750, and 1000 come complete with remote control head, speaker, connecting cables, and mounting rack for trunk-mounting the transceiver. The 750 provides all 23 channels and is priced at $229; the 500 has nine channels and sells at $179.50.

GLEN E. SCHAEFER
Glen-Nan, Communications
Des Moines, Iowa

Six, Seven, Eight . . . Ten?

■ The text for "Three Letter Quiz" (January, 1964) says that nine out of ten correct answers is a good score. Want to bet that nobody ever got nine out of

ten on this quiz? The only way to do it would be to score nine correct answers and then let the tenth go by default. If all spaces are filled, the possible scores are 0, 1, 2, 3, 4, 5, 6, 7, 8, and 10—no 9. Right?

JIM MORRISSETT, K7VNM, WA6EXU, KFA0592
San Diego, Calif.

Right. But nine out of ten is still a good score. —30—

Out of Tune

SIMPLEX Transistorized Ignition (*February*, 1964, *page* 47). The value of resistor *R2*, given as 100 ohms in the Parts List, should be 10 ohms. It is labeled correctly on the schematic diagram. —30—

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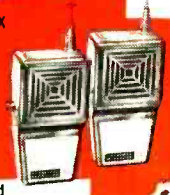

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CIRCLE NO. 16 ON READER SERVICE PAGE

Tips and Techniques

HANDY HOLDER FOR HARDWARE

If you attach a large and small rubber suction cup back to back, the result is a handy stick-on hardware holder. Fill the hole in the larger cup with epoxy cement, and insert the screw lug of the smaller. The holder can be attached to TV cabinets, tool box lids or other supports, and used for small parts, nuts, bolts or washers. —*John A. Comstock*

QUICK SERIES CONNECTION OF DRY CELLS FOR EXPERIMENTS

When you need some multiple of 9 volts d.c. for an experimental hookup, the quickest way to get it is to plug two or more 9-volt transistor batteries together, as shown. Make the output connection to the two terminals left exposed on the directly connected dry cell bank. Incidentally, you can use connectors taken from discarded cells for the wire ends to make connection and disconnection easy. —*Patrick Snyder*

CONVENIENT MOBILE MOUNT

To mount mobile gear without chopping into the dashboard, bolt an inverted chassis to the floor board of your car. Four bolts and nuts are then mounted to the bottom of your transceiver; they will also serve as legs if you decide to use the unit on a table

(*Continued on page* 20)

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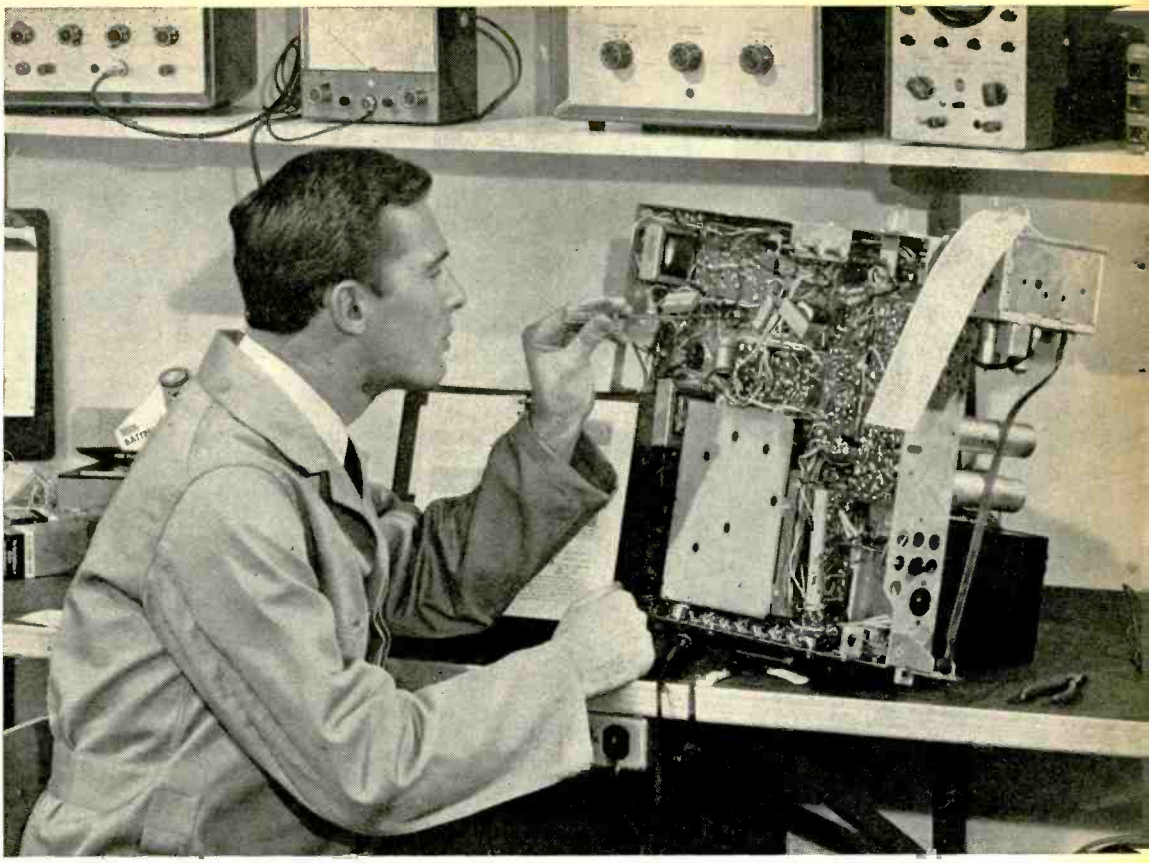

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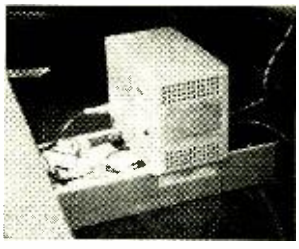
Tips

(*Continued from page* 14)

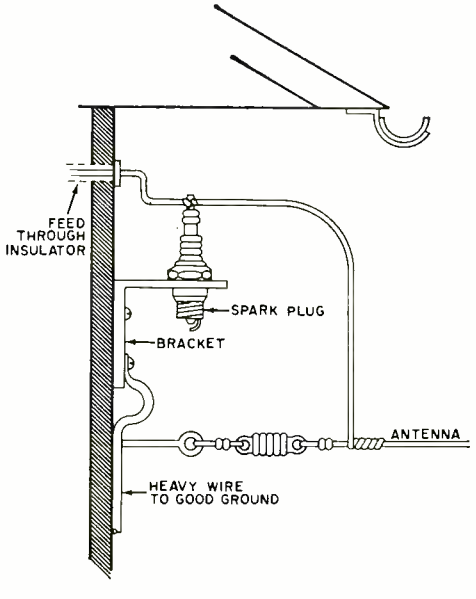


at home. These "legs" slip into four holes drilled into the lip of the car-mounted chassis. The trough formed by the inverted chassis is lined with a folded towel and stores your mike, screwdriver, log, etc. A piece of wood is drilled for crystal storage and bolted behind the transceiver. The unit can be quickly and easily removed for fixed station use, leaving only the chassis pan in the car.

—*Ross A. Sheldon*

LIGHTNING PROTECTION WITH IMPROVISED SPARK GAP

An outside antenna can be something of a hazard in thunderstorms if not well grounded. Of course, nothing will give complete protection if the antenna gets a direct stroke, but for dissipating the ordinary charges induced on the antenna during



thunderstorms, an ordinary spark plug can be connected to do a good job, without significant loss of signals at other times. Mount the plug in a bracket made of thick scrap aluminum, and connect the antenna and lead-in as shown. Make the mounting

Tips

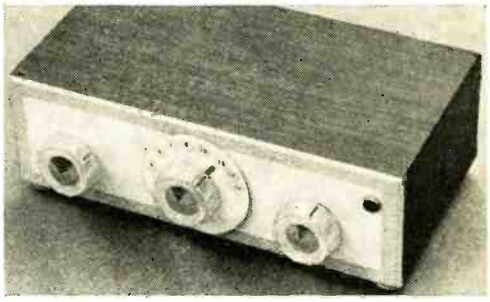
(*Continued from page* 20)

hole a snug fit, so the plug will cut its own thread as you wrench it home, and *don't* forget the ground wire.

—*Stanley Jay*

DRESS UP YOUR CABINET

The unusual appearance of the front panel on the cabinet shown in the photograph is obtained by covering the panel with medium-coarse sandpaper. Two coats of air-

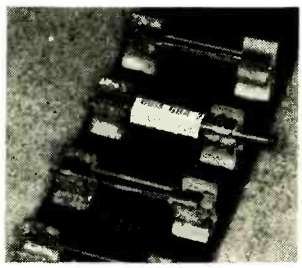


plane dope add a touch of color. And what looks like a "walnut" cabinet is an aluminum cabinet that has been covered with adhesive-backed decorative "contact" paper; as long as the equipment doesn't get too hot, this method of improving its looks is safe, and the effect is quite attractive.

—*Tim Callan*

HOW TO LOCATE BLOWN LOW-AMPERE FUSES

Locating blown low-ampere fuses under an auto dashboard or in complicated electronics gear can be a problem, especially where the light is dim. The usual practice is to pull the fuses one at a time and examine them visually or check for continuity with an ohmmeter. You may find it convenient to replace blown fuses with indicating fuses, such as the Buss GBA series. A red pin will extend from the fuse body when the fuse blows out. The indicating fuses are available with ¾-, 1-, 1½-, 2-, 3-, and 4-ampere ratings.



—*Kent A. Mitchell, W3WTO*

New Products

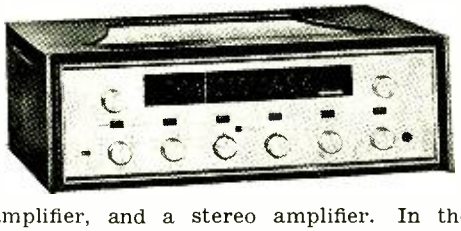
Additional information on products covered in this section is available from the manufacturers. Each new product is identified by a code number. To obtain further details on any of them, simply fill in and mail the coupon which appears on page 15.

STEREO CENTER SPEAKER SYSTEM

75 Designed for use with any existing stereo amplifier, *Conar Instruments'* Model 3SP center-channel stereo speaker system is said to provide the true "left-plus-right" center signal without additional crossovers, gimmicks, or amplifiers. With it, the left and right speakers can be separated 15 to 30 feet for proper stereo perspective. Frequency response is 40 to 17,000 cycles, power capacity 25 watts, and impedance 8 or 16 ohms. Price, $39.50, in oiled walnut cabinet with anodized aluminum trim.

60-WATT STEREO RECEIVER

76 The Knight KN-360, announced by *Allied Radio Corporation,* incorporates in one chassis a stereo FM tuner, conventional FM tuner, AM tuner, stereo preamplifier, and a stereo amplifier. In the FM section, the IHFM sensitivity is 2.5 microvolts for 20 db quieting, and the i.f. bandwidth is 300 kc. The amplifier has an IHFM power output of 60 watts, 30 watts per channel. Frequency response is ± 1 db, 20-20,000 cycles, and harmonic distortion is less than 0.6%. The 5¼" x 16" x 15" unit incorporates all the latest design features—including a stereo indicator, bar-type tuning indicator, front panel stereo headphone jack, and dual concentric bass and treble controls for each channel. Price, $249.95. A brown metal case is available for $12.95, a walnut wood case for $23.95.



CB TRANSCEIVER

77 New from *Globe Electronics* is the "President VIII," a CB transceiver incorporating a tunable receiver covering all 23 CB channels, a spot switch for exact tuning, illuminated S-meter, built-in public address system, tri-purpose power supply (117 volts a.c. or 6 and 12 volts d.c.), adjustable squelch, and 18-tube performance through 12-tube, 2-diode circuitry. On transmit, the unit can be operated on any of eight crystal-controlled channels, with an external crystal socket providing a ninth channel. The 5-watt-input transmitter is controlled by a push-to-talk relay.

PORTABLE VOM

78 Easily-readable voltage, current, resistance and decibel measurements can be made with the *Lafayette Radio Electronics* TE-900 portable VOM which incorporates a 6" meter scale in red and black for good visibility. The basic 50-microamp meter movement allows 20,000 ohms-per-volt sensitivity on d.c., and 5000 ohms-per-volt on a.c. The TE-900 covers 0-5000 volts a.c. or d.c. in six ranges; the lowest range in either case is 0-2.5 volts. Six current ranges are also provided, running from 0-50 μa. to 0-10 amperes. Three resistance

ranges permit measurements from 0 to 20 megohms. Accuracy is ±3% full scale on d.c., ±4% on a.c. A decibel scale runs from −20 to +50 db. Price, $26.95. Test leads, batteries, and leather carrying handle are included.

5" BROADBAND OSCILLOSCOPE

79 *Sencore, Inc.'s* PS127 oscilloscope provides high sensitivity of .017 volt r.m.s. for 1" vertical deflection at full bandwidth and therefore does not include a narrow-band position. Features are: Z-axis modulation, direct plate connections on the rear, positive sync locking, and a horizontal sweep range up to 500 kc. Frequency response is down only 3 db at 10 cycles, making a superior scope for video work as well as audio. And as a special feature, the 5000-volt breakdown rating on the low-capacity probe enables the user to check waveforms in high-voltage circuits that normally are not measurable with such a scope. Price, $169.50.

CB ANTENNA "CO-PHASER"

80 *Hy-Gain Antenna Products Corporation* has announced a CB antenna "Co-Phaser" which adds directional versatility and range to phased collinear base-station arrays. With a flip of the dial, the Co-Phaser transfers the CB'er from 3.86 db additional "broadside" gain to 4.5 db additional "end-fire" gain off either end of his phased array. The unit has no tubes or circuitry to introduce noise or interference, and actually cuts co-channel interference due to the extra omnidirectional gain it provides in the antenna system. Price, $14.95.

TUNABLE CB ANTENNA

81 *G.A.M. Electronics, Inc.* has announced a base-loaded type mobile antenna for use in the 27-mc. Citizens Band. Since the vertical whip is only 38" long, the CB-11 can be mounted for good efficiency either on the roof of an automobile, or on the cowl or trunk lid. There is a tunable loading coil at the base of the CB-11; the whip is rotated to adjust the tuning slug and is locked in place by tightening a nut. When correctly adjusted, VSWR is less than 1.2:1 on all 23 Citizens Band channels. Price, $14.50.

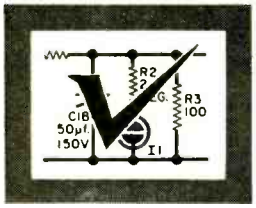
HAND-HELD DYNAMIC MICROPHONE

82 A new hand-held dynamic microphone developed by *Altec Lansing Corporation* for mobile operation is said to provide greatly improved performance over ordinary carbon microphones. To eliminate ambient background noise, the "Dyna-Mike" is designed with a "suspended" diaphragm assembly and packaged in a perforated case to allow omnidirectional access of sound to the diaphragm. Background noise strikes the diaphragm from both front and back due to its placement and the case configuration. The result is a dissipation of audio energy from the background source. The "Dyna-Mike" is available in two models. The 695A has an integral transistor amplifier, permitting it to directly replace any carbon-type microphone without alteration in circuitry. The 696A is identical, less amplifier, and is available as a low- or high-impedance unit.

COMPACT SPEAKER SYSTEM

83 Low distortion and wide frequency range are achieved in *Electro-Voice's* "E-V TWO" speaker system through the use of two separate drivers. Frequencies above 800 cycles are handled by a high-frequency driver and diffraction horn combination which insure wide, smooth dispersion of critical high frequencies, especially when the "E-V TWO" is used in stereo systems. The 12" woofer features a ceramic magnet, edgewise-wound voice coil, and a linear suspension. Measuring 14" x 25" x 13½", the "E-V TWO" can be used with any amplifier. Frequency response: 30 to 15,000 cycles. Nominal impedance: 8 ohms. Power-handling capacity: 30 watts program, 60 watts peak. The system is available in either an oiled walnut or mahogany cabinet. —30—

Operation Assist



THROUGH THIS COLUMN we try to make it possible for readers needing information on out-dated, obscure, and unusual radio-electronics gear to get help from *other* readers. Here's how it works: Check over the list below. If you can help anyone with a schematic or other information, *write him directly*—he'll appreciate it. If *you* need help, send a post card direct to OPERATION ASSIST, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. Give the maker's name, the model number, year of manufacture, bands covered, tubes used, etc. Be sure to print or type everything legibly, including your name and address, and be sure to state specifically what you want, i.e., schematic, source for parts, etc. Remember, *use a post card;* we can handle them much faster than letters. And don't send a return envelope; your response will come from fellow readers. Because we get so many inquiries, none can be acknowledged, and POPULAR ELECTRONICS reserves the right to publish only those requests that normal sources of technical information have failed to satisfy.

Schematic Diagrams

RCA Victor Model TA-128 TV-AM/FM-phono combination, year unknown; **Admiral** Model 4H 145B TV-AM/FM-phono combination, made 1949. (Bruce Dane, 45 Parkway Dr., Syosset, L.I., N.Y. 11791)

Magnascriber De luxe Model 160 wire recorder, made by Standard Business Machines (Chicago), also any other technical data. (Dallas H. Waltman, 17 E. Mason Ave., Alexandria, Va. 22301)

Philco Model 66 BC and s.w. receiver, 5 tubes, about mid-30's. (Cedric Walker, 4426 Ambrose Ave., Los Angeles 27, Calif.)

Stromberg Carlson Model Fr-503/504 hi-fi tuner/amplifier; **National** NC-46 communications receiver; **Detrola** Model 554-1-61A radio, year unknown. (John S. Yaniga, 597 Joralemon St., Belleville, N.J.)

Philco Model 37-675, code 122, 5-band BC and s.w. radio; **Coronado** Model 11B 11-tube console radio; **Crosley** Model 220A 12-tube AM/FM radio; no dates known. (Charles T. Huth, 146 Schonhardt, Tiffin, Ohio 44883)

Zenith Model 1207 12-tube, 3-band, BC and s.w. radio, about 1939. (D. Smith, 9201 Meyers, Detroit 28, Mich.)

Movie Sound 8 sound movie projector (8 mm.), made by Calvin Co., about 1953. (Robert Koontz, 1018 Washington St., Huntingdon, Pa.)

Heath Model AR-3 receiver, also construction manual. (B. Dugas, 218 Anthony, Cornwall, Ont., Canada)

Jackson Model 103 tube tester, date unknown. (David Shores, 6515 Wydown, P.O. Box 1019, St. Louis 5, Mo.)

Linear Equipment Labs Model HF1 oscilloscope, ser. 681. (George Lukas, 888 Mass Ave., Cambridge, Mass.)

(*Continued on page* 28)

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Operation Assist

(*Continued from page* 26)

Silvertone 3-band, BC and s.w., 8-tube radio, chassis 101-631, part of radio-phono combination, no date. (Stephen Bartlett, Walpole St., Dover, Mass.)

Lysco Model 913 Marine Radiotelephone, ser. 063. (E. R. Anderson, 2473 Bayview Ave., Wantagh, N.Y.)

McMurdo Silver Masterpiece VI, 5-band, 16-tube BC and s.w. receiver and power supply, no date. (P. O. Gilliam, Glen Hotel, Apt 34, 807 Eighth Ave., S., Seattle 4, Wash.)

Stewart Warner Model R-1671-AS, no date. (Frank Grucelski, Rte. 1, Box 292, Thorp, Wis.)

Hallicrafters Model R-58A/ARO8 UHF receiver, BC 906-D frequency meter, also any other data. (A. H. Regene, 2315 S. 5th St., Rockford, Ill.)

Hammarlund HQ-129-X communications receiver; **Webster-Chicago** Model 228-1 wire recorder, ser. 113616, no date. (Ron Koelling, 900 S. 5 Ave. West, Newton, Iowa)

Portogram (Preel Works) British record player, about 1955. (Carlos Roberts, 343 McGlynn Rd., Warminster, Pa. 18974)

Morrow Falcon mobile receiver, 5 ham bands and BC, about 1958. (J.D. Grigas, 258 Coe Rd., Clarendon Hills, Ill.)

R-48A/TRC-8 military surplus receiver, 230 to 250 mc.; **PP-28/MPN-1** military surplus power supply; **Harvey Radio Labs** 7-tube transmitter, companion to 501A receiver, about 1945. (K1WYS, 261 Raynor Ave., Whitman, Mass. 02382)

Harvey Wells TBS-50D transmitter, no date; also operating instructions. (Richard W. Randall, CMR 3, Box 8056, APO 929, San Francisco, Calif.)

Superior Model 650 signal generator, 100 kc. to 35 mc., no date. (Joe Schumacher, 223 Redrock Dr., San Antonio 13, Texas)

Mendes Model MS225 5-tube radio, ser. 50068, 4 bands, 20 to 2000 meters (15 mc. to 150 kc.) (James H. Prout, 1810 Woodmont Rd., Huntington 1, W. Va. 25701)

Radio Power Amplifier Model 7-AB, Electric Storage Battery Co., about 1927; also any technical data. (Melton Crownover, Box 207, Clinton, Ark. 72031)

BC-733 surplus receiver, 108 to 110 mc., AM. (Russell Spear, 2410 La Salle St., Eau Claire, Wis.)

Xerox Co. power supply Model 9T 63 Y 200462, made for GE (Scott Daniels, 1749 Popham Ave., New York, N.Y. 10453)

CW-52063A surplus radio transmitter, uses CW-47142 coil set. (Lance Mastrov, 145 E. 8 St., Brooklyn 18, N.Y.)

McMurdo Silver Model 906 signal generator, 90 kc. to 170 mc, about 1948. (James P. Ligman, 17 Golf View Rd., Lake Zurich, Ill.)

Superior Model 650 signal generator, 100 kc. to 35 mc. (Joe Schumacher, 223 Redrock Dr., San Antonio 13, Texas)

Special Data or Parts

R1155A communications receiver, British made, need manual, U. S. equivalents for tubes. (Harold Parusel, 98 Burris St., Hamilton, Ont., Canada)

Atwater Kent Model 10 radio, ser. 7752942, need parts source, parts list, schematic. (William Van Buskirk, P. O. Box 102, Station V, Brooklyn 15, N.Y.)

BC 342 receiver, maintenance manual needed. (Robert B. Winn, P.O. Box 214, Plano, Texas 75074)

RCA TMV-122-B oscillograph, about 1940, power transformer needed. (Larry Brodsky, 710 LaSell Drive, Champaign, Ill. 61822)

UTC Model PO 93077 transformer, specifications and use needed. (WN2HFS, 106 Westfield Rd., Buffalo 26, N.Y.)

Philco Model 620WR 6-tube, 3-band, BC and s.w. radio, alignment and operating data needed, also schematic;

Philco Model 38-15 5-tube, 2-band, BC and s.w. radio, alignment and operating data needed, also schematic. (C. R. Bluhm, 4 Elm Ct., Little Falls, N.J. 07424)

(*Continued on page* 30)

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

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

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

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CIRCLE NO. 20 ON READER SERVICE PAGE

Operation Assist

(*Continued from page 28*)

Kaydette Model 1140 11-tube, 2-band BC and s.w. radio, about 1930, ser. JJ-2790, source of parts and schematic needed. (Jerry Heien, 1518 Rohde Ave., Berkeley, Ill.)

Midwest Model 816, series 16, 15-tube radio, ser. S164016, antenna data, PM speaker replacement for original electrodynamic, and schematic needed. (G. R. Grover, Box 401, Canal Fulton, Ohio)

Firestone code F-C-114, 3-band radio, BC and s.w., stock nr. S-7400-3, no date, source of parts and schematic needed. (S. A. Colburn, 328 Hayes Ave., McDonald, Ohio 44437)

BC-AR-429 surplus receiver, coils C-341, -342, -343, -344, -345, and -348 needed, buy or swap. (H. E. Wenden, 52 East South St., Worthington, Ohio)

Telechron Model 8H59 4-tube "Musalarm," tuning coil and schematic diagram needed. (Alan Kramer, 78-07 84th St., Glendale 27, N.Y.)

Sparton Model 987, 8-tube, BC and s.w. radio, about 1937, any technical data including schematic. (R. M. Okula, 1093 Ostrander Ave., Riverhead, L.I., N.Y.)

Philco Model 650, 8-tube, 4-band BC and s.w. radio, any technical data, including schematic and alignment steps, tubes 6A7, 42, etc. (Don Van Wienen, 11297 56 Ave., Allendale, Mich. 49401)

RCAF preamplifier, ref. no. 10D/4240, about 1944, made by Radio Production Alliance, information on power supply, source or specifications needed. (Sid Kaplan, 964 146 St., Edmonton, Canada)

BC-603-C surplus receiver, operating and/or maintenance manuals, also schematic. (Stanley M. Forman, 874 Chestnut St., Waban 68, Mass.)

Atwater Kent Model 328, 3-band, 8-tube radio, power transformer or suitable replacement unit needed, also schematic. (F. E. Horton, 630 S. 4th St., Festus, Mo.)

Supreme Model 580 signal generator, De luxe series, ser. 580-511; **Supreme** Audolyzer Model 562, ser. 1968, instruction books and schematics needed on both. (T. McClaskey, 2965 Jarrell St., Huntington 5, W. Va.)

Stewart Warner PP-1240/GPX power supply, part of Decoder Model KY118-GPX, any information and schematic needed. (J. W. Hall, 420 Swan St., Dunkirk, N.Y. 14048)

Policalarm Model PR-30 FM receiver, 30-44 mc., about 1951, source of parts, schematic, etc., needed. (Andrew Webster, 1265 Lee St., White Rock, B.C., Canada)

Heathkit Model AR-3 receiver, construction manual needed. (C. L. Wood, Rte. 3, Box 243, Talladega, Ala.)

Sperry Type SP-1, single-pack two-way radio, used by railroads, 155-174 mc., instruction books, schematic diagrams and any data needed. (Frank H. Bremer, 517 E. 178th St., Bronx, N.Y. 10457)

TS 34A/AP surplus oscilloscope, operating manual, any other data, schematic. (Russell Spear, 2440 La Salle St., Eau Claire, Wis.)

Emerson Model BM-206, 5-tube BC radio, ser. BM-2517052, any data or drawings. (Paul F. Arutt, 1200 Harbor Rd., Hewlett, N.Y. 11557)

McMurdo Silver Model 900 VTVM, calibration data needed. (H and H Electr., Box 534, Norman, Okla. 73070)

Lafayette Model MS-270 2-gang variable capacitor, 87 and 195 pf., or replacement. (Michael D. Sachs, 1-A Field Rd., Danbury, Conn. 06811)

BC-1364 radiosonde receiver, surplus, any technical data, and schematic. (Eric Bolland, 306 S. Van Buren St., Stoughton, Wis. 53589)

Korting MT 158(S) tape recorder, instruction manual. (Hank Skrzypek, 4728 Schlaff, Dearborn, Mich.)

Solar "Exam-eter" capacitor analyzer, and **Supreme** Set Tester, Model 504-B, manuals and/or schematics on both. (Charles W. Ball, 138 S. Queen St., York, Pa. 17403)

—30—

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- White-noise signals to allow the stereo channels to be matched in level and in tonal characteristics.
- Four specially designed tests to check distortion in stereo cartridges.
- Open-air recording of moving snare drums to minimize reverberation when checking stereo spread.

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- ✓ **Pickup tracking — the most sensitive tests ever available to the amateur for checking cartridge, stylus, and tone arm.**
- ✓ **Hum and rumble — foolproof tests that help you evaluate the actual audible levels of rumble and hum in your system.**
- ✓ **Flutter—a test to check whether your turntable's flutter is low, moderate, or high.**
- ✓ **Channel balance — two white-noise signals that allow you to match your system's stereo channels for level and tonal characteristics.**
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ALSO: ✓ **Stereo Spread**
Speaker Phasing
Channel Identification

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The non-test side of this record consists of music recorded directly on the master disc, without going through the usual tape process. It's a superb demonstration of flawless recording technique. A demonstration that will amaze and entertain you and your friends.

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Note to professionals: The Model 211 can be used as a highly efficient design and measurement tool. Recorded levels, frequencies, etc. have been controlled to very close tolerances — affording accurate numerical evaluation when used with test instruments.

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The Model 211 Stereo Test Record is a disc that has set the new standard for stereo test recording. Due to the overwhelming demand for this record, only a limited number are still available thru this magazine. They will be sold by POPULAR ELECTRONICS on a first come, first serve basis. At the low price of $4.98, this is a value you won't want to miss. Make sure you fill in and mail the coupon together with your check ($4.98 per record) today.

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(Please Print)

Address _____

City _____ Zone _____ State _____

Sorry—No charges or C.O.D. orders! PE44

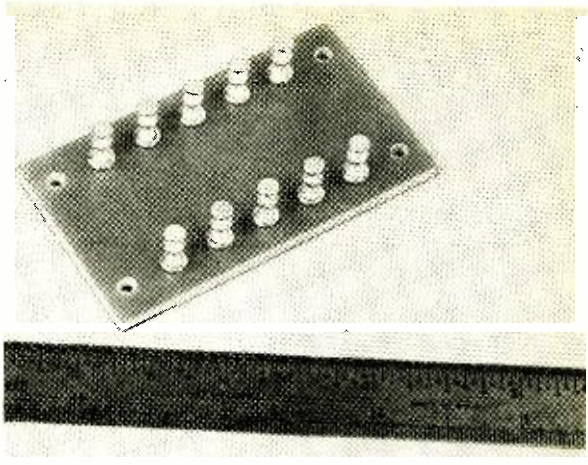
CAR BATTERY SAVER

By R. C. APPERSON, JR.

Never again will your wife leave the lights on and kill the battery—this little "computerized" gadget makes forgetting an impossibility

ONE MISERABLE RAINY MORNING, we climbed into our car and headed to work, picking up riders along the way. In order to let fellow drivers know we were on the highway, the headlights were flicked on, and conversation engulfed the group. The rest of the drive was just sufficient to let the stimulating conversation sweep all thoughts of headlights from the driver's mind. Once in the company parking lot, the ignition switch was quickly cut off, and all passengers made a mad, splashing dash for the front door. Two high candle-power lamps remained on, doing no useful work, but sapping those ampere-hours from the car's battery. The weather was clear when quitting time rolled around. All loaded aboard the car, and—urrr, urrr—then, nothing. The language that followed was much stronger than the battery, and a vow was made to find a way to remedy the problem. Here is the device that has eliminated many

CAR BATTERY SAVER



Terminal board was used for the prototype, but layout is noncritical; terminal strips can be used.

trips to the battery charger; it's yours for a very few dollars and a little time.

How It Works. As in computer logic circuitry, certain conditions must be present before the device generates a signal. When the stage is set properly, the little gadget comes alive with a raucous 100-cycle squawk that won't allow you to leave your lights on. In fact, when this thing sounds off, you'll wish for a second that you never heard of headlights!

The signal is generated only when the headlights are on and the ignition is off. If the ignition is on, nothing happens.

Computer Logic: The Battery Saver

The circuit used in this project follows computer logic to an extent. The desired action does not fit either "AND" or "OR" gate conditions. "AND" gates operate with both inputs present, and "OR" gates with either one input or the other. The design of the Car Battery Saver is believed to be new, and the author has assigned a typical logic circuitry name to it: an "IF ONLY" gate. IF ONLY the headlights are on and the ignition is off, the device provides an output in the form of a raucous warning signal that emanates from the loudspeaker. It doesn't *let* you forget the lights! The "IF ONLY" gate theory of operation can best be seen by examining the simple circuit.

Headlight and ignition voltages cause no disturbance either, but the removal of the ignition voltage if headlight voltage is applied starts the action. A look at the circuit will explain why.

