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POPULAR ELECTRONICS

AUGUST 1969

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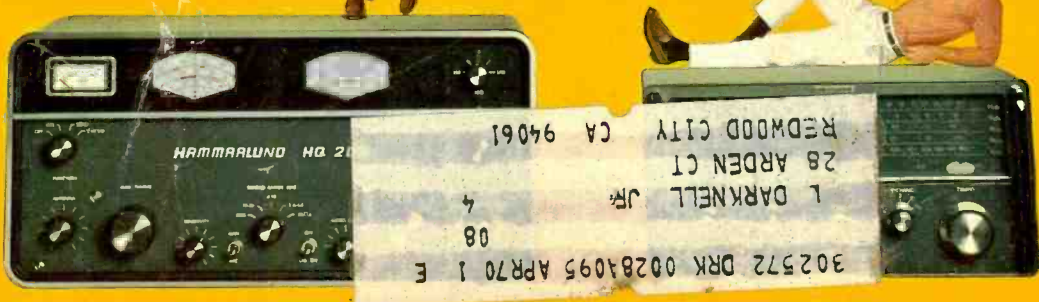

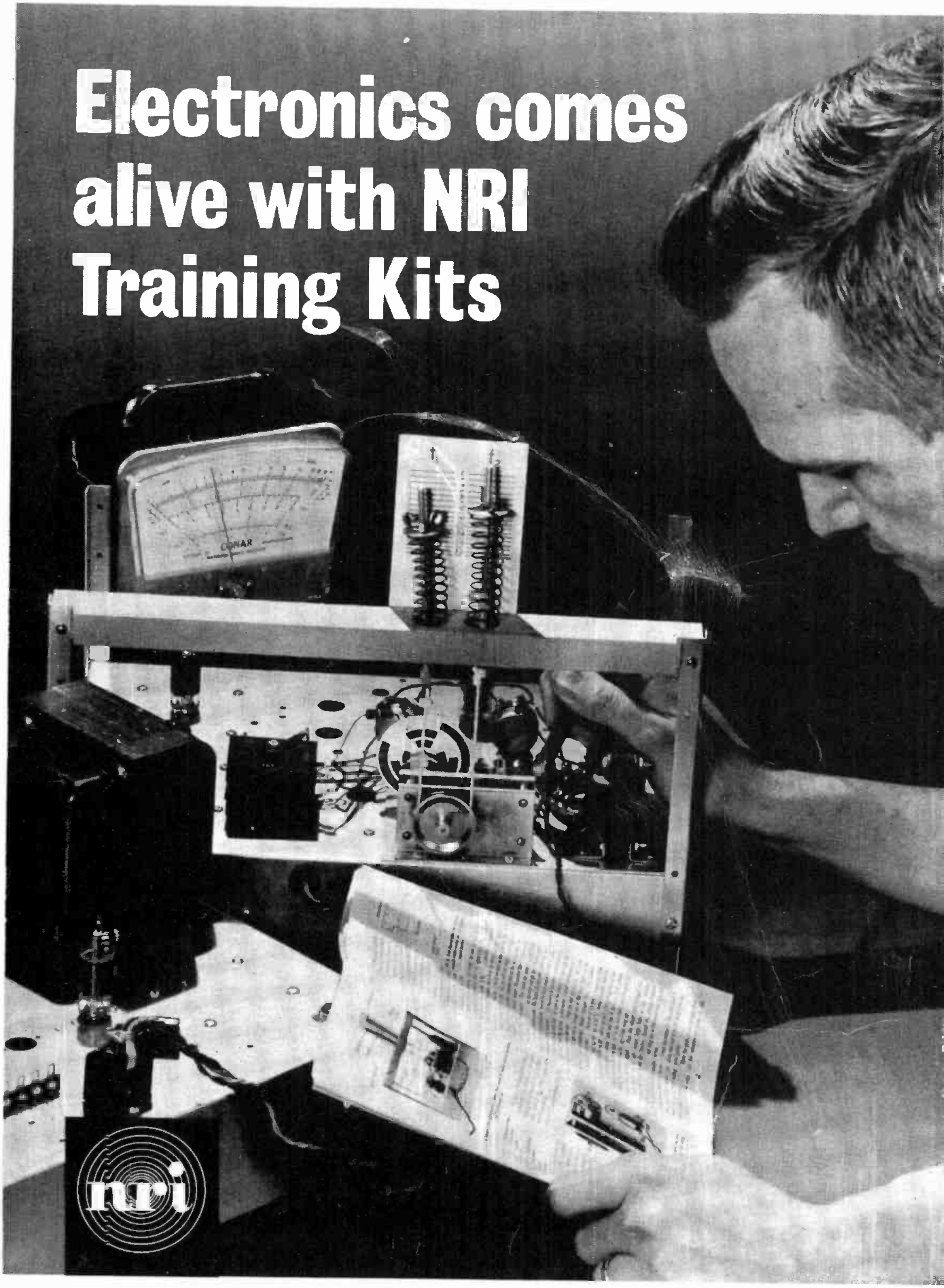
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POPULAR ELECTRONICS

VOLUME 31 NUMBER 2

AUGUST, 1969

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SPECIAL ON CB EQUIPMENT

FEATURE ARTICLES

DEPARTMENTS

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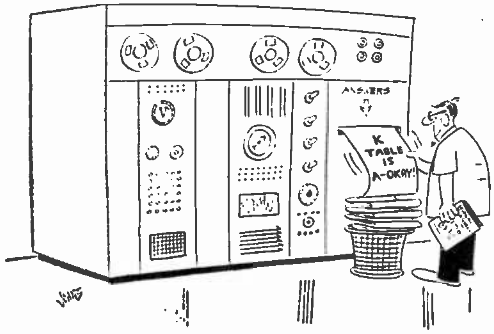


INDEPENDENT PART SUPPLIER

I understand that many POPULAR ELECTRONICS readers are having difficulty in finding the IRC-CTS No. T239 24-p.d.t. switch specified for the Binary Adder ("Demonstrating Binary Computation With The Binary Adder," April 1968). I will supply this item for $10 postpaid anywhere in the U.S.A. to anyone interested in completing this project.

VERNON CERNY
7052 Sophia St.
Van Nuys, Calif. 91406

WHAT A TIME SAVER!

I would like to comment on Gary Van Dyk's article, "The K Table" (May 1969). To begin with, I have always doubted the validity of any table such as this. So, I checked the published table through an IBM 1401 computer. I found, much to my surprise, that your K Table has greater accuracy than the average experimenter will ever need. And, boy, what a time saver!

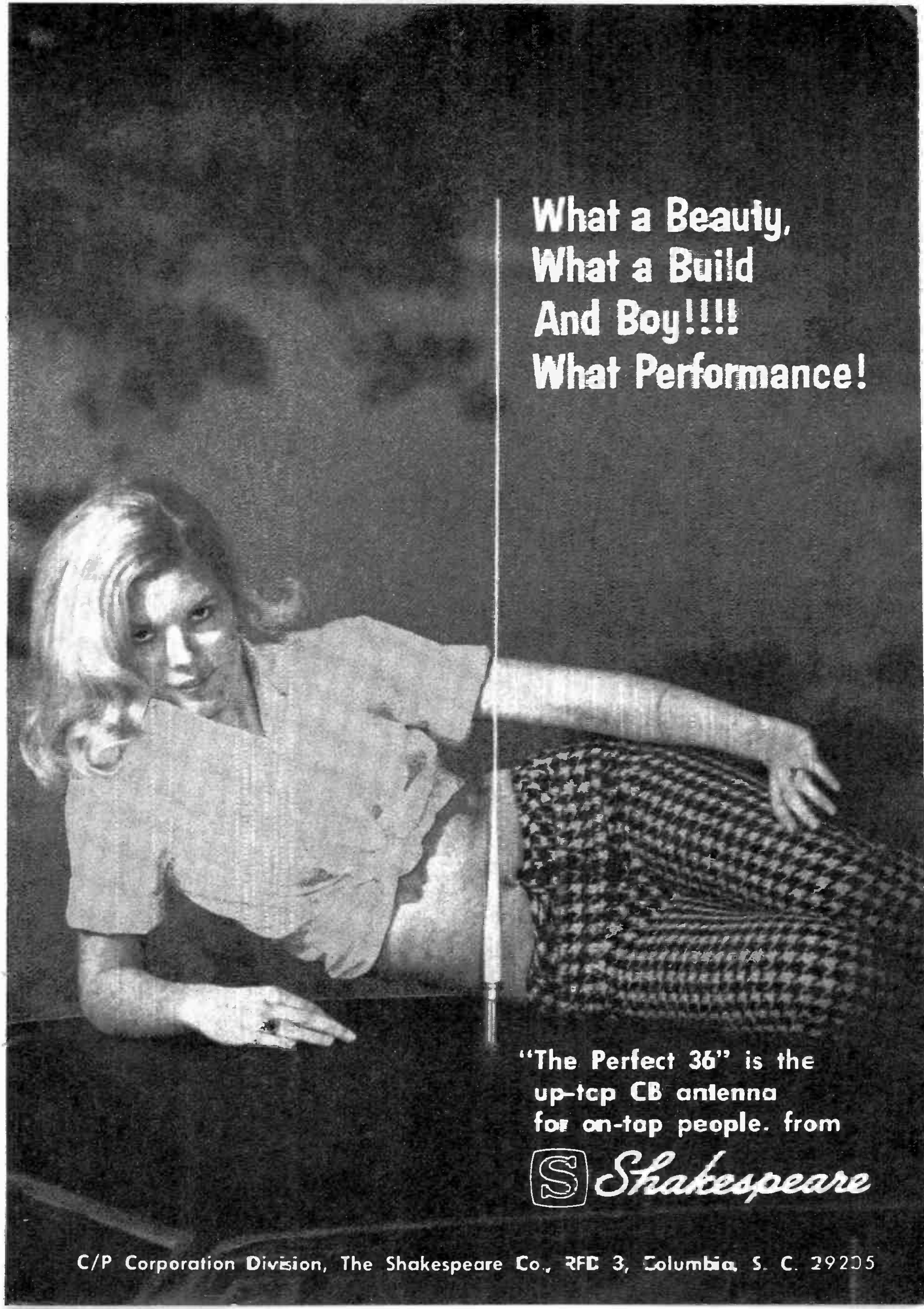
MIKE CHEPPONIS, WA3GY019
Culver, Ind.

While the article, "The K Table" is very helpful, are you aware that POPULAR ELECTRONICS published an even better article on the same subject back in April 1955? I refer to "A Single Layer Coil Design Chart."

Arvida, Quebec
CHARLES W. ADAMS, VE2DBA

Charles, you have an amazing memory. But isn't it also amazing how complex computers have made a topic that was once readily handled in a nomogram!

(*Continued on page* 10)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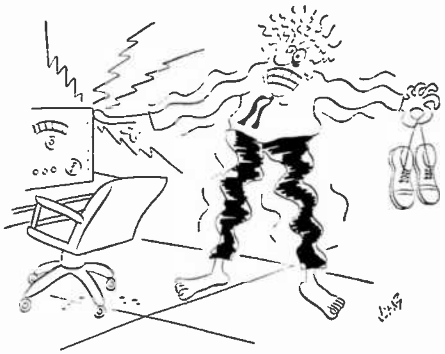
LETTERS (*Continued from page 8*)

BOY, THAT SMARTS

Every time I touch the cabinet or toggle switches of my Hallicrafters Model S-77A short-wave receiver while it is in operation, I receive a pungent electrical shock. This happens only when I don't have something between my feet and the concrete floor of my basement where I keep my receiver. I have tried to end this problem by grounding the



receiver to a cold water pipe, but unless I have shoes on, the shocks still keep coming. A friend of mine has a different receiver, but the same problem. Apart from wearing shoes every time I wish to use my receiver, can anything be done to solve my shocking problem.

EDWARD SWYNAR
Oshawa, Ontario, Canada

You got something against shoes or something? Seriously, though, you shouldn't operate your receiver until the problem is cleared up. Under just the right conditions—like a really damp floor—even shoes won't be much help. You would be wise to put some permanent waterproof insulation between you and the floor, like vinyl tile or carpeting. You would be even wiser to read the "Edison Roulette" article starting on page 33 of this issue.

ONE MORE ZERO, PLEASE

I would like to point out one small error in your otherwise excellent write-up of the cassette in the "Stereo Scene" column (June 1969). You specify the frequency response of the *Teac* Model A-20 cassette deck as being 60-1000 Hz. Wouldn't this be more like 60-10,000 Hz? I should think that by this time cassettes have progressed at least as far as the 10,000-Hz upper frequency limit.

NEIL G. LEVENSON
Princeton, N.J.

You're correct. The frequency response should have been—and actually was—given as 60-10,000 Hz for the Teac Model A-20. However, someone at the printing plant forgot to hit the ZERO key four times. The result: only three zeros.

TAKE ONE new literature

To obtain a copy of any of the catalogs or leaflets described below, simply fill in and mail the coupon on page 15 or 115.

An eight-page catalog just issued by *ALCO Electronic Products, Inc.*, presents the company's line of miniature switches and front-panel components. This short form catalog lists the expanded line of miniature switches, keyboard switches and pushbutton modules, machined aluminum knobs, terminal strips, readout indicators, pilot light assemblies, and miniature lamps.

Circle No. 75 on Reoder Service Poge 15 or 115

Just recently published by *Switchcraft, Inc.*, is catalog No. A-404 listing the company's complete line of "Audio Accessories," including connectors, adapters, cable assemblies, switches, mixers, etc. In addition to standard phone and phono connectors, the listing covers a full line of professional-type jacks and plugs and the "Switchcraft/PREH" European-type connectors. Among the switches listed are push buttons, slides, and modern rockers, and a "cordette" hand-held push button pendant assembly. In the equipment line are Switchcraft's famous "Mix Master" four-channel microphone/source mixer, speaker volume controls, stereo/mono selectors with channel reversing abilities, and a pushbutton stereo speaker switching system. All items listed are accompanied by complete specifications, descriptions, and retail price.

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The "FINCO MATV Planning Manual" (available for $1 per copy from the *Finney Company*, 34 West Interstate St., Bedford, Ohio 44146) is a basic textbook that describes systems design and planning. Written for technicians who want to educate themselves in the Master Antenna TV business, the 30-page booklet describes MATV products and the fundamentals of system design and design calculations. Also included in the manual are sample VHF and all-channel system diagrams, a dB-to-voltage multiplier chart, a coaxial cable and transmission line guide, TV channel assignments, and a glossary of commonly used MATV terms.

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ELECTRONICS library

QUIET

CONTROL SYSTEMS FOR TECHNICIANS

by G.T. Bryan

In a world where automation is growing in importance, there is an expanding need for trained technicians to maintain and repair automatic control equipment. This book is aimed at those people. All aspects of the automatic controls (remote, process, position, etc.) are presented in this elementary work. The appendices and glossary provided should be enormously helpful to students and technicians in becoming familiar with the symbols and terms unique to this field.

Published by Hart Publishing Co., Inc., 510 Sixth Ave., New York, N.Y. 10011. Hard cover. 328 pages. $12.50.

HOW TO SELECT AND USE HI-FI AND STEREO EQUIPMENT—Volumes I and II

by Murray P. Rosenthal

How does the prospective buyer of hi-fi and stereo equipment spot the features that add up to the best buys in a particular price range and avoid those which are well packaged, but low quality? Almost everyone who has had the task of choosing hi-fi components is familiar with this problem. This two-volume set was written to serve as a guideline for best cost/quality selection. Volume I concentrates on the basic hi-fi and stereo equipment; speaker systems, headphones, preamplifiers, amplifiers, tuners, and receivers. Volume II, a more specialized study, deals with record players, tone arms, cartridges, tape recorders, and other equipment that can be added to the basic system at any time.

Published by Hayden Book Co., Inc., 116 West 14 St., New York, N.Y. 10011. Soft cover. 114 pages Volume I; 104 pages Volume II. $3.25 each.

ELECTRONICS REFERENCE DATABOOK

by Norman H. Crowhurst

Until your reviewer read the preface to this book, the thought that there might be two different types of people using "databooks" never entered his mind. Crowhurst (a prolific writer on subjects involving audio or electronics theory) says that all other databooks make the mistake of presuming the user *knows how* to employ the figures and formulas he finds in such books. If this is so,

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8 a

LIBRARY *(Continued from page 14)*

then the approach of detailing the actual use may become the fashionable thing. Frankly, this reviewer has mixed feelings, and if brevity was the keynote in other databooks, then this text suffers by being overly verbose. The pendulum has swung too far in the opposite direction. However, Crowhurst deserves an "A" for effort and conviction—and an "A+" for thoroughness. This might well be quite a valuable book to home study students.

Published by TAB Books, Blue Ridge Summit, Pa. 17214. 232 pages, 45 tables. $7.95 hard cover; $4.95 soft cover.

ELECTRONICS FOR TECHNICIANS
by Abraham Marcus

This book deals with the phenomena of electronics in physical rather than mathematical terms. It is divided into three sections. Section I deals with the electron tube, types and uses. Section II is devoted to the full range of semiconductor devices used today. And Section III encompasses a general study of how the electron tube and transistor are used in modern civilization. In this final section, discussions of power supplies, amplifiers, oscillators, and the various circuits used in the home, industry, communications, and computers are examined.

Published by Prentice-Hall, Inc., Englewood Cliffs, N.J. 07632. Hard cover. 496 pages. $9.95.

RECENT ARRIVALS

TO WALK THE STREETS SAFELY
by Congressman James H. Scheuer

A well-reasoned plea for improvements in law enforcement and methods to prevent "predatory" crimes. Emphasizes need for more radio communication facilities.

Published by Doubleday & Co., Inc., 501 Franklin Ave., Garden City, N.Y. 11530. Hard cover. 236 pages. $5.95

RADARS: NEW CONCEPTS
by Michael H. Carpentier

The philosophy of radar equipment design is analyzed and avenues for further study are carefully detailed. Tells what can or cannot be expected from present designs.

Published by Gordon and Breach Science Publishers, 150 Fifth Ave., New York, N.Y. 10011. Hard cover. 269 pages. $8.00.

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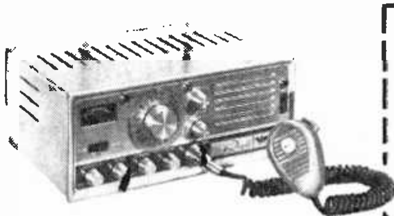

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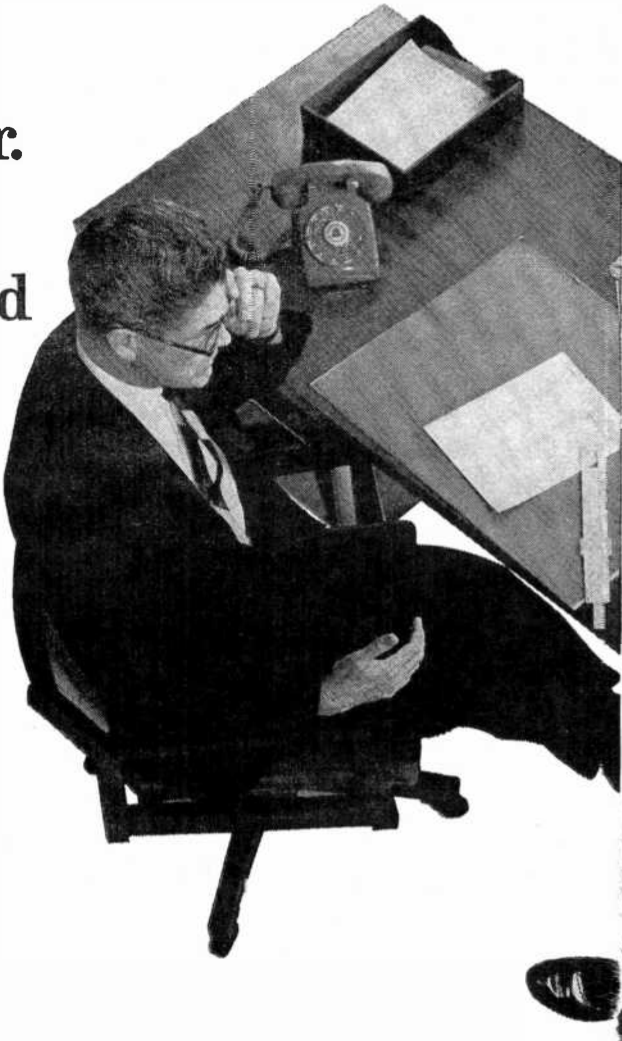

Could they be talking about you?

You'll miss a lot of opportunities if you try to get along in the electronics industry without an advanced education. Many doors will be closed to you, and no amount of hard work will open them.

But you can build a rewarding career if you supplement your experience with specialized knowledge of one of the key areas of electronics. As a specialist, you will enjoy security, excellent pay, and the kind of future you want for yourself and your family.

Going back to school isn't easy for a man with a full-time job and family obligations. But CREI Home Study Programs make it possible for you to get the additional education you need without attending classes. You study at home, at your own pace, on your own schedule. You study with the assurance that what you learn can be applied to the job immediately.

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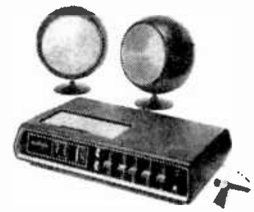
NEW PRODUCTS

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 on page 15 or 115.

STEREO CASSETTE RECORDERS

Two new stereo cassette recorders, the "Constellation" Model RS-250S and "Orbitone" Model RS-252S, have been added to *Panasonic*'s line of home entertainment products. Both recorders feature slide-rule and push button controls, and a locking fast-forward and rewind lever enables rapid selection of that particular portion of the tape you wish to hear. Another switch allows presetting the recorder for mono, stereo-record, or playback change-over. Twin VU meters are used for monitoring recording levels. The Orbitone, the more elaborate model, has in addition to the basic recorder mechanism a FET AM/FM/stereo FM tuner. Both recorders are capable of developing 20 watts of peak music output power to drive Panasonic's exclusive-design "Solar Scoop" spherical speaker systems. Constellation and Orbitone come in attractively finished midnight black cabinets with silver highlights.



Circle No. 78 on Reader Service Page 15 or 115

SOLDERING GUN WEIGHS ONLY FIVE OUNCES

Solid-state design which eliminates the need for a transformer is responsible for the drastic weight reduction featured in the *Ungar* Model 6760 soldering gun. Weighing only five ounces (exclusive of three-wire power cord), the 6760 features a high-low temperature selector, electrically inert soldering tip, and independent heating element cartridge and tips. The new soldering gun is uniquely designed to assure damage-free soldering of IC's, FET's, and all other heat-sensitive solid-state components. Another welcome feature is a knurled nut that loosens to allow the user to rotate the entire heating element cartridge for proper orientation of the soldering tip. And the idea of using separate soldering-tip heating-element design eliminates the user's cost duplication every time he has to replace a worn tip. Included with the soldering gun are long chisel, pyramidal, and short chisel soldering tips.

Circle No. 79 on Reader Service Page 15 or 115

CB, MARINE, AND AERONAUTICAL ANTENNA

A new half-wave, 4-dB gain, omni-directional base station antenna with a new configuration and electrical characteristics has been announced by *Antenna Specialists Company.* Designated the Model M-227 "Mighty Magnum III," this new antenna is the latest version of the Magnum series first introduced in 1961. The overall configuration of the M-227 is similar to the previous versions, but notable differences exist in the loading static arrester assembly at the top of the five-section aluminum dipole, and the new "Power-Tip" radials. The static arrester is a double loop that is designed to improve static drain-off, reduce noise, and lower the radiation angle. The radials are substantially shorter than on previous models, and therefore more rugged. The VSWR is rated at 1.05-to-1 at centerband, 1.4-to-1 at band edges.

Circle No. 80 on Reader Service Page 15 or 115

ECONOMY CONSOLE SPEAKER SYSTEM

The new "Aries" speaker system, available in either contemporary, traditional, or modern furniture cabinet styles from *Electro-Voice, Inc.*, integrates fine furniture design and construction with a new high in acoustical performance—all at moderate cost. Each cabinet style is carefully detailed with a tasteful selection of hardware, grille cloth, and appropriate finish. High-density particle board is used throughout the basic enclosure for warp-free rigidity. Both glue and screws are used for the 2" X 4" braced panels to supply a totally sealed rigid enclosure. Within the cabinets are a 12" woofer, 6" midrange speaker, and 2½" tweeter, blended smoothly together by a deluxe crossover network. A 9½-pound magnet structure is used to provide the woofer with high efficiency consistent with precise transient response and exceptionally low distortion.

Circle No. 81 on Reader Service Page 15 or 115

PRIVATE TV LISTENING

The first private "wireless" listening device, called the "Cybernet," designed especially for TV receivers is being marketed by *Infinite Inc.* The sound portion of TV programs is retransmitted as a radio signal with a carrier frequency in the standard AM broadcast band; any portable receiver can serve as a pickup. The crystal-controlled transmitter re-

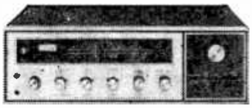
PRODUCTS (Continued from page 22)

quires only minutes to attach to any TV receiver—color or monochrome, console or portable. Equipped with a three-position mode switch, the Cybernet allows regular, semiprivate, and totally private listening. Technical specifications: 735-1035 kHz operating frequency, depending on crystal used; 60-mW nominal r.f. input power; 4-8 ohm audio input impedance; self-contained 9-volt battery power source.

Circle No. 82 on Reader Service Page 15 or 115

140-WATT AM/FM STEREO RECEIVER

Kenwood's Model KR-100 AM/FM stereo receiver is a modestly priced, truly deluxe stereo receiver. Its efficient power amplifier section develops 140 watts of music power (IHF) at 4 ohms, 110 watts at 8 ohms; less than 0.5% distortion; and a frequency range of 13-70,000 Hz. The receiver's control and



input complement allows accommodation of the most sophisticated stereo system requirements, including provisions for two turntables. A separate preamplifier output and two pairs of speaker outputs, plus center channel, are also featured. The front end has a 1.8-μV sensitivity and four IC's and two FET's for increased FM selectivity and reception. Also included are front-panel jacks for dubbing/tape recording and headphones, push button controls to regulate interstation muting, loudness control, tape monitor, and low and high filters.

Circle No. 83 on Reader Service Page 15 or 115

MULTIFUNCTION TRANSISTOR TESTER

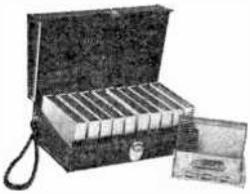
Capable of functioning as an a.f.-r.f. signal tracer, the Model LTC-901 transistor tester made by *Leader Instruments Corp.* indicates beta and Iceo of transistors as well as diode quality. The in- and out-of-circuit tester's tracer circuit consists of an oscillator, signal injector, a.f.-r.f. probe, and high-gain solid-state audio amplifier with small speaker. Technical specifications: Beta from 0 to 100 and from 0 to 200

±10% full-scale deflection; Iceo from 0 to 1 mA ±10% full-scale deflection; voltage—0-20 V d.c.; current—0-50 mA d.c.; signal tracer output—100 mW at 90 dB gain; a.f. tracer probe impedance—100 k; r.f. tracer probe impedance—50 k; 1000 Hz and harmonics signal injector. The LTC-901 is completely self-contained, drawing power from its own battery. A kit of seven test leads is supplied with the basic instrument.

Circle No. 84 on Reader Service Page 15 or 115

NEW CASSETTE AND CARTRIDGE ACCESSORIES

To give the cassette and cartridge tape user the same type of convenience and fidelity-enhancing products enjoyed by reel-to-reel tape enthusiasts, *Robins Industries Corp.* is introducing 41 new cassette and cartridge accessories. They include head demagnetizers and bulk erasers for cassettes and eight-track cartridges, cassette



splicers, storage cabinets and carrying cases, and cataloging and protection items for cassettes and eight-track cartridges. Also, for the regular tape and phone market, there are an automatic shut-off for the amplifier as well as the tape deck, professional splicers, a stylus timer, and a tone arm cueing device.

Circle No. 85 on Reader Service Page 15 or 115

ANTENNA LIP MOUNT

Designated the Model TLM and engineered for rugged duty, ease of installation, and long life, *New-Tronics Corporation*'s trunk lip-mounting antenna requires no drilling. The clamp and antenna base support is made of ⅛"-thick cold-rolled, carbonized plated steel for rigid, stationary support. Easily installed in seconds on the rear or side of any car trunk lip, the TLM assures superior grounding for lowest SWR and minimum noise. To facilitate lead installation, the assembly includes New-Tronics' exclusive "break-cable" adapter, with all connections factory soldered, plus a special coax cable retainer to keep the lead hidden and avoid pinching when the trunk lid is closed. The TLM accommodates a wide range of antennas with the standard ⅜"-24 base.

Circle No. 86 on Reader Service Page 15 or 115

EIGHT-TRACK CARTRIDGE RECORDER

The Model 811-R preamplified eight-track stereo cartridge recorder made by *Telex Communications Division* features four logic circuits that are designed to ease operation. Two logic circuits in the record-mode allow choice of auto-stop at the end of any single program or at the end of the tape. The other two circuits in the play-mode permit selection of auto-stop at the end of the tape or continu-

ous play. Othe· features include a record interlock that prevents accidental erasing in the play-mode, power indicator lamp, and a system that automatically turns on power when the cartridge is plugged in. A VU meter and left- and right-channel volume give the user full control over the record mode. The preamplified outputs of the 811-R can be plugged into any existing stereo system.

Circle No. 87 on Reader Service Page 15 or 115

Midland 5-Watt Transceiver!

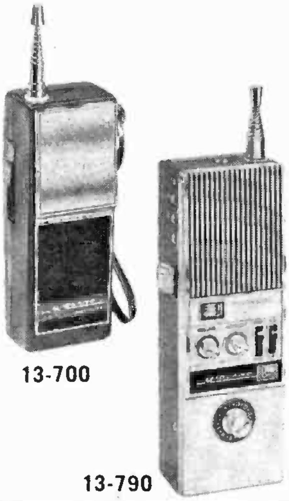
It breaks the high price barrier $69.95

MIDLAND 5-WATT 6-CHANNEL HAND-HELD POWERHOUSE

- Integrated Circuit, new concept in maximum solid state efficiency.
- Sensitive superheterodyne receiver has tuned RF, active AGC, battery-saver.

Maximum 5-watt power plus 6-channel versatility now combined with hand-held convenience. Extra value features: long-range Call Signal,® hi-level push-pull audio modulation, PA switch, hi-lo battery saver switch. 3-way meter indicates battery level, RF output, signal strength. Jacks: battery charger, AC adaptor, external mike, antenna. Includes channel 7 crystals, earphone and leather case. **Model 13-770**

4 more reasons why Midland leads the field in CB...



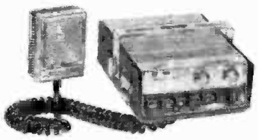
13-700

13-790

1-Watt 2-Channel. Solid state. High-level class B push-pull audio, active AGC circuit. Jacks for battery charger, AC adaptor. With earphone, channel 11 crystals. Model 13-700 **$29.95**

23-Channel 5-Watt. Power and performance of big base-mobile units. Solid state, Integrated Circuit, 23-channel equipped. Has dual conversion receiver with tuned RF, squelch. Model 13-790 **$149.95**

Deluxe AC/DC 23-Channel Base-Mobile. 4 Integrated Circuits, F.E.T. front end, forward/reverse SWR meter. Built-in clock-timer, delta tune. Model 13-877 **$189.95**



5-Watt 6-Channel Base-Mobile. Solid state Integrated Circuit. Superhet receiver has tuned RF, 3 IF stages, AGC. With channel 9 crystals. Model 13-855 **$69.95**

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CIRCLE NO. 24 ON READER SERVICE PAGE

Boy, do they. Stuff like HetroSync® Circuitry that substantially reduces spurious frequencies.

A Pearce-Simpson exclusive.

Our dual conversion superhet receiver that pulls in signals where others fade. Nuvistor front end that gives you a very fine signal to noise ratio. The result: the biggest ears in the industry.

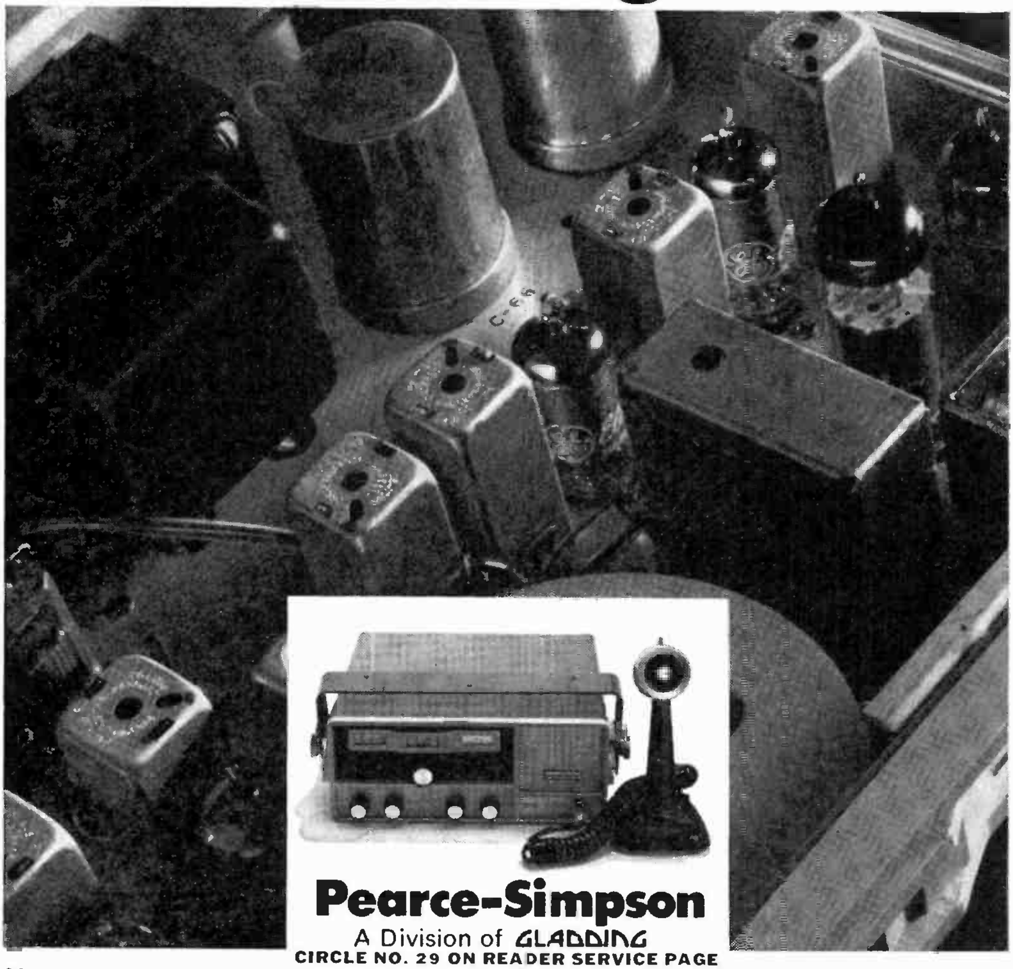
Automatic speech clipping by high level saturation limiting. Big, easy to read dual function S Meter and RF Output Meter. Illuminated channel selector. Modulation indicator. Transistorized AC/DC power supply. Not to mention complete hand wired circuitry.

