

Build "Real Sound" Hi-Fi Expander

POPULAR ELECTRONICS

OCTOBER
1964

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Make Models Come When You Whistle

Do's and Don't's of New CB Rules

How to Tune for Ships at Sea

9-Volt Battery Eliminator

VOM Calibrator

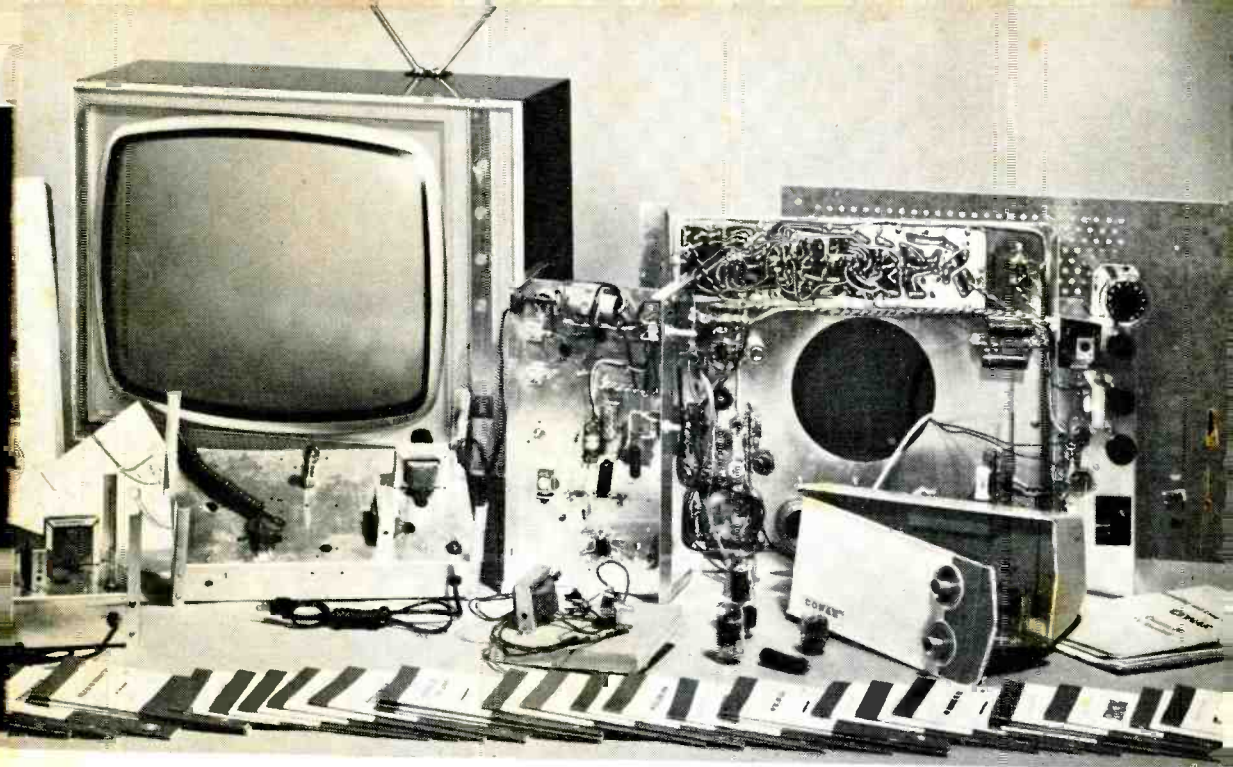


Bargain P.A. Amplifier
Uses 25¢ Transistors

(see page 69)

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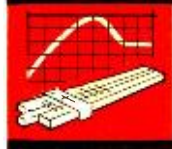
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POPULAR ELECTRONICS is Indexed
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This month's cover photo by Bruce Pendleton

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OCTOBER, 1964

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*Dynamic realism from tapes, discs, and FM? Here, for the first time
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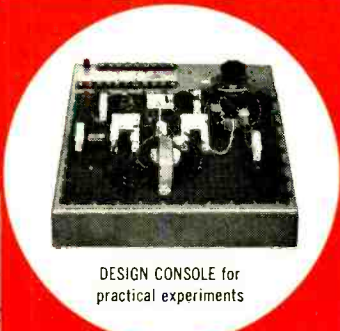
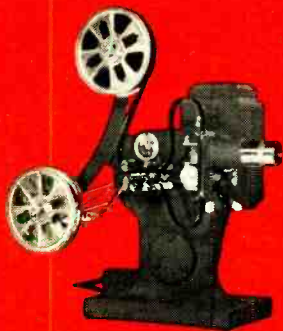
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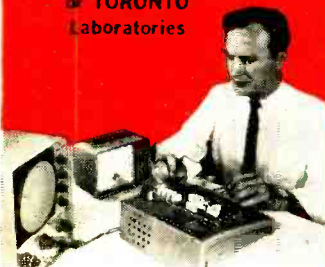
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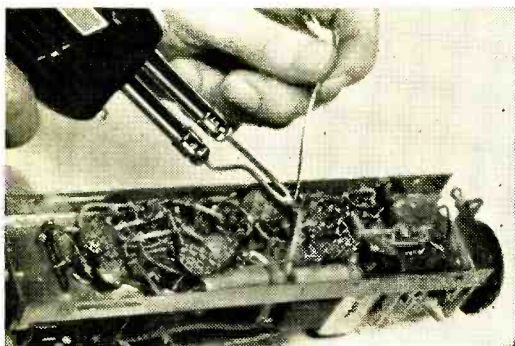
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SOLDERING TIPS FOR HI-FI KIT BUILDERS



AVOID USING TOO MUCH SOLDER

Apply just enough solder to make a secure connection. Excess solder may fill up tube sockets, freeze switches or cause short circuits.



USE A DUAL HEAT GUN

Use the low heat trigger position to prevent damage when soldering near heat-sensitive components. Switch to high heat only when needed.

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1958...the RCA Radio-Phone Series

1959...the RCA Mark VII

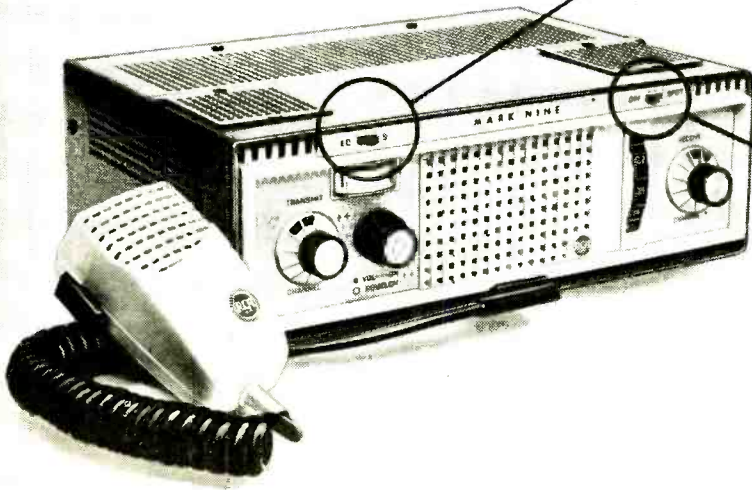
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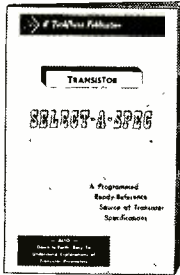
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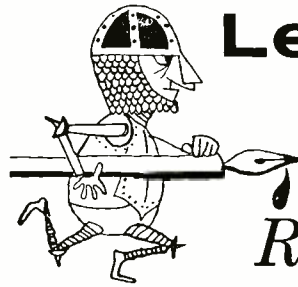
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■ I recently built "Big TC" (July, 1964) and am pleased with the results. I substituted high-voltage TV capacitors (500 to 2000 pf., 20 to 30 kv.) for the handmade ones, and filled the space between the primary and the secondary with paraffin for better insulation. The last of several models I constructed put out about a million volts. Incidentally, readers interested in Tesla coils should enjoy *Prodigal Genius, The Life of Nikola Tesla*, a book by John J. O'Neil. One of Tesla's coils was unbelievable—the primary was wound on a form 80 feet in diameter, and the secondary ended in a three-foot copper sphere 200 feet from the floor. It produced bolts of artificial lightning 135 feet long at a potential of over 100,000,000 volts!

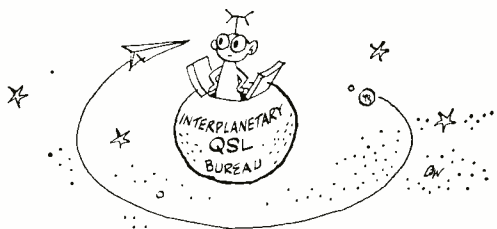
ROGER BRADFORD
Media, Pa.

Wanted: Interplanetary QSL Bureau

■ I enjoyed "DX'ing Jupiter" (August, 1964), but something puzzles me—does Jupiter give QSL cards? Seriously, it was a very good article.

DENNIS C. McMAHON
Brooklyn, N.Y.

■ The only thing you forgot to include was how to verify reception. After all, Jovian QSL's would prob-



ably measure ten feet by six, and weigh forty pounds!
VICTOR J. BELLINO, WPE3EIV
Abington, Pa.

■ I have heard Jupiter signals, and am now eagerly awaiting your announcement of a "Worked All Planets" award.

JAY BOOTH, WPE3FVN
Wilmington, Del.

"Do Hams Control TV?" Asks Viewer

■ I would be interested in knowing just where we, the people, stand in regard to amateur radio operators. Do they, by virtue of the fact that they are licensed
(Continued on page 10)

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NEW!

Hy-Gain

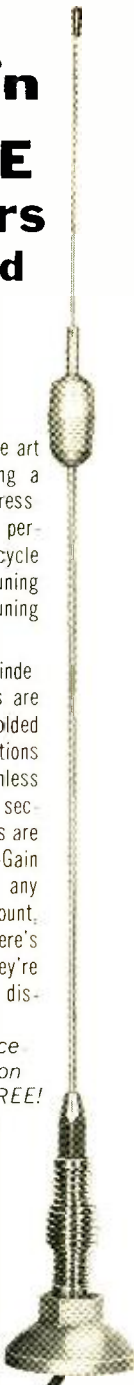
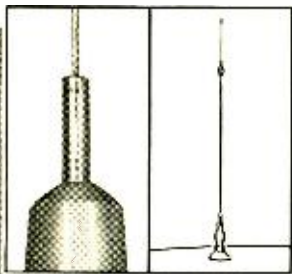
SOLID STATE Mobile Toppers for Citizens Band

- Hy-Q Solid State Loading Coil
- 23 Channel Broadband Performance
- Precision Adjustable Tuning

Now...a major advance in the state of the art...new Hy-Gain Mobile Toppers...featuring a space-age Hy-Q solid state loading coil expressly designed to deliver a new dimension in performance on all 23 channels of the 27 megacycle Citizens Band. New concept adjustable tuning rod allows "no cutting" lifetime precision tuning for optimum performance on any vehicle.

New Hy-Gain Mobile Toppers are virtually indestructible...Hy-Q solid state loading coils are totally encapsulated in ever-enduring molded polystyrene...whip sections and tuning sections are of low wind resistant top quality stainless steel (except telescoping model where whip section is chrome plated brass) . . . all mounts are field tested to take maximum abuse. New Hy-Gain Mobile Toppers are available for mounting any place on any vehicle...roof mount, deck mount, cowl mount, fender mount...you name it, there's a Hy-Gain Topper that will fill the bill! They're available now from your favorite Hy-Gain distributor or dealer.

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HY-GAIN ANTENNA PRODUCTS CORP.
8499 N.E. Highway 6 - Lincoln, Nebraska
CIRCLE NO. 14 ON READER SERVICE PAGE

Letters

(Continued from page 6)

by the Federal Government, have control over all TV viewers? Do we have to sit and wait till they are tired of broadcasting before we can enjoy television? Do these operators have a set of rules they must stick to? We have taken the suggestions of these operators and added filters to our sets: when the filters did not help, they suggested we have our sets realigned. Do we *have* to go through all of this in order to watch TV?

DANE T. LLOYD
West Mifflin, Pa.

No, Dane, a ham ticket does NOT give anyone control over the TV viewer; but ownership of a TV set—which as often as not may be incapable of rejecting a strong local signal due to faulty installation, adjustment, or design—does NOT give the TV viewer control over the entire radio spectrum. Yes, hams do have a set of rules by which they must abide; they can be found in Volume 6, Part 97, of the FCC Rules and Regulations available from the U.S. Government Printing Office for \$1.25. While it would be impossible for us to diagnose the specific cause of interference in your case, we would like to observe that it can undoubtedly be cured by good will and cooperation on both sides. Most amateurs are quite willing to help solve interference problems, although they have no legal obligation to do so as long as their transmitters are "clean"—that is, not producing spurious or harmonic radiation on TV frequencies.

Electronics Primer—Revisited

■ Re•fer•ring to "Electronics Primer" (August, 1964), I think you will find that Eng'land doesn't and nev'er did own the Sand'wich Is'lands. We u'su•al•ly call them Ha•wai'i, one of the U•nit'ed States, re•mem'ber?

LESLIE F. GARRETT
Derry, N.H.

Captain James Cook, the great English navigator, discovered the Islands in 1778, although it is true that



he did not take possession. However, a British naval officer did take possession of the Sandwich Islands in 1843, and held them for a short time until admonished by higher authorities. Cry, Read'er Gar•rett, cry!

"Bug" Batteries Available

■ Your mention of do-it-yourself biocells in "The Amazing 'Bug' Battery," February, 1964, issue aroused



No matter where you march in this parade, you're a leader. Army training gives you the habit of leadership, gives you the confidence people respect.

If you're good enough, you get full recognition in the Army. And think of how proud she'll be of you and your sharpshooter's medal.



Something to write home about...your experiences in the many fascinating cities and countries where American soldiers are stationed.



Share great moments with other great guys

No wonder some of the greatest songs of all time have been marching songs—there's nothing as stirring as the feeling you're part of a great group moving as a perfect unit.

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Talk to your local Army recruiter. Let him help you find out if the Army is right for you...and if you're right for the Army. The moments you spend with him may lead to that great moment when you discover that...if you're good enough to get in, a proud future can be yours in today's *action*

Army



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CIRCLE NO. 9 ON READER SERVICE PAGE

Letters

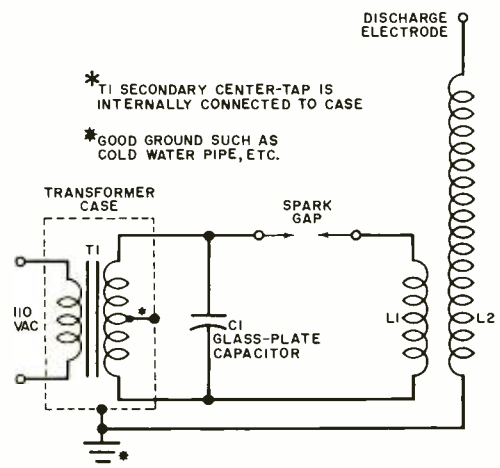
(Continued from page 10)

a great deal of interest. Since the Electron Molecule Research kit is no longer available, we are accepting orders for the Rowland BioFuel Cell (see page 43 of Feb. issue—Ed.). It is available under Stock No. F 39 A 369-R for \$14.95.

J. W. RUBIN
 Allied Radio Corp.
 Chicago, Ill.

"Big TC" Modifications Increase Safety

■ A safer hookup for "Big TC" (July, 1964) is shown in the schematic below. Many neon sign transformers of the type used for T1 are center-tapped; the tap is connected to the case of the transformer. Grounding



the case and returning the bottom of the Tesla coil secondary to ground eliminates the difference in excitation potential between the secondary and the case. Grounding also reduces the shock hazard should the transformer break down internally.

CHARLES CARINGELLA
 Ontario, Calif.

P.E. Project Award?

■ How about an award in the form of a decal to be given to builders of POPULAR ELECTRONICS' construction projects who can supply written and photographic evidence that they have assembled a unit exactly as presented in P.E.? Most experimenters are proud of a well-built and finished project, and it would take only the addition of a brightly colored decal reading "Constructed Exactly as Stated in POPULAR ELECTRONICS Magazine," or "Precision of Construction Verified by the Editors of POPULAR ELECTRONICS," to add that final touch.

ROBERT "BOB" BRANDON
 Canyon, B.C., Canada

Thanks for the idea, Bob. If enough readers feel it's a good one, we may do it.

SSB Favored for CB

■ Why is it that CB'ers cry for more channels, which the FCC cannot provide, and ignore the obvious solution: single sideband. CB SSB would double the 23

(Continued on page 20)

SCOTT'S TOP RATED LT-110 FM STEREO TUNER KIT NOW AT A NEW LOW PRICE ... \$139.95

"... 1.88 uv sensitivity by a home alignment procedure without instruments ... an exceptional feat ..."

Electronics Illustrated



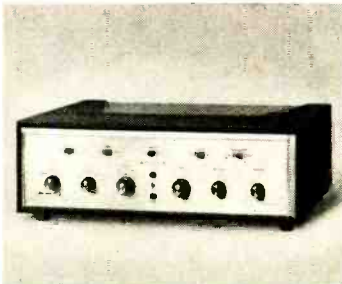
Here's terrific news for you kit builders! Now, the famous Scott LT-110 tuner kit ... top rated by every audio expert ... built by thousands of hi fi enthusiasts ... is available in handsome new styling at a truly modest price.

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Here's what the technical editor of *Electronics Illustrated* said about the LT-110: "If you have hesitated to go into stereo FM because of imagined complexities and highly technical skills and knowledge that might be required, fear no more. The LT-110 shows you how to enjoy stereo FM the easy way."



LK-72B 80-Watt Stereo Amplifier Kit. This popular amplifier kit delivers enough power to drive any speaker system, and at an outstanding price. Complete range of control features includes switched front panel headphone output, complete recording facilities, and provision for driving a third or center channel loud-speaker system without additional amplification. Only \$149.95.



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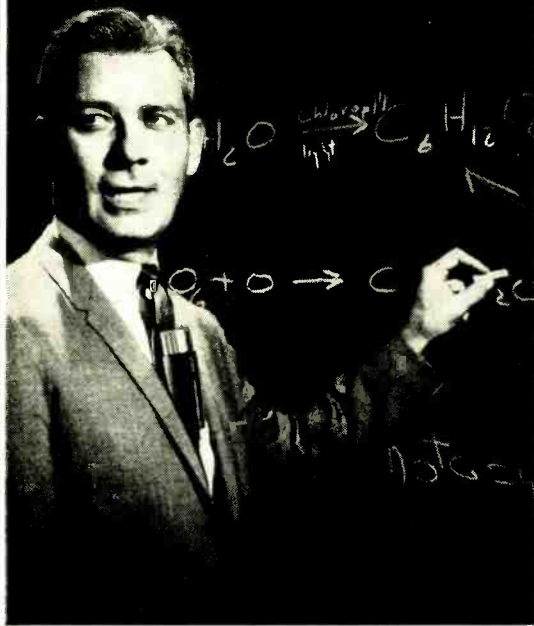
CIRCLE NO. 36 ON READER SERVICE PAGE

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- Remove guarantee registration card from microphone package.
- Specify whether you wish high impedance or low impedance lavalier microphone in the comment section of guarantee registration card.
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- That's all there is to do. Your microphone will be sent to you post paid. Sorry, no C.O.D.s.