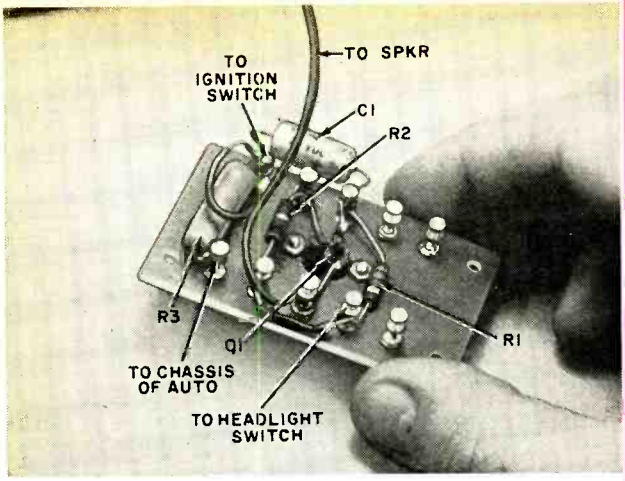
IF ONLY Gate, Generator. If you have a resistor and capacitor in series with a car battery, the capacitor will charge through the resistor to the full battery potential. If you have a resistor and capacitor connected in series and then to sources of like potential (both to the positive terminal of the car battery, for example), the capacitor cannot charge as no current flows from the battery. This, basically, is the IF ONLY principle.

How do we apply this in the car? We have two controls that switch voltages from the same source. Let the headlight voltage be the supply, and the ignition the hold-off signal. Since a reference point is required for the supply, a resistor is placed between the normally-grounded circuit element and the ground. The ignition voltage is dropped across it. Only one-half watt is dissipated as hold-off power. This is a negligible load to a battery being charged by a generator.

The signal generator itself is simple. It is a unijunction relaxation oscillator delivering pulsed energy to a speaker at a 100-cycle rate as determined by the *R1*, *C1* time constant.

Unijunction *Q1* does not conduct until *C1* charges through *R1* to a potential determined by the unijunction characteristics and the supply voltage. When this potential is reached, the emitter allows *C1* to discharge into base number 1. This turns on the unijunction and a current pulse is drawn through the speaker, producing an audible tone.

Protective resistance for the unijunction is provided by *R2*, and *R3* is the resistor logic. Obviously, *C1* won't charge if a voltage at the top of *R3* is equal to the voltage at the top of *R1*. When



Parts placement is clearly shown above. Connection to the automobile is done as described in the text.

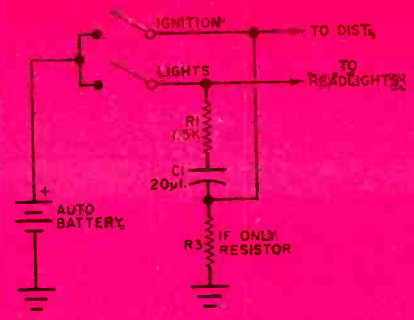
the voltage at the top of *R3* disappears, *C1* charges, and the circuit emits the warning.

The "Battery Saver" is flexible. Move the location of *R3* and the battery saver system will operate on a car with either positive or negative ground. Voltage is not critical either. The only difference between a 6- and 12-volt system is a slight volume decrease with the lower voltage.

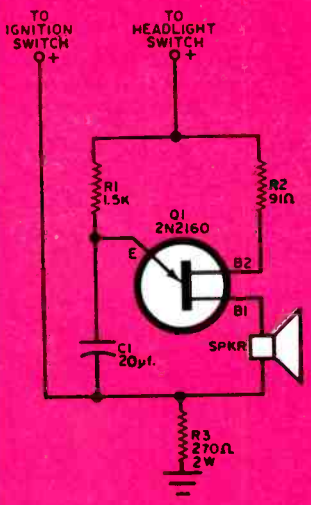
Building The Unit. Any small container large enough to house the speaker will make a suitable cabinet for the unit. Circuit layout and wiring is not at all critical, but the author's layout is shown for your convenience. Three leads are brought from inside the cabinet which go to the ignition, headlights, and auto chassis ground. The speaker is attached to the case after holes are drilled in the box to let the sound out. Small screws mount the speaker to the cabinet. The speaker terminals also serve as tie points for one base lead and the negative side of the capacitor. The hold-off resistor

PARTS LIST

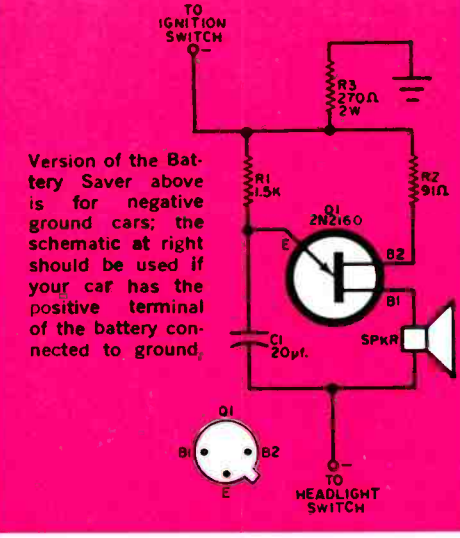
C1—20-μf., 25-d.c.w.v. electrolytic capacitor
Q1—2N2160 unijunction transistor
R1—1500-ohm, ½-watt resistor
R2—91-ohm, ½-watt resistor
R3—270-ohm, 2-watt resistor
1—Miniature speaker, 8 ohms
1—Minibox or other housing
Misc.—Terminal strips or board, wire, etc.

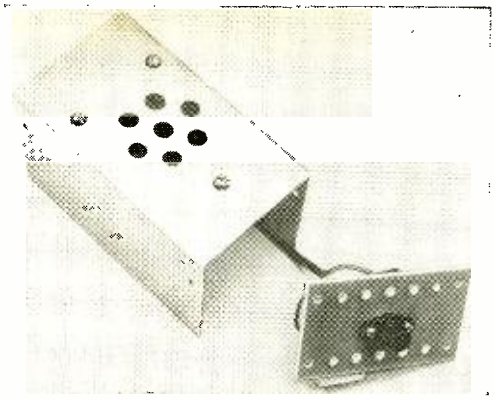


Basic IF ONLY circuit is integrated into auto electrical system as above. This drawing is for illustration only; actually, C1, R2, and R3 are in Battery Saver.



Version of the Battery Saver above is for negative ground cars; the schematic at right should be used if your car has the positive terminal of the battery connected to ground.





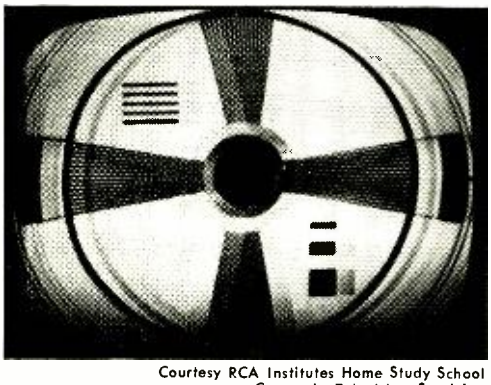
You can mount finished unit in almost anything, even plastic soap dish. This one fits in Minibox.

and the lead that goes to the ignition connect to this capacitor lead. Care must be exercised when soldering to the unijunction, and a heat sink should be used; remember, *it's a transistor.*

Mounting the Battery Saver. After determining the polarity of your car's electrical system, choosing the proper circuit and constructing the Battery Saver, the last step is to mount it in the car and hook it up. One self-tapping screw will secure the case in any location you choose. When it is in place, connect the ground lead under a bolt on the dash or to any metal that is in common potential with the frame of the car. Connect the ignition wire to the cold accessory side of the ignition switch. This is the terminal normally used for a radio or other accessories. Turn on the ignition as a test; nothing should happen. Connect the other lead to the headlight switch on the side that goes to the headlights, or again, the "cold" side of the switch. With the switch off, no voltage should be measured. Then, with the ignition switch on, turn on the headlights. Still nothing should occur. However, when you turn off the ignition with the headlights on, your Battery Saver will come to life with a loud blat.

You have built, tested and installed a device that will save you considerable trouble. Of course, the acid test comes when you trade cars. Which do you pull out first: the Battery Saver or those new tires? —30—

Trouble-Shooting TV Ghosts



Courtesy RCA Institutes Home Study School Course in Television Servicing

TELEVISION GHOSTS are caused by signals arriving at the TV set via several paths. When these paths are of different lengths, as they usually are, multiple images called "ghosts" appear on the screen. It is often helpful if you know path length differences, and these can be obtained with simple calculations. The duration of one scanning line on the screen is equal to 84 per cent of the horizontal oscillator period of 63.5 microseconds. The remaining 16 per cent of the period is blanking interval. During this time, a signal traveling at the speed of light would go 52,500 feet, or almost ten miles. In order to determine the path length difference then, you simply measure the horizontal separation between the main signal and a ghost image, and divide by the width of the raster. Finally, multiply the result by 52,500, and you get the path length difference in feet.

With this information, it is often possible to discover how the signal which forms the ghost image is being reflected, and to compensate for it by relocating your TV antenna, or by using an antenna with greater gain in one direction.

—*Charles Erwin Cohn*

Ten killed, a hundred injured . . . warning time was needed,

and to meet the need, hams and CB'ers forged

Tornado Alley's Emergency Net

By LES HUNTER

NOT ONE but thirteen tornadoes struck various towns in southern Illinois and southeastern Missouri on December 18, 1957. Extensive communications facilities for warning area residents were not then in existence, and the only hint of the destruction to come were the general forecasts broadcast by local radio and television stations.

Hardest hit was Murphysboro, in Jackson County, Ill. Ten people were killed, nearly 100 injured, and property damage totaled over two million dollars. The town was left without electricity and with only emergency telephone service. Firemen used all available water to fight fires in the wrecked area. Volunteer workers helped with the rescue of the injured. The homeless were sheltered in schools. Outside civil defense teams brought in emergency power units for the hospital, water pumping station, court house, and city hall.

As the clean-up got under way, county officials, volunteer workers, and area inhabitants, appalled by the damage, asked themselves what could be done to protect lives and property from a future onslaught of tornadoes so common in this part of the Midwest.

Communications the Key. Thanks to the lessons learned in 1957, a tornado alert today would activate a coordinated team of amateur and Citizens Band radio operators, and area residents in the path of one of the vicious wind storms would be immediately warned to take cover. "We have built one of the strongest communications networks in the country," says Dr. Frank Bridges, civil defense coordinator at Southern Illinois University in Carbondale, seven miles from Murphysboro. "It really works. Anyone who doubts it should listen in on a practice drill."

A few weeks after the 1957 disaster,

After test alert, officials checked maps and messages to see how closely airplanes, simulating tornadoes, were tracked across state by net members.

At the mike is Don Cornell, W9ATL, largely responsible for organizing the net. For his efforts, the town of Murphysboro recently voted him an award.

a capacity crowd attended a civil defense "Storm Warning" dinner at the University, and double the number came to a follow-up meeting at which a storm-warning plan was formulated. Shawnee Amateur Radio Association (SARA) members were assigned the task of organizing a radio network.

Meanwhile, Murphysboro adopted a civil defense ordinance, appointing C. R. Riseling, W9BJE, communications director, and Don Cornell, W9ATL, radio officer. Both used their own equipment while the city looked for money it could legally spend for two-way emergency stations.

As president of SARA, Cornell arranged the first test drill for the storm warning net. Business firms furnished airplanes that took the roles of tornadoes. Participating county control stations had amateurs as outpost spotters. When the planes were sighted, control was notified and the message relayed to a radio broadcast station in time for a theoretical warning.

After just two months of operation, the net experienced its first actual alert. Murphysboro outpost observers, prepared for the worst, watched a funnel cloud disperse across the Mississippi River in Missouri. State CD officials commended the net for its operation that day.

"Universal" Radio Net. Today, the county-wide network has almost a hundred spotters in every town and village. The net can be said to be "universal" in that it includes radio enthusiasts of all sorts—21 amateurs, 26 CB'ers, and 50 unlicensed members. Formal organization is under Radio Amateur Civil Emergency Service (RACES) regulations, and permits are issued by Cornell, now Jackson County radio officer. Both he and Rev. W. D. West, K9BWI, county CD director, decide on when to warn citizens to take cover.

Under RACES regulations, a member who is not licensed may operate a station—after being fully instructed in operating techniques—during emergencies and official tests. He is not allowed to adjust the equipment. Each time the net goes into operation, a notice is broadcast stating the purpose of the operation and requesting other stations to keep off the frequency. The FCC gets an official RACES report on each such operation.

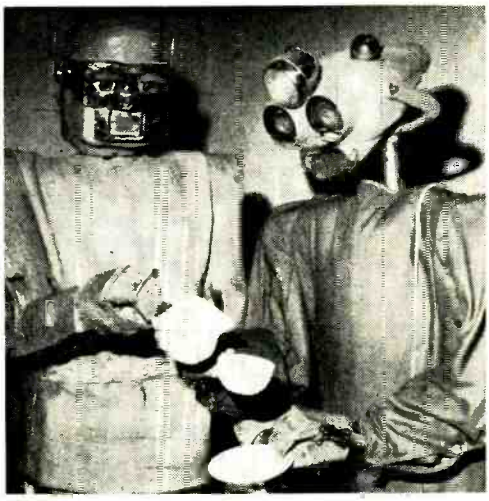
Area Citizens Banders got into the act in 1962; it was felt that the additional mobile units they could provide would render invaluable assistance. Now participating under RACES permits, they operate a highly efficient, disciplined net, tracking weather fronts across the county with short, accurate reports. A CB control station feeds information to the county control station located in the basement of Murphysboro city hall.

New Relay Station. This year Jackson County purchased ground on a high Ozark hill in the northwest part of the

(*Continued on page* 95)

LIGHT BEAM TV—Transmission of a picture over invisible light beam demonstrates GE's new data link consisting of small sender (left) and receiver (atop TV). System may be used to control missile launchings.

ROBOT FAMILY—Created by Klaus Scholz of Vienna, these robots are capable of simple physical functions. Newest (right) is more versatile than other, will eventually be equipped with speech and hearing circuitry, and a transistorized "brain."



"WATERCOM"—The weird mouth mask worn by the young lady is part of new Bendix underwater communications system. Throat mike runs to sound transmitter attached to breathing tanks. Divers within 100 yards can hear voice without special equipment.

MICROWAVE ABSORBER — Huge pyramid carried by New York secretary is a microwave absorber made of urethane foam by B. F. Goodrich. They're used for lining anechoic satellite test chambers.

WHO REALLY STARTED WORLD WAR I?

What happens when the words of long-dead statesmen are analyzed by an electronic computer? Researchers tried it, and came up with surprising results

By W. STEVE BACON,
Managing Editor

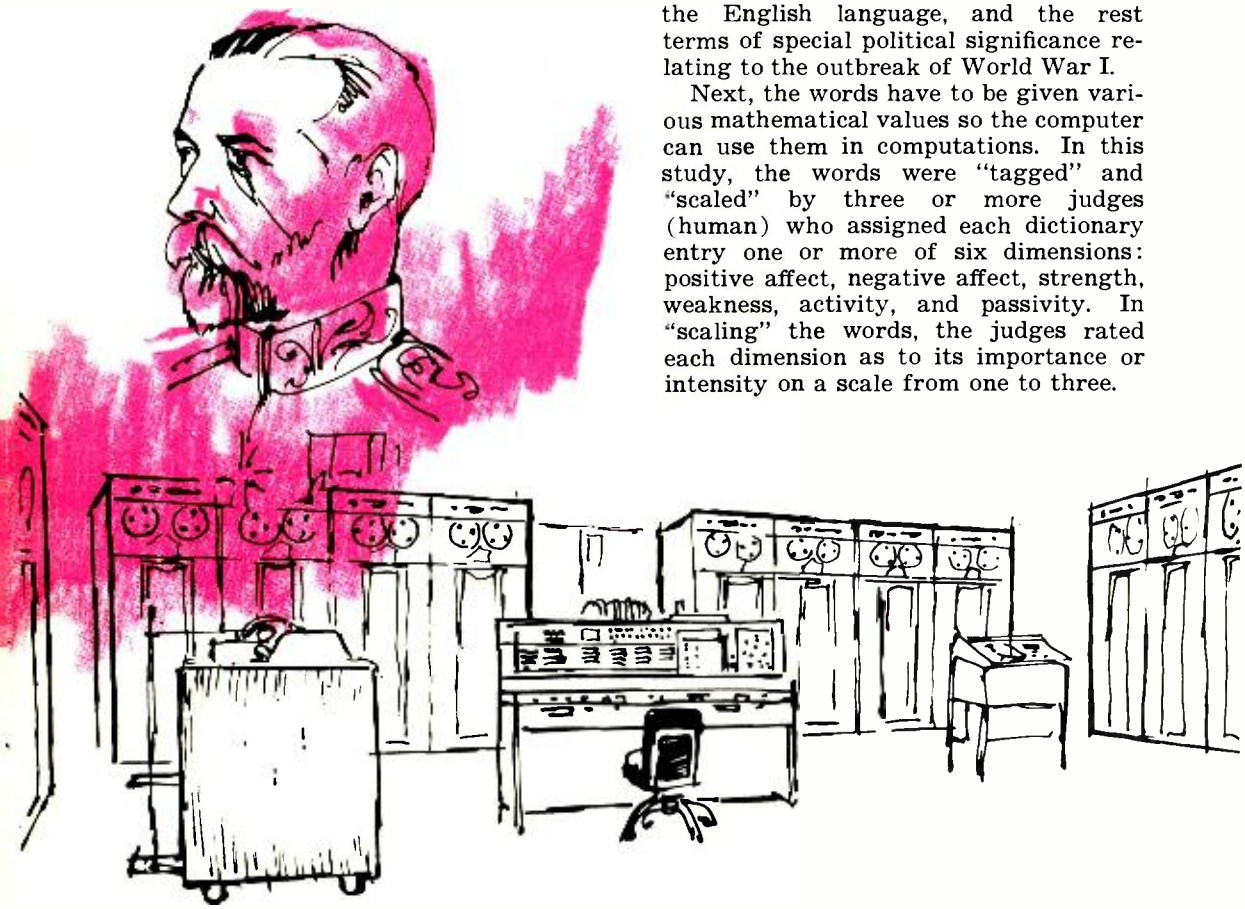
AS LORD KELVIN, famed 19th century British mathematician and physicist, once said, "When you can measure what you are speaking about, and express it in numbers, you know something about it. But when you cannot measure it or express it in numbers, your knowledge is of a meagre and unsatisfactory kind." Thanks to our rapidly expanding computer technology, more and more things can be expressed in numbers. The story of Stanford University's studies in "International Conflict"—why wars break out and why small wars grow into big wars—bears this out in astounding fashion.

Picking World War I as a thoroughly documented period of crisis with published speeches, press interviews, official releases, secret coded documents, diplomatic memos and other sources of information readily available, Stanford political scientists turned to computer technology to help analyze great masses of data. Working over the material for the critical six weeks before the war, the computers, an IBM 7090 and a Burroughs 220, came up with a number of startling conclusions, some of which run contrary to the history books.

Turning Words Into Numbers. Modern computers can handle mathematical problems at a truly fantastic rate—advanced machines solve thousands of complex equations in minutes—work that would take a team of expert mathematicians years to accomplish. When you ask a computer to handle *words*, however, the situation gets complicated.

The first step is to provide the computer with a "dictionary," that is, impress a signal of some sort at different "addresses" in the computer's memory, each representing a word. For the Stanford research, the computer was given a vocabulary of 3485 words, 3000 of which were commonly used words in the English language, and the rest terms of special political significance relating to the outbreak of World War I.

Next, the words have to be given various mathematical values so the computer can use them in computations. In this study, the words were "tagged" and "scaled" by three or more judges (human) who assigned each dictionary entry one or more of six dimensions: positive affect, negative affect, strength, weakness, activity, and passivity. In "scaling" the words, the judges rated each dimension as to its importance or intensity on a scale from one to three.



Give words numerical values, and a computer can analyze them. Above is Dr. Robert C. North, director of the Stanford University project, at the console of the IBM 7090.

The result was that the machine could be fed a word such as "abolish" and quickly spit out an analysis: in machine language, "NEG1STR3ATV3." To interpret, the word "abolish" has a negative affect of low intensity, a connotation of strength of high intensity, and a connotation of activity of high intensity!

Next, the computer was "taught" the names of people and places in a separate geographical and biographical dictionary. The word "Kaiser," for example, triggers a conditioned response in the machine that might go as follows: "KAISER = WILHELM + GERMANY + EMPEROR + PRUSSIA + KING." Finally, the machine was equipped with special "overstate" and "understate" tags so that it could analyze a statesman's manner of speaking. It was also instructed to disregard unimportant words and to allow for words of negation.

Preparing the Data. The most important step in electronically analyzing World War I was to break the data into "themes" or basic units consisting of the following: (1) the state which perceives the action; (2) the state whose action is being perceived; (3) the action itself; and (4) the target of the action.

Since there is no way by which a computer can discriminate between the functions of words in a sentence, it was also necessary to add subscripts to words conforming to the basic elements of the theme. Using the numbers above, an example might look like this: "Germany/1 feels/1 that France/2 is hostile toward/3 it/4." Still other subscripts were used to identify the time of the perception, whether or not the perceiver is perceiving something at home or in a foreign country, and whether or not he is offering an observation, an interpretation, or a reaction to something.

The Conclusions. What were the startling conclusions that the machines came up with in their attempts to second-guess the historians? They reported that during those six critical weeks before The Great War, Germany and Austria-Hungary regarded themselves as targets of hostility rather than agents of it; that France felt the same way; that the decision-makers for all the five major powers involved—Austria-Hungary, Ger-

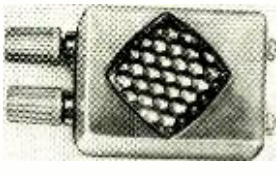
(*Continued on page* 96)

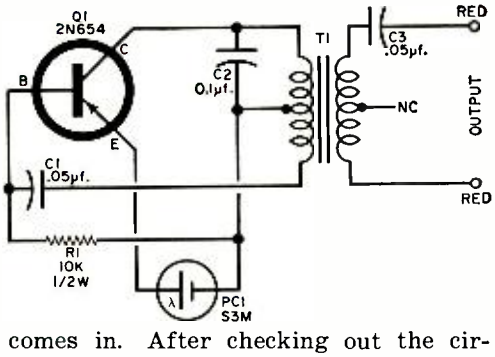
SPEED SERVICE WITH SIMPLE INSTRUMENTS

Here are some inexpensive instruments that will solve a great number of problems for almost any serviceman or experimenter. You build them simply, and use them often

By CARL HENRY

Light-Powered Oscillator

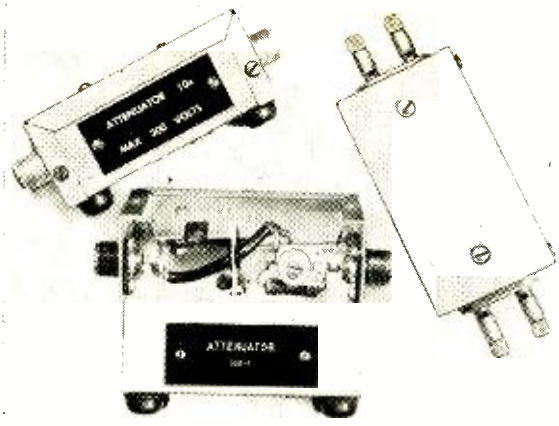


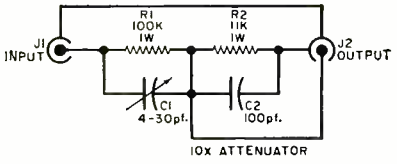


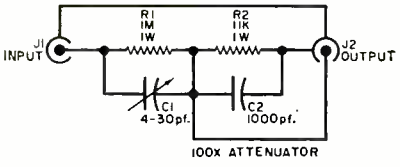
POWERED BY a solar cell for carry-anywhere testing, this oscillator's "battery" never runs down. In normal room lighting, the frequency is about 500 cycles and in sunlight increases to 2000 cycles; the unit works well to about 70 foot-candles. Output voltage ranges from .2 to almost 1 volt. The unit is built in the box that the transformer comes in. After checking out the circuit, the box can be filled with epoxy resin; the solar cell comes in its own case, and can be mounted outside the box. The transistor can be interchanged with either a 2N241A or a 2N109. Capacitor *C3* is rated at 400 volts. An Argonne AR-162 serves as *T1*, while *PC1* is an International Rectifier S3M.

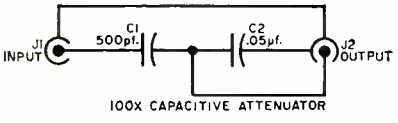
Three Handy Attenuators

OFTEN, THE SIGNAL you want to measure exceeds the maximum input ratings of your instrument. This can occur in the horizontal section of a TV set, or the spark of an automobile, etc. The upper two circuits on the next page describe attenuators for extending the range of scopes, volt-ohm-milliammeters and other amplifier/measurement circuits. Capacitors are used to compen-









sate the attenuator for higher frequencies, and these are adjusted by feeding a 10- or 100-kc. square wave to the attenuator input. Connect a scope to the output and set the trimmer for the best square-wave response with no peaking or rounding of the leading edge.

The attenuators are built into 2¼" x 2⅝" x 4" Miniboxes, and are fitted with a shield between the input and output circuits. This can be bent from scrap aluminum to fit the box. Drill a ⅜" hole in the shield and fit a rubber grommet in the hole to pass the lead wires through. When the box is completed, mount four rubber feet on the bottom.

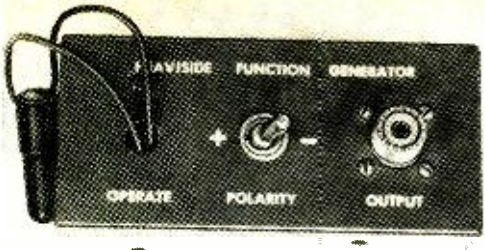
The third attenuator is an all-capacitor type with accuracy not much better than 10 per cent. With any signal, the output will be a true reproduction of the input, attenuated 100 times. To avoid leakage across the capacitors, use ceramic types. Capacitor *C1* is rated at 20 kilovolts, *C2* is 600 volts. Clean the capacitor bodies with alcohol and use high-leakage, low-loss connectors. This circuit has been used at up to 30 kilovolts but it is recommended that this voltage not be exceeded. The attenuator should prove accurate from one cycle to any frequency but distributed inductive and capacitive effects limit it to 30 mc.

In constructing the above attenuator, be sure to use high-voltage insulated dual metal binding post connectors.

Simple Signal Generator

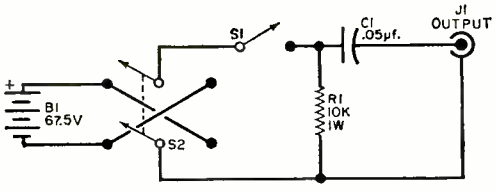
ONLY FOUR COMPONENTS? There's a catch—the generator transmits only one "step" pulse each time it is turned on. While this is no problem with long-persistence scopes, using the unit will normally involve constant on-off switching. This inconvenience, however, is offset by the versatility of the instrument. It is handy for testing amplifiers, and, after some experience, interpreting frequency response is easy. Switch *S1* must be a mercury switch to guarantee a clean trace—other types are too noisy.

The step, a long square wave, is handy for checking low-frequency response, and since it is infinitely long, it will also check ringing and surges in d.c. and low-frequency a.c. circuits. Load down the

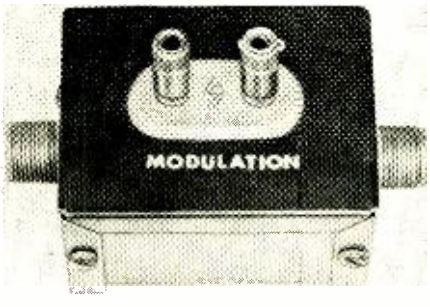


output with a 100-ohm resistor, and the resultant waveform will be a sharp spike for use on high-frequency circuits.

Capacitor *C1* has a working voltage of 600 volts. The author built his unit into a 2¼" x 2¼" x 4" utility box. The output connector is an Amphenol 83-1R coaxial type, and the outboard device seen in the photo is mercury switch *S1*. Toggle switch *S2* reverses the polarity of the battery, and therefore the polarity of the output pulse at connector *J1*.



Simple AM Modulator

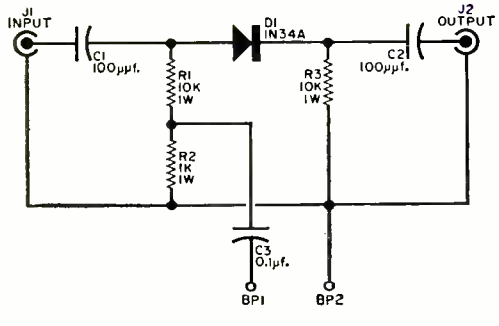


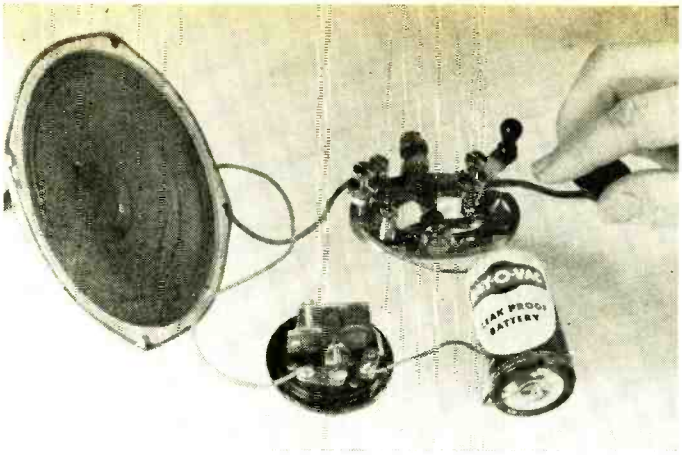
ANY NONLINEAR circuit element will cause modulation between two signals that are impressed across it. The unmodulated signal is applied across resistors *R1* and *R2*, with the modulating signal fed to *R2* only. The diode *D1*, our nonlinear circuit element, does the modulating.

The modulator is ideal for adding an audio signal to generators that do not provide audio. The output is complex, containing a percentage of AM, a small amount of phase modulation, and a mixture of unmodulated a.f. and r.f., but the first tuned circuit the signal reaches will clear this up.

BP1-BP2 is a National double binding post, and capacitor *C3* should be rated at 400 volts or better. The cabinet used to house this instrument is a 1⅝" x 2⅛" x 2¾" Minibox. Input and output connectors are Amphenol 83-1R coaxial types.

The unit has application in most electronics labs, and can achieve unusual effects such as pulse modulation, audio modulation of audio, etc. The completed unit is small and convenient, yet rugged enough for any tool kit. -30-



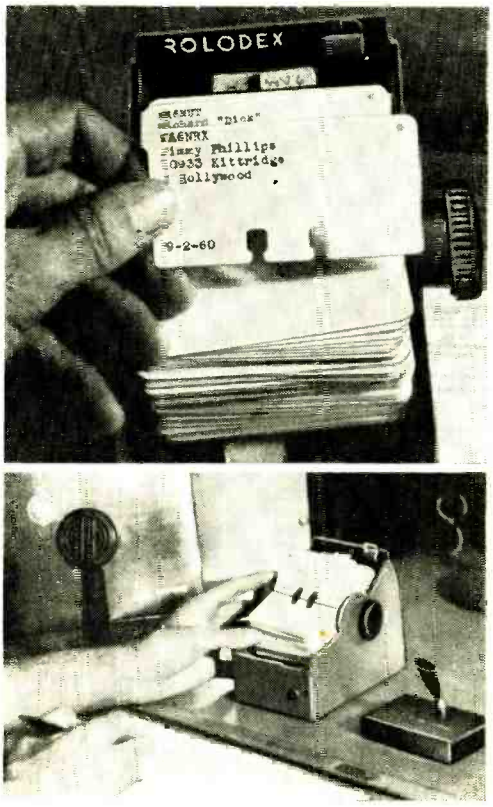


Connect a loudspeaker in series with a key, battery and a buzzer. Now you can hear the sound from the buzzer easily!