But what really frosts them is how we put all of these goodies into a compact, 23-channel beauty like the Guardian—include crystals, microphone, power cords and mounting cradle—and beat the daylights out of their prices:

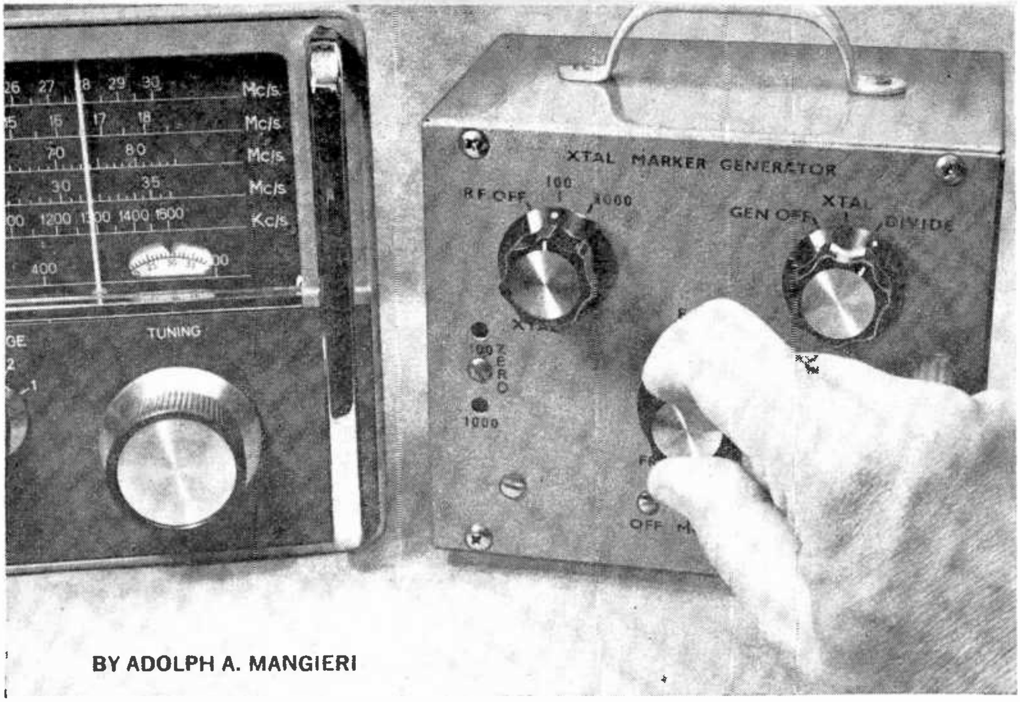
Guardian 23 (which is both a mobile and base unit) with palm microphone, $269.90. Guardian 23B (base station with built-in preamp), $264.90. With Super Mod ceramic desk microphone, $279.90.

Write us and we'll send you a spec sheet on the whole line. Pearce-Simpson Inc., P.O. Box 800, Biscayne Annex, Miami, Fla. 33152. Dept. PE-869

Our competitors hate our guts.



CIRCLE NO. 29 ON READER SERVICE PAGE



BY ADOLPH A. MANGIERI

IC FREQUENCY SPOTTER/STANDARD

SELECT YOUR MARKER PIPS AT 1000, 500, 200, 100, 50, 20 OR 10 kHz

UNLESS you have an expensive, highly sophisticated receiver, trying to locate a specific short-wave frequency is usually pretty much a gamble. The best you can do is tune your receiver to the approximate "ball park" and then painfully and slowly start searching.

Nowadays, most serious hams and SWL's use either built-in or added-on crystal-controlled frequency calibrators. However, in most cases, these permit you to tune only to 100-kHz pips on the dial and you still have to search between them. In fact, just trying to locate an ordinary marker in a maze of signals is often a problem. Usually you have to turn the calibrator on and off several times before you are sure you are tuned to it and not to some unmodulated carrier on the air.

Now, if you build the "IC Frequency Spotter," you can get switch-selectable, crystal-controlled marker pips at every 1000, 500, 200, 100, 50, 20, and 10 kHz clear out to 30 MHz (the limit of most commercial short-wave receivers). By flipping a switch. you can tone-modulate the marker so that it can be spotted easily in a crowd of carriers.

Using integrated circuit (IC) flip-flops as frequency dividers, one crystal can do the work of four. Thus, if you need 25-kHz markers for ham-band spotting, you can use a 125- or 250-kHz crystal. As an added feature, the audio tone, which is approximately 600 Hz, is available for audio testing. The various square waves of different frequencies that are present in the circuit can be used for checking scope sweeps, testing audio amplifiers for ringing, etc. The Frequency Spotter is self-powered (thus completely portable) and is easy to construct at modest cost.

PARTS LIST

B1—3.75-4.5-volt battery (see text)
BP1, BP2, BP3—5-way binding post (E.F. Johnson 111 or similar)
C1—0.01-μF disc capacitor
C2—200-pF capacitor
C3—100-pF capacitor
C4,C5,C6—0.02-μF disc capacitor
C7—0.033-μF capacitor
C8—22-pF capacitor
C9,C10—5-80-pF trimmer capacitor (Elmenco 462, Allied 43F3512, or similar)
D1—Silicon rectifier 1N2071
IC1—Quad two input gate (Motorola MC724P or HEP 570)
IC2,IC3—Dual J-K flip-flop (Motorola MC790P)
Q1—Silicon npn transistor (Motorola HEP-55)
R1—15,000-ohm
R2—10,000-ohm
R3—270-ohm
R4,R5—4700-ohm
R6—2700-ohm
R7—470,000-ohm (see text)
R8—68,000-ohm (see text)
(All resistors ½-watt)
S1,S3—Two-pole, three-position, non-shorting switch (Mallory 3223J)
S2—Three-pole, four-position, non-shorting switch (Mallory 3234J)
S4,S5—S.p.s.t. slide switch
XTAL1—100.000-kHz crystal (James Knight H93 or similar)
XTAL2—1000-kHz crystal (James Knight H93 or similar)
Misc.—Crystal sockets (2); flea-clip board terminals (17, Vector T28); 3¼" x 4½" copper-clad board; 4" x 5" x 6" case (Budd AU1029HG); knobs (3); battery holders; IC sockets (3, optional, Elco 8358, Allied 47F-5701); hardware; solder; etc.
Note—Integrated circuit are available from Allied Radio Corp., 100 N. Western Ave., Chicago, Ill. 60680. For MC724P, order 50F26 MC724P MOT; for MC790P, order 50F26 MC790P MOT.

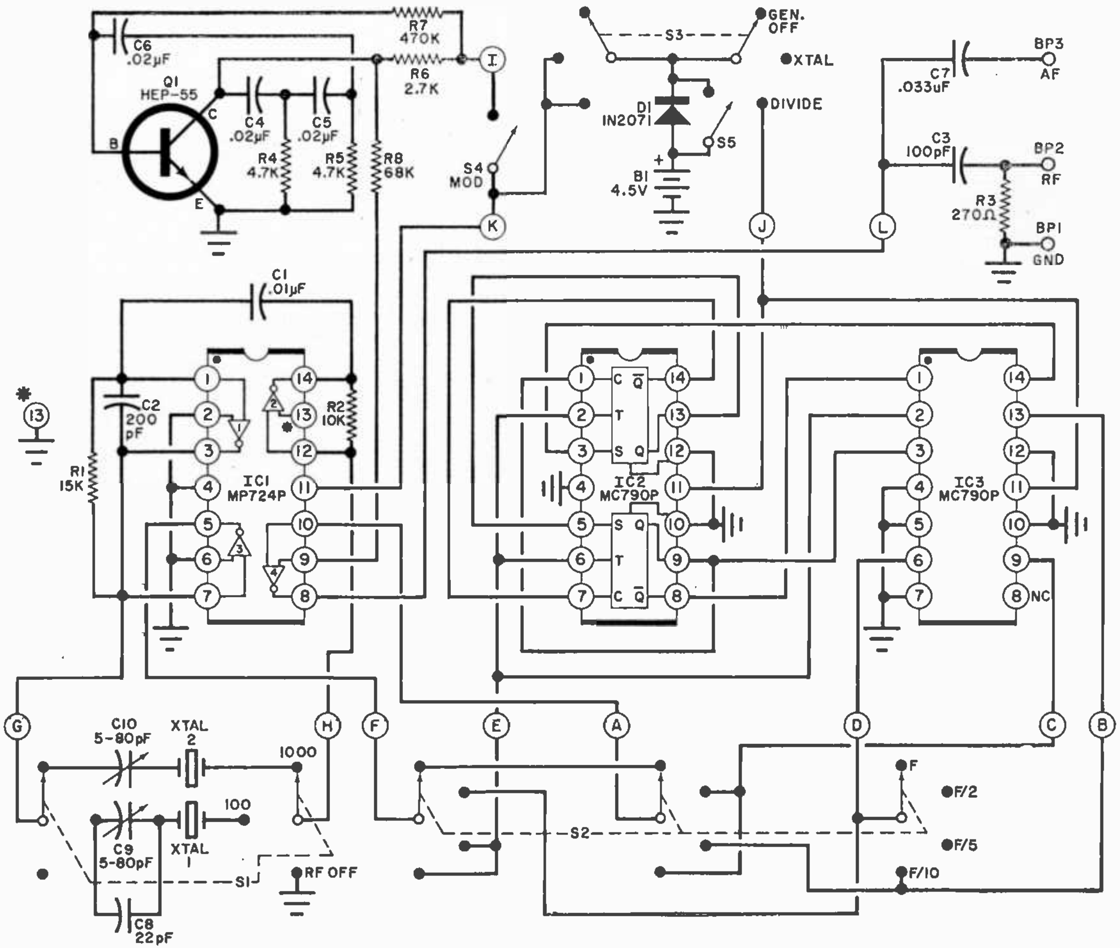


Fig. 1. The circuit consists of a switch-selectable crystal oscillator followed by a switch-selectable countdown made up of JK flip-flops. This enables a broad range of r.f. outputs. A built-in audio modulator helps identify r.f. signal.

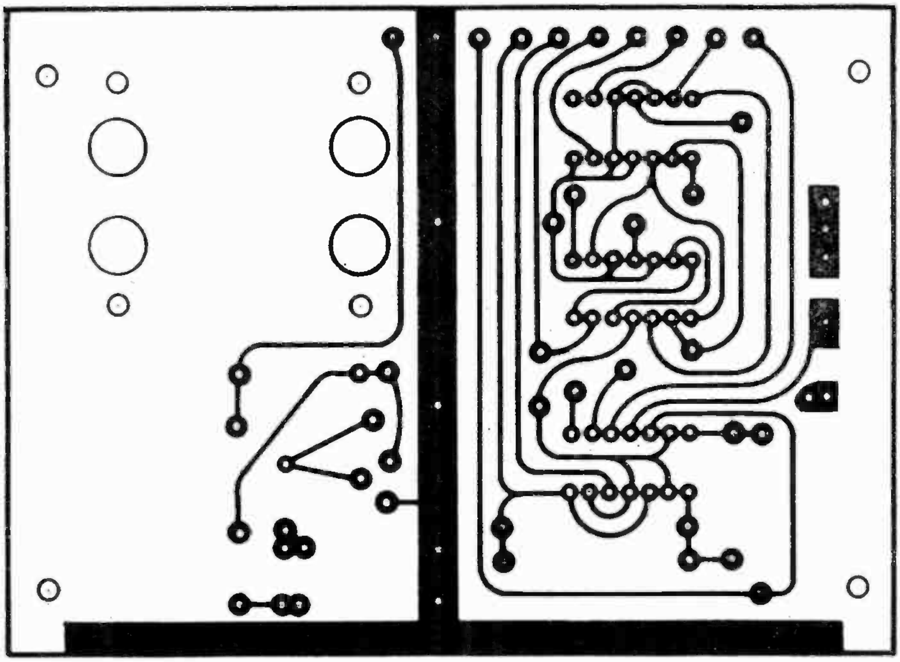
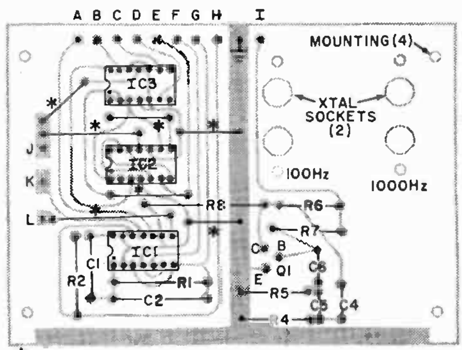


Fig. 2. Actual-size printed circuit foil pattern can be etched to build the Frequency Spotter. Two crystal sockets are shown, but only one may be used. Input/output connections are at top.

Construction. The circuit of the Spotter is shown in Fig. 1. Because of the complexity of the circuit, it is recommended that a printed circuit board be used. An actual-size foil pattern for such a board is shown in Fig. 2. Once the board has been fabricated and drilled, install flea clips for the connections to the board and for the mounting of resistors *R7* and *R8*. Install the components as shown in Fig. 3, being sure that the IC's are properly oriented as indicated by the notch and dot code at one end. The use of the optional 14-pin, in-line IC sockets will eliminate any chance of damaging the IC's during soldering. Include both crystal sockets, even if you plan to use only one crystal at first.

For complete shielding, use a metal enclosure for the Spotter. The author mounted all controls and output jacks on the metal front panel. The PC board is supported on two L-brackets so that it is about ⅝″ from the panel and 1″ from the bottom (see Fig. 4).

Frequency trimmer capacitors *C9* and *C10* are mounted on a piece of plastic attached to the front panel with a ½-inch spacer as shown in Fig. 5. Drill suitable holes in the front panel for insertion of a screwdriver to tune the two trimmers. Wire the rotary switches as shown in Fig. 6. Resistor *R3* is mounted directly between the r.f. output jack *BP2* and the ground jack *BP1*. Connect *C3* and *C7* from pin L on the board to their respective binding posts. Make sure that *BP1* is thoroughly grounded to the metal panel—scrape away the paint or finish under it, if necessary. Also be sure that the panel and the chassis are in good electrical contact when assembled. Mount the bat-



*JUMPER
A THRU L-BOARD TAKE-OFFS

Fig. 3. Component installation. Observe notch and dot code on IC's to ensure proper installation. The values of R7 and R8 may have to be adjusted, so mount them on flea clips to facilitate changes.

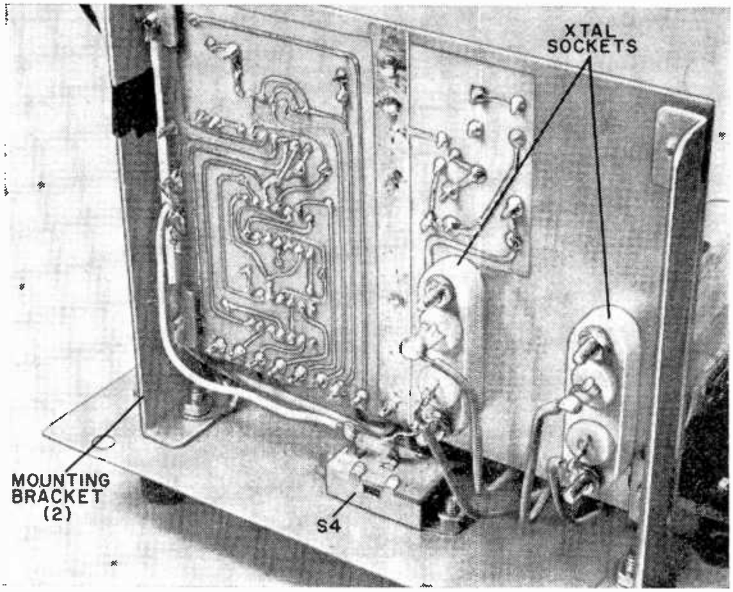


Fig. 4. The PC board is secured to a pair of brackets which are mounted on the front panel. Other than the batteries, everything else is mounted on the removable front panel. Batteries are in mounting clip on the rear panel.

tery holders on the rear panel, making sure that enough clearance is left for the PC board. Connect the minus side of the battery to *BP1* and the plus side to the rotor of *S3*.

The battery you choose depends on how much you expect to use the Spotter. With a 4-volt battery, current drain is about 90 mA; with 4.5 volts, it is 115 mA. At this rate, conventional zinc D cells would provide about 30 hours of operation; alkaline cells, 70 to 90 hours.

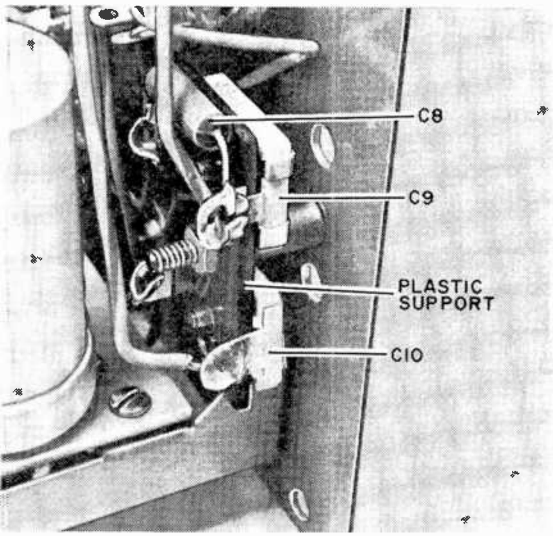


Fig. 5. Two frequency trimmer capacitors mount on a small piece of plastic attached to front panel. Appropriate holes provide for screwdriver trimming.

Rechargeable nickel-cadmium cells can also be used if the Spotter is to be in operation frequently.

The IC's are rated for a maximum voltage of 4.0 volts. Since fresh zinc and alkaline cells supply about 4.5 volts, diode *D1* has been used to cut the voltage down. When the voltage (under load) across the cells drops to about 3.5 volts, *D1* can be removed from the circuit by closing *S5*. Mount *S5* and *D1* on the rear panel.

Circuit Adjustment. Set trimmer capacitors *C9* and *C10* to their maximum capacitance and set *S1* to the 100 kHz position, *S2* (FREQUENCY) to F, *S3* to XTAL, and *S4* (MOD) to OFF. Connect an insulated wire to the RF output jack *BP2* and wrap the loose end several times around the antenna lead of your receiver. Tune the receiver to WWV at any frequency except 2.5 MHz. Adjust *C9* to obtain a zero beat between the generator and WWV. Place *S1* in the 1000 kHz position and adjust *C10* for a zero beat. Try to zero beat during the WWV silent period (unmodulated) and adjust the coupling between the Spotter and the receiver so that the marker signal is about the same level as WWV. Close *S4* (MOD) and verify the presence of 600 Hz modulation on the carrier. If you have a scope handy, check for the presence of a 600-Hz audio signal at *BP3*.

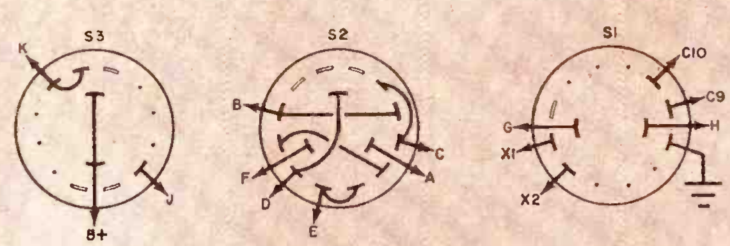
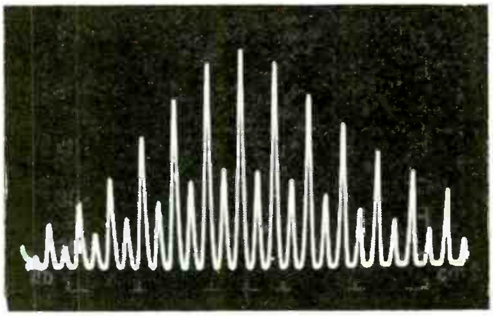
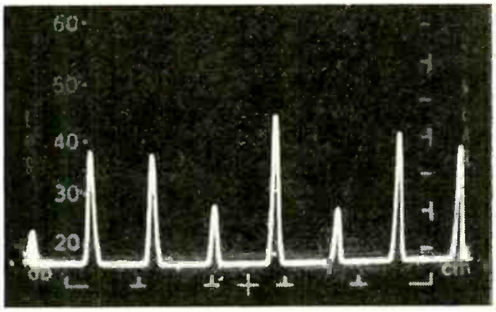
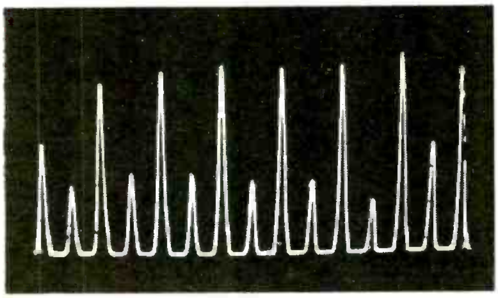


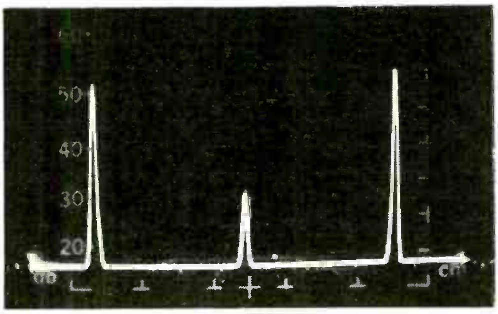
Fig. 6. If you use the specified switches, wire them as in these rear views.





These waveforms were taken from a Squires-Sanders "Bandscanner." Upper left shows spread of 10-kHz pips centered at 7250 kHz (hump due to receiver tuning). Upper right shows 20-kHz pips centered at 25,850 kHz. Lower left are 10-kHz pips centered at 25,850 kHz, and lower right are 50-kHz pips centered at 25,850 kHz. In all cases, the pips are clean and distinct, permitting accurate frequency calibration down to 10 kilohertz.





HOW IT WORKS

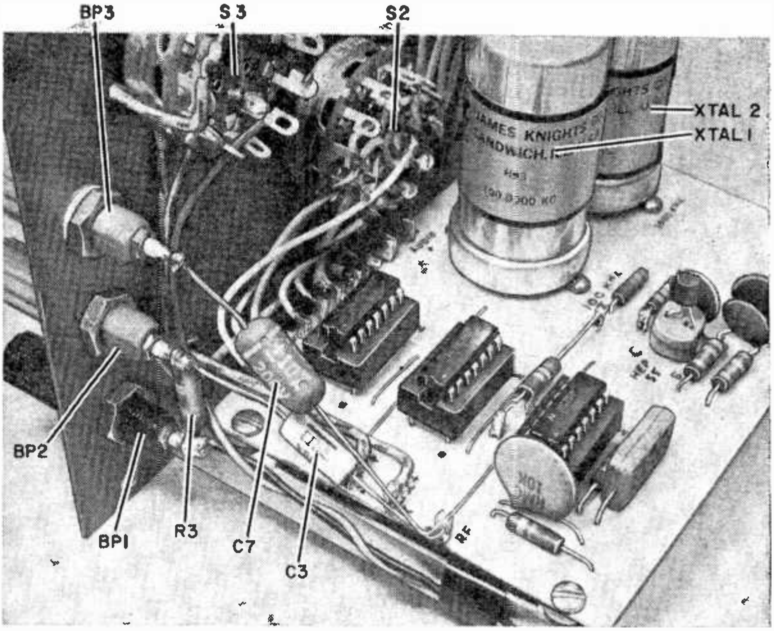
Gates 1 and 2 of *IC1* are cascaded to form a linear, high-gain amplifier biased by *R1* and *R2* and stabilized by *C2*. One of the quartz crystals is inserted in the amplifier positive feedback network through switch *S1* to sustain crystal-controlled oscillation. The crystal resonates in the series mode and acts as a very sharp feedback filter. Trimmer capacitors *C9* and *C10* provide for zeroing of the r.f. output for exact frequency calibration.

The oscillator output is applied to a buffer-driver stage (gate 3 of *IC1*) which drives dual JK flip-flops *IC2* and *IC3*. With *S2* in the F position, the flip-flops are bypassed and the marker interval at *J2* is equal to the crystal frequency. For the F/2 position of *S2*, flip-flop 4 of *IC3* divides the crystal frequency by two; for F/5, flip-flops 1 and 2 of *IC2* and flip-flop 3 of *IC3* (with their feedback networks) divide the frequency by five; and for F/10, the F/5 circuit drives the F/2 flip-flop to divide by ten.

The flip-flop outputs are square waves which feed into one input of the output stage (gate 4 of *IC1*). The output of gate 4 goes through a high-pass filter (*C3-R3*) which produces a sharply spiked r.f. output at *J2*.

High-gain transistor *Q1* is connected as an RC phase-shift audio oscillator with *R7* providing bias for a sine-wave output of about 600 Hz. Resistor *R8* couples the audio to the second input of gate 4 to tone modulate the r.f. marker signals.

Diode *D1* and switch *S5* provide a way to reduce the battery voltage when using new zinc or alkaline cells.



Overall view of the frequency spotter. The use of IC and transistor sockets is optional. Note that resistor R3, and capacitors C3 and C7 are mounted off the board.

At this time, you can adjust *R7* and *R8* to produce 100% modulation while observing the RF output on the scope.

For final tests, assemble the generator within its metal case, making sure that the front panel is electrically bonded to the rest of the case. Couple the generator to the receiver antenna, and check all marker intervals generated.

Although all IC's tested for *IC1* produced almost identical outputs, if you find that the 100-kHz markers are not clean and steady, it may be necessary to increase the value of *C2* by about 50 pF to correct for gain variations. On the other hand, it may be necessary to decrease *C2* by a small amount if *XTAL2* does not oscillate.

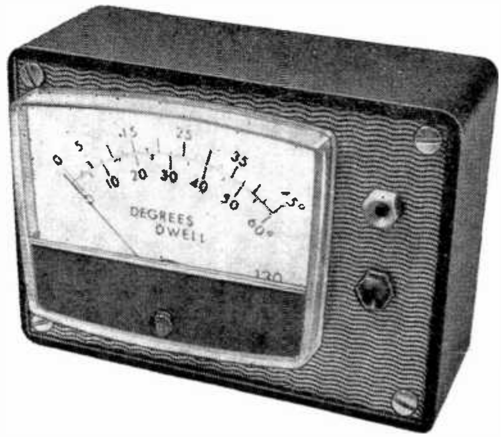
Application. Connect the ground (*BP1*) of the Spotter to the ground of the receiver and connect a short length of insulated wire to the RF output jack. Wrap a couple of turns of the other end of the wire around the antenna lead of your receiver. After performing the WWV zeroing on both crystals, the generator is ready to use.

Normally, marker signal strength will decrease as *S2* (FREQUENCY) is rotated from F to F/10. In the case of the shorter intervals, it may be necessary to make a direct contact to the receiver antenna terminals to pick up the markers. In all cases, avoid using excessive marker signal strength to avoid picking up images. Images are weak responses appearing at odd frequencies on the dial, depending on the receiver i.f. If you want to calibrate the receiver dial, remove its antenna completely to avoid picking up other signals. In calibrating, start with the larger intervals and work down to the smaller ones. You can use either the internal audio modulation or, if the receiver is equipped with a BFO, the zero beat method can be used.

Check the crystal zero beat with WWV everytime you use the calibrator, and touch up the frequency by adjusting the appropriate trimmer, if necessary.

Battery aging has little effect on the 100-kHz crystal and only a slight effect on the 1000-kHz crystal. In either case, any drift can be corrected by adjusting the appropriate trimmer. Battery minimum voltage is about 3.3 volts, checked under load, with *S3* on DIVIDE. -30-

SIMPLICITY+ DWELL METER



BY JACK SADDLER

Build automotive accessory using HEP components

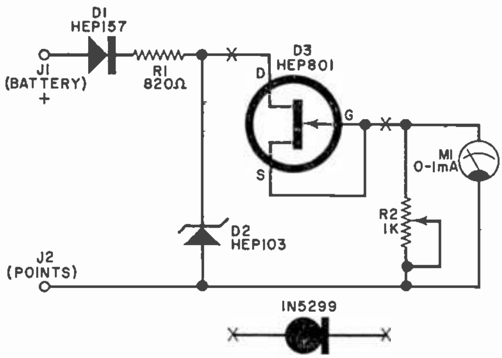
The high-compression engines used in modern cars and boats perform well only when they are properly tuned. They must be checked regularly to make sure that they are tuned up. One of the most important measurements that is made in the process of tuning up an engine is the checking of the dwell time of the distributor cam-point system.

Now, for less than the cost of one commercial engine tune-up, you can build an accurate dwell meter to check your engine's performance. The dwell meter can be used, as is, for 4-, 6-, or 8-cylinder engines with 6-, 12-, or 24-volt batteries (negative ground) and either conventional, transistor, or capacitor-discharge ignition systems. The meter is protected against voltage transients or accidental reverse voltages.

What Is Dwell? As the engine-driven distributor cam rotates, it opens and closes the points. When the points are closed, battery current flows through the primary of the ignition coil and builds up a magnetic field. When the points are open, the current through the coil is interrupted and the magnetic field collapses. Since the ignition coil is a large-ratio auto-transformer, the collapsing magnetic field induces a very high voltage at the upper end. It is this voltage that fires the spark plugs. The dwell time is the interval during which the points are closed and the magnetic field builds up. If the dwell is too short (for the engine under consideration), the magnetic field built up is not strong enough to produce a very high voltage and the plugs do not fire properly. If the dwell time is too long, too much current is drawn through the coil (and any transistors associated with the ignition system), which may result in damage to these components. Engine manufacturers specify the correct dwell setting for each type of engine. This information is given in the applicable engine manual.

As the engine is used, the constant wear on the distributor cam blunts the relatively sharp corners on the cam and causes the points to remain closed longer. If this abrasion process is allowed to continue, the cam will finally get so bad that the opening of the points is affected. Mis-

Strapping the Source to the Gate in the FET converts it to a constant-current diode. The strange-looking 1N5299 symbol is that of a constant-current diode that can be used to replace the FET. Either device can be used in the circuit.



PARTS LIST

D1—Silicon diode 1N4004 or Motorola HEP157
D2—6.2-volt, 500-mW zener diode 1N5234 or Motorola HEP103
D3—Field-effect transistor 2N5458 or Motorola HEP801; or current-regulator diode 1N5899
J1, J2—Banana plug or binding post (one red, one black)
M1—0-1-mA meter (Allied 52A7209, 52A7214, or similar)
R1—820-ohm, 5%, ½-watt resistor
R2—1000-ohm potentiometer (Mallory MTC-4 or similar)
Misc.—Mounting cabinet, rub-on numbers, mounting hardware, etc.
Note—A printed circuit board is available for $0.75 from Project Supply Co., P.O. Box 555, Tempe, Ariz. 85281. A meter is available for $5.95 and a complete kit including case and modified meter for $9.95 from the same source.

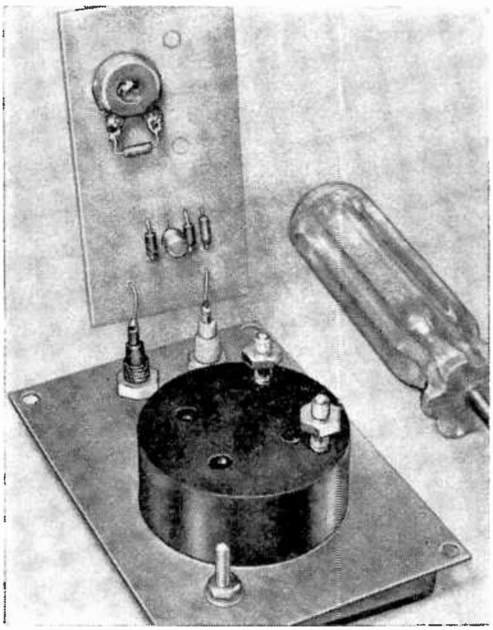
firing and sluggish performance result. Thus measuring and maintaining the proper dwell time is essential to good engine efficiency.

Dwell time is adjusted and corrected by installing new points in the distributor and setting them to the correct gap as specified by the manufacturer. Dwell

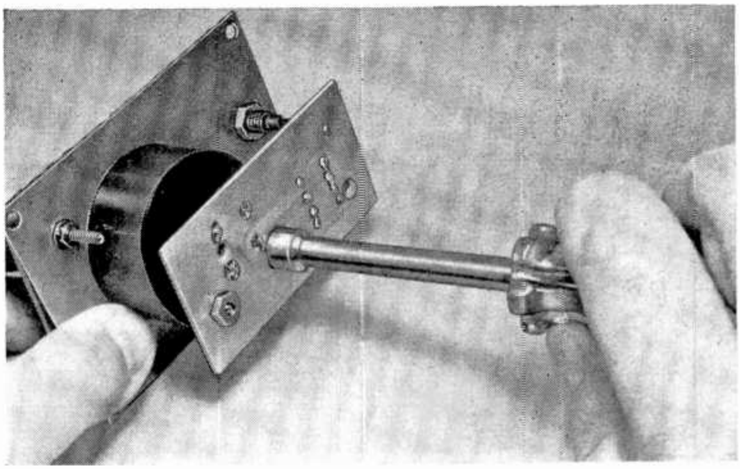
METER CALIBRATION TABLE

To convert 0-1-mA meter readings to dwell angle.

Original scale	0	0.2	0.4	0.6	0.8	1.0
4-cylinder	0	18	36	54	72	90
6-cylinder	0	12	24	36	48	60
8-cylinder	0	9	18	27	36	45



The author mounted his circuit on a PC board, then mounted the PC board to the meter terminals. Solid or flexible wire connections can be made between PC board and the two banana jacks J1 and J2 on the panel.



Once the circuit is assembled, secure it to the meter screw terminals. Electrical connections to the meter are made via printed circuit wiring. Drill a small hole through the PC board to provide screwdriver access to R2.

is also affected by point-to-point wear and since this wear may not be even, measuring the physical gap is not always a good indication of dwell. For this reason, most engine mechanics use some form of dwell meter to make sure that everything is working properly.

Construction. Once you have decided on the meter to be used, its scale must be altered to indicate dwell time (actually measured in degrees) rather than amperes. To do this, gently remove the meter cover to expose the scale—taking care not to damage the needle. In many cases, it is possible to remove the old numbers by rubbing with an eraser having a very fine grit. Using the table as a guide, substitute the dwell angle numbers for the original markings. If you expect to use the meter with only one type of engine you can use just one scale although the scales for 4-, 6-, and 8-cylinder engines are given in the table.

The easiest way to apply the new numbers is with commercially available rub-on lettering. Remove fingerprints or any other smudges on the meter face using alcohol applied with a fine, lint-free cloth. After meter calibration, gently replace the protective cover.

The author built the circuit on a small printed circuit board that mounts directly on the meter terminals. Parts placement is not critical, however, so any other form of construction may be used.

HOW IT WORKS

Silicon diode *D1* prevents damage to the remainder of the circuit from either accidental reversal of the input leads or the large negative-going voltage spikes present on the distributor points. In case either condition occurs, the diode does not conduct.

Zener diode *D2*, in conjunction with resistor *R1*, clips the input voltage to a fixed level to prevent damage to the meter and diode *D3*. The zener voltage is not critical. A 6.2-volt unit was used here because it is readily available.

Diode *D3* is unique. Essentially, it is a constant-current semiconductor device. You can use either a field-effect transistor with its gate connected to its source or a constant-current diode. In either case, it acts as a resistance whose value automatically increases with voltage, thus maintaining an almost constant current through the device.

Meter *M1* indicates the average current flowing through the circuit and it is calibrated by variable potentiometer *R2*.

Operation. Connect *J1* to the positive terminal of the battery and *J2* to the chassis of the vehicle. The meter will deflect upscale. Adjust potentiometer *R2* to get an exact full-scale deflection. The device is now calibrated.