CIRCLE NO. 37 ON READER SERVICE PAGE

POPULAR ELECTRONICS

POPULAR ELECTRONICS

PRODUCT SERVICE PAGE

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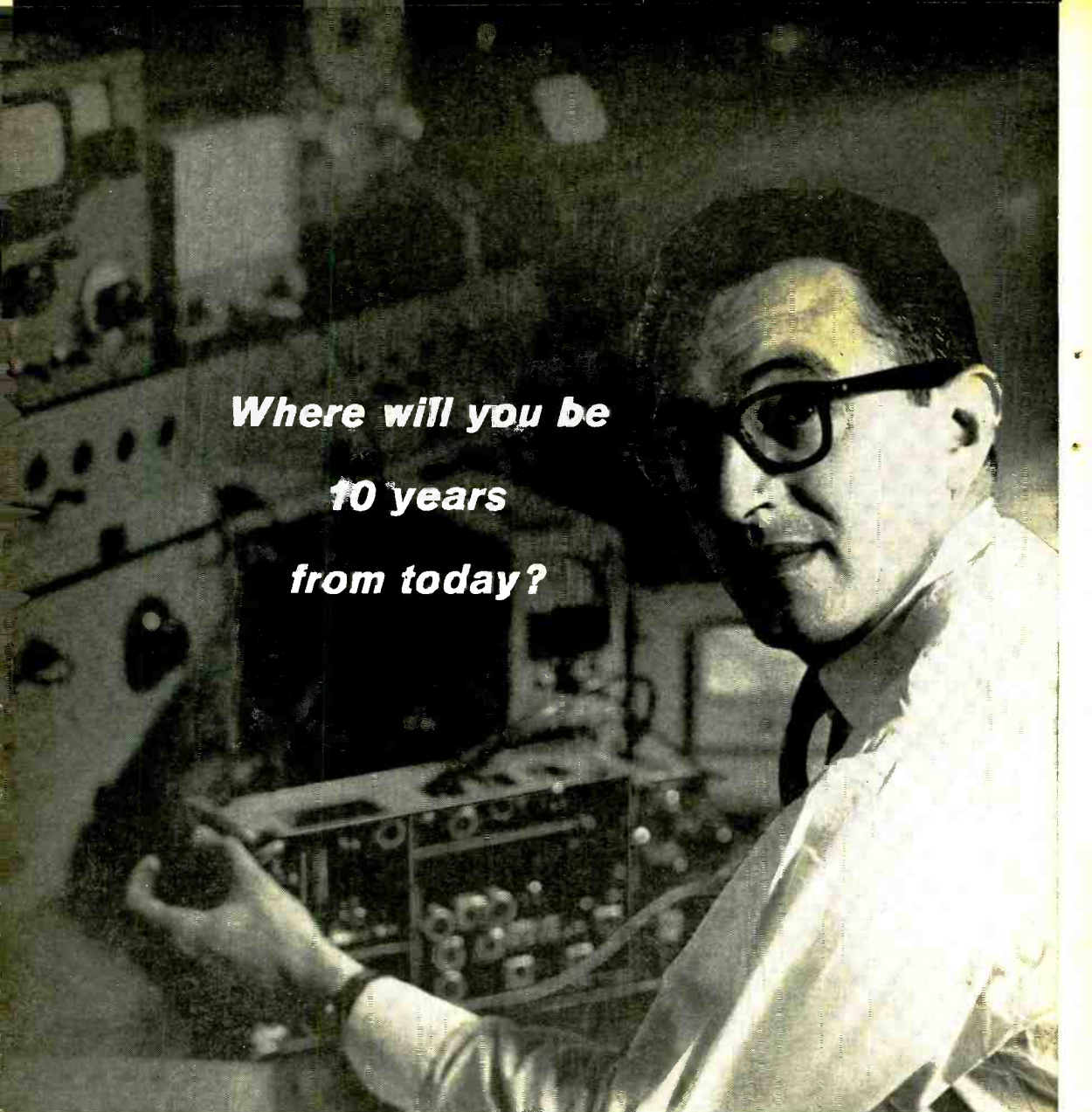
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TV Serviceman, Electronic Tester, Junior Technician	Electronics and Television Receivers (V-3)	2 yrs. High School with Algebra, and Physics or Science or RCA Preparatory Course.
Transistor Circuits Specialist	Transistors	Radio background
Color TV Service Technician	Color Television	Television background
Industrial Electronic Technician	Automation Electronics (V-14)	Radio and Transistor Background
Computer Service Technician	Digital Computer Electronics (V-15)	Radio and Transistor Background
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Automation Technician	Automation Electronics	Radio and Electronic Fundamentals
Transistor Circuits Specialist	Transistors	Radio and Electronic Fundamentals
Transmitter Technician, Communications Specialist	Communications Electronics	Radio and Electronic Fundamentals
Communications, 1st Class FCC Licensee	FCC License Preparation	Radio and Electronic Fundamentals
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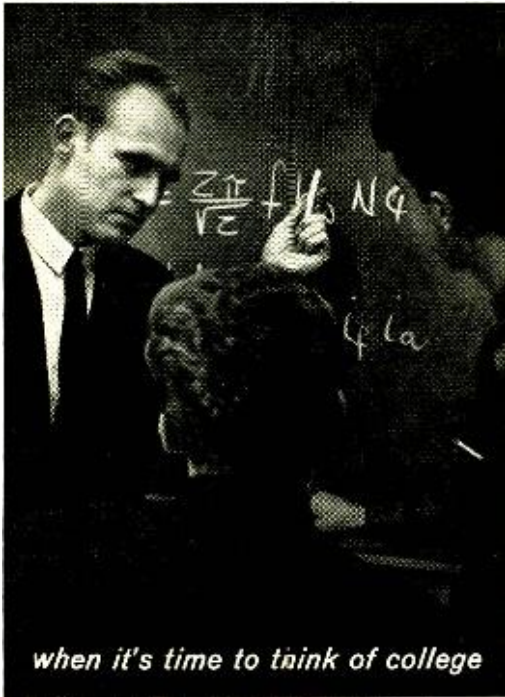
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 2-years or 4-years

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Letters

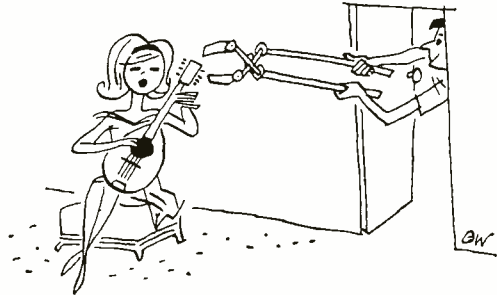
(Continued from page 12)

channels to 46, and lighten the load for those with CB claustrophobia. Some action by the FCC *now*, before we get hemmed in like sardines, requiring all new CB rigs manufactured to be SSB (except walkie-talkies) would be as welcome as a million dollars.

DOUG EASTON
San Diego, Calif.

Cat Whisker In the Key of E

■ The reader who wanted a source for old-time cat whiskers ("Letters From Our Readers," August, 1964) may be interested in this tip: Back in the days when this item was in popular use, we found that the "E" mandolin string made the best cat whisker. You simply



wind about four turns around a $\frac{3}{32}$ " drill, cut to size to fit the detector mounting and, after straightening the ends, install it and find the crystal's most sensitive spot. Incidentally, we used a "test buzzer" for this last operation.

C.E. HOOVER, WOKWY
Ames, Iowa

Stereo TV Sound Wanted

■ With the addition of multiplex stereo to many FM radio stations, I have been wondering if television stations will be transmitting stereo in the near future? The idea seems feasible since the audio portion of a TV program is FM; the only problem would seem to be the expense.

SGT. JAMES O. MOSHER
Sumter, S. C.

The possibility of TV stereo transmissions would seem to be highly unlikely, Jim, due to the fact that a relatively crowded (with video information) TV channel could not accommodate a hi-fi multiplex sound signal without interfering with the picture.

Out of Tune



Microphones (August, 1964, pages 47-48). The microphone shown in silhouette on page 47 and identified as the Electro-Voice Model 644 on page 48 is actually the Electro-Voice Model 642 "Cardiline" priced at \$229.32.

Spotty® . . . handy spotlight for autos, trucks and boats.



Spotty is always ready to use . . . no batteries to run down or wear out . . . plugs into cigarette lighter. Complete with 10 ft. wire. (6 or 12 volt—Bulbs interchangeable.)

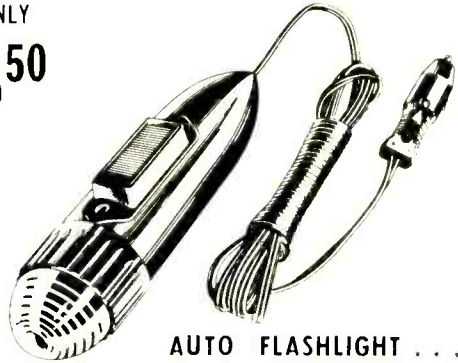


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Please ship me the following:

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Sorry—No charges or C.O.D. orders. PE-102
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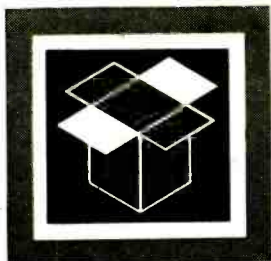
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ALL THREE ONLY

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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 which appears on page 15.



ALL-PURPOSE SOLDERING GUN

A new concept in soldering instruments makes possible heat ranges from 25 to 450 watts in one small, lightweight gun—the Model 450 “All Gun” announced by *Wen Products, Inc.* Simply by changing tips on the gun, you obtain the proper heat for heavy-duty (200 to 450 watts), medium-duty (100 to 200 watts), and light-duty (25 to 100 watts) applications. Through the use of automatic thermal regulation, the range of heat power is automatically adjusted to the right level for a particular job. When the standard (heavy-duty) tip is employed, the Model 450 comes up to heat 36 times faster than a comparable 500-watt soldering iron. Price, \$13.95 including the standard tip. The medium-duty and fine-point tip are \$1.30 each.

Circle No. 75 on Reader Service Page 15

TRANSISTORIZED AUTOMOTIVE TACHOMETER

The “Transitach” Model 250 announced by *Delta Products, Inc.* is a precision-engineered automotive tachometer featuring a 250-degree D’Arsonval jeweled meter with translucent back-lighted dial. An easily adjustable set pointer provides accurate shift point indication. Each unit is individually calibrated for accuracy, easily read on its long scale (over 200% longer than most 90-degree tachometers). The conversion circuitry is wired on a printed-circuit board. Suitable for mounting on any vehicle, the “Transitach” comes in five different versions: 0-8000 rpm,

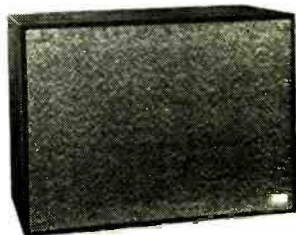


Circle No. 76 on Reader Service Page 15

12 volts; 0-6000 rpm, 12 volts; 0-8000 rpm, 6 volts; 0-6000 rpm, 6 volts; and 0-8000 rpm, 4 cylinders, 12 volts. Price, \$49.95, complete with housing and hardware.

SPEAKER SYSTEM AND UNDERWATER SPEAKER

There are two new entries in the hi-fi speaker field from *LTV University*. The “Medallion Monitor” system (shown in the photo) is a fixed-grille bookshelf version of the well-known “Medallion XII” with improved speakers. It includes a 12” woofer, an 8” mid-range speaker, and the “Sphericon Super Tweeter.” Response is claimed to be virtually undistorted from 20 to 40,000 cycles. Price, \$129, net. The second entry, the Model MM-2PPS, is designed specifically for underwater use. Featuring completely waterproofed, hermetically sealed internal components and a polypropylene plastic housing, this speaker has a frequency response of 100 to 10,000 cycles and a full-range power capacity of 30 watts. One MM-2PPS will distribute sound throughout a pool up to 30 feet square.

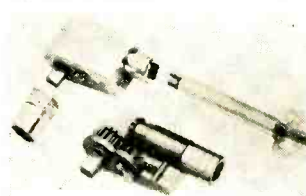


Circle No. 77 on Reader Service Page 15

“SPINNING-RATCHET”

Ratcheting and spinning actions can be combined in the “Spinning-Ratchet” introduced by *Amtronix, Inc.* which permits easy access to difficult jobs. (Both outside and inside views of the unit are shown in the photo.) The ratcheting action provides leverage for breakaway and final tightening, spinning for high speed.

The handle of the ratchet is any conventional square-drive spinning handle; all $\frac{1}{4}$ ” square-drive socket equipment fits the unit, and $\frac{3}{8}$ ” equipment can be used with a size converter. Price, \$7.95.



Circle No. 78 on Reader Service Page 15

“RANGE-BUSTER” ANTENNA

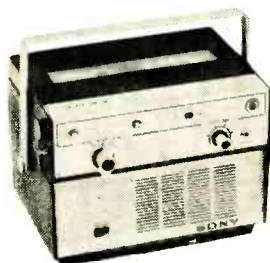
Master Mobile's Model CB-35 antenna will maintain a 1.2:1 SWR (or less) over the entire Citizens Band. Consisting of a stainless steel layover extension and a flexible stainless steel whip with weather-sealed center-loaded coil, it can be mounted anywhere on a car and performance will remain the same. It can be utilized with any mount terminating in a $\frac{3}{4}$ ”-24 thread and matches 52-ohm coaxial cable. The whip is easily cut to a specific frequency by removal of the whip

stud; adjustment for minimum SWR is then made with a setscrew type adapter. Price, \$19.95 net. Other "Range-Buster" models are also available, ranging in price from \$15.95 to \$16.95.

Circle No. 79 on Reader Service Page 15

"VOICE COMMAND" TAPE RECORDER

A voice-activated mechanism and automatic gain control eliminate the need for manual control of the Sony Model 905 "Voice Command" battery recorder recently announced by *Superscope, Incorporated*. The unit instantaneously starts recording at the sound of the user's voice, while automatically adjusting gain. The upper part of the Model 905 is an independent battery-operated 4½-pound portable recorder; the base contains an a.c.-operated hi-fi playback amplifier, speaker, and battery charger. Tape speeds are 3¾ and 1½ ips; frequency response is 90-9500 cycles. Price, less than \$159.50 complete with leather case and \$11 lifetime nickel-cadmium rechargeable batteries.



Circle No. 80 on Reader Service Page 15

"STEREO SEARCHER"

The LT-87 "Stereo Searcher" introduced by *Lafayette Radio Electronics* is intended for use with FM tuners utilizing external multiplex adapters. Easily connected between adapter and tuner, the LT-87 provides an audible tone signal through the speaker system for instant identification of a stereo FM station broadcast. A single switch controls the tone function. Size: 2¼" x 3" x 9½". Price of the "Stereo Searcher," with connecting cable, and instructions, \$19.95.



Circle No. 81 on Reader Service Page 15

TRIPLE-PLAY AUDIO TAPE

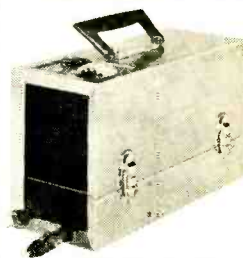
Eastman Kodak Company has announced a music-quality triple-play audio tape, Type P105, which packs 3600 feet of tape on a 7" reel to give more than 1½ hours of uninterrupted music at 7½ ips. Where extended play is important, the 7" reel will give six hours of 4-track stereo, or 12 hours of 4-track mono per reel at 3¾ ips. A high-output oxide coating results in a signal-to-noise ratio as much as 6 db greater than that of conventional triple-play tapes, yet Type P105 has a signal-

to-print ratio comparable to most low-print tapes. The new tape is also available on a 5" 1800-foot reel and a 3¼" 600-foot reel.

Circle No. 82 on Reader Service Page 15

PORTABLE SELF-CONTAINED POWER SUPPLY

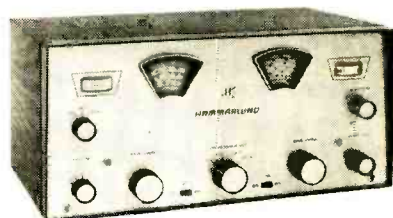
Designed for the traveler who wants the convenience of "home" electricity, the *Tera-do* "TRAV-ELECTRIC" portable power supply has a self-contained storage battery and inverter. It provides 117 volts, 60 cycles, anywhere—at a turn of the switch. It does not depend on a car or boat battery. Weighing 29 pounds, the "TRAV-ELECTRIC" will operate lights (fluorescent or incandescent), tape recorders, portable TV sets (11" screen size), record players, electric can openers, electric drills, and hundreds of other small electric appliances. Price, \$69.50.



Circle No. 83 on Reader Service Page 15

GENERAL-COVERAGE RECEIVER

Continuously tunable from 540 kc. to 30 mc. in four bands, the *Hammarlund* HQ-66 receiver features a ten-tube superheterodyne circuit; electrical bandspread tuning with direct dial calibration; temperature-compen-



Circle No. 84 on Reader Service Page 15

sated high-frequency oscillator for excellent stability, and a built-in automatic noise limiter to minimize static bursts and ignition interference. An exclusive "auto-response" circuit permits a complete range of audio output—from the sharp response required in short-wave reception to the broad response necessary for hi-fi broadcast reception. Price, \$159.95.

COMBINATION SIGNAL-WARNING DEVICE

The "Sonalert" is a versatile combination signal-warning device designed by *Electropac, Inc.*, for use with communication equipment, fire and burglar alarms, appliances, medical instruments, and other applications. It has no mechanical linkages or contacts, and can be mounted on a panel or junction box in seconds. The solid-state design is arc-free and produces no r.f. to interfere with equipment operation. Weighing just 1¼

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CIRCLE NO. 35 ON READER SERVICE PAGE

New Products

(Continued from page 23)

ounces, the unit responds to only 3 ma. of current at 6 volts d.c. with a sound output of 70 db. The sound output level can be increased to 80 db by raising the applied voltage to 28 volts. Price, \$4.95.

Circle No. 85 on Reader Service Page 15

PORTABLE BATTERY-OPERATED AMPLIFIER

A new portable amplifier that works on flashlight batteries and weighs only seven pounds with the batteries installed is now available from *Perma-Power*. Suitable for music, pag-



Circle No. 86 on
Reader Service Page 15

ing, p.a., and most sound system applications, indoors and out, the "Ampli - Vox" Model S-700 is rated at 25 watts E.I.A. music power, 40 watts peak. Frequency response is 50 to 15,000 cycles. A single control turns the amplifier on and off and adjusts the volume. There are two inputs, and outputs for two 8-ohm speakers. Ten flashlight batteries will provide 200 hours of operation. Price, \$69.95 net, without batteries.

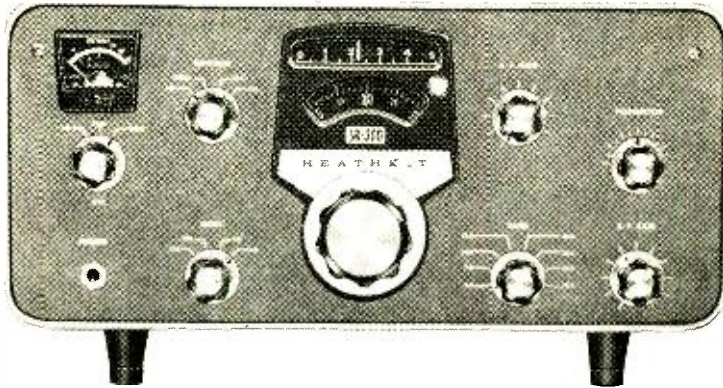
-30-



Basic electronics will be taught through the medium of electronics when "Electronics At Work" bows over New York City's TV Channel 13-WNDT on October 5. Designed for high school students, the course should also be of interest to pre-engineering students. It will be broadcast every Monday, Wednesday, and Friday at 12:30 p.m., and repeated at 11:10 p.m.

The first radioman ever assigned to the World War II battleship *USS Massachusetts*, Stirling M. Olberg, W1SNN, recently "signed on" for her "last voyage." During August 8-14, the ship was towed from Norfolk, Va., to Fall River, Mass., to go on display there. Along the way, Olberg, now a Raytheon Company engineer, operated a ham station where 56 radio operators once transmitted coded orders to Allied striking forces. Using the call W1USN, the station was active on the 20-, 40-, and 80-meter bands.

The NEW Quality Standard In Ham Receivers...



HEATHKIT® SB-300...Only \$265!

Here's What The Experts Say! Oct.-Nov. issue of *Radio-TV Experimenter*: "How does the final product perform? Just GREAT!" *CQ*, October issue: "The production of a kit to build an amateur receiver having performance equal to or better than that of many high-priced factory-built receivers is most unusual — yes, even amazing! Such is the Heathkit SB-300." Also see the article in the July issue of *QST*.

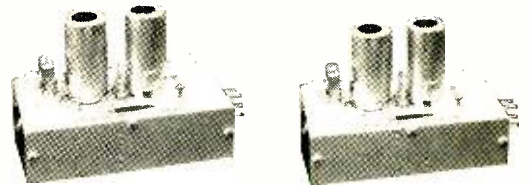
Here's What SB-300 Owners Say! Bill Pinkenson, K3WPH, Philadelphia: "For the first time in my amateur career I was able to tune side band with the ease of AM. The quality and audio response is terrific. I sure can see the amount of thought and engineering that went into this quality receiver." Al Tschirhart, WA5EGG, Houston: "I made side by side comparisons with a receiver which was commercially built and I have one conclusion. Why pay over twice as much for a receiver which is no better than the SB-300?"

These are just a few of the typical responses the magnificent SB-300 is enjoying. It truly represents both the *New* quality and value standard in ham receivers today. Just one more example of why you can count on Heath to bring you the best for less.

Compare These Professional Features!

- Complete Coverage of 80 through 10 meter amateur bands with all crystals furnished, plus provision for VHF converters
- Prebuilt, calibrated linear master oscillator (LMO)
- 25 kc per tuning knob revolution offers bandspread equal to 10 feet per megacycle
- Built-in crystal calibrator
- 2.1 kc crystal bandpass filter
- Stability of 100 cps after initial warmup
- Wiring harness & two heavy-duty circuit boards for easy assembly
- Professional styling & performance at 60% savings!

Kit SB-300, (less speaker) 22 lbs. \$265.00
 SBA-300-1, Optional AM crystal filter (3.75 kc), 1 lb. \$19.95
 SBA-300-2, Optional CW crystal filter (400 cps), 1 lb. \$19.95



New! 6 & 2 Meter Converters! Easy to install on rear cabinet panel of SB-300 with simple plug-in connections for antenna & power cables. 1 switch activates either converter. 6 meter converter covers from 48 to 54 mc (50 to 52 mc w/crystal supplied). 2 meter converter covers 142 to 150 mc (144 to 146 mc w/crystal supplied).

SBA-300-3 (6-meter) 2 lbs. \$19.95
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CIRCLE NO. 13 ON READER SERVICE PAGE



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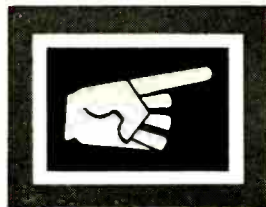
NEW CHROME FRONT PANEL—METER
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Now the best transceiver is even better. The NEW Regency "Range Gain" with its exclusive Double Side Band Reduced Carrier Transmitter gives you all the power you need for horizon-line operating range PLUS metered control so you do not exceed the FCC limit. PLUS you get new clarity in reception... pulls in even more distant signals than ever. 23 crystal-controlled channels—transmit and receive included. The word is out. Ask your friends about the "Big R." There is nothing on the market to match it, and the price is right. See your Regency dealer now.

FULL ONE YEAR WARRANTY

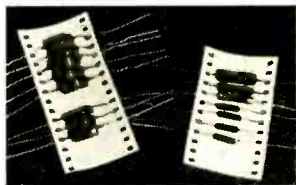
Regency **ELECTRONICS, INC.**



**Tips
and
Techniques**

**"FILM" STORAGE
FOR SMALL PARTS**

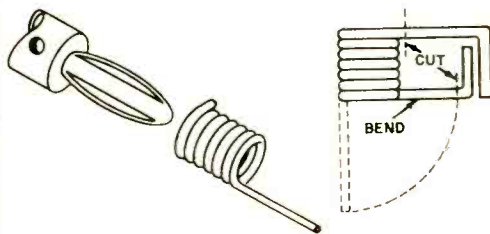
Small parts, such as resistors, capacitors and diodes, often become tangled and hard to locate when they are stored haphazardly in boxes. An easy way to keep them in order is to slip their leads through the perforations of 35-mm. film strips as shown. The film strips, together with the components, can then be neatly filed or tacked to a convenient shelf for easy access.