New Lungs for the Buzzer

IN LIEU of a code practice oscillator, many students of the code use a small, high-frequency buzzer in series with a battery and key. While this system works fairly well, the buzzer is a poor electricity-to-sound converter. To beef it up and create an inexpensive "CPO" suitable for large or small groups, add a loudspeaker in series with it. The current is drawn through the speaker voice coil, interrupted at a high-frequency rate, and the sound is big enough for classroom instruction. It is not necessary to increase the battery voltage at all, and the battery life will be unimpaired by the inclusion of a loudspeaker in the circuit.

—C. E. Miller



Rotating QSO File

KEEPING TRACK of your on-the-air contacts is not easy. Many hams try to file QSL cards, but not all hams QSL, and not all use the same size cards. A rotary file like the one shown here is available at most stationers, and prices start at $5 depending on size and capacity. On the front of the card, list the ham's call letters, name, address, phone number (for locals) and, if you choose, date of initial contact. The reverse side is used to record additional information such as QSL record, equipment, and personal details including name of XYL, junior ops, etc. With this system, you can develop a reputation as a memory expert on your favorite bands. It's better than using the limited remarks column of the logbook, and far better than frantically thumbing through the callbook.

—L. F. Kiner, K6VNT

Tune Away Rock-Bound CB Receiver

Tune the whole band with your crystal-controlled receiver and this unit

By R. L. WINKLEPLECK, KHA1353

MANY CB RIGS are equipped for fixed tuning, with no provision whatever for variable tuning. If the receiver is able to accept 23 crystals, this is no problem—except for the mortal blow to the pocketbook! Unfortunately, a great number of CB'ers are rock-bound to four, six, or eight channels, when they would prefer to listen clear across the CB spectrum.

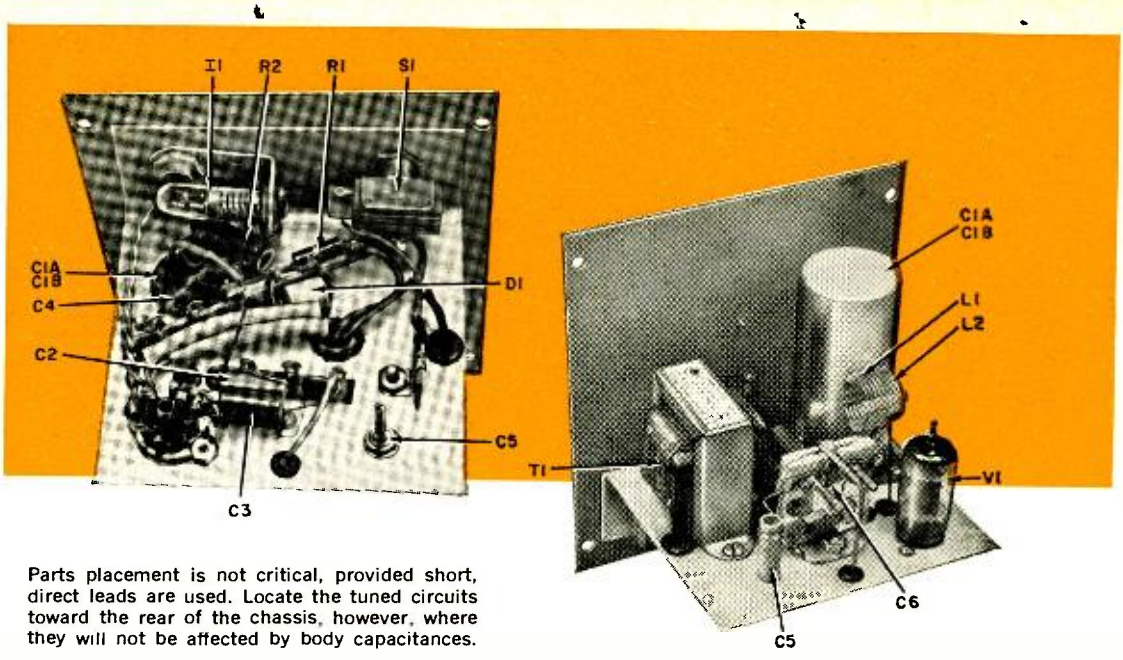
This simple outboard tuner helps to solve the problem. Cost of construction is modest, and it's an interesting but not a difficult project. It consists simply of a calibrated variable frequency oscillator which plugs directly into one of the crystal receive sockets. No modification of the transceiver is required.

How It Works. The tuner is a simple triode oscillator. Its dependability and stability make it a logical choice for this job. The parallel inductance and capacitance in the grid circuit determine the frequency of oscillation. These oscillations are then fed to the converter tube of the superheterodyne receiver to produce a difference frequency matching the i.f. frequency of the receiver. For example, let's assume that your receiver has an i.f. of 455 kc. If this tuner is adjusted for a frequency of 27,560 kc., you'll hear any signal on 27,105 kc. (channel 12). No special technical knowledge or frequency measuring equipment are required to build and operate the unit.

To make the tuner more universal in application, a capacitor (*C5*) is provided to place the oscillations in a range of 24 to 33 mc. It can, therefore, be used with any CB superheterodyne receiver except the new synthesized-frequency receivers on the market today. These tune all 23 channels anyway, and do not require a tuner.

Another capacitor (*C6*) is added which tunes a 300-kc. range to spread the 23 channels over the entire dial and make accurate tuning easy. Commercial coils are used for *L1* and *L2* to eliminate guesswork and experimentation.

Building The Tuner. While the tuner can take any form the builder chooses, it is necessary to provide rigidity and adequate ventilation. Keep all leads as short and direct as possible, and provide



Parts placement is not critical, provided short, direct leads are used. Locate the tuned circuits toward the rear of the chassis, however, where they will not be affected by body capacitances.

good ground connections. Keep the tuning circuits as far back as possible from the front panel to reduce body capacity effects.

Over half the construction costs can be saved by borrowing the operating voltages from the receiver. You'll need 6.3 volts for the filament and approximately 150 volts B-plus. If the available voltage is too high, add a resistor in the B-plus line to drop it to the proper level.

The author's unit is built into a 4″ x 5″ x 6″ utility box. An L-shaped aluminum chassis is fitted to the front panel with the switches and pilot light assembly. Power transformer, filter capacitor and tube are up front, the coils and tuning capacitors at the rear. Use tie strips wherever necessary.

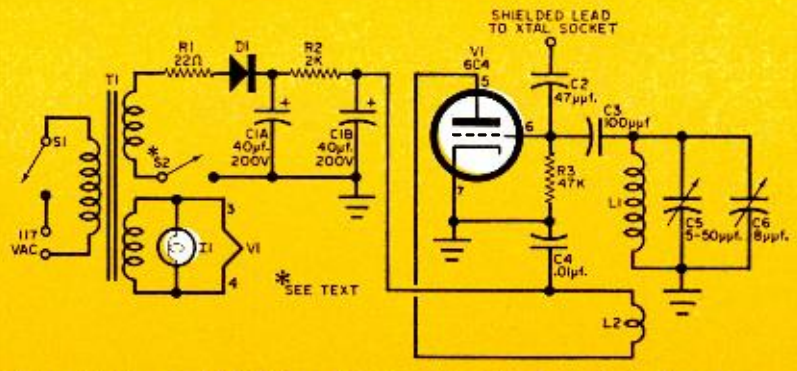
A vernier tuning dial is highly desirable. This is attached to the bandspread capacitor *C6* with a short length of Bakelite rod. The broad tuning capacitor, *C5*, is a piston type, and a mating hole in the bottom of the cabinet permits adjustment after the cabinet is buttoned up.

The coils are formed from a single length of commercial coil stock as specified in the Parts List. Unwind one or two turns at one end to form a lead wire, then leave five turns for *L1*. Cut the next turn at the center, and unwind a half turn each way for the inner leads of both *L1* and *L2*. Three more turns are left for tickler coil *L2*. Unwind a bit more for the final lead, and trim the plastic coil supports. The balance of the coil stock can be saved for a future project. The plastic supports hold the coils in alignment, and exactly one turn apart.

Use a short length of shielded cable, such as microphone cable, to connect the tuner to the CB receiver. The shield is grounded to the chassis at the tuner end, and the other end is terminated with a plug to fit the crystal socket. You can use an old crystal for this termination, or a couple of pieces of large diameter wire will do the job nicely. One side of your crystal socket will probably be grounded, and the shield wire should go to this side.

Adjustment and Calibration. Before assembling the unit in its cabinet, you should check for approximately 150 volts at the plate of the tube (pin 5) and be sure that the filament lights. You can check for oscillation by reading about five volts negative at the grid (pin 6). If the circuit is not oscillating, try reversing the leads to the tickler coil, *L2*.

Put the unit in the cabinet, connect the tuner to the CB rig, and turn both units on. Allow them to warm up for about 15 minutes. Turn the crystal se-



Schematic diagram of the Citizens Band tuner. Switch S2 is used to allow warm-up.

PARTS LIST

C1a, C1b—40-40 μf., 200-volt dual electrolytic capacitor
C2—47-μμf. mica capacitor
C3—100-μμf. mica capacitor
C4—0.01-μf. disc capacitor
C5—5-50 μμf. piston capacitor (JFD VC-50CB)
C6—8-μμf. variable capacitor
D1—400-PIV, 200-ma. or better, silicon rectifier
I1—Pilot lamp assembly
L1, L2—Construct from B & W Miniductor #3007 (⅝" diameter, 16 turns per inch) as described in text
R1—22-ohm, ½-watt resistor
R2—2000-ohm, ½-watt resistor
R3—47,000-ohm, ½-watt resistor
S1, S2—S.p.s.t. toggle switch
T1—Power transformer; primary 117 volts a.c.; secondary windings 125 volts, 6.3 volts (Stancor PS-8415)
V1—6C4 vacuum tube
1—4" x 5" x 6" utility box
1—7-pin miniature tube socket
1—L-shaped aluminum chassis to fit utility box
Misc.—Hardware, wire, a.c. line cord, solder, tie strips, rubber grommets, shielded cable, plug to fit crystal socket

lector to the socket in which the tuner is plugged. Set the plates of *C6* to the half-meshed position and, with a signal coming in from another station, you are ready to make the only adjustment required.

Insert a long plastic screwdriver through the bottom of the cabinet and slowly adjust *C5* until you pick up a signal. A small fraction of a turn will take you through several channels, so tune slowly and be patient. This adjustment is simplified if the receiver has an "S"-meter but your VTVM, connected across the a.v.c. line, will work as well. Spot a few signals off the air on the dial, and from these, you can locate the balance of the channels. They are equally spaced except for an extra space between channels 3-4, 7-8, 11-12, 15-16, and 19-20. There's a double space between 22 and 23.

There are two places on *C5* where any given signal will be heard. This represents the signal plus the i.f. frequency, and the signal minus the i.f. frequency. Try both settings, and if a difference is noted, use the better of the two.

This is a good, dependable, economical Citizens Band tuner. It is, however, not a precision instrument, and exhibits some drift during warm-up. When you first turn it on, you may find channel 9 where channel 4 was last night. This represents a drift of only 60 kc. in 28,000, so it isn't bad. (Improving the unit significantly would raise the cost by a factor of ten.) You can search for the correct frequency, or allow a ten- or fifteen-minute warm-up period.

Optional switch *S2* permits you to open the B-plus line to allow for this warm-up. Turn switch *S1* to the "on" position, and the tube filaments will light. The unit will not function, however, until switch *S2* is closed. This standby function of *S2* permits you to warm the tuner up in silence without the disturbing background noise normally associated with a receiver.

Do not attempt to use the tuner to replace one of the crystals in your transmitter. For one thing, the drift of this

unit precludes its use for controlling a transmitter, and more important, such units are illegal on the Citizens Band!

One other small problem may vex you, but you can usually remedy it before it occurs. It is not likely that your CB transceiver is an a.c.-d.c. type or one of those with a "universal" transformer power supply that allows considerable leakage current to ground; but if it is, you may well wind up with a "hot" chassis, and at the least, some hum problems. In any event, measure between the chassis and ground with an a.c. voltmeter. If you get a reading, try reversing either or both plugs in their sockets. As long as both units are transformer-operated, it would be a good idea to ground them securely.

To calibrate the dial properly, start with pencil markings that can easily be erased to make changes as you use the tuner. When, after a few weeks, you find that the dial is set to your satisfaction, you can remove the dial and, using India ink or press-on letters, make the markings permanent. A protective coat of fixative will prevent the markings from rubbing off.

If you want to dress up the tuner to match your CB rig, remove the panel and paint it with a spray enamel, using masking tape where necessary. Spray on several light coats instead of one or two heavy coats to prevent dripping. Reassemble the unit, and add lettering with decals or press-on letters.

After you use the unit to tune across the CB channels a few times, you'll begin to wonder how you ever got along without it. You may even decide to change a few of the crystals in the transmitter section of your transceiver to get on a more useful or active channel. -30-

Economy CB S-Meter

A REALLY inexpensive S-meter circuit has been with us for a long time, but the general lack of suitable meters has made its use uncommon. Now, Shurite has come up with a small, inexpensive meter for this application. The trick lies in the fact that the needle of the instrument is at rest on the *right* side of the scale at 40 db over S9. As the current through the meter increases, the needle moves down-scale to the *left*. Simply insert the meter in any superhet circuit which draws maximum current under no-signal conditions and less and less current as signal strength increases, and presto, you've got an accurate S-meter!

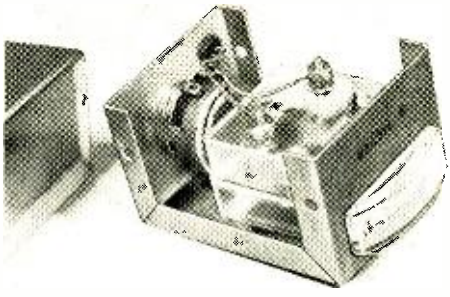
A convenient edgewise model with conventional S-meter scale, the meter is identified as Model 350, Stock No. 3333, priced at $3.45. Probably any mail-order house handling Shurite can supply it, but Walter Ashe Radio Co. of St. Louis has the only catalog listing noted. The movement is 0-5 d.c. ma.

The only other part needed to construct the "Economy CB S-Meter" is a 10,000-ohm, 1-watt potentiometer. Simply connect one end lug of the potentiometer to one meter terminal, and the center lug to the other meter terminal, and you've got it. To install the unit in your transceiver (or other superhet), just break the B-plus lead going to the plate of the receiver r.f. stage and insert the meter-potentiometer combination in series with it. The best place to break the B-plus lead is between the power supply and the r.f. output circuit of the r.f. amplifier—usually at the bottom end

The Economy S-Meter can be built into a receiver or transceiver or constructed as an outboard unit as shown here. One advantage of the Minibox version is that it can be installed in an automobile where the driver can easily glance at it.

of the primary of the r.f. bandpass transformer, leaving the lead between the other end of the primary and the tube plate intact.

When no signal is being received, the current is greatest, and the potentiometer can be adjusted for a zero meter reading (if the meter won't read down-scale, just reverse the leads to the meter). When a signal is picked up by the



All it takes are two parts—an inexpensive meter that reads from right to left, and a shunt

By MAX MILLER

receiver, the automatic volume control (a.v.c.) reduces the plate current flow, and the meter moves up-scale, indicating the relative strength of the signal. The meter reading is, therefore, dependent on the a.v.c. action of the receiver which is proportional to signal strength.

The foregoing makes clear that the Eonomy S-Meter can be used only with a superhet having a.v.c.-controlled stages. An a.v.c.-controlled r.f. stage is usually necessary, since the r.f. tube is most often the only a.v.c.-controlled stage drawing enough current (5 ma.) for full meter deflection. Since this fits the specifications of 75 per cent of all CB rigs and many amateur receivers, chances are good that you can install the S-meter as described. In some cases, it may be possible to apply the same idea to the receiver's second i.f.

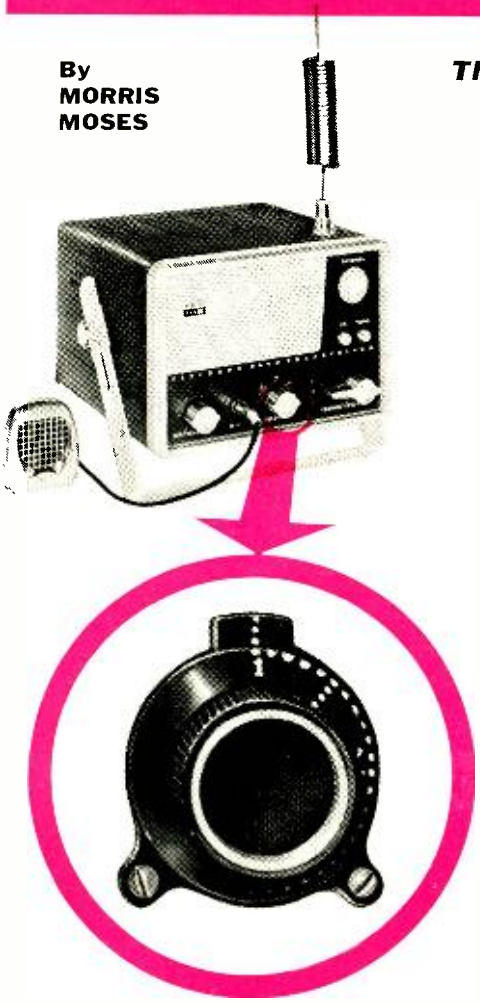
There's plenty of space to mount the S-meter on the front panel of many rigs, but another arrangement for mobile installations is to mount the S-meter and pot in a 2¾" x 2⅛" x 1⅝" Minibox (CU-2100) as shown above. The plastic meter mounting tabs are clipped off to fit the box, and the meter secured with epoxy cement. The pot—use one with a stub shaft slotted for screwdriver adjustments—mounts in the opposite end of the box.

Connect the S-meter to the rig with a length of two-conductor cable (well-insulated), and secure it directly in front of the driver atop the dashboard. This way you can watch the road and the meter simultaneously. -30-

Update Your Eico 760

By
MORRIS
MOSES

The ease and accuracy of precision tuning costs you just $1



Remove metal scale and paint it black. For CB use, re-mark dial by using drops of white paint or ink.

DOES YOUR CB rig lack a vernier tuning knob for effortless, precision tuning? If it does, you can probably add one very inexpensively. The Eico 760 is a good example of a transceiver which can be easily modified. The new knob is one of a number of Japanese-manufactured vernier tuning dials that are available in several sizes. The author's (Calrad VD-36, 36 mm.) is about 1½" in diameter and costs a dollar. Installation is simple.

Take time to measure the inside length of the vernier knob bushing. You will probably have to cut off a portion of the shaft extending from the CB transceiver's tuning capacitor. Most rigs provide a coupling bushing with setscrews for this shaft. If this is the case, loosen the setscrews, remove the shaft, and cut off the required amount with a hack saw; file off any burrs.

The vernier tuning dial has two threaded receptacles to receive screws for mounting. Carefully mark the panel with a sharp punch and drill two holes through the panel and chassis apron. That's all there is to mounting the vernier dial.

Since your new dial will be marked with an arbitrary 0-100 or 0-10 scale, you'll probably want to calibrate it. One method is to first paint the dial face a jet black using a quick-drying black enamel. The steel plate engraved with the original scale is removable, which makes the job easy.

When the black paint is dry, use a toothpick to place round drops of white ink or enamel at each of the 23 assigned channel positions. When the drops are dry, use a pen and straightedge to draw dividing lines every few divisions. Finally, print in channels 1, 6, 12, 18, and 23; or, if you prefer, label only those channels you're interested in. You'll be able to tell at a glance which channel you're on, and you'll enjoy vernier accuracy when you tune. -30-

Revamp Your CB for Better Noise Limiting

Conversion to the Makino circuit requires almost no new circuit components

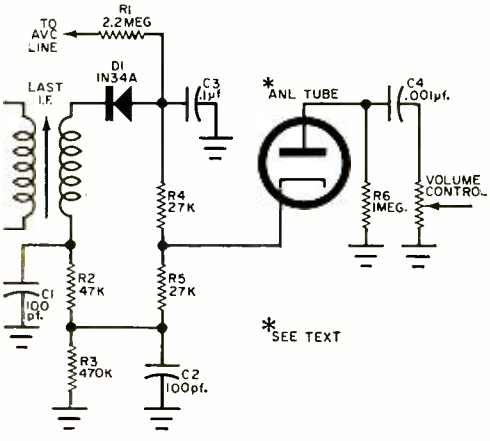
By R.L. WINKLEPLECK
KHA1353

MOBILE NOISE is the worst bugaboo of Citizens Band radio. No one but a dyed-in-the-wool CB'er would put up with it. After the newness wears off the rig, it is noise more than anything else which kills the day-to-day enjoyment of instant communications.

After you've given your car the full noise-suppression treatment—spark plug suppressors, bypass capacitors, etc.—and find you still have ignition noise problems, you may be tempted to give it up as a hopeless job, especially if your car is a bad offender. Before you do, however, you might try the noise limiter modification described here for the technically-minded CB enthusiast. The limiter, which really deserves to be called a "silencer," is known as the Makino circuit after its Japanese designer, and its simplicity makes its excellent performance all the more amazing to the user.

This circuit does not eliminate ignition noise. It does, however, reduce even noisy ignitions to a level which can be easily squelched out. In most installations, if the receiver squelch is set to just quiet background noise with the ignition off, starting the car will not break the squelch. The Makino circuit is particularly effective on sharp peak noises of all kinds.

Makino noise limiter as applied to a typical CB transceiver; only new parts are resistors R4-R5.



The Makino Circuit. Let's take a look at the limiter circuit. As shown in the schematic, the diode detector, *D1*, is connected so that it conducts on the negative part of the cycle when a signal is received. This negative voltage is below ground, since the other end of the i.f. transformer is grounded. The negative-going signals charge the large capacitor, *C3*, and the effect is to establish a negative bias on the cathode of the ANL or noise limiter tube. This negative, below-ground d.c. bias is kept constant by *C3*, and the result is that the ANL tube—note that its plate is carried to ground through a 1-megohm resistor—is forward-biased, and conducts.

Meanwhile, audio signals appear at the junction of *R4-R5*, and reach the volume control without difficulty, where they are passed on to the audio amplifier. Although audio signals are grounded at the junction of *D1-C3* by *C3*, they reach the cathode of the ANL through *R2-R5* (*R3*, *C1*, and *C2* represent formidable impedances at audio frequencies).

Although the audio signals swing the voltage on the cathode of the ANL tube in a positive direction, they do not do so to the extent that they cut the tube off. When a noise pulse comes along, however, the audio level rises *sharply* in a positive direction, and the ANL is quickly cut off, isolating the pulse from the audio circuit. At the same time, however, the circuit recovers very quickly when the pulse terminates—so quickly that you would never know the noise was there.

Modifying Your Transceiver. Deciding how to modify your own transceiver is the only part of the job we cannot detail here. The great number of variations in transceiver circuitry means that you'll have to do a bit of "homework" with a diagram of the receiver section of your unit before you can go ahead. If you can properly analyze the present detector/noise limiter arrangement in your rig, you'll have little difficulty in determining how to change over to the Makino circuit.

One of the interesting aspects of this conversion is that you will probably have to buy almost no new components—typically, only two 27,000-ohm resistors, *R4* and *R5*, are required. You may find that your transceiver uses a vacuum-tube diode detector; if so, so much the better. In many cases, the Makino circuit works better when a vacuum tube is used. The *C1*, *C2*, *R2*, *R3* filter network connected to the lower side of the last i.f. transformer secondary was a part of the original circuit in the transceiver modified by the author. The components used in your rig may not have exactly the same values shown, but you'll recognize their similarity, and no parts changes are needed.

Among the changes you will probably have to make is reversing the polarity of the diode detector; this also holds true for the ANL tube. Reconnect the automatic volume control (a.v.c.) line to the junction between the diode detector and *C3*; *R1* and *C3* (or components close in value to them) will probably be found in the transceiver as part of the original a.v.c. setup. Again, give the schematic of your rig a lot of careful study before making with the soldering iron, and success should crown your efforts. -30-

Double CB Talk Power

For a signal with sock, build a compression amplifier with automatic modulation control

ALTHOUGH MANY CB'ers are not aware of it, you can almost double the effective "talk-power" of a CB transmitter with the addition of a legal, rather inexpensive accessory to your rig. The name of this handy gadget? The compression amplifier.

As with other units of this type, the compression amplifier illustrated here raises the average modulation level of the transmitter while, at the same time, limiting peak modulation to something under 100 per cent. To the listener, the audio will seem to double. Although other types of limiters may produce equal results, the one described was selected because it can be constructed in compact form at a moderate price—about $6 or $7.

A look at the block diagram on page 56 will give you a good idea of how the compression amplifier functions in con-

junction with a CB transceiver. With the switch at "IN" position, the amplifier is connected in series with the microphone. Voice signals are amplified and passed on to the transmitter audio system. At the modulator, a sample of the signal is taken, rectified by the 1N34 diode, and filtered to provide a negative voltage which increases and decreases with average voice level. The negative voltage is fed back to the amplifier to control its gain, making it act much like an automatic gain control.

The result is that weak signals produce very little voltage feedback and so are given maximum amplification. Loud signals—which would tend to overmodulate the transmitter—generate a negative voltage which reduces amplification. The average signal level is much greater with the compressor than without it, so the average modulation percentage will be closer to 100 per cent—a considerable increase in useful voice-power output.

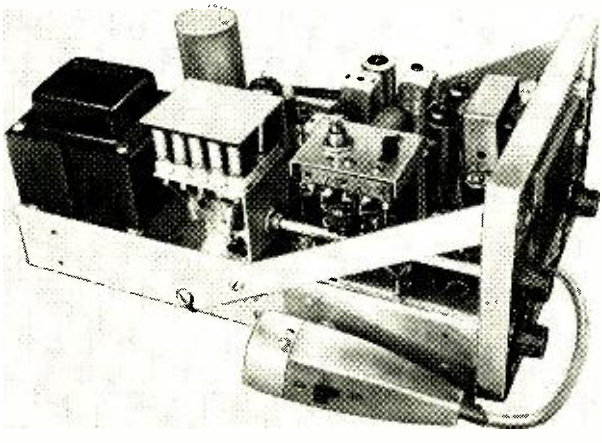
There is a limit to the amount of compression that can be used, for it does alter voice characteristics. Very deep compression makes a voice sound like it's coming from a barrel. On the other hand, a moderate amount of compression will add little, if any, noticeable distortion to a transmitted audio signal.

Amplifier Construction. The author's prototype compression amplifier was built in a 1⅝" x 2⅛" x 2¾" Minibox for mounting inside or outside a CB transceiver; this particular layout was used simply because the completed amplifier fits within a Johnson "Messenger" transceiver.

As shown in the photos on this page and page 56, "IN-OUT" switch *S1* and gain control *R11* are mounted at one end of the box. Punch a hole and mount a 7-pin miniature tube socket with shield base on the large flat surface of the main part of the box. For point-to-point wiring, mount two four-lug terminal strips on a ¾" spacer (the spacer keeps connections out of the way of the tube socket) in the center of the box, and a five-lug strip at the end with *S1* and *R11*.

Although input and output connections may be terminated at jacks (*J1*, *J2*, *J3* in the schematic) if you build an outboard amplifier, the author wired his unit directly to a transceiver as an integral part of the rig.

There is nothing critical about the wiring of the unit, layout of the parts, or lead lengths provided some care is taken to avoid hum pickup. The components listed in the Parts List were selected primarily because they are available from local supply houses. Disc ceramic capacitors were used in some places because they are small, paper capacitors with low voltage ratings for the same reason. Capacitor *C4* is a 50-



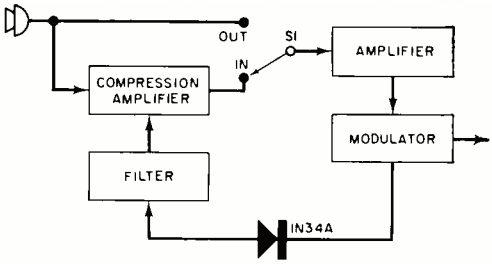
Compression amplifier, here installed in author's Johnson "Messenger," is the small chassis with the screwdriver-adjust pot and slide switch mounted on top. Unit makes possible high average modulation without over-modulation.

By W.H. MINOR, 6Q5030

w.v.d.c. ceramic disc of the variety used in transistor circuits. All resistors and capacitors, as well as diode *D1*, are supported on the three terminal strips.

Installation and Wiring. When the amplifier is completed, mount it so that there is a good ground between the Minibox and set chassis; alternately, add a ground wire if the amplifier is an outboard unit. Run an unshielded wire from pin 4 of the 12BA6 to the positive side of the 12-volt filament supply, and the B-plus lead to the best filtered point in the transceiver's B-plus network. Between 150 and 250 volts of B-plus will operate the compression amplifier.

The next step is to connect a short shielded lead from *J2* (or from *C1* and ground if *J2* is not used) to the modulator of the transmitter. If the set uses an output transformer as a modulation choke, connect this lead to the plate of the modulator tube. If the set has a modulation transformer, connect the shielded lead to the power amplifier side of the secondary of the transformer. Finally, using shielded wire, connect a microphone to *J1*, and the output of the compression amplifier to the microphone input jack of your transceiver. The unit is now ready to test.

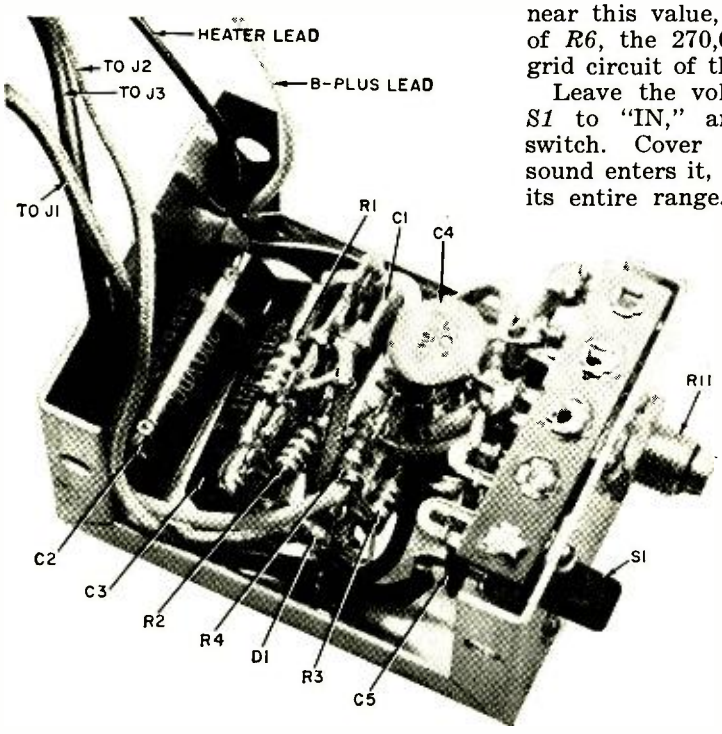


A diode and filter arrangement sample audio at the modulator and increase or reduce amplifier gain.