To use, connect *J1* to the positive terminal of the battery and *J2* to the ungrounded distributor point. When the engine is running, the meter will indicate the dwell angle or dwell time of the points. This should be compared with the suggested dwell angle for the engine. If necessary, adjust the point gap in accordance with the manufacturer's instructions until the correct dwell is obtained. —30—


WARNING

ANNUAL CATALOG OF 5-WATT CB EQUIPMENT

PREPARED BY THE STAFF OF POPULAR ELECTRONICS

THIS IS the 9th Annual CB Equipment Catalog. As in preceding years, the Editors of POPULAR ELECTRONICS have assembled all available information on 5-watt (input) CB transceivers, itemized the features of each manufacturer's product(s), and presented it in the following pages in tabular form. Refinements have been made in the current listings and to the best of our knowledge the list is complete and up-to-date as of June 15, 1969.

The Spin-Off. The total dollars invested in CB equipment is well into the hundreds of millions. The one-millionth CB'er may be licensed early in 1970. Although the critics of CB decry its very existence, it is becoming more and more obvious that CB has provided the impetus and the technology to enhance the performance of ham radio, public safety and maritime mobile electronic equipment. Antennas, hand-held receivers, synthesized circuits—and even low-power communication techniques—are finding their way into radio services other than CB.

An interesting variety of new ideas in CB equipment will appear in the fall inventories. A few of them are summarized below. The proven products continue to be marketed and, dollar-for-dollar, the CB'er investing in new gear has a greater choice today than at any time in the past.

Take Note: Lafayette's "Telsat 150" is an interesting combination of a complete 23-channel CB transceiver and a hiband VHF receiver. Although the mobile reception of police signals may be prohibited in certain cities, the Telsat 150 fills a void that has bothered CB'ers (especially those devoting time to public service activities) for several years. Heretofore, a CB rig and a separate VHF receiver or converter were the answer to monitoring volunteer fire and police channels while tied into a local CB net. . . . Midland International has gone wild for CB and is importing an extensive line of unusual equipment. Most exciting are the two SSB models (13-778 and 13-880) which feature dual transmitters. One transmitter is for high-level AM and the other for upper or lower SSB operation. In most SSB set-ups, the user does not have a good AM facility; or, if he does, its power output or modulation have been compromised. Both of these units have i.f. noise blankers (for far superior noise suppression than possible on AM) using integrated circuits. . . . Also on the SSB bandwagon is Mark Products with a brand-new base station called the "Sidewinder 46". This transceiver can be used on either sideband of the 23 channels or put on straight AM—which to us sounds like 69-channel capability.

Tram now has a mobile companion piece for its Titan II heavy-duty base station. Called the "Corsair," the Tram mobile will transmit any one of 23 channels, and receive SSB on 46 channels. Optimum selectivity is obtained through the use of a Collins mechanical filter while i.f. noise blanking makes mobile operation a pleasure. . . . A new name in the CB marketplace is Commander, which has taken up where Amphenol left off. Commander has one CB rig we can't wait to test—the model 778 "Scanalyzer." This will be the first CB receiver (part of the overall transceiver) that will permit the operator to constantly monitor activity on all 23 channels! And, if that isn't enough, the Scanalyzer will include a 24-hour clock, internal SWR measuring, and an optional module to permit monitoring any of 9 additional channels outside of the band. You can monitor without impairing the CB functions.

The above has been a "teaser" to show that, in CB, things are happening.

INTERPRETING THE TABLES

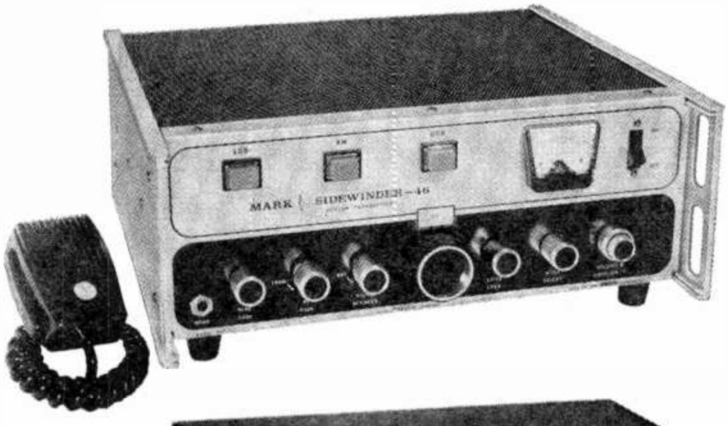
Type of Signal: The majority of CB transceivers broadcast a straight amplitude-modulated (AM) signal. Several models reduce the strength of the carrier and pack slightly more power into the sidebands—which contain the all important modulation information. The latter signals are referred to in the Table as "DSB" (double-sideband with reduced carrier). A few transceivers are capable of receiving single-sideband (SSB) signals, but not capable of transmitting a true single-sideband signal. Most CB transceivers cannot convert an SSB signal into readable modulation.

No. of Transmit Channels: All duly licensed Class D stations may operate on any one of 23 channels in the CB 11-meter band. Transmissions must be better than 0.005% in frequency deviation. This column in the table indicates the maximum number of channels in a particular model. Check Notes 5, 10, 11, and 20.

No. of Xtal Receive Channels: A majority of CB transceivers incorporate some crystal-controlled receiving channels although alternative tunable "spotting" methods are just as satisfactory. Transceivers with frequency synthesis (Note 1) automatically provide the identical number of transmitting and receiving channels—all crystal-controlled.

Tunable Receiver: A means of keeping the cost of a CB transceiver down while adding convenience is to make the re-

(*Continued on page* 50)



Just coming on the market is this Mark "Sidewinder-46" a CB transceiver designed for superior SSB operation.

Top-of-the-line from Midland is this Model 13-880 featuring SSB divided 46 channel CB transceiving.

Manufacturer	Model	Type of Signal	No. of Transmit Channels	No. of Receive Channels	Is Receiver Tunable?	Power Supply (Volts)	Type of Receiver	Circuits Use	Notes	Price
Allied Radio Corp. 100 N. Western Ave. Chicago, Ill. 60680 40 Reader Service Number	A-2564	AM	23	23	no	12	dual superhet	solid-state	1,2,3,7,8,12,22	$149.95
	A-2567	AM	23	23	yes	117 & 12	dual superhet	tubes	1,2,3,7,8	$179.95
	A-2568	AM	23	23	no	117 & 12	dual superhet	solid-state	1,2,3,7,8,12,22	$199.95
B & K, Dynascan Corp. 1801 W. Belle Plaine Chicago, Ill. 60613 41	Cobra-V	AM	5	5	no	12	superhet	solid-state	2,11,23	$ 99.95
	Cobra-17	AM	23	23	no	12	superhet	solid-state	1,2,7,8,23	$179.95
	CAM-88	AM	23	23	yes	117 & 12	dual superhet	tubes	1,2,3,7,8,12	$219.95
	CAM-98	AM	23	23	yes	117 & 12	dual superhet	tubes	1,2,3,7,8,12	$239.95
Browning Labs, Inc. 1269 Union Ave. Laconia, N.H. 03246 42	Golden Eagle	AM	23	23	yes	117	dual superhet	tubes	2,4,6,7,8,9, 13,15,21	$465.00
	Eaglette	AM	23	23	no	12	dual superhet	solid-state	1,2,3,6,7,12, 15,23	$204.50
Commander 133 North Jefferson Chicago, Ill. 60606 43	750	AM	6	6	no	12	superhet	solid-state	11	$ 79.95
	777	AM	23	23	no	12	dual superhet	solid-state	1,3,7,8,10,23	$169.95
	778	AM	23	23	yes	117 & 12	dual superhet	solid-state	1,2,3,7,8,10,13	$399.95
Courier Communications, Inc. 439 Frelinghuysen Ave. Newark, N.J. 07114 44	Courier 23	AM	23	23	yes	117 & 12	dual superhet	tubes	1,3,7,8,12	$199.00
	Courier 23 Plus	AM	23	23	yes	117 & 12	dual superhet	tubes	1,3,7,8,9,12	$229.00
	Courier Clipper 23	AM	23	23	no	12	dual superhet	solid-state	1,2,3,8,10,12, 18,23	$159.95
	Courier Classic	AM	23	23	yes	12	dual superhet	solid-state	1,3,7,12,23	$199.00

	Courier Royale	AM	23	23	yes	117 & 12	dual superhet	tubes	1,2,3,7,8,9,12,15	$299.00
	Courier TR5	AM	5	5	no	12	superhet	solid-state	5,10,11,12,22,23	$ 99.00
	Courier Traveller	AM	23	23	yes	12	superhet	solid-state	1,2,7,22,23	$159.00
	CWT-50	AM	6	6	no	—	superhet	solid-state	2,3,11,18,23	$ 99.95
Demco Electronics Bristol, Ind. 46507 45	Chalet	AM	6	6	no	12	superhet	solid-state	1,7,8,12,23	$189.95
	Ravelle 23	AM	23	23	yes	117 & 12	dual superhet	tubes	1,3,7,12	$249.50
	Super Satelite	AM	23	23	yes	117	dual superhet	tubes	1,2,7,8,9,10,13	$450.00
EICO Electronic Instruments Co., Inc. 283 Malta St. Brooklyn, N.Y. 11207 46	7923	AM	23	23	yes	12	superhet	solid-state	1,7,8,12,23	$189.95
Fanon Electronic Industries 100 Hoffman Place Hillside, N.J. 47	Fanfare 23	AM	23	23	no	12	dual superhet	solid-state	1,2,3,8,10,12,18,23	$159.95
	M2300	AM	23	23	yes	117 & 12	dual superhet	tubes	1,3,7,8,12	$189.95
	SFT-600	AM	12	12	no	117 & 12	dual superhet	solid-state	3,7,8,11,12	$109.95
	SFT-800	AM	23	23	yes	12	dual superhet	solid-state	1,2,7,22,23	$119.95
	XM2300	AM	23	23	yes	117 & 12	dual superhet	tubes	1,3,7,8,9,12	$199.95

NOTES

1—Has frequency synthesis circuit
2—Transmitter circuitry includes a system of speech clipping or modulation percentage boosting
3—Modulator can be switched to "Public Address" from front panel
4—Unit has a "Spotting" switch on front panel
5—Unit has a transmit crystal socket on front panel
6—Transceiver has socket connections to use manufacturer's selective calling system
7—Meter on front panel reads "S-units"
8—Meter on front panel reads approximate or relative power output
9—Receiver features low-noise Nuvistor r.f. stage
10—This description fits basic unit—see manufacturer's catalog for optional accessories
11—Transceiver requires 2 crystals per channel
12—Rear skirt provision for remote speaker (paging)
13—Transceiver features dual antenna (switched) input/output connections
14—Transceiver has power switching to reduce transmitter input to 100 milliwatts
15—Receiver features front panel r.f. sensitivity switch or control
16—Transceiver may be tuned to either sideband for SSB mode of operation
17—Main body of transceiver is mounted in trunk and operated from driver's position by remote control
18—Walkie-talkie
19—Transceiver feeds received signal to car radio; no complete receiver in this package
20—Requires only 1 crystal per controlled channel (transmit/receive)
21—BFO in receiver for SSB reception
22—Receiver features i.f. noise blanking
23—A.C. power pack available

Manufacturer	Model	Type of Signal	No. of Transmit Channels	No. of Receive Channels	Is Receiver Tunable?	Power Supply (Volts)	Type of Receiver	Circuits Use	Notes	Price
Hammarlund Mfg. Co. 20 Bridge Ave. Red Bank, N.J. 07701 48 Reader Service Number	HQ-205	AM	6	6	yes	117	superhet	tubes	4,5,7,11,15	$259.95
Heath Company Benton Harbor, Mich. 49023 49	GW-14	AM	23	23	no	12	superhet	solid-state	7,8,10,11	$ 76.95 (K) $124.95 (W)
	GW-22A	AM	5	5	no	117	superhet	tubes	10	$ 47.95 (K)
	GW-22D	AM	5	5	no	12	superhet	tubes	10	$ 49.95 (K)
International Crystal Mfg. Co., Inc. 18 North Lee Oklahoma City, Okla. 73102 50	MO-23	AM	23	23	yes	12	dual superhet	hybrid	1,2,17	$205.00
E. F. Johnson Company Waseca, Minn. 56093 51	Messenger I	AM	5	5	no	117 & 12	superhet	tubes	10,11	$114.95
	Messenger III	AM	12	12	no	12	dual superhet	solid-state	2,3,6,10,11,23	$159.95
	Messenger 100	AM	6	6	no	12	superhet	solid-state	2,3,6,10,11,23	$129.95
	Messenger 110	AM	5	5	no	12	superhet	solid-state	2,10,11,23	$ 99.95
	Messenger 123	AM	23	23	no	12	superhet	solid-state	1,2,7,10,23	$169.95
	Messenger 124	AM	23	23	no	117	superhet	solid-state	1,2,3,7,8,10,12	$289.95
	Messenger 125	AM	5	5	no	12	superhet	solid-state	2,10,11	$ 99.95
	Messenger 223	AM	23	23	no	117	dual superhet	tubes	1,2,7,8,10	$214.95
	Messenger 320	AM	23	23	no	12	superhet	solid-state	1,2,7,8,10,23	$199.95
	Messenger 323	AM	23	23	no	12	dual superhet	solid-state	1,2,3,6,7,8,10,12,23	$229.95

Kaar Electronics Corp. 232 Wescott Drive Rahway, N.J. 07065 52	TR336	AM	11	11	no	12	superhet	solid-state	6,10,11,12,23	$159.95
	TR337	AM	23	23	no	12	superhet	solid-state	6,7,8,10,12, 20,23	$229.95
Lafayette Radio Electronics Corp. 111 Jericho Turnpike Syosset, N.Y. 11791 53	Dyna-Com 5A	AM	3	3	no	—	superhet	solid-state	2,8,10,11,13,18	$ 79.95
	Dyna-Com 12	AM	12	12	no	—	superhet	solid-state	2,8,10,11,13,18	$ 99.95
	HB-525C	AM	23	23	yes	12	dual superhet	solid-state	1,2,3,6,7,10,12, 23	$149.95
	HB-625	AM	23	23	yes	12	dual superhet	solid-state	1,2,3,6,7,10,12, 22,23	$189.95
	Comstat-19	AM	9	9	yes	117	superhet	tubes	10,11,14	$ 59.95
	Comstat-23-II	AM	23	23	no	117	dual superhet	tubes	2,3,6,7,8,10	$ 99.95
	Comstat 25A	AM	23	23	yes	117 & 12	dual superhet	tubes	1,2,3,6,7,8,	$139.95
	HB-23	AM	23	23	no	12	dual superhet	solid-state	1,6,7,10,12, 20,23	$ 99.95
	HB-600	AM	23	23	yes	117 & 12	dual superhet	solid-state	1,2,3,6,7,10, 12,22	$219.95
	HE-20T	AM	12	12	yes	117 & 12	superhet	solid-state	3,6,7,8,11	$ 89.95
	Telsat 23	AM	23	23	no	117 & 12	dual superhet	solid-state	1,2,3,6,7,8	$159.95
	Telsat 150	AM	23	23	yes	117 & 12	dual superhet	solid-state	1,6,12,13,22,23	$199.95

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Manufacturer	Model	Type of Signal	No. of Transmit Channels	No. of Receive Channels	Is Receiver Tunable?	Power Supply (Volts)	Type of Receiver	Circuits Use	Notes	Price
Mark Products Co. 5439 West Fargo Ave. Skokie, Ill. 60076 54 Reader Service Number	Invader 2305	AM	23	23	no	12	dual superhet	solid-state	1,3,7,8,12	$169.95
	Sidewinder 46	AM/SSB	46	46	yes	117	superhet	solid-state	1,2,7,8,15,16,22	$495.00
Midland International Corp. 1909 Vernon Street North Kansas City, Mo. 64116 55	13-770	AM	6	6	no	12	superhet	solid-state	3,7,8,11,12,18, 23	$ 69.95
	13-772	AM	12	12	no	12	superhet	solid-state	3,7,8,11,12,18, 23	$ 79.95
	13-778	AM/SSB	3	3	yes	12	dual superhet	solid-state	16,18,22,23	$219.95
	13-790	AM	23	23	no	12	dual superhet	solid-state	1,2,3,7,8,12, 18,23	$149.95
	13-855	AM	6	6	no	12	superhet	solid-state	11,23	$ 69.95
	13-870C	AM	23	23	no	12	dual superhet	solid-state	1,2,3,7,8,12,23	$139.95
	13-872	AM	23	23	yes	12	dual superhet	solid-state	1,2,3,7,8,12,23	$159.95
	13-876	AM	23	23	yes	117 & 12	dual superhet	solid-state	1,2,3,7,8,12	$169.95
	13-877	AM	23	23	yes	117 & 12	dual superhet	solid-state	1,2,3,7,8,12	$189.95
	13-880	AM/SSB	23	23	yes	117 & 12	dual superhet	solid-state	1,2,3,7,8,12, 15,16,22	$329.95
	13-890	AM	23	23	yes	117	dual superhet	tubes	1,3,7,8,12	$129.95
Olson Electronics, Inc. 260 S. Forge St. Akron, Ohio 44308 56	CB-8	AM	8	8	no	12	superhet	solid-state	11,23	$ 59.99
	CB-12	AM	12	12	no	12	superhet	solid-state	3,11,23	$ 99.99
	CB-88	AM	23	23	no	12	superhet	solid-state	1,7,8,	$169.50

Pace Communications Corp. 24049 S. Frampton Ave. Harbor City, Calif. 90710 57	Pace 100	AM	6	6	no	12	dual superhet	solid-state	6,7,10,11	$129.95
	Pace 2300	AM	23	23	no	12	dual superhet	solid-state	3,6,7,8,10,11,12	$200.00
	Base Station	AM	23	23	no	117	dual superhet	solid-state	1,7,8,12,15	$330.00
Pearce-Simpson, Inc. DIU Gladding Corp. Box 800, Biscayne Annex Miami, Fla. 33152 58	Companion II	AM	5	5	yes	117 & 12	superhet	tubes	5,11,12	$159.90
	Companion IV	AM	10	10	no	12	superhet	solid-state	3,11,12,23	$139.90
	Director 23	AM	23	23	no	12	dual superhet	solid-state	1,7,12,23	$269.90
	Guardian 23B	AM	23	23	no	117 & 12	dual superhet	tubes	1,7,8,9,12,15	$269.90
	Panther	AM	5	5	no	12	superhet	solid-state	11,23	$ 99.90
J. C. Penney Co., Inc. 1301 Avenue of the Americas New York, N.Y. 10019 59	Golden Pinto	AM	23	23	yes	12	dual superhet	solid-state	1,2,7,8,22,23	$159.00
	Pinto Jr.	AM	6	6	no	12	superhet	solid-state	10,11,23	$ 69.00
	Pinto-23	AM	23	23	no	12	dual superhet	solid-state	1,3,7,8,23	$129.00
	Pinto-23B	AM	23	23	yes	117 & 12	dual superhet	solid-state	1,2,3,7,8,12	$159.00

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Radio Shack Corp. 730 Commonwealth Ave. Boston, Mass. 02215 60 Reader Service Number	TRC-18	AM	12	12	no	12	dual superhet	solid-state	3,7,8,12,20,23	$ 99.95
	TRC-24	AM	23	23	no	12	dual superhet	solid-state	1,3,7,8,12,23	$139.95
	TRC-29	AM	23	23	yes	117 & 12	dual superhet	solid-state	2,3,7,8,12,23	$169.95
	TRC-100	AM	6	6	no	12	superhet	solid-state	2,3,11,18,23	$ 69.95
Regency Electronics, Inc. 7900 Pendleton Pike Indianapolis, Ind. 46226 61	Imperial	DSB	23	46	yes	117 & 12	dual superhet	tubes	7,8,12,16	$329.00
	Range Gain II	DSB	23	23	yes	117 & 12	dual superhet	tubes	1,7,8	$269.00
	500	AM	12	12	no	12	superhet	solid-state	3,11,12,23	$ 99.95
	GT-523	AM	23	23	yes	12	dual superhet	solid-state	1,3,7,8,12,23	$189.00
	Formula 12	AM	12	12	no	117	superhet	solid-state	3,7,8,11,12	n.a.
	Formula 23	AM	23	23	no	117	dual superhet	solid-state	1,3,7,8,11,12	n.a.
Robyn Company P.O. Box 478 Rockford, Mich. 49341 62	T-123	AM	23	23	yes	117 & 12	dual superhet	tubes	1,2,3,7,8	$179.00
	TR-123	AM	23	23	no	12	dual superhet	solid-state	1,2,3,7,8,23	$139.95
	TR-605	AM	6	6	no	12	superhet	solid-state	1,3,8,12,18,23	n.a.
Sears, Roebuck and Company 3245 W. Arthington Chicago, Ill. 60607 63	6556	AM	5	5	no	12	superhet	solid-state	2,10,11,23	$ 99.95
	6558	AM	12	12	no	12	dual superhet	solid-state	2,6,10,11,23	$134.95
	6562	AM	23	23	yes	12	dual superhet	solid-state	1,2,3,6,7,8, 10,12,23	$199.95

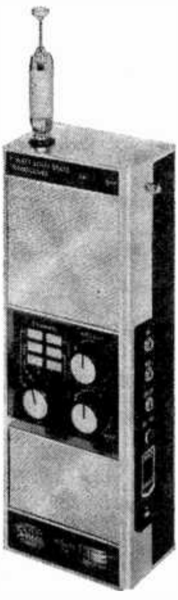
Sonar Radio Corp. 73 Wortman Ave. Brooklyn, N.Y. 11207 64	FS-23	AM	23	23	yes	117 & 12	dual superhet	tubes	1,6,7,8,9,10, 11,12	$299.95
	J-23	AM	23	23	no	12	dual superhet	solid-state	1,3,6,10,12,23	$239.95
	T-6	AM	6	6	no	—	superhet	solid-state	3,8,11,12,18,23	$139.95
Squires-Sanders, Inc. Martinville Rd. Liberty Corner, N.J. 07938 65	Flagship	AM	23	23	no	117	dual superhet	solid-state	1,2,3,7,12,13, 15,22	$299.95
	Commodore	AM	23	23	no	12	dual superhet	solid-state	1,12,22,23	$199.95
	Skipper	AM	23	23	no	12	dual superhet	solid-state	1,2,3,7,12,15, 22,23	$159.95
SSBCO P.O. Box 101 Northtown Station Chicago, Ill. 60645 66	Lancer-23	AM	23	23	no	12	dual superhet	solid-state	1,7,8	$139.95
Tram Corporation Lower Bay Rd. Box 187 Winnisquam, N.H. 03289 67	Corsair	AM/DSB	23	46	yes	12	dual superhet	solid-state	2,3,7,12,16,20, 22,23	$415.00
	Titan	AM	23	23	yes	117	dual superhet	tubes	2,4,7,8,12,15	$425.00
	Titan II	AM/DSB	23	46	yes	117	dual superhet	tubes	2,4,8,12,15,16	$495.00
Utica Electronics, Inc. 2917 W. Irving Park Rd. Chicago, Ill. 60618 68	RME Six-Sixty		6	6	no	117 & 12	dual superhet	tubes	7,8,11	$ 79.95
	RME Six-Eighty		6	6	no	117 & 12	dual superhet	tubes	2,7,8,11	$114.95

NOTES

1—Has frequency synthesis circuit
2—Transmitter circuitry includes a system of speech clipping or modulation percentage boosting
3—Modulator can be switched to "Public Address" from front panel
4—Unit has a "Spotting" switch on front panel
5—Unit has a transmit crystal socket on front panel
6—Transceiver has socket connections to use manufacturer's selective calling system
7—Meter on front panel reads "S-units"
8—Meter on front panel reads approximate or relative power output
9—Receiver features low-noise Nuvistor r.f. stage
10—This description fits basic unit—see manufacturer's catalog for optional accessories
11—Transceiver requires 2 crystals per channel
12—Rear skirt provision for remote speaker (paging)
13—Transceiver features dual antenna (switched) input/output connections
14—Transceiver has power switching to reduce transmitter input to 100 milliwatts
15—Receiver features front panel r.f. sensitivity switch or control
16—Transceiver may be tuned to either sideband for SSB mode of operation
17—Main body of transceiver is mounted in trunk and operated from driver's position by remote control
18—Walkie-talkie
19—Transceiver feeds received signal to car radio; no complete receiver in this package
20—Requires only 1 crystal per controlled channel (transmit/receive)
21—BFO in receiver for SSB reception
22—Receiver features i.f. noise blanking
23—A.C. power pack available

(*Continued from page* 41)
ceiver tunable and to have a modest number of crystal-controlled transmitting channels. In this column in the Table, some frequency synthesis transceivers are considered to be *not* tunable (no). Any bandspread tuning of a receiver with this circuit is limited and is generally crystal-controlled—meaning that the i.f. input can be shifted about 2.5 kHz above or 2.5 kHz below the nominal channel frequency. In some transceivers such tuning has been given the name "Delta Tuning." Receivers with frequency synthesis and Delta-type tuning are shown here as tunable (yes).

Power Supply: In this Table, the household a.c. line voltage has been "standardized" at 117 volts. Various manufacturers use 110, 115, or 117 volts in their literature, but we have stuck with the latter since it is closer to the true line voltage throughout most of North America. Many transceivers use circuits that permit operation from 12-volt automobile batteries, and a few can be powered from 6-volt batteries. In the Table, the word "and" means that the transceiver contains some sort of universal power supply permitting operation from any of the input voltages shown. The word "or" means that the transceiver contains one power supply and that the supply itself can be changed to switch from base station (117 volts) to mobile (12 or 6 volts).



These 5-watt input, hand-held transceivers are typical of the new equipment now offered CB'ers. The Sonar T6 (above) may even be used for PA (with an external speaker). The Midland unit (left) will receive 3 SSB channels as well as AM.

Receiver: There are only two types of receiver circuits in CB transceivers. They are related and are either straight superheterodynes, or dual-conversion superhets. The latter is generally more selective and able to cope with interference from adjacent channels or other CB'ers with transceivers operating within one-quarter to one-half mile away. Attention should be paid to the possibility that a simple superhet circuit may include crystal or mechanical filtering to provide selectivity comparable to a dual-conversion superhet.

Circuit: Transceivers can use all "tubes" or some tubes and some transistors—"hybrid." A unit with transistors and semiconductor diodes only is called "solid-state."

It should be noted that every transceiver listed has two features that are not itemized—a variable squelch and a noise limiter.

Notes: A detailed breakdown of the coding numerals for this column appears at the foot of each odd-numbered page. These numerals refer to specialized features that are not common to all CB transceivers.

Price: No attempt has been made to differentiate between so-called "list" prices and the usual CB'er "net" prices in the Table. Many manufacturers supplied list prices for inclusion in this CB catalog leaving the discounting of price to the individual dealer and purchaser. Readers are urged to shop around and compare prices after selecting transceivers that best suit their individual requirements. The letter K identifies the transceiver as being a kit and the letter W as the wired version of the same unit. -30-

BY D. J. HOLFORD

I Want To Be A Spy, Mr. CIA Man

ARMCHAIR SPYING VIA SHORT WAVES IS BECOMING FASHIONABLE

THERE IS wide interest in the application of electronic espionage by the major world powers. Numerous methods are employed to obtain vital information relating to the military potential of a foreign government's electronic or communications services. All of the major powers have established radio spectrum monitoring facilities. These may be wholly land-based or on planes, satellites, or ships at sea.

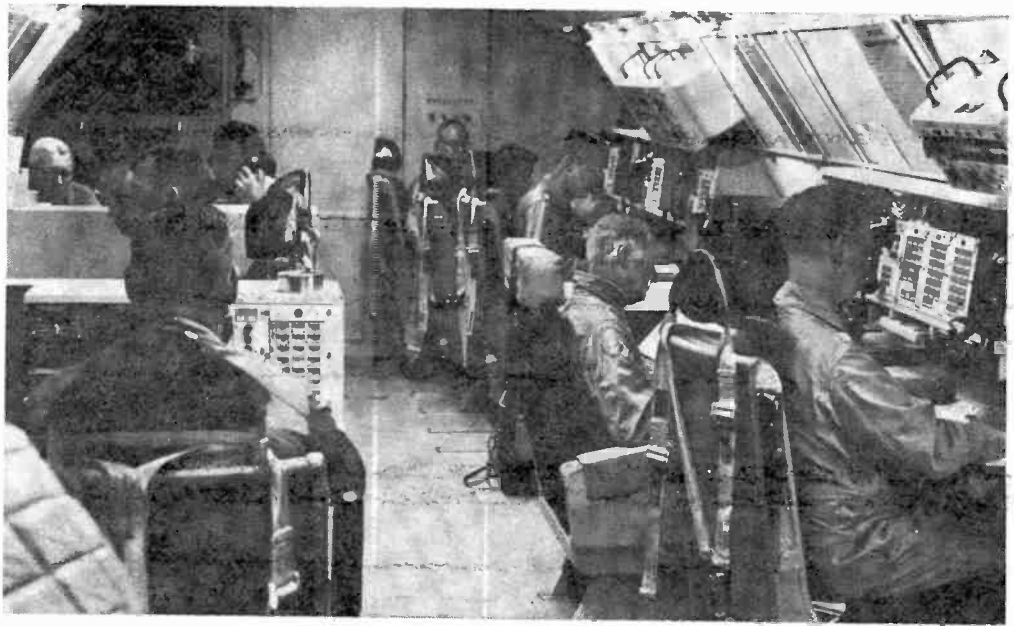
The U2 affair, seizure of the USS Pueblo, and downing of the EC-121 are examples of events involving search vehicles being used to gather electronic and communications intelligence.

Practically every SWL has at one time heard signals that just didn't seem "right." But while there are many mysterious and supposedly secret communications methods and facilities, there appear to be just as many electronic services working more or less in the broad daylight. On occasion some of these communications methods are too obvious to be true and the listener is left guessing as to whether or not he is hearing the real thing. Certainly the idea of establishing a dummy communication system to forestall the revelation of a real system is not beyond the scope of military thinking.

What One Search Revealed. The SWL, particularly the so-called "Utility DX'er," will frequently hear signals and radio traffic patterns that lend themselves to home-brew electronic espionage. An example was the search by the author in the aviation band between 6525 and 6765 kHz. These frequencies are generally used for communications between en route aircraft and ground stations. Various frequencies were monitored until, at almost the top of the band, a frequency was found with numerous single-sideband (SSB) stations regularly exchanging a variety of coded messages. Some of the messages were routine matters concerning planes in flight, but soon a pattern was found wherein what appeared to be four ground stations regularly transmitted coded broadcasts almost identical in content.

Further listening revealed that the four principal stations all addressed messages to *Sky King* and identified themselves as *Migrate*, *Democrat*, *Outway*, and *Retail*.

Each routine broadcast to *Sky King* was annotated with the interesting instruction, "do not answer." And, to compound the mystery, each routine broadcast ended with a subtly different identifier.



Men aboard EC-135 airborne command post (Sky King?) are ready to assume control of SAC's intercontinental range bombers and missiles should SAC underground and alternate command posts become inoperative.
(U.S. Air Force Photo)

The frequency in question was measured to be 6762 kHz. The frequency itself was occasionally identified by both aircraft and ground stations with the code name *Quebec*. The use of other code names quickly established the idea that multiple frequencies were possibly being used at the same time.

Since the first channel had been located in a band assigned to aviation, a search was made of the other high frequency aviation bands. Within 30 minutes a second channel was located and within a few days a total of seven channels had been identified. Obviously, others are in use, but have not been located since they possibly are on frequencies well outside the normal long-range aviation bands.

CHANNEL CODE NAMES

VICTOR	4725 kHz
QUEBEC	6762 "
ROMEO	9027 "
BRAVO	11,220 "
SIERRA	13,245 "
MIKE	15,041 "
TANGO	17,976 "

(All frequencies upper sideband)

CHECK-IN TIMES

MIGRATE	05 and 35 after the hour
DEMOCRAT	07 and 37 " " "
OUTWAY	09 and 39 " " "
RETAIL	11 and 41 " " "

But Who Is Sky King? Through all of the monitoring on the seven channels, the station referred to continuously as *Sky King* was never heard. On occasion, *Sky King* also seemed to have a counterpart whose name—appropriately enough—was *Sky Bird*.

Since the content of all messages was obviously military, even the most inexperienced espionage agent might draw some very obvious conclusions. First, the messages themselves must be of very great importance, and second, the receiving station is probably airborne or why else would aviation frequencies be utilized. Lastly, there must be "many" airborne receiving stations scattered over many thousands of miles, or why else would so many different frequencies be used at the same time.

If you draw the same conclusion as that of the author, doesn't it sound as though we are listening in on the airborne alert force of the USAF Strategic Air Command?

Now, will someone tell me about *Looking Glass*, who broadcasts a somewhat similar message pattern on such frequencies as 15,034.5 kHz.? —30—

BUILD THE

Dorm Special

A STEREO SYSTEM FOR CRAMPED QUARTERS

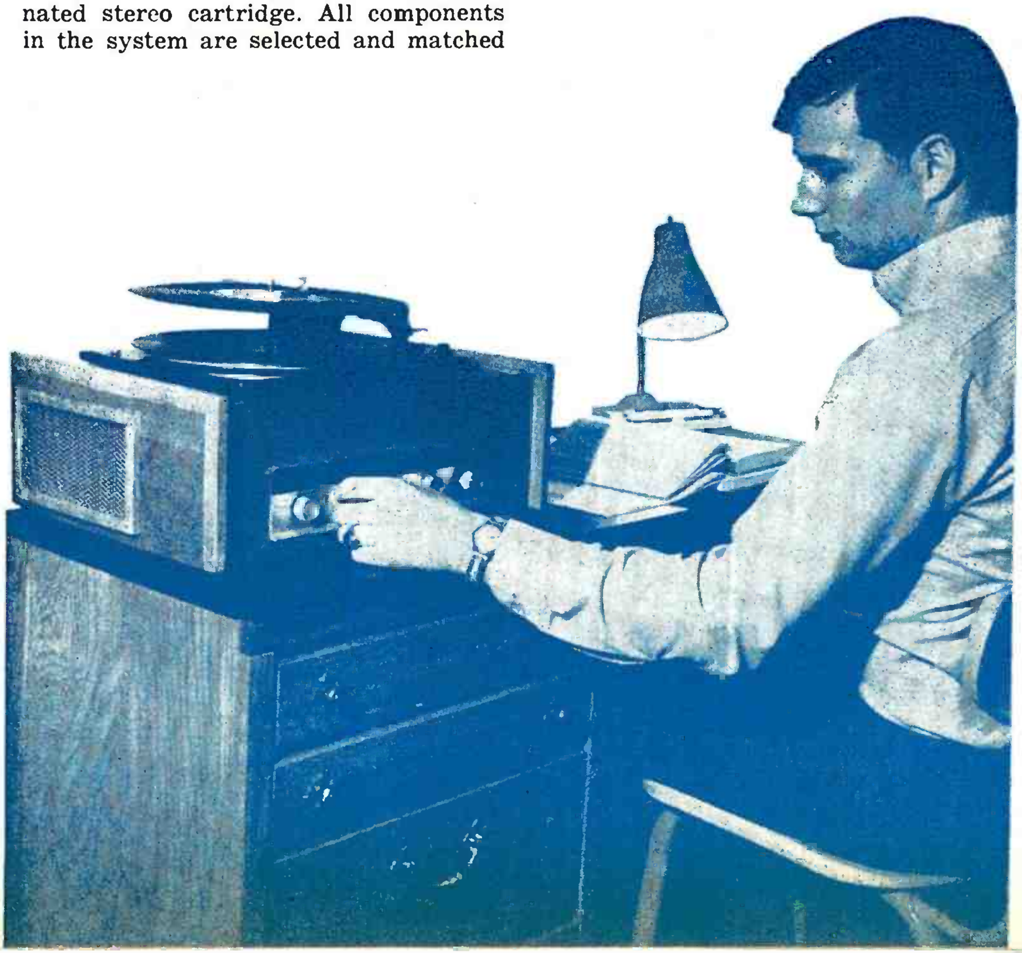
BY DAVID B. WEEMS

THE "Dorm Special" Stereo System, a true compact for tight places, has something for everyone. It's ideal for the cramped quarters in a college dorm, as a handy second system for a game room, or even as a first stereo system in a crowded apartment.