—Art Blaske

**SNAP-TYPE CLOTHESPIN
MAKES BANANA PLUG ADAPTER**

There's probably a bunch of banana-plug-to-pin-jack adapters in your home—in the family clothespin bag. To make an adapter, take the spring off a snap-type clothespin and cut the arms of the spring as shown here. The straight end of the spring can



be soldered to a printed-circuit board, giving you a banana jack, or you can insert the end in a pin jack and use leads terminated in banana plugs.

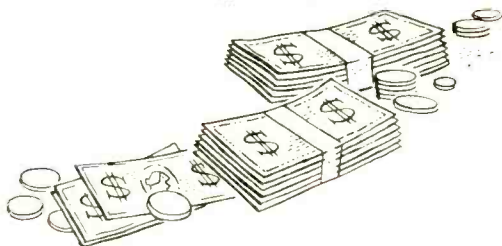
—R. D. Holen

**WATCH OUT FOR
EUROPEAN PARTS VALUES**

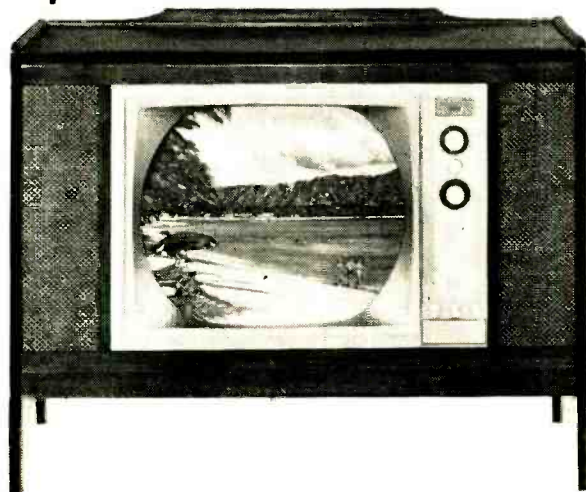
Be wary when dealing with European component designations. German resistors have their values printed on the sides, but the letter "K" used in these labels stands for

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Regardless of what you pay for other Color TV



it can't perform as well as this one...



and yet a Heathkit set costs as little as \$399!

Exclusive Heath Features For Unequalled Performance! That's right. No matter how many of your hard-earned dollars you pay for another brand of color TV, *none* can equal the performance of the Heathkit All-Channel, High Fidelity 21" Color TV! Why? *All* color sets require minor periodic adjustments to maintain peak picture performance. The Heathkit GR-53A is the *only* set with a "built-in service center" that provides facilities for perfect picture adjustments. Heath's simple-to-follow instructions and detailed color photos show you exactly what to look for and how to achieve it . . . quickly, easily! You become the expert! Results? Beautiful, true-to-life color pictures day in and day out . . . and *no* costly color TV service calls for simple picture alignment.

But don't take our word for it. See the special articles on the Heathkit GR-53A in the May issue of **Popular Electronics**, June issue of **Radio-TV Experimenter**, February issue of **Popular Mechanics**, April issue of **Science & Mechanics**, and the August issue of **Radio-Electronics**.

Then tear out the coupon and order yours now!
 Kit GR-53A, chassis, tubes, mask, VHF & UHF tuners, mounting kit, speaker, 127 lbs. \$399.00

THE ONLY COLOR TV YOU CAN INSTALL 3 WAYS!

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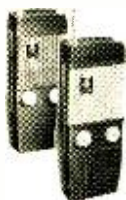
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"MESSENGER III"—Everything you want in a CB transceiver—a husky signal, extreme sensitivity, razor-sharp selectivity—and complete flexibility for base station, mobile, public address, or battery powered portable use! Double conversion receiver—set-and-forget "Volume" and "Squelch" controls—11 channel coverage—"Tone Alert" Selective Calling System available as accessory.

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117 Volt AC Power Supply. . . . \$ 29.95 Net

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CIRCLE NO. 16 ON READER SERVICE PAGE

Tips

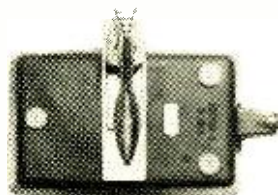
(Continued from page 26)

a decimal point, with the result that 6K8 means 6800 ohms (6.8K) and 68K means, as you might expect, 68,000 ohms. On diagrams, you may find that a comma is used in place of a decimal point, and the number "1" might look more like a "7". The letter "P" on many foreign diagrams means microfarad, so that 1P would be 1.0 μ f. And the designation "1001F" indicates a 1000-ohm precision resistor.

—William B. Adams

**TIE BAR MAKES
MICROPHONE CLIP**

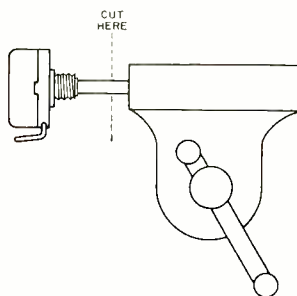
The microphones furnished with most tape recorders are designed for hand-held use. But it is often advantageous to have both hands free or to make the mike less conspicuous—when conducting interviews, for example. A clip-type tie bar can be attached to the back of the mike with epoxy cement.



After the cement is thoroughly dry, you can easily clip the mike to a pocket or lapel; if the mike is small enough, it can be clipped to the tie itself. This frees the hands for such things as making notes or adjusting equipment. —Hartwell M. Hughes

**HOW TO CUT
CONTROL SHAFTS**

When cutting short a potentiometer shaft, always hold the shaft, not the control, in your vise. The vibration caused by a hack-

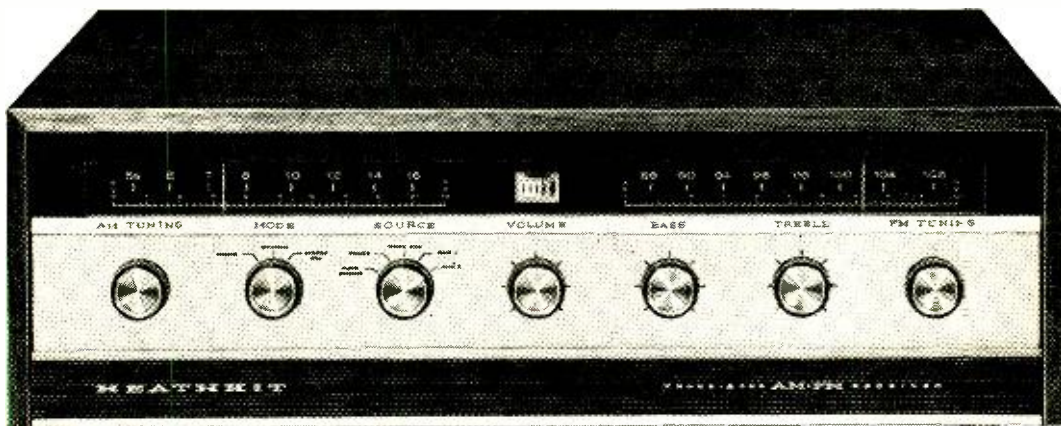


saw creates tremendous stresses that can damage bearing surfaces inside the control and make it noisy and possibly intermittent. The danger can be further reduced if a fine-tooth

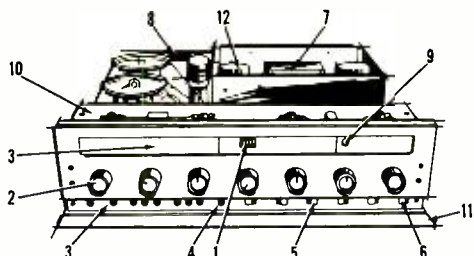
saw is used. After the shaft has been cut, finish the job by dressing down the rough edges with a file—a slight chamfer will allow the knob to seat easily in place.

—Donald E. Lancaster

first all-transistor stereo receiver kit!



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Two power amplifiers plus two preamplifiers that produce 40 watts continuous, 66 watts JHF music power . . . wide-band AM, FM, FM Stereo tuners . . . all beautifully housed in one compact, "low-silhouette" walnut cabinet. Add cool, instant operation plus the clean, unmodified sound of its 43 transistor, 18 diode circuit, and you have the exciting Heathkit Stereo Receiver. The first all-transistor stereo receiver kit! And it costs just \$195.00!

Advanced features include automatic switching to stereo; inputs for mag. phono & two other sources; filtered tape recorder outputs; high-gain RF stages; squelch control; AFC; effortless flywheel tuning; external antenna terminals; and preassembled FM "front-end" and 4-stage AM-FM I.F. strip. Just add two speakers, and you have a complete stereo system. "Transistor sound," designer styling, advanced features, and unmatched savings & performance . . . more than enough good reasons to move up to the Heathkit AR-13A Stereo Receiver. Tear out the coupon & order yours now!

Kit AR-13A, 34 lbs. \$195.00



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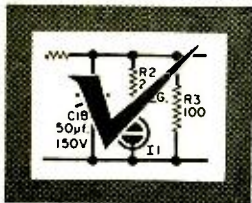
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HF-175

CIRCLE NO. 13 ON READER SERVICE PAGE

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 readers. Here's how it works: Check over the list below. If you can help anyone with a schematic or other information, *write him directly*—he'll appreciate it. If you need help, send a post card direct to **OPERATION ASSIST**, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016. Give the maker's name, the model number, year of manufacture, bands covered, tubes used, etc. Be sure to print or type everything legibly, including your name and address, and be sure to state specifically what you want, i.e., schematic, source for parts, etc. Remember, *use a post card*; we can handle them much faster than letters. And don't send a return envelope; your response will come from fellow readers. Because we get so many inquiries, none can be acknowledged, and POPULAR ELECTRONICS re-

serves the right to publish only those requests that normal sources of technical information have failed to satisfy.

Schematic Diagrams

Crosley "Armstrong" regen. receiver, type 6, no. 1.113.149, dated 1914. (Hilary J. Haupt, Cmr Box 1148, Selfridge AFB, Mich.)

Philco Model 118 superhet receiver. Tunes BC and 4.2-12.0 mc. (Eugene Wagner, 1611 6th Ave., Kearney, Nebr.)

Philco Model 40-150 receiver, code 121. Tunes BC and s.w. bands. (H. H. Chase, 1916 St. Albans Rd., San Marino, Calif.)

Approved Electronic Instrument Model A-200 signal generator. (Dave Barta, 100 S. 5th, Leavenworth, Kans.)

Mendes Type MS225W 5-tube German-made receiver, no. 5006S. Covers 4 bands. (James Prout, 1810 Woodmont Rd., Huntington 1, W. Va.)

Scott FM-AM "Philharmonic" receiver. Covers 150 kc.-64 mc. in 4 bands. Has 27 tubes on tuner chassis. 6 on power amp./supply. (Douglas W. Johnson, 1590 Walton, Rochester, Mich.)

Stromberg-Carlson Model 340-M receiver, ser. H2 179472. Has EM speaker, 7 tubes and "eye." (Gordon E. Fish, 2648 Jackson Dr., Salem, Va. 24153)

Silvertone all-wave receiver, chassis 110555, about 1939. 10 tubes. (Clyde Balsley, 3246 Larga Ave., Los Angeles 39, Calif.)

Philmore Model 7001C, 2-band regen. receiver. (J. Schmelzer, 174 Shenandoah Rd., Buffalo, N.Y. 14220)

Daco Model 606 tube tester, ser. 1841. (Ray Hatfield, 610 Scott St., Bloomington, Ill.)

Superior Equipment Co. Model CA-11 signal tracer. (John Atwood, 36 Belleclaire Ave., Longmeadow, Mass. 01106)

(Continued on page 32)

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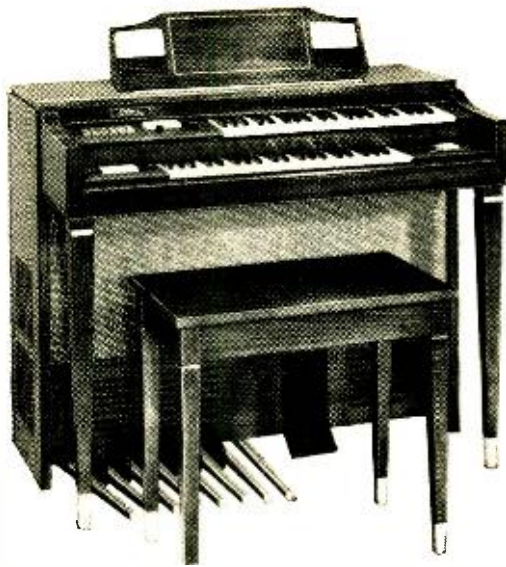


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CIRCLE NO. 13 ON READER SERVICE PAGE

Operation Assist

(Continued from page 30)

RCA Model MI-1329A 16-mm. movie projector/amplifier, ser. P-5226, type PG-170. (S. LeRoy French, 71 Summer St., Lynn, Mass. 01901)

National HRO Model GR-9 receiver, ref. 10EW/841. Tunes 1.7-30 mc. Built for R.C.A.F., circa W.W.II. (G. Floyd, 160 Victoria St., W., North Bay, Ontario, Canada)

GE ST-2A oscilloscope, about 1949. (Tom Jones, 1811 Leola St., Lomita, Calif.)

Crosley "Super II" Model 1117 receiver. Tunes BC, s.w. in 2 bands. (Gary K. Williams, 25446 Keeler, Detroit, Mich. 48239)

Philco 2-band receiver, type 60, code 121. Tunes 1.5-4 mc. (R. L. Young, Woodmont, Conn.)

Slagle Radio Co. Model 9 receiver, ser. 561, built around 1927-28. Tunes BC, s.w. bands. (Wm. P. Stiles, 6980 Trenton-Franklin Rd., Middletown, Ohio 45042)

Westinghouse Model S13 8-tube receiver, ser. 151549, about 1936. Tunes BC and s.w. (Bill Gilmour, 19 Edgewood Ave., Hamilton, Ont., Canada)

RCA rack-mounted receiver built for C.A.A. in 1930's. R.f. section, CA-436; power control, CA-438; power supply missing; i.f. amplifier, CA-437. (C. W. Averre, Box 22, Fletcher, Okla. 73541)

Spartan Model 1567 receiver, chassis 1567. (Ron Koehler, 4924 Pacific Ave., Long Beach 5, Calif.)

Crosley Model 739A 2-band, 7-tube receiver. Covers BC and s.w. (Joe Blum, Rte 1, New Washington, Ohio)

Atwater Kent Model 49 receiver, circa 1926. (Jim Rhodes, 12312 W. 51 St., Shawnee Mission, Kan.)

Temple 5-tube radio-phonograph combo., about 1946, model unknown. (Mark Hodes, 833 Corbin Ave., New Britain, Conn.)

Atwater Kent Model 1560 receiver. (Gene F. Elmore, Rte 1, Box 146, Spencer, W. Va.)

Atwater Kent Model 42 receiver. (Ronald Ferrell, Box 904, Delano, Fla.)

RCA Victor "Duo" Canadian-made 6-tube receiver, about 1940. Covers BC and s.w. (David Anderson, Box 397, Carnduff, Sask., Canada)

Sylvania Model 5 synchroscope, 1945, designed by M.I.T. Radiation Lab. (John J. Browne, The Abbey School, Canon City, Colo.)

Link Model 2750 FM mobile transceiver. (A. P. Goodwin, 6605 Azalea Dr., Little Rock, Ark. 72204)

Radio Craftsman C-300 equalizer-preamp, about 1953. (J. A. Lefley, 7423 S. Kingston Ave., Chicago 49, Ill.)

Hudson American Corp. "Corsair II" marine radiotelephone. Has 4 bands, 7 tubes. (B. Kasha, 256 Old Rd., Sewaren, N.J. 07077)

Philco Model 46-420 AM receiver, code 125. (James Wineke, 108 First Ave., Reisterstown, Md.)

Belmont Radio Corp. Model R.E.H. 1-CDL-46271 BC-s.w. receiver. Navy surplus. (D. R. Ward, 5297 Branciforte Dr., Santa Cruz, Calif.)

RCA Ltd. AT12 transmitter, R.C.A.F. surplus, ref. 100/3684. (Don Vitz, 323 Waverly Ave., Cincinnati, Ohio 45215)

Crosley Model 170 9-tube BC-s.w. receiver. (R. E. Taylor, 1611 Jones Ave., Bowling Green, Ky.)

Special Data or Parts

Philco battery-powered r.f. generator, about 1940; covers 110 kc.—20 mc.; uses 1C6 tubes. Schematic and 1C6 tube needed. (D. Bertollo, 40 Bamford Ave., Hawthorne, N.J. 07506)

Crosley Model 816 receiver. "Phantom conductor audio expressionator" 41187 tube wanted, or source for modern replacement. (Ray G. Hunter, R.R. #1, Greenville, Ill.)

Philco Model 90 9-tube AM console, circa 1928. Schematic and parts list wanted, plus pictorial if possible. (Phillip McDonald, Benvenuea, Berkeley, Calif.)

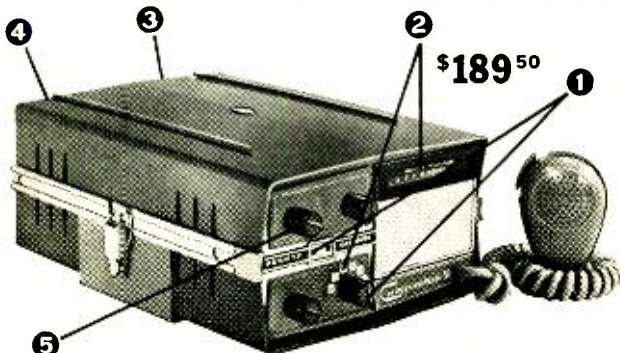
(Continued on page 38)

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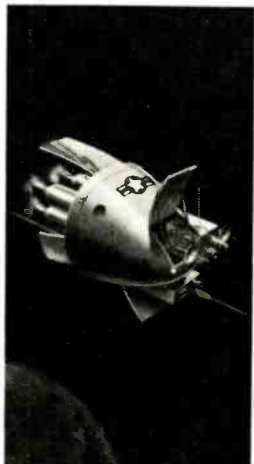
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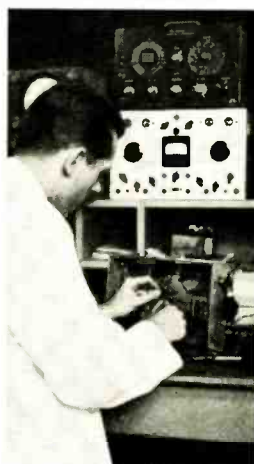
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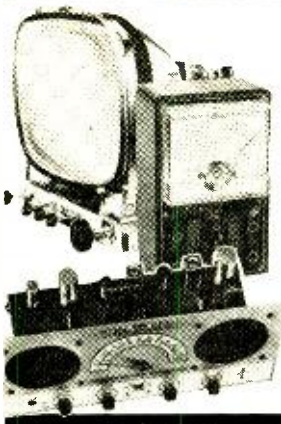
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Operation Assist

(Continued from page 32)

Crosley Model 51 2-tube amateur receiver, ser. 11108E. Source for parts and schematic wanted, plus any other info. (Armand J. Brucato, Grove St., Norfolk, Mass. 02056)

Crosley Model 52TF receiver, ser. 76. Schematic and service manual needed. (M. Fedorka, 688 Old Town Rd., Trumbull, Conn. 06611)

Atwater Kent Model 40 receiver. Technical data and schematic needed. (Larry Carris, 2833 Randolph Rd., Sufield, Ohio)

Superior Instrument Model TV-11 tube tester. Schematic and latest roll chart wanted. (Christie Urback, 3145 Salmon St., Philadelphia 34, Pa.)

Atwater Kent Model 20 receiver, around 1925; has 5 01A's. Schematic, parts list, technical data and operating info needed. (David Stefum, 2606 August Way, Rancho Cordova, Calif. 95670)

Atwater Kent Model 944 4-tube receiver. Operating data and schematic needed. (Keith Christensen, Vaughn, Mont. 59487)

Philco 2-band, 8-tube radio, type 18, code 121, before 1939. Schematic wanted and year of manufacture. (D. Lovett, Box 107, Keller, Va. 23401)

RCA 7-tube, BC-s.w. radio console, ser. A 012049, chassis RC606, about 1945. Parts list, schematic and voltage check chart needed. (Edward Levy, 65-27 175 St., Flushing, N.Y. 11365)

Emerson Model AC 168 5-tube superhet receiver. Service info needed, plus diagram and antenna data. (C. J. Beaumont, 439 Central Ave., Brooklyn 21, N.Y.)

Euophon FM receiver made in Italy, 1960 model. Parts list needed. (Steve Donohoe, 22310 Sandy Lane, Cleveland, Ohio 44126)

Philco Model TH-5 BC-band radio, code 121; has 5 loctal tubes. Schematic and voltage info wanted. (P. W. Puxley, 240 Highfield, Moncton, N.B., Canada)

Crosley Model 51 regen. receiver, about 1914; uses 2 Cunningham C-299 tubes. Operating instructions, schematic, and source for replacement tubes needed. (Doug Ortman, 2419 Caribbean Ct., Orlando, Fla. 32805)

Westinghouse "Radiola III-A" regen. receiver, about 1923. Schematic and battery info wanted, plus Myers tubes and Western Electric VT-1's. (J. F. Hall, 2750 Gosworth Rd., Victoria, B.C., Canada)

RCA Model R52-7741 broadcast receiver with Victor 245 amplifier, about 1930. Schematic and types 26, 27, 45 tubes needed. (E. W. Millican, 824½ Dorchester, Houston 22, Texas)

BC-1000A Signal Corps transceiver built by Philco in 1944; has 18 tubes, 40 channels, crystal-controlled. Schematic and specs or Army technical manual wanted. (David W. Misk, 1327 S. Oak Park Ave., Berwyn, Ill. 60402)

Hickock Model 546 tube tester. Operating manual and schematic needed. (Louis A. Josephson, 2331 Addison St., Houston 25, Texas)

Philco Model A-361 radio, code 121. Dial-cord stringing diagram wanted. (C. D. Prater, 106 Fulton Ave., Winchester, Ky.)

Simpson Model 351 TV antenna compass meter and termination box. Instruction manual needed, plus info on hookup and repair. (Al Hawkes, Hawkes TV Service, 10 Hardy Rd., Westbrook, Maine 04092)

Howard Radio Model 718X 3-band, 12-tube receiver; tunes from 550 kc. to 18 mc. Schematic and operating info needed. (T. W. McGraw, 794 Sunshine Dr., Los Altos, Calif.)