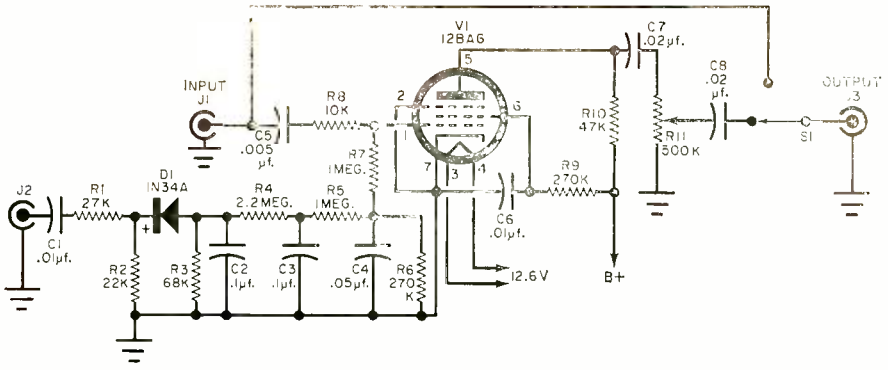
Testing and Adjustment. Before you try testing the compression amplifier, load your transmitter into a good dummy antenna in the usual manner, with switch *S1* in "OUT" position. Monitor the signal with a second unit a few yards from the transmitter. The transmitter should operate and sound exactly the way it did before modification.

With *S1* still in "OUT" position, connect a 20,000 ohms-per-volt d.c. voltmeter from the junction of *R4* and *R5* to ground. Press the transmit switch and whistle into the microphone. The meter should show a peak reading of about −2 volts. If the voltage is not near this value, increase the resistance of *R6*, the 270,000-ohm resistor in the grid circuit of the 12BA6.

Leave the voltmeter in place, throw *S1* to "IN," and press the transmit switch. Cover the microphone so no sound enters it, and rotate *R11* through its entire range. The monitor receiver



Top view of Minibox used for compression amplifier. Many of the components are hidden below the two tie strips (mounted in center of box on a single ¾" spacer) and front tie strip.



Circuit diagram of the compression amplifier. Layout and wiring is, for the most part, non-critical.

PARTS LIST

C1—0.01-μf., 1000-volt ceramic disc capacitor
C2, C3—0.1-μf., 200-volt paper capacitor
C4—0.05-μf., 50-volt ceramic disc capacitor
C5—0.005-μf., 600-volt ceramic disc capacitor
C6—0.01-μf., 600-volt ceramic disc capacitor
C7, C8—0.02-μf., 600-volt ceramic disc capacitor
D1—1N34A germanium diode
J1, J2, J3—RCA phono jacks (optional)
R1—27,000 ohms
R2—22,000 ohms
R3—68,000 ohms
R4—2.2 megohms
R5, R7—1 megohm } *All resistors ½-watt*
R6, R9—270,000 ohms } *½-watt*
R10—47,000 ohms
R11—500,000-ohm potentiometer
S1—S.p.d.t. slide switch
V1—12BA6 vacuum tube
1—1⅝" x 2⅛" x 2¾" Minibox (CU3000A)
1—7-pin miniature tube socket with shield
Misc.—Terminal strips, ¾" spacer, hardware, shielded cable, wire, solder

should detect no noise and very little, if any, hum. Hold the transmit switch on, and whistle a loud, sustained tone into the microphone. Adjust volume control *R11* so that no change occurs in the measured voltage as the compressor switch is thrown from "OUT" to "IN."

To make sure the compressor is working, switch the unit out and whistle softly into the microphone. Without changing the volume of the whistle, switch the unit in. There should be a very noticeable increase in volume from the monitor. The increase is more readily detected if the monitor volume control is set low.

On the Air Tests. Try the amplifier while in communication with another unit at least a mile away. With the compression amplifier off, your transceiver should sound as it normally does; with the amplifier on, there should be a decided increase in volume at the receiving unit. Ask the other operator to carefully check voice quality. There may be some change, but your voice should be easy to understand and not muffled.

If the quality is not as desired, back the volume control (*R11*) off slightly to lower compression. This may be necessary, particularly if there is a tendency to shout or talk loudly into the mike. The unit works best if a normal tone is used—even a little on the soft side. Let the amplifier do the work.

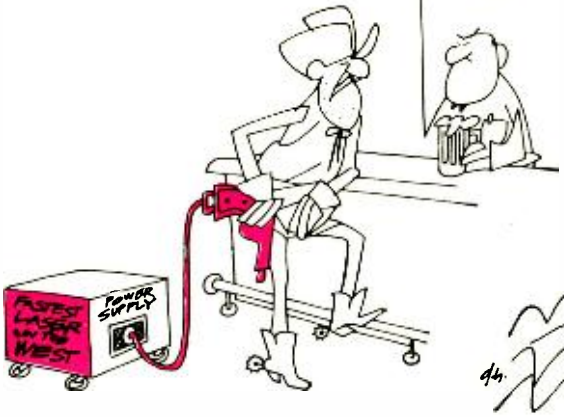
As a last suggestion, take the transmitter to a qualified technician and ask to have the modulation level checked. With the instruments he has available, he will be able to make optimum adjustments, and show you the best way to hold the mike and speak into it. He should be able to show you an oscilloscope picture of the signal which will reveal just how much increase in modulation the amplifier provides.

The compression amplifier installed in the author's Johnson "Messenger" increased the average percentage of modulation from about 25 per cent to about 50 per cent with only a faint change in voice quality. The modulation peaks were found to be about 85 per cent with very little distortion. —30—

"THERE'S A LASER

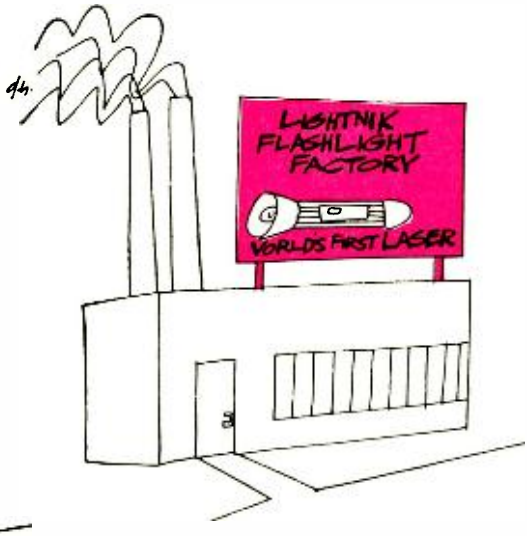
MOVIES

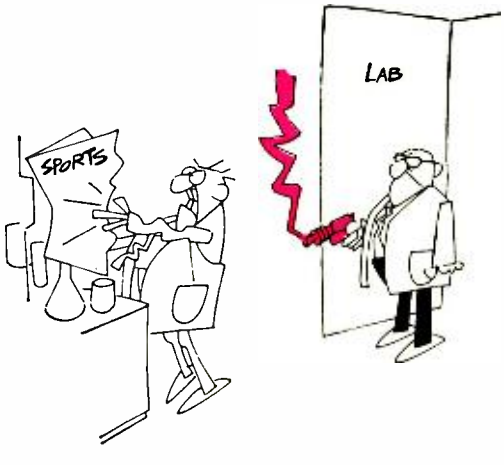
The LASER will create a new western hero.



SCIENCE

The Russians will of course have invented the LASER first.





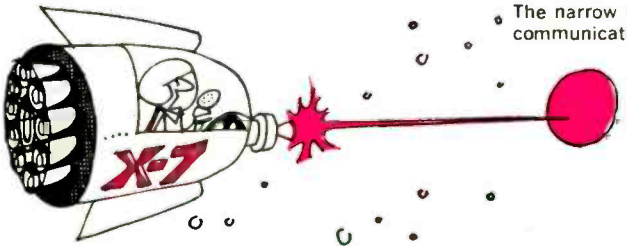
CHEMISTRY

The LASER will be used as a catalyst to speed up experiments.

IN YOUR FUTURE"

By DAVE HARBAUGH

SPACE COMMUNICATIONS

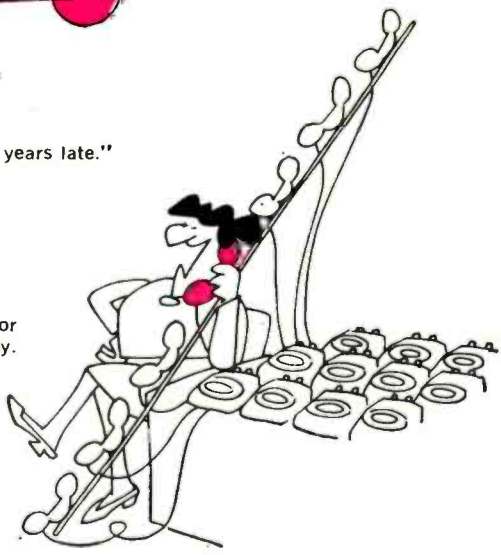


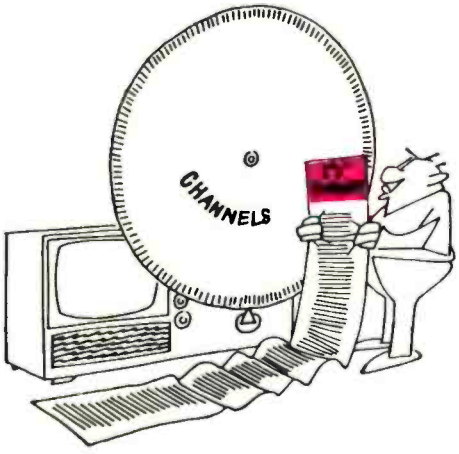
The narrow LASER beam will make possible private communications to and from space.

". . . Honey, don't wait dinner . . . I'll be a few light years late."

TELEPHONE

A single LASER could produce enough bandwidth for 10 billion telephone conversations simultaneously.



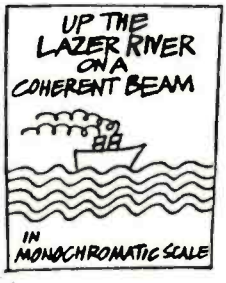


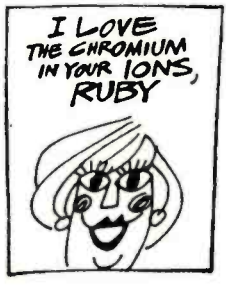
TELEVISION

There will be many more channels to choose from.

MUSIC

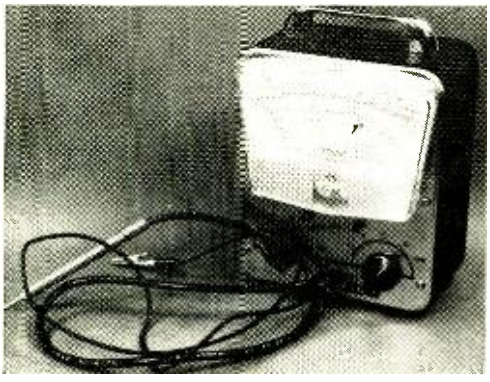
The LASER will undoubtedly inspire songwriters.

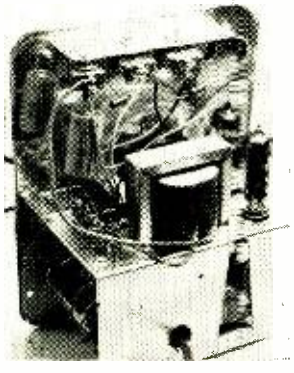




Product Reviews

VACUUM-TUBE VOLTMETER KIT





Probes (above) are permanently attached. Calibrating controls at top of unit (left) are set after construction, reset if battery change becomes necessary.

Reader Service No. 84 (see page 15)

ONE NICE THING about this meter is that you won't lose the probes and there are so few of them. *Conar Instruments*' Model 211 VTVM has only two leads, both of which are permanently attached. The function switch takes care of all selecting with no switching of wires. The unit measures d.c. voltages from 0 to 1200 volts in six steps, and goes from 0 to 1200 volts a.c. in six steps with a separate meter scale for peak-to-peak a.c. in six steps from 0 to 3200 volts. Six ranges are also provided for ohms, with the low range reading from 0 to 1000 ohms (10 ohms center scale), and the high range from 0 to 1000 megohms (10 megohms center scale). Accuracy of the meter is ±3% for d.c. readings, ±5% on a.c. to 6 mc., and ±10% for resistance readings.

For additional ruggedness, a 0-1 ma. meter is used. The necessary sensitivity is achieved by using a 12BH7 (degassed and pretested) in the bridge circuit. Input resistance of the unit is 12.2 megohms and shunt capacitance is 52 $\mu\mu$f. An optional high-voltage probe is available to extend the d.c. range of the instrument to 30,000 volts.

The unit can be completely assembled and ready for use in less than five hours of building time. Complete building and calibrating instructions are included.

CITIZENS BAND TESTER KIT

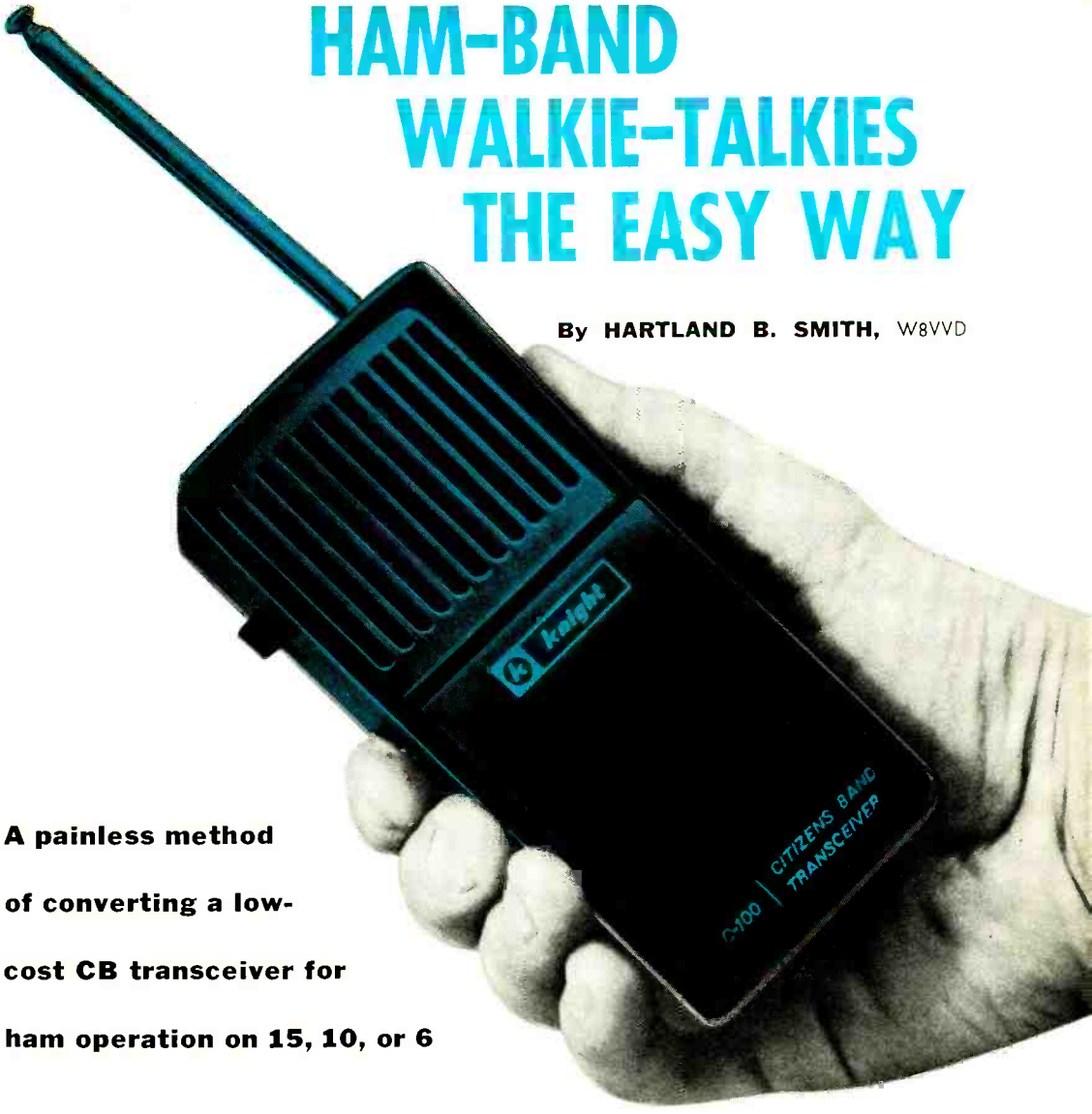
Reader Service No. 85 (see page 15)

THERE'S scarcely a test you can make on a CB transceiver that you can't make with *Allied Radio*'s Knight-Kit Ten-2 Citizens Band Checker. In addition to measuring relative SWR, output power, positive and negative modulation percentage, field strength and crystal activity, you can also use the unit as a signal monitor, crystal-controlled r.f. generator, and audio generator, or a code practice oscillator.

It takes approximately six hours of building time to complete the tester, and a few hours more of familiarization to learn to use it properly. Even if your rig is working well, the tester will help squeeze that last possible bit of performance out of it. If it isn't working well, this unit will probably tell you why.

HAM-BAND WALKIE-TALKIES THE EASY WAY

By **HARTLAND B. SMITH,** W8VVD

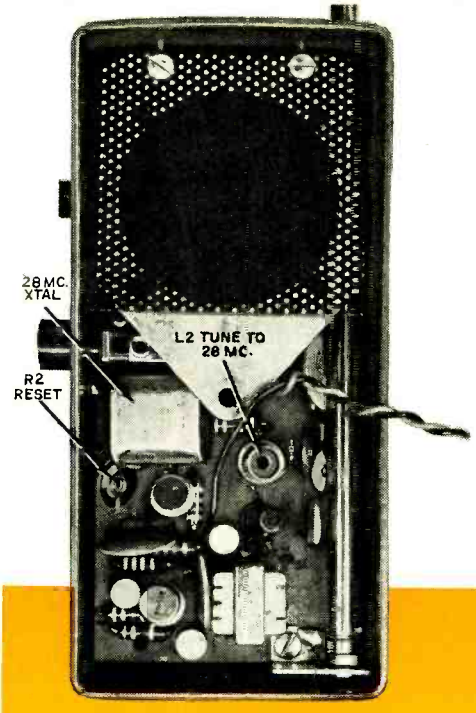


A painless method of converting a low-cost CB transceiver for ham operation on 15, 10, or 6

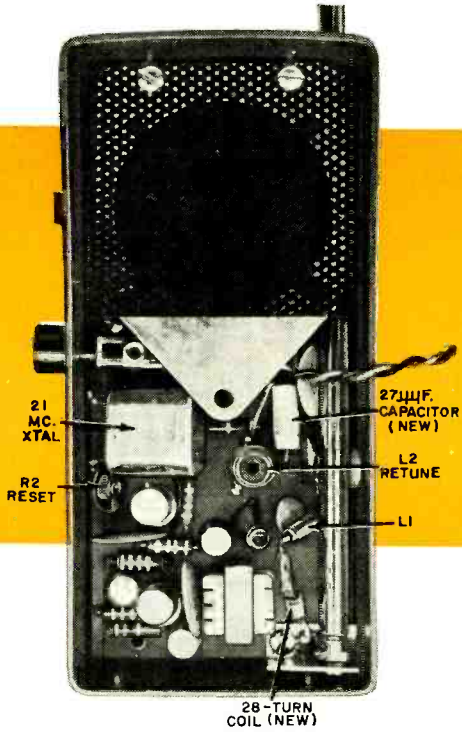
A WALKIE-TALKIE is undoubtedly one of the niftiest gadgets you can have around the ham shack. Whether you need an extra communications link for CD and emergency work, want to keep in touch with your friends at hamfests and conventions, or just want to contact your home station while adjusting an antenna or while checking TVI, a pocket-sized transceiver will handle the job admirably.

Although few amateurs need to be sold on the merits of walkie-talkies, the lack of suitable ham-band units has kept most operators from putting the useful little rigs to work—with the exception of totally home-brew jobs. Now, however, every station can boast at least one walkie-talkie thanks to the introduction of low-cost transceivers originally designed for the 27-mc. CB service.

The Knight-Kit C-100 is one transceiver that readily lends itself to 6-, 10-, and 15-meter ham-band conversion. As a matter of fact, the



Ten-meter conversion requires only one new part: a 28-mc. crystal. Adjust R2 if necessary for optimum regeneration and peak L2 for best sensitivity, and you're on the air.



Fifteen-meter version of the C-100 uses a 21-mc. crystal, a 27-$\mu\mu$f. capacitor, and an added coil wound on a 1-meg resistor to give the antenna coil (L1) more inductance.

C-100 is so easy to put together, and the changeover to amateur operation so easily accomplished, that you can go on the air with the unit no more than three hours after you first open the shipping carton.

One of the attractive features of the project is its surprisingly low cost: The transceiver kit sells for $9.95, and additional parts required to convert it cost only $2 to $5, depending on the choice of band and your ability to scrounge up bargain crystals.

Before attempting circuit revisions, make sure your C-100 is properly wired and operates satisfactorily on the 27-mc. band. Getting the unit to fire shouldn't prove difficult, since both the printed-circuit board and the detailed instruction manual supplied with the kit make error-proof wiring almost a certainty.

Ten-Meter Conversion. As you've no doubt already guessed, the switch to 10 meters is the easiest. Only one new part is required—a third-overtone, 28-mc. crystal. Since miniature crystals, like the one furnished with the kit, are still not sold by many ham distributors, you may have to settle on one of the larger HC-6/U types. Luckily, there is plenty of room inside the C-100 for one of these bigger rocks.

After taking the speaker, switch, antenna, and chassis out of the walkie talkie case, carefully remove the 27.035-mc. crystal. Don't overheat the printed-circuit board in the process! Insert and solder bare wires, each ¾" long, in the two holes vacated by the 27-mc. crystal. Apply a layer of clear cellophane tape over the metal cover of the new 28-mc. crystal to prevent it from shorting against nearby components. Then solder the pins of this crystal to the two ¾" wires.

Put all the components back in the transceiver's case. Extend the antenna,

throw on *S2*, and adjust the slug in *L2* for greatest sensitivity using an external signal source such as a signal generator, VFO, grid-dip oscillator, or the station transmitter. A slight shift in the setting of *R2* may also be required for optimum regeneration.

Tune a communications receiver to the walkie-talkie's crystal frequency. If the carrier comes on instantaneously every time you push *S1*, the conversion is complete. However, if the crystal turns out to be a bit balky and doesn't always want to start up when *S1* is actuated, very carefully unwind two or three turns from *L1*. This slight inductive change should reduce oscillator loading sufficiently to insure reliable operation.

Fifteen-Meter Conversion. Replace the 27.035-mc. crystal with a third-overtone, 21-mc. unit. Solder a 27-$\mu\mu$f. tubular ceramic capacitor across the terminals of *L2*. The position of this added capacitor can be seen in the photo of the 15-meter unit. Now, using #32 enameled wire, wind a 28-turn coil on the body of a half-watt resistor valued at no less than 1 megohm. Solder the ends of the coil to the resistor leads and then trim the leads to $\frac{5}{16}$".

Unsolder and remove from the circuit board the end of *L1* nearest the antenna bracket. Connect this end of *L1* to one lead of the 28-turn coil, and solder the other lead of the 28-turn coil to the antenna bracket close to the bracket mounting screw. Bend both coils to one side so they will clear the antenna rod. Then adjust *L2* and *R2* for best 21-mc. reception.

Six-meter conversion is slightly more complex than other versions. Coil L2 is revamped as described in text, a capacitor connected in series with C5, and L1 replaced.

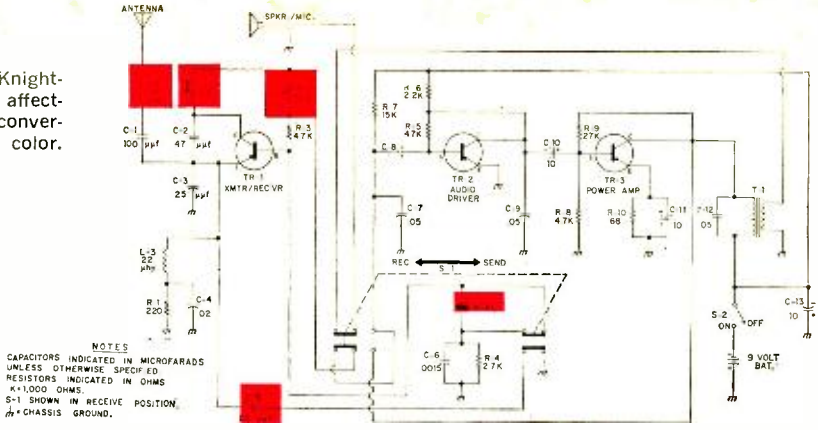
Six-Meter Conversion. Install a third-overtone, 50-mc. crystal. Temporarily remove *L2* from the printed-circuit board. Disconnect the top end of this coil from the lug on the coil form to which it is soldered. Unwind and snip off five turns. Spread the remaining four turns out until they are spaced the diameter of the wire. Now resolder the top of the coil to the lug, and replace *L2* on the circuit board.

Connect a 20-$\mu\mu$f. disc capacitor in parallel with *C5*. The easiest way to accomplish this is to take *C5* off the board. Wrap and solder its leads around those of the 20-$\mu\mu$f. capacitor. Then, put both capacitors in the spot previously occupied only by *C5*.

Replace *L1* with a 25-turn coil of #28 enameled wire wound on the body of a 1-megohm, 1-watt resistor.

Adjust *L2* and *R2* for good 6-meter reception. If no setting of *R2* produces stable regeneration, change the capacitor in parallel with *C5*. Some value between 15 and 30 $\mu\mu$f. should prove satisfactory. If regeneration still isn't right, even after making the capacitor change, take two or three turns off *L1*'s replacement. Don't cut this coil too much, though, or you'll reduce antenna radiating efficiency.

Conclusion. The reliable communication range of a converted C-100 is somewhere between 500 and 1500 feet. The exact distance depends not only on location; but also upon whether you're in contact with a fixed station or another

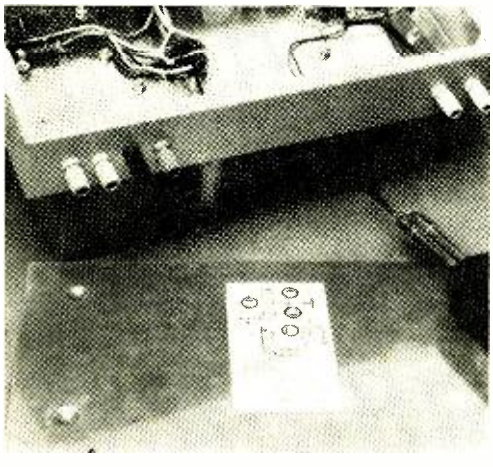


Schematic of the Knight-Kit C-100. The parts affected by the ham-band conversions are shown in color.

walkie-talkie. Considering the transceiver's low cost and simple circuitry, this degree of performance is excellent, and is more than adequate for most purposes requiring a tiny rig.

A final word of caution is in order. While it is true that you need no permit of any sort to operate a C-100 on the Citizens Band, only the holder of the proper class of amateur ticket can actuate the send-receive switch when the unit is converted to an amateur frequency. Unlicensed ham-band transmissions are strictly taboo! —30—

Stop Searching for Schematics



OFTEN, when an electronics project is completed and in operation, the magazine containing the article from which it was built is placed in a pile and eventually lost or mislaid. When trouble occurs with the unit, much time is lost trouble-shooting the now-forgotten circuit. To avoid this difficulty, the circuit information can easily be made a part of the project.

Carefully cut out the diagram from the magazine or, if you like your reading material uncut, have a photostat or copy photo made of it. If you modified the circuit in any way, use a pen and ruler to indicate the changes.

To prepare the diagram for mounting, get several pieces of plastic sheeting (one brand is "Plan-Vu Plastic Sheets," which are available at low cost) or a roll of plastic film with adhesive backing. Cover both the front and back of the diagram and trim around the edges with sharp scissors.

Now use some rubber cement to mount the diagram on the top or bottom of the chassis. This way, you'll have it when you need it! —*A. A. Wicks*

COVER STORY

Unique Walkie-Talkie a $19.95 Kit

New 100-milliwatt Knight-Kit has superhet receiver

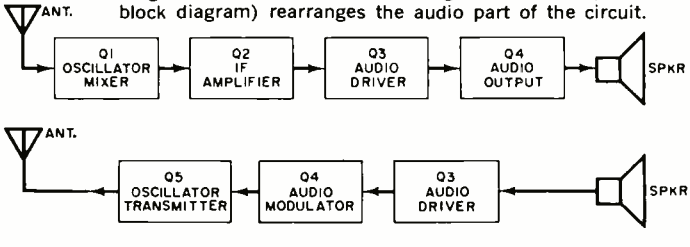
UNLICENSED "walkie-talkie" style transceivers, permitted on the Citizens Band by the Federal Communications Commission, have just about reached their peak of perfection if the Knight-Kit C-555 (*Allied Radio Corp.*) is any barometer. One year ago, Allied introduced a $10 Knight-Kit hand-held transceiver that has been selling like hot cakes (see modification story in this issue on page 61). Due to the use of a super-regenerative receiver, however, this lower cost model tended to be non-selective, considering the close crowding of the CB channels. A superhet receiver was the obvious answer, and for $19.95 you get one in the brand-new C-555.

The Editors of POPULAR ELECTRONICS assembled two transceivers in five hours. A thorough tune-up to put all of the circuits right on the nose required another hour. (By the way, we recommend using the light bulb provided as a preliminary measure, but separating the two units by a quarter mile for final settings of *L1, L2, T1,* and *T2.*) Under test, the units worked up to one-half mile over poor terrain, and close to a mile when contacting a 5-watt base station. The most impressive features of the C-555 are the quiet receiver and good modulation percentage and quality.

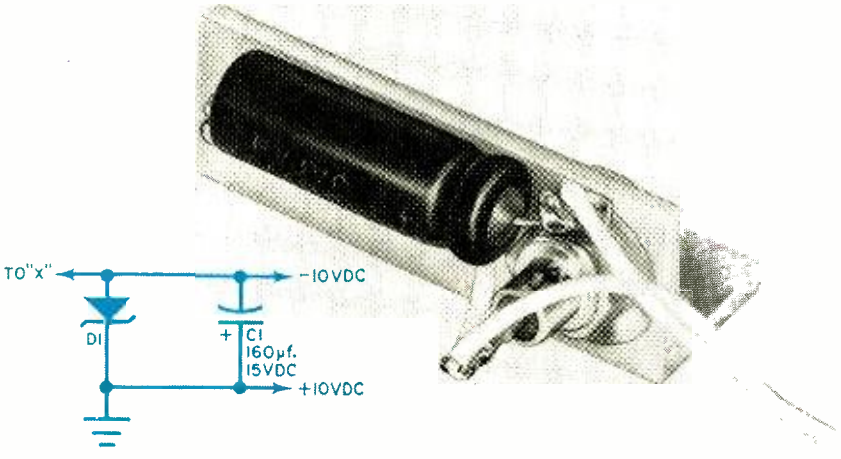
The basic kit costs $19.95. Transmit and receive crystals are extra ($1.95 each), and available for any channel between 2 and 22. A 9-volt battery (transistor radio type) is also required. In our tests, a new battery operated the receiver continuously for 60 hours. -30-

Reader Service No. 86 (see page 15)

Receiver line-up (top block diagram) shows circuit arrangement. A diode detector is used between the i.f. stage and audio driver. Switching to transmit (lower block diagram) rearranges the audio part of the circuit.



Hybrid Circuit for



Schematic for zener diode version is shown above. Current increases through diode as load current goes up. Diode can safely handle one ampere.