The Dorm Special has a first-rate amplifier for hi-fi stereo reproduction of long-playing records and can also be used with a FM stereo receiver or other source. The amplifier is a Heathkit solid-state stereo Model AA-14 capable of 15 watts (IHF) per channel output power or a total continuous output of 20 very clean watts. The amplifier is complemented by a Garrard 40 MK II automatic record turntable with a performance-coordinated stereo cartridge. All components in the system are selected and matched to provide better performance than you would normally obtain from most department store compacts.

The built-in speakers specified for the Dorm Special are wafer-type "Poly-Planars," an unorthodox—but nevertheless practical—design that incorporates a flat polystyrene "cone." These speakers provide good sound reproduction at modest volume levels, but they are rated at only 5 watts; so if you want ear-splitting volume, external speakers are a necessity.

The stereo effect of the built-in side-mounted Poly Planar speakers is particularly suited to close-in listening. And when you move the Dorm Special to



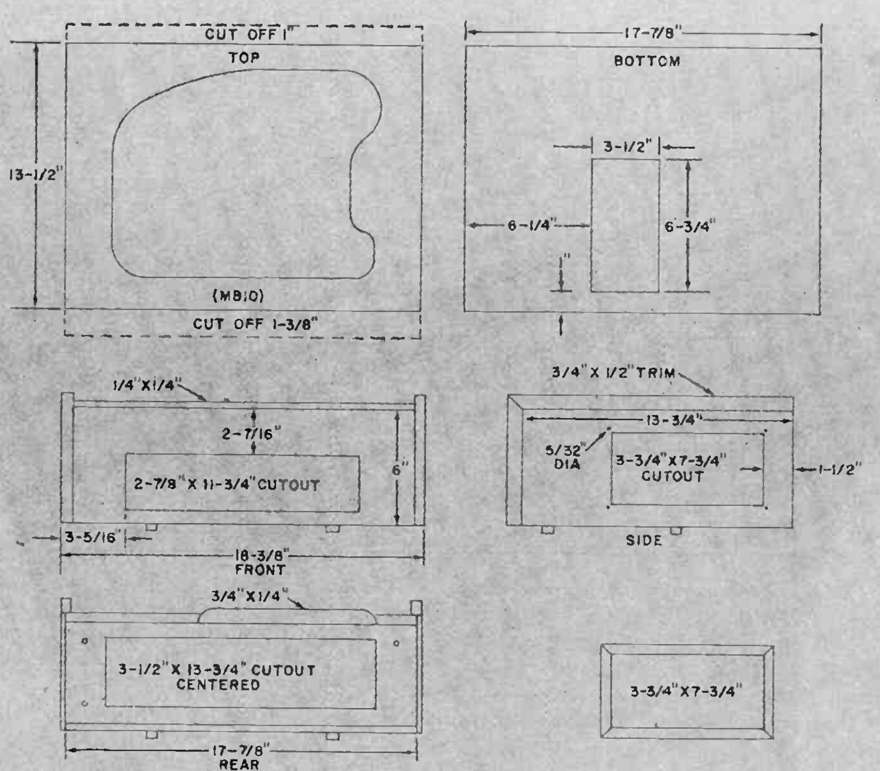


Fig. 1. Be sure, when removing excess material from the MB10 turntable base board, that the assembly is oriented as shown in the drawing at the upper left.

BILL OF MATERIALS

1—Heathkit Model AA-14 solid-state amplifier kit
1—Garrard Model 40 MK II automatic turntable
1—Stereo cartridge (see text)
1—Garrard Model MB10 mounting board
1—Garrard Model DC 40A dust cover
2—ERA Poly Planar Model P-5 speakers (Olson Electronics, 350 S. Forge St., Akron, Ohio 44308)
1—17⅞" x 6" piece of ¼" plywood for front panel
2—13¾" x 6" pieces of ¼" plywood for sides
1—17⅞" x 6" piece of ¼" plywood for back panel
1—17⅞" x 13½" piece of ⅜" plywood for bottom
2—14½" pieces of ¾" x ½" pine miter cut at one end for side trim
2—6½" pieces of ¾" x ½" pine miter cut at one end for side trim
1—Approximately 17½" piece of ¼"-square pine for front rim
1—9" piece of ¾" x ¼" screen molding for rear rim
4—8¾" pieces of ⅜" x ½" pine for speaker frame
4—4¾" pieces of ⅜" x ½" pine for speaker frame
8—⅛" x 1" bolts and nuts for speaker mounting
4—#6 x 1" sheet metal screws for amplifier mounting
2—Switchcraft Type 12A phone jacks
2—Switchcraft Type 227 phone plugs
1—5' line cord with plug
Misc.—spade lugs (5); wood glue; stain; grille; finishing nails; ¼" wood dowel; wire; solder; etc.

roomier quarters, the system pays off; just plug in a pair of good external speaker systems, and you have really big sound.

Construction. The sides, front, and back of the Dorm Special are made of ¼" plywood, the bottom of ⅜" plywood. The Garrard changer mounting board listed in the Bill of Materials serves as the top. Solid pine is used to finish off the rough edges of the plywood.

Being sure to orient the cutout in the board properly, cut off the 1" and 1⅜" pieces of the changer mounting board as shown in the upper left of Fig. 1. Cut the other pieces as shown.

When all pieces have been cut to size,

Fig. 2. Sides, bottom, front, assemble with glue and wire brads. Do not allow brads to go into wood at an angle—sides are very thin plywood.

glue and nail the front panel to the bottom. Then glue and nail the sides to the front and bottom as shown in Fig. 2. Note that the sides overlap the front and bottom. Finally, fit the turntable mounting board into place, and glue and nail it down.

Next, cover the raw edges on the tops and fronts of the side pieces with pine. Glue and nail pieces of ¾" × ½" pine over the exposed edges. Where the two pieces of pine on each side join, they should be miter cut to 45° to produce a finished corner. Immediately wipe away any glue that bleeds out from between the sections being joined.

A ¼"-square piece of pine should now be cut to size and fitted between the sides along the front edge of the top of the cabinet. Glue and nail this strip down, again immediately removing any glue that bleeds out. Then glue and screw a ¾" × ¼" pine strip along the rear edge of the turntable mounting plate as shown in the rear-view drawing in Fig. 1 and in the lower photo on page 57.

The ventilation slot in the rear apron of the cabinet should now be covered with a piece of expanded aluminum cut about ¼" larger than the slot itself. Attach the grille to the rear apron on the inside surface, using a hard-set cement, such as "liquid solder." Weight or clamp the grille and apron together until the cement sets. Then attach ¾" × ½" cleats inside the cabinet with glue and screws, allowing ¼" of clearance on all sides for the rear apron to drop into place flush with the rear edges of the top, bottom, and side members of the cabinet.

The speaker grilles can be mounted from the inside of the cabinet in the same manner used for the ventilation grille, or you can frame mount them as illustrated

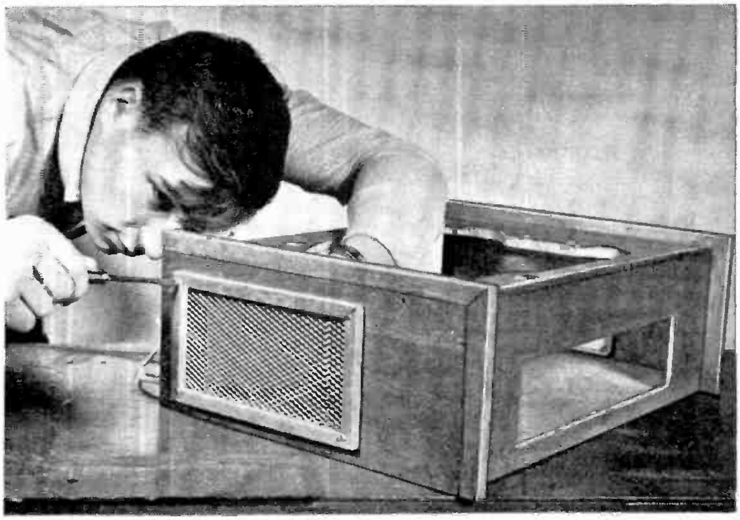


Fig. 3. Screws at four grille frame corners should go through frames, cabinet sides, and speaker mounting holes. Tighten enough to hold everything in place.

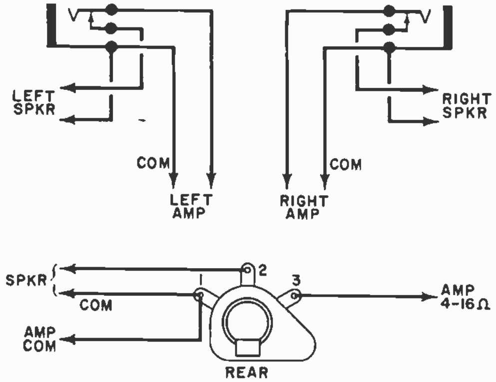


Fig. 4. At top is schematic diagram of amplifier output connections to jacks and Poly Planar speakers; immediately below is a phone jack wiring guide.

in the photo at the beginning of this article. For frame mounting, cut the frame parts to size and groove the rear inside edge of each section to accept the grille materials. Glue the frames together and let sit for at least two hours or until the cement has set firmly. Then use a speaker to locate the 5/32" holes at each corner of the frame for mounting.

Now sand all exterior surfaces of the cabinet and speaker frames. Apply a coat or two of stain to the sanded surfaces. You can use an oil finish or a hard-gloss varnish or lacquer finish after the stain dries.

Assembling the Amplifier. The Heathkit Model AA-14 solid-state stereo amplifier recommended for use in the Dorm Special comes in kit form. It is available for $64.95 (plus postage) from the Heath Company, Benton Harbor, Michigan 49022.

The excellent assembly manual provided with the amplifier kit contains thorough wiring instructions and describes how each stage in the circuit operates. Consequently, this article will not attempt to repeat the instructions in the manual. However, before starting assembly, open the manual to page 24. The first three steps on this page describe the installation of the line cord in hole J of the amplifier chassis. Add to these steps the following: "Pass the line cord through the hole drilled for it in the rear panel of the cabinet prior to passing it through hole J of the amplifier chassis." This way, you will not have to remove and replace the power plug when bringing the power cord out from the cabinet.

For all other instructions on how to assemble the amplifier kit, refer to the manual. If you have not done much kit building, it is recommended that you carefully read through the "Kit Builder's Guide" also supplied with the amplifier.

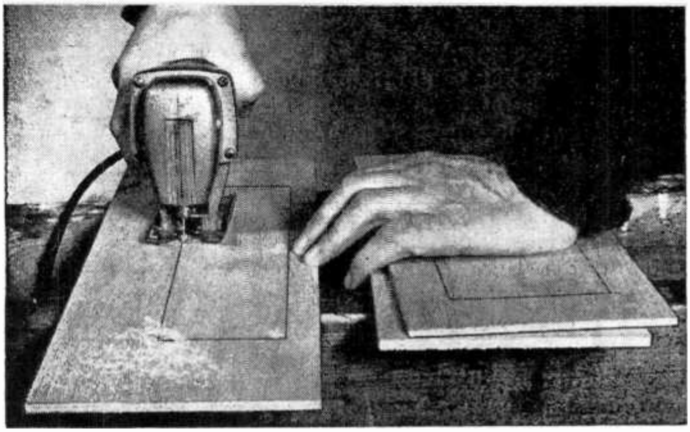
Final Assembly. Glue a piece of open-weave black cloth over the inside of each speaker cutout in the cabinet to prevent the white speakers from showing through. Then cut two pieces of speaker cord to 15" and strip away 1/4" of insulation from each conductor on both ends. Solder the leads at one end of each cord to the speakers. Then mount the speakers with 1/8" hardware through the mounting frames, cabinet sides, and speakers as shown in Fig. 3. (If you wish, you can sandwich a piece of expanded aluminum grille between the mounting frames and cabinet walls as shown.)

Install the amplifier in the cabinet. Then prepare four 5/16"-long spacers from 1/2" wood dowel. Drill a 5/32" hole through the center of each spacer. Set the amplifier in the exact position it will occupy inside the cabinet, and mark the locations of each of the plastic feet on the bottom of the cabinet.

Remove the amplifier from the cabinet, drill a 5/32" hole through the center of each marked position, and rubber cement a spacer at each location. Remove the plastic feet from the bottom plate of the amplifier chassis and the knobs and dec-

HEATHKIT AA-14 STEREO AMPLIFIER TECHNICAL SPECIFICATIONS

Continuous output power—10 watts/channel
IHF music power output—15 watts/channel
Output impedance—4 through 16 ohms
Damping factor—50 or better
Hum and noise—Phone: −60 dB (below 10-mV input); Tuner: −63 dB; Auxiliary: −63 dB
Frequency response—12-60,000 Hz ±1 dB; 6-100,000 Hz ±3 dB
Power response—15-50,000 Hz ±1 dB; 7-90,000 Hz ±3 dB
Input sensitivity—Phono: 4.5 mV; Tuner: 300 mV; Auxiliary: 300 mV
Input impedance—Phono: 47,000 ohms; Tuner: 180,000 ohms; Auxiliary: 180,000 ohms
Channel separation—45 dB or better
Total harmonic distortion (THD)—1% or less at 20-20,000 Hz at rated output; 0.5% or less at 1000 Hz at rated output
I.M. distortion at rated output—1% or less, using 60 and 6000 Hz mixed 4:1
Phono equalization—RIAA



Sabre saw is best for making cutouts in thin plywood. If sabre saw is not handy, carefully use crosscut keyhole saw.

orative front panel from the front of the receiver. Discard the #6 × ¼" sheet metal screws, and replace them with #6 × 1" sheet metal screws.

Set the amplifier in place on the spacers. Then push a 1" sheet metal screw through each plastic foot, and fasten the feet in place by inserting the screws through the bottom/spacer holes and into the original screw holes in the bottom of the amplifier. Replace the front panel and knobs.

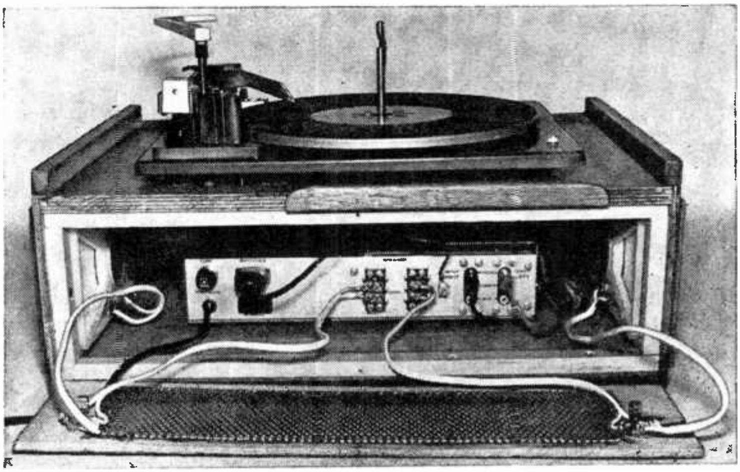
Strip away ¼" of insulation from all conductors of two more 15" lengths of speaker cable. Then, at one end of each cable, solder spade lugs.

Now, mount the output jacks in their respective holes in the rear panel of the cabinet. Solder the "hot" (ribbed or perforated) lead of one of the cables to lug 3 and connect but do *not* solder the other lead to lug 1 of the right output jack as illustrated in Fig. 4. Connect the spade lug attached to the unmarked lead of this cable to the COM and the "hot" spade lug to the other *right* output terminals on the amplifier. Use the same procedure to connect the *left* output terminals and jack together.

Locate the speaker cord that goes to the left soldering lug on the right speaker, and solder this lead to the common post on the right output jack. Solder the other lead from the right speaker to lug 2 on the same jack. Then repeat this procedure for the left jack/speaker connections. (Note: It does not matter which side of the speaker voice coils is connected to the common lug; just be consistent in wiring the speakers to the jacks.) Make sure that none of the leads touch the metal ventilation grille.

Now, before installing the record changer, make the following changes: First, cut the line cord to a length of 8" and install a new plug. Cut the green grounding wire to a length of 5" and solder a spade lug to the cut end. Next, mount the changer on its board, making

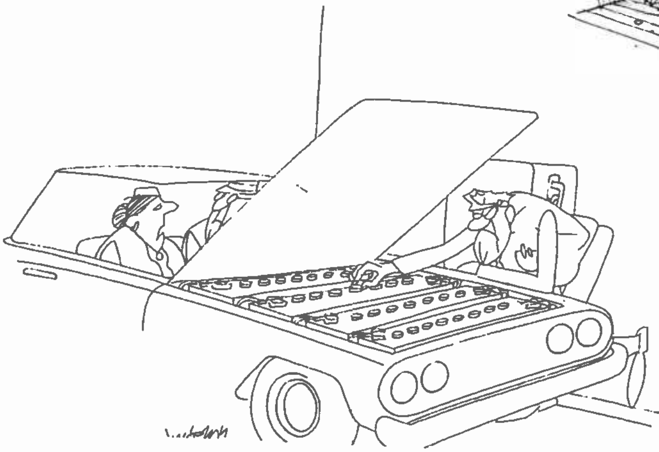
(*Continued on page* 110)



View of compact system from rear shows amplifier at center, flanked on both sides by speakers. Rear panel drops down and out to allow access to AA-14 amplifier connections.

Hobnobbing with Harbaugh

Here's a letter from Popular Electronics. You didn't make "Amateur Station of the Month."



When they ask to check the battery, you should tell them this is an electric car you built.

Three R7's. . . . ten C2's. . . . five R10's, 2200 ohms. . . . six SCR1's. . . .

AMATEUR RADIO EQUIPMENT / 1969-70 / Review & Preview

BY HERB S. BRIER, W9EGQ

THE HOTTEST entries in the amateur radio equipment sweepstakes remain the SSB/CW transceivers. Although there was nothing too new to be seen in the marketplace within the past twelve months there have been refinements, price changes, model deletions, etc. Here is the status of ham gear as of June 1, 1969.

Transceivers. As new as it is sophisticated, the CX-7 SSB/CW/AM transceiver from the **Signal One Division** of Electronic Communications, Inc., a subsidiary of the National Cash Register Company, is all solid state except for a convection-cooled 8072 tube in the transmitter output stage. Power input is 300 watts, continuous duty, on all modes and amateur frequencies between 1.8 and 30 MHz, and—if desired—on three other additional 1-MHz bands between 2.0 and 14 MHz. No tuning (except the VFO dial) is required over any band of frequencies where the antenna feedline SWR does not exceed 2:1. The CX-7 has digital readout with better than 100-Hz accuracy, and two built-in VFO's allow single or split-frequency operation at will. Two 8-crystal lattice filters produce a 2-kHz bandwidth with an almost perfect shape factor. Two optional CW filters are available. Full CW break-in operation using a built-in electronic keyer or conventional keying, noiseless VOX operation, a noise blanker, and a built-in power supply are other features in the CX-7. The price is $1595.

Also in the $1500 region, the **Hallicrafters** SR-2000, 5-band, 2000-watt (PEP) transceiver is priced at $1545 with power supply. But for a mere $780, plus $120 for the power supply, the **Hallicrafters** SR-400, 400-watt "little brother" of the SR-2000 is available. The two units have such features as "receiver incremental tuning" (RIT) to change receiver tuning a few kHz without affecting the transmitted frequency, 2.1-kHz receiver bandwidth, built-in noise blanker, and 0.5-μV receiver sensitivity. In addition, the SR-400 includes a variable notch filter to eliminate heterodynes and a 200-Hz CW filter. Both units can be operated in conjunction with the HA-20, VFO/control console ($200).

In the over-$1000 bracket is **Collins Radio Company's** tried and proved, deluxe KWM-2 transceiver. Nominal frequency coverage is the amateur bands between 3.5 and 30 MHz. But almost any band of frequencies in that overall range can be added to the coverage. Most **Collins** owners consider cost a secondary consideration; although, the basic KWM-2 sells for $1150. You can figure on another $200 for the basic speaker/power supply console. In addition, many other deluxe options, such as a noise blanker, crystal-control adapter, 12-volt and 24-volt power supplies, remote VFO, and control consoles, are available.

Still going strong after 55 years in the amateur field, **National Radio Company Inc.'s** newest NCX-500 hybrid, 5-band, AM/CW/SSB transceiver's $425 price tag is quite a stepdown from the Collins, Signal/One, etc. levels. Nevertheless, the NCX-500's 500-watt power rating, 2.8-kHz bandwidth, 0.5-microvolt sensitivity, and other features make it an excellent unit to bear the National name. The NCX-500 matching 117/234-volt power supply sells for $99.

At **R. L. Drake** they continue to capture a fair share of the amateur market with the TR-4, 5-band, 300-watt, SSB/CW/AM transceiver at $600. Its companion 117-volt power supply sells for $100, and the 12-volt d.c. supply for $125.00. The matching speaker console ($20) houses the power supply. A remote VFO at $100 and a noise blanker at $129 are additional options for the TR-4. Incidentally, the 8-crystal lattice filter in today's TR-4 has a better shape factor than filters in earlier units.

Galaxy Electronics' new hybrid, GT-550, 5-band SSB/CW transceiver has been completely restyled for improved appearance and operating convenience. In addition, **Galaxy's** receiver performance is reported to be even better, and its new PEP power rating is now 550 watts input. GT-550 options include a plug-in VOX unit, crystal control adapter, remote VFO, 300-Hz CW filter, and matching speaker. The price tag reads $449, plus $90 for the 117-volt supply or $125 for the 12-volt, d.c. supply.

Operators on a limited budget who are happy with 3.8 and 7.2 MHz SSB operation might investigate **World Radio Laboratories** Duo-Bander 84 selling at $159 with built-in speaker, but less power supply. The standard 400-watt, 117-volt, a.c. supply sells for $80, while a 250-watt supply is available for about $30 less. A 12-volt supply is also available.

Still on the economy motif, **Swan Electronics'** new Cygnet, 260-watt; 5-band SSB/CW transceiver is priced at $395 with built-in 117-volt/12-volt power supply. Add $100 and they give you the deluxe model Cygnet. For twice the power, Swan offers the 500C at $520, plus $105 for the 117-volt power supply/speaker console. A combination 117-volt/12-volt supply is also available. A plug-in VOX unit, remote VFO, and other Swan options are available.

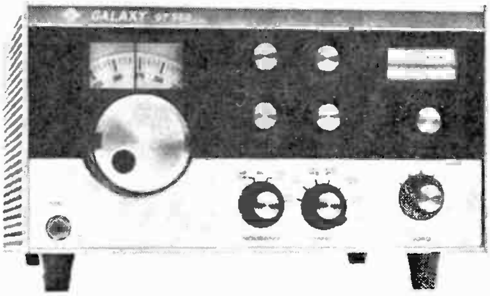
If you consider kit building as a part of amateur radio, the **Heath Company** offers many opportunities to do your "thing." At the top of the **Heath** line is the SB-101, 5-band, SSB/CW transceiver kit rated at 180 watts, PEP, for $370. The package includes a preassembled VFO, crystal calibrator, VFO or crystal-controlled operation, built-in VOX, and CW sidetone oscillator. An external VFO and a sharp CW filter are available options. Unusual for **Heathkits,** the SB-101 is available in ready-to-go form—for $540, less power supply.

For $240, **Heathkit's** HW-100 SSB/CW transceiver does virtually everything like the SB-101 but not quite so elegantly. And in the $105-$110 region, **Heath** offers single-band (1.8, 3.8, 7.2, and 14.2 MHz) SSB kit transceivers that perform excellently, regardless of their modest cost. Matching power supplies for all Heathkit SSB/CW transceivers sell for $50 for the 117-volt, a.c. unit, $65 for the d.c. unit.

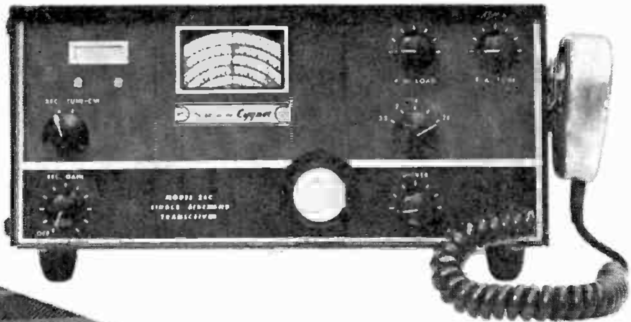
From Japan via **Spectronics** comes the **Yaesu-Munson,** FTdx-400, 500-watt, SSB/CW 5-bander. For its $600 price tag—written in clear American dollars—the FTdx-400 offers all the features of a first-line transceiver, including dual-frequency calibrator, built-in VOX, and off-set receiver tuning up to 10 kHz off the transmit frequency. The power supply is built in.

The first successful hybrid amateur SSB transceiver was the SBE-33 covering the amateur bands from 3.5 to 21.45 MHz at the 135-watt level. Now called the SB-34 and available from **Linear Systems, Inc.,** its 23-transistor, three-tube circuit has undergone sundry modifications to keep up with solid-state technology. The SB-34 retains its mechanical filter for 2.1-kHz bandwidth, receiver off-set tuning, and built-in a.c./d.c. power supply. In fact, the SB-34 price tag of $449 is for a complete, one-package SSB station, less microphone.

Separate Transmitters and Receivers. A separate receiver will usually out-perform a transceiver on *receive* when the going gets rough. As a result, many amateurs prefer separate transmitters and receivers to transceivers in their home stations. Actually a matched transmitter-receiver pair, such as the **Collins** 32S-3/75-S-3B ($1706 with speaker and power supply), **Drake** T-4XB/R-4B ($1000 with speaker and power supply), or **Heathkit** SB-401/SB-301 ($580 with speaker), can be locked together for transceive-type operation or operated independently at the snap of a switch.



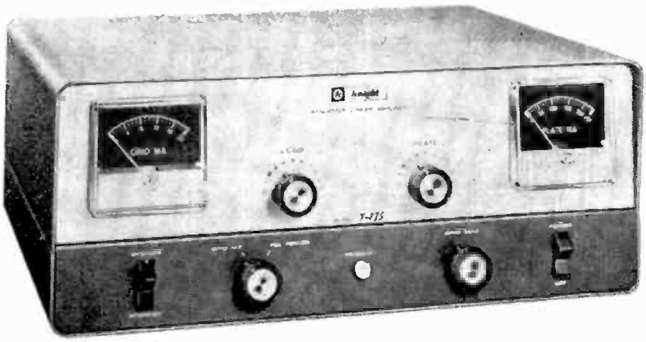
Designed for either mobile or fixed station use, the Galaxy GT-550 is rated at 550 watts SSB or 360 watts on CW. Primary dial calibration is 5 kHz and the vernier tuning is at a ratio of 72:1. This transceiver is one of the most compact models around.



The Swan "Cygnet" is the little brother of the popular 500C. SSB power rating is given as 260 watts and Swan claims that the receiver sensitivity is second to none. Unlike some transceivers, the Cygnet is self-powered.

New Drake TR-6 has a lot of circuitry in a small cabinet. Manufacturer rates this transceiver at 300 watts SSB/AM/CW. It is designed for the 6-meter band, but may be run down to 49.4 MHz to cover some of the MARS frequencies.

Also for 6-meter operation is this modestly priced Lafayette HA-460 straight AM transceiver. It is self-powered and covers the low end of the band. The HA-460 has a built-in low-pass TV filter.



Knight-Kit T-175 linear amplifier can deliver up to 300 SSB or 150 watts CW. Unit contains internal switching network for instant antenna changeover.

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Automatic Controls. Prepares you to be an Automatic Controls Electronics Technician; Industrial Laboratory Technician; Maintenance Technician; Field Engineer.

Digital Techniques. For a career as a Digital Techniques Electronics Technician; Industrial Electronics Technician; Industrial Laboratory Technician.

Telecommunications. For a job as TV Station Engineer, Mobile Communications Technician, Marine Radio Technician.

Industrial Electronics. For jobs as Industrial Electronics Technicians; Field Engineers; Maintenance Technicians; Industrial Laboratory Technicians.

Nuclear Instrumentation. For those who want careers as Nuclear Instrumentation Electronics Technicians; Industrial Laboratory Technicians; Industrial Electronics Technicians.

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Other amateurs supplement their transceivers with independent receivers to work DX stations that transmit and receive on different frequencies or to "SWL." A sampling of receivers suitable for these purposes range from the **Allied Radio's** new A-2516 ($169.95); **Hammarlund** HQ-110-AC/VHF ($360) and HQ-215 ($530); **Hallicrafters** SX-130 ($200) and SX-146 ($295); **Galaxy** R-530 ($695); **Drake** 2-C ($229); **Lafayette Radio Electronics** HA-600T ($100) and its brand-new hybrid HA-800T ham-band receiver (price not set at press time); **National** HRO-500 ($1600); and **Squires-Sanders** SS-1R ($995).

Sideband Above 50 MHz. The **R. L. Drake** TR-6 ($600), the **Gonset** GSB-6 ($395), **Heathkit** SB-110 ($300), and the improved **Swan** 250C ($420) bring SSB transceivers to 50 MHz at about the same cost as the lower frequencies. In addition, owners of lower frequency SSB gear can cover the 50- and 144-MHz bands with "transverters." The **Collins** 62S-1 transverter ($895) covers both bands. **R. L. Drake's** TC-6 ($250) and TC-2 ($300) transverters cover the 50- and 144-MHz bands, respectively. **Swan's** improved TV-2B ($295) and **Heathkit's** SB-500 ($189) cover the 144-MHz band.

AM Equipment. Except for the **Heathkit** DX-60B, 5-band, AM/CW transmitter ($80), all the new AM gear is for frequencies above 28 MHz, often in the form of 5- to 25-watt transceivers, complete with built-in speakers and 117-volt/12-volt power supplies. Among such transceivers are **E. T. Clegg Associates'** "66'er" and "22'er" matched-pair for 50 and 144 MHz ($250 each), noted for their excellent receiver performance; and **Gonset's** 24-watt, 50-MHz Communicator IV ($310). Also, **Hallicrafters'** SR-42A, 144-MHz transceiver ($220) contains a 12-watt transmitter and a sensitive receiver with a squelch circuit to eliminate speaker noise when no signal is being received. **Lafayette Radio Electronics'** 28- and 50-MHz 20 watters—the HA-410 for 28 MHz ($100) and the HA-460 for 50 MHz ($115)—both contain built-in transmitter VFO's, as does the **Lafayette** HA-750, solid-state, 50-MHz 5 watter ($120).

In kits, **Allied Radio Company's** Knight-Kit 50-MHz TR-106 ($120) features 15 watts transmitter power and a dual-conversion receiver. A matching VFO is available ($25). **Heathkit's** improved hybrid HW-17A ($130) covers the 144-MHz band. Finally, we cannot overlook **Heathkit's** ubiquitous "Twoer" and "Sixer" "lunchboxes" at $45 each. Twelve-volt power supplies for the last three units are extra—as are transmitting crystals for all.

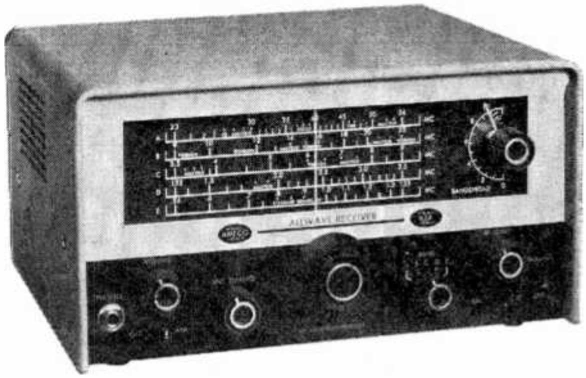
In the straight transmitter group, the 185-watt, **Clegg Zeus** ($525) covers 50 and 144 MHz with built-in VFO or crystal control. And the **Ameco** Division of Aerotron, Inc., offers the TX-62 75-watt, 50- and 144-MHz crystal-controlled, AM/CW transmitter at $160.

VHF Converters. When a transceiver is not used, the simplest way to receive VHF/UHF signals efficiently is through a converter ahead of a low-frequency receiver. **Ameco, Clegg, Drake,** and **Heathkit** are among those offering such converters. Prices start at under $20.

Novice Code Equipment. Of special interest to Novices and code buffs are **Heathkit's** HW-16, CW transceiver ($120) and **Drake's** 2-NT CW transmitter ($130). The HW-16 performs on the 3.5-, 7-, and 21-MHz bands, and the 2-NT is a 5-bander. Both transmit crystal-controlled signals at the 75- to 100-watt level. The 2-NT "transceives" with the Drake 2-C receiver, by the way. Also available are the model 400 25-watt, 3-band CW transmitter from **Conar** Division of National Radio Institute (kit $33) and the **Ameco** AC-1T, 15-watt 2-bander (kit $25), both worth considering as Novice "first" transmitters. Transmitter crystals for all units mentioned are extra.

To allow maximum space to cover items of maximum interest to the greatest number of amateurs, we have omitted the names of manufacturers who are only in the amateur accessory business or whose products are of very limited appeal to the average amateur. Furthermore, we have devoted little space to accessories, but the manufacturers listed on page 118 will gladly give you more information on any item.

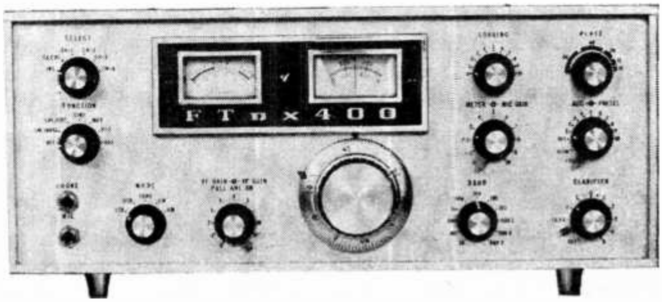
(*Continued on page* 118)



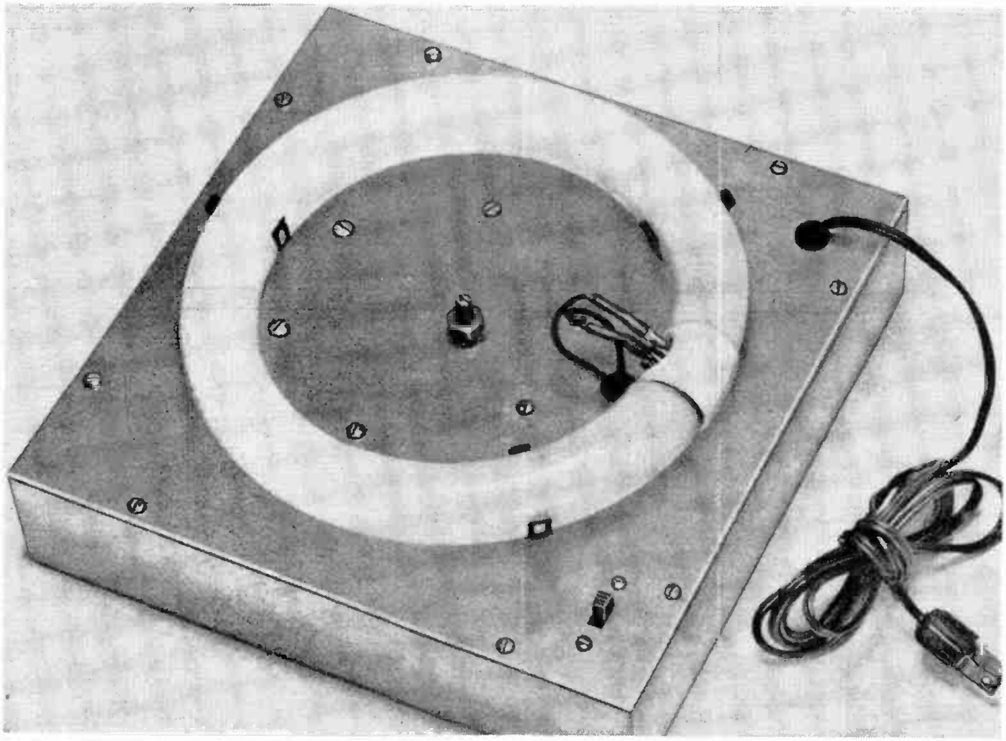
All-solid-state Ameco R-5 receiver has continuous tuning from 0.54 to 54 MHz. May be operated from a.c. line or from an external battery pack. A noise limiter, BFO and band-spread tuning are included.