Fordly F-1000 AM-FM car radio. Parts for dial drive or new mechanism wanted. (John Manney, 240 Pater-son Plank Rd., E. Rutherford, N.J.)

Bremer-Tully "Counterphase" assembled kit, prior to 1925; has 5 201A's. Coils and variable capacitors needed; also schematic. (E. Hollstadt, 3957 Minnehaha Ave., Minneapolis, Minn. 55406)

Grebe Type CR-5 radio, ser. 455; tunes 150-3000 meters. Schematic and source for parts needed. (A. J. Williams, 2111 Fifth Ave., Altoona, Pa.)

-30-

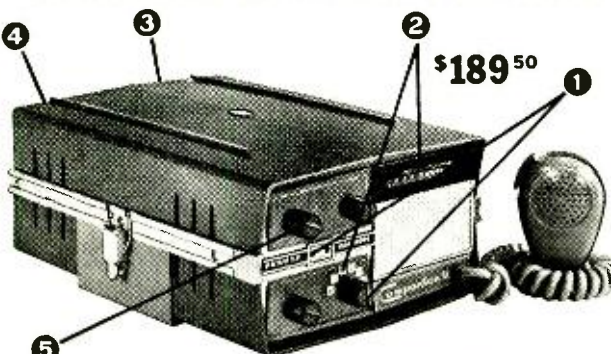
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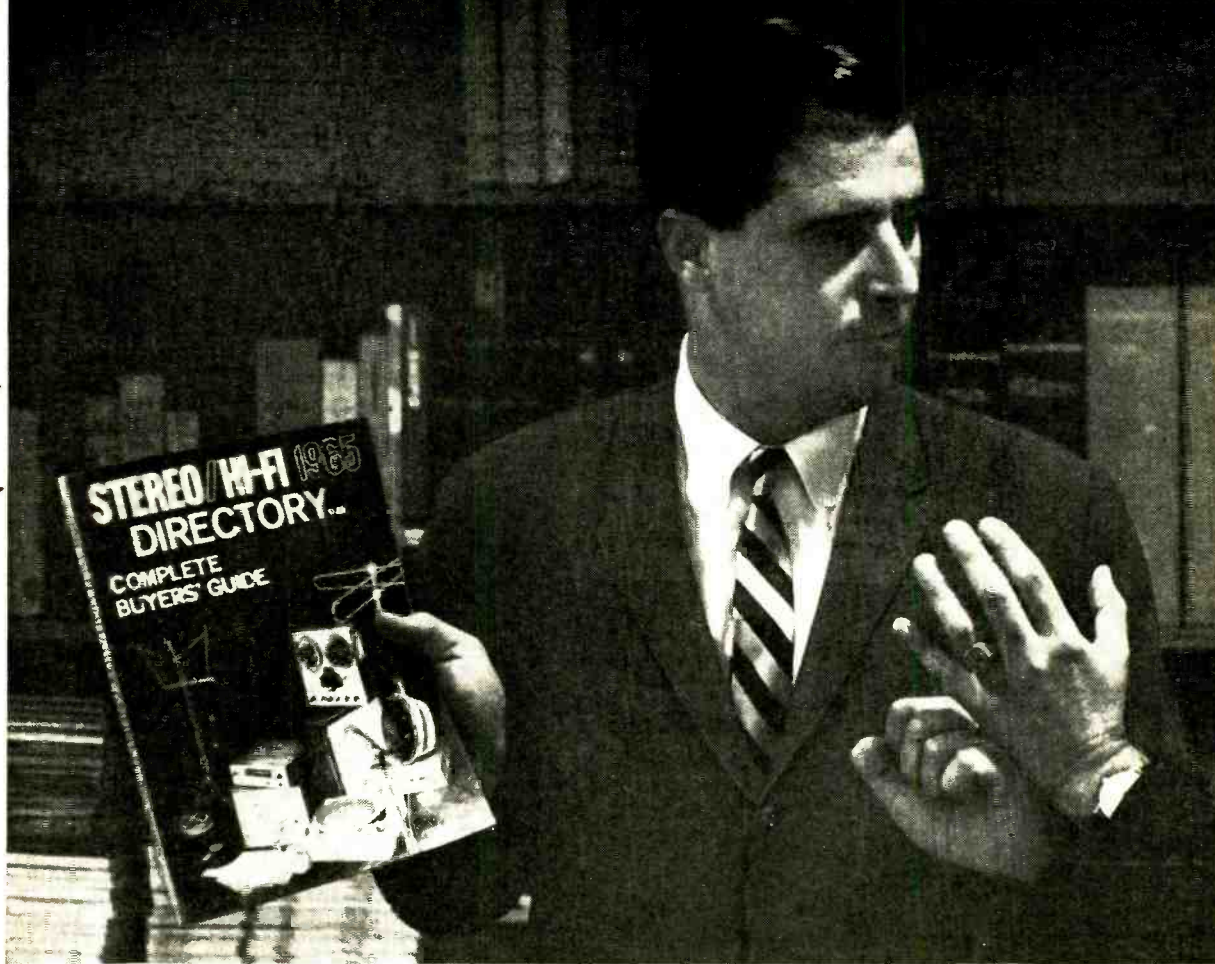
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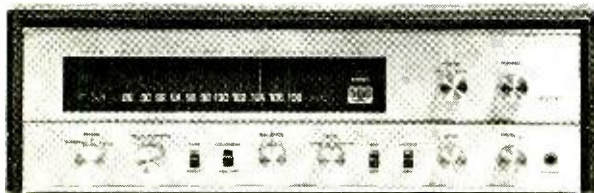
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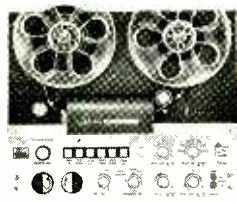
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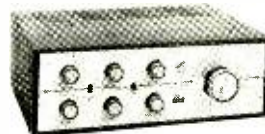
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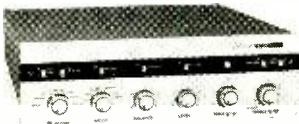


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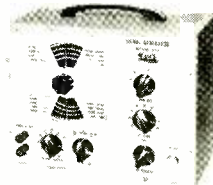


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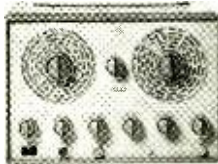
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By ROGER H. RUSSELL

Add dynamic realism to FM stereo and to your tapes and records. Superbly designed and inexpensive to build, this little unit is alone in its class

WHILE NEW GADGETS for the audiophile have not been slow in making an appearance on dealers' shelves, at least one has been consistently shoved aside or completely ignored: the volume compressor-expander. Here, for the first time, is a method of controlling the dynamic range of your hi-fi system for less than \$25.00. And the low cost is not the only attractive feature. Hirsch-Houck laboratory tests reveal that P.E.'s volume compressor-expander is virtually unmatched in its performance, even when compared to commercial units costing much more.

What exactly is volume compression-expansion? It's as simple as this: The dynamic (loudness) range of live program material is usually much wider than a recorder or broadcast transmitter can handle. If, for example,



Controls on front of unit (photo above) are threshold controls which determine the level at which expansion or compression takes place. Panel lamps *I1* and *I2* glow in proportion to the voltage of the audio tapped from speakers; switches control power, function.

Controls at rear of unit are d.c. balance pots which are adjusted initially. A cartridge, tuner, or other audio source is connected to inputs; outputs go to amplifier. Speaker jacks allow unit to sample amplifier output at speakers and react accordingly.



the gain is set halfway up, the soft parts will be accompanied by noise (tape hiss, hum, etc.) and the loud parts will be distorted from overdriving the recording or broadcast amplifier. Unfortunately, the solution to this problem—turning up the amplifier on soft passages and turning it down on loud ones—destroys the dynamic range of the original program material.

Since automatic volume compression is used to some extent in all commercial recording and broadcasting, volume expansion offers the audiophile an easy way to restore dynamic realism to a broadcast or to a tape or disc recording. On the other hand, the volume compression of which this unit is capable will be useful for those who want to listen to background music or who want to listen to the hi-fi without disturbing their neighbors.

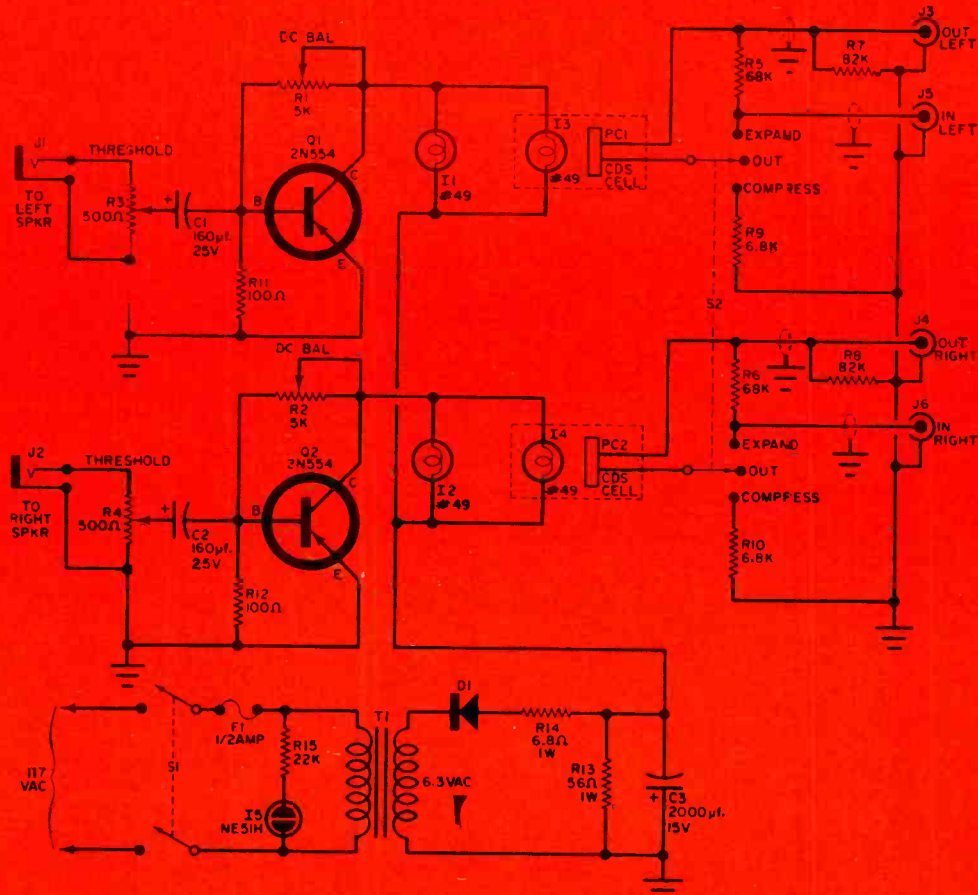
How It Works. The idea of using a lamp and cadmium sulphide photocell in a feedback circuit is not new, but few experimenters have had the chance to try this circuit in their hi-fi systems. Use of transistor amplifiers—unique with this unit—allows expansion and compression at relatively low listening levels.

Output voltage at the speaker terminals of each stereo channel is used to drive a transistor amplifier/limiter which, in turn, controls the intensity of

a lamp. The intensity of the lamp causes the resistance of a cadmium sulphide photocell to change. The CdS cell is switched in a voltage divider to either aid or retard the input voltage to the amplifier.

Since the input impedance of the transistor amplifiers is high compared to the impedance of the speakers, connecting the unit to the speaker terminals has virtually no effect on speaker performance. With the d.c. balance controls (*R1* and *R2*) adjusted so the lamps just go out with no audio at the speakers, a slight voltage input at the bases of *Q1* and *Q2* will fire the transistors and the lamps will begin to glow. The lamps will glow brighter as higher voltage is applied to the point where the transistors begin to saturate. The amplifiers act as limiters at this point—since a higher input will not increase output—preventing the bulbs from burning out.

Photocells *PC1* and *PC2* are placed next to lamps *I1* and *I2* respectively, and vary in resistance from almost infinity when the lamps are dark to a few hundred ohms when they are brightly lighted. For volume expansion, the photocells are switched into the part of a voltage divider circuit in series with the audio source (tuner, phono cartridge, etc.) and the audio amplifier. Resistors *R5* and *R7* in the left channel, and *R8* and *R6* in the right channel, are selected

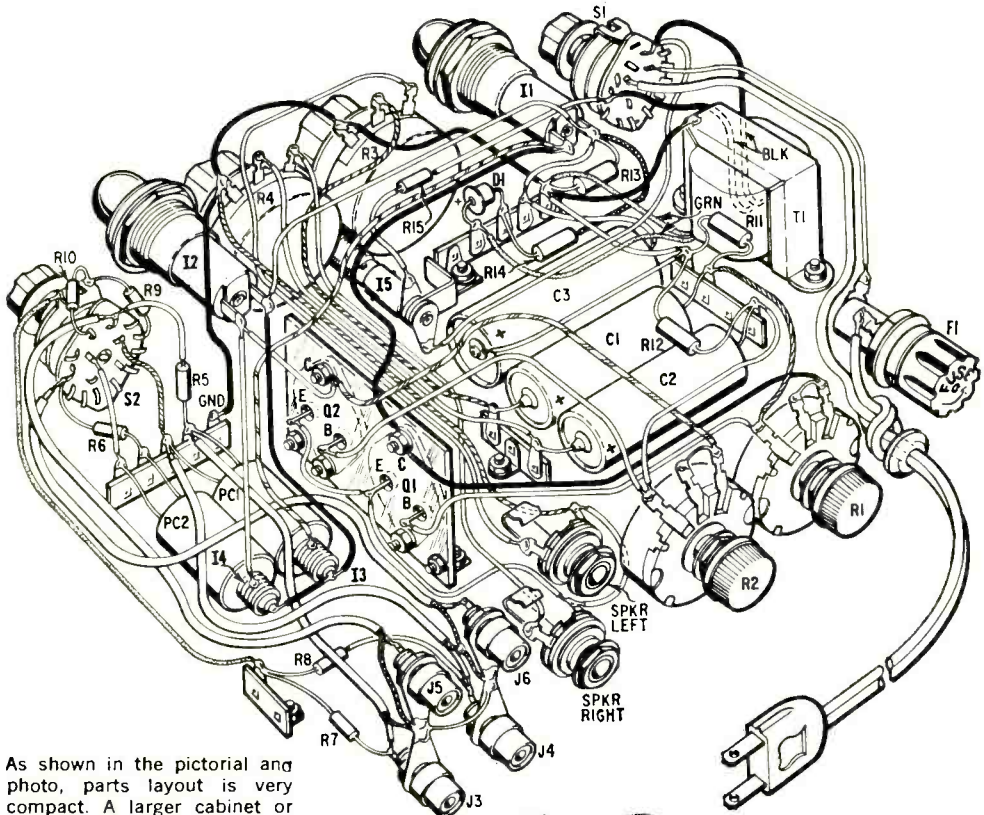


Simple circuit is duplicated for each channel. Basically, it consists of a transistor amplifier that drives a pilot bulb. Photocell for each channel is in a voltage divider circuit which changes value as the light falling on the cell changes.

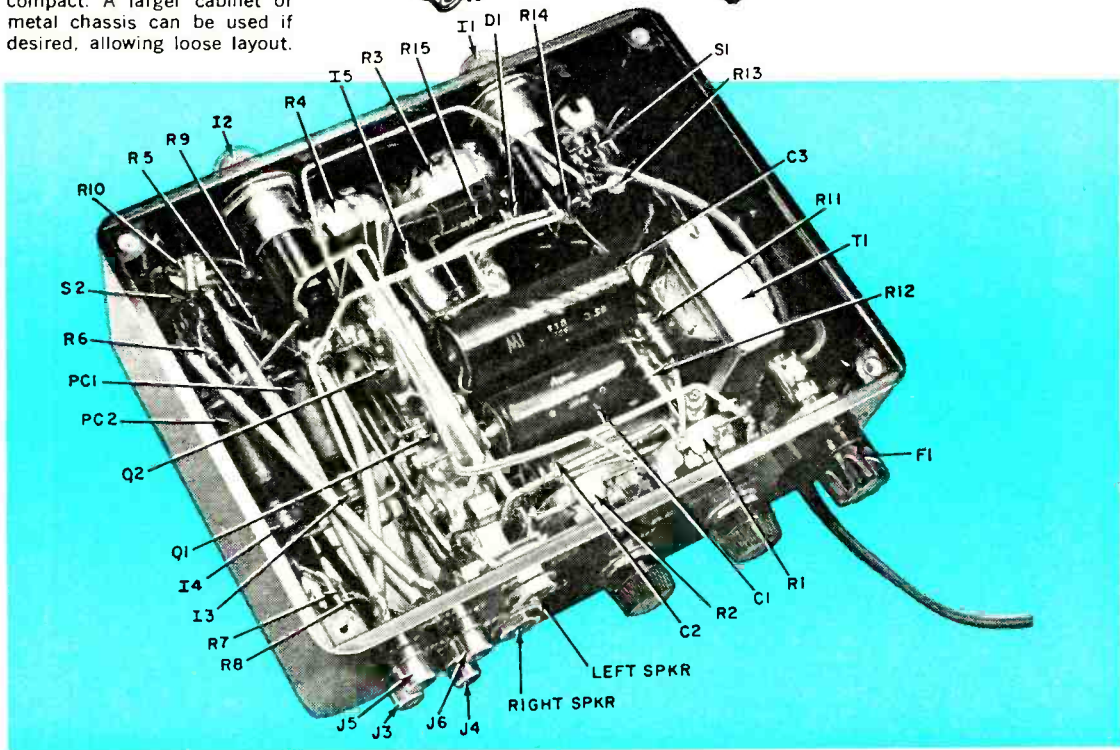
PARTS LIST

C1, C2—160- μ f., 25-volt electrolytic capacitor
 C3—2000- μ f., 15-volt electrolytic capacitor
 D1—200-PIV., 750-ma. "top hat" silicon diode
 F1— $\frac{1}{2}$ -ampere fuse, type 3AG
 I1, I2, I3, I4—#49 pilot lamp (GE)
 I5—NE-31H neon bulb
 J1, J2—Standard open-circuit phone jack (for speaker connections)
 J3, J4, J5, J6—Phono pin jack (single mounting hole type)
 PC1, PC2—Cadmium sulfide photocell (Lafayette MS-922 or equivalent)
 Q1, Q2—2N554 power transistor (Motorola) or equivalent
 R1, R2—5000-ohm, 4-watt wire-wound potentiometer
 R3, R4—500-ohm, 4-watt wire-wound potentiometer
 R5, R6—68,000-ohm, $\frac{1}{2}$ -watt, 5% resistor
 R7, R8—82,000-ohm, $\frac{1}{2}$ -watt, 5% resistor
 R9, R10—6800-ohm, $\frac{1}{2}$ -watt, 5% resistor
 R11, R12—100-ohm, 1-watt, 5% resistor

R13—56-ohm, 1-watt, 10% resistor
 R14—6.8-ohm, 1-watt, 10% resistor
 R15—22,000-ohm, $\frac{1}{2}$ -watt, 10% resistor
 S1, S2—4-pole, 3-position rotary switch (Lafayette SW-30 or equivalent)
 T1—Filament transformer, 6.3 volts @ 1 ampere
 1—Bakelite cabinet (Lafayette MS-218, 2 $\frac{1}{4}$ " x 5 $\frac{1}{4}$ " x 6 $\frac{3}{4}$ ", or similar)
 1—Panel for cabinet above (Lafayette MS-219)
 2—Panel lamp assemblies for I1 and I2 (Dialco 930 series less resistor or equivalent)
 1—Bayonet-type bulb holder for I5
 1—Fuse holder for 3AG fuse
 1—Length of polystyrene tubing, $\frac{3}{8}$ " o.d., $\frac{3}{8}$ " i.d. (Lafayette P-475 or equivalent)
 1— $\frac{1}{8}$ " polystyrene sheet cut to 1 $\frac{3}{4}$ " x 2 $\frac{3}{4}$ " for mounting Q1 and Q2
 Misc.—Rubber grommets, terminal strips, 6-32 x $\frac{1}{4}$ " hardware, knobs, wire, shielded cable, a.c. line cord, small brackets for mounting Q1-Q2 mounting board, cement, tape, plastic lens for I5, etc.



As shown in the pictorial and photo, parts layout is very compact. A larger cabinet or metal chassis can be used if desired, allowing loose layout.



to give the desired amount of expansion—about 6 db in this case—as the resistance of *PC1* and *PC2* changes. Voltage relationships for expansion can easily be seen in the curve below. With the unit in the “out” position (*PC1* and *PC2* out of the circuit), any increase in audio input results in an equal increase in output as shown by the straight-line “out” curve.

In the “expand” position, a small increase in the input causes a large increase in output, and this *unequal* change in voltages is where expansion occurs. Did we get something for nothing? No, because the output was 6 db less than the input to start with (6 db is the “line” or insertion loss of the unit), but the amplifier doesn’t know this. On “expand,” it sees the output only as a fast rising voltage.

For compression, *PC1* and *PC2* are switched into voltage dividers that now include *R9* and *R10* as well as *R5* and *R7* and *R6* and *R8*. Here, *PC1* and *PC2* are connected in parallel across the audio source in combination with *R9* and *R10* respectively. As shown by the “compress” curve below, a large increase in input results in a small increase in output. This unequal change is where

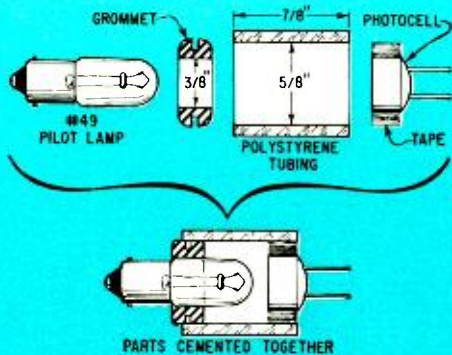
compression occurs, to a maximum of 15 db. The amplifier now sees the output as a slowly rising voltage.