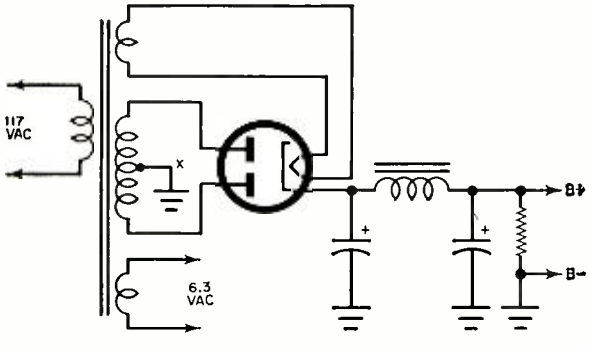
Good heat sink is prime requirement of zener regulator above. No insulation is required between diode, bracket. Capacitor connects to standoff.

Put that high-voltage bench supply to work powering your transistor projects— a simple addition gives you a handy low-voltage tap

By ROY E. PAFENBERG, W4WKM

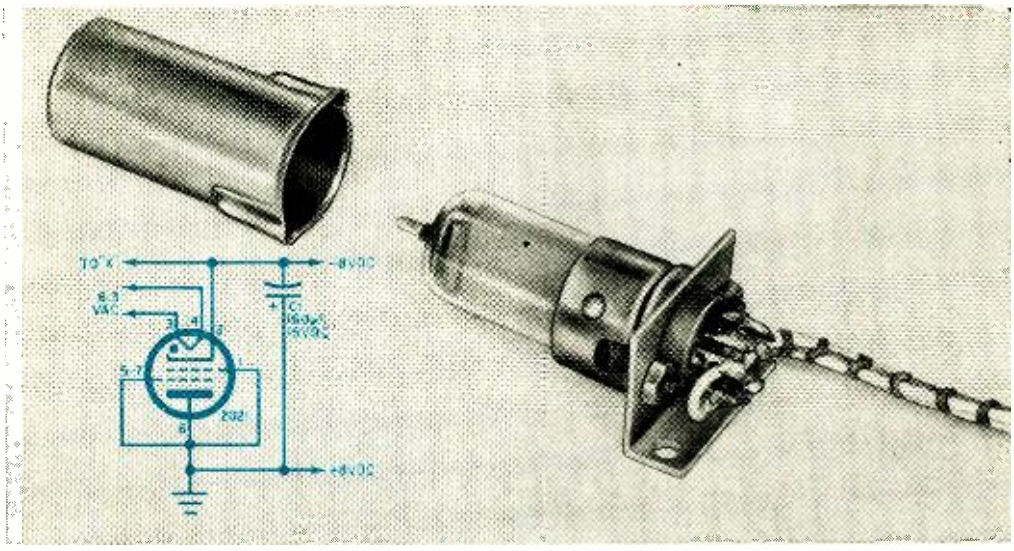
AN A.C.-OPERATED power supply furnishing a range of commonly used voltages is a "must" for experimental electronics work. These "bench supplies" range from very elaborate commercial units to those built on open chassis from junk box parts. Most such supplies were designed for use with vacuum tube circuits, but with the popularity of transistors on the upswing, they have limited application.

One answer to this problem can be found in the assemblies shown here. Either of the units will convert a conventional B-plus supply to furnish suit-



Typical supply is shown in schematic (right). Attach regulator at "X." Disconnect tap, connect to low-voltage regulator input, and then ground the regulator.

Transistor Power



Schematic diagram of 2D21 regulator. Higher voltages can be obtained by adding additional tubes, but increase voltage rating of C1 appropriately as well.

Tube regulator is assembled on bracket of bent-up aluminum sheet scrap. This mounts under supply chassis. Capacitor C1 is not shown in photograph.

able low-voltage outputs for transistor work. A peculiarity of this conversion is that the current that may be drawn from the low-voltage tap is limited to a value somewhat less than the combined bleeder—high-voltage output current. This is no drawback with tube or tube-and-transistor equipment, however, and another bleeder can always be added to the high-voltage end of the supply if you need more current while using the low-voltage tap exclusively.

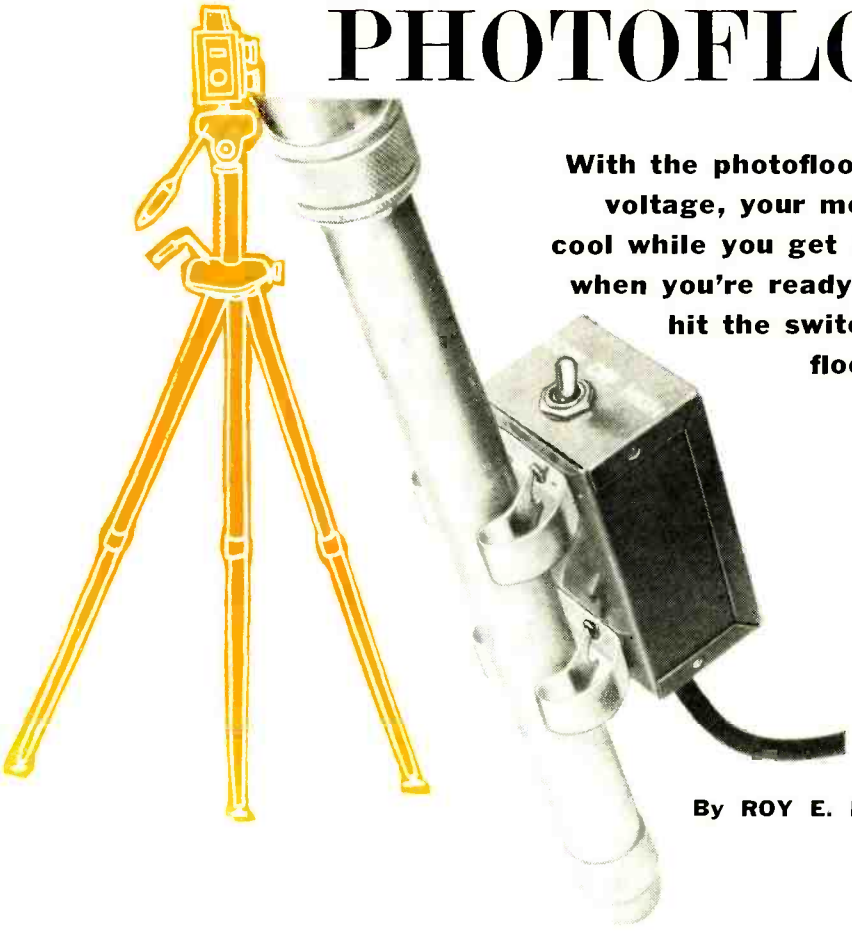
How It Works. If you insert a resistor in series with the transformer center-tap in a conventional power supply, a voltage (determined by the current in the circuit) will be developed across the resistor. This is how negative bias voltages have been obtained for years. When you insert a *zener diode* in series with the center tap, the rectified voltage across it causes the diode to conduct, and the voltage drop remains constant over a wide range of bleeder and external load current of the B-plus output. While the voltage of the diode is subtracted from the output, it is negligible when considered as a percentage of the output.

The second version of this circuit uses a cold-cathode, gas-filled 2D21 thyratron. As the voltage drop of a gas tube is fairly independent of current variation, a well-regulated voltage is developed. The 2D21 is inexpensive, which adds to the appeal of this version.

Building the Regulators. Construction details are shown for assemblies designed for installation under the chassis of the supply. In the diode version, ¾-inch aluminum angle stock is used to mount diode *D1* and capacitor *C1*. A standoff insulator is used for one end of the capacitor. No insulation is required for the diode stud, as in the usual grounded bias supply. The aluminum provides a good heat sink for the diode, which is an International Rectifier 10-watt, 10-volt unit. You can substitute at will, but do not exceed the diode current ratings.

In the 2D21 version, bend up a small bracket from scrap aluminum for the tube socket. You can, if you wish, increase the voltage output of the 2D21 circuit by adding additional tubes in series, but be sure to increase the working voltage rating of the capacitor if you make such a change. -30-

PHOTOFLOOD



With the photofloods at half voltage, your model stays cool while you get set. Then, when you're ready to shoot, hit the switch for full floodlighting

By ROY E. PAFENBERG
W4WKM

IN ADDITION to making your model more comfortable, either of these units will add to the life of your floodlights. You will still get sufficient light at the half-way position to eliminate shadows and adjust the camera, provided you open the diaphragm.

In the two-socket version, the voltage is divided between the lamps with d.p.d.t. switch *S1* in one position; when it is in the other position, full voltage is applied to the lamps. This version requires no parts other than the sockets, switch, and housing.

One of the new low-cost silicon diodes makes the single-lamp "Life Extender" a snap to build. Should the diode fail, which is the worst that can happen, full voltage will be applied to the lamp in the case of a short, or no voltage if diode *D1* opens.

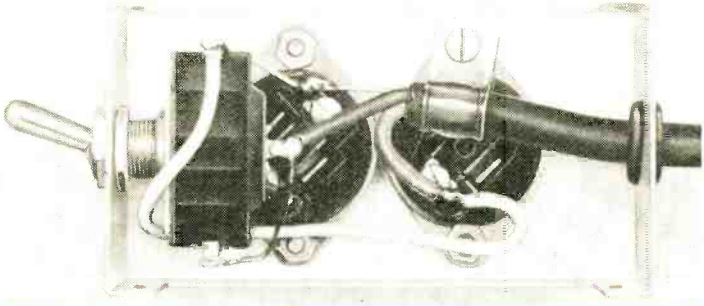
Either unit will fit in a 1⅝" x 2¼" x 4" Minibox. Note that heavy-duty (AWG 16) line cord and wiring is used. Make ½" holes at either ends of the box, one for switch *S1* and the other for the line cord grommet.

In the one-socket version, switch *S1* is an s.p.d.t., center-off type. The sockets are all Amphenol 61-MIP-61F and require a 1⅛" hole plus two mounting holes. Diode *D1* is a 12-amp., 400-PIV unit. The author used Lafayette stock number SP-268 for *D1*; an insulated mounting kit is also available (SP-272).

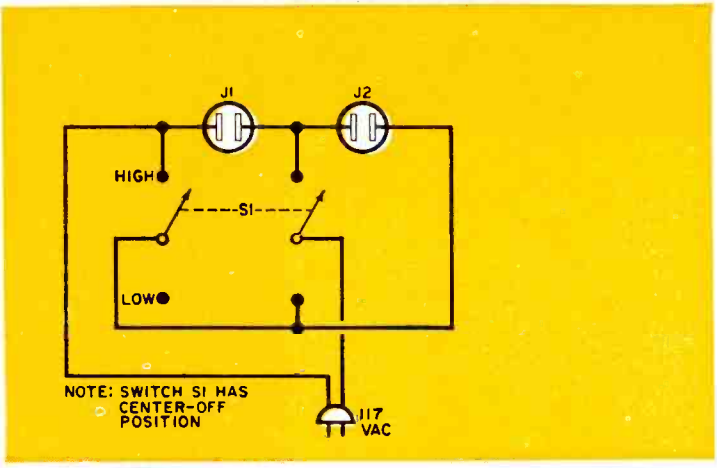
For added convenience, tool board mounting clips can be obtained at your local hardware store, and fitted to the bottom of the case. These make it possible to snap the unit to a leg of your tripod, always within reach.

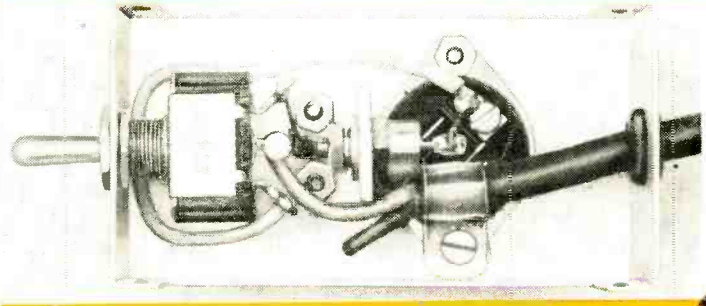
Are these projects worthwhile? If you build one and use it, you'll wonder how you got along without it. —30—

LIFE EXTENDERS

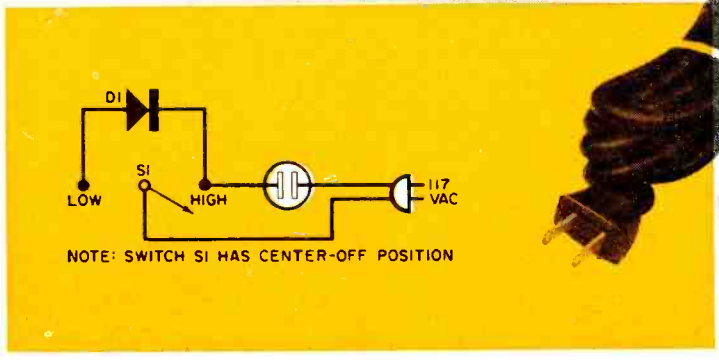


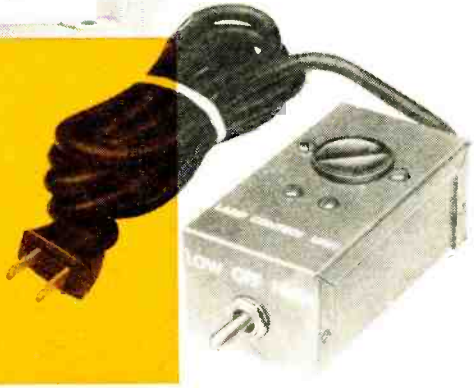
Two outlets can be connected in series or parallel by throwing the switch. When they are connected in series, only half the voltage goes to each light. Parts needed are sockets, switch, housing.





With the switch in the center position, the lights are off. Throw the switch one way and you get full lighting. With the switch in the other position, the diode is in the circuit, and the voltage is then cut in half.





Transistor Topics

By **LOU GARNER,** Semiconductor Editor

FROM TIME TO TIME in past columns we have featured circuits abstracted from the literature of semiconductor manufacturers. Each time such circuits have been presented, a number of readers have written to ask that they be made a regular part of the *Transistor Topics* column—like "Readers' Circuits" and "Transitips." Not only do space limitations prevent our doing this but, unfortunately, the majority of the practical circuits developed by manufacturers are of interest only to advanced design engineers. Recently, however, we discovered the two circuits shown in Figs. 1 and 2, which may be of real value to hobbyists.

Hams and advanced experimenters working with UHF should find the circuit in Fig. 1 of genuine interest. A Class C power amplifier operating at 160 mc., the circuit originally appeared in Volume 1, Issue 4, of the *TI Technical Newsletter* (published by Texas Instruments, Inc., 13500 North Central Expressway, Dallas, Texas). According to TI, the circuit has a power output of 750 mw., a 3-db bandwidth of 15 mc., and an operating efficiency of 25%. It is designed to power a 50-ohm load when driven by a 50-ohm source.

A type 2N2863 *npn* transistor *(Q1)* is used in the common-base configuration. Pi matching networks are used at the input and output for impedance matching to insure optimum performance. Capacitor values are given in pf ($\mu\mu$f.) and inductance values in μh. Capacitors *C1*, *C6*, and *C7* are small disc or tubular ceramics, while *C2*, *C3*, *C4*, and *C5* are trimmers. Connectors *J1* and *J2* are standard high-frequency coaxial jacks. The original circuit was assembled on a 0.032-in. brass chassis with a metal shield passing between the collector and emitter pins of the transistor socket.

An *RC* phase-shift audio oscillator suitable for use as a CPO or as a fixed-frequency tone source, the circuit in Fig. 2 was featured in Bulletin No. SM-3929 (published by Sylvania Electric Products Inc., 100 Sylvan Rd., Woburn, Mass.). When properly adjusted, it should be capable of delivering a reasonably stable, good-quality sine-wave signal and, therefore, should be suitable for amplifier distortion tests.

In this circuit, a *npn* transistor *(Q1)* is used in the common-emitter configuration. Base bias is furnished by voltage-divider *R6-R7* in conjunction with emitter resistor *R9*, bypassed by *C8*. Output control *R8* serves as *Q1*'s collector load, while the feedback necessary for oscillation is furnished by the phase-shift network made up of *C1* through *C6* and *R1* through *R6*. Capacitor *C7* provides the output coupling path. Operating power is furnished by a 12-volt battery, *B1*, controlled by s.p.s.t. switch *S1*.

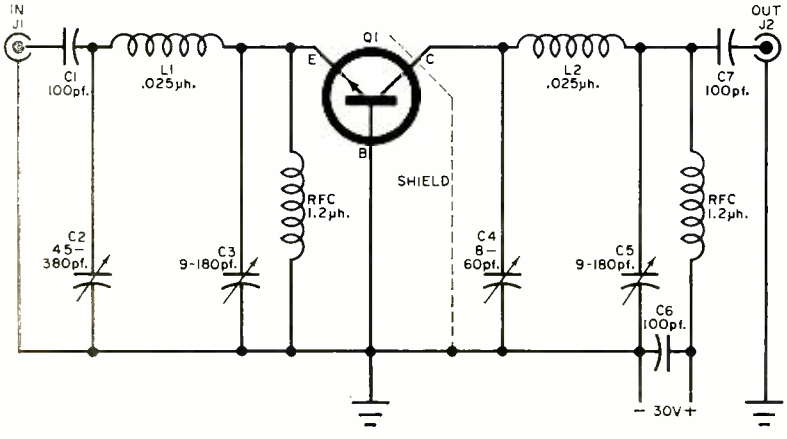


Fig. 1. A Class C power amplifier operating at 160 mc. suggested by TI. Output is 750 mw. and bandwidth is 15 mc. at 3 db.

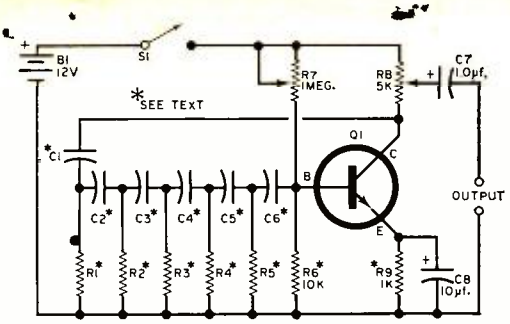


Fig. 2. Sylvania's phase-shift audio oscillator circuit for use as CPO.

The phase-shift oscillator can be assembled on a small chassis or etched circuit board, as preferred. Transistor *Q1* is a type 2N35 but other *npn* units should work satisfactorily. Except for bias potentiometer *R7* and output control *R8*, all resistors are half-watt units. Capacitors *C7* and *C8* are 1.0-μf. and 10-μf., 15-volt electrolytics, respectively. The values of *R1* through *R6* and *C1* through *C6* are determined by the desired operating frequency. For 1-kc. operation, *R1* through *R5* are 5100 ohms, while *C1* through *C6* are 0.05-μf. units. For 15-kc. operation, *R1* through *R5* are 2200 ohms, while *C1* through *C6* are 0.008-μf. units.

Either ceramic or paper tubular capacitors can be used. A toggle, slide, or rotary switch will serve as *S1*. Power supply *B1* can be made up of eight penlight cells in series . . . or may consist of two *Burgess* Type Z4 6-volt batteries in series, whichever is more convenient. Bias control *R7* is adjusted for optimum performance after all wiring is completed and checked.

Reader's Circuit. Originally developed for a Science Fair project, the circuit in Fig. 3 (on p. 72) was submitted by Richard Gawlik (187 Jefferson St., Brooklyn, N. Y.). A beat-frequency type audio signal generator, the device, according to Dick, will supply audio signals from 50 cycles to 18 kc. Easily assembled in two or three evenings, it should be useful for testing and servicing phonograph amplifiers, p.a. systems, modulators, intercoms and similar types of audio equipment.

Three *pnp* transistors (*Q1*, *Q2*, and *Q3*) and one *npn* transistor (*Q4*) are used. Transistors *Q1* and *Q2* operate as "tickler feedback" r.f. oscillators while *Q3* and *Q4* are employed in a complementary detector-amplifier circuit. The common-emitter configuration is used in all stages.

In operation, the r.f. signals developed by *Q1* and *Q2* are combined in an r.f. transformer (*L5/L6/L7*) and applied to a detector, *Q3*. The resulting audio signal (representing the difference beat note) is amplified by *Q4* and delivered as the output through impedance-matching transformer *T1*. Except for *C3*, the two r.f. oscillators are virtually identical, with *C4* and *C5* serving as coupling capacitors and *R1* and *R2* as base bias resistors in their respective stages.

Transistor *Q1*'s operating frequency is determined by tuned circuit *L1/C1/C3* and that of *Q2* by *L3/C2*. The feedback necessary to start and maintain oscillation is furnished by *L2* (*Q1*) and *L4* (*Q2*). Transistor *Q3* is operated without bias as a detector, while *Q4*'s base bias is furnished through *Q3* and current limiting resistor *R3*. Separate power supplies are used in each section, with *B1*, controlled by *S1a*, furnishing power to *Q1* and *Q2*, and *B2*, controlled by *S1b*, supplying power to *Q3* and *Q4*.

Readily available components are used in the circuit. Transistors *Q1*, *Q2*, and *Q3* are general-purpose *pnp* types, such as 2N107's or CK722's, while *Q4* is an *npn* type 2N170. Capacitors *C1* and *C2* are 365-pf. padders while *C3* is a 50-pf. tuning capacitor; *C4* and *C5* are small 0.05-μf. disc ceramics. Resistors *R1*, *R2*, and *R3* are all half-watt units. Almost any standard transistor output transformer can be used for *T1* . . . typically, an Argonne Type AR-116. Batteries *B1* and *B2* are three- and six-volt units, respectively, and both may be made up by connecting penlight cells in series. Switch *S1* is a d.p.s.t. toggle, slide, or rotary type.

The coils are either modified or hand-wound units. Coils *L1* and *L3* are "Hi Q" broadcast-band ferrite loopsticks, while *L2* and *L4* each consist of about five to ten turns of #20 magnet wire wound directly on top of their respective main coils (*L2* on *L1*, and *L4* on *L3*). The r.f. mixer transformer is wound of #20 magnet wire on a 1"-diameter thread spool or similar form. Coils *L5* and *L6* each consist of 20 turns and are wound next to each other. Coil *L7* is made up of 60 turns wound directly on top of *L5* and *L6*.

Dick's variable frequency audio generator can be assembled on a small chassis or breadboard fashion, as preferred. Neither layout nor lead dress is overly critical, but the two r.f. oscillators should be physically separated to minimize any tendency for one to "lock" with the other. All coil assemblies should be mounted at right angles with respect to each other. Signal leads should be kept short and direct.

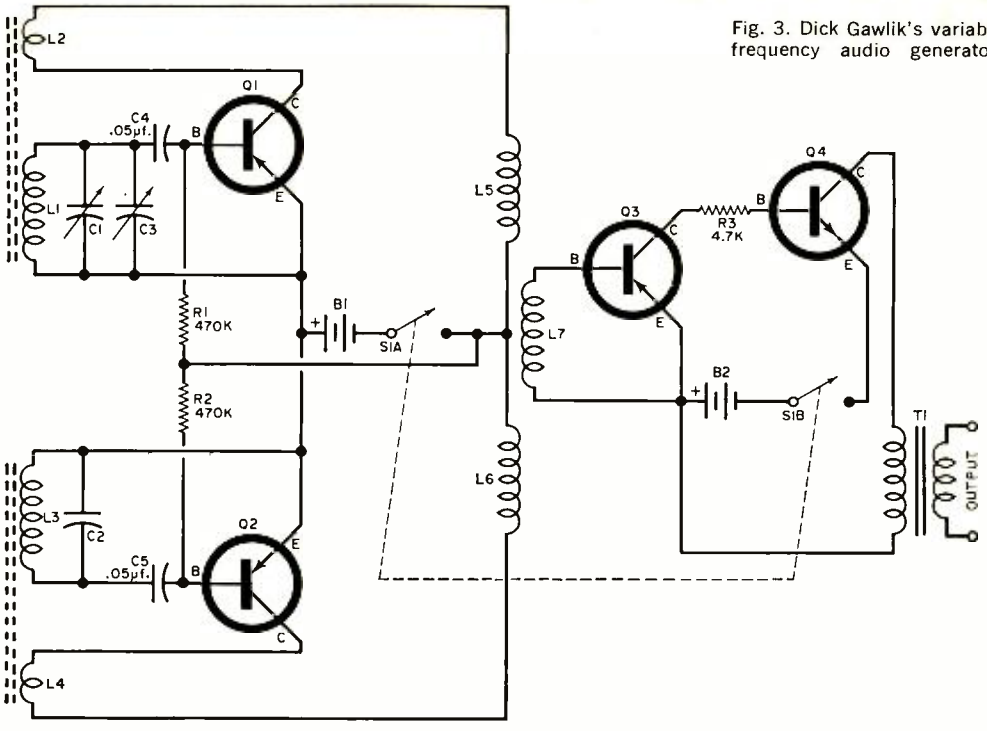
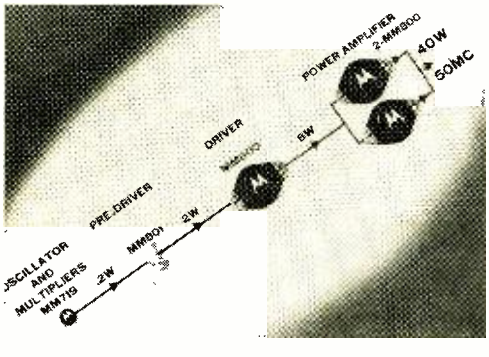


Fig. 3. Dick Gawlik's variable frequency audio generator.

With the wiring completed and checked, preliminary operational tests should be made by connecting a pair of headphones to *T1*'s secondary winding. If the circuit is working normally, you'll obtain an audible "beat" note as you tune one of the r.f. oscillator stages through its range. It should be possible to tune through zero-beat by adjusting either *C1* or *C2*. If either (or both) of the r.f. stages fails to oscillate, try reversing the connections to the appropriate feedback winding (*L2* or *L4*).

In practice, the r.f. oscillators are first set to "zero-beat" by adjusting *C1* and *C2*. Afterwards, *C3* is used as a tuning control. If fitted with a suitable dial, *C3* can be calibrated by checking the instrument's output against audio signals of known frequency (as might be obtained from a commercial audio generator).

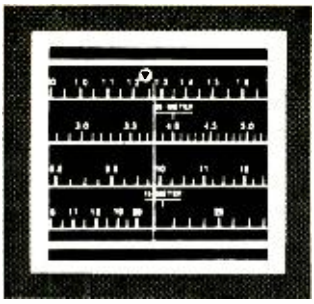
Motorola's new VHF power transistor line, arranged here in the order in which they might be used in a transmitter circuit, for example.



Transitips. Thermal runaway can be a serious problem when using power transistors. If a transistor is used near its maximum ratings, it may overheat slightly under some conditions. As the transistor's internal temperature rises, its resistance drops. This, in turn, permits an increase in base and, of course, collector currents. The increased current flow leads to further heating and to a further drop in internal resistances . . . and so on. Once started, the process causes a rapid build-up of internal temperatures and currents, until the transistor destroys itself.

The "best" way to avoid thermal runaway is to use transistors well within their maximum ratings, to use adequate heat sinks, and to avoid circuit operation where high ambient temperatures are present. In addition, it is good practice to use circuits which incorporate some type of temperature compensation in their biasing arrangement. Two such circuits are illustrated in Figs. 4 and 5, on page 108.

(*Continued on page* 108)



Across the Ham Bands

By **HERB S. BRIER,** W9EGQ
Amateur Radio Editor

AMATEUR RADIO AND PUBLIC SERVICE

IN RECENT MONTHS, thoughtful amateurs, such as Herbert Hoover, Jr., W6ZH, president of the ARRL, and Ivan H. Loucks, W3GD, Chief of the Amateur and Citizens Radio Division of the FCC (speaking unofficially as an amateur) have pointed out many times that amateur radio is more than just a hobby—it is also a *service*. And the ham's record of *public* service is what will determine the future of this hobby.

Studying and learning enough code and electronic theory to pass the amateur license examinations can be classed as a public service, because knowledge is power, and the more we learn, the more we contribute to the strength of the United States. But simply obtaining an amateur license is not enough; how we use that license is equally important.

We become of increasing value to our country as we continue to increase our knowledge and skill, and as we share our abilities by helping others obtain their licenses. And there are other important aspects of public service—message handling, for example.

When the average ham thinks of public service, he visualizes the headline, "Amateur Radio Brings Help When All Other Communications Fail!" But would *you* know what to do if you were suddenly confronted with an emergency situation? If the next station you work should ask you to handle an important message, would you know how to copy it exactly as it was sent? Could you handle many such messages—one after another—as long as the emergency lasted?

Obviously, before you can honestly say "yes" in answer to such questions, you need actual on-the-air message-handling experience. To obtain this know-how, have fun, and perform a public service while doing so, you can join one of the amateur traffic nets that operate regularly in the different amateur bands. A list of these nets is available free of charge on request from the

Novice Station of the Month

E. Frederick Ramsey, WN8KMO, of Portsmouth, Ohio, usually operates his efficient Novice station—consisting of a Knight-Kit T-150 transmitter (throttled down to 75 watts), a National NC-300 receiver, and a "trap" dipole antenna—on 80 and 40 meters. In ten weeks, Fred has contacted 26 states. WN8KMO will receive a one-year subscription to POPULAR ELECTRONICS for his photo. If you would like to enter our Novice Station of the Month contest, send us a clear picture of your station—preferably showing you at the controls—along with some information about yourself, your equipment, and operating achievements. Entries go to Herb S. Brier, Amateur Radio Editor, Box 678, Gary, Indiana.

American Radio Relay League, Inc., 225 Main St., Newington, Conn.

Listen to the net of your choice long enough to get an idea of how it operates. Then report in to the net control station, or wait until the end of a net session and ask one of the net members for information on joining it.

Don't get the idea that you must be a big-time traffic man to join a net. A half-hour an evening, one or more days during each week is enough, leaving you plenty of time to rag-chew or chase DX. And while the messages handled in these nets are seldom of overwhelming importance, many of them are from men overseas in military service to their families at home and mean a great deal to them. This kind of service makes friends for amateur radio and for you as an individual.

Ed Osborne, KN7ZMA, Ajo, Ariz. (right), operates a homebrew 60-watter. Ed wisely leaves ample room for his keying arm on the operating table.

Steve Harder, WNØFSW, Garner, Iowa, (left), uses a WRL Meteor SB-75 transmitter and a Heathkit HR-20 receiver. He has worked 29 states and Okinawa.

CLASSIC HAM CIRCUITS

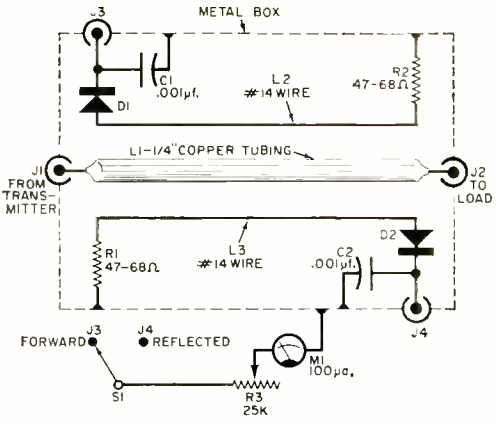
Time was when few hams worried much about antenna impedance matching, or transmission line standing-wave ratios. Most transmitting antennas were fed via a tuned two-wire transmission line with conductors spaced 6″ to 10″ apart; and an "antenna tuner" was used to couple the transmitter to the antenna. Tuning consisted of adjusting the antenna tuner until the antenna system was drawing the desired amount of power out of the transmitter. Of course, the transmission line often operated with a high standing-wave ratio (SWR), but if the signal reports were good, nobody worried about it.

Later, however, the introduction of more sophisticated transmitters, coaxial-fed antennas, low-pass filters for TVI elimination, etc. (all of which work best under matched conditions), made the ability to measure transmission line SWR of great importance to amateur, commercial, and military transmitter services. As a result, after World War II, several instruments for measuring SWR in transmission lines were described in the technical press. But most of them had serious disadvantages—such as being overly expensive, inconvenient to use, of limited accuracy, or easily damaged.