Hybrid 2-meter transceiver is a new item from Heathkit. The HW-17 operates from a.c. but can be supplied from a transistorized d.c. supply. Unit is rated at 8 to 10 watts straight AM output.

Most hams say this CX7 transceiver from Signal/One is the only really new thing on the ham market. It has as many features as there are knobs on the front.



Top-of-the-line from Japan is this Yaesu-Munson FTdx-400 5-band transceiver. Rated at 500 watts, it has offset tuning, 25-kHz calibrator, plus built-in VOX and full power supply.



BUILD THE PPFL

A UNIQUE LIGHT FLASHER IS THE

Pulsating Psychedelic Fluorescent Lamp

BY L. EDWARDS

FLASHING LIGHTS have many uses—some serious and some just for fun. The PPFL (Pulsating Psychedelic Fluorescent Lamp) falls in both categories and its flashing rate can be varied from about one flash per second to many times per second. Thus it can be used for window displays and Christmas lighting, as a warning light, or as a rhythm-conscious lamp that flashes in synchronization with an audio signal.

Since it uses a fluorescent lamp, the PPFL runs cool and interesting patterns can be obtained by using either straight or circular lamps. As an added bonus, an ultra-violet fluorescent lamp can be used in conjunction with fluorescent paints or decals to get some effects that are really a blast.

Construction. The basic fluorescent flasher, whose circuit is shown in Fig. 1, can be built in, or on, almost any type of chassis. In the author's version, an 8″ circular lamp was mounted on a 10″ × 10″

CAUTION

Persons subject to epileptic seizures should not watch this—or any other—pulsating light display. Nobody should stare at this—or any other light display—for long periods of time.

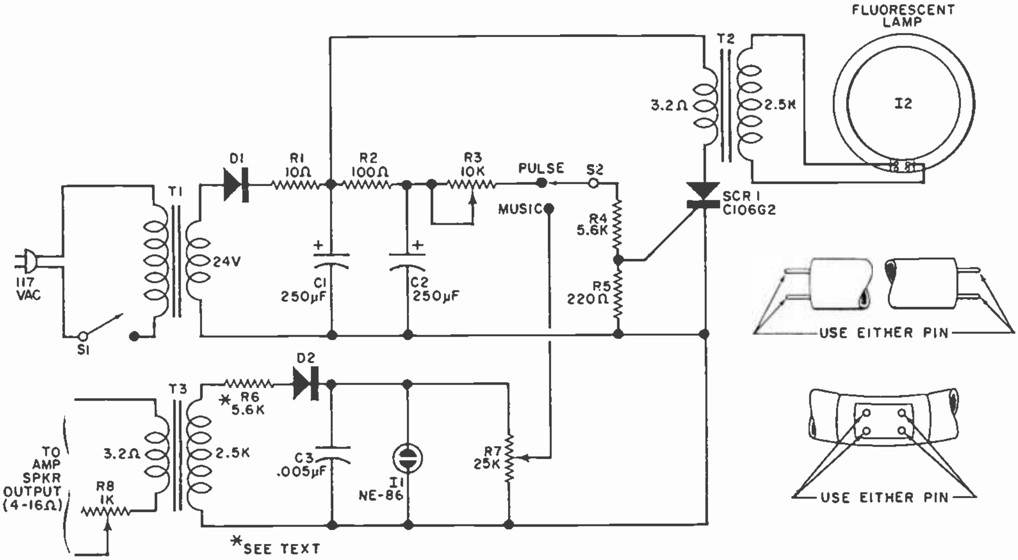


Fig. 1. To protect the amplifier, the value of R6 can be increased when driving the PPFL from a very high signal level. Be cautious of the lamp driving leads when the system is operating, as you can get quite a jolt when the SCR fires. The entire music portion can be eliminated for plain blinking.

PARTS LIST

C1,C2—250-μF, 50-volt minimum, electrolytic capacitor
C3—0.005-μF capacitor
D1,D2—1-ampere, high-voltage silicon diode rectifier
I1—NE-86 neon lamp (don't use NE-2)
I2—Fluorescent lamp
R1—10-ohm, 1-watt resistor
R2—100-ohm, 2-watt resistor
R3—10,000-ohm potentiometer
R4—5600-ohm, ½-watt resistor
R5—220-ohm, ½-watt resistor
R6—5600-ohm, 1-watt resistor (see caption)
R7—25,000-ohm potentiometer (see text)
R8—1000-ohm potentiometer
S1—S.p.s.t. switch
S2—S.p.d.t. switch
SCR1—C106G2 silicon controlled rectifier (G-E)
T1—117-volt to 24-volt step-down transformer (Knight 54F4710 or similar)
T2,T3—3.2-ohm to 2500-ohm output transformer (Knight 54F2063 or similar)
Misc.—Chassis for electronics, mounting for lamp, lamp pin connectors (2), line cord, insulated hookup wire, mounting hardware, etc.
Note—A complete kit of parts containing everything but the fluorescent lamp and including a steel wall-mounting box is available for $34.90 or having a drilled and punched aluminum front panel for use with your own wooden case for $30.90. Order from Lyman E. Greenlee, P.O. Box 1036, Anderson, Ind. 46015. Postage paid in continental U.S. No overseas orders, please.

piece of aluminum having four wooden supports fixed to the aluminum sheet. Since there are only two connections to the lamp, the circuit may be mounted in a conventional metal box with the lamp as a separate fixture.

Once the method of construction has been determined, wire the circuit point-to-point using multi-lug terminal strips to support the various components. To avoid thermal damage, use a heat sink on the leads when soldering the semiconductors. A long-nose plier is good for this purpose.

The connections to the fluorescent lamp pins can be simplified by attaching metal connector sleeves to the ends of the wires leading to the lamp and sliding the sleeves over one set of lamp terminals.

If the lamp is to be used anywhere but in a private home, it must be mounted in a metal case to avoid fire hazards and protect against accidental shocks. Some means of protecting the relatively fragile fluorescent lamp against accidental breakage must also be used. This can be accomplished by putting a metal screen around the lamp, by installing it in a protected commercial fixture, or by putting it in a ceiling-type fixture.

Operation. Almost any type of lamp can be used in the PPFL, even some that might not work in a conventional fixture. There will be some blackening of the ends of the tube with use, but this is normal when pulse operation is used. Some types of fluorescents work better than others.

HOW IT WORKS

In the pulse mode of operation, transformer *T1* steps the commercial 117-volt line power down to 24 volts. This is rectified by *D1* and filtered by *R1*, *C1*, *R2*, and *C2* to produce about 45 volts into an open circuit.

When *SCR1* is not conducting, it blocks power to the primary of *T2*, a step-up transformer. As *C2* charges, the voltage on the SCR gate circuit (*R3*, *R4*, *R5*) builds up. When this voltage reaches the required level, the SCR fires and *C1* is discharged across the primary of *T2*. The high-current pulse in the primary of *T2* produces a high-voltage pulse in the secondary which is sufficient to flash the fluorescent lamp. Capacitor *C2* is also discharged during this interval, but it discharges at a slow rate through *R2*. This increases the pulse width and allows *T2* to saturate and provide a stronger voltage pulse to the lamp.

Since the voltage across *C1* drops almost to zero when it fires, *SCR1* returns to its non-conductive state after the pulse and the cycle is repeated. The flashing rate is determined by the setting of potentiometer *R3*.

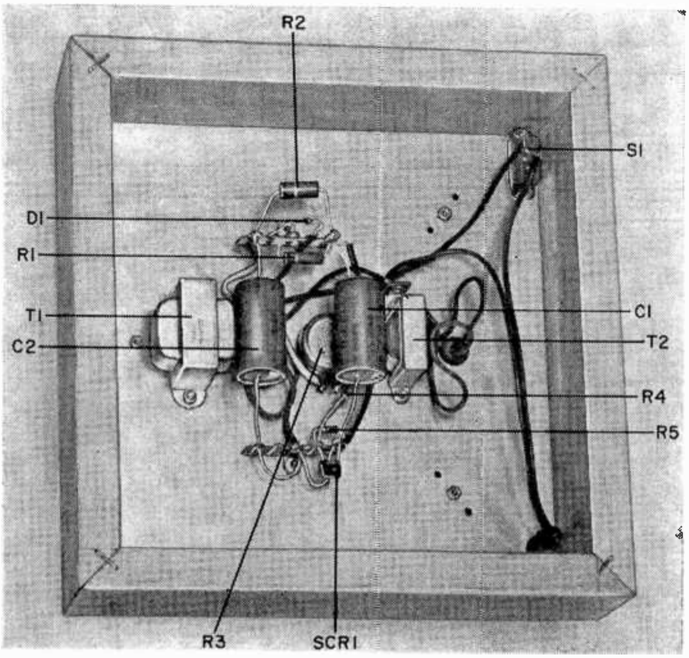
When the system is in the MUSIC mode of operation, the trigger voltage for *SCR1* is derived from a step-up transformer *T3*. A rectifier-filter network is composed of *R6*, *D2*, and *C3* while neon lamp *I1* acts as a voltage regulator. The NE-86 neon used here incorporates a radioactive (non-dangerous) tracer so that it will strike at a lower voltage than a conventional NE-2. Potentiometer *R7* is used to adjust the firing level, while *R8* adjusts the input level to prevent a high-power amplifier from damaging transformer *T3*.

Check the circuit for possible wiring errors before applying the a.c. power. Place *S2* in the PULSE position and allow a few moments for the two electrolytic capacitors to charge up. The lamp should then start pulsing at a rate determined by the setting of potentiometer *R3*.

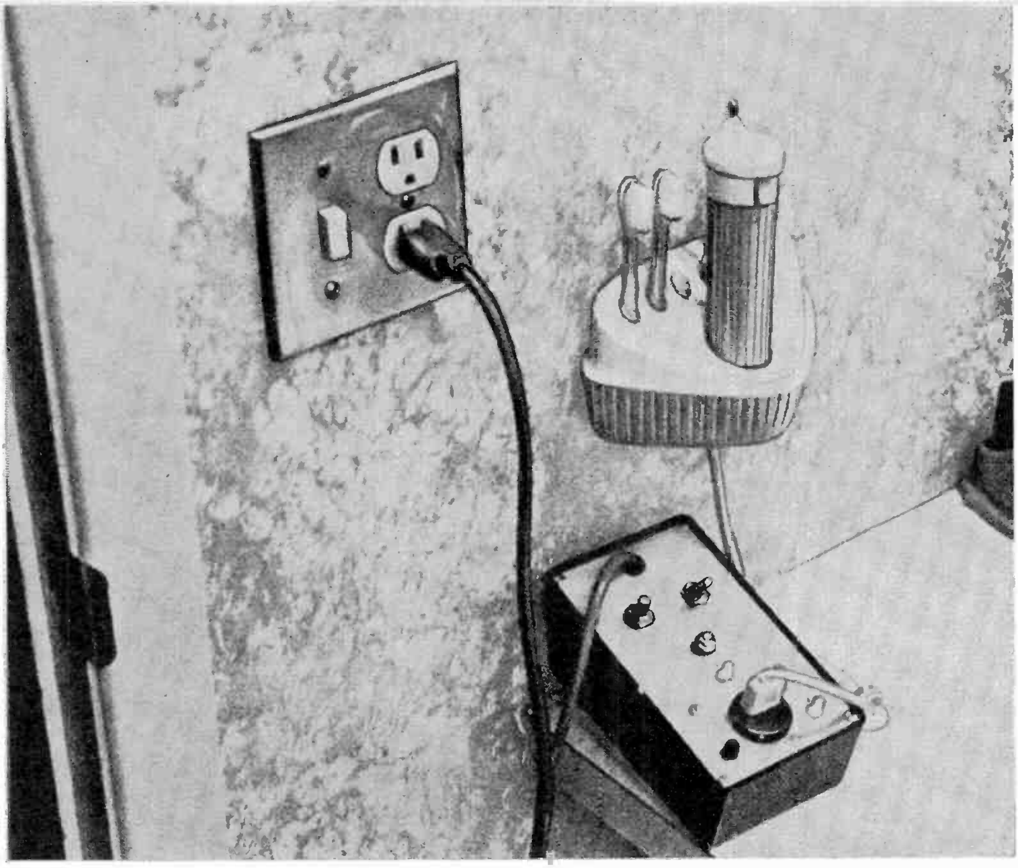
Place *S2* in the MUSIC position, and connect the audio input line to the output terminals of the audio amplifier or radio being used as the audio source. Set potentiometer *R8* to its maximum resistance, and set *R7* at its halfway mark. With the audio source set to the desired output level, slowly adjust *R8* and *R7* to get a flashing indication of the lamp. Use the maximum value of *R8* with the amplifier operating at normal level and adjust *R7* for the best trigger. If you want to simplify things a little, substitute a pair of 10,000-ohm resistors in series for *R7* and take the trigger voltage from the center connection.

If you want to flash a 4′ fluorescent, change *T2* to a transformer with an impedance ratio of 3.2 to 10,000 ohms. For an 8′ fluorescent or a string of fluorescent lamps in series, use an automobile ignition coil for *T2*. (Do not use the ballast resistor that is associated with the ignition coil in the car.)

Do not handle the lamp leads while the circuit is operating as you can get quite a jolt when the lamp fires. This means the PPFL should be protected or safely out of the way where children are concerned. —30—



The author's PPFL before installing the music portion. The added components can be fitted into one of the empty corners. It is not necessary to mount the fluorescent lamp on this chassis, and almost any type of lamp holder will suffice. Just make sure that the lamp cannot be accidentally broken.



Why Play Edison Roulette?

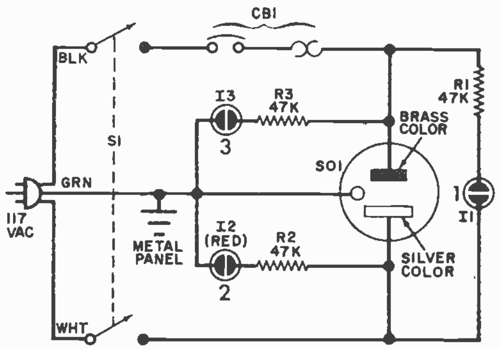
GROUND TESTER MINIMIZES ACCIDENTAL ELECTROCUTION

BY LYMAN E. GREENLEE

AS AN ELECTRONICS hobbyist, one of the most embarrassing (to say the least) ways you can die is through electrocution in your own home. It can ruin your whole day!

Quite seriously, it does happen. Unfortunately, many ordinary hand tools and appliances are wired so that, if a primary power lead should break due to vibration, improper handling, etc., the entire electrical resources of your local power plant can be literally at your fingertips. This happens if the hot lead of the power line comes into contact with the metal portions of the device while you are touching it and your body is making a reasonably good ground return path for the current.

To avoid accidental shock and even electrocution, most appliance manufacturers use a three-lead power cable. In this system, besides the two conventional power leads, there is a third, safety, lead. This lead, which is connected to a metal portion of the appliance, is brought out to a third terminal (usually a rod-like metal pin) on the plug. In the socket, the third terminal is con-



PARTS LIST

CB1—Circuit breaker to suit load
I1-I3—Neon lamp
R1-R3—47,000-ohm, ½-watt resistor
SO1—Three-wire power socket (Amphenol 160-10 or similar)
S1—D.p.s.t. switch, current rating to suit load
Misc.—Plastic utility box 7¼" x 3¾" x 1⅞" with metal cover; three-conductor power cord with plug (length as required); two-to-three-conductor adapter (optional); 4-lug terminal strip (2), plastic mounting for neon lamps (one red, two white); ⅛" grommet for power cord; mounting hardware, etc.

Fig. 1. The circuit is simple and foolproof if wired correctly. Under normal conditions, only lamps 1 and 3 should be lit. If lamp 2 comes on, the "cold" lead is 117-volts above ground.

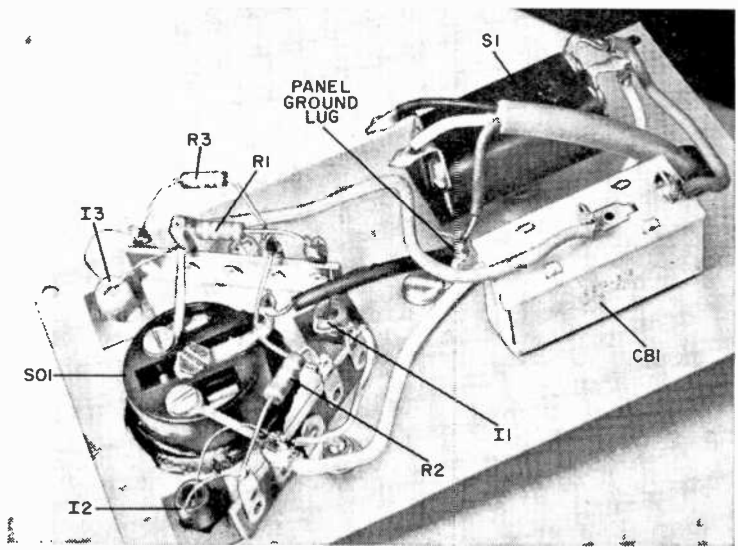
nected to earth ground. If, for any reason, the electrical system within the appliance fails and contacts the metal part, a short circuit is made and a fuse is blown. This three-wire system is a must for any location where there is the slightest possibility that a person using a power tool or other appliance might make a ground while touching the device.

Even with this precaution, however, there is a way to keep tabs on the possibilities of inadvertent shocks—build the handy Ground Tester shown here. If you follow the instructions carefully and keep an eye on the three visual indicators, you may reach a ripe old age—without a sudden electrical termination.

Construction. For safety, the circuit (Fig. 1) should be built in a plastic utility box having a metal cover. Drill holes in the cover to fit the three-lead power socket (*SO1*), circuit breaker *CB1*, power on-off switch *S1*, three neon indicators, and a pair of four-lug (none grounded) terminal strips. You can use the layout shown in the photograph or make up your own as long as the three neon lamps are clearly visible.

In mounting the components make sure that lamp *I2* has a red lens to make it clearly distinctive. Wire the circuit

The entire circuit can be assembled on the metal panel. Make sure that this panel is grounded to the green lead of the cable.



WHAT A SHOCK!

Unlike a rattlesnake, electricity gives no warning before it strikes. When it does, the damage can range from a tingle, to a shock, to death by electrocution. However, like the woodsman who knows where the snake lies in wait, the electronics hobbyist also should be aware of where the electric shock can be encountered.

Look around you. In the kitchen, close to grounded sinks and other metal fixtures, there is probably an a.c.-d.c. radio. Although the manufacturer went to some trouble to make the radio electrically safe, did you repair it recently and substitute a knob with a set screw for the friction-fit one that was there originally? That set screw can be "hot" with 117 volts to the grounded metalwork; and if you have the radio plugged in the wrong way (how do you know you haven't?) and reach to tune the radio while leaning on the sink, this may be the last sentence you ever read. And if you're using a radio out of its protective case—forget it! What about the toaster? Would you want to take the chance of touching both the plugged-in toaster and the kitchen faucet, radiator, or other grounded metalwork? Try it. If you survive, keep reading.

Now let's go to the laundry room—site of many deaths by electrocution. Isn't your washer/dryer pretty close to the grounded sink? What about the moist floor? It makes a very good conductor of electricity, especially when either the washer or dryer has a loose wire that makes contact with the metal shell.

Now out to the yard or down to the boat dock. Do you get a comfortable feeling when using a power tool to do a hard job? You may not feel so good when you stop to think that only a few thousandths of an inch may stand between you and your Maker. If vibration loosens up a screw or if a piece of fishpaper changes position, bye-bye, dear reader.

Why this preoccupation with death? Because most of us live in an electrical environment and many of us are not aware of just how close to termination we are—even if it's just sitting at the breakfast table with the electric toaster or coffee pot near one elbow and the other elbow leaning on the radiator.

So what can you do about all of this? It's simple. Open both eyes and check everything in sight that has a 117-volt power cord attached. If you have the slightest doubt of the safety of any device, be sure that its metal sections are grounded to earth. In the case of large appliances such as washers and dryers, use a heavy-gauge wire between the metal frame and a cold-water pipe. For small, portable devices, read this article—and go three-wire!

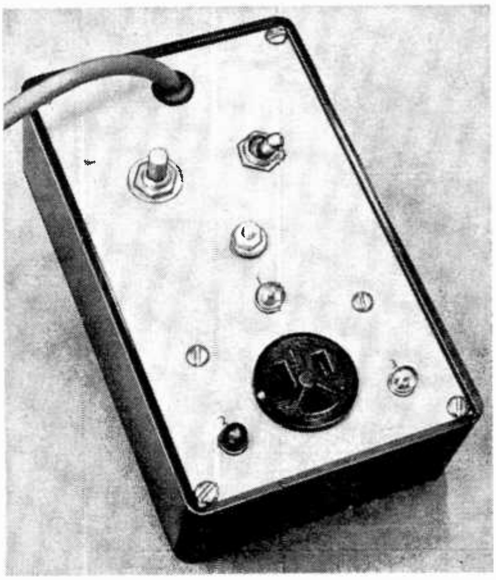
as shown in Fig. 1, taking care to observe the color code.

In the three-conductor power cable, the black wire is for the hot lead, white is for the neutral, or grounded, side of the power line, and green is for the actual ground. Socket *SO1* is also color coded: the copper-colored terminal is for the hot side and should be connected to the black lead; silver terminal to the white lead; and the narrow ground connector to the green lead. Make sure that the green lead is also connected to the metal panel of the plastic box.

Wire the three neon lamps (*I1*, *I2*, and *I3*) and their respective current-limiting resistors (*R1*, *R2*, and *R3*) so that the neon lamps are slipped into the plastic mounts through the metal cover with the leads and resistors on the terminal strips. Identify the lamps with the numbers 1, 2, and 3 on the front of the cover.

Choose the value of the circuit breaker to suit the largest load you will be using. A 7A breaker is adequate for most hand tools, but a larger capacity may be used for heavier applications. Do not, however, use a breaker rated over 15A since that is maximum for the #18 wire in the power cord.

Use. If you do not have a three-wire system in your home or on your bench,



The front panel displays a neat, uncluttered look. The circuit breaker is the push-to-reset type. Keep an eye on red lamp number 2.

CHECKING INSTRUCTIONS

Indicators Lit	Condition
1 and 3	Wiring correct. Only safe condition.
1 and 2	"Hot" and "neutral" wiring reversed. **DANGER**, must be corrected.
2 and 3	Ground is "hot." **DANGER**, must be corrected.
All	Should never happen. If it does, **DANGER**, must be corrected.
None	No power.

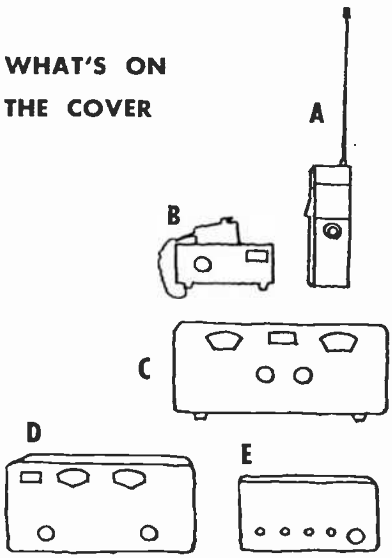
WARNING: Any time that light #2 (red) is lit, **DANGER TO LIFE AND LIMB** exists. Wiring should be checked immediately.

you can still use the ground tester by putting an adapter into the regular wall plug. The adapter has the conventional two prongs on the male side and three sockets on the female side with a short, usually green, ground lead coming from one side. Be sure that the adapter ground wire is adequately grounded. In many cases, particularly in large urban areas where the electrical code is strict and metal-armored cable is used, the outlet box itself is grounded. The adapter ground connection can then be made to one of the box mounting screws. If there is any doubt, or if your electrical system uses plastic-covered cable, run a separate wire from the adapter ground to an actual ground (cold-water pipe, outside ground, etc.).

If you have followed the wiring diagram carefully and identified the three neon lamps (being sure that lamp 2 is red), operation of the ground tester is actually very simple. Plug the tester into a three-conductor wall outlet (or grounded adapter) and observe the condition of the three neon lamps. Under normal conditions, only lamps 1 and 3 should be lit. If all three lamps light, either there is no ground or it is not proper and the outlet should NOT be used until the trouble has been remedied. If lamp 1 is out and the other two are lit, the polarity is reversed. Again DO NOT use the outlet until it has been fixed. This is also true if lamps 1 and 2 are lit and 3 is out. In any case, if the red lamp (number 2) is lit at any time, YOU COULD GET KILLED. Have an electrician investigate the wiring.

If your power tools or appliances do not have three-wire power leads, remove the old two-wire lead and replace it with a three-wire cable. Connect the two power leads to the proper places and connect the ground (green) lead to the metal portion of the device. This can be accomplished in a variety of ways. Usually, a sheetmetal fastener will do. -30-

WHAT'S ON THE COVER



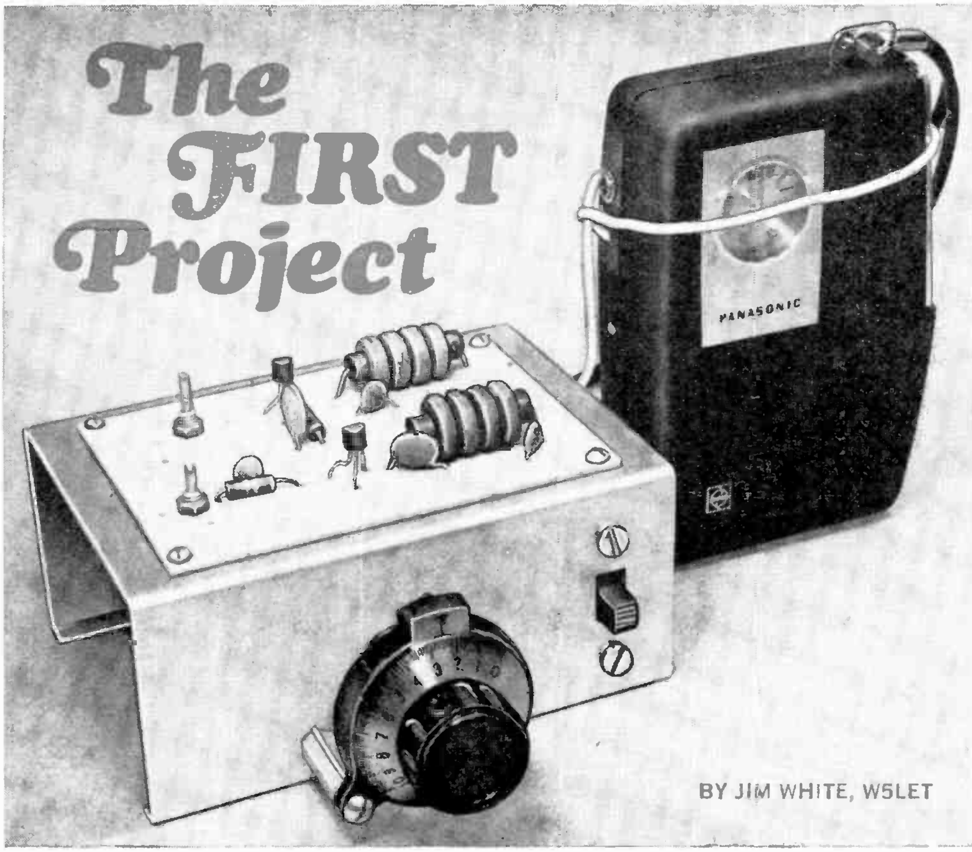
A Courier's "Clipper-23" has a full 5-watt input, dual-conversion superhet, and all 23 channel transmit/receive capability.

B The Tram "Coursair" is the mobile companion of the Tram "Titan II". It has an unusual mix of AM, DSB and SSB facilities.

C Several new features have been added to the Hallicrafters SX-122A. This receiver and the two below will be discussed soon.

D Hammarlund has modified the very popular HQ-100 and changed the styling. The unit features a flexible Q-multiplier circuit.

E First of a new line of receivers on the American marketplace is the British Eddystone Model EC-10. See writeup in September.



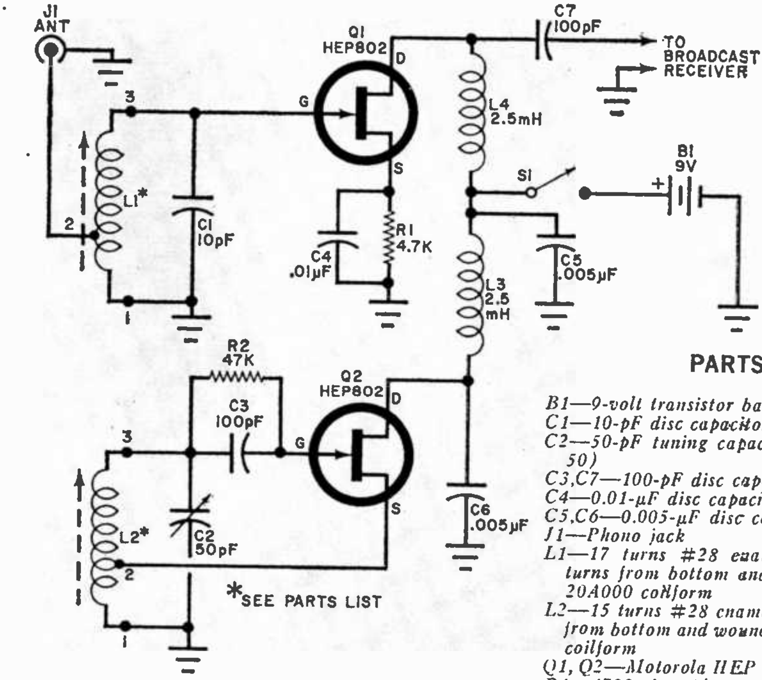
SHORTWAVE CONVERTER MAKES IDEAL BEGINNER'S CONSTRUCTION EFFORT

THE HOBBYIST beginner in electronics generally favors a first project that is practical, foolproof in design, and easy to operate. He also wants his first project investment to be small; after all, he is venturing into an area about which he knows very little and does not want to be stuck the first time out.

Few beginner projects qualify on all these points as well as this short-wave converter for AM broadcast receivers. The converter is practical since it more than doubles the versatility of virtually any AM receiver (it allows you to listen in on radio amateurs, Citizens Banders, and anything else on AM between 14 and 31 MHz). It is foolproof; only a handful of components are needed to provide a maximum efficiency. Only two controls—main tuning and power on/off—make it easy to operate. And it is inexpensive (about $7 for all new parts, circuit board, and chassis).

About The Circuit. The short-wave converter is designed to use to good advantage two field-effect transistors (FET's) that sell for less than a dollar apiece. Referring to Fig. 1, FET *Q1* is the mixer and FET *Q2* is the local oscillator for the converter.

The local oscillator in this case is designed to be tunable, departing from the usual crystal oscillators found in most commercially made converters. By making the oscillator tunable, you can set your receiver to a quiet spot on the dial so that the output of the converter does



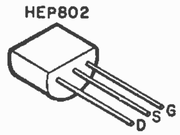


Fig. 1. Local oscillator (Q2) signal is induced into mixer circuit Q1 through mutual inductance existing between coils L1 and L2.

PARTS LIST

B1—9-volt transistor battery
C1—10-pF disc capacitor (see text)
C2—50-pF tuning capacitor (Hammarlund HF-50)
C3,C7—100-pF disc capacitor
C4—0.01-µF disc capacitor
C5,C6—0.005-µF disc capacitor
J1—Phono jack
L1—17 turns #28 enameled wire, tapped 3½ turns from bottom and wound on Miller Type 20A000 coilform
L2—15 turns #28 enameled wire, tapped 5 turns from bottom and wound on Miller Type 20A000 coilform
Q1, Q2—Motorola HEP 802 field effect transistor
R1—4700-ohm, ½-watt resistor
R2—47,000-ohm, ½-watt resistor
S1—S.p.s.t. side switch
Misc.—Battery connector; 4½"x3¼"x2" aluminum utility box; printed circuit board; vernier dial; shielded wire; hardware; hookup wire; solder; etc.

not have to compete with strong broadcast signals. Also, this uncommon design helps to keep component cost down.

Closing switch *S1* applies power from battery *B1* to the converter circuit. With an antenna connected to the circuit through jack *J1*, short-wave signals will be picked up by the converter. Simultaneously, the incoming frequency and the output frequency of the local oscillator will be mixed due to the mutual coupling between *L1* and *L2*. The incoming short-wave signal and the oscillator signal frequencies are mixed in *Q1*, producing, at the output, a difference frequency within the tuning limits of the AM broadcast band. This new signal frequency is coupled through capacitor *C7* to your receiver where it is handled as though it were any other broadcast-band signal.

Construction. For convenience, and to avoid unwanted interaction between components, it is recommended that you use printed-circuit wiring when assembling the converter. The drawing at the left in Fig. 2 provides all the details needed for etching and drilling your own circuit board.

Mount and solder in place on the circuit board all resistors, capacitors, and the two radio-frequency chokes (*L3* and *L4*) as shown in the drawing at the right in Fig. 2. Then wind coils *L1* and *L2* on their slug-tuned forms (see Parts List for instructions); carefully identify each coil according to its part designation. Mount and solder into place *L1* and *L2*, securing them with the nuts provided with the coil forms.

Next, bend the two outer leads (*emitter* and *drain*) of each transistor slightly toward the flat surface of the case but away from each other. Then bend the center or *source* lead slightly toward the rounded part of the case. Now, all you have to do is pass the leads through the holes in the circuit board (see drawing for location of case flat), and very carefully solder into place. (Don't use too much heat.)

Prepare the top section of the aluminum utility box as follows. Measure in ½″ from each side edge, ⅜″ in from the front edge, and ½″ in from the rear edge to find the limits of the cutout for the circuit board. Strike four pencil lines to guide you during machining. Then, with a nibbling tool, or a fine-tooth hacksaw, make the cutout. Use a file to deburr the exposed cut edges. Drill the mounting holes for the board and bolt the board down with #6 machine hardware.

Now mount *C2* and *S1* on the front and *B1* and *J1* on the rear of the utility box: for the battery, form a clamp from the material previously removed to make the circuit board cutout. Finally, interconnect the parts and board. Do not forget to connect *C1* between lugs 1 and 3 of *L1*.