The amount of expansion is determined by the size of *R5* with respect to *R7*, and the size of *R6* with respect to *R8*. If *R5* and *R6* are made larger, more expansion may be obtained; if they are made smaller, less expansion will result. On “compress,” smaller values for *R9* and *R10* will give more compression; larger values will give less.

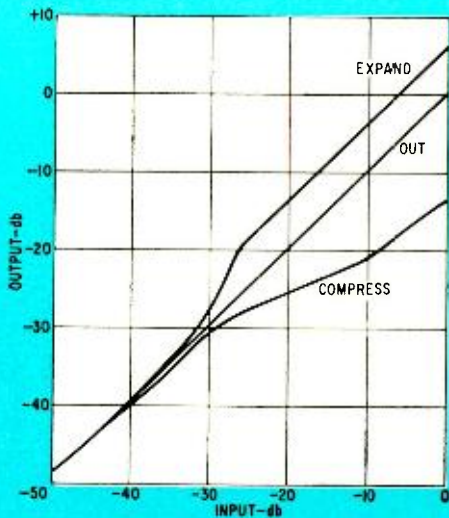
Construction. Although a metal chassis can be used for the compressor-expander, a Bakelite instrument case was selected for ease of construction—it can be drilled and filed much like wood—and compactness. Place drafting tape on the front and rear of the case and use a pencil to locate holes to be drilled. Larger holes should be filed or reamed as large drills can cause chips around the hole being cut.

Mount the components using lock washers on the inside to prevent slippage on the smooth Bakelite. The power transistors do not require a heat sink in this application and are mounted on a piece of clear polystyrene. If transistors *Q1* and *Q2* are mounted on a metal

(Continued on page 114)

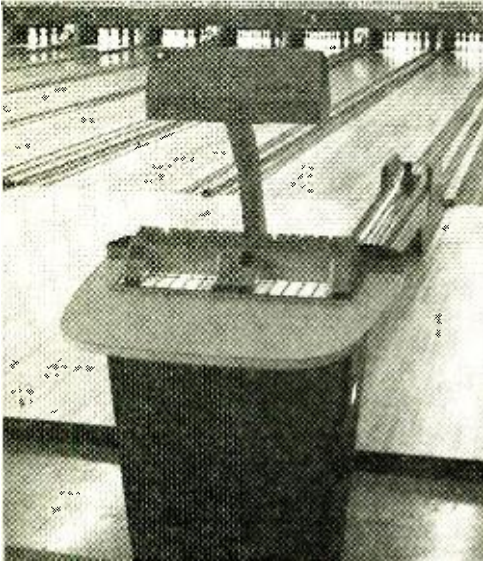


Photocell-pilot lamp assemblies—one for each channel—are constructed as detailed here (see text).



Hirsch-Houck laboratory curve shows 6 db expansion and a maximum of 15 db compression for P.E. unit.

New Job for Computers



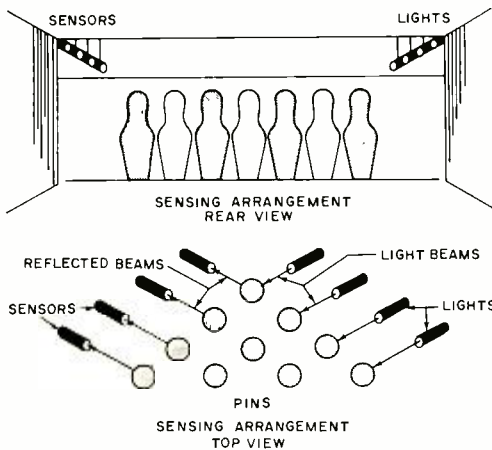
The American Bowling Congress started testing the "ScoRite" robot scorekeeper last June. By the time you read this article, one of the new computers may already be installed in your local bowling alley.

YOU ROLL the ball down the alley, and if you knock down all the pins, that's a strike, and you don't bowl again until it's your turn. If you don't knock down all the pins the first time you throw the ball, you get another chance. If you knock the rest of them down with your second ball, that's a spare. If you still have some standing after your second ball, the number of pins you knocked over gets marked down for the frame, but if you make a strike or spare, you don't mark anything down until after you throw one or two more balls. Confusing? You bet it is—if you're just learning to bowl! But now electronics is in the picture in the form of the "ScoRite," a fully automatic score keeper built by DoBan Labs, Sunnyvale, Calif., and being tested by the American Bowling Congress.

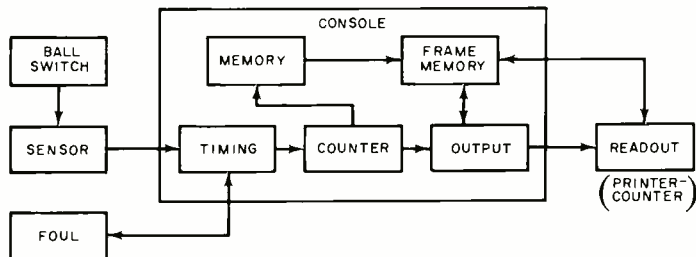
When the ball strikes the back of the alley, and before the automatic pinsetter goes to work, four lights at the left of the lane flash in rhythm, 25 milliseconds apart. The pins still standing reflect the beams to four sensors on the right. The signals from the sensors are added, subtracted from ten, and stored in a memory bank until a second ball is thrown and the process repeated. The computer adds the scores for each frame and provides a printed score sheet at the end of the game.

An extra added attraction is built into the "ScoRite." If you feel the need for refreshment, or if the cute gal two alleys away seems in need of coaching, the "ScoRite" will let you flip one of its switches and take off. The unit will then obligingly await your return, meanwhile continuing to keep score for the other players.

—W. R. Wise



Drawing of sensing arrangement above and block diagram at right show basic method of operation. The frame memory stores strikes and spares, as score for frame in which strike or spare is bowled is determined in the following frame.





FIDO'S WHISTLE- CONTROLLED FLIVVERS

"Radio" model control with a dog whistle?

You'll want to try this simple, yet highly unusual, remote control unit

A SURPRISING number of conventional thinkers insist that dog whistles are good only for calling dogs. These folks are, of course, mistaken. A dog whistle can also be used to call an automobile—a battery-operated miniature—or to stop and start just about anything else that lends itself to remote control.

If you've been wanting to try your hand at the fascinating radio control hobby but have hesitated because of cost or circuit complexity, you should investigate the properties of the so-called "silent" dog whistle. This tiny device's two most important virtues, simplicity and economy, make it a natural starting point for those who want to experiment with remote control of moving objects. "Fido's Flivvers" are examples of what can be

By **HARTLAND B. SMITH**, W8VVD

October, 1964



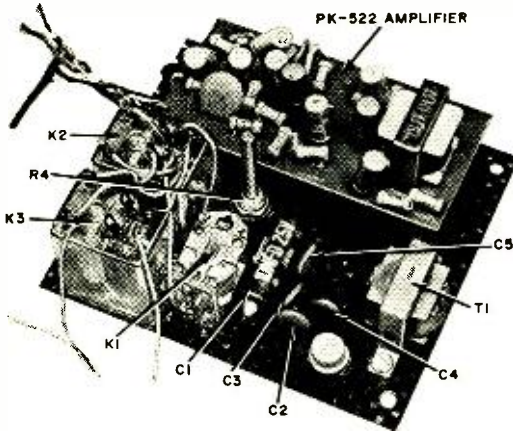
FIDO'S WHISTLE-CONTROLLED FLIVVERS

accomplished along this line without spending a great deal of money, and even more intricate control arrangements (steering, etc.) are feasible. In any event, you're sure of drawing a crowd of amazed, skeptical onlookers when you tell them that your model answers to a dog whistle!

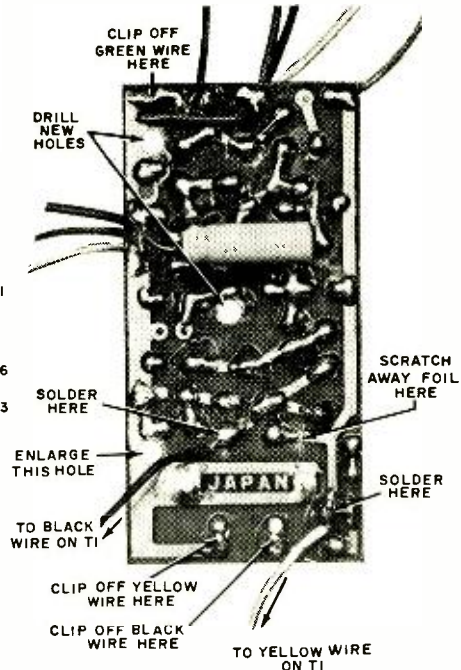
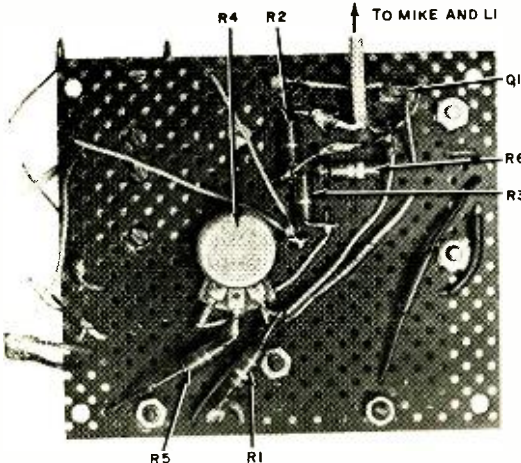
Control Unit. As shown in the schematic, the output from a crystal mike is fed to a frequency-selective network and then into a factory-built three-transistor amplifier, the Lafayette PK-522. Transformer *T1* couples the amplifier output to relay amplifier *Q1*, which actuates *K1*. In turn, *K1* operates the latching circuit consisting of *K2* and *K3* which starts and stops the car.

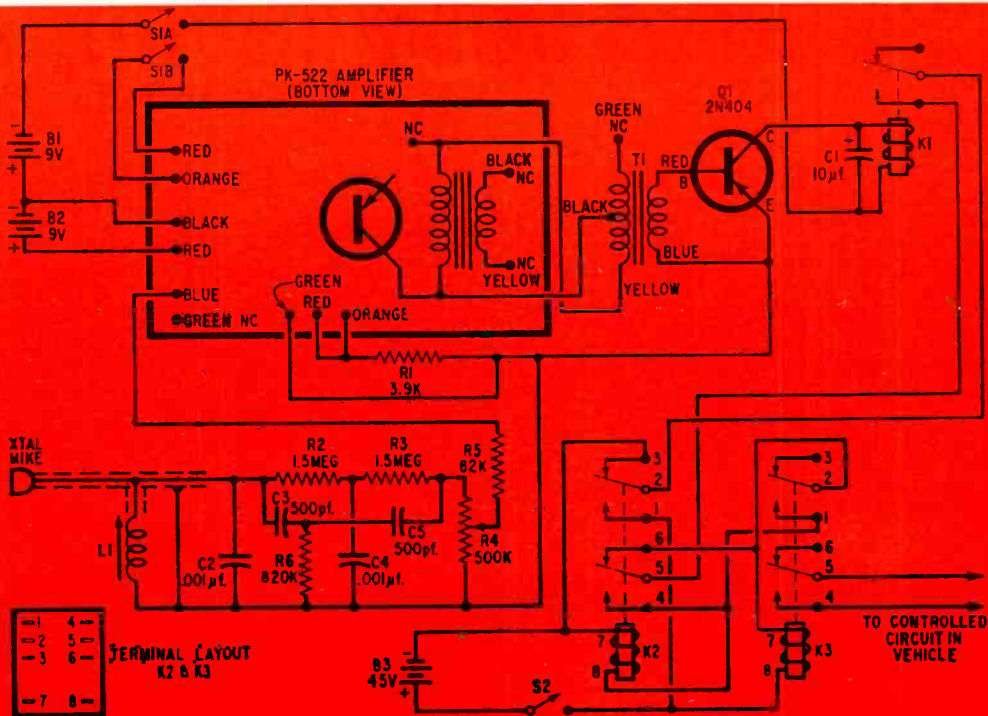
As indicated in the photos below, a piece of 3" x 3½" perforated circuit board serves as a chassis for the PK-522. Before mounting the amplifier, clip off its green input wire as well as the yellow and black speaker wires. Directly above the "AN" portion of the word "JAPAN," etched in the PK-522's circuit board, there is a blob of solder where one lead of the output transformer primary is connected. With a scribe, knife or other sharp instrument, carefully scratch away the foil running to this point. Make the scratch about ¼" to the right of the solder blob. Remove only enough foil to break the electrical connection.

The main branch of the conductor



The entire whistle-control unit is built on a 3" x 3½" piece of perforated circuit board as shown in the photos. A Lafayette PK-522 three-transistor amplifier is modified as shown and mounted on the board with spacers. Other major components are three relays and a relay amplifier made up of *Q1* and associated components. The layout is not especially critical, although the filter input circuit should be compact with reasonably short leads between parts.





All components within the heavy black lines are part of the PK-522; those outside are added. Use shielded wire for the mike lead and for the leads to coil L1 if it is remotely mounted.

PARTS LIST

B1, B2—9-volt transistor battery
 B3—45-volt battery (Burgess U30 or equivalent)
 C1—10- μ f., 25-volt electrolytic capacitor
 C2, C4—0.001- μ f. ceramic disc capacitor
 C3, C5—500-pf. ceramic disc capacitor
 K1—S.p.d.t., 5000-ohm relay (Lafayette F-260)
 K2, K3—D.p.d.t., 5300-ohm relay (Lafayette F-332)
 L1—45-215 mh. TV width coil (Stancor WC-14 or J. W. Miller 6330 available from Burstein-Applebee Co., 1012 McGee St., Kansas City 6, Mo., under Stock No. 17B764 @ \$1.76)
 Q1—2N404 transistor
 R1—3900-ohm, $\frac{1}{2}$ -watt resistor
 R2, R3—1.5 megohm, $\frac{1}{2}$ -watt resistor
 R4—500,000-ohm miniature volume control (Lafayette VC-37 or equivalent)
 R5—82,000-ohm, $\frac{1}{2}$ -watt resistor

R6—820,000-ohm, $\frac{1}{2}$ -watt resistor
 S1—D.p.s.t. slide switch
 S2—S.p.s.t. slide switch
 T1—Transistor driver transformer: primary, 10,000 ohms; secondary, 2000 ohms center-tapped (Argonne AR-109)
 1—Three-transistor amplifier (Lafayette PK-522)
 1—Miniature crystal mike (Lafayette PA-40)
 1—"Silent" dog whistle
 1—3" x 3 $\frac{1}{2}$ " perforated circuit board
 1—Transistor socket
 Misc.—Machine screws, spacers, wire, solder, foam rubber, cotton, tape, etc.
 Antique auto, the "Flying Dutchman," made by Remco Industries, 113 North 13th St., Newark 7, N.J.; 1934 Duesenberg Convertible by Ideal Toy Corp., Hollis 23, N.Y.

broken in this step runs along the right-hand edge (see photo at left). At the bottom end, just beyond where it jogs a bit to the left, there is another solder blob; attach a 6" length of hookup wire to this blob. Solder a second 6" wire to the other transformer primary terminal which you will find directly above the letters "JA." These two leads go to T1's black and yellow wires.

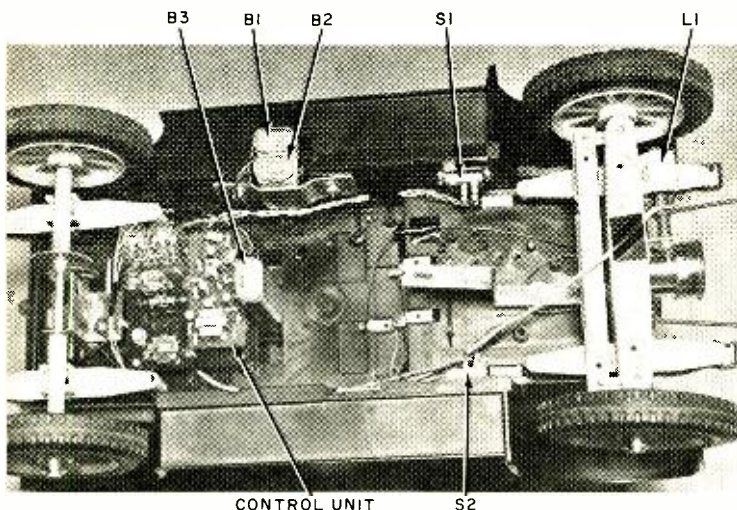
As originally supplied, there are two

small mounting holes in the PK-522's printed board. The hole to the left and slightly above "JAPAN" should be enlarged to pass a 6-32 screw. Drill new holes at the upper left corner and at the center of the board. Three 6-32 x $\frac{3}{4}$ " screws, with $\frac{1}{16}$ " spacers, hold the amplifier to the main board.

Mount the other components as shown in the photos, positioning and bolting down T1, R4, K1, K2, and K3. The ca-



FIDO'S WHISTLE-CONTROLLED FLIVVERS



Bottom view of the "Flying Dutchman" (see the photo on the first page of this article) showing location of control unit. With this car, the unit fits underneath, the batteries in the hollows as shown. The coil (L1) was mounted at the front to avoid inductive pickup from car motor. Holes were drilled just behind front fenders for mounting switches S1, S2.

capacitors and resistors are simply pressed through the holes and wired into the circuit. Transistor *Q1* is mounted on the board at the corner near *T1*, and the other component leads soldered directly to its socket.

Installation. If the model you plan to control is large enough, you can hide most of the components—as was done with the toy car shown above and in the photo on the first page of this article. In this car (a Remco Industries "Flying Dutchman"), the control unit was placed under the car while *S1* and *S2* were mounted just above the running boards. Four pieces of $\frac{1}{4}$ " polystyrene rod $\frac{3}{8}$ " long were cemented to the underside of the car floor to support the circuit board. Before installation, one end of each rod was drilled and tapped for 6-32 mounting screws.

Oddly enough, it was possible to clamp *B1* and *B2* inside the dummy battery compartment molded in one running board. Battery *B3* was pressed into the hollow rear seat support.

To prevent *L1* from inductively picking up unwanted electrical impulses from the drive motor located at the rear of the car, it was bolted to the front axle. The microphone was hidden behind twelve $\frac{1}{8}$ " holes drilled in the rear seat, and mounted using sponge rubber and



Holes were drilled in back seat of "Flying Dutchman," mike mounted behind with foam rubber, tape.

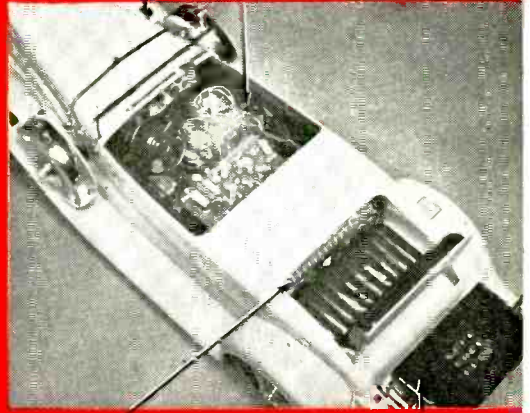
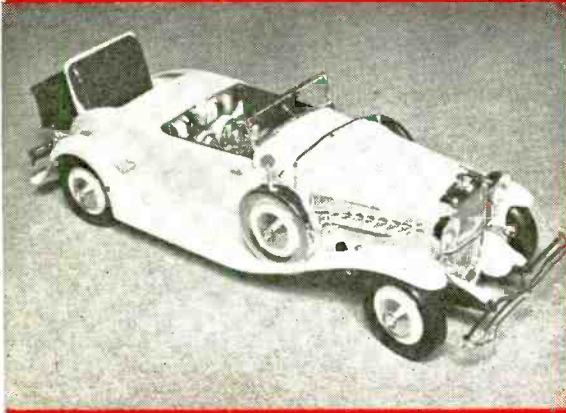
tape to minimize mechanical vibration and transmission of low-frequency rumble. Shielded wire must be used to connect both the microphone and *L1* to the junction of *C2*, *C3*, and *R2*. Finally, one of the leads to the auto's battery-powered motor was broken and the ends connected to terminals 4 and 5 of *K3*.

Duesenberg Convertible. The photos at right illustrate a conversion of Ideal Toy Company's 1934 Duesenberg Convertible—a sophisticated model in kit form with built-in "Cam-a-matic Action" which steers the car, shifts it into forward or reverse, and turns the headlights on and off. However, since these

Duesenberg Convertible lends itself to whistle control; the model also has automatic steering, gear shifting, and light switches built into it.

Control mechanism easily fits into the front seat of Duesenberg; microphone and B1 are hidden in balsa wood box cemented to car's luggage carrier.

S1 CONTROL UNIT



B1, B2 AND B3 PERCHED
ATOP CAR'S 3 MOTOR
BATTERIES

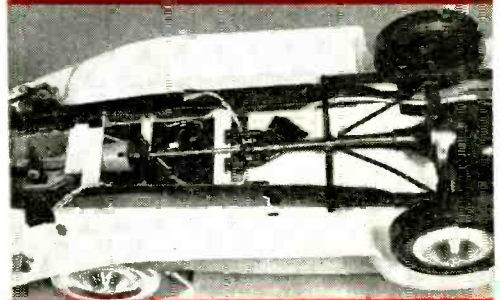
L1 AND MICROPHONE
IN THIS BOX

operations are automatically repeated in a fixed sequence after the car has been manually started, the danger of a disastrous collision is ever present. Without remote control, a fellow can wear himself out chasing after the car to prevent it from crashing into the davenport, TV set, or a floor lamp.

Since space limitations precluded mounting it under the car, the control unit was mounted in the space normally occupied by the Duesenberg's front seat. Switches S1 and S2 were located in the front fenders just ahead of the spare wheels, and both L1 and the microphone were housed in a small box fashioned from balsa wood and painted black. The box was then cemented to the rear luggage rack. As shown in the bottom photo, the microphone was floated in absorbent cotton to minimize vibration problems.