On September 15, 1949, however, the Naval Research Laboratory published NRL Report 3538 in which O. Norgoden described "A Reflectometer for H-F Band," for use with Navy antennas. It used a directional coupler to separate the forward and reflected current in the antenna transmission line and provided a d.c. output to a microammeter calibrated to indicate directly how well the transmission line was matched to its load.

Major advantages of Norgoden's reflectometer circuit were its simplicity, accuracy, and usability over a wide frequency range. In addition, it could be left connected permanently in the transmission line for continuous monitoring. Its one disadvantage was that it was necessary to disconnect and reverse the reflectometer in the line to obtain an exact SWR measurement.

The Monimatch SWR Bridge. It was not until late 1956, when Lewis G. McCoy, W1ICP, described an amateur version of Norgoden's reflectometer in *QST* (October, 1956) that amateurs and commercial services generally learned about the instru-



Schematic diagram of W1ICP's Monimatch SWR bridge. The two reflectometers in the back-to-back configuration permit instantaneous SWR readings.

PARTS LIST

C1, C2—0.001-μf., 600-volt ceramic capacitor
D1, D2—1N34A or 1N270 germanium diode (matched pair)
J1, J2—Coaxial connector (to match line connector)
L1—5" length of ¼"-diameter copper tubing
L2, L3—4½" length of #14 copper wire (spaced ¼" from L1)
M1—100-μamp. d.c. meter
R1, R2—47-to-68 ohm, 1-watt carbon resistor (matched pair of correct value for impedance desired)
R3—25,000-ohm potentiometer, linear taper
S1—S.p.d.t. switch

spacing of the pickup lines from the center conductor determine the design impedance of the monimatch—usually 50 or 75 ohms to match standard coaxial cable—and the length of lines *L1, L2,* and *L3* determine the sensitivity of the unit. Their lengths should not exceed 1/20 wavelength at the highest frequency at which the instrument is to be used, however; otherwise, the bridge may upset the normal operation of the transmission line.

Operation. With the transmitter carrier "on" at a normal level, switch *S1* is placed in the "forward" position and the sensitivity control *R3* is adjusted for a full-scale deflection of the indicating meter. The switch is then placed in the "reflected" position and the meter reading noted. If the transmission line is perfectly matched to its load, the meter reading will drop to zero. A 2:1 mismatch will produce a ⅓-scale reading, a 3:1 mismatch will produce a ½-scale reading, etc.

Whether you call it a "reflectometer," a "monimatch," or any other name, Norgoden's and McCoy's little gem is a valuable tool for keeping ham and CB fixed and mobile antenna installations working at peak efficiencies.

Wanda Michalski, K9GAW, Gary, Ind., operates SSB with a Hallicrafters HT-37 driving a Heathkit "Warrior" into a Hornet three-band beam or dipole. The receiver in her shack is a Drake 2B.

ment. In February, 1957, *QST*, Lew described an improved "Monimatch Mark II," which is the prototype of practically all "in-the-line" type SWR bridges used by amateurs, CB'ers, and others today.

The clever thing about W1ICP's Monimatch circuit is that it combines two reflectometers, back-to-back, in a single cabinet, and switches the indicating meter between them to permit obtaining instantaneous SWR readings without having to disconnect and reverse the connection to the unit.

How It Works. Referring to the diagram, the center conductor of *L1*—a short length of copper tubing—and the monimatch case act as a continuation of the coaxial transmission line. Pickup line *L2* inductively picks up a small amount of the forward power in line *L1*, and line *L3* similarly samples the reflected power. These samples are rectified by germanium diodes *D1* and *D2* (note that they are connected to opposite ends of the two pickup lines) and fed to the indicating meter via switch *S1*.

The value of resistors *R1* and *R2* and the

LATEST ON LICENSE FEES

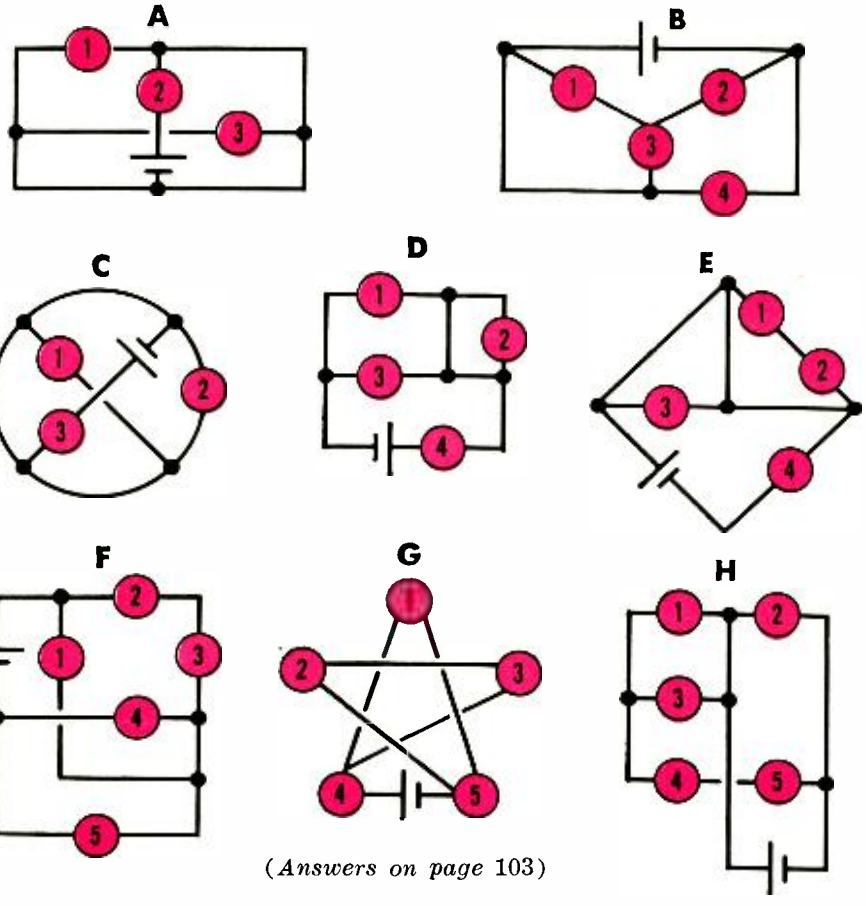
Just a few hours before they were scheduled to go into effect, a Federal court in Chicago enjoined the Federal Communications Commission from collecting its proposed schedule of amateur, commercial, and CB license fees until March 1, 1964. This

(*Continued on page 98*)

Brightest Light Quiz

In each of the circuits (A-J) below, all of the bulbs have the same voltage and current rating. Because of the way in which they are connected, however, one bulb in each circuit lights up brighter than the others. Can you find it? Check the bulb you think is the bright one.

By ROBERT P. BALIN



(*Answers on page* 103)

On the Citizens Band

with **MATT P. SPINELLO,** KHC2060, CB Editor

HAVE YOU EVER worked a job in Milwaukee, Wis., on Friday; had to be in Muskegon, Mich., on Saturday—with a commitment to work in Chicago on Sunday—all on the same week end? Such is a typical jaunt of jazzman Dave Remington and his "Dixie Six." "It's all a part of it" Dave informed us while squirting his trombone slide with water from a plastic spray dispenser. On the piano two feet behind Dave stood a 100-mw. transceiver, monitoring channel 15, in case any of the guys in the band had arrived and were trying to contact him.

CB & ALL THAT JAZZ

Dave Remington, an accomplished professional musician, sports an affluent trombone style all his own, fronting one of the better Dixieland jazz bands in the country. As a Midwest favorite, Dave and his crew have several Vee Jay record albums under their belt, work the finest clubs in the Midwest, and generally are found booked into Chicago's famed "Bourbon Street" and "Jazz Limited" night clubs.

We met Dave during one of his one-night stands at Holiday Acres in Rhinelander, Wis., where he and his musicians were about to snuff out 1963 with their New Year's Eve performance. When we asked Dave about his long trips between jobs and the problems involved, he informed us that CB radio had taken much of the sting out of traveling, making even a 300- to 350-mile excursion to a one-nighter a pleasant journey. "The comforting knowledge that someone is at the other end of that microphone, especially while traveling at night through blizzards, and freezing, slippery weather, takes a big load off my mind," Dave said.

During their travels, the band is usually divided into three or four cars. A 5-watt CB rig in the "master" car generates the control center, while the other cars manage 100-mw. hand-held transceivers inside their vehicles, some with 1-watt hand-held transceivers and temporary whip antennas affixed to rain gutters. The hand-held mobiles usually take the lead, the control vehicle bringing up the rear. Should the "talkies" get out of range or run into trouble, the control unit will eventually overtake them to assist.

Even more important to Dave and his musicians is the use of CB gear while on location for any length of time. Dave pointed out that on several previous visits to Holiday Acres some of the band has been divided among the 27 cottages and two homes located on the 720-acre spread. On such occasions a temporary base station is

Jazzman Dave Remington pulls up at Holiday Acres. Jim and Doris Zambon, proprietors, with daughter Chris (left), and fans, greet Dave in his loaded CB-equipped station wagon. CB radio is a must for long trips on one-night hops.

Meet the three Z's. Chris and Kim Zambon put the dog, Zorro, through his CCB (Canine Citizens Band) paces. Dogs CAN be trained to use CB—one way!

set up in one of the cottages with a mobile whip hung on the roof. Since the cottages are without telephones, the rest of the entourage is kept in touch with the Holdiay Acres ballroom, with the control station and with one another, through the use of several walkie-talkies. Dave reports that this system not only enables him to inform the group of rehearsal and job times, but also lets everyone know who forgot his belt, who's out of tobacco, and mostly, when it's chow time! In the event of a phone call for one of the group, the "talkie" in the resort's field house promptly initiates a relay, thus saving someone an 18-below-zero (in some instances) stroll.

We asked Dave if things were so musically tough down south that he was forced to make 300- to 400-mile trips in sub-zero weather to play a one-nighter near the Canadian border. We should have never asked! Of all of his comments that followed, probably the most appropriate was (in musician talk—much the same way we might converse in 10-signal blurbs), "It's a gass!" He informed us that sub-zero or no sub-zero, a trip to Rhinelander meant the group could ski, skate, ride a horse-drawn sleigh, take ski-plane rides, or toboggan down a slope right out onto Lake Thompson. "And," said Mr. Remington, "with my walkie-talkie on my back, my wife can reach me from our cottage any time!"

Dave admitted that there were several occasions during the summer visits to the resort that held advantages over the winter visits—like when the motor boat drowned out his wife's voice on the talkie. "I got home two hours late," he said with a grin. "Of course, when you get too tied up fishing for muskies, you can always accidentally drop the transceiver overboard, too!" (He was kidding. We don't recommend it!)

CB-Controlled Canine. To say that Dave Remington's CB'ing jazz band leaves its mark electronically, as well as musically, is much too mild a statement. Chris and Kim Zambon, offspring of the Rhinelander resort owners, decided to make an experiment using walkie-talkies. Zorro, their 6-month-old German shepherd, became the victim. With a transceiver strapped to his collar, Zorro was sent out to obey "distant" commands.

On the first trip Zorro tried to digest the CB unit for lunch, but couldn't quite reach it. After a little prompting he finally took off for the woods, returning when called ten minutes later. Since this could have been coincidence, Zorro was given several more workouts, and though hesitant and possibly a little confused, he eventually returned when his caller continued to lead him through the speaker of his own walkie-talkie.

Zorro didn't get it down pat the first day, but he proved a point. In time he could be trained to handle more rewarding missions, such as finding a child, other family members, or members of the staff at the resort. Once found, the "hunted" could take over the conversation with the transceiver, giving Zorro a pat on the back, of course!

New Zealand Joins the Band. Dallas A. McKenzie, BC/SW monitor ZL1PE1AJ, of the New Zealand Radio DX League, has passed the word along about the allocation of a Citizens Radio Service in New Zealand. The "country of the emerald isles" is located approximately 7000 miles southeast of Los Angeles. Application for a license in the new service may be obtained from any Government Post Office in the British Commonwealth. Comparing their licensing fee with our new $8 law (postponed until March 1, 1964, as we go to press), New Zealanders must submit $2.80 annually, which would bring the total to $14 for a five-year period, or $6 more than our $8 fee for the same period.

The frequencies of operation allowable in the New Zealand service are as follows: 26.425, 26.45, 26.415, 26.5, 26.525, 26.55, 26.575 mc., and 465 mc. Frequency tolerances be-

(Continued on page 94)

Monthly Short-Wave Report

By **HANK BENNETT,** W2PNA/WPE2FT
Short-Wave Editor

WHAT'S HAPPENING ON THE SHORT-WAVE BANDS?

MANY of our readers have expressed concern about the fact that short-wave listening seems to have deteriorated in quality over the past few years. Although most of us are aware of exactly what is happening on the short-wave bands, let us briefly describe the situation for those folks who may not be familiar with the peculiarities of the short waves.

Short-wave transmissions are generally based on the activity of the sunspots. When there is a maximum of sunspot activity, the short-wave channels are good far up into the high-frequency portion of the radio spectrum. With a minimum of sunspot activity, the higher frequencies have to be largely abandoned, temporarily, in favor of the lower frequencies. A complete cycle of sunspot activity, from the high point to the low point and back to the high point, takes eleven years. The cycle is now approaching the low point.

Two photos of the listening post of Dan Guthrie and Frank Karcher of Spruce Pine, N.C. Although this is a CB station, the DX'ing is liable to cover any frequency. Dan is shown above with a small portion of their 8692 QSL cards; at right is the equipment corner. The station is about 900 feet from Blue Ridge Parkway, some 3000 feet high.

A few years ago, during the last peak of sunspot activity, there were many stations being reported above 25 mc., including the audio channels of both English and French TV stations as well as a number of unidentified stations in the 27- to 40-mc. range which may possibly have been Russian Far Eastern FM stations. During this period of exceptionally good short-wave reception, the conditions on the medium waves (540-1600 kc.) were extremely poor for the DX hunter, although numerous Europeans were noted at times. There were many short-wave stations operating in the 17-, 21-, and 25-mc. bands, and a notable lack of them in the 49- and 41-meter bands (5800-7300 kc.).

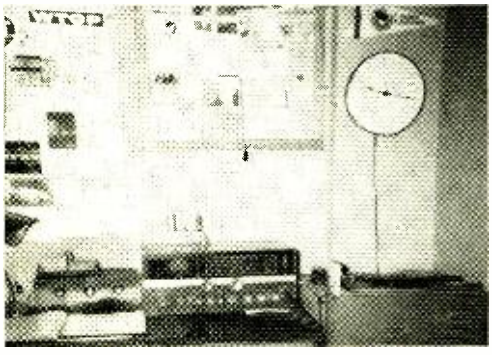
As the sunspot activity declined, more and more of the 17- to 25-mc. stations moved their transmissions down into the 15-, 11-, and 9-mc. bands. Even now, with a continuing decline of sunspot activity, many stations have opened transmissions in the 6- and 7-mc. bands. For example, London has two active channels in the 75-meter amateur band—on 3975 and 3952.5 kc.; these broadcasts are generally heard well evenings in eastern North America although they are not necessarily designed for reception here.

While the short-wave stations continue to move lower in frequency, the medium-wave stations are proving to be well worth going

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.

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Australia	Melbourne	17,840, 15,220 9580	2030, 2130, 2330 0745
Bulgaria	Sofia	6070 (and/or 9700)	1900, 2000, 2300
Canada	Montreal	9625, 9585, 5990	1800 (Caribbean) 0215, 0300 (W. Coast)
East Congo	Leopoldville	11,755	1630, 2100, 2230
Czechoslovakia	Prague	11,905, 9795, 9550, 7345, 5930	2030, 2330
Denmark	Copenhagen	15,165 9520	0700 2100
Finland	Helsinki	15,185	1530 (Mon., Fri.)
West Germany	Cologne	11,795 9640, 6160 9735, 9575, 6145	1010 2035 0000
Hungary	Budapest	9833, 7215, 6234	1930, 2030, 2200, 2330
Italy	Rome	11,905, 9575	1930, 2205
Japan	Tokyo	15,205, 15,175, 11,780	1830
Lebanon	Beirut	11,890	1630
Netherlands	Hilversum	17,810, 15,445 11,950, 9590 7125, 6085 6035, 5985	1030 (Tues., Fri.) 1415 (Tues., Fri.) 1630 (exc. Sun.) 2030 (exc. Sun.)
Portugal	Lisbon	6185, 6025 (and/or 9740)	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840 9660 6065	0900 2215 2045
Switzerland	Berne	9665, 9535, 6165 15,315	2035 0950
U.S.S.R.	Moscow	9740, 9730, 9700, 9680, 9660, 9650, 9620, 9610, 9570, 7320, 7310, 7240, 7200, 7150 (may not all be in use at any one time)	1730, 1900, 2000, 2100, 2300, 0040
Vatican City	Vatican City	9645, 7250, 6145	1950



One of POPULAR ELECTRONICS' regular reporters is Irwin Belofsky, WPE2BYZ, of Brooklyn, N. Y., whose shack is shown here. Irwin's equipment includes a Hallicrafters SX-110, a crystal calibrator, an RCA tape recorder, and an Eico preamplifier. He has 86 countries logged, 67 verified.

after. Stations in Latin and South America are being heard regularly. Many of the Caribbean area stations, rarely heard in North America, are coming through now, in some cases with extremely strong signals. Along the East Coast and considerably inland as well, Europeans are being heard with regularity in the evenings.

The 160-meter amateur band (in portions of the 1800-2000 kc. range) is very active at present, with a number of transatlantic contacts possible. And we would assume that during this period of minimum sunspot activity the European long-wave band (below 500 kc.) would be received in eastern N.A., although we have had no reports to this effect—probably because of the lack of receivers that tune this range.

The sunspots will continue to decline in activity just a bit longer, and then the trend

will gradually be on the upswing for the next five and a half years. Reception on the higher frequencies will become increasingly better, and more and more stations will return to currently abandoned channels. When conditions change for the better, there will probably be a far greater array of shortwave stations to be heard than ever before. And, in the meantime, conditions will continue to be good on the medium waves and in the lower part of the high-frequency spectrum.

Station Lists. New issues of *Broadcasting Stations of the World,* dated March 1, 1963, are now available from the Superintendent of Documents, Government Printing Office,

(*Continued on page* 100)

The monitor registration sign of Sidney Gillis, of Dover, N.H., is WPE1DJW. Sidney's hobby corner features a Hallicrafters SX-100, with other equipment covering the 30-50 and 150-175 mc. bands.

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

ALL radio listeners interested in furthering the hobby of SWL'ing—regardless of whether you DX on the BCB, VHF, TV, SW, or FM bands—are eligible to apply for a POPULAR ELECTRONICS "Certificate of Registration." You must have verified (have QSL cards from) a minimum of five radio stations, of which one was outside the borders of the United States. There is no age limit, or special equipment qualification; the only requirement is that the applicant have a sincere interest in radio communications.

All certificates are filled in and lettered before mailing; they are mailed flat and unfolded. If you want to register and receive your WPE identification sign, fill in the application blank below before May 15, 1964. Mail with 25 cents in coin to: Monitor, POPULAR ELECTRONICS, One Park Avenue, New York, N. Y., 10016. Canadians should use their own currency. All other applicants not in the U. S. A. should use five International Postal Reply Coupons. Allow 2-4 weeks for processing.

(Please Print) (Do not fill out)

Name . . . . . .

Street, City and Zone . . . . . .

State and Zip . . . . . .

Receivers in use Make . . . . . Model . . . . . .

Make . . . . . Model . . . . . .

Age Occupation . . . . . .

Ham/CB call -letter assignment(s) . . . . . .

I listen mostly to SW Broadcast Hams CB BCB VHF VLF . . . . . .

I use the following antennas . . . . . .

I have QSL cards and countries verified. Check if subscriber to P.E. . . . . .

Signature . . . . . Date . . . . . .

(Good only until May 15, 1964)

The Educated Nursing

CARL AND JERRY, on their way home from Parvoo University for Easter vacation, were driving the back roads, enjoying the budding signs of spring so welcome after the long and bitter winter.

"Well, what do we do this vacation?" Carl asked as they rolled along a gravel road. "I'd like to forget all about books for a few days and build something wild in the lab the way we used to."

"We'll think of something," Jerry promised. "Say, what's that funny-looking little hill in the field over there to the left?"

"That's an old Indian burial mound," Carl replied. "I used to hunt arrowheads on it when I visited a cousin living near here."

"Hey! That reminds me. Did you ever hear of a Differential Proton Precession Magnetometer?"

"Nope," Carl confessed, "and I wouldn't wish a name like that on a dog. Anyway, what's the connection between Indian mounds and your proton whatchamaycallit?"

"I read in the November, 1963, issue of the *Indiana History Bulletin* that such an instrument is being used to make a magnetic survey of the big Angel Mounds archaeological site in the southern part of the state. Mr. Glen A. Black is directing the operation for the Indiana Historical Society, and he wrote the article which got me curious. I've been doing some digging—no pun intended—and I find the proton magnetometer a very interesting gadget."

"Try and convince me," Carl challenged.

"O.K. The proton magnetometer was developed at Oxford University. It's essentially a device to accurately measure very small magnetic fields, such as the fraction of a gauss—between 49,000

Bottle

By JOHN T. FRYE W9EGV

and 61,000 gammas—presented by the earth's magnetism. The funny part about the whole thing is the 'complicated' basic apparatus: it consists of a coil of wire wound around a half-pint plastic bottle of water!"

"Go on. Now you've got *me* curious," Carl admitted.

"The proton, or hydrogen nucleus, acts like a tiny bar magnet spinning on its long axis. It has both magnetic and gyroscopic properties. As a magnet, it aligns itself with the magnetic field of the earth in its locality just like a compass needle. If it's temporarily twisted out of alignment, it 'gyrates' back into line with the wobbling motion of a spinning top. The frequency of those gyrations is directly proportional to the strength of the magnetic field."

"Where does the jug of water and the coil come in?"

"Water is two-thirds hydrogen atoms, and a half-pint contains a billion billion protons, give or take a proton or so. Now if you send a direct current through the coil of wire around the bottle for a few seconds, the resulting magnetic field twists the protons out of alignment with the weaker magnetic field of the earth. Remove the current and the protons start waltzing around to get back into their original position. The moving, combined magnetic field of all those gyrating protons cuts the turns of the coil and produces a small a.c. voltage in it. The frequency of that voltage is an exact indication of the strength of the magnetic field."

"That's neat!" Carl exclaimed. "How's it used in archaeology?"

"It was first put to use at Sybaris in southern Italy. In the sixth century B.C., enemies from the neighboring city of Croton destroyed Sybaris, leveled it, and diverted the Crathis River to flow over the site and cover it with silt."

"I somehow get the feeling the Crotoni didn't like the swinging Sybariti very much."

"You better believe it. Anyway, the archaeologists didn't know where to look for the buried ruins. Italian soil in this region is magnetic, but the limestone from which the Sybarites originally built their wall is not. When they surveyed the flat plain of the ancient river with the proton magnetometer they found abrupt changes in the magnetism of the ground below by which they could trace the location of the buried wall for nearly a mile.

"Three different proton magnetometers have been used at Angel Mounds here in Indiana with pretty good results. The first was the Model M-49 built by Varian Associates of Palo Alto, California. Another was an English model, the Elsec 592/A, built by Littlemore Scientific Engineering Company. The one they're using now, the LMB II, was built by a man named Scollar at the Rheinisches Landesmuseum in Bonn, Germany. All three will show the presence of many buried materials by indicating slight differences in the strength of magnetic readings taken directly above."

"That's it!" Carl exclaimed. "We'll build a proton magnetometer and survey that Indian mound back there!"

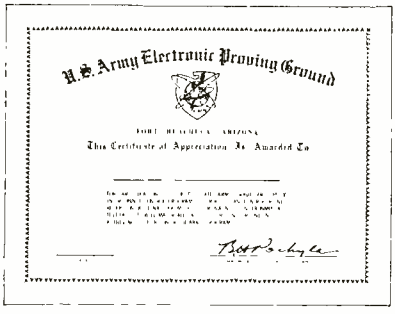
"Now hold on," Jerry demurred. "The proton magnetometer is simple in theory but very sophisticated in practice. The voltage output of the coil is only about a microvolt. That means you need a lot of noise-free amplification before you can measure the frequency. And you should measure that frequency to approximately one part in 25,000. Protons normally make about 2000 gyrations per second at the earth's surface. A typical reading would be 2000.64 cycles per second. Increasing the magnetic field five gammas (.00005 gauss) raises the frequency only to 2000.84 cycles. Being able to measure point-two of a cycle change at that frequency takes real good equipment."

"Aw come on! Don't tell me Parvoo has educated the experimenter out of you. We used to do a lot of things because we didn't know they couldn't be done. Where's your old make-do spirit?"

"O.K., O.K.! You've made your point.

(*Continued on page* 104)

U.S. Army to Issue "Interference" Certificates


U.S. Army Electronic Proving Ground

This Certificate of Appreciation Is Awarded To

AS PART of a study to measure and analyze r.f. interference under simulated battlefield conditions, the U.S. Army's Electronic Proving Ground at Fort Huachuca, Ariz., will issue certificates (see sample, left) to all those verifying special test transmissions.

Testing is done between the hours of 1430 and 2230 GMT, Monday through Friday. AM, c.w., and RTT transmissions are made on frequencies ranging from 1.5 to 54 mc., and from 225 to 400 mc. FM is used from 20 to 400 mc. The transmissions begin as follows: "This is Alpha Alpha Seven X-Ray Yankee . . ." The call AA7XY is also used on c.w.

All amateur operators and SWL's are asked to help in the study by sending complete reception reports to the Signal Officer, U.S. Army Electronic Proving Ground, Fort Huachuca, Ariz. Include data on your receiver and antenna when reporting. —30—

NOVICE CROSSWORD PUZZLE

By Stephen Nelson

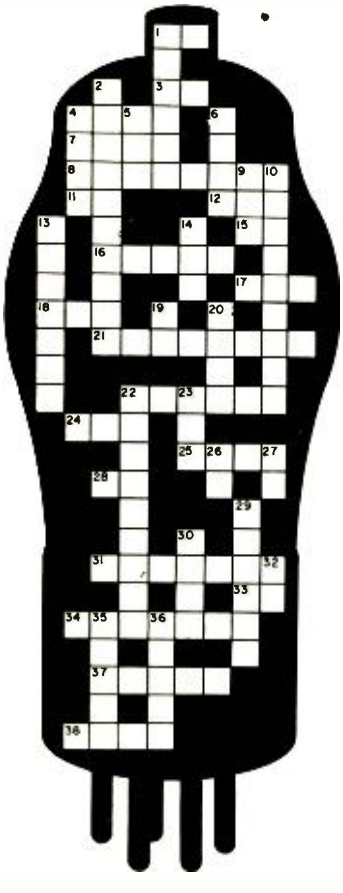
ACROSS

1 Audio frequency: abbrev.
3 Public address system: abbrev.
4 Enclosure.
7 Your turn to talk.
8 R.f. rectifier.
11 Elevated railroad.
12 Article.
15 Megacycle: abbrev.
16 Undesired sound.
17 Unwired equipment (sold as).
18 Ungrounded connection.
21 Multiple of the fundamental.
22 Selective a.f. or r.f. network.
24 Heater: abbrev.
25 Electrode in vacuum tube.
28 General call to any ham station.
31 Device to radiate radio waves.
33 Direct current: abbrev.
34 Frequency-controlling element.
37 Two-element vacuum tube.
38 Dot-dash signals.

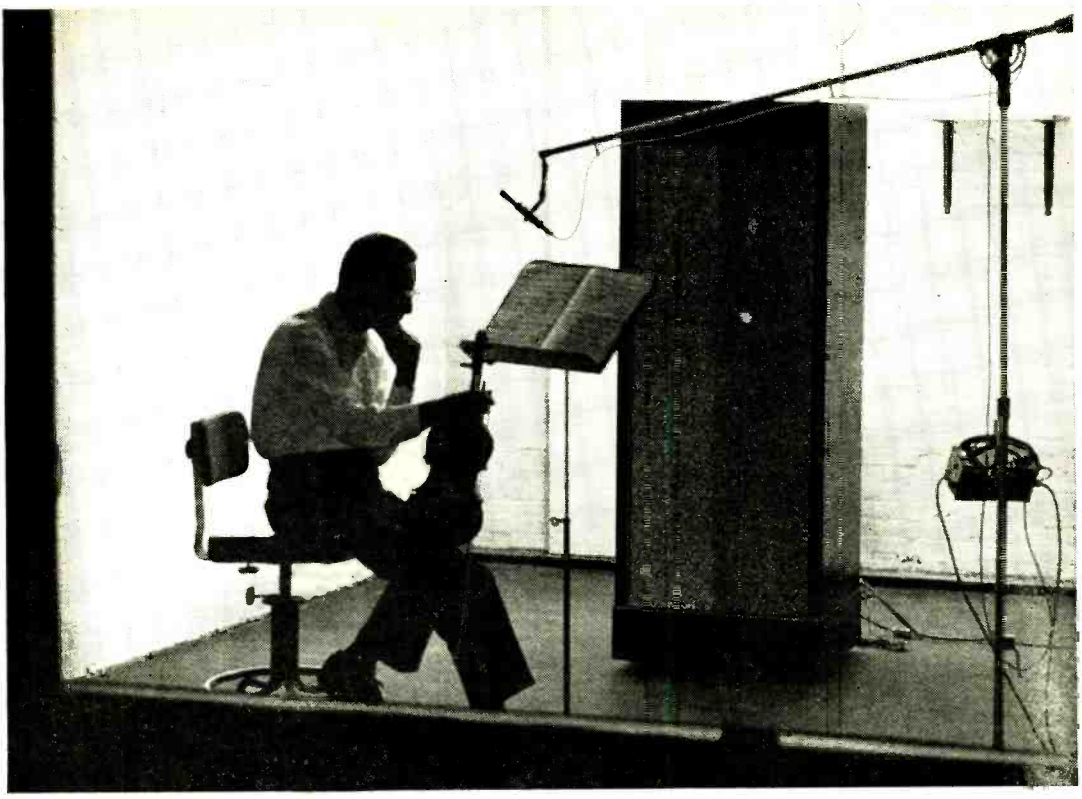
DOWN

1 Unit of current flow.
2 Divide 300 by frequency in mc. to get ———.
4 International Morse ————.
5 Knobs are held by ——— screws.
6 Practical unit of electrical power.
9 Unit of resistance to current flow.
10 Device to produce pulsating d.c. from a.c.
13 Electron-emitting electrode.
14 Signal evaluation code.
19 End of message: abbrev.
20 Unit of electromotive force.
22 Number of cycles per second.
23 Record of station activities.
26 Radio frequency: abbrev.
27 Distant.
29 First name: slang.
30 To get a license, you must pass a ————.
32 Alternating current: abbrev.
35 Receiving set.
36 Cathode-ray test instrument.

(*Answers on page* 98)



Now . . . a new EASTMAN Sound Recording Tape!



LISTEN . . . New "R"-type Binder Assures Long-Term Sound Clarity . . .

AT LAST, a much superior binder—one that provides a super-smooth, tough, homogeneous oxide layer which dramatically suppresses tape noise and intermodulation distortion!

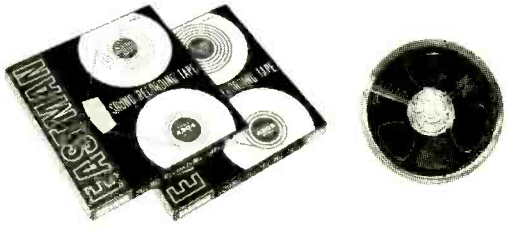
Extremely abrasion-resistant, it prevents oxide build-up on the recording head, assures long-term excellence of performance.