One more thing; direct tuning of *C2* is touchy. It is suggested that you invest

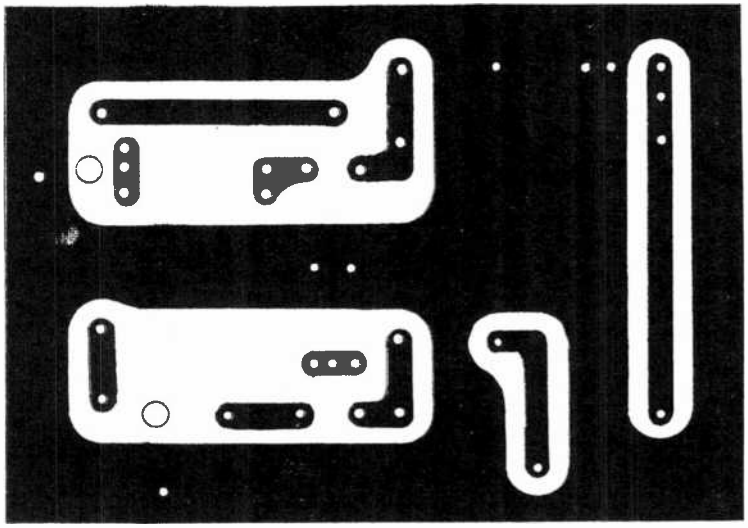
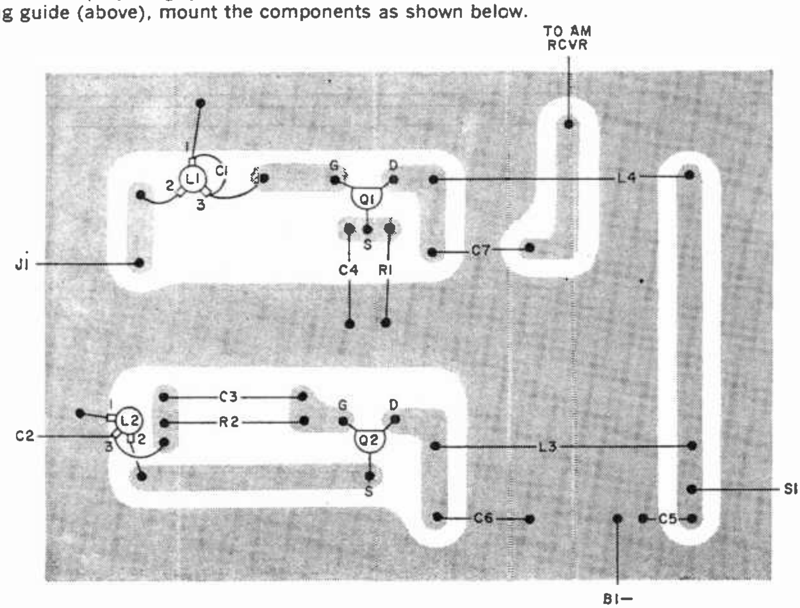
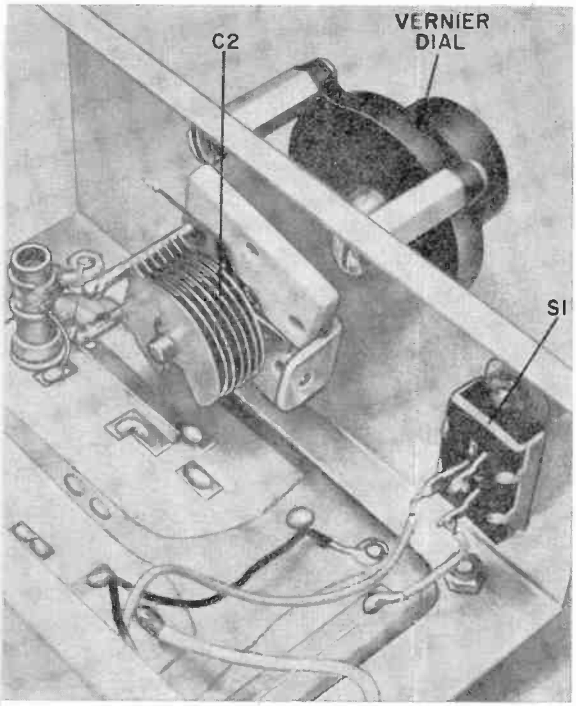


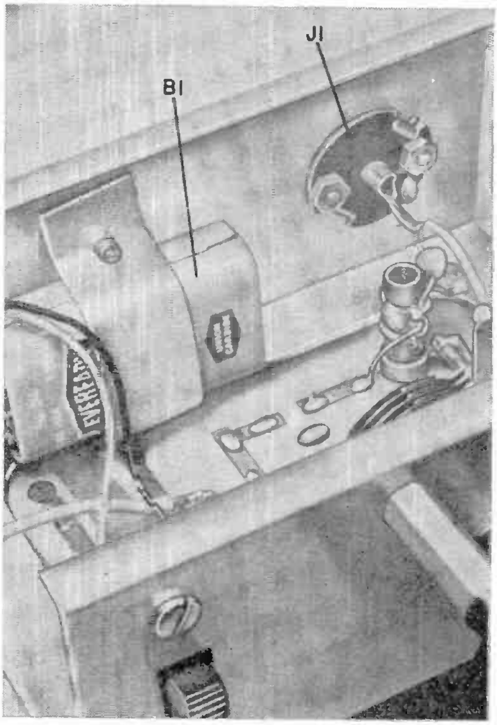
Fig. 2. After preparing printed circuit board according to etching guide (above), mount the components as shown below.

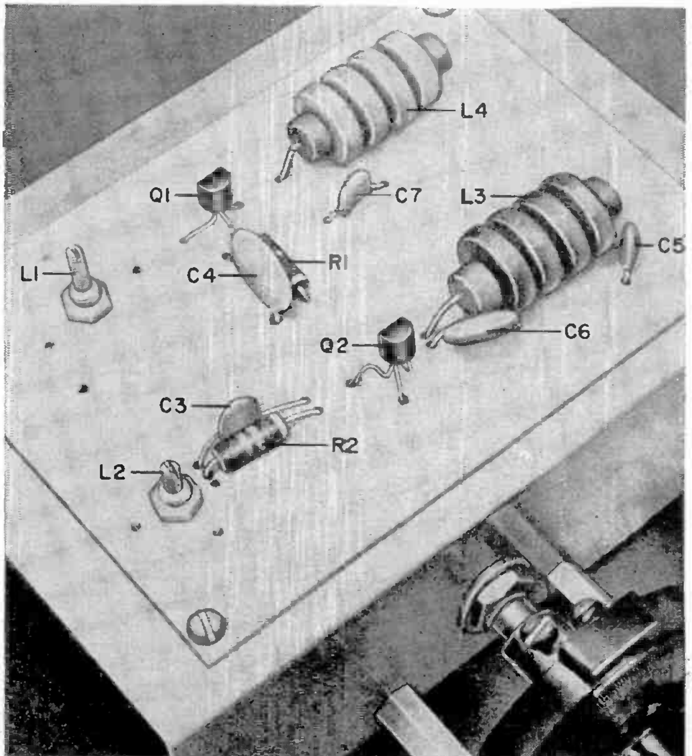




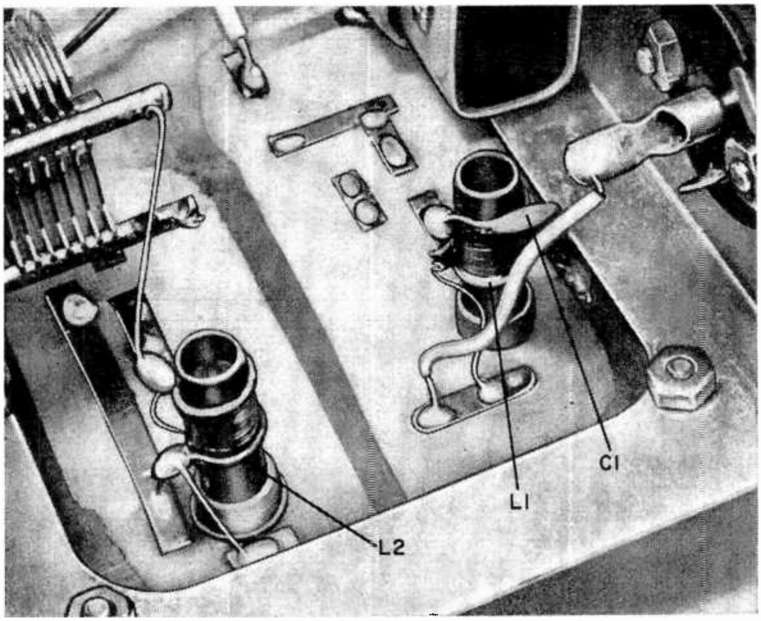
Before mounting vernier dial, rotate shaft of C2 until capacitor plates are fully meshed and knob on vernier dial is on zero position so that C2 and vernier dial rotate stop-to-stop in unison.

Battery clamp should be fashioned from material removed from cutout. Bolt battery and clamp in place as shown below.





All components in converter circuit (except B1, C2, S1, and J1) mount directly on circuit board. Note orientation of case flats and leads on both transistors.



Capacitor C1 should be soldered directly to appropriate lugs of L1. Make capacitor leads as short as possible. Also note that lead from lug 1 of L2 goes to upper terminal post of C2 when C2 is oriented as shown opposite.

an additional 89 cents for a vernier dial that will eliminate this problem. (The vernier dial shown in the photos is a Lafayette Radio Electronics No. 99 T 6031.)

Tuning and Using the Converter. The short-wave converter can be used with any AM receiver tuned to about 1600 kHz. However, the more sensitive and selective the receiver, the more you can expect from the converter. If you use a small portable receiver, a short length of wire from *C7* brought into proximity with the receiver's antenna will provide fair results. Reception, however, will be much better if you make a slight modification to the receiver; a modification that will in no way affect the performance of the receiver.

First, wind several turns of insulated solid hookup wire around the receiver's internal ferrite-core antenna. Then solder one end of this wire to the receiver chassis and make the other end available externally—perhaps through a pin jack. Now, run a small shielded wire from *C7* in the converter to the hookup wire coil just installed in the receiver, grounding the braid at both ends to the chassis.

Connect an antenna to the converter via *J1*. Switch on power to the converter and receiver, and set the receiver dial to about 1600 kHz. With tuning capacitor *C2* in the converter set fully counterclockwise, adjust the slug of *L2* until you hear ham stations at the high end of the 10-meter band. Now peak *L1* for maximum signal strength while listening to the receiver.

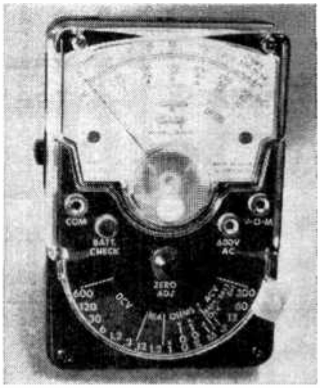
You should now be able to tune in the 27-MHz CB'ers, as well as the 13-, 16-, and 19-meter overseas broadcasters. Some increase in signal strength can be had by adjusting *L1* to the part of the tuning range in which you are most interested. *C1* can be increased to about 25 pF in value if 15 meters is your main interest.

The Beginner's Short-Wave Converter may not be the ultimate in sensitivity or selectivity but, connected to a good receiver, it does a surprisingly good job. The first tryout after construction had the converter pulling in stations from Havana, Mexico City, Paris, London, Moscow, Johannesburg, etc.—all in about a half hour! —30—

the product gallery

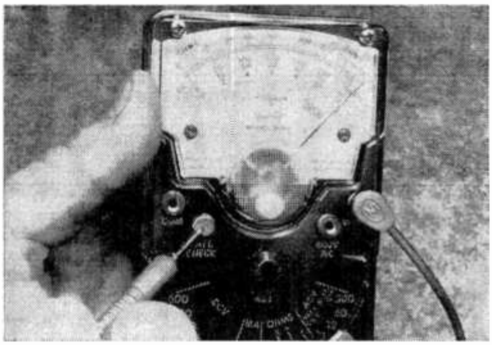
REVIEWS AND COMMENTARY ON ELECTRONIC GEAR AND COMPONENTS

POCKET-SIZE FET MULTIMETER
(Triplett Model 310-FET)



While most instrument manufacturers during the past two years have come out with at least one model transistorized multimeter, only one so far seems to think such instruments belong in the field as well as on the bench. Needless to say, *Triplett Electrical Instrument Company*'s Model 310-FET, weighing in at only 14 ounces and measuring only 4¼" x 2¾" x 1⅛", may very likely spell the death knell for conventional field-type multimeters.

At first glance, the 310-FET might very well fool you into believing that it is just another one of those $4.95 imported and very conventional multimeters. But don't let looks fool you. This pocket-size instrument features IGFET circuitry, constant 10-megohm input resistance on all d.c. ranges, sensitivity about ten times greater than most conventional bench-type VTVM's in the 0.3-volt range, and resistance measuring capabilities to 5,000 megohms.



A thumb switch on the side of the meter case reverses input polarity, a single switch on the front allows you to choose your test mode and range, and there is even a provision for attaching an a.c. clamp-on ammeter adapter (optional). Adding to ease of operation in the field is a BATT CH'K position on the mode/range switch that allows the user to check the condition of the built-in battery. Simply set the switch to BATT CH'K, touch the red test lead to a metal contact on the face of the meter (right), and read battery condition directly from the position of the meter pointer. If the battery is okay, the meter pointer will be within or upscale of the BATT OK block on the meter face.

It's difficult to believe that so much versatility can be built into a king-size-cigarette-package case—even after you put the Model 310-FET through its paces. But in the face of incontrovertible evidence, we have no choice but to believe. The 310-FET, selling for $70, is everything Triplett claims.

Circle No. 88 on Reader Service Page 15 or 115

TECHNICAL SPECIFICATIONS

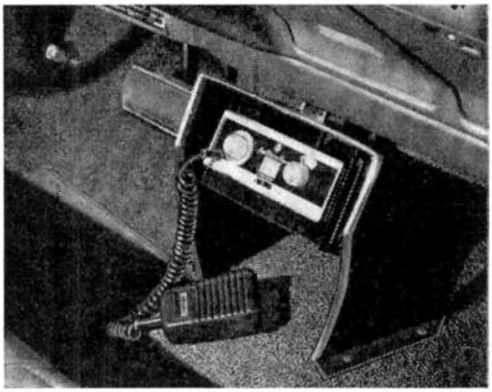
D.C. volts ranges—to 0.3, 1.2, 6, 30, 120, 600 volts at 3% accuracy full-scale
D.C. input resistance—10 megohms on all ranges
D.C. current ranges—to 120-μA and 1.2 mA full-scale (has zero center scale) at 3% accuracy full-scale
A.C. volts ranges—to 3, 12, 60, 300, 600 volts at 4% accuracy full-scale
A.C. input impedance—5000 ohms/volt
Resistance ranges—X1, X100, X10K, X1Meg (has 50 ohms center-scale)
Meter—50-μA suspension
Short circuit current—30 mA
Maximum power applied to device under test—11 mV
Circuit IR drop—300 mV
Load on 100 k circuit—1%
Overload protection—will withstand 600 volts on 0.3-volt d.c. range

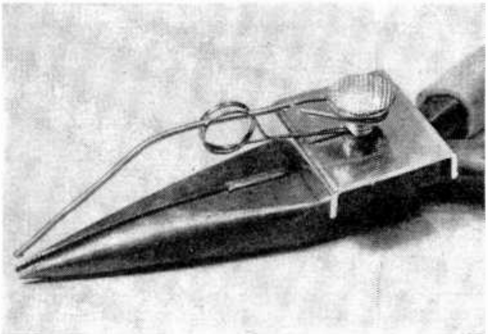
CAMEL MOUNT

(K & R Enterprises)

The 1969 passenger cars are a marvel of sleek design and superb performance, but the motor companies forgot to leave room for a CB transceiver. If you face the problem of finding that your car has no under-the-dash-panel room try a K & R "Camel Mount". Although designed for cartridge players, the mount is also ideal for a CB unit. The side panels are adjustable and the mount may be bolted to the floor over the transmission hump. Sturdy and moderately priced.

Circle No. 89 on Reader Service Page 15 or 115





SOLDER JOCKEY

Every electronics hobbyist and builder sometime or other wishes that he had a third hand. This little item is a magnet with an attached spring clip that you use to position and hold the solder in place right on your pliers. It sells for $1.00, postpaid (P.O. Box 1427, Long Island City, NY 11101) and is deceptively handy.

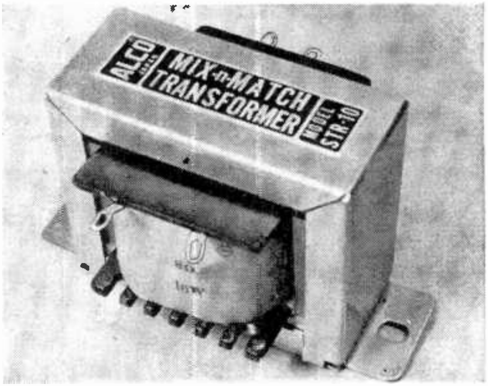
Circle No. 90 on Reader Service Page 15 or 115

MIX-n-MATCH TRANSFORMER

(Alco STR-10)

This innocuous looking transformer is one of the handiest components we've seen in several years. It is the Alco STR-10 and has 3 isolated windings with the same impedance—8 ohms. You can use the STR-10 to blend two stereo channels to a mono output, or use it to mix two different receiver outputs to feed the same loudspeaker. Or, tie two STR-10's in series to get multiple speaker outputs from the same source. A 5-watt version sells for $4.00 and the 10-watt (shown) is $6.00.

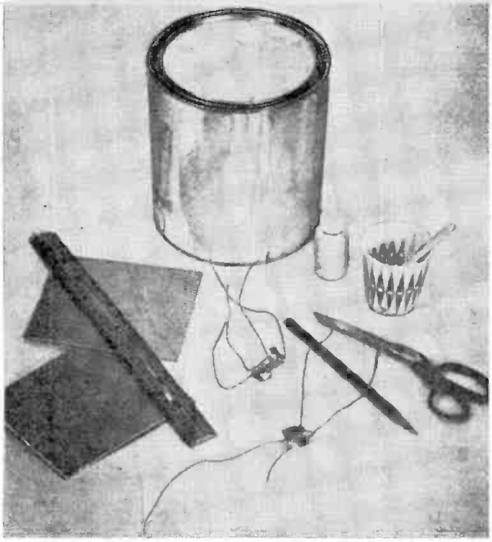
Circle No. 91 on Reader Service Page 15 or 115



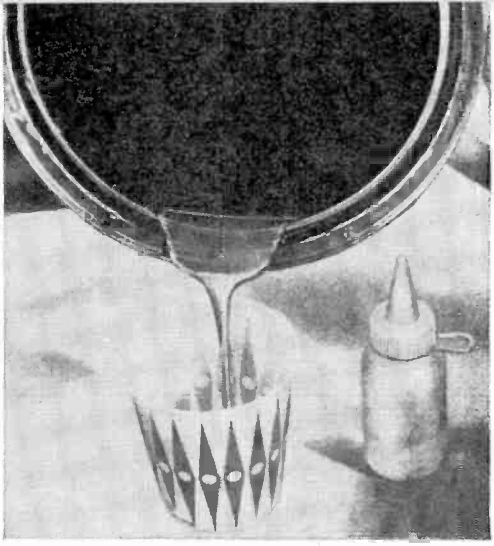
UP-DATING TUBE TESTER CHARTS

Those Popular Electronics readers with tube testers that are 3 to 10 years old frequently find it impossible to find out how to check 1968-69 tubes. Generally, the tube tester can handle the newer tubes, but there is no information on "setting up." The Editors have found that an up-dating subscription service does exist for testers manufactured by Allied (Knight), Conar (NRI), Eico, Heath, Jackson, Mercury, Precision, and Sylvania. You can get up-to-date tube "setting up" data and any necessary adapters. The prices for all items appear quite modest.

Write: Coletronics Service, Inc., 1744 Rockaway Ave., Hewlett, N. Y. 11557. Tell them Popular Electronics sent you.



Except for epoxy resin compound and hardener (in can and small bottle at top), all materials used in circuit potting are common household items.



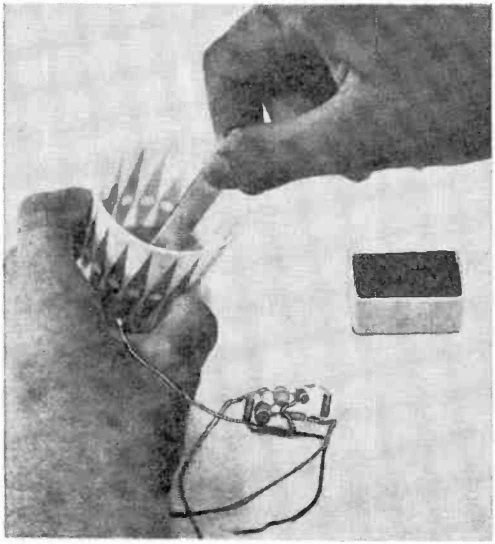
Using wood stirrer and paper cup, mix just enough resin compound and hardener to pot circuit adequately. (See mixing instructions on resin can.)

ENCAPSULATE YOUR CIRCUITS

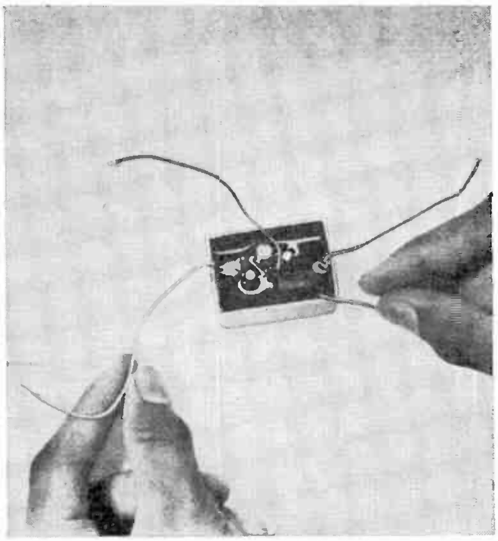
BY ALBERT H. COYA

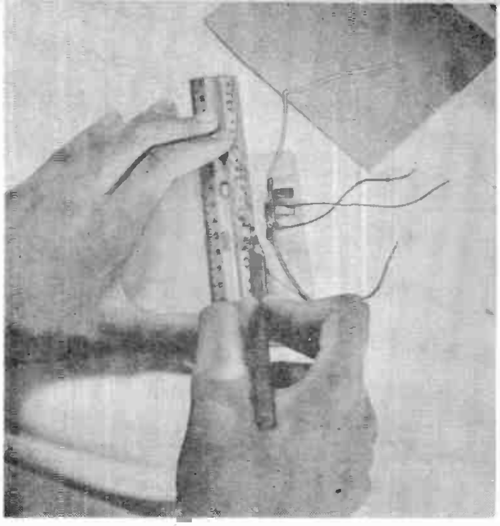
IF YOU'RE tired of making printed circuit boards for your simpler projects, why not borrow the casting technique some electronics manufacturers use for their experimenter modules? In addition to being inexpensive, the casting technique produces a finished circuit that is immune to moisture and foreign matter and is much more durable than either printed or chassis wired circuits.

After checking self-supporting circuit for shorts, being sure all components are in a single plane, stir the potting compound once more before pouring.



Set circuit into the form and pour in enough potting compound to cover half way. Orient leads as desired. Then pour in the rest of the compound.





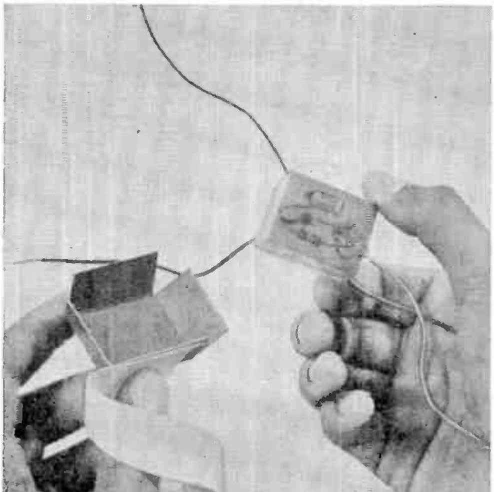
Next, prepare your potting form from lightweight cardboard (allow $\frac{1}{4}$" clearance on all sides of the circuit) and secure the edges with masking tape.

To prevent potting compound from adhering to form, liberally coat all interior surfaces of the form with Vaseline using a brush or a scrap stirrer.

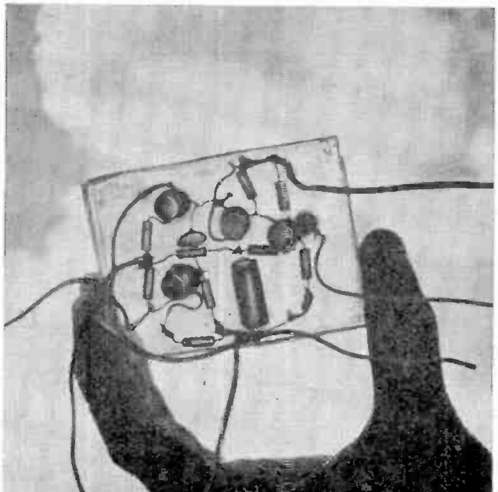
Commercially available modules are commonly cast in a black opaque epoxy resin. But for your purposes, the crystal-clear resin available from most marine supply stores is preferable. The clear resin allows you to read color codes and identifying numbers of components and to trace out the circuit if your module ever has to be replaced or reproduced.

Circuit construction inside the block of resin is simple. After assembling the circuit, making it self supporting and as compact as possible, check that the components are oriented so that their value coding and markings are unobstructed. Make sure that no unwanted short circuits exist and that all joints are properly soldered. Now you're ready to encapsulate the circuit following the instructions in the photos and captions.

After allowing enough time for compound to set, remove the circuit from the form; discard form. Clean away Vaseline, and circuit is ready to use.



Crystal-clear block permits you to trace circuit, interpret color codes, and—if components are properly oriented—even read identification numbers.



Reliability and MTBF

A FEW WORDS ON THE FREQUENCY OF REPAIRS

AFTER YOU build a project, do you have any idea of how long it will operate before it needs repair? Do you have any idea how long your kitchen radio will play before it starts giving trouble? Or your TV set? Have you ever wondered why transistor radios seem to work forever (unless you drop them or start fiddling with the insides) while tube sets seem to go on the blink regularly?

It all has to do, of course, with what we call reliability—and what reliability engineers call "mean time between failure" or MTBF. A numerical value, in hours, for MTBF can be calculated for any given piece of equipment by using a simple mathematical expression. Although the value thus determined is not infallible since there are too many variables (temperature, voltage variations, humidity, shock and vibration, etc.), experience has shown that a reasonable amount of faith can be placed on MTBF calculations.

A fundamental assumption used in MTBF calculations is that failure of one part causes failure of the entire system—otherwise why have that particular part at all? Thus, to determine the MTBF of an electronic system, we first need to know the failure rate of each of the parts that make up the system.

Failure rates for the most important electronic components in use today are shown in the table. These values were arrived at through extensive testing by various component and system manufacturers.

The use of the table in calculating MTBF can best be shown through an example. Assume we have a transistor radio containing 10 transistors, 11 resistors, 1 potentiometer, 6 inductors (including chokes and transformers), 12 paper capacitors, 6 ceramic capacitors, and 5 electrolytic capacitors.

First find the failure rate for each type of component from the table. Multiply the failure rate by the number of components of that type and add all of the resulting figures. Thus:

Transistors: 10×0.04	$= 0.400$
Resistors: 11×0.001	$= 0.011$
Potentiometers: 1×0.2	$= 0.200$
Inductors: 6×0.2	$= 1.200$
Paper capacitors: 12×0.01	$= 0.120$
Cer. capacitors: 6×0.001	$= 0.006$
Elec. capacitors: 5×0.03	$= 0.150$
	2.087

So the total failure rate is 2.087% per 1000 hours. To find the MTBF, divide the total failure rate into 100,000.

$$\text{MTBF} = 100{,}000/2.087$$
$$= 48{,}000 \text{ hours (approx.)}$$

Once this is known, establish how many hours a day the device will be used, and

TYPICAL COMPONENT FAILURE RATES

COMPONENT	FAILURE RATE (% per 1000 hours)
Resistor, composition	0.001
Resistor, film	0.002
Capacitor, paper	0.01
Capacitor, molded mica	0.003
Capacitor, ceramic	0.001
Capacitor, electrolytic	0.03
Choke	0.2
Transformer	0.2
Potentiometer, composition	0.2
Transistor	0.04
Semiconductor diode	0.02
Vacuum tube	5.0

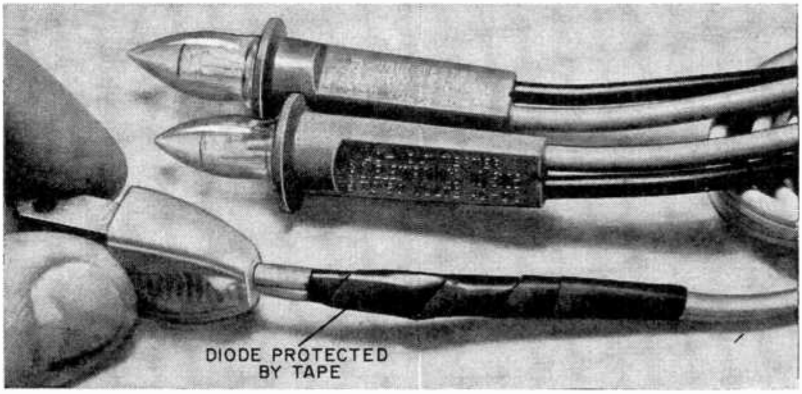
you can then calculate how many days, weeks, months, or years, the system will probably operate.

If we were to determine the MTBF for the same radio with five vacuum tubes instead of the 10 transistors, we would come out with about 3700 hours. Now you know why transistor radios last longer.

How can you improve the reliability of a piece of electronic equipment? You can start by derating the components you use. If physical size is not too big a problem, use resistors with a higher wattage rating or capacitors with higher voltage ratings. The use of premium tubes, high-quality components, heat sinks for tubes and transistors, and cooling fans can also improve reliability. A good rule of thumb is to derate all components by 50% and use them in a cool environment. -30-

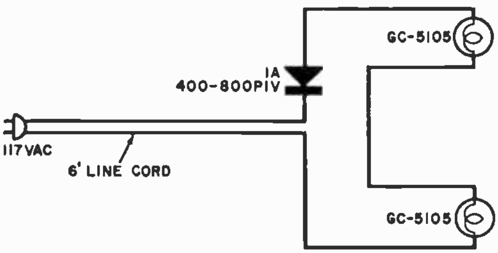
Mini Trouble Light

BY NEIL JOHNSON



ONE OF THE most powerful *un*natural laws of electronics states that, when trouble occurs, it will most likely be in the darkest, most remote corner of a large, heavy chassis. It may be possible to get test leads, soldering iron, or other tools into the trouble, but you probably won't be able to see what you are doing.

Of course you can use a standard trouble light but if you hang it too close, you stand the chance of burning your fingers on the hot bulb or frame. If it's too far away, the shadows created may only worsen the problem. Then there is always the "game" of how to support the unwieldy thing.



The diode can be any rectifier type; polarity is not important. With diode cutting the voltage in half, small lamps put out more than enough light.

If you have encountered this situation, build the Mini-Trouble lamp shown in the schematic and photograph. It consists of a pair of GC-5105 (GC Electronics) low-voltage miniature test lamps connected in series with a conventional silicon rectifier diode (1 ampere at 400-800 PIV) to the 117-volt power line. This circuit is used because each lamp is rated at 5 to 50 volts which adds up to 100 volts for the pair. The diode conducts on every other cycle of the supply, thus dropping the available voltage down to about 60 volts. This is sufficient to produce a good light output from the pair of lamps. Because of their small size, one lamp can be inserted close to the work, while the other is left hanging or placed so as to observe a meter scale.

To construct the trouble light, open one lead of a length of line cord (with a 117-volt plug at the end), and connect the diode, in either direction of polarity, in series with the line. After soldering, wrap the joint in plastic electrical tape. Solder the two lamps and line cord as shown in the schematic, and insulate the joints with tape. -30-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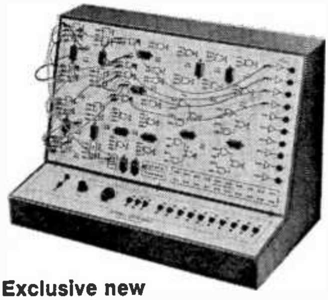

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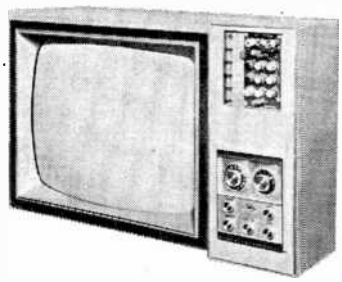

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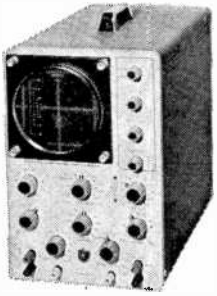

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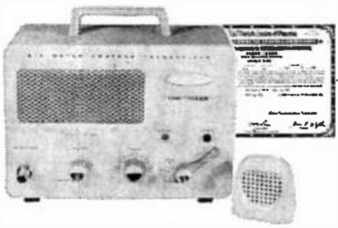

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ENGLISH LANGUAGE NEWS BROADCASTS FOR THE MONTH OF AUGUST

Prepared by ROGER LEGGE

TO EASTERN AND CENTRAL NORTH AMERICA

TIME-EDT	STATION AND LOCATION	FREQUENCIES (MHz)
7:00 a.m.	Stockholm, Sweden	15.315
7:15 a.m.	Melbourne, Australia	9.58, 11.71
7:45 a.m.	Copenhagen, Denmark	15.165
8:15 a.m.	Montreal, Canada	9.625, 11.72, 15.325
6:30 p.m.	Vilnius, USSR (Sun., Fri.)	11.79, 12.03, 15.15
7:00 p.m.	Helsinki, Finland	15.185
	Montreal, Canada	9.625, 15.19, 17.72
	Moscow, U.S.S.R.	11.87, 11.96, 15.265
7:30 p.m.	Johannesburg, South Africa	5.98, 6.075, 9.705
8:00 p.m.	London, England	6.11, 9.58, 11.78, 15.14
	Peking, China	17.673, 17.855
	Sofia, Bulgaria	9.70
8:30 p.m.	Kiev, USSR (Mon., Thu., Sat.)	11.735, 15.265
	Stockholm, Sweden	11.95
8:50 p.m.	Brussels, Belgium	6.125
	Vatican City	9.615, 11.785, 15.285, 17.81
9:00 p.m.	Berlin, Germany	9.73, 11.89
	Budapest, Hungary	9.833, 11.91, 15.16
	Havana, Cuba	9.525, 15.285
	Madrid, Spain	6.13, 9.76, 11.815
	Prague, Czechoslovakia	7.345, 9.54, 11.99, 15.37
	Rome, Italy	11.81, 15.41
9:30 p.m.	Berne, Switzerland	9.535, 11.715, 15.305
	Cologne, Germany	6.12, 9.735, 11.925
	Tirana, Albania	6.20, 7.30, 9.50
10:00 p.m.	Hilversum, Holland (via Bonaire)	11.73
	Lisbon, Portugal	6.025, 11.935, 15.125
	London, England	6.11, 9.58, 11.78, 15.14
	Moscow, USSR	11.735, 11.87, 15.15
	Peking, China	15.06, 17.673
10:30 p.m.	Beirut, Lebanon	15.285

TO WESTERN NORTH AMERICA

TIME-PDT	STATION AND LOCATION	FREQUENCIES (MHz)
7:00 a.m.	Tokyo, Japan	9.505
9:00 a.m.	Stockholm, Sweden	15.315
6:30 p.m.	Tokyo, Japan	15.195, 17.825, 21.64
7:00 p.m.	Melbourne, Australia	15.32, 17.84, 21.74
7:30 p.m.	Bonaire, Neth. Antilles	15.345
	Johannesburg, South Africa	5.98, 6.075, 9.705
8:00 p.m.	London, England	9.58, 11.78, 15.26
	Madrid, Spain	6.13, 9.76, 11.815
	Moscow, U.S.S.R.	11.735, 11.90, 15.15
	Peking, China	15.095, 17.673, 17.795
	Prague, Czechoslovakia	7.345, 9.54, 11.99, 15.37
	Seoul, Korea	15.43
	Taipei, Taiwan	15.125, 15.345, 17.89
8:30 p.m.	Berlin, Germany	9.73, 11.825, 15.445
	Stockholm, Sweden	11.705
	Tirana, Albania	6.20, 7.30
9:00 p.m.	Budapest, Hungary	9.833, 11.91, 15.16
	Havana, Cuba	9.525, 11.76
	Lisbon, Portugal	6.025, 11.935, 15.125
	Moscow, USSR (via Khabarovsk)	15.14, 17.79, 17.88
	Peking, China	15.095, 17.673, 17.795
	Sofia, Bulgaria	9.70
9:30 p.m.	Bucharest, Rumania	11.94, 15.25
	Kiev, USSR (Mon., Thu., Sat.)	11.735, 11.96, 12.01
9:45 p.m.	Berne, Switzerland	9.72, 11.715
	Cologne, Germany	6.145, 9.545, 11.945
10:00 p.m.	Havana, Cuba	9.525
	Hilversum, Holland (via Bonaire)	9.715, 11.73
	Quito, Ecuador	15.255
	Tokyo, Japan	17.785
11:00 p.m.	Moscow, USSR (via Khabarovsk)	15.14, 17.79, 17.865
11:30 p.m.	Havana, Cuba	11.93

AMATEUR RADIO

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

MYSTERY, INSPIRATION, AND ADVENTURE

As JIM, K5VRL, tells it in the Oklahoma City VHF Club *News*, the mysterious signal was spotted just under 50 MHz. Then it moved into the 6-meter amateur band and gurgled back and forth as if someone were trying to adjust an unstable VFO. Once, Jim pinpointed the signal as coming from a nursing home, but it flitted away and began appearing unpredictably in different parts of Oklahoma City. At last, Doc, WA5CZN, put a finger on the source of the mystery signal—a 1965 Pontiac GTO automobile! Receiving permission from the owner (a woman) to examine the car, K5VRL and Tom, K5VRN, traced the signal to the dome-light circuit and killed it by pulling the dome-light fuse.