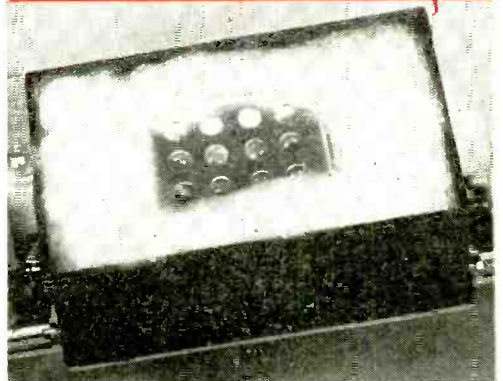
Room was found for B1, B2, and B3 in the car's battery compartment in front of the rumble seat; a few pieces of sponge rubber squeezed between the batteries and the car body prevent them from flopping around when the vehicle is handled. The Duesenberg's regular on-off switch is actuated by pushing on the tail-pipe. The wire running from this switch to the drive motor was cut, and

(Continued on page 115)



Bottom view of completed Duesenberg. Long wires are prevented from dangling on ground by taping them to car body at strategic intervals.

Box on luggage carrier with recessed ferrules. Coil L1 is hidden normally by the absorbent cotton in which the microphone is nested.





HIGH SEAS CALLING

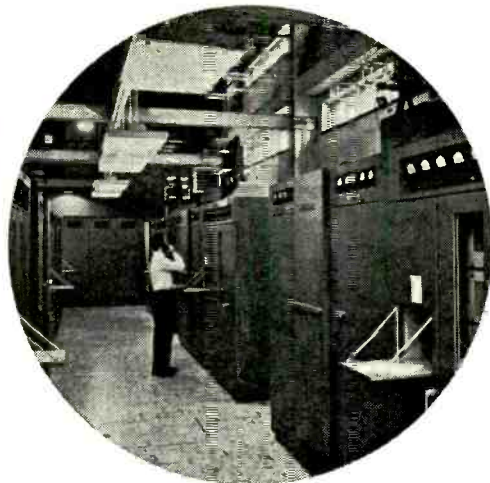
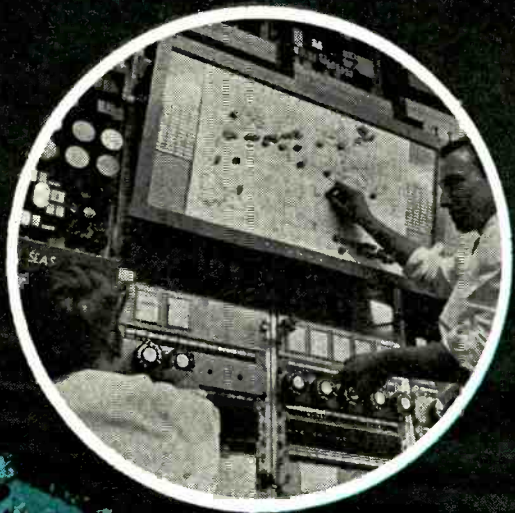
Romance of the high seas
short-wave receiver and

By E. H. MARRINER, W6BLZ

FAR OUT in the ocean a passenger ship plows through the blue Pacific on its way across the sea. Down in a stateroom, a businessman picks up a telephone and places a call through the ship's radio to his home office many thousands of miles away. Far to the south, on the Gulf of Tehuantepec, a puff of wind laden with strange odors from the coast of Mexico gently rolls a tuna boat. In the cabin, a fisherman has just listened to the weather report and is placing a call to California for a chat with his family after a hard day's work. These and many similar conversations

can be heard by the SWL if he knows where to listen on his short-wave receiver.

Overseas Radiophone Service. For many years, the Long Lines Division of the American Telephone and Telegraph Co. has offered an overseas radiophone service for ships. The high seas telephone service provides two-way telephone communication between a vessel at sea and a land telephone. A long-range service, separate from the coastal harbor service which is used by small vessels in local waters, it was designed for use by ships that sail further than



Circle photos courtesy AT&T Long Lines Dept.



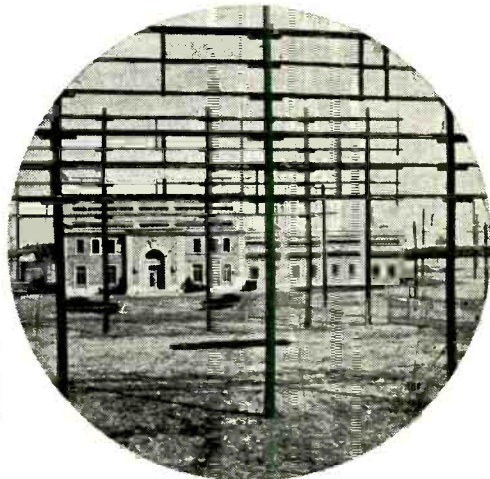
Photo of Queen Elizabeth courtesy Cunerd Lines

comes into your home via your you can hear it all clearly

a few hundred miles from the U. S. mainland.

This service is available 24 hours daily and calls may be placed either to or from a ship. Skilled technicians and operators maintain the shore stations, broadcast storm warnings, and are alert for distress calls. The radiotelephone distress call is "MAYDAY" (pronounced like the French "M'aider" meaning "help me"). Urgent calls are preceded by the word "PAN."

These communications take place in the 4-, 8-, 13-, 17- and 22-megacycle bands. The choice of frequency depends



Ship's position is plotted (inset) and optimum antenna, transmitter, are chosen for communications by shore-based technicians. Transmitting station at Lawrenceville, N.J. (top) contains banks of transmitters. Rhombic antennas (above) direct calls toward Europe, Africa, and South America from New Jersey.

upon the varying distance between the shore and ship station together with the daily and seasonal variations in radio propagation conditions. (The coastal stations used for small boat contacts are located in the 2-megacycle band.) Over 1700 vessels make use of the high seas telephone service, with the bulk of the traffic being between the shore stations and some 70 liners that ply the Atlantic, Pacific, and Mediterranean areas.

HIGH SEAS CALLING

To provide these long-distance contacts, special rhombic antennas, some of them 640 feet long, are used. The antenna circuit chosen depends on the ship's position. The transmitter and receiver are switched to the "optimum" frequency as indicated on current propagation charts, and the station then listens to be sure the channel is clear. If it is not, since only an emergency call would warrant interruption, the next higher or lower frequencies are tried instead.

How to Listen. The first step in tuning in on these conversations is to consult the table below. You should have a well-calibrated short-wave receiver, of course. Sometimes even then it is hard to locate these stations, as the transmissions are short. If you have a good frequency meter, you can set the receiver up and wait for the stations to come on, or a crystal calibrator will permit you to tune your receiver to the proper frequency. You can also tune back and forth across the band where you think a particular station should be at the times listed for special speech tests by the shore station.

For example, shore station KMI at Oakland, Calif., broadcasts test speech at 0100, 0300, 0500, 0700, 1900, 2100 and 2300 GMT. These broadcasts are made

during the first five minutes of the hour on 4377.4 kc., the second five minutes of the hour on 8754.4 kc., the third five minutes on 13182.5 kc., the fourth five minutes on 17342.5 kc., and the fifth five minutes on 22695.5 kc.

Twice daily KMI broadcasts a recording from the Weather Bureau stating if there are any storm warnings for the area covered. These broadcasts are made during the latter part of each of the test speech periods and throughout the day until the warning is canceled.

The Big Switch. All ship stations must convert to single-sideband operation by 1970, and the change-over is already in progress. While the cost of this change will be high and certain difficult problems will have to be solved, such as maintaining rigid frequency tolerances, the added range and clarity will make the conversion worthwhile.

As with any short-wave listening, nobody can guarantee that what you will hear will always be exciting—the content of the conversations will vary. (Divulging what you hear is, of course, not permissible under the Communications Act of 1934.) But if you are looking for new and fascinating ways to explore with your receiver, don't overlook the high seas telephone service—or the "call" of the sea!

-50-

LONG-DISTANCE HIGH SEAS RADIOTELEPHONE SERVICE

Shore Station Location	Station Call-Sign	Area Covered	Shore Transmitting Frequencies (kc.)	Ship Transmitting Frequencies (kc.)
New York, N.Y.	WOO-WOY	Atlantic	4396.6	4091.6
			4409.4	4104.4
			*4434.9	*4129.9
			8773.6	8223.6
			8811.9	8261.9
			13161.5	12361.5
			13196.5	12396.5
			17321.5	16491.5
			17356.5	16526.5
			22681.5	22031.5
22716.5	22066.5			
Oakland, Calif.	KMI	Pacific	4377.4	4072.4
			8754.4	8204.4
			13182.5	12382.5
			17342.5	16512.5
			22695.5	22045.5
Miami, Fla.	WOM	Caribbean	4428.6	4123.6
			8792.8	8242.8
			13154.5	12354.5

*Authorized for use from December 15 through March 15 only

NEW RULES TO GOVERN CB

AFTER considering Docket 14843 for some 20 months, the Federal Communications Commission, in a surprise move, adopted it on July 22 with few changes. Docket 14843 substantially alters Part 95 of the Rules and Regulations governing the Citizens Radio Service. The more important "Do's and Dont's" in the new rules are listed below in "quick-glance" capsule format.

DO use channels 9, 10, 11, 12, 13, 14, and 23 for interstation communications. Continue to use and monitor channel 9 as an emergency aid channel for travelers; this practice now has "semi-official" FCC approval.

DO get a copy of Part 95 of the FCC Rules and Regulations governing the Citizens Radio Service (CB). Note particularly the list of "prohibited" uses of CB itemized under Part 95.83. This section is in sharp contrast with the previous Rules which contained little about prohibited uses but itemized a few permissible communications.

DO use *your* equipment and a *different* call-sign if you qualify as a member of a duly licensed group activity such as a volunteer fire company, CD service, etc. You are then a mobile unit of the primary licensee.

DO follow the new rule limiting interstation communication to five minutes "on" and five minutes "off." This rule does not apply to units of the same station or to emergency communications.

DO continue to operate and use your old call-sign after moving to a new permanent address. However, you must apply within 30 days for a new call-sign, and be sure to notify the FCC of your temporary address.

DO be prepared to use any CB channel in case of emergency. Part 95.85 of the new Rules permits a waiver of all restrictions where immediate safety of life or immediate protection of property can be demonstrated.

DON'T use channels 1, 2, 3, 4, 5, 6, 7, 8, 15, 16, 17, 18, 19, 20, 21, and 22 for communications with stations other than your own mobile units. Interstation communications is now restricted to seven channels.

DON'T use CB for hobby communications, i.e., operating your station just to be "on the air." Don't interfere maliciously with the communications of another CB station. Don't test to solicit signal reports or discuss the performance of your equipment with stations other than your own mobile. Don't communicate with foreign "CB" stations.

DON'T use *your* call-sign when participating as a member of a CD, fire, or police auxiliary group. This group may need a new license and should apply for sufficient mobile units to include your station.

DON'T circumvent the "five-by-five" rule by changing frequency—it is now illegal to shift channels for this purpose. Remember that all stations in an exchange must observe the five-minute silent period.

DON'T operate from a new permanent address unless you have filed an application within 30 days after the change of address and simultaneously notified the FCC Engineer in Charge of the Radio District.

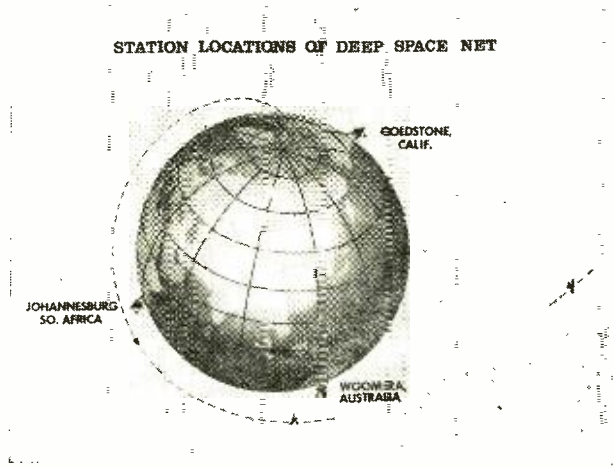
DON'T abuse the emergency provision. After each emergency use of a channel not designated for that purpose, you must file a notice of such use with the Engineer in Charge of the Radio District.

EDITOR'S NOTE: The new Citizens Band Rules were received only a few days prior to the closing of this issue. Nevertheless, it is evident that before these changes go into effect (November 1, 1964), several petitions and/or court actions will be taken to stall the implementation of the changes. In reviewing the 20-month period since the rule changes were first suggested, it appears that CB has gone a long way to conquer and alter some of its own defects. CB has continued to grow in terms of public interest and public service. Although the staff of POPULAR ELECTRONICS feels that certain rule changes were overdue, the finalized version of Docket 14843 appears to us to be overly suppressive. Unfortunately, many of the filings made by CB'ers in response to the original Docket were unrealistic and painted (to the Commissioners) a poor picture of CB. If you are a CB'er, we urge you to intelligently express your sentiments in original letters to your Congressman and the FCC to support petitions for a rehearing and presentations of new evidence proving the value of CB. A proposal for the resolution of the "hobby-style" communications problem will appear in the November issue of POPULAR ELECTRONICS.

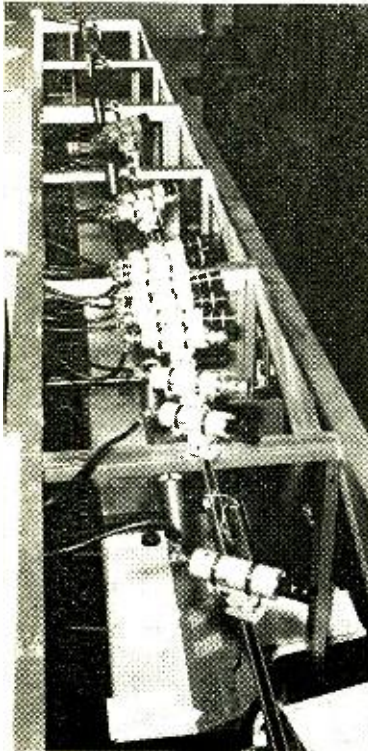
100 Eyes to the Sky

THE Jet Propulsion Laboratory of the California Institute of Technology has set up a command center in Pasadena to control unmanned space flights. One hundred miniature TV cameras are used in a closed-circuit TV system to handle key communications functions. Measurements and tracking data telemetry from one or two satellites are received at one of the three stations of the Deep Space Network and transmitted to the JPL command center via radio or landline. The data are quickly processed and displayed throughout the center via the CCTV system. Kin Tel—a division of Cohu Electronics, Inc.—developed the miniature TV cameras.

-30-



Data from deep space is relayed from tracking site stations.



Cameras observing master status board provide data for display throughout Jet Propulsion Lab command center.



At flight path status console, push buttons select displays.

Directors in mission control closely follow all developments.



Advanced Experimenter's Corner

INEXPENSIVE SCOPE and VOM CALIBRATOR

By HARRY R. NEWHOFF

Use constant-current diode to build simple, accurate, five-step voltage calibrator

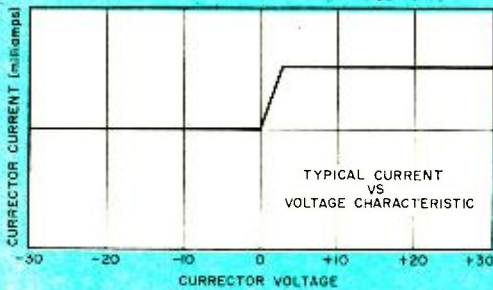
MOST electronics experimenters are familiar with zener diodes and how these devices can be used to limit voltage—thus providing one of the ingredients for a voltage calibrator. However, a far more practical component is the little known constant-current diode called the "Currector" which is manufactured by the CircuitDyne Corporation, Laguna Beach, Calif., a subsidiary of Telonic Industries Inc.

The Currector has some of the charac-

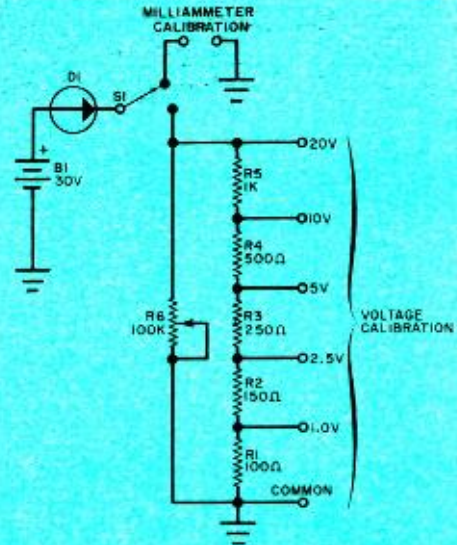


Checking out the voltage calibration of an EICO 680 transistor and circuit tester. Note that in this prototype model the voltage input is through tip jacks (left-hand corner of chassis) not shown in the wiring diagram or Parts List. If unit is intended for d.c. tests only, the battery can be mounted under the chassis.

The "CP3" Corrector maintains a steady output current flow from 3 to 30 volts input.



- B1—30-volt battery, or a.c. source—see text
 D1—10.5-ma. "Corrector," available from Te-
 lonic Engineering Co., Box 277, Laguna Beach,
 Calif. for \$8.50 (CP3, polarized model)
- | | |
|--------------|---|
| R1—100 ohms | } All resistors
1/2 watt,
1% tolerance
or better |
| R2—150 ohms | |
| R3—250 ohms | |
| R4—500 ohms | |
| R5—1000 ohms | |
- R6—100,000-ohm potentiometer, slotted shaft
 with lock nut
 S1—S.p.d.t. toggle switch
 Misc.—Eight 5-way binding posts, terminal
 board, chassis, solder, wire, etc.



The calibrator represents a simple application of Ohm's law. Current flow is preset, and the resistors all have precision values.

teristics of a zener diode, but it does not regulate voltage—it regulates current flow. Once a voltage "knee" is reached (see graph above), the Corrector conducts its rated current. The Corrector is available in 64 different current values ranging from 1 to 20.5 ma.

There are other advantages in using a Corrector as a calibrating component. One of the more important is that the same circuit can be used as a high-accuracy d.c. voltage standard or as an a.c. standard (for some purposes) by merely changing the supply voltage. Such convenience is impossible with zener diode regulation unless a dual anode zener diode is used, at a much higher cost.

Polarized and nonpolarized Correctors are offered by the manufacturer. The one difference between them is that the polarized series will conduct current in only one direction, whereas the nonpolarized version will regulate current flow in either direction.

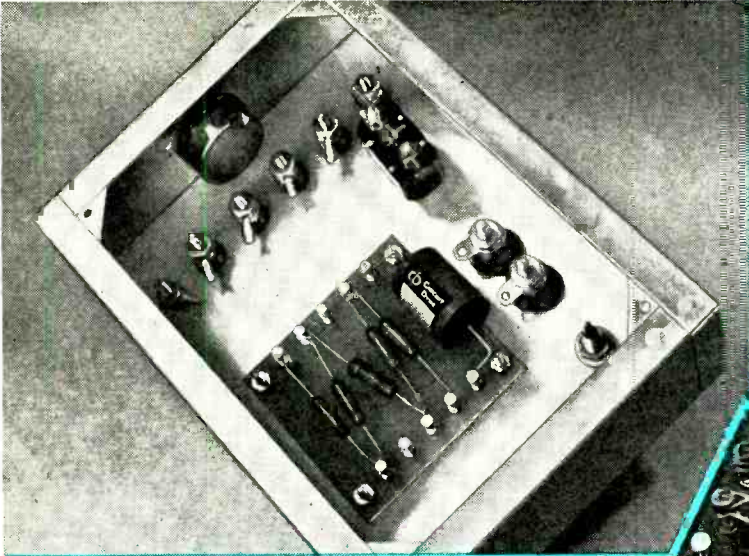
A Practical Calibrator. The Corrector can be built into a circuit as shown in the wiring diagram above and the calibration readings will be at convenient 1-, 2.5-, 5-, 10- and 20-volt takeoff points. Once the exact milliamper current flow

has been established in this circuit, the precision of the *Calibrator* depends upon the accuracy of the resistor series network.

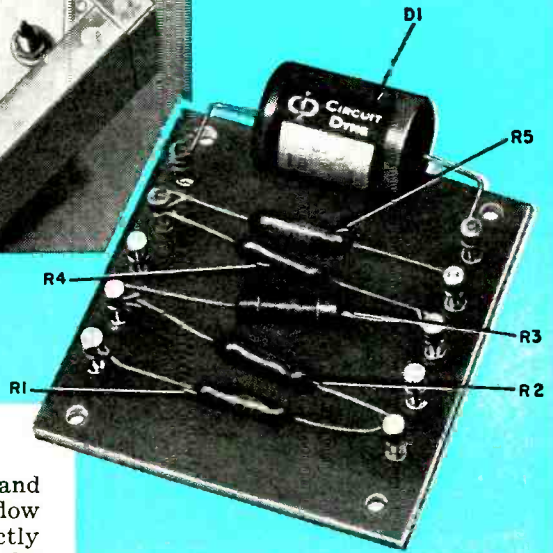
Resistors *R1* through *R5* are commonly available values obtainable at most parts supply houses with a 1% tolerance, and on special order from major mail order houses with a 0.1% tolerance. The unit built for this article was wired up on a 10-terminal board and mounted on metal spacers inside an ordinary 5" x 7" x 2" aluminum chassis. Each calibration point is brought out to a separate five-way binding post.

An additional function for calibrating milliammeters has been included in this unit. An s.p.d.t. toggle switch (*S1*) places the Corrector in series with two additional binding post connections that may be used to deliver 10.5 ma.

It is possible to build a calibrator in which *R6* is eliminated and a 10-ma. Corrector is substituted at *D1*; however, the accuracy will be limited by the $\pm 5\%$ accuracy of the Corrector. A better method—that shown—is to use a 10.5-ma. Corrector with *R6* in parallel with the *R1* to *R5* resistor network. The voltage at the 1-volt tap is then mea-



Any wiring arrangement can be used in building the calibrator. This unwired model is shown inside a plain 5"x7"x2" aluminum chassis.