Equally important are outstanding magnetic characteristics which make possible two superlative tapes . . . a superb low-noise, *high-output* tape and an extra *low-print* tape.

STRONGER: DUROL support material, a specially prepared form of cellulose triacetate, is a good 40% stronger. *When it breaks . . . it breaks clean.*

MORE CONVENIENT: A continuously repeated permanent legend on the back of the tape offers a means of indexing.

Ask for EASTMAN Tapes at leading electronic supply houses: *Type A303,* a superior low-print tape with output comparable to a fine general-purpose tape . . . also *Type A304,* a high-output tape with low print-through.



For fast threading and extra convenience—the unique, handy, Thread-Easy Reel with indexing scale and built-in splicing jig.

For details, see your electronic supplier or write:
Magnetic Product Sales
EASTMAN KODAK COMPANY
Rochester, N.Y. 14650

CIRCLE NO. 8 ON READER SERVICE PAGE

DX AWARDS

POPULAR ELECTRONICS' exciting new contest for SWL's registered with the WPE Short-Wave Monitor program is just getting under way! To be eligible for one of these new awards, you must have verified stations (any frequency or service) in at least 20 different states in the U.S. To apply for your award, read the rules carefully, and fill out the coupon below.

1 Each applicant must be a registered WPE Short-Wave Monitor, and must enter his call letters on the application form.

2 Each applicant must submit a list of stations (any frequency or service) for which he has received verifications, one for each state heard. The list should contain 20, 30, 40, or 50 states, depending on which DX award is being applied for. The following information must be furnished in tabular form and in alphabetical order by state for each verification:

(a) State heard
(b) Call-sign of station verified and location
(c) Frequency
(d) Date station was heard
(e) Date of verification
(f) Indicate whether broadcast was a normal transmission for the class of station received, or a test.

All the above information should be copied from the station's verification. Do not list any verification you cannot supply for authentication on demand.

3 All pertinent verifications, whether QSL cards or letters, should be carefully packaged and stored by the applicant until such time as instructions are received to send in some or all of them for checking purposes. Instructions on how and to whom to send the verifications will be given at that time. Failure to comply with these instructions will disqualify the application.

4 A fee of 50 cents in coin must accompany the list of verifications to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible for an award. Applicants outside of the United States may send 60 cents (U.S.) in coins of their country if they so desire. Please do not send International Reply Coupons (IRC's) when applying for a DX Award.

5 Apply for the highest DX award for which you are eligible. If, at a later date, you become eligible for a higher award, then apply for that award, following these rules and regulations exactly as before.

6 Mail your verification list, fee, and the application form to: Hank Bennett, Short-Wave Editor, POPULAR ELECTRONICS DX AWARDS, P. O. Box 254, Haddonfield, N.J., 08033. Include in the envelope only those items which are directly related to your entry for the award. Do not include an application for a Short-Wave Monitor Certificate (you are not eligible for any of the awards until you have a Monitor Certificate in your possession). If you want to ask other questions or supply news items, reports, etc., please use another envelope.

POPULAR ELECTRONICS' DX AWARD APPLICATION FORM

(please print)

WPE Call Letters _____ Name _____

Address _____ City _____ State _____ Zip Code _____

Please enter my application for the following POPULAR ELECTRONICS' DX AWARD:

(check one) **20** ☐ **30** ☐ **40** ☐ **50** ☐

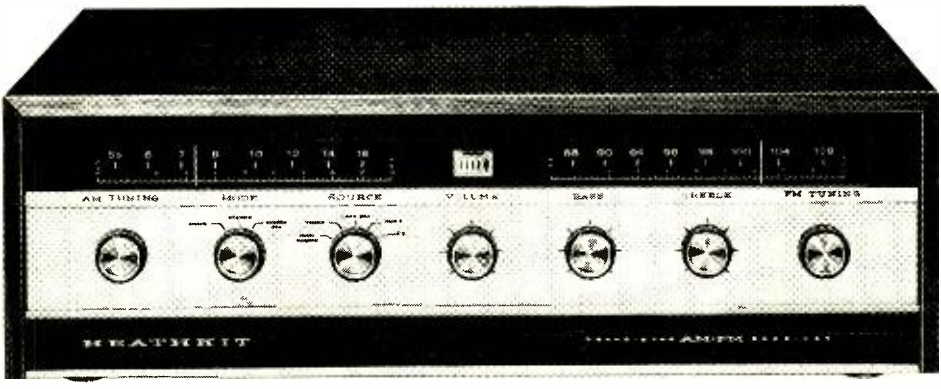
☐ I have enclosed a list of the required number of states, and I hereby certify that I hold a verification from at least one station (any frequency or service) in each of the states listed

☐ I have enclosed 50 cents to help cover the costs of processing and mailing my DX Award

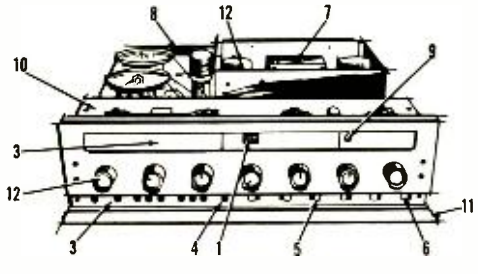
Signature _____ Date _____ 1964

Mail to Hank Bennett, POPULAR ELECTRONICS DX AWARDS, P. O. Box 254, Haddonfield, N. J.

first all-transistor stereo receiver kit!



New! Cool-Operating Heathkit Receiver Combines All-Mode Tuner & 40-Watt Amplifier Into One Compact Walnut Cabinet . . . Only $195.00



1. Tuning meter **2.** Individual AM and FM tuning **3.** Input level controls **4.** Level balance control **5.** Local-distance switch **6.** Speaker phase switch **7.** Transformer operated power supply **8.** AM rod antenna **9.** Stereo indicator light **10.** Preassembled FM "front-end" **11.** Hinged lower front panel (conceals secondary controls) **12.** Regulated and electronic filtered power supply **13.** Illuminated slide-rule dial • 43 transistor, 16 diode circuitry • Dimensions: 17" L x 5⅜" H x 14¾" D.

Two 20-watt power amplifiers...two separate preamplifiers... plus wide-band AM, FM and FM Stereo...all beautifully housed in one compact, "low-silhouette" walnut cabinet. Add to this, cooler, faster operation with no fading, no faltering, just clean, pure, unmodified sound, and you have the exciting new Heathkit Stereo Receiver. The first all-transistor receiver in kit form! And it's so easy to own...just $195.00!

Advanced features in addition to those shown at the left include: automatic switching to stereo; inputs for magnetic phono and two other sources; filtered tape recorder outputs; high-gain RF stages, squelch control; AFC; effortless flywheel tuning; external antenna terminals; and preassembled FM "front-end" and 3-stage AM-FM I.F. strip. Just add two speakers and a phonograph or tape recorder, and you have a complete music system. "Transistor sound," designer styling, advanced features, plus big savings...more than enough good reasons to move up to the "better listening" of the New Heathkit Stereo Receiver!

Kit AR-13, 30 lbs.....$195.00

HEATHKIT® by Daystrom 10-4-2

HEATH COMPANY · Benton Harbor, Michigan 49023
In Canada: Daystrom, Ltd., Cooksville, Ont.

FREE 1964 HEATHKIT CATALOG

See the latest products in Heathkit's wide, wonderful line. Over 250 do-it-yourself kits for stereo/hi-fi, marine, TV, electronic organ, amateur radio, test instruments, educational and home and hobby items that will save you up to 50%. Send for your free copy today!

Name_____

Address_____

City_____ State_____ Zip No._____

Prices & specifications subject to change without notice.

☐ Enclosed is $195.00 plus postage, please send Kit AR-13 Stereo Receiver.

☐ Please send complete detail and specification sheet on the AR-13 Stereo Receiver.

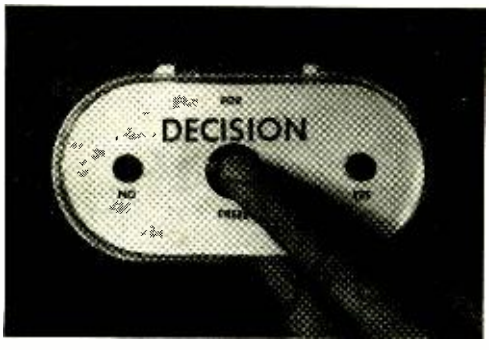
☐ Please send Free copy of 1964 Heathkit Catalog.

HF-165

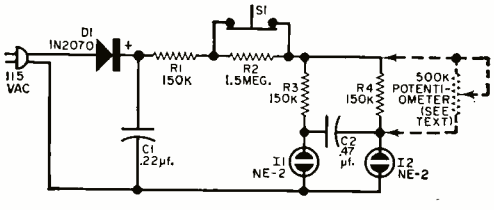
CIRCLE NO. 12 ON READER SERVICE PAGE

THE PROCRASTINATOR'S COMPANION

Pick the winner electronically with this little box that automatically gives you a "yes" or "no" decision

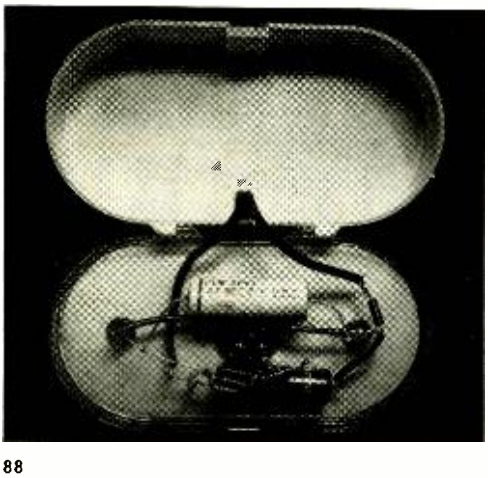


Want to know the score? You just press the button.



A 1N2070 or any 400 PIV silicon diode can be used for D1. Potentiometer is for calibration only.

The author's unit was built into a small plastic case, with all of the wiring done point-to-point.



WHETHER OR NOT you happen to be a procrastinator, you'll find this little gadget handy when it comes to making tough decisions—such as laying odds on the horses running in the daily double. Ask a question, press the button, and the answer appears in the form of a lighted neon bulb labeled "yes" or "no."

A look at the circuit reveals the secret: *C2*. Suppose *I1* has fired. When it does, it lights, and there is a voltage drop across it and *R3*. This causes *C2* to charge up through *R4* toward the supply voltage. When it reaches *I2*'s ionization point, *I2* fires and *C2* begins charging in the opposite direction, taking the voltage at *I1* down to where it extinguishes.

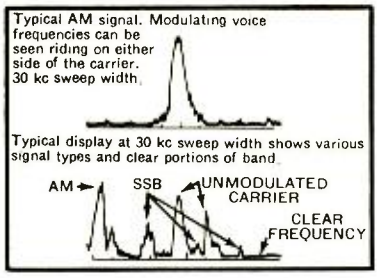
The whole process becomes clear if you recall that NE-2's require a "kick" of about 10 volts over their operating voltage to fire them, and a drop in voltage below the operating point to extinguish them. By coupling *I1* and *I2* together with *C2*, they flash merrily back and forth—at a rate too fast to stop at will—until *S1* is pressed. When this happens, *R2* lowers the supply voltage to a point too low to ionize either of the bulbs, but high enough to keep lit which ever of the bulbs is ionized at that instant.

The unit can be built into any plastic case large enough to hold the parts; holes lined with grommets hold *I1* and *I2*. Switch *S1* is a s.p.s.t. normally-closed push-button type (Hart and Hegeman 3391 or equivalent). Since NE-2's operate at slightly different voltages, *I1* and *I2* have to be matched to light randomly. Another method is to vary *R4*. Simply connect a 500,000-ohm potentiometer in its place and adjust until operation is random ("yes" and "no" bulbs light an equal number of times after many trials). Measure the resistance of the pot and substitute a resistor of the same value in its place.

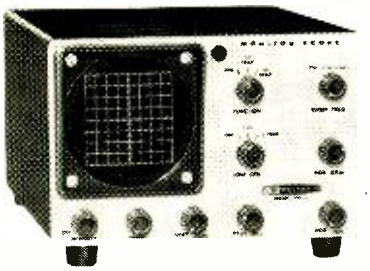
"The Procrastinator's Companion" can be used as a substitute coin-flipper, a "go—no-go" device for playing games, or for laying odds—you'll think of many other possible uses for it! —*R. C. Apperson, Jr.*

WATCH IT, HAMS & CBers

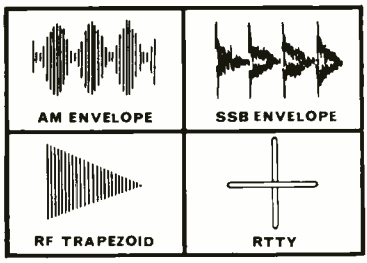
MODEL HO-13



WITH THE NEW HEATHKIT® "HAM-SCAN" SPECTRUM MONITOR



MODEL HO-10



...AND THE HEATHKIT® SIGNAL MONITOR

NEW! Heathkit "Ham-Scan" Spectrum Monitor . . . HO-13

• First of its type in kit form! • Adds "sight" to "sound" of amateur & CB radio operations • Operates with most receivers & transceivers • Monitors signals up to 50 kc above & below receiver frequency • Identifies SSB, AM & CW signal types, band openings, etc. • Ideal for checking carrier & sideband suppression in SSB transmitters or as a CB channel monitor.

Kit HO-13. . .11 lbs. $79.00

SPECIFICATIONS—Receiver IF: 455, 1600, 1650, 1681, 2075, 2215, 2445, 3000, 3055, 3395 kc. **RF Amplifier—Response:** ±0.5 db at ±50 kc from receiver, IF. **IF**—350 kc. **Sensitivity:** Approx. 100 uv input for 1" vertical deflection at full gain setting. **Horizontal deflection—Sweep generator:** Linear sawtooth, recurrent-type (internal). **Frequency:** 10 to 50 cps, variable. **Sweep width:** 30 kc or less, to 100 kc ±20%. Continuously variable. (Approx. 15 kc to 100 kc for 455 kc IF). **Resolution:** 1.5 kc (frequency difference between two 1" pips whose adjacent 3 db points coincide. Measured at slowest sweep speed and at 30 kc sweep width). **Power supply:** Transformer operated, fused at ½ ampere. **Low voltage:** Full wave voltage-doubler circuit provides 250 volts @ 20 ma, & 580 volts @ 6 ma. **High voltage:** Half wave circuit provides —1600 volts @ 1 ma for CRT. **Power requirements:** 120 volts AC, 50/60 cps, 40 watts. **Tube complement:** 3RP1 CRT (medium persistence green trace), 1V2 HV rectifier, 6AT6 detector 6EW6 RF amplifier, 6C10 sweep generator/horizontal amplifier, (2) 6EW6 IF amplifier, 6EA8 oscillator/mixer, (4) 500 ma silicon diode low voltage rectifiers, crystal diode. IN954 voltage-variable capacitor. **Controls:** On-Off/Intensity, focus, horizontal gain, sweep width, pip center, horizontal position, pip gain, vertical position, sweep frequency/AGC, astigmatism. **Dimensions:** 5¼" H x 7⅞" W x 11" D.

Heathkit Signal Monitor. . . HO-10

• Monitors transmitted & received signals • Displays envelope, AF & RF trapezoid patterns • Automatic switching on envelope patterns • Specially designed for amateur & CB radio use • Instructions included for low-power CB use • Requires no additional tuning on 160 through 6 meters • Handles power inputs from 5-watts to 1 kilowatt • Use with all tube-type receivers with up to 500 kc I.F. • Easy to install in antenna system feed line (50-75 ohm).

Kit HO-10. . .11 lbs. $59.95

SPECIFICATIONS—Vertical response: ±3 db from 10 cps to 500 kc. **Sensitivity:** 500 mv per inch deflection. **Input resistance:** 50 k ohm. **Horizontal response:** ±3 db from 3 cps to 30 kc. **Sensitivity:** 800 mv per inch deflection. **Input resistance:** 1 megohm. **Sweep generator: Recurrent type:** 15 to 200 cps (variable). **Tone oscillators:** Approximately 1000 cps and 1700 cps. **Output voltage:** 15 mv (nominal). **GENERAL: Frequency coverage:** 160 through 6 meters (50-75 ohm coaxial input). **Power limits:** 5 watts to 1 kilowatt output. **Front panel controls:** Function Selector, Sweep Frequency, Tone Generator, Horizontal Gain, Horizontal Position, Vertical Position, Vertical Gain, Focus, Intensity/Off. **Rear control:** Xmtr. Atten. Attenuates 0 to 24 db at approximately 6 db per step. **Power supply:** Transformer operated, fused ½ amp. **Power requirements:** 105-125 VAC, 50/60 cps, 35 watts. **Dimensions:** 5¼" H x 7⅞" W x 10½" D.

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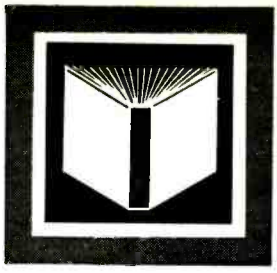

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SINGLE SIDEBAND PRINCIPLES AND CIRCUITS

by E. W. Pappenfus, W. B. Bruene, E. O. Schoenike

When you take three experts in a given field, each of them recognized for his individual contributions to that field, and assign them the task of writing a book, the results are bound to be impressive. Pappenfus, Bruene and Schoenike have amassed a wealth of knowledge and experience between the covers of this work. While the book was planned for the engineer, it also serves the needs of advanced technicians and amateurs. Over three hundred illustrations help clarify sticky points, and the book is well-suited to home study. The many tables, charts, nomographs and typical circuit schematics make this a valuable reference work.

Published by McGraw-Hill Book Co., 330 West 42 St., New York, N.Y. 10036. 374 pages. Hard cover. $14.75.

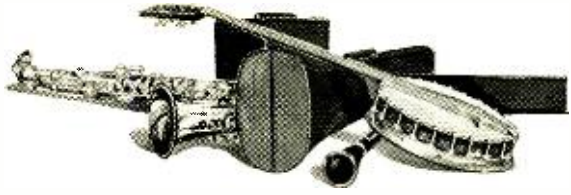
ELECTRONIC ENGINEERS AND TECHNICIANS REFERENCE HANDBOOK

If you've wondered about some of those circuit principles that receive a quick "once-over" in standard handbooks, this text will go far to fill you in on the basics—especially those needed to fully understand or design a piece of equipment. Included are chapters on power dissipation and transfer, amplification and bias, semiconductors, LC oscillators, multivibrators, diode clampers and clippers, capacitors, inductance, impedance, resonant circuits, and network solutions. In addition to the technician, the advanced hobbyist can profit greatly from the material presented.

Published by Howard W. Sams & Co., Inc., 4300 West 62 St., Indianapolis 6, Ind. Hard cover. 224 pages. $4.95.

(*Continued on page 92*)

You could assemble an orchestra-



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Bookshelf

(*Continued from page* 90)

AUDEL'S TELEVISION REPAIR MANUAL

The number of electronics technicians that cut their teeth on one or more of the famous Audel service books is legion. Some time ago, the Howard W. Sams publishing company assumed control of Theodore Audel & Co. and this TV repair guidebook is the first offering in electronics resulting from this new association. For those few readers who have never seen or read an Audel Guide, the books are distinguished by certain features: The type is large, the text is straightforward, explanations are almost unbelievably simplified, and the subject coverage is comprehensive. The current *Television Repair Manual* is no exception—it ranges from color TV to basic antenna installation. For the part-time or "beginning" repairman, this Audel Guide will repay its nominal cost many times over.

Published by Theodore Audel & Co., 4300 West 62 St., Indianapolis 6, Ind. Hard cover. 504 pages. $5.00.

WHAT YOU SHOULD KNOW ABOUT YOUR TAPE RECORDER

This pocket-size book attempts to do something a bit more detailed on a subject which has been casually treated by some other consumer publications in the field—an explanation of the principles that lie behind the gleaming exterior of a tape recorder. Published by a firm specializing in recording accessories, it should find a place on many hobbyists' bookshelves.

Published by Robins Industries Corp., 15-58 127 St., Flushing, N.Y., 11356. 92 pages. Soft cover. $1.

Free Literature

A new Crystal Directory for Citizens Band equipment is now available from Texas Crystals, 1000 Crystal Drive, Fort Myers, Fla. Both transmitter and receiver crystals are listed for models of some 64 different CB equipment manufacturers in this 12-page bulletin (No. 1065) . . . The complete line of Sony tape recorders, microphones, and other accessories is illustrated and described in *two* full-color catalogs entitled "All New from Sony." Catalog B-64 is a comprehensive 16-page 11" x 8¼" brochure, while Catalog S-64 is a pocket-size condensed version of the larger bulletin. Write to Superscope, Inc., 8150 Vineland Ave., Sun Valley, Calif., for either one. —30—

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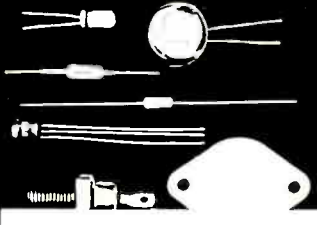

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On the Citizens Band

(*Continued from page 78*)

tween 26.425 and 26.575 mc. may not exceed .005%; on 465 mc., .01%. As for emission, telephony (voice) only is permissible; however, amplitude, frequency, or phase modulation may be used (i.e., AM, FM or PM).

The equipment may consist of separate transmitter and receiver units or combinations (transceivers) such as we are familiar with in this country. Unlike many American CB units on the market, external controls for the adjustment of transmitter frequency are not allowed in this service, nor is the operation of any other controls that may affect the transmitter frequency.

Statistically Speaking. The Kaar Engineering Corporation, Palo Alto, Calif., arrived at some interesting tabulations on the types of applications for which their CB equipment is being used. Based on a 90-day period of sales, the results were for 6-, 12-, 117- and 32-volt equipment purchased.

Sixty per cent of the units sold were bought by private individuals, which could indicate marine or land use, possible large-scale farming operations, or even resale in their own communities or to members of their CB club. Kaar stated that in some of these instances from six to eight units were purchased.

Other units were purchased for commercial fishing boats, work boats, barges and yacht basins; for industrial in-plant and out-of-plant applications. Plumbing and heating contractors rang up a small percentage of the purchases, as did public works and utilities. Other categories of buyers included: excavating contractors, pleasure boats, lumber, milling and logging operators, doctors and veterinarians, funeral homes, concrete contractors, auto repair stations and tow services, geophysical research, recreational facilities, petroleum industries, Civil Air Patrol, general construction contractors, game and fish preserves, local government aviation departments, transportation companies, taxis, volunteer fire departments, radio stations, drugstores, horse, cattle and dude ranches, dry cleaners, and Jeep clubs.

Although these statistics may not be representative of the uses of CB on a nationwide scale, they do give a definite indication of the multiple uses to which CB is put.

Club Chatter. The Citizens Emergency Mobile Patrol, Reseda, Calif., has responded to our plea for CB clubs to "stand up and

be counted" by OTCB. In a recent issue of the *Modulator,* the club newspaper, past-president Scott Stucker, KEJ5772, thanked the membership for their support over the last year and for their voluntary efforts.

During 1963, C.E.M.P. members participated in Operation SABIN, aiding Civil Defense officials during a polio epidemic in Pasadena, Calif.: assisted in traffic control at the Rose Parade; and handled emergency and safety communication traffic during the Riverside Race (NASCAR).

Other events at which C.E.M.P. members assisted in the past, and plan to do a repeat performance this year, include the L.A. Times Grand Prix, The Golden State 400, and the Motor Trend 500 races. The club also covered communications for this year's Tournament of Roses event in Pasadena by handling the crowds and traffic going into the Rose Bowl. Equipped? All Citizens Emergency Mobile Patrol members must carry the following equipment in their cars at all times: first-aid kit, fire extinguisher, flashlight, extra batteries and bulb, four red flares, fuses for CB radio, two blankets, 120-volt extension cord, and a pad of paper and pencils.

The South-Eastern Pennsylvania Citizens Band Club of Chester, Pa., held its annual election at the December meeting. New officers are president Dominick D'Andreamatteo, KCD5479; vice president Thomas Russell, KCC0156; treasurer Norman McFadden, KCD1490; and secretary Robert Kaufman, 3W4242.

The *Heterodyne Gazette,* official monthly of the 11 O-M CB Radio Club of Toledo, Ohio, lists its current officers as follows (note the "veteran" call-signs): Rich Taylor, 19A4109, president; Bill Noyes, 19A-7926, vice-president; Kenny Revard, 19W-7239, secretary; Jim Owen, 19W4248, treasurer.

CB Broadcaster editor Bill Brown, Greater Dallas (Texas) Citizens Band Club, has seen to it that a copy of their clean-cut newspaper has reached this desk monthly, as have several other club editors. However, this month it became obvious that Bill's efforts are now being presented via the keys of a new typewriter. The news is as well-written as in the past, the paper is laid out in the same way, but five words now dominate the bottom of each page of the *CB Broadcaster.* They might well be placed among the pages of all CB club newspapers in the future. They read: "PARTICIPATE —DO MORE IN '64!"

Many thanks for sending those fine letters verifying CB club address changes, new officers, and club activities. This action will enable us to direct special mailings to those clubs active in worthwhile public service activities and assure their listing in a possible directory this fall. If you haven't checked in yet this year—do it now!

Matt, KHC2060

Tornado Alley's Net

(*Continued from page* 38)

county for a relay station to provide better communications with the Weather Bureau at Cairo, Ill., and State Alternate CD Control at Belleville, Ill. The Belleville station is control for 25 counties of the Southwest Illinois Mutual Aid Area, and coordinates reports from 42 different nets, including information from St. Louis' Lambert Field Weather Bureau and its radar storm watchers. Cornell, at the relay station, is alternate control for the Mutual Aid Area.

When the Cairo Weather Bureau notifies the Jackson County Civil Defense unit of severe weather and possible tor-

nado conditions existing, warnings are flashed to all schools and hospitals in the county, three radio stations, and WSIU-TV at the University. RACES operators tune their receivers to the net frequency and await reports.

Proof of the net's efficiency came in April, 1962, when net members stationed at sirens were able to sound "take cover" signals in Murphysboro just before a tornado struck farm buildings, homes, trees, and utility lines northwest of town. About the same time, another spotter saw a tornado cloud south of the town. Warned, Murphysboro residents went to the southwest corners of their basements.

Don Cornell wonders—with many others—had there been such a warning system then, would there have been ten people killed in the December 18, 1957, Murphysboro tornado? "Tornado Alley's Emergency Net" is proof of their determination not to let it happen again. —30—

Who Started World War I?

(*Continued from page* 42)

many, France, Russia, and Great Britain —regarded themselves as "agents of friendship." And each felt that his friendship was not returned.

The statesmen of each of the five major powers felt their "injury" most strongly "at the time when they were making policy decisions of the most crucial nature." Thus, the Stanford researchers, headed by Dr. Robert C. North and including professors Jan F. Triska and Richard A. Brody, say that "at the very time when the situation most urgently required a calm assessment of events, intentions, and capabilities, leaders in Vienna, Berlin, St. Peterburg, London, and Paris were under the most severe stress."

Computerized State Department? While the conclusions arrived at by the computer can be easily disputed by professional historians, the scientists feel they have made an important point: world crises can be analyzed in great detail using computers and, given sufficient data, conclusions can be drawn that will

assist policy makers in the conduct of foreign affairs.

As Stanford's Dr. North puts it, "The techniques of research we are developing may someday enable us to enlarge the saying that 'those who fail to learn from history are doomed to repeat it,' to include the further statement that 'those who fail to learn from computer projections of the future are doomed to experience all of its pitfalls.'" —30—

Across the Ham Bands

(*Continued from page 75*)

step was taken to give the courts time to determine whether or not the Commission has the legal right to charge license fees. As a result, many hams (and CB'ers) who obtained new, renewed, modified, or upgraded licenses between January 1 and March 1, 1964, are a few dollars richer than they expected to be. We'll keep you informed of later developments.

News and Views

Tom Garritamo, WN9JGX, 5302 Drummond, Chicago, Ill., 60639, started his Novice career using the "High-Performance Transmitter" described in the January, 1962, *Across the Ham Bands* to feed a 40-meter dipole. Now,

Answers to Novice Crossword Puzzle on page 84

in preparation for the arrival of his General ticket, he is using a Johnson Valiant squeezed down to 75 watts. A Hallicrafters SX-117 handles the receiving chores. Cards from 32 states and the Panama Canal Zone surround a Rag Chewers' Club certificate on his shack wall . . . **To all SWL's.** Here's a perfect example of how not to get a reply to the SWL cards you send to hams: "Dear W——, please send me your QSL card. I heard you, but you didn't hear me." The ham who received this gem showed it to me and then threw it in the wastebasket . . . **F. "Bin" Stone, WN2KTJ,** 625 Orchard Parkway, Niagara Falls, N.Y., finds that his Lafayette vertical antenna does a good job on 40 and 15 meters, where he has worked 25 states and Puerto Rico. An Eico 723 transmitter pushes his r.f. up the antenna, and a Hallicrafters SX-42 receiver pulls the incoming r.f. down the antenna.

Jud Lindsey, WN2HWV, R.D. 1, Pine City, N.Y., parlayed a P.E. short-wave monitor certificate (WPE2IBN) and a CB ticket (KIC1874) into his ham ticket. On the ham bands, he has worked 42 states, a "mess" of Canadians, and a few DX stations; but Jud admits that he gets "shook up" when he hears DX stations calling him, which has held down his DX total. A homebrew transmitter running 60 watts to a very hot 6L6 feeds a combination 80-40 meter dipole 15′ high, and a National NC-88 receiver aided by a Heathkit Q-Multiplier rounds out the equipment at WN2HWV . . . **Steve Gorenbein, WN6EVZ,** Van Nuys, Calif., was so anxious to tell us about the fine results he is getting with his new Hy-Gain 18V vertical antenna that he forgot to give us his address. But the new antenna has been spraying the r.f. from his Heathkit HX-11 transmitter all over the western half of the United States on 40 meters. He receives on a "vintage" Hallicrafters S-40 receiver . . . **Paul, WN2GQM,** reports that Al Rezza, WA2SRK, is net manager of the New Jersey Novice Net. The net meets on 3725 kc. on Tuesdays and Thursdays at 0020 GMT, which translates to Mondays and Wednesdays at 7:20 p.m., EST. The net "call up" is "CQ NJNN," and all New Jersey Novices are invited to join.

Edgar M. Osborne, Jr., KN7ZMA, 1301 Washington Ave., Ajo, Arizona, likes to build as well as operate. He uses a home-built 60-watter for "DX'ing" and a home-built 12-watter for local rag-chewing. Ed operates on the 80-, 40-, and 15-meter Novice bands and has 14 states logged; a Hammarlund HQ-105 receiver occupies its share of Ed's operating desk . . . **Jack Taylor, WA5EIN,** 1456 Champlin Cir., Handsboro, Miss., worked 49 states, three Hawaiians, two Mexicans, and a Cuban in the 40-meter Novice band with his Heathkit DX-40 transmitter. Jack had a dipole antenna and a National NC-173 receiver. Santa Claus brought him a Heathkit "Marauder" transmitter last year, which he uses on 40- and 20-meter AM, SSB, and c.w., although he still spends much time in the 40-meter Novice band to help Novices work Mississippi for the worked-all-states award . . . **Dorothy M. Broughton, WN4QDZ,** P.O. Box 6333, Mobile, Ala., worked 44 states, a handful of Canadians, a Cuban, and a Russian in her first 10 weeks on the air—all on 40 meters! An Eico 720 transmitter runs 60 watts to feed a 40-meter dipole antenna. Dot also has a seldom-used "inverted-V" antenna, which will probably have been replaced by a Gotham vertical antenna by the time you read this. A Hallicrafters SX-110 receiver completes her equipment. If you'd like to work a 24-year old YL, look for WN4DQZ on 40 meters almost every night after 9:00 p.m., EST.