When Jim returned later for another examination of the car, the woman told him that she had informed her ex-husband of the investigation. He confessed that he had hired a private detective to "bug" the car so that he could keep track of her comings and goings. The woman and a friend removed the "bug"—a little black box—from the car. Jim describes it as looking like a simple converter. The woman presumably still has the device, but the phantom signal of Oklahoma City is heard no more.

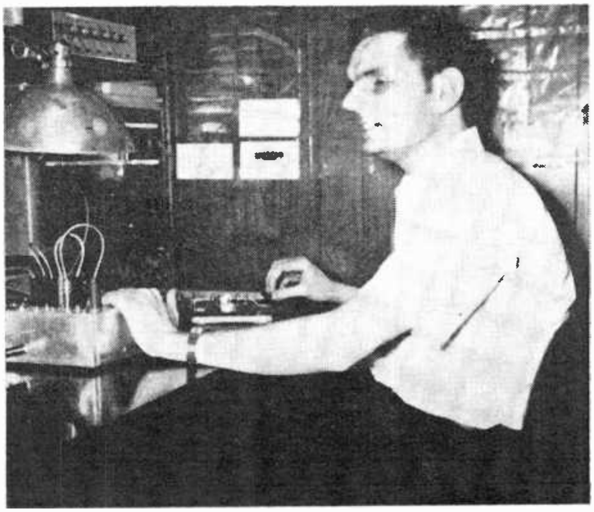
Sleep-Learning the Code. Does It Work? After several years of happiness on VHF with a technician license, Vic, WA9DJY, decided to obtain a General license. But Vic soon discovered that increasing his code speed to pass the 13-WPM code test was more of a challenge than he had expected.

While reading the advertising brochure on "sleep-learning," Vic saw code listed as suitable for the sleep-learning technique; so he decided to give the method a trial. He needed a tape recorder, an automatic timer, a pillow speaker, and an endless tape of the code lesson.

Each night for 6 weeks Vic went to bed with the tape recorder on the table beside him. After a few nights, the recorder's turning on and off and the code issuing softly from the pillow speaker did not disturb his sleep, but his code-copying ability did not improve either. On the other hand, it did disturb his wife and she had no interest in learning the code.

Finally convinced that there were no short

AMATEUR STATION OF THE MONTH



Richard Joy, WN6UYB, 1025 Danbeck Ave., Santa Rosa, Calif. 95404, has never seen an amateur station or heard a radio signal; yet he has worked approximately 20 states using a Johnson Adventurer transmitter, Collins 75A1 receiver, and Hy-Gain 14AVQ antenna. Blind and deaf since the age of two, Rick copies code at 15 WPM by placing his fingers on the voice-coil spider of a loudspeaker to feel vibrations. To adjust his equipment, he uses an auditory comparator to transform changes in current to frequency variations. He teaches use of such special equipment at the New York Institute for the Blind. WN6UYB gets a year's subscription for winning this month's Amateur Station Photo Contest. To enter, send a clear photo (preferably black and white) of you at the controls of your stations with some information about your amateur career to Photo Contest, c/o Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, Post Office Box 673, Gary, Indiana 46401.

cuts to learning the code, Vic resolved to copy the code-practice transmissions from W1AW, the American Radio Relay League headquarters station in Newington, Conn., every night possible until he could copy at least 15 WPM "solid." One month later, Vic passed the General class examination.

WA9DJY's experiences parallel those of most code students. Once you have learned to identify the code characters—a matter of a few hours—the only way to acquire copying speed above a few words per minute is by actually copying the code while fully awake. W1AW sends code practice twice a day every day of the year (except for a few National holidays). Of course, if you have a Novice license, you get some code practice automatically while working other stations. But even under these circumstances, copying W1AW a few minutes each day will accelerate your code progress.

Charles Miller, W5WLX, Baltimore, Md., took his Advanced tests in January after 15 years as a General. His Drake T4/R4 combination, homemade antenna coupler and 66" center-fed antenna work for 3.5 to 29.7 MHz with 40 states and 10 countries.

W1AW Code Practice Schedule. W1AW transmits code practice twice each day on frequencies 20 kHz up from the low-frequency edges of the amateur CW bands (3520, 7020, 14020, 21020, 28020, and 50020 kHz) and on 1805 and 145,600 kHz. At 7:30 p.m., Eastern Time, the transmitted speeds are 10, 13, and 15 WPM. Two hours later (9:30 p.m. Eastern Time), the speeds are 5, 7½, 10, 13, 20, and 25 WPM on Sunday, Tuesday, Thursday, and Saturday. They are 35, 30, 25, 20, and 15 WPM (in that order) on Monday, Wednesday, and Friday. W1AW code-practice transmissions are identified by "QST QST QST DE W1AW . . ." sent in code at a speed of 5 WPM at the start of each practice session.

From the Mailbag. *A5 Magazine,* a bimonthly Amateur TV bulletin published by Don Levine, WB2UMF, reports (from Tom, WB6YZE) that members of the Southern California Amateur TV Club televised the 1969 Tournament of Roses parade from the Los Angeles Sheriff's Department helicopter. Tom, W6ORG, operated the TV camera and 5-watt, 435-MHz transmitter and 144-MHz FM transmitter in the helicopter.

On the ground, Dave, W6QDP; Gene, WA6KPB; Rudy, WA6EPX; Tom, WB6YZE; Paul, K6INQ; and Morris, K6JET, manned the command posts between the parade starting point and the Rose Bowl. They received the TV pictures from the helicopter, and all stations were in communications with each other on 144 MHz.

The Los Angeles County Sheriff's Dept. is now reported to have a TV transmitter installed in its traffic-control helicopter.

In *Spurious Radiations,* Rockaway (N.Y.) Amateur Radio Club's publication, Louis R. Mateo, WB2MVK, reports that club member Francisco "Pancho" Millet, WN2-FLE, was a sea-going radio operator before leaving Cuba. The day after making his first contact as a Novice, Pancho sailed as the radio operator on a Liberian tanker. The tanker ran aground on a rocky bank off northern Colombia. Pancho sent an SOS, and most of the crew was removed safely. But the captain, Pancho, and a few crewmen remained aboard to wait for the arrival of a rescue tug. The next day, however, a fire broke out in the engine room. You're right! Pancho sent another SOS. This one was answered by the Colombian Coast Guard. It took Pancho and his companions to Santa Marta, Colombia.

There the members of the Magdalena

(*Continued on page* 102)

Bill Cohn, President, and Dic, WN9ZXM, and Bob, WN9ZBP, members of the Radio and Electronics Club, Niles North High School, Skokie, Ill., have Johnson Ranger and 6N2 transmitters, Hammarlund HQ-170 receiver, and a Mosley triband beam to work.

SOLID STATE

By LOU GARNER, Semiconductor Editor

MICROWAVE design engineers and technicians often refer to themselves jokingly as "plumbers." In one sense, the nickname is quite appropriate because the hollow metal waveguides used for UHF and SHF resemble piping, while an experimental microwave set-up may look more like a plumber's nightmare than an electrical circuit.

By analogy, solid-state device designers and technicians might some day refer to themselves as "jewelers," not only because the actual devices are jewel-like and require precision workmanship, but because precious and semi-precious stones are being used. Gold, silver, and other costly metals are employed extensively in the various manufacturing processes. Ruby rods are used as lasers while spinel, sapphire, and diamonds have been used in a variety of semiconductor devices.

A research and development team at the Autonetics Division of the North American Rockwell Corporation not only pioneered work on silicon-on-sapphire but has been studying the operation of microwave devices using gallium-arsenide semiconductors on spinel, sapphire, and beryl substrates. Theoretically, such devices could offer a number of advantages, including better temperature stability, higher power handling capabilities in the GHz ranges, and improved yield ratios.

The general construction of a GaAs diode on a sapphire substrate is illustrated in Fig. 1. A chemical vapor-deposition process is used to form the basic device, while metallic contacts are sintered in place. A metal ground plane on one side of the substrate permits the device to be used with microstrip transmission lines at GHz frequencies.

Meanwhile, experiments at the Bell Telephone Laboratories have shown that the operation of some semiconductor devices can be improved by mounting them on diamond substrates. At room temperatures, the thermal conductivity of diamond is higher than that of any material used in conventional heat sinks and nearly five times greater than that of copper. Since the internal temperature of a semiconductor device must be kept below a prescribed maximum, the higher thermal conductivity of diamond permits higher device power dissipation for a given heat-sink temperature.

In one experiment, about 3 watts of continuous-wave power at 14 GHz was obtained from a silicon avalanche diode mounted on a diamond, or approximately four times the maximum obtainable from a similar device on copper. In another experiment, a gallium-arsenide junction laser mounted on diamond, as shown in Fig. 2, was operated in the continuous-wave mode with a heat-sink temperature of only −68° C. Previously, the laser was mounted on copper and the heat-sink temperature had to be lowered to −132° C for proper operation.

Although most of the work thus far has been of a developmental nature, the day

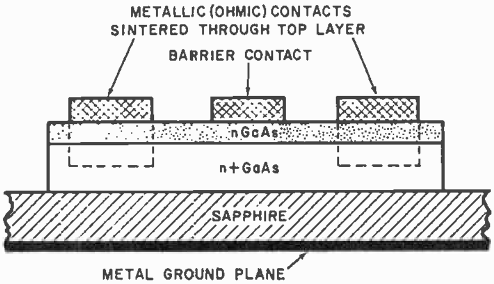


Fig. 1. GaAs diode on sapphire is made by vapor deposition with sintered metallic contacts added.

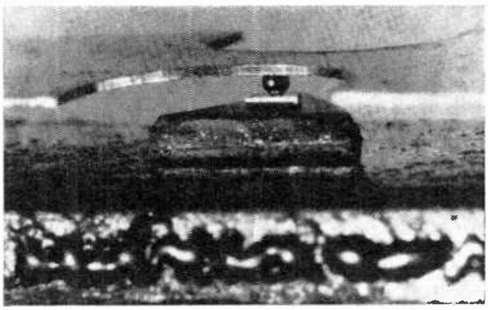


Fig. 2. Diamond-mounted laser operates continuous-wave with heat-sink temperature of only −68° C.

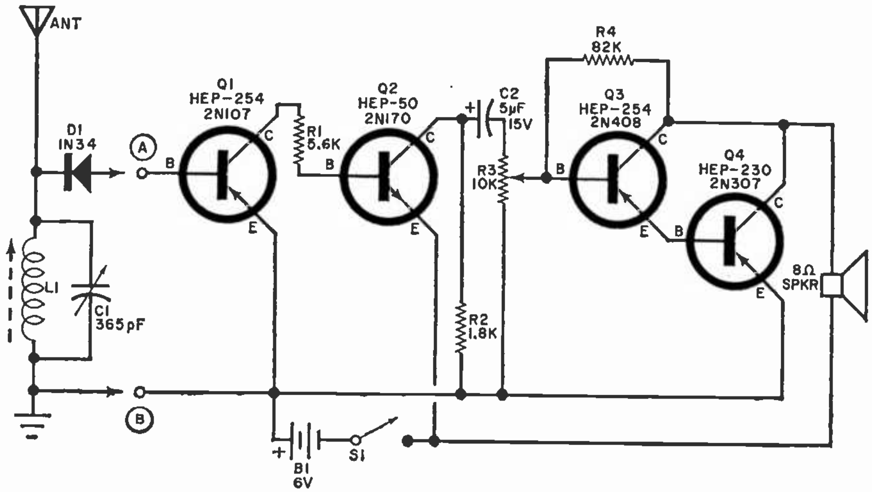


Fig. 3. Two popular circuit configurations, a direct-coupled complementary amplifier and a high-gain Darlington power stage, are combined in this easy-to-build receiver project.

may come when precious stones are used extensively in production devices, even if they command a premium price.

Reader's Circuit. Featuring two popular circuit configurations in a single design, the simple four-transistor receiver schematic given in Fig. 3 was submitted by reader Douglas Hoff (140 Lorane Ct., Vacaville, California 95688). It is an excellent one-evening project for the beginner and can also be used for circuit demonstration educational experiments.

In the circuit diagram, *Q1* and *Q2* form a direct-coupled complementary amplifier while *Q3* and *Q4* are connected as a high-gain Darlington power stage. Capacitive coupling is used between the complementary and Darlington amplifier circuits.

In operation, an r.f. signal is selected by a tuned circuit *L1-C1* and detected by diode *D1*. The resulting audio signal is applied to *Q1-Q2*, with an amplified signal developed across *Q2*'s collector load resistor *R2*. Resistor *R1* serves to limit *Q2*'s base current. The amplified signal is coupled through *C2* to volume control *R3* and applied to the Darlington power amplifier which drives the PM loudspeaker. Distortion-reducing inverse feedback, as well as *Q3*'s base bias, are applied through *R4*.

Any construction technique may be used for circuit assembly, for neither parts placement nor wiring dress is critical. Typically, the project may be assembled breadboard fashion, on perf board, on an etched-circuit board, or on a small chassis, as desired.

Although originally designed for use as a simple receiver, Doug suggests that the basic circuit can be used as a low-power phono amplifier simply by replacing the tuned circuit-detector section (*L1-C1-D1*) with a high-output ceramic or crystal cartridge, extra volume control (*R5*), and d.c. blocking capacitor (*C3*), as shown in Fig. 4. Here, *R3* is set for maximum resistance and *R5* is used as a gain control.

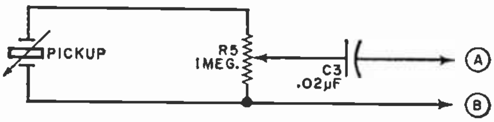


Fig. 4. The circuit in Fig. 3 can also be used as a low-power phono amplifier with these additions.

Manufacturer's Circuit. Unlike our featured Reader's Circuit, the design illustrated in Fig. 5 is *definitely not for beginners*. Rather, it is a project which should offer a real challenge to the advanced hobbyist, professional technician, and even an engineer. One of several related schematics given in the specifications folder for RCA's type 2N5470 high-frequency transistor (File No. 350), it is a suggested circuit for a 2-GHz grounded-collector power oscillator. The basic oscillator may be used as part of a multi-stage system, or as a self-contained signal source for UHF tests and experimental studies.

The transistor is an interesting unit in itself. An epitaxial silicon *npn* planar device employing an "overlay" emitter-electrode construction, the transistor is intended for solid-state microwave radiosonde, communications, and S-band telemetry applications. It is housed in a special ceramic-metal coaxial package featuring low distributed capacities and parasitic inductances, and is suitable for use in coaxial, stripline, and lumped-constant circuits. With a 55-volt rating, the 2N5470 has a maximum power dissipation of 3.5 watts at 25° C and can handle peak collector currents of up to 0.4 ampere. When used in properly designed circuits, it can deliver 1-watt output at 2 GHz or a 2-watt output at 1 GHz.

In the diagram, *C2* and *C3* are feed-through capacitors (Allen-Bradley type FA5C), *L1* and *L2* are hand-wound r.f. chokes, with each consisting of 4 turns of No. 33 wire, having a 0.062-inch I.D. and a length of 3/16 inch, *L3* is a 3/64-inch length of No. 22 wire, while *X1* is a 0.82 pF "gimmick" (Quality Components type 10% QC).

At GHz frequencies even a short length of hook-up wire may act as an r.f. choke and wiring capacities as low as a few pF can act as effective r.f. shorts. Layout and lead dress, then, are *extremely critical* and professional UHF construction techniques must be followed to insure optimum performance.

In the Laboratories. Here's a capsule round-up of some solid-state research and development work reported during the past few months. While most of the items described are experimental units, they may be forerunners of practical "off-the-shelf" devices which will be manufactured within the foreseeable future.

● An ultrasonic generator powered by a Gunn oscillator has been reported by the Electrotechnical Laboratory in Tokyo. In the experiments, a small gallium-arsenide Gunn diode was bonded to a quartz delay rod. When a pulsating voltage, variable from 280 to 700 volts, was applied to the diode, coherent ultrasonic waves at 140 MHz were detected at the end of the quartz rod. The work tends to substantiate earlier predictions that ultrasonic radiation could be produced by Gunn devices, but additional tests will be necessary before the theoretical predictions are fully confirmed.

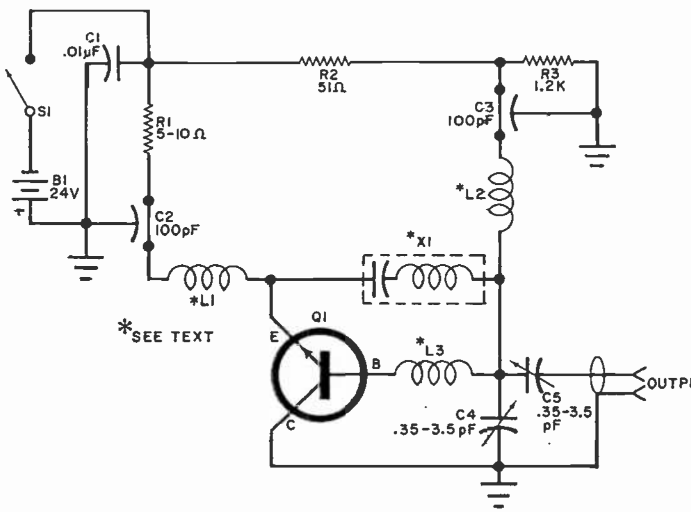
● A magnetically sensitive transistor has been developed by inventor Edward C. Hudson, Jr. The new unit is similar to a small-signal silicon planar device, but with two collector electrodes. In practice, it is operated as a differential amplifier with a magnetic field rather than base input signals serving as a control force. Without a magnetic field, the emitter current divides equally between the two collectors. As a magnetic field is brought near the device, the emitter current is deflected slightly, causing one collector current to increase, the other to decrease, thus developing a differential output signal across the collector loads.

● Prototype organic semiconductor devices have been developed at the Air Force Cambridge Research Laboratories. The experimental units are thin-film organic photovoltaic cells. Produced by sandwiching special organic materials between very thin aluminum and gold electrodes deposited on a glass matrix, the device can deliver open-circuit outputs up to one volt or currents up to five microamperes.

● High-power r.f. transistors have been assembled using a new construction technology developed by RCA. Dubbed "laminated" transistors, the new devices are formed on a pair of silicon wafers, one of which serves as the emitter-base, the other as the base-collector. The separate wafers are fused into a single unit under heat and

(*Continued on page* 114)

Fig. 5. This 2-GHz grounded-collector power oscillator can be used as part of a multi-stage system or as a self-contained source of signals for UHF test work.



SHORT-WAVE LISTENING

By HANK BENNETT, W2PNA/WPE2FT
Short-Wave Editor

THE LONG-WAVE BROADCAST BAND

OF ALL the various frequency ranges for the general listener to tune, perhaps the one that is the most neglected and least known is the long-wave broadcast band. This is the frequency range of approximately 150 to 400 kHz.

This band is not used in North America by regular broadcasting stations but it is widely used in Europe. Many high-powered transmitters operate in this band and the stations can often be heard in North America. To hear the Europeans requires a combination of good receiving conditions and an efficient antenna (assuming your receiver has the necessary tuning band).

One active long-wave listener tells us that he has listened to long-wave in many sections of the country and, almost without exception, reception is difficult to impossible when in the vicinity of high-voltage a.c. power distribution lines. This would rule out reception on most a.c.-powered receivers, he claims, though we do not subscribe to that theory. Further, our monitor says that transistor or other battery-operated receivers must be removed at least 200 feet from all a.c. street lines and at least one-quarter mile from high-voltage (tension) lines. These facts alone, he claims, discourage listeners from ever attempting any serious long-wave DX'ing. Generally speaking, given reasonable receiving conditions—including an absence of summertime static—reception of European long-wave stations is quite possible since signals are often strong. Many of these broadcasters radiate hundreds of thousands of watts. However, if you happen to tune during periods of auroral activity on summer static forget it!

Reception of stations below 190 kHz are usually free of QRM; above 190 kHz there is often QRM from the beacon stations but the stronger broadcast signals can still be identified.

Our monitor says that a long-wire antenna is not necessarily the best; for maximum efficiency a vertical should be used. He suggests a wire run straight up to the top of a tree, perhaps 50 feet or higher. In any case, the higher the antenna, the better your chances for reception of the long-wave broadcasters. Even a 62-inch whip antenna will work, as our monitor will attest, for the following stations were logged with such an antenna coupled to a home-made transistor converter working into an auto receiver at 1500 kHz:

151 Hamburg, West Germany; in German at 2300.
155 Tromso, Norway; 2230-0000 with pop music; also around 0530.
164 Allouis, France; often strong 2200-0700 in French; cuts power to 250,000 watts at 2300.
173 Moscow, USSR, weak but in the clear from 2230-2300 on Saturday and Sunday; also 0430 in Russian news.
180 Saarbrucken, West Germany; in French from 2200; again around 0530 with music, news and commercials.
191 Motala, Sweden; around 0500; QRM from TUK, Nantucket beacon.
200 Droitwich, England; 2200-0000 and

(*Continued on page* 100)

Tom Schultz, Cherry Hill, N.J. is registered as WPE2QJJ and is on the air as WN2JII. Shown here are his Hallicrafters SX-99 receiver and others from Relistic and Silvertone, a Heathkit Q-Multiplier and a Jackson signal generator. Tom has 90 countries logged with 42 of them verified. Since picture was taken he has added a National NC-300.

NEW SUMMERTIME OPERATING SCHEDULES FOR INTERNATIONAL BROADCASTERS

ENGLAND

BBC—LONDON

World Service Transmissions Beamed To The Western Hemisphere

For North America:

15,140	2115-0215	9580	0000-0330
11,780	2245-0245	9510*	2200-0330
6110	2300-0415		

For West Indies, Central and South America (north of the Amazon, including Peru):

21,740	1030-1315	15,260*	2200-0415
21,550	2000-2315	15,070	2245-0330
17,790	1030-1315	11,750	2245-0330
17,740	2000-0030	9580	2300-0330
15,290	2000-2315	9510*	2200-0330
6110	0000-0415		

For South America (south of the Amazon, excluding Peru):

21,500	2000-2315	15,070	2245-0330
17,790	2115-2245	11,750	2245-0330
15,400*	1745-2115	9600	2200-0415
15,260*	2000-0415	9510*	2200-0330

Frequencies marked with an asterisk indicate transmissions via the BBC Atlantic Relay, Ascension Island.

SWEDEN

RADIO SWEDEN, STOCKHOLM

Radio Sweden has this listing of English language transmissions:

0030-0100	North America (East)	11,950
0200-0230	North America (East)	11,950
0330-0400	North America (West)	11,705
0515-0545	Asia	17,840
1100-1130	North America (East)	15,315
1100-1130	Europe	9625
1230-1300	Far East	15,105
1230-1300	Africa	21,690
1400-1430	Asia	21,585
1400-1430	North America (East)	15,315
1600-1630	Middle East	21,585
1600-1630	North America (West)	15,315
1900-1930	Africa	15,240
1900-1930	Middle East	11,860
2045-2115	Far East	11,705
2045-2115	Europe	6065
2245-2315	South America	11,705
2245-2315	Far East	15,155
2245-2315	Europe	1178 (medium-wave)

NORWAY

RADIO NORWAY, OSLO

Radio Norway presents "Norway This Week" in English on Sundays and Mondays as indicated in the following schedule:

Sundays:	0800-0830	21,730, 21,655, 15,345, 15,175
	1200-1230	25,730, 21,730, 21,655, 17,825
	1400-1430 1600-1630 1800-1830	25,730, 21,730, 21,670, 21,655, 17,825
	2000-2030	25,730, 21,730, 21,670, 21.655, 15,175
	2200-2230	25,730, 21,730 21,655, 17,825, 15,345
Mondays:	0000-0030	21,655, 17,825, 15,345, 15,175
	0200-0230 0400-0430	11,860, 11,850, 11,735

HOLLAND

RADIO NEDERLAND, HILVERSUM

Schedule of English Transmissions

Time	Area Served	Stations and Frequencies
0155-0320 (D)	North America (Eastern)	B 11,730
0455-0620 (D)	North America (Western)	B 11,730 B 9715
0625-0750 (D)	New Zealand	B 11,730
0755-0920 (D)	New Zealand, Australia	B 9715
0925-1050 (S)	Europe	L 9715 L 5980
0925-1050 (W)	W. Australia, S.E. Asia	L 21,480 L 17,810
1355-1520 (D)	S. Asia, Europe	L 21,480 L 17,810 LR 6020
1525-1545 (*)	North America	L 21,570 L 17,810
1725-1745 (*)	North America	B 17,810
1755-1815 (*)	North America	B 17,830
1755-1950 (D)	Africa	L 21,570 B 15,220 L 11,730
1955-2120 (D)	Europe	L 9715 L 6085 LR 6020
2125-2250 (W)	North America (Eastern)	L 15,425 L 11,730

(D) = Daily (W) = Weekdays (S) = Sundays (*) = Tuesday and Friday
(L) = 100 kW transmitter at Lopik with directional antenna
(LR) = 10 kW transmitter at Lopik with omnidirectional antenna
(B) = 300 kW transmitter at Bonaire with directional antenna
(BR) = 300 kW transmitter at Bonaire with omnidirectional antenna
Note: Sunday English transmissions consist of "Happy Station Program".

DX COUNTRY AWARDS PRESENTED

To be eligible for one of the DX Country Awards designed for WPE Monitor Certificate holders, you must have verified stations in 25, 50, 75, 100, or 150 different countries. ("Letters of Certification" will be issued to those who have over 150 countries verified in steps of 10.) The following DX'ers recently received their awards.

25 COUNTRIES VERIFIED

John Banta (WPE2PHU), Bay Shore, N. Y.
Mike Ligeza (VE3PE1EX), Markham, Ont.
Steven Schwartz (WPE2QLN), Brooklyn, N. Y.
Zachary Widup (WPE9IXS), Plainfield, Ill.
Wayne Rothermich (WPEØEQA), St. Charles, Mo.
Bill Jack (WPE3HLM), Flourtown, Pa.
Tim Price (WPE8EPV), Cincinnati, Ohio
Ronald Szymczak (WPE9IXA), Chicago, Ill.
Floyd Dunlap (WPE5EWU), Houston, Texas
Eugene Purdum, Jr. (WPE3GRB), Westminster, Md.
Tom Robbins (WPE9ITG), Dekalb, Ill.
Victor Weisskopf (WPE5EYJ), Tacoma, Wash.
Bradford Wall (WPE6GCJ), San Bernardino, Calif.
Arnold Rosett (WPE3HIF), Philadelphia, Pa.
Michael Lynch (WPE2QEA), Auburn, N. Y.
Alain Miville-de Chene (VE2PE1NC), Quebec, Que.
Lt. Lee Cook (WPE5EXJ), Biloxi, Miss.
Dan Seibel (WPE6HCU, San Leandro, Calif.
Harold Ort, Jr. (WPE2QHN), Gloversville, N. Y.
Henry Gac (WPE8JST), Detroit, Mich.
Jeff Utter (WPE6HDJ), Carlsbad, Calif.
Mitchell Stern (WPE2QIA), Brooklyn, N. Y.
James Blumenfeld (WPE2QGD), Monticello, N. Y.
Scott Brockway (WPE2QJP), Rome, N. Y.
Laurie Coghlin (VE4PE7N), Winnipeg, Man.
William Grove, Jr. (WPE3HDH), Airville, Pa.
Terry Smedley (WPE7CSN), Seattle, Wash.
Peter Fort (WPEØFFP), Kansas City, Mo.
Thomas Henry (WPE2PSZ), Staten Island, N. Y.
Robert Gormley (WPE2PPU), Yonkers, N. Y.
Dean Frey (VE6PE7N), Fort Saskatchewan, Alta.
Al Rasmussen (WPE2PYN), West New York, N. J.
Peter Vegter (VE5PE6G), Regina, Sask.
Gary Vosper (WPE2QCO), San Angelo, Texas
Frank O'Donnell (WPE6HFD), La Habra, Calif.
James Perley (WPE6GXL), Reseda, Calif.
Mark Winslow (WPEØFGF), Ballwin, Mo.
Terry Moorby (VE3PE2OI), Sharbot Lake, Ont.
Martin Shulman (WPE2QHF), Spring Valley, N. Y.
Michael Spengler (WPE2QFB), Englewood, N. J.
Louis Schulman (WPE8JTX), Cleveland Heights, Ohio
Edward Smith, Jr. (WPE4JSG), Savannah, Ga.
John Mac Donald (WPE2QOV), East Orange, N. J.
Craig Koukol (WPE9JLN), Naperville, Ill.
Steven Kuropatwa (WPE2PNL), Bronx, N. Y.
John Kiernan (WPE2EMN), New York, N. Y.
Bob Raymond (WPE1HOE), Bradford, Mass.
Eric Hansen (WPE6HBT), Selma, Calif.
Lee Schmicker (WPE2QFA), Wanaque, N. J.
Jerry Monroe (WPE2QIR), Alden, N. Y.
Larry Kramer (WPEØPQ), Brighton, Colo.
John Wallace (WPE3APX), Pittsburgh, Pa.
Richard Lewinski (WPE8KAS), Wyandotte, Mich.
Barry Glaser (WPE2PUM), Brooklyn, N. Y.

50 COUNTRIES VERIFIED

Donald Gross (WPE7CQX), Roseburg, Ore.
Roy Carroll (WPE2QAA), Neptune, N. J.
David Hailey (WPE4ENX), Nashville, Tenn.
Paul Farmanian (WPE6GVG), Glendale, Calif.
Donald Weber (WPE8IPJ), Westlake, Ohio
Steve Kamp (WPE5EUT), Irving, Texas
Larry Beat (WPE8JJX), Toledo, Ohio
Ethel Fogleson (WPE8JEA), Cleveland, Ohio
Jerry Heien (WPE9BOD), Berkeley, Ill.
Elaine Walton (WPE8JLR), Bedford, Ohio
Thomas Creery (WPE2PHZ), Conklin, N. Y.
Steve Harper (WPEØFBI), St. Louis, Mo.
Bill Kaiser (WPE8JLL), Paw Paw, Mich.
Edward Bassett (WPE9EHF), Toledo, Ill.
Terry Boles (WPE4JJF), Atlanta, Ga.
Clifford Duncan (VE5PE5V), Cut Knife, Sask.
Thomas Martin (WPE2PBT), Westwood, N. J.
J. R. Hawkins (WPE8GDP), La Vergne, Tenn.
Michael Feinstein (WPE2QAV), Bridgeton, N. J.
Ann Parker (WPE9JJC), Chicago, Ill.
Charles Harris (WPE2OGK), Rochester, N. Y.
Jack Gladden (WPE5EXI), Fort Worth, Texas
William Caldwell (WPE6HER), Los Angeles, Calif.
Jack Kallmeyer (WPE8GYZ), Kettering, Ohio
Dick Vessell (WPE9EIL), Bloomington, Ill.
Tom Williams (WPE9JEL), Crown Point, Ind.

75 COUNTRIES VERIFIED

Bill Kaiser (WPE8JLL), Paw Paw, Mich.
Michael Feinstein (WPE2QAV), Bridgeton, N. J.
Richard Spear (WPE3HEI), Baltimore, Md.
Bob Hagerman (WPE8INH), Hemlock, Mich.
Bob Emery (WPE3HFZ), Allentown, Pa.
Samson Voron (VK2PE2R), Coogee, N.S.W., Australia
Dave Listort (WPE2FGX), Elmont, N. Y.
Jim Kowalski (WPE9GZB), Two Rivers, Wisc.
Victor Tan Yew Seng (9V1PE1B), Raffles Park, Singapore

0430-0700 in English with pop music. QRM from TUK.

209 Kiev, USSR; around 2300 and 0430; QRM from a weather station in Houston, Texas.

218 Oslo, Norway; around 0530; possible heavy QRM from CLB beacon in Carolina Beach, S. C.

227 Warsaw, Poland; at 2230-2300 and again around 0500.

233 Luxembourg; pop music at 0530; QRM from the New Orleans weather station. Power is 1,100,000 watts.

CURRENT STATION REPORTS

The following is a resume of current reports. At time of compilation all reports were as accurate as possible, but stations change frequency and/or schedule with little or no advance notice. All times shown are Greenwich Mean Time (GMT) and the 24-hour system is used. Reports should be sent to Short-Wave Listening, P. O. Box 333, Cherry Hill, N. J. 08034, in time to reach us by the fifth of each month; be sure to include your WPE identification and the make and model number of your receiver.

Biafra—A surprising catch was that of *Voice of Biafra*, Enugu, on 7302 kHz from 2330-2350 in English and with native music. Rechecks find this frequency in steady use.