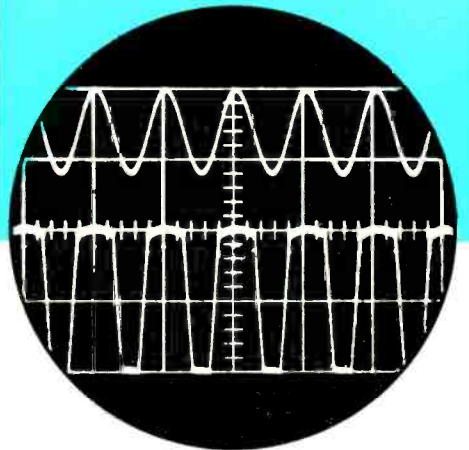


As a matter of convenience, the five precision resistors were soldered to terminals on an epoxy fiber-glass board.

sured with a precision instrument and $R6$ is adjusted until the current flow through the $R1$ to $R5$ network is exactly 1 ma. This procedure will improve the accuracy of the calibrator to better than 1%. If a 20,000-ohms-per-volt VOM is being checked out, the maximum additional error due to loading should be on the order of 0.5%.

A.c. Calibration. The foregoing applies particularly to d.c. calibration of VOM and VTVM test instruments. To check oscilloscopes for a.c. calibration, the 30-volt battery should be replaced with a 56- to 96-volt peak-to-peak sine wave (16 to 34 volts r.m.s.). The exact voltage is not critical, but must be high enough for clipping action to occur and still be under 35 volts r.m.s., the maximum rating of the CP3 Corrector specified in the Parts List. The resultant waveform at the 20-volt tap is shown at bottom right, and measures 40 volts peak-to-peak. (The sine-wave trace above it is shown for comparison.)

As you might suppose, this circuit should not be used to calibrate an r.m.s. voltmeter due to the fact that the waveform is clipped, and r.m.s. applies only to a pure sinusoidal signal. -30-



Calibrator can be used for a.c. scope checks. Flattened bottom trace, 40 volts peak-to-peak, is from the 20-volt tap.



Transistor Topics

By **LOU GARNER**, Semiconductor Editor

THERMOELECTRIC POWER has become a practical reality in the less than two years since commercially built generators became available, and the five years since the dramatic introduction of an isotope-fueled device. It was back in January, 1959, that the U. S. Government announced the development of a five-pound atomic-powered device capable of generating electricity directly from an isotope heat source. This first unit, dubbed "SNAP III" (Systems for Nuclear Auxiliary Power) not only proved the principle of direct conversion, but awakened new interest in the almost forgotten concept of thermoelectricity.

"SNAP III" power supplies, orbited in the Transit IV-A and IV-B navigational satellites, were built by the 3M Company for delivery to the Martin-Marietta Corp. for fueling. This front-runner in a series of developments in the power generation field led to the first commercial line of thermoelectric generators announced by 3M in 1962.

Today, propane-fired thermoelectric generators are "riding the rails" in radio-equipped train cabooses, working silently atop western mountains as the power source for remote radio relay stations, and send-

ing current deep into the earth for the cathodic protection of well casings and pipelines. A U. S. Forest Service radio relay on Black Butte, near Bend, Oregon, has been operating since the summer of 1962 from power supplied by a thermoelectric generator.

A few months ago, thermoelectric power and a newly developed portable microwave communications set were linked together to carry both the image and voice of Rear Admiral Torgerson, director of communications-electronics, Joint Chiefs of Staff, from his office in the Pentagon (Arlington, Va.) to delegates to the annual AFCEA convention assembled in a hotel in downtown Washington, D. C. (see photo).

Thermoelectric power generators are, in a sense, semiconductor "cousins" to tran-

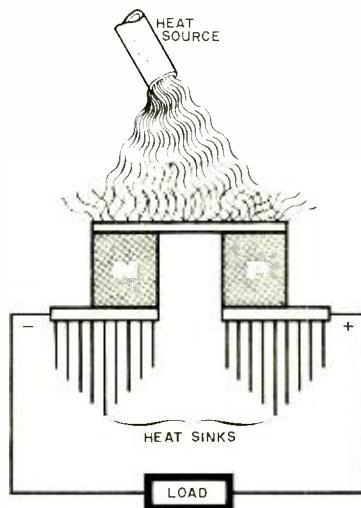
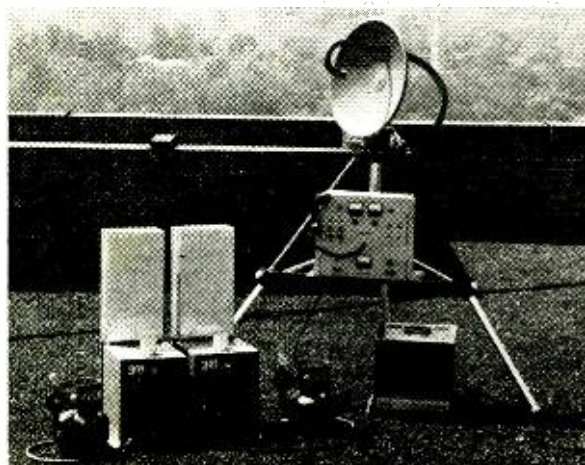
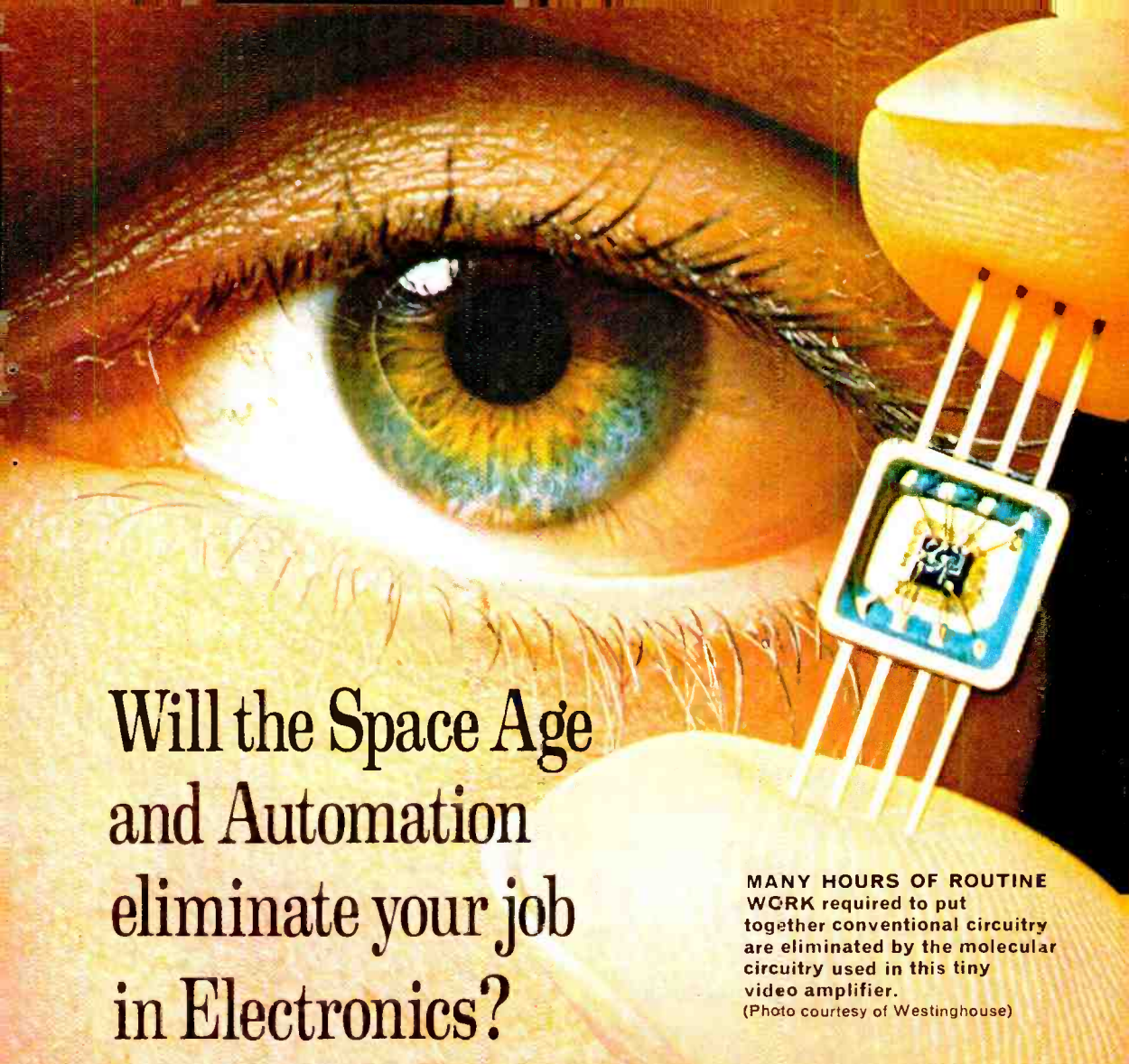


Fig. 1. Basic diagram of a thermoelectric generator. Commercial units incorporate many p-n modules wired in a series-parallel arrangement.



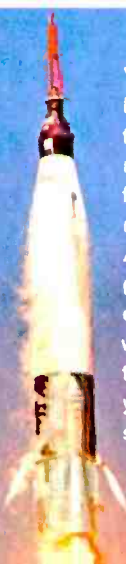
The two 3M Company thermoelectric generators shown at left in photo were used recently to power a portable microwave communications system.



Will the Space Age and Automation eliminate your job in Electronics?

MANY HOURS OF ROUTINE WORK required to put together conventional circuitry are eliminated by the molecular circuitry used in this tiny video amplifier.

(Photo courtesy of Westinghouse)



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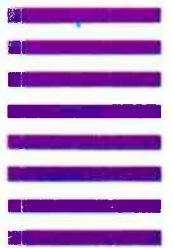
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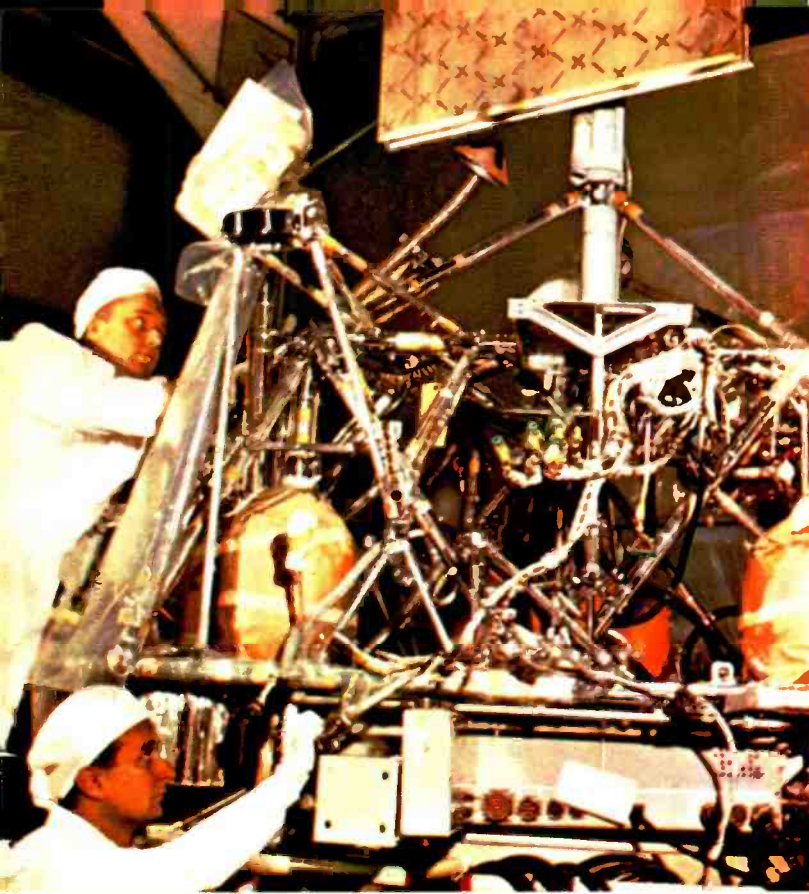


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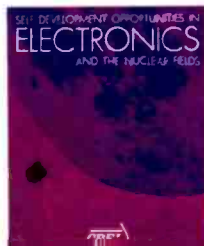
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E-36



sistors and diodes (see "The Fabulous Diodes," POPULAR ELECTRONICS, May, 1964). Their basic principle of operation is shown in Fig. 1 on page 60.

A standard generator consists of a large number of series-parallel-connected semiconductor thermocouples, each similar to the single module in Fig. 1. The *p* and *n* type semiconductor "slugs" are bonded together alternately with heavy metal straps. Finned heat sinks or similar cooling means are used on one side while heat is applied to the opposite side. In operation, the electrons and positive holes undergo thermal diffusion from the high to the low temperature side, developing an electrical voltage. This potential difference (voltage) is maintained as long as there is a temperature difference between the two sides of the device.

Commercial thermoelectric generators come in four standard sizes, with rated outputs of 7, 12, 20 and 40 watts. Load voltages range from less than 1 volt for the 7-watt unit to 6 volts for the 40-watt type, but special d.c.-to-d.c. converter-limiters are available to supply 6, 12, or 24 volts. Either bottled propane or natural gas can be used as the basic fuel.

Present-day gas-fired thermoelectric generators sell for between \$20 and \$40 per watt output. The actual operating cost, however, including fuel and a five-year "write-off" of equipment costs, is less than \$1 per kwh, or approximately one-tenth the cost of supplying similar quantities of power from primary batteries. Looking to the future, equipment costs are expected to drop to as low as \$1 per watt output, with potential applications growing by leaps and bounds with each reduction in equipment cost.

Manufacturer's Circuit. Last month we featured a simple phono preamplifier circuit developed by General Electric for use with magnetic pickups. There are, of course, many hobbyists who prefer ceramic car-

tridges. These readers will find the circuit shown in Fig. 2 useful. Another GE design, the instrument is equalized for a standard RIAA response when used with cartridges having an internal capacitance of from 1000 to 10,000 pf.

A pair of direct-coupled *npn* transistors are used in this circuit. Transistor *Q1* serves as a high-gain common-emitter amplifier while *Q2* is an impedance-matching emitter-follower. The preamp can be used to drive standard power amplifiers with moderate to high input impedances.

In operation, resistor *R3* serves as *Q1*'s collector load. The base bias of *Q1* is obtained from its collector terminal and supplied through series resistors *R1* and *R2*. These two resistors also form part of the equalization network in conjunction with capacitors *C1* and *C2*.

With direct coupling between stages, *Q2*'s base bias is furnished by a voltage-divider made up of *Q1*'s load, *R3*, and *Q1*'s emitter-collector resistance. Level control *R4* serves as *Q2*'s emitter load, with the output signal furnished to jack *J1* through output coupling capacitor *C3*. Operating power is supplied by *B1*, controlled by switch *S1*.

Standard components are used in the circuit. Resistors *R1*, *R2* and *R3* are half-watt units and potentiometer *R4* is a standard control. Capacitors *C1* and *C2* can be either ceramic or mica types, but should have a 10% tolerance rating; their working voltages are not critical. Capacitor *C3* is a 25-volt electrolytic, with its size determined by the input impedance of the power amplifier with which the unit is employed. Generally speaking, a 1- to 2- μ f. unit can be used for high impedance loads, but values up to 50 μ f., or more, may be required for good low frequency response if the preamp is to drive a moderate-impedance power amplifier.

Transistors *Q1* and *Q2* are GE's new low-cost epoxy-cased silicon units, type 2N2926. Power switch *S1* may be any s.p.s.t. type—toggle, slide, push-button, rotary, or even a control-mounted type switch, if preferred. Power supply *B1* is a 22½-volt battery. With a current drain of only 2 ma., a small hearing aid battery (Burgess U15) would be suitable for intermittent use, but a larger

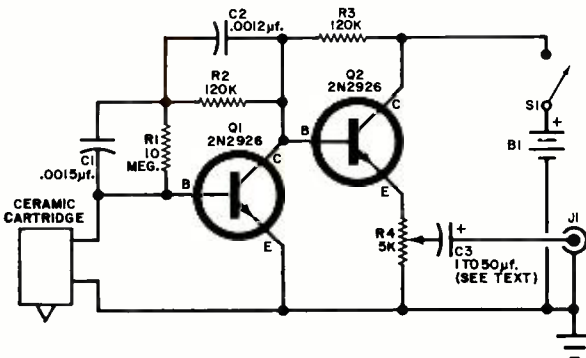


Fig. 2. This preamplifier circuit was designed by General Electric for use with ceramic cartridges, and features the new low-cost 2N2926 *npn* transistors.

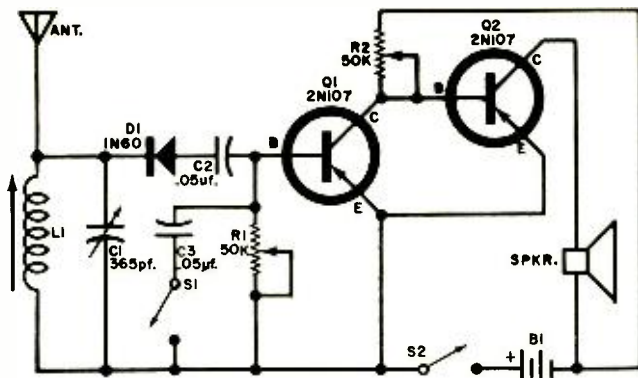


Fig. 3. Reader Wesley Morey's receiver circuit. Potentiometer R2 is adjusted for best output—see text.

battery (typically, a Burgess XX15) can be used for maximum life.

Since neither layout nor lead dress is critical, individual builders can use any of several construction methods. Some may prefer a conventional metal chassis while others may want to design a printed-circuit board layout.

Hum and noise pickup can be minimized by mounting the entire preamp, including power supply, in a small shielded metal case. A standard phono jack or any similar jack will serve as output connector *J1*. As is customary, shielded cable should be used for connecting the preamp to the phono cartridge and to the power amplifier.

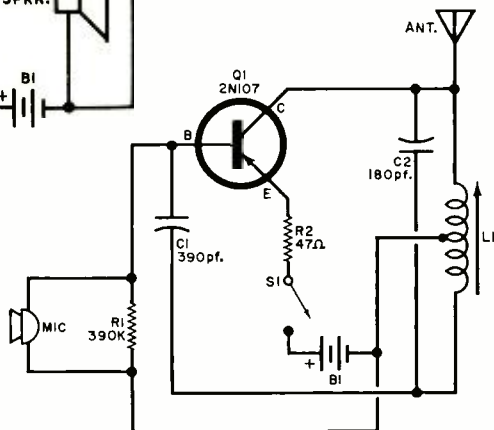
Readers' Circuits. Of all the circuits we've featured in past columns, "win" and "place" positions have been won, invariably, by simple broadcast-band receiver and wireless microphone designs. This month we are featuring one of each.

The receiver circuit in Fig. 3 was among several interesting ones submitted by Wesley Morey (P. O. Box 3, Brome, Quebec, Canada). It is a simple adaptation of a two-stage direct-coupled amplifier using *pnp* transistors in the common-emitter configuration.

The r.f. signals picked up by the antenna are selected by tuned circuit *L1-C1* and detected by diode *D1*. The resulting audio signals are coupled through *C2* to the two-stage direct-coupled amplifier, *Q1-Q2*. Potentiometer *R1* serves as a gain control while *C3* and *S1* are used as a simple "losser-type" treble-bass control. Potentiometer *R2* is used both as *Q1*'s collector load and as an adjustment for *Q2*'s base bias. A loudspeaker voice coil serves as *Q2*'s collector load. Operating power is supplied by *B1*, controlled by *S2*.

Low-cost components are employed. Antenna coil *L1* is a broadcast-band "vari-loopstick" and *C1* is a small 365-pf. variable capacitor. Capacitors *C2* and *C3* are 0.05- μ f. ceramic or paper units, while *R1*

Fig. 4. Wireless microphone circuit submitted by Ken Maness. Antenna can be a 2- or 3-foot "whip" type.



and *R2* are 50,000-ohm volume controls. Both *S1* and *S2* are s.p.s.t. toggle or slide switches. Diode *D1* is a 1N60, and transistors *Q1* and *Q2* are 2N107's. The loudspeaker has an 8-ohm voice coil; size is not critical, and 4-, 6- or 8-inch units can be used. Power supply *B1* is a 9-volt battery and, if desired, can be made up by connecting six penlight cells in series.

Wesley's circuit can be assembled on a small chassis, on a Masonite breadboard, or on an etched circuit board, as preferred. Neither layout nor wiring should be critical, but care should be taken not to overheat the diode and transistor leads if these components are soldered in position.

In practice, a short to moderately long antenna can be used for the reception of nearby local stations. Potentiometer *R2* is adjusted for optimum output, but this control should NOT be set to its minimum resistance position to obtain maximum volume as the transistors might be damaged.

Reader Ken Maness (P.O. Box 263, Church Hill, Tenn.) submitted the wireless microphone circuit shown in Fig. 4. It features a single *pnp* transistor in the common-emitter configuration as a base-modulated, modified Hartley oscillator.