Collins Waters, WØAZD, 2808A Dayton St., St. Louis, Mo., 63106, has had the misfortune of losing most of his QSL cards and logbooks in a fire and would appreciate it if any ham who worked WØAZD in 1961 would send him a duplicate QSL card to comfirm the contact . . . **Ronnie Martin, WN5HLL,** 4724 Elmwood Dr., Baton Rouge 14, La., uses a Heathkit "Cheyenne" transmitter converted to crystal control held down to 72 watts input. A Knight-Kit R-55 receiver, and a 40-meter "inverted-V" antenna 23′ high complete the installation. Ronnie likes 40 and 15 meters and has 29 states and three Canadians worked.

Remember, whether you work 160 meters or the microwaves, this is *your* column. Your pictures, "News and Views," and suggestions are always welcome. Send them all to Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Ind., 46401. 73,

Herb, W9EGQ

Short-Wave Report

(*Continued from page* 81)

Washington, D.C., 20402. This publication comes in three parts—or volumes.

Part 1 lists all radio broadcasting stations—*except those in the United States*—according to country and city (521 pages, $2.25). Part 2 contains the same information as above, but is indexed according to frequency (503 pages, $2.25). Part 3 contains two sections, one for FM broadcasting stations, and the other for TV, each separately indexed by country, city, and frequency. Additional technical information on these stations is included (564 pages, $2.50).

All three parts of the publication are available only from the Government Printing Office, not from the U.S.I.A., VOA, or Foreign Broadcast Information Service.

New Club. Your Short-Wave Editor always hesitates to mention newly formed SWL clubs in this column until such time as they have had a chance to get properly organized and are in a position to handle large numbers of new members. However, one has come to our attention that we feel is worth mentioning in spite of its infancy. It is a radio club for blind students.

Located at 4834 Old York Rd., Philadelphia, Pa. 19141, this club is headed by Joe Johnston, WPE3FDN. Its primary aim is to help blind people learn about and enjoy the hobby of short-wave listening. Interested persons should contact Mr. Johnston directly for further information.

Current Station Reports

The following is a resume 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., 08033, 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.

Afghanistan—A new schedule from *R. Kabul* reads: in Eng. to the Far East at 0530-0600 on 9650 kc., to Australia and S. E. Asia at 0500-0530 on 9595 kc., and to Pakistan and India at 0900-0930 on 6000 kc.; to Europe in German at 1330-1400 and in French at 1400-1430 on 9635 kc. Their new address is P. O. Box 159, Kabul.

Andorra—According to overseas sources, *R. Andorra* has moved back from 5990 kc. to 6195 kc. and is noted closing at 1300.

Ascension Island—The BBC has placed an order for four 250-kw. xmtrs to be installed on Ascension Island to improve service in Africa and Latin America. Test xmsns were made in 1963. Other tests continue on the medium waves (exact frequency not specified) with 10 kw.

Australia—*R. Australia* is to have a booster station at Darwin to relay programs to Asia. This station will use three 200-kw. xmtrs and is scheduled to be in operation by 1967.

Brazil—*R. Rural*, ZYZ32, Rio de Janeiro, was heard as early as 0430 in Portuguese. Station ZYT29, *R. Diario da Manha*, Florianapolis, 9675 kc., is often heard at 1700-2150 with music and news. Station ZYR227, *R. Gazeta*, Sao Paulo, 9685 kc., is good from 1800 to 2200 but there may be considerable QRM at times. Station ZYR56, *R. Excelsior*, Sao Paulo, 9585 kc., is noted around 1900 and also at 0200-0300 with Portuguese language and music. Station ZYR83, Aparecida, 9635 kc., is seldom noted around 1830-1930 due to QRM but has Latin American and pop U.S. music, Portuguese language.

Canada—In the February column we mentioned that CFCX, Montreal, once was licensed as VE9DR. Fred Baines of New Glasgow, N.S., has written to CFCX claiming that he verified VE9DR in 1932 when the station was in Drummondville and again in 1936 after they had moved to Montreal. Station CFCX, 6005 kc., is now up to 500 watts to the Canadian Northland and to the West Indies; they relay CFCF, 600 kc.

Canary Islands—Station EA8AB, *R. Clube de Tenerife*, has verified with a letter. It is owned and operated by *Padron Industria Radioelectrica*, Viera y Claviejo No. 1, Santa Cruz de Tenerife. This station is on 7295 kc. with 500 watts.

Ceylon—*VOA*, Colombo, was briefly tuned on 9667 kc. (announced) at 0700 with musical selections and listeners' mail, mostly from Djakarta. The Commercial Service has been heard daily at 0900-1000 in Eng. with various types of western music.

Colombia—Station HJOG, *R. Santa Fe*, Bogota, is good on 4965 kc. from 2300 to 0000, all-Spanish, with frequent ID's. A newscast is given at 2300.

Denmark—Copenhagen has issued a new schedule that lists a 0700-0800 xmsn to N.A. on 15,165 kc., replacing the old 2200-2300 xmsn. The 2030-2130 xmsn on 9520 kc. remains the same. Other xmsns: on 15,165 kc. at 1230-1310 to Greenland, and at 1330-1430 to S. Africa; on 9520 kc. at 1645-1745 to South America. From Monday through Friday the N.A. and African xmsns consist of 30 minutes in Danish and 30 minutes in English.

Dominican Republic—Unidentified for some time, the station on 2400 kc. is *R. San Pedro*, HIHE (?), San Pedro de Macoris. It is noted with typical Latin American programs and with closing anywhere from 2138 to 2202. Another new station is *R. Santa Maria*, possibly located in La Vega, on 2380 kc.; they s/off at 2130 after an anthem.

Egypt—A commercial station is to be opened in Port Said in 1964 to boost British trade in

the Middle East area. The programs will be similar to those of *R. Luxembourg* but entirely in Arabic. Some DX'ers in Sweden are of the opinion that the station will be located in Cyprus to replace the old *Asharq al Adna*, while others apparently feel that the whole story is a hoax. Does anyone have any definite information on it?

England—*Sweden Calling DX'ers* reports that the *R. Manx*, Isle of Man, station is expected to be on the air during the spring. The license issued to *R. Manx* earlier is for a low-powered xmtr supposedly to cover only the island. The island had hoped to start its own *R. Luxembourg* but it now appears that the station will be a summer radio service for visitors.

Germany (East)—*R. Berlin International*'s new schedule reads: to Central Africa in Eng. at 2330 on 11,795 kc., at 0830 on 17,825 kc., at 1100 on 11,795 kc., and at 1430 on 9615 kc.; to W. Africa in Eng. at 0130 on 15,255 kc., at 0730 on 17,825 kc., at 1230 on 9615 kc., and at 1630 on 5970 kc.; to South and Central America in Spanish at 1800 and 2100, in Portuguese at 1700 and 2000, and in German at 1900 and 2200, all on 9615 and 9725 kc.; to N.A. (east) in Eng. at 2000 and 2130 and in German at 2030 and 2200 on 6050 kc.; to N.A. (west) in Eng. at 2245 and 2345 and in German at 2315 on 6080 kc.

Germany (West)—Cologne now operates on 9735 kc. (replacing 15,405 kc.) dual to 11,795 kc. for the 1010-1050 xmsn to N.A.

Ghana—Accra is good on 4915 kc. at 2200-2205 with Eng. news, then organ music to

DX Awards Presented

The following DX'ers have qualified for awards this month (150, 50, and 25 countries verified). Congratulations, and welcome to the Awards List!

One Hundred and Fifty Countries

Lars Ryden (SM5PE1B), Kallhall, Sweden

Fifty Countries

Jack Winther (WPE6BJD), Moraga, Calif.
Michael Brumberger (WPE2HNZ), Brooklyn, N.Y

Twenty-Five Countries

Luis S. Valdivieso, Jr. (WPE2KPJ), Jamaica, N.Y
Bruce M. Lane (WPE1FLR), Bedford, Mass.
Charles Schwartzbard (WPE2TA), Passaic, N.J.
Larry G. Standley (WPE4FZS), Gastonia, N.C.
Donald F. Heitzmann (WPE2KHH), Garden City, N.Y.
David Williams (WPE7IK), F. E. Warren A.F.B., Wyoming
Robert Dockery (WPE4EPE), Asheville, N.C.
Jerry Gers (WPEØCZL), St. Louis, Mo.
Gerald R. Dalum (WPEØDEH), Aurora, Colo.
Leon Fleischer (WPE1EJF), Wakefield, Mass.
Alexander Chytra (WPE8FZY), Campbell, Ohio
John R. Demchyk (WPE3FDJ), Northampton, Pa.
Marshall H. Cannell (WPE1FHL), Wellesley Hills, Mass.
Jim Grubbs (WPE9CFQ), Scott A.F.B., Ill.

2220 s/off. The 11,800-kc. channel is also noted in Eng. to Europe and the United Kingdom from 1550 to 1636/close; news and commentary at 1550-1605.

Haiti—Station 4VEH, Cap Haitien, 11,835, 9770, 6120, 2450, and 1035 kc., has added a DX program on Saturdays at 0715-0730. The station signs off temporarily at 2030 on Fridays, Saturdays, and Sundays. The morning scheduled s/off is extended to 1000 on Saturdays and Sundays and to 0930 on Fridays.

Hungary—Budapest now broadcasts to N.A. at 1930, 2030, 2200, and 2330 (one half hour each time) on 9833, 7215, and 6234 kc. There is also a new musical program at 2230-2300 on the same channels.

Malaysia—*Suara Malaysia* uses these xmtrs: Tebrau, Johore, on 6105, 7110, and 11,900 kc. with 100 kw.; Kuala Lumpur on 9750 kc., and Jurong, Singapore, on 9635 kc., both 50 kw. For the Malayan Domestic Service: Penang in Malayan on 7280 and 9515 kc. with 10 kw.; Kuala Lumpur in Indian on 6135 kc., in Chinese on 6025 kc., with 10 kw. and 5 kw. respectively. Penang carries Eng. on 7200 kc. Another outlet, believed to be in Kuala Lumpur, was noted on the West Coast on 4994 kc. at 0730-1130.

Netherlands Antilles—*Trans World Radio* will operate from Bonaire, some 35 miles from the original location on Curacao. They expect to be on the air early in 1964. Power ratings have been set at 260 kw. for the short waves and *52,000 watts* for the medium waves, reportedly 800 kc.

Portuguese Guinea—Station CQM, *Emissora da Guine*, 7945 kc., Bissau, was noted at 1448-1540 with U.S. pop tunes and Portuguese vocals.

Reunion—*R. Reunion* has been heard on 7245 kc. at 1445 with French pop music, IS at 1458, French news or a talk at 1500.

South Africa—*R. South Africa* was noted on 11.900 kc. at 1420-1500 with pop music and in Afrikaans, and on 7275 kc. from 2240 to 2300 s/off with Afrikaans news and commercials. *Springbok Radio* was logged on 9720 kc. at 0030 with pop music, news, and commercials.

Togo—Lome, 5047 kc., has an Eng. newscast around 1600 but this one is rough to log due to heavy QRM.

Windward Islands—St. Georges, Grenada, was found on 2460 kc. at 2030-2115, with an Eng. newscast at 2100-2114.

Yugoslavia—*R. Belgrade* broadcasts in Eng. at 1030-1100 on 15,235, 11,735, and 9505 kc.; at 1330-1400 on 7200 and 6100 kc.; and at 1700-1715 on 9505, 7200, and 6100 kc. There is also a parallel xmsn on 1268 kc. with a 100-kw. xmtr for the medium-wave DX'ers.

Clandestine—*Sweden Calling DX'ers* and many European DX'ers report an unidentified station known generally as the "Kiss Me Honey" station (that recording is reportedly played often—Ed.) at 0945 on 6095 kc., at 0930-1030 and until fade-out around 1400 on 11,695 kc. Has anyone in N.A. been able to log this one?

Radio Peyk-e-Iran, location unknown, is noted on 11.400 kc. from 0930 s/on and on 11,695 kc. around 0930-1030 with QRM from the "Kiss Me Honey" station mentioned above. This, too, is strictly a European logging so far as we know.

Medium Waves

Activity on the medium waves continues to increase and reception is excellent many evenings. Your Short-Wave Editor has personally logged good catches from areas southwest through south to northeast, but very little is being heard from areas to the west. Here are some of the stations currently being reported, listed by frequency in kilocycles:

540 XEWA, San Luis Potosi, Mexico

575 TIJC, *Cadena Musical*, San Jose, C.R., at 0015

638 San Sebastian, Spain; news in Spanish to 1915 s/off

644 Antiqua; musical requests in Eng. at 1830

645 HOS22, Colon, Panama; news in Spanish at 2245-2300

647 BBC, London; concert at 1645, news at 1800

684 Madrid, Spain; Spanish music at 1830, frequent ID's

728 *R. La Coruna*, Spain; news in Spanish to 1915 s/off

746 Hilversum, Netherlands; Dutch religious program at 1800

764 Sottens, Switzerland; church service at 1845

782 Miramar, Portugal; excellent to 2030 s/off

SHORT-WAVE CONTRIBUTORS

David Goodwin (*WPE1DXG*), Lawrence, Mass.
Maynard Graden (*WPE1EWD*), Norwich, Conn.
Henry Brown, Jr. (*WPE1EXZ*), Falmouth, Mass.
Karl Kristiansen (*WPE1FLT*), New Bedford, Mass.
Richard Silva (*WPE1FMY*), New Bedford, Mass.
Irwin Belofsky (*WPE2BVZ*), Brooklyn, N. Y.
Melvin Granick (*WPE2GAT*), Laurelton, N. Y.
Larry Davis (*WPE2GOG*), East Setauket, N. Y.
Harley Rutstein (*WPE2HKR*), Englewood, N. J.
Bill Van Alstyne (*WPE2IGK*), Webster, N. Y.
Sheldon Klink (*WPE2JGG*), Newark, N. J.
Robert Quade (*WPE2LLB*), Rochester, N. Y.
Jan Dyroff (*WPE3DSC*), Norristown, Pa.
Bill Wilson (*WPE3DUC*), Folcroft, Pa.
John Feldman (*WPE3EHU*), Feasterville, Pa.
George Oppegard (*WPE3ELI*), New Castle, Del.
Steve Russell (*WPE3EWZ*), Bethesda, Md.
Chuck Edwards (*WPE4BNK*), Fort Lauderdale, Fla.
Roy Moore (*WPE4FWH*), Hazard, Ky.
Mike Strauss (*WPE4GHV*), Ormond Beach, Fla.
Tom Norman (*WPE4GXV*), Florence, S. C.
Curt Cochran (*WPE5HDV*), Kingston, Tenn.
Shaler Hanisch (*WPE6BPN*), Hartford, Conn.
Dave Brown (*WPE6EMI*), Woodland Hills, Calif.
Gray Scrimgeour (*WPE6EYS*), La Jolla, Calif.
Tom Moffitt (*WPE8IMH*), Jackson, Mich.
Tim Shaw (*WPE8IUV*), Bay Village, Ohio
Mike Koralewski (*WPE8CVC*), Wyandotte, Mich.
Wayne Benkinney (*WPE8EEI*), Flint, Mich.
George Schnabel (*WPE8EMO*), Ashtabula, Ohio
Robert French (*WPE8FGH*), Bellaire, Ohio
William Milligan (*WPE8FIE*), Youngstown, Ohio
Steve Terry (*WPE9AG*), Evanston, Ill.
J. D. Arendt (*WPE9DX*), Aurora, Ill.
John Tow (*WPE9EHV*), Birmingham, Ala.
John Beaver, Sr. (*WPE0JE*), Pueblo, Colo.
Ian Roberts (*VK2PE2E*), Newport Beach, N.S.W. Australia
Marlin Field, Benton Harbor, Mich.
Andrew Kwiatkowski, Chicago, Ill.
Joe Piechuta, Meriden, Conn.
Vince Stasen, Cedars, Pa.
Harold Tate, Clarksburg, W. Va.
Steve Weinstein, Pittsburgh, Pa.
Station CFCX, Montreal, Quebec
Sweden Calling DX'ers, Stockholm, Sweden

SHORT-WAVE ABBREVIATIONS

BBC—British Broadcasting Corporation	QRM—Station interference
Eng.—English	R.—Radio
ID—Identification	s/off—Sign-off
IS—Interval signal	s/on—Sign-on
kc.—Kilocycles	VOA—Voice of America
kw.—Kilowatts	xmsn—Transmission
N.A.—North America	xmtr—Transmitter

818 Cairo, Egypt; Arabic chants at 1800
828 YNOL, Managua, Nicaragua; Eng. religious programs
836 Nancy, France; talk in French at 0100
845 Rome, Italy
855 PJC2, *R. Curom*, Willemstad, Curacao
944 Toulouse, France; talk in French at 0100
953 *R. Internacional*, Madrid, Spain, at 1745
1043 Dresden, East Germany; German at 1930
1125 TISRB, San Jose, C.R.; pop Latin American music at 2015
1160 Strasbourg, France; under KSL at 0130
1286 Prague, Czechoslovakia; in Spanish, light operatic music at 1800-1830 on Sundays
1375 St. Pierre et Miquelon; jazz on Saturdays at 1930
1500 Fort de France, Martinique; 1800 over WTOP

A new station recently heard on the air is *R. Barbadoes* on 795 kc. This one is excellent evenings, all-English. Power rating still not known . . . An Ohio DX'er reports clear reception of XERF, 1570 kc., Ciudad Acuna, Mexico, around 0000 . . . A report from Florida lists Jamaica as being strong on 750 kc. at 0930-1018 . . . Many listeners report hearing TIFC, San Jose, C.R., on 1075 kc. evenings . . . One West Coast report lists 1YZ in Rotorua, New Zealand, 800 kc., early mornings after CKOK, Penticton, B.C., signs off . . . Several DX'ers, including your Short-Wave Editor, logged WROB, West Point, Miss., on 1675 kc., far from its assigned spot on 1450 kc. A fast report to the station was answered with thanks and the information that they had had trouble in one of the circuits . . . Keep close watch on 800 kc. for the new superpowered *Trans World Radio* outlet. With over a half million watts, it should be clearly heard in many areas of North America. —30—

Light Quiz Answers

(*Quiz on page 76*)

A—2	F—1
B—4	G—4
C—3	H—2
D—4	I—3
E—4	J—4

The Educated Nursing Bottle

(*Continued from page* 83)

I'm game. I admit I have a couple ideas I'd like to try."

"So what are we waiting for?" Carl asked with a pleased grin as his foot mashed down on the accelerator.

THE FIRST THING the boys did the next morning was buy a plastic nursing bottle and wrap the whole length of it with No. 22 enameled wire and connect the ends to a coaxial fitting. The next few hours were spent revamping a high-gain transistorized amplifier they had built previously. They installed their best low-noise transistor in the front end and used tuned circuits to peak the amplifier fairly sharply at 2000 cycles to get maximum gain. Finally they were satisfied that the one-microvolt signal from the coil would produce the 30 millivolts or so Jerry said they needed.

"How are we going to measure the frequency?" Carl wanted to know.

"We don't need to *measure* the frequency—all we need to know is the relative frequency change produced by a change in the magnetic field around the bottle. We'll use Lissajous figures."

While talking he hooked the output of a code practice oscillator to the horizontal amplifier of the scope and adjusted the gain for a one-inch horizontal trace. The variable sine-wave generator was connected to the vertical amplifier and the gain adjusted for a one-inch vertical trace. When both signals were going through the amplifiers, a one-inch square of light filled with moving lines appeared on the scope face, but when Jerry set the frequency of the generator exactly to that of the code practice oscillator, a kind of nervous circle was displayed. The slightest change in the generator frequency set this hoop of light to turning one way or the other.

"That circle shows both oscillators are running at the same frequency with a ninety-degree phase shift," Jerry said, thinking out loud. "The slightest difference in frequency will set the pattern moving, and the number of revolutions it makes a second is the number of cy-

cles of difference. If it takes ten seconds to make a revolution, that means there's only one-tenth of a cycle difference between the two frequencies, right?"

"Right. So what next, genius?" Carl asked.

"Let's get busy and build the most stable 2000-cycle audio oscillator we can. We'll use a vernier control so we can vary it a few cycles either way."

They decided on a Wien-bridge oscillator and built it as ruggedly as they could, using air-dielectric capacitors, precision resistors, and VR tubes to hold the voltage steady. A small variable capacitor permitted the frequency to be varied a few cycles in either direction. The completed oscillator was connected to the horizontal scope amplifier.

Coaxial cable from the coil around the bottle went to a switching box. When a button on this box was pushed, an ampere of current from a battery was sent through the coil. Releasing the button connected the coaxial cable to the input of the transistorized amplifier going to the vertical scope amplifier. After the bottle was filled with water and placed on the floor in an east-west position, Jerry held the button down for six seconds and then released it while both boys eagerly watched the scope. The horizontal line traced by the audio oscillator expanded to a rectangle, held there for a few seconds, and then slowly collapsed.

"We're getting a signal from the coil!" Jerry exulted. "Now let's see if we can tune our oscillator to the frequency put out by the protons."

This took several tries, but finally they managed to get the desired glowing circle on the face of the scope every time the button was pushed and released. It was rather fuzzy-looking, indicating the presence of some noise, but it served the purpose.

A magnet from an old speaker was placed on the floor near the bottle, and now when the button was pressed and released, the scope pattern revolved rapidly, showing a decided change in the frequency from the bottle. The audio oscillator frequency had to be increased several cycles to restore the circle to the face of the scope. Moving the magnet away from the bottle lowered the frequency.

"We're in!" Carl gloated. "Tomorrow we'll take it out to the Indian mound and start digging up buried treasure!

THE NEXT MORNING, low gray clouds were scudding across the sky and the south wind smelled of rain. Despite the unpromising weather, however, the boys couldn't wait to try their "bottle prospecting," as Carl termed it, and they loaded their gear into the car and took off.

The farmer on whose land the mound stood readily gave them permission to try out their proton magnetometer, and even let them drive down a lane to the base of the mound. This helped, because

they had borrowed a small, but heavy, gasoline-powered generator from the amateur radio club to power the non-transistorized equipment. Jerry fired this up in the trunk of the car and ran an extension cord from it to a card table set up near the bottom of the grassy knoll. The scope, audio oscillator, and preamplifier were placed on the table and turned on. A couple of hundred feet of RG58/U coaxial cable connected the sensing unit to the amplifier.

After everything was thoroughly warmed up, Carl carried the bottle about a hundred feet up the slope of the mound and placed it, pointing in an east-west position, on the ground. Jerry had no trouble in synchronizing the audio oscillator with the signal sent back from the bottle after the button was pushed and released.

While the farmer watched curiously, Carl moved the bottle about ten feet, and Jerry took another reading. The pattern moved ever so slowly until Jerry stopped it by readjusting the oscillator. They repeated this process several times without finding any indication of a sharp change in the magnetic field.

In the meantime, the sky was growing darker and the wind was picking up. Carl began working down the slope toward the card table.

"Hold it! The pattern's spinning like a merry-go-round!" Jerry suddenly shouted. "Move the bottle back to where it was and make sure our oscillator frequency hasn't shifted."

But when the bottle was returned to the previous spot, the familiar fuzzy circle appeared on the scope. A few more readings revealed a small area about a yard in diameter of sharply increased magnetism. The boys hastily got spades from the car, and the farmer ran to the barn to get his shovel. All three started digging furiously.

At a depth of only a few inches they ran into some cans, but the "bottle prospector" showed that the magnetic object was still in the earth below. Then the farmer's shovel struck rotting wood. The boys watched intently as he carefully moved aside the soft earth and revealed—an old-fashioned wall-type telephone! A single check with the magnetometer revealed that this was the source of the magnetism, and at this moment great drops of rain began spattering down.

The farmer helped the boys hurriedly place their equipment inside the car, and then he got in with them as a heavy shower drummed on the roof.

"Now I recall we had a trash pit there when I was a kid," the farmer mused. "I can't rightly remember how that old telephone got there, but I reckon the telephone company just left it when new phones were put in."

"And after all these years the magnets in that crank-type ringer magneto still have enough moxie in them to drive the scope crazy," Jerry said. "Well, we didn't find any buried treasure, but our do-it-yourself proton magnetometer sure works."

"I'm satisfied," Carl admitted, gazing fondly at the wire-wrapped nursing bottle he held in his hand. —30—

Transistor Topics

(*Continued from page 72*)

In the circuit of Fig. 4, *Q1*'s base bias is furnished by collector feedback resistor *R1* in conjunction with emitter resistor *R2*, bypassed by *C2*. If *Q1*'s average collector current starts to increase—as it may, due to overheating—base bias is reduced automatically by two actions. The increased collector current produces an increased voltage drop across *T1*'s primary winding, reducing the d.c. available to *R1* and thus reducing the base bias voltage. At the same time, the increased emitter current through *R2* reduces the voltage difference between

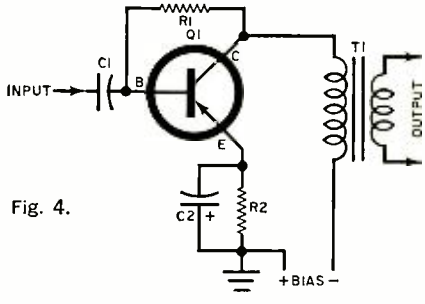

Fig. 4.

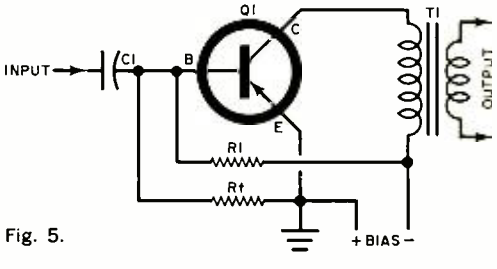

Fig. 5.

the emitter and base, further reducing the bias current. The net result of the drop in fixed bias is to reduce the collector current, restoring it to the proper value.

A slightly different technique is shown in Fig. 5. At first glance, the biasing method appears to be a standard one, with base bias furnished by means of voltage-divider *R1-Rt*. The difference lies in the use of a *temperature-sensitive* resistor for *Rt*. This component is mounted close to transistor *Q1*. As *Q1*'s temperature rises, *Rt*'s value is lowered, reducing the base bias voltage and thus *Q1*'s collector current. In some cases, a semiconductor resistor or selected diode may be used for *Rt* rather than a fixed resistor.

Until next month . . .

—Lou

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ELECTRONIC Parts Bargains Semiconductors, Tubes, etc., free catalog for postcard. Franklin Electronics, Box 51A, Brentwood, N. Y. 11717.

CHANGE Black-White TV To Color In Moments. Send Size Screen, $2.98. Delecto Electronics, 4725 45th N.E., Seattle 05, Wash.

JAPAN & Hong Kong Electronics Directory. Products, components, supplies. 50 firms—just $1.00. Ippano Kaisha Ltd., Box 6266, Spokane, Washington 99207.

CB WPE QSL Cards, Samples Free. Radio Press, Box 24, Pittstown, New Jersey.

"SPECIAL! WPE-SWL-CB-QSL cards, 3 colors, $2.50 per 100—Free Samples, Garth, Jutland, New Jersey."

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

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

QSLs CB or HAM. Glossy two colors, $2.00 per 100 postpaid. Free sample. Hobby Print Shop, Umatilla, Fla. 32784.

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SAVE Service Fees. Repair your own Television. Send Make and Model no. of your set for Individual instructions. $2.95. Television—16125 Foothill, Fontana, Calif.

TRANSISTOR ignition described June and October Popular Electronics, "Operation Pickup." Complete kit finest components quickly assembled. Guaranteed. Negative ground kits $14.95 Postpaid. Positive ground $19.95 Postpaid. Specify 6 or 12 volt when ordering. Electromart, 1616 S. 81st St., Milwaukee, Wis.

WPE-CB-QSL cards—Brownie-W3CJI—3111A Lehigh, Allentown, Pa. 18103. Catalogue with samples 25¢.

CB-WPE-QSL Cards. Call Letter Decals 15 samples 10¢. Dick, W8VXK, 1996 P N. M-18, Gladwin, Mich.

QSL-CB-SWL Letters and cards. $2.00 and $3.00 per 100. Samples 10¢. Martin, 828-B Schuylkill Ave., Reading. Pa.

PRINTED Circuit Boards. Hams. Experimenters. Free catalog. P/M Electronics, Box 6288, Seattle, Wash. 98188.

ONE Transistor Ignition described in February issue Popular Electronics. Complete parts kit available at low cost. Write for complete information. Electromart, 1616 S. 81st St. Milwaukee, Wis.

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	1J3	.79		6BA6	.50		6SK7GT	.95		12DL8	.88
	1K3	.79		6BC5	.61		6SL7GT	.84		12DQ6	1.04
	1R5	.77		6BC8	1.04		6SN7	.65		12DS7	.84
	1S5	.75		6BE6	.55		6SQ7GT	.94		12DT5	.76
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	1U5	.65		6BF6	.44		6T8	.85		12DT8	.78
	1X2B	.82		6BG6	1.70		6U8	.83		12DW8	.89
	2AF4	.96		6BH8	.98		6V6GT	.54		12DZ6	.62
	3AL5	.46		6BJ6	.65		6W4	.61		12ED5	.62
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	3BY6	.58		6BQ7	1.00		7EY6	.75		12FA6	.79
	3BZ6	.56		6BU8	.70		7Y4	.69		12FM6	.50
	3CB6	.56		6BX7	1.11		8AU8	.90		12FR8	.97
	3CS6	.58		6BZ6	.55		8AW8	.93		12FX8	.90
	3DG4	.85		6BZ7	1.03		8BQ5	.60		12GC6	1.06
	3DK6	.60		6C4	.45		8CG7	.63		12J8	.84
	3DT6	.54		6CB6	.55		8CM7	.70		12K5	.75
	3GK5	.99		6CD6	1.51		8CN7	.97		12L6	.73
	3Q4	.63		6CG7	.61		8CS7	.74		12SF7	.69
	3S4	.75		6CG8	.80		8EB8	.94		12SK7GT	.95
	3V4	.63		6CL8	.79		8FQ7	.56		12SL7	.80
	4BQ7	1.01		6CM7	.69		9CL8	.79		12SN7	.67
	4CS6	.61		6CN7	.70		11CY7	.75		12SQ7GT	.91
	4DT6	.55		6CQ8	.92		12A4	.60		12U7	.62
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	5V6	.56		6EA8	.79		12AX4	.67		25CU6	1.11
	5X8	.82		6EB5	.73		12AX7	.63		25DN6	1.42
	5Y3	.46		6EB8	.94		12AY7	1.44		25EH5	.55
	6AB4	.46		6EM5	.77		12AZ7	.86		25L6	.57
	6AC7	.96		6EM7	.82		12B4	.68		25W4	.68
	6AF4	1.01		6EU8	.79		12BD6	.50		32ET5	.55
	6AG5	.70		6EV5	.75		12BE6	.53		35C5	.51
	6AH4	.81		6EW6	.57		12BF6	.60		35L6	.60
	6AH6	1.10		6EY6	.75		12BH7	.77		35W4	.42
	6AK5	.95		6FG7	.69		12BK5	1.00		35Z5	.60
	6AL5	.47		6FV8	.79		12BL6	.56		36AM3	.36
	6AM8	.78		6GH8	.80		12BQ6	1.16		50B5	.69
	6AQ5	.53		6GK5	.61		12BR7	.74		50C5	.53
	6AS5	.60		6GK6	.79		12BV7	.76		50EH5	.55
	6AT6	.49		6GN8	.94		12BY7	.77		50L6	.61
	6AT8	.86		6H6	.58		12BZ7	.86		70L7	.97
	6AU4	.85		6J5GT	.51		12CN5	.56		117Z3	.85
	6AU6	.52		6J6	.71		12CR6	.67		807	.75

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