(Continued on page 111)

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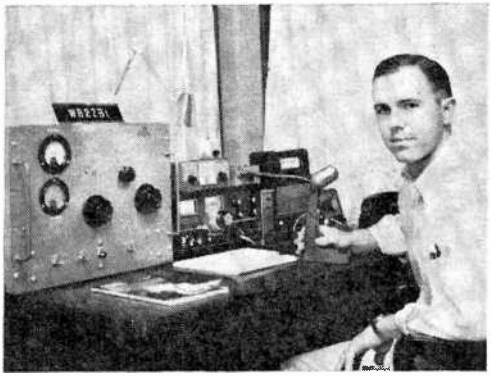
CIRCLE NO. 23 ON READER SERVICE PAGE

AMATEUR RADIO

(*Continued from page 94*)

Amateur Radio Club immediately adopted Pancho and arranged phone patches so that he could talk to his family in the United States. Pancho, in turn, sent code practice to the club's aspiring amateurs. He became a member of the Rag Chewers' Club (RCC) as a result of his first amateur contact.



Tom Massey, WB2ZBI, Glen Rock, N.J., has worked all states and 85 countries. A Swan 500C transceiver drives a homebrew linear amplifier to feed a Mosley TA-33 beam or a doublet antenna. He operates SSB and CW but says he prefers the latter.

Contest Weekend. During the weekend of August 16-17, all amateurs are invited to participate in two QSO Parties—the QRP Amateur Radio Club International QSO Party and the Indiana QSO Party. For the first, times are 2000 GMT Saturday to 2400 GMT Sunday. QRP club members send RST, state/province/country, and QRP number. Others send RST, state/province/country, and power. Earn two points per contact. Suggested frequencies: 3575, 3720, 3980, 7075, 7170, 7280, 14075, 14330, 21075, 21120, 21430, 28075, 28600 kHz. For the Indiana Party, times are 2300 GMT Saturday to 2300 GMT Sunday. Indiana stations send QSO number, RST, name of county (92 maximum). Others send QSO number, RST, name of state/province/country. One point per contact. Suggested frequencies: 3535, 3745, 3912, 7040, 7155, 7260, 14085, 14285, 21120, 21320, 28070, 28820 kHz, and 50.1-50.5, 145-147 MHz.

In each party, the same station may be worked once in each phone and CW band. Your score equals QSO points multiplied by the number of different states, provinces, and countries (outside USA and Canada) or counties worked. QRP Party scores go to: Mike Czuhajewski, WA8MCQ, R3, Paw Paw, Mich. 49079. Indiana Party scores to: Olen Coulter, K9KFM, 319 N. Colorado, Hobart,

Ind. 46342. They will mail official rules of ther respective parties if you send them a stamped, addressed envelope.

Hamfest. The annual Hamfest for the Washington, D.C. metropolitan area, sponsored by the Foundation for Amateur Radio, will be held at the Gaithersburg (Md.) Fairgrounds on Sunday, Sept. 21, from 1000 to 1700 hours.

Tom, WN3KQA, Aliquippa, Pa., has 48 states and 11 countries using a Heathkit HX-11 transmitter, a Drake R-4A receiver and 40- and 15-meter dipoles.

NEWS AND VIEWS

Walter Page Pyne, WA3EOP, 717 Oak Hill Ave., Hagerstown, Md. 21740, has come up with a good idea. He points out that many prospective Novices do not know whom to ask to be their volunteer examiners for their Novice or Technician class exams. He suggests that General or higher class amateurs who write to "News and Views" might indicate their willingness to act as such an examiner. He is our first volunteer. Walt now has his Advanced ticket. He operates SSB with a Heathkit HW-100 and CW using a homebrew 10 watter. His antenna is an indoor Joystick. Walt says succinctly, "It works" . . . **Dave Bushong, WN6CSK,** Chula Vista, Calif., worked 180 stations and received over 60 QSL cards his first four weeks on the air. Forty meters was the scene; a Heathkit HW-16, CW transceiver and a half-wave dipole were the means. We can't give you Dave's address; he moved to Washington, D.C., shortly after writing but forgot to give us the address . . . **Mike Gassman, WNØYCN,** 6500 North Campbell, Gladstone, Mo. 64118, made a discovery that will surprise positively no one: he found out that his new Mosley MP-33, tri-band beam gets out better than his old inverted-V dipole. Mike has a Johnson Adventurer running 50 watts and a Heathkit HR-10B receiver.

Wayne A. Korn, K7PPZ/MM, USC & GSS "Surveyor," 1801 Fairview Ave. E. Seattle, Wash. 98102, and Bob Roberts, W7LNP, operate from the United States Coast and Geodetic Survey Ship "Surveyor." Their ocean is the Pacific, their frequency is 14.3-14.33 MHz, and the time is most evenings around 0330 GMT. The K7PPZ/MM equipment consists of a Heathkit HW-100 transceiver and an SB-200 linear amplifier feeding a vertical antenna. Although the primary purpose of the station is to run "phone patches" between the crew and their folks at home, Wayne and Bob are happy to work everyone they can . . . **John S. Fulton, WN5WFE,** 901 N. Thomas, Carlsbad, New Mexico 88220, has 37 states, including Hawaii and Alaska, confirmed. Japan and Brazil are his best DX catches. His equipment is a Heathkit DX-60 transmitter, Radio Shack Realistic DX-150 receiver, and a choice of a 15-meter dipole or a 35-foot wire, 10 feet high for an antenna. If you need New Mexico, John will attempt to arrange a sked for you . . . **Raymond O'Donnell, WA3FMI,** 11 Jackson St., Dallas, Pa. 18612, leads an active amateur life. In the early evenings, he is on 75-meter SSB; in the early morning hours, he is on 80- or 20-meter CW; in between times, he might be anywhere between 160 and 6 meters. His gear includes Heathkit DX-100 and SB-10 SSB adapter, Gonset G-76, Hammarlund HQ-110A receiver, etc. All he has for antennas are a 6-meter beam, 10, 15, 20-meter beam, 80/40 meter doublet, 160-meter inverted-V, 10, 15, 20-meter "trap" dipole, and seven 100 to 500-foot "long wires."

Ivan Zuckerman, WN4LXR, 3311 S.W. 18 St., Miami, Fla. 33145, worked 13 states his first month on the air with a homebuilt, 17-watt transmitter. Graduating to a Heathkit DX-60B transmitter, he added 14 states and six countries to his total. Ivan uses a Drake 4B receiver, and his antennas are a Hy-Gain 3-element beam up 22 feet and a 40-meter inverted V . . . The nearest that we can come to associating a set of call letters with **Frank Arcinolo,** 16 Patten Rd., North Haven, Conn. 06473, is to report that Frank's dad used to be W1NZM. Using dad's old National HRO-7 receiver and Heathkit DX-100 transmitter, WN1???'s total is 18 states worked, mostly on 40 meters. Frank's antenna is a "Windom," 50 feet high strung across a river in his back yard! . . . **Philip Ragusa, WN2JAF,** 2295 W. 11th St., Brooklyn, N.Y. 11223, thinks his record might encourage others who must operate under less than ideal conditions. He uses a Johnson Adventurer transmitter and a Monarch HAM-1 receiver (a new one on us) and has worked seven states. But the "big" thing is his antenna. Tenants in his apartment building are forbidden to put up outside antennas; so Phil uses a 35-foot piece of wire. Ten feet of the wire is inside the apartment, and the rest is just thrown out the window.

If we haven't given enough attention to your state or amateur band or your favorite amateur activity, you are in an ideal spot to correct the injustice. Write that letter you have been thinking of to "News and Views," and—if you have one available—include a clear picture of you and station. Black and white photos are preferred. Also, we hope to continue to receive your club bulletin or to be put on the mailing list, if we are not already there. The address is: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Ind. 46401.

73, *Herb, W9EGQ.*

Ray O'Donnell, WA3FMI, Dallas, Pa., can work all bands from 1.8 through 54 MHz with 10 antennas.

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This is the new Allied model 2660 portable 6-band radio. It's $69.95.

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DORM SPECIAL

(Continued from page 57)

sure that the transit screw clips go through their proper holes in the mounting board.

Plug the line cord from the record changer into the SWITCHED outlet on the rear apron of the amplifier. Then connect the green grounding wire to the GND post. Finally, gather the excess phono cable into a neat bundle at one side of the amplifier (see photo on page 57), and plug the two cables into their proper PHONO input jacks on the rear of the amplifier.

If your changer was supplied with a cartridge, you are now ready to test the system out. (Most hi-fi suppliers offer a package deal when you buy the record changer specified in the Bill of Materials. The mail order houses, for example, charge $44.50 for the record changer and only one cent more for your choice of a cartridge. However, while the cartridges offered in the package deals produce excellent sound, in the Dorm Special, the magnetic field generated by the amplifier's power transformer might induce a slight hum into the cartridge or pickup lines. To avoid this problem, you might want to substitute the Grado Model FTR solid-state cartridge.)

If you elect to use the Grado FTR, cut ⅛" from the bolts supplied with it before attaching the cartridge to the mounting plate. Then twist the leads to the cartridge to prevent electrostatic hum, and push the connecting lugs onto the cartridge pins as illustrated in the instruction sheet provided with the cartridge.

Now test the system. If everything works correctly, secure the rear plate of the enclosure in place with flathead wood screws.

Your Dorm Special hi-fi system, you will find, sounds clean and true, although you will not get room-shaking bass from the small built-in speakers. For that, you will have to connect larger speaker systems to the system via the output jacks on the rear panel of the enclosure. —30—

SHORT-WAVE LISTENING

(*Continued from page* 100)

listed for 4915 kHz, is now on 4912 kHz, up from previously logged 4898 kHz, in Spanish until 0300 closing, with much QRM from Brazilian stations.

Burma—What is thought to be Rangoon on a new frequency is the station noted on 4725 kHz some mornings around 1135 in native language and native music.

China—*R. Peking* was found on 15,500 kHz at 1054 with an anthem but under heavy jamming and RTTY QRM. The s/off came abruptly on completion of the anthem.

Columbia—HJJG, *R. International*, Cucuta, noted on 4975 kHz at 0805-0815 in Spanish. *R. Corona Internationale*, Manizales, 5020 kHz, is good at 0430 with typical L.A. programming but with an English ID every half hour. *Emissoras Nuevo Mundo*, Bogota, can be heard to past 0330 on 4755 kHz.

Czechoslovakia—*R. Prague* has this English schedule: To Europe at 1200-1230 on 9560, 11,960 and 15,285 kHz, 1630-1700 and 1900-1930 on 5930 and 7345 kHz; to Africa at 1530-1630 on 9605, 15,285 and 17,840 kHz (also to Europe on 6055 kHz and to S. Asia on 11,990 and 21,735 kHz) and 1730-1830 on 5930, 7345, 9605, 11,990, 17,840 and 21,735 kHz; to N.A. at 1400-1500 (Sunday only) on 15,445, 17,840 and 21,735 kHz, 0100-0200 and 0300-0400 on 5930, 7345, 9540, 9630, 11,990 and 15,365 kHz (and also on 17,840 at 0100-0200); to the Far East and Australia at 0700-0800 on 9575, 11,800, 15,310, 21,485 and 21,700 kHz (and to Europe on 6055 and 9505 kHz). Medium-wave xmsn's in English to Europe are given at 2200-2230 on 1286 kHz.

Denmark—*R. Denmark*, Copenhagen, has been testing 15,165 kHz to N.A. in English at 2330; the signal is excellent but there is heavy QRM from ZYN7, Brazil. This channel is also noted at 1255 with DX items and at 1300 with "DX Window".

Ecuador—HCRP1, *R. Catolica*, Quito, has been on 5062 kHz for years despite a listing for 5055 kHz. It was logged around 0200 with a religious period.

Egypt—*Ici le Caire* is the ID given in French during test xmsn at 0125-0200 on 11,813 kHz. Programming was pop music and in French and Arabic.

El Salvador—YSS, San Salvador, is excellent at times on 6010 kHz with usual Spanish music and many ID's. S/off time is 0500 with four notes on a xylophone and the national anthem.

Finland—*R. Finland*, Pori was found with English at 1800-1830 on 15,185 kHz at good level.

France—Paris has Portuguese to L.A. at 2355-0030, Spanish to 0058, and in French from 0100 on 11,975 kHz (a new frequency) in dual to 15,140 kHz. A xmsn in English was logged at 0520-0530 on 7180 kHz and into French at 0530.

Germany (East)—*R. Berlin International* has English for the East Coast at 0100 on 11,890 and 9730 kHz. A new frequency is 15,145 kHz, found from 1515 s/on in French with news but not heard on normal parallel channel of 11,745 kHz.

Ghana—Late information received from *R. Ghana*, Accra, shows this current schedule: To N.A. and Caribbean areas at 2000-2100 on 11,850 and 9760 kHz; to South Africa, Central Africa and Australia at 1500-1545 on 17,910 and 21,545 kHz; to West Africa at 1400-2215 on 6130 kHz; to Europe at 2045-2215 on 9545 and 15,285 kHz; and to East Africa at 1400-1430 on 17,910 kHz, 1500-1545 on 21,720 kHz, 1645-1730 and 1815-1900 on 15,285 kHz. An outlet on 4915 kHz has been heard well at 0600 with English news and commentary.

Guatemala—The tentative listing last month for

La Voz de Nahuala has been confirmed; details were as listed.

India—*All India Radio*, P. O. Box 500, New Delhi, has Indian vocal and instrumental music and world commentaries in English at 1815-1915 on 15,080 kHz.

Iran—The North American Short-Wave Association advises that *R. Iran* is now using 17,740 kHz at 1930 in French and dual to 15,135 kHz. Teheran has also been checked here at 1730-1800 at solid level in Russian with varied types of music.

Italy—*R. Roma*, Rome, has been found on a new and unlisted frequency of 15.340 kHz, dual to 11,810 and 9575 kHz, in Italian to N.A. with pop Italian vocal and instrumental music and a period of classical music.

Lebanon—*R. Lebanon*, Beirut, has this current schedule: to Africa at 1830-2030 on 15,350 kHz with English at 1830-1900; to South America at 2300-0100 on 17,715 kHz with no English scheduled; to N.A., Antilles and Europe at 0130-0400 on 11,820 kHz with French at 0130, Arabic at 0200 and 0300, English at 0230 and Spanish at 0330. Omnidirectional xmsn's are broadcast daily at 0430-0730 and 1625-1820 on

SHORT-WAVE CONTRIBUTORS

William Brechlin *(WPE1HNZ)*, Berlin, Conn.
John Costa *(WPE2QAR)*, Massapequa, N. Y.
Martin Shulman *(WPE2QHF)*, Spring Valley, N. Y.
Michael Szoke *(WPE2QUM)*, South River, N. Y.
Charles Clay, Jr. *(WPE2QWE)*, Climax, N. Y.
Wade Smith *(WPE3FGX)*, Clemson, S. C.
George Sprout *(WPE3GMW)*, Reading, Pa.
Bruce Eisenhard *(WPE3HFC)*, Lafayette Hill, Pa.
Peter Romeika *(WPE3HMV)*, Rosemont, Pa.
Grady Ferguson *(WPE4BC)*, Charlotte, N. C.
Ray Lindquist *(WPE4JYB)*, Miami, Fla.
David Weronka *(WPE4KBE)*, Durham, N. C.
Michael Dopson *(WPE4KCF)*, Enterprise, Ala.
Jerry Stuart *(WPE5EKT)*, Lawton, Okla.
Richard Fortson *(WPE5EWX)*, Edinburg, Texas
Charles Bennett *(WPE5SW)*, Sumrall, Miss.
Jim Young *(WPE6ENA)*, Wrightwood, Calif.
W. W. Mosby *(WPE6EXG)*, San Jose, Calif.
Allen Webb *(WPE6HCG)*, Pasadena, Calif.
Robert Tate *(WPE6HLJ)*, San Francisco, Calif.
Tom Christian *(WPE7CXG)*, Seattle, Wash.
Charles Dobbins *(WPE8BEV)*, Detroit, Mich.
Art Mitchell *(WPE8KCL)*, Steubenville, Ohio
Gary Beaumont *(WPE9JQJ)*, Cambridge City, Ind.
John Patterson *(WPE9JQL)*, Oswego, Ill.
William Maves *(WPE9JQS)*, Menomonie, Wisc.
A. R. Niblack *(WPE9KM)*, Vincennes, Ind.
John Beaver *(WPEØAE)*, Pueblo, Colo.
C. Vernon Hyson *(WPEØCNF)*, Somerville, N. J.
Jack Bacon, Jr. *(WPEØFDJ)*, Bloomington, Minn.
Mike Carrick *(WPEØFLX)*, Omaha, Nebr.
Mike Wormington *(WPEØFMK)*, Overland Park, Kan.
Jack Perolo *(PY2PE1C)*, Sao Paulo, Brazil
Christopher Stark *(VE1PE1AO)*, Canning, N. S.
Vern Breitkopf *(VE2PE1JA)*, Montreal, Que.
Bertram Baggaley *(VE3PE2PH)*, Hamilton, Ont.
David Alpert, Morton Grove, Ill.
Leo Alster, Rahway, N. J.
Warren Armstrong, Birmingham, Mich.
Erwin Batchelder, Jr., West Newbury, Mass.
Joseph Bazsika, South Plainfield, N. J.
Wayne Huhta, Coal Valley, Ill.
Ed Jomantas, Detroit, Mich.
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Aloysius King, St. Louis, Mo.
Gene Moser, Coloma, Mich.
Mike Owen, Glen Arm, Md.
Reid Rowlett, Greensboro, N. C.
Henry Seidner, Pearl River, N. Y.
Carl Swiderski, Cherry Hill, N. J.
Rolf Syvertsen, Aboard M/S Bergensfjord, On Cruise
R. Prague, Prague, Czechoslovakia
R. Sweden, Stockholm, Sweden
North American Shortwave Association, Altoona, Pa.

5980 kHz and at 0925-1600 on 9545 kHz.

Liberia—ELWA, Monrovia, is excellent with English news and interviews at 0610 on 11,950 kHz. A new frequency is 15,095 kHz, heard at 2000 with ID and religious programming.

Martinique—A colorful photographic postcard of a sugar plantation accompanied a QSL letter sent by FZF76, Centre de Fort de France, for reception of their daytime radiotelephone (public service) xmsn to New York on 17,575 kHz. The station has a power rating of 20 kW. This is one of those "circuit adjustment" stations that many readers report hearing. Sent with the reception report were some local postcards, a brief resume of the listener and his town, and 3 IRC's. Listen around 1100.

Nicaragua—*R. Zelaya,* Bluefields, noted on 5945.5 kHz with many old American pop records, infrequent ID's and very poor modulation from 0100 tuning.

Pakistan—*R. Pakistan,* Karachi, is often noted with dictation-speed English news at 1335-1350 daily on 17,945 kHz.

Peru—OAX7I, *R. Madre de Dios,* Puerto Maldanado, 4951 kHz, is noted often after 0000. OAX9D, *R. Tropical,* Tarapoto, is fair on 9710 kHz at 1100. Owner and manager Juan Pablo Mori would appreciate reports and promises prompt replies by card.

Rhodesia—Lusaka has been found on 5012 kHz, fair to good level, with English news at 0400.

Spain—*Radio Nacional de Espana,* Madrid, continues to air English xmsn's at 0100, 0200 and 0300, each for 45 minutes, on 6130 kHz.

USSR—*R. Kiev* operates Monday, Thursday and Saturday at 0030-0100 on 15,270, 12,030, 11,740 and 11,710 kHz with a repeat at 0430-0500 on 12,010, 11,960, 11,740 and 9600 kHz. A separate European xmsn is listed for 1900-1930 on 15,170, 15,150 and 11,710 kHz. *R. Leningrad* is heard on 11,700 kHz at 1055-1115 with commentary, ID and a musical interlude. The IS is given three times at 1100.

Vatican City—A new frequency for *R. Vaticana* is 21,560 kHz, noted at 1520 in English to S.E. Asia.

Windward Islands—*Windward Islands Broadcasting Service,* St. Georges, Grenada, has this current schedule: to Eastern Caribbean on 3280 kHz at 2155-0215, 5015 kHz at 1545-2245 and 9550 kHz at 1545-1800; to Jamaica on 11,970 kHz at 2315-0215 and 15,105 kHz at 1545-1800; to British Isles on 11,700 kHz at 2135-2245 (November-February), 15,105 kHz at 1945-2130 (November-February) and on 21,690 kHz at 2015-2130 (March-October). Special broadcasts are aired on 15,100 kHz at 2000-2130 and on 21,515 kHz at 1445-2000. All above frequencies are rated at 5000 watts. Listeners in S.E. United States might also try for the *W.I.B.S.* local stations at Grenada, 535 kHz, Dominica, 695 kHz, and St. Vincent, 705 kHz, all 500 watts, St. Lucia, 1575 kHz, 250 watts, and Carriacou, 1045 kHz and Chateau Belair, 1535 kHz, both 25 watts.

Clandestine—*Radio of the South Vietnam Front For Liberation* (Vietcong) has again been noted at 1136 with Oriental music on 10,030 kHz. This one seems to vary in frequency down to 10,015 kHz.

CITIZENS BAND JAMBOREE CALENDAR

August 10, Metropolitan Area Radio Club (Silver Spring, Md.), Marshall Hall Amusement Park, Rte 210, Washington, D.C. Contact Ray Neely, P.O. Box 1433, Landover, Md. 20785.

August 16 and 17, Pioneer CB Radio Club, Inc., Holt Moffitt Field, Lexington, N.C.

September 27 and 28, West Virginia CB Radio Assoc., Inc., Beckley Radio Club Grounds, Crow, W. Va. Contact Ted England, KPN8419, P.O. Box 628, Beckley, W. Va.

SOLID STATE

(*Continued from page* 97)

pressure and then hermetically sealed in glass. One laboratory unit assembled in this fashion has delivered 800 watts at 1 MHz, while powers as high as 300 watts at 30 MHz may be possible in future units, thus rivaling the r.f. power levels of moderately large vacuum tubes.

New Devices. Turning from the experimental to the practical, General Electric is now offering an "over-the-counter" monolithic integrated circuit capable of delivering 5 watts of continuous audio power into a 16-ohm load. Identified as the PA246, the new IC is designed for use in tape recorders, AM/FM receivers, TV sets, intercoms, record players, and low-power p.a. systems.

With an eye towards the consumer equipment market, Motorola Semiconductor Products Inc. (P.O. Box 20912, Phoenix, Arizona 85036) has introduced a pair of new monolithic IC devices.

One, the MC1304, is an FM multiplex stereophonic signal demodulator. The new device not only separates the stereo signal's left and right channels but also provides audio muting to eliminate interstation hiss during tuning; acts as an automatic switch to convert weak stereo signals to mono signals for distortion-free reception; and supplies a drive signal to activate a panel-mounted indicator lamp when a stereo signal is received. Assembled in a tiny, dual in-line ceramic package, the CM1304 circuit contains the interconnected equivalent of 30 transistors, 10 diodes, and 27 resistors.

Motorola's other new integrated circuit is a self-contained chroma demodulator for color television receivers. Requiring only the chroma signal and two reference phases to produce low-impedance color difference drive signals, the new device, designated type MC1325, is said to be less expensive than a comparable circuit built with individual components.

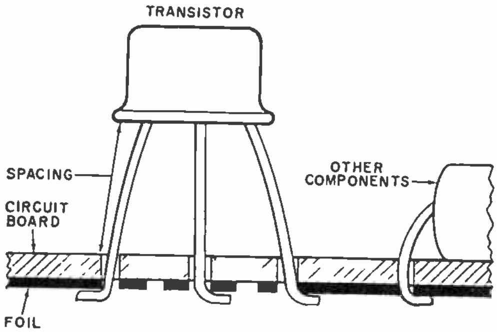

Fig. 6. In experimental work with semiconductors on PC board, allow sufficient spacing to permit the attachment of a heat sink during soldering.

Transitips. As a general rule, transistors, diodes, and other components are mounted flush against printed-circuit boards and their leads, after crimping, are clipped to minimum length. While excellent for final assembly, this construction technique can cause problems if used on experimental or test projects. The resultant shortened leads may permit a semiconductor device to be overheated by repeated applications of a soldering iron to the circuit board as parts are removed and replaced.

If you work with experimental designs assembled on circuit boards, you can minimize the chances of heat damage to your expensive semiconductor devices if you keep their leads at maximum length, allowing the devices to "stand" above the board, as illustrated in Fig. 6. The increased lead length not only reduces heating, but permits the use of a clip-type heat sink (or a pair of long-nose pliers) where extensive soldering is required. —*Lou*

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8 b

OPERATION ASSIST

Through this column we try to make it possible for readers needing information on outdated, obscure, and unusual radio-electronics gear to get help from other P.E. readers. Here's how it works: Check 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 postcard to Operation Assist, POPULAR ELECTRONICS, *One Park Avenue, New York, N.Y. 10016. Give maker's name and model number of the unit. If you don't know both the maker's name and the model number, give year of manufacture, bands covered, tubes used, etc. State specifically what you want, i.e., schematic, source for parts, etc. Be sure to print or type everything legibly, including your name and address. Do not send an individual postcard for each request; list all requests on one postcard. Because we get so many inquiries, none of them can be acknowledged.* POPULAR ELECTRONICS *reserves the right to publish only those items not available from normal sources.*

Madison-Fielding (Crosby) series 440 receiver. Instruction manual and schematic diagram needed. (Alan Boritz. 80 Cheshire Rd., Bethpage, NY 11714)

Philco Model 41-285. Schematic and manual needed. (Walt Rauscher, Jr., Jolly Rd. R.D. #4, Norristown, PA 19401)

World Radio Labs Model 65 globe scout. Schematic and operating manual needed. (Terry Habron, Humphrey's Ave., Pennsville, NJ 08070)

Wakata-Bussan Model TR-900 Japanese tape recorder. Layout, PC board, schematic, parts list, and alignment information needed. (Fletcher M. Foster, 1719 Elizabeth Ave., Modesto, CA 95350)

Webcor Model 2891-1B and Model 2822-1C tape recorder. Service manuals 79P493T and 79P497T needed. (A.G. Gomez, 730 E. 13 St., Hialeah, FL 33010)

Heathkit Model 0-5 oscilloscope. Schematic and operating manual needed. (Walter W. Sivigny. 5 Miles St., Hamden, CT 06514)

EICO Model 777 CB transceiver. Operating manual and/or instruction on use needed. (B. Langdon, 6 Sussex Pl., Deer Park, NY 11729)

Webcor Model 14X223 record changer amplifier. Schematic needed. (R.L. Fredenberg, RD #4, Middletown, NY 10940)

Akai Model M-8 Japanese tape recorder. Schematic, parts list, and any information needed. (Ralph Lomgobardi, 164 Ross St., Batavia, NY 14020)

Eico Model 147 signal tracer. Manual and schematic needed. (George F. Marts, 4201 Colvin Dr., St. Louis, MO 63123)

Lafayette Model HE-45a 6-meter transceiver. Manual, operating instructions, and schematic needed. (Robert Hajdak, 4 Homer St., Greenville, PA 16125)

Motorola Model 51T23 AM-SW. Schematic needed. (Cliff Paris, 1122 Highland Dr., Grand Prairie, TX 75050)

Motorola FPTRU-1 Packset. Antenna, mike, crystals needed. (Frank H. Magyar, P.O. Box 543, Stratford, Conn. 06497)

Lansing power amplifier, from 35-mm projector, prior 1943. Schematic needed. (Juergen F.A. Seifert, 1384 W. Lawn Dr., Slidell, LA 70458)

Philco Model 20 receiver. Schematic, operating instructions, parts list, and source of parts needed. (David W. Robbins, 7902 W. Hiawatha, Tampa, FL 33615)

Atwater-Kent Model 246 superheterodyne. Schematic, source of parts, alignment data needed. (Henry Leong, 180 Park Row, Apt. 12B, New York, NY 10038)

Hallicrafters Model S-38-E. Operating manual and schematic needed to borrow. (Harry E. Dieckman, 2664 Gemini St., Harvey, LA 70058)

Hallicrafters S-53-A general coverage receiver. Operating manual and/or schematic needed. (Richard R. Rubin, P.O. Box 509, Monticello, NY 12701)

RCA Radiola 18. Schematic and source of parts (especially output transformer and type 26 tube) needed. (Virgil R. Cantrell, 121 Greenwood Pl., Decatur, GA 30030)

Hallicrafters Model SX62 receiver. Wanted to buy. (G. Frank Laco, 1036 Steel St., Johnstown, PA 15902)

Sparton Model 1059 a.c. receiver; type 8L9 chassis. Schematic, parts list, and service information needed. (Keith Kolander, 705 Shamrock Dr., Opelika, AL 36801)

Philco code 121 receiver; chassis 37-3630A. Schematic and alignment data needed. (William Mann, 111 Tenth Ave., Brantford, Ont., Canada)

Wright Model EX90 aircraft transceiver. Repair manual and/or schematic needed. (Barton Buehler, 3322 Goldsmith St., San Diego, CA 92106)

Graetz Komtesse Model 1111E table model FM/AM receiver. Schematic or at least power transformer specifications needed. (R. Van Etten, 810 Princess Dr., W. Lafayette, IN 47906)

Heathkit Model 0-10 oscilloscope. Construction manual needed. (Edward Weber, 7831 Beland Ave., Los Angeles, CA 90045)

Silvertone Model 4789; covers 3 bands. Schematic, alignment data, and any information needed. (Stan W. Folsom, 5944 Ridgemoor Dr., San Diego, CA 92120)

Philco Model 490 and 490A. [illegible] ...atic and operating instructions needed. (M.F. Hussey, 528 E. 17 St., Marysville, CA 95901)

Link Radio type 11-UF, FM receiver, ser. No. 6893, Ed. 7c. **Link Radio** FM transmitter, type 75-UFM, Ed. 7B, ser. No. 63200. Schematic and/or other data needed. (Richard Knapp, 2006 Grand Ave., Nashville, TN 37212)

Hallicrafters Model SX-110 receiver. Schematic and operating manual needed. (Anthony Manderski, 321 Ellis Ave., Irvington, NJ 07111)

Philco Model 60-505 AM and marine band receiver. Schematic, tube chart, and alignment data needed. **Turner** Model TV-3 UHF converter. Schematic and alignment data needed. (Bruce Brandl, Rt. 3, Box 157, Stevens Point, WI 54481)

RCA Model MI-6350 Victor-Phone inter-communication system. Schematic needed. (John Hupke, Jr., 4826 Walsh Ave., E. Chicago, IN 46312)

Hallicrafters Model S-52 receiver. Schematic and operating manual or alignment data needed. (R. L. Wood, P.O. Box 439, Larkspur, CA 94939)

Hallicrafters Model S-38C or S-38. Schematic and/or operating manual or service information needed. (Ron Adams, 74 Terrel Dr., Milford, CT 06160)

Century Electronics Model 201 condenser-resistor analyzer. Schematic and operating instructions needed. (C. W. Linden, 4268 N. Carruth, Fresno, CA 93705)

RCA sentinel BC receiver, circa 1932. Schematic and parts specs needed. (Todd Folger, 695 Lyncott, N. Muskegan, MI 49445)

Marconi black and white TV; has 18 tubes. Tube layout and schematic needed. (Lawrence Meikle, RR #1, Richmond, Ont., Canada)

Superior Instruments Model 660-A signal generator. Schematic and instruction manual needed. (George W. Karlish, Box 929, El Dorado, AR 71730)

Collins ART-13/MT-283 aircraft transmitter. Operating manual, schematic, and plans for power supply needed; also plans for conversion to amateur use. (Larry DeVito, 18 Bee Dr., Hauppauge, NY 11787)

Heathkit Model DX-40. Construction manual needed. (Tom Delano, 4129 Coffman Ln., Minneapolis, MN 55406)

Heathkit Model G-1 signal generator. Schematic needed. (John Keyes, 17495 Mallory, Bloomington, CA 92316)

Silvertone Model 371928 AM/SW receiver, circa 1936. 6N6G or 6N6GT tube needed. (A. Ossowski, 412 E. 12 St., Erie, PA 16503)

Stromberg-Carlson Model 1110 receiver. Alignment data and schematic needed. (Jeff A. Hollinshead, 122 Landis Ave., Waynesboro, PA 17268)

Philco Model 38-12, code 121. Schematic needed. (Alan Pecherer, 24 Clairidge Ct., Montclair, NJ 07042)

Heath DX-100 160-10m transmitter. Plastic dial 464-M3 needed. (Richard Loken, Box 141, Drake, Sask., Canada)

Multi-Elmac Model PMR-7. Power cord and any other information needed. (H. Gellman, 8326 Alma St., Philadelphia, PA 19152)

RME Model 99. Schematic and alignment data needed. (Lawrence R. Steele, 219 N. Holyoke, Wichita, KS 67208)

Philco Model G-30415 Seventeener portable TV. Schematic and manual needed. (John F. Tipsword, Jr., 2408 Robin Ln., Rolling Meadows, IL 60008)

Kuhn Electronics Model 3538 AM/FM/VHF receiver. Tube replacement and wiring diagram needed. (M. Todd, 12 Park St. East, Apt. 209, Port Credit, Ont., Canada)

Dumont type 224-A oscilloscope. Operating instructions, schematic and probes needed. **Precision Apparatus** Model E-200-C signal generator. Operating manual and schematic needed (Joseph J. Williams, 26 Wallkill Rd., Sparta, NJ 07871)

Readrite Meter Works Model 410 tube tester. Schematic and Type '01-A tubes needed. (Steve D. Swift, 6211 Gladiator Dr., Olympia, WA 98501)

Freed-Eisemann Model FE-15-N0312DD receiver. Manual and schematic needed. (Paul A. Simpson, 3720 Sanford Dr., Brunswick, OH 44212)

DuMont Model 208B scope. Schematic, waveform chart and any additional information needed. (W.R. Ebert, 57 Leland Rd., Rochester, NY 14617)

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AMATEUR RADIO EQUIPMENT

(Continued from page 66)

ADDRESSES OF MANUFACTURERS

(Each manufacturer will be pleased to send you more information. Mention that you saw the product discussed by Herb S. Brier, W9-EGQ, in the August POPULAR ELECTRONICS.)

Allied Radio Corporation (Knight-Kit)
100 N. Western Ave., Chicago, IL 60680

Ameco Div., Aerotron, Inc.
P.O. Box 6527, Raleigh, NC 27608

E. T. Clegg Associates, Inc.
Littell Rd., East Hanover, NJ 07936

Collins Radio Co.
Cedar Rapids, IA 52406

Conar Div., National Radio Institute
Washington, DC 20016

R. L. Drake Co.
430 Richard St., Miamisburg, OH 45342

Galaxy Electronics
10 S. 34 St., Council Bluffs, IA 51501

Gonset Div., Aerotron, Inc.
P.O. Box 6527, Raleigh, NC 27608

Hallicrafters Company
600 Hicks Rd., Rolling Meadows, IL 60008

Hammarlund Mfg. Co.
20 Bridge Ave., Red Bank, NJ 07701

Heath Company
Benton Harbor, MI 49023

Lafayette Radio Electronics Corp.
111 Jericho Turnpike, Syosset, NY 11791

Linear Systems, Inc.
220 Airport Blvd., Watsonville, CA 95076

National Radio Co., Inc.
37 Washington St., Melrose, MA 02176

Signal/One Div., Electronic Communications Inc.
2200 Anvil St., St. Petersburg, FL 33710

Spectronics
Box 356, Los Alomos, CA 97020

Squires-Sanders, Inc.
Martinsville Rd., Liberty Corner, NJ 07938

Swan Electronics Corp.
Oceanside, CA 92054

World Radio Laboratories
345 W. Broadway, Council Bluffs, IA 51501

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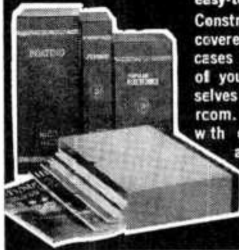

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