In operation, the circuit's basic operating frequency is determined by tuned circuit *L1-C2*. Emitter resistor *R2* serves to stabilize operation, while base bias is supplied through *R1*. The feedback necessary to

(Continued on page 94)

Build the

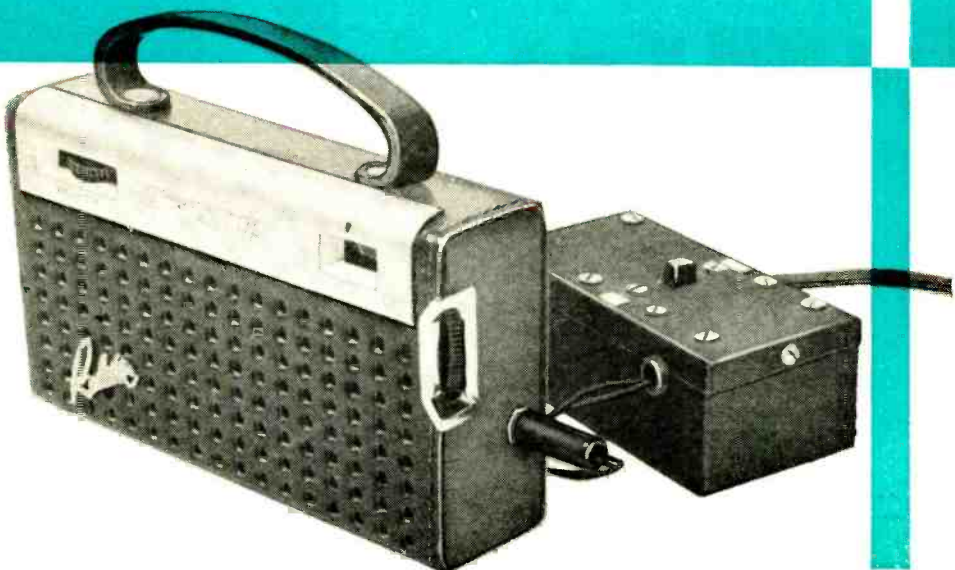
AUX-9

Substitute this 9-volt power supply for batteries when using your transistor radio around the house

By THOMAS H. CHARTERS

IF YOU USE your transistor portable at home, this power supply will be a worthwhile investment. You simply plug it into the transistor radio, and the radio plays from the a.c. house wiring. (When you take the radio out of the house, just disconnect the supply; the radio will then operate with its built-in battery.) Such a power supply should be small, inexpensive, easy to connect and disconnect, and have low a.c. ripple and good regulation characteristics with changing load current. The "AUX-9" was designed with these characteristics in mind.

The "AUX-9" delivers 9 volts for load currents ranging from 0 to 16 ma., a range found to be adequate for good-quality transistor radios. A.c. ripple content is about 3 mv. peak-to-peak. The output voltage varies less than 0.4 volt from no load to full load. A jack is added to the radio, and when the supply is plugged in, the radio's battery is automatically disconnected. (Removing the plug permits the jack to close, and



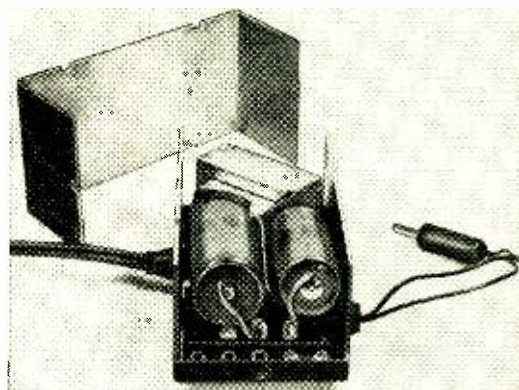
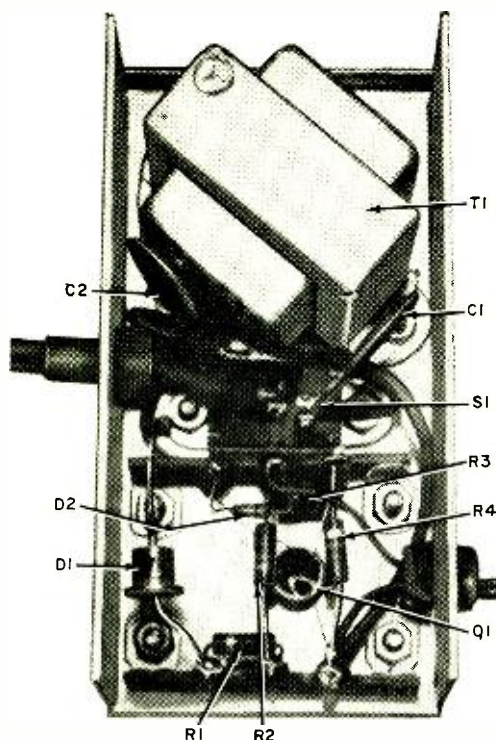


Photo at left shows location of parts. Capacitors C3 and C4 have been removed for clarity. Photo above shows unit with the two electrolytics mounted in place.

the radio is again fully portable.) Shunt-type regulation makes the unit "short-circuit safe." With an exposed plug, inadvertent shorting of the output of the supply may occur, but it doesn't matter because the short-circuit current is internally limited to 24 ma. Cost of parts for the "AUX-9," if all are purchased new, is about \$9.00. Many of these parts are common items, however, and if you have them on hand, this figure can be trimmed somewhat.

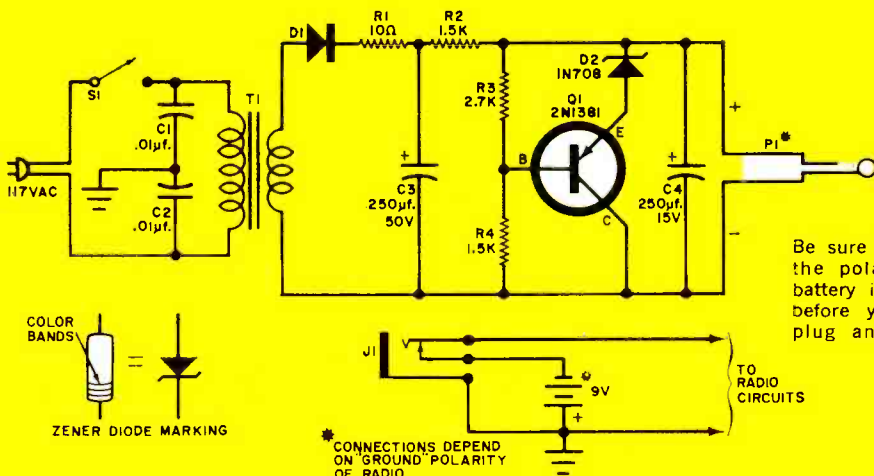
How It Works. A shunt-type regulator circuit controls the output voltage by maintaining a constant current through a series limiting resistor—in this case, 18 ma. through *R2*. Should the load current requirement increase, less current—in the same amount as the increase—flows through the shunt path, thereby maintaining the same current through the series resistor and therefore the same output voltage. Here is a typical sequence of events that will demonstrate the operation.

Assume that the load requires an ad-

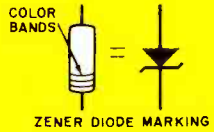
ditional 2 ma. This will cause a drop in the output voltage, which in turn will cause a drop in the voltage across voltage divider *R3-R4*. Although the voltage across the zener diode (*D2*) remains relatively constant, there will be a net reduction in emitter-base voltage and a subsequent reduction of collector-emitter current flowing through the transistor of about 2 ma. Therefore, the 18 ma. through *R2* will not have changed much, and the output voltage remains nearly constant.

The circuit provides good filtering for the a.c. ripple across capacitor *C3*. The d.c. voltage across this capacitor is 36 volts, with a 900 mv. ripple. This is reduced to 9 volts with a 3 mv. ripple. Resistor *R1* limits the turn-on surge of current through diode *D1*. (This surge is caused by the lack of initial charge on capacitor *C3*.)

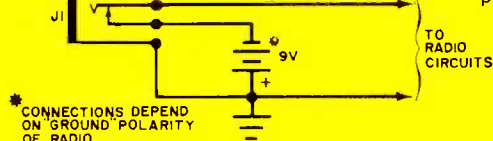
Building the "AUX-9". The recommended drilling layout shown on the next page should be used if the chassis-mounted components you use are the



Be sure to determine the polarity of the battery in your radio before you wire the plug and the jack.



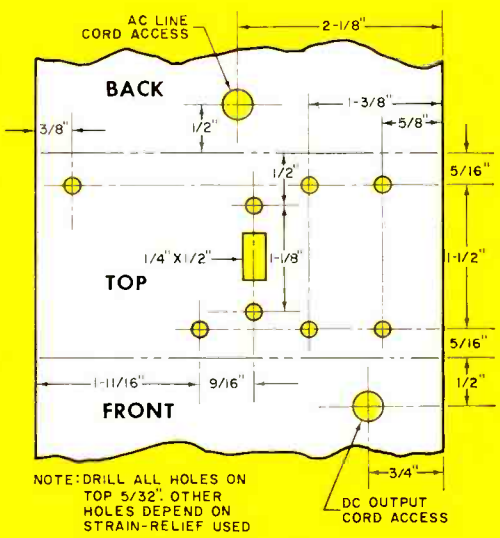
ZENER DIODE MARKING



* CONNECTIONS DEPEND ON GROUND POLARITY OF RADIO

PARTS LIST

- C1—C2—0.01-µf., 500-volt disc capacitor
 - C3—250-µf., 50-volt tubular electrolytic capacitor
 - C4—250-µf., 15-volt tubular electrolytic capacitor
 - D1—200-PIV, 500-ma. silicon rectifier (Texas Instruments 1N1487 or equivalent)
 - D2—5.6-volt, 400-mw. zener diode (Hughes Aircraft 1N708 or equivalent)
 - J1—Subminiature phone jack (Switchcraft 42A or equivalent)
 - P1—Subminiature phone plug (Switchcraft 740 or equivalent)
 - Q1—2N1381 germanium transistor (Texas Instruments)
 - R1—10 ohms
 - R2—1500 ohms
 - R3—2700 ohms
 - R4—1500 ohms
- } all resistors
} 1/2-watt carbon
- S1—S.p.s.t. slide switch
 - T1—Filament transformer: primary, 117 volts a.c.; secondary, 24 volts (Birstein-Applebee 18B506, or equivalent)
 - 1—1 5/8" x 2 1/8" x 4" aluminum box
 - Misc.—Terminal strips, line cord and plug, hardware, wire, solder, plastic tape, etc.



Recommended drilling layout for the cabinet.

exact ones specified in the Parts List. Observe diode and capacitor polarities; do not wire plug P1 into place as yet.

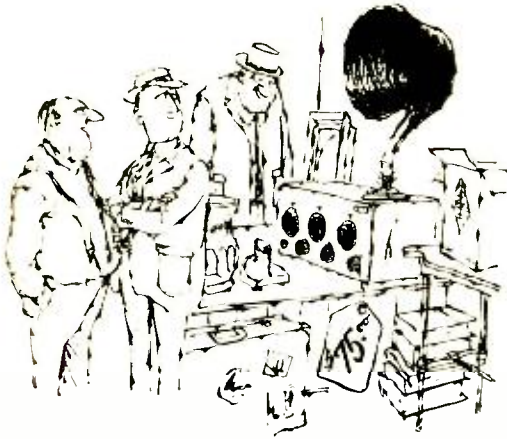
After completing the other wiring, open the transistor radio, and determine if the battery in the radio has its positive or negative terminal grounded. If the positive terminal is grounded, wire in the output plug (P1) as shown in diagram above, center. If the negative terminal is grounded, wire the plug with the sleeve to negative, the tip to positive.

The two electrolytic capacitors, C3

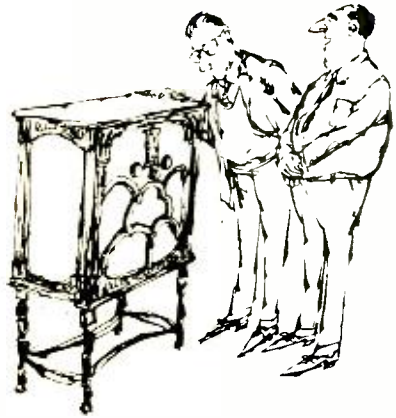
and C4, should be wired in last. Use insulated sleeving on all leads. While C4 could be omitted, this would increase the ripple to about 7 mv. peak-to-peak.

Place a strip of plastic electrical tape inside the chassis next to diode D1 to keep it from touching the case. Use additional tape to keep the chassis from touching the leads of C3 and C4. Finally, apply on-off labels to the case near slide switch S1.

Jack J1 is a closed-circuit miniature jack that must be mounted on the radio
(Continued on page 100)



"Watch that character try to offer me \$2 for that old radio."



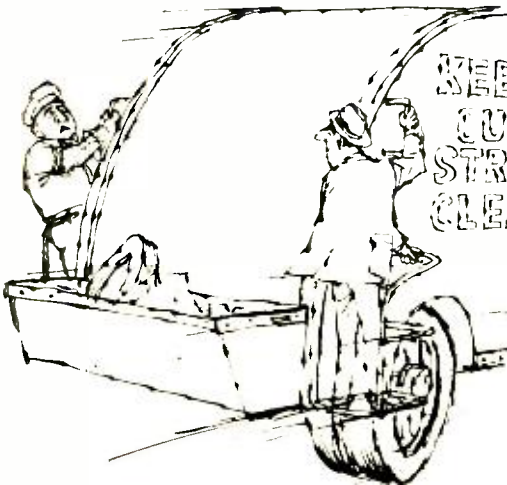
"Outside of a nuvistor r.f. stage, a transistorized audio section, a silicon rectifier, a ferrite antenna, and a diode detector, it's a real classic."

YE ANTIQUE RADIO COLLECTOR

By RODRIGUES



"... Oh, stop it, Joe—you'll never be able to make a 201-A."



"Of course, there are some days when none of those radios turn up, Mr. Claypool."



"Really, aren't you carrying this antique radio hobby too far?"

IF YOU are like most electronics experimenters, you spend considerable time browsing through catalogs and flyers from parts dealers and distributors. Also, if you're like the author, those tempting packages of bargain-priced transistors are just too much to resist. Sometimes we get stung, but this amplifier has proven to be an extraordinary exception—the push-pull power output transistors cost only 50 cents.

As transistors go, the power transistors in this circuit are old. They look very much like the 2N158's manufactured by CBS-Hytron (now out of business) which sold for \$5 apiece. The distributor* says they have a 15-watt power rating, and we are inclined to believe it. Since this amplifier runs at 3 watts output, it runs cool without the incorporation of a heat sink. The cutoff frequency is higher than that of most audio power transistors and the frequency response of this small amplifier is remarkably good.

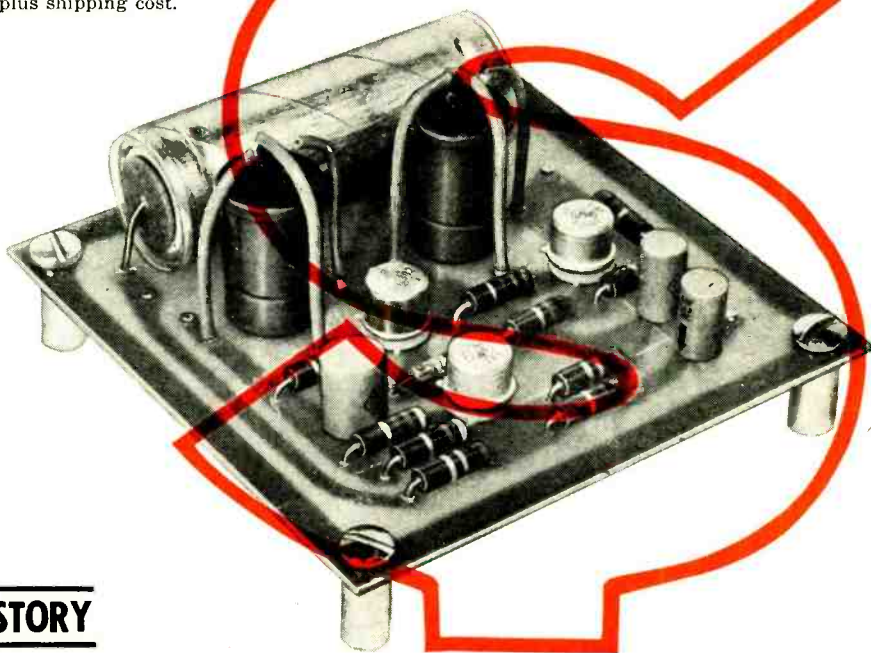
The "Bargain Page Amplifier" is a versatile little package of audio power. It may be operated from either a positive- or negative-ground 12-volt automotive supply. It can be used as a mobile public address system, modulator,

*Radio Shack, 730 Commonwealth Ave., Boston 17, Mass. Stock number 27K1230. Four transistors for 99 cents, plus shipping cost.

THE BARGAIN PAGE AMPLIFIER

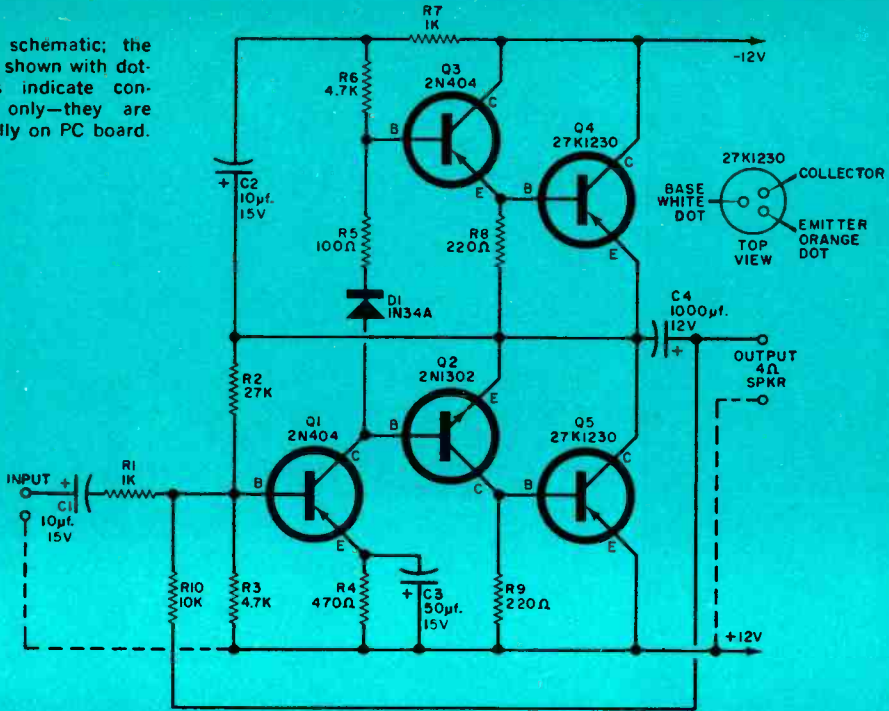
*All-purpose transistorized
printed circuit board
amplifier has 3-watt output
over an audio range
of 30 to 20,000 cycles*

By DANIEL MEYER



COVER STORY

Amplifier schematic; the terminals shown with dotted lines indicate connections only—they are not actually on PC board.



PARTS LIST

C1, C2—10- μ f., 15-volt electrolytic capacitor
 C3—50- μ f., 15-volt electrolytic capacitor
 C4—1000- μ f., 12-volt electrolytic capacitor
 D1—1N34A germanium diode (or equivalent)
 Q1, Q3—2N404 transistor (or equiv.—see text)
 Q2—2N1302 transistor (or equivalent—see text)
 Q4, Q5—Bargain transistor (Radio Shack stock number 27K1230, or 2N1038-1)

R1, R7—1000 ohms
 R2—27,000 ohms
 R3, R6—4700 ohms
 R4—470 ohms
 R5—100 ohms
 R8, R9—220 ohms
 R10—10,000 ohms

All resistors
 1/2 watt

Misc.—Circuit board available from author at

430 Redcliff Drive, San Antonio, Texas 78216
 for \$2.50 (epoxy glass) or \$2 (phenolic base),
 solder, wire, batteries, cabinet, etc.

Optional Power Supply

C5—500- μ f., 12-volt electrolytic capacitor
 C6—1000- μ f., 12-volt electrolytic capacitor
 D2, D3—50-PIV @ 1-amp. silicon diode (Mallory S-50 or equivalent)
 D4—1N3022 zener diode, 12 volts at 1 watt (Texas Instruments)
 Q6—2N256 transistor (or equivalent)
 R11—100-ohm, 1/2-watt resistor
 S1—S.p.s.t. toggle switch
 T1—Filament transformer; primary, 117 volts a.c.; secondary, 24 volts a.c. CT

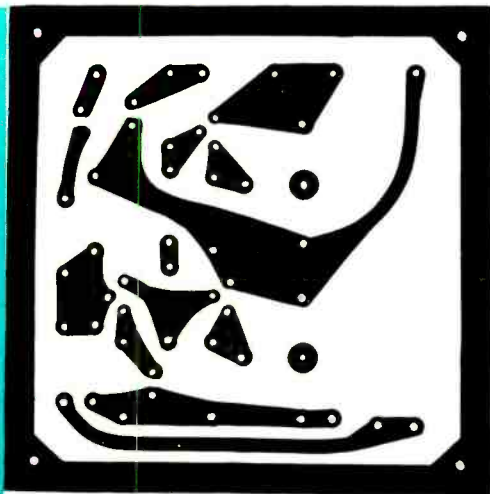
or audio amplifier. The amplifier makes a neat, practical audio system for use with a low-cost portable phonograph. The setup for such a project can be very simple—a pair of 6-volt lantern batteries, plus the amplifier tucked away in the back of a speaker baffle.

Because this unit has a wide frequency response, it can be used with wide-range speakers in a hi-fi system.

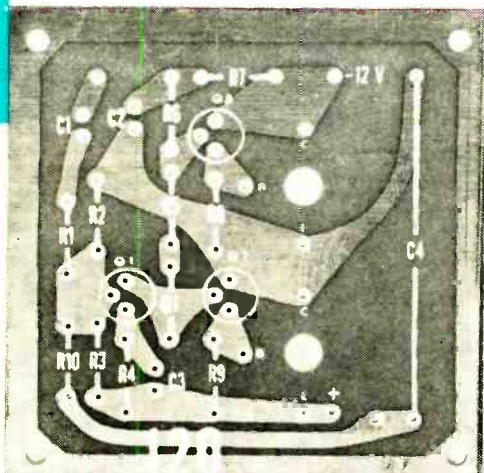
How It Works. The output transistors, Q4 and Q5, although in series with the 12-volt power supply, look like push-pull amplifiers to an audio signal. These two transistors are slightly forward-

biased to minimize distortion at low volume levels. With no signal input, Q4 and Q5 draw about 10 ma. At full volume output with this circuit, the output transistors will draw up to 400 ma. The mode of operation is Class AB₂; transistor Q4 can be thought of as amplifying the negative portion of the audio signal and Q5 as amplifying the positive portion.

Transistor Q2 is a phase inverter as well as a low-impedance driver amplifier. Transistor Q3 performs a similar function sans the phase inversion. Voltage amplification to drive these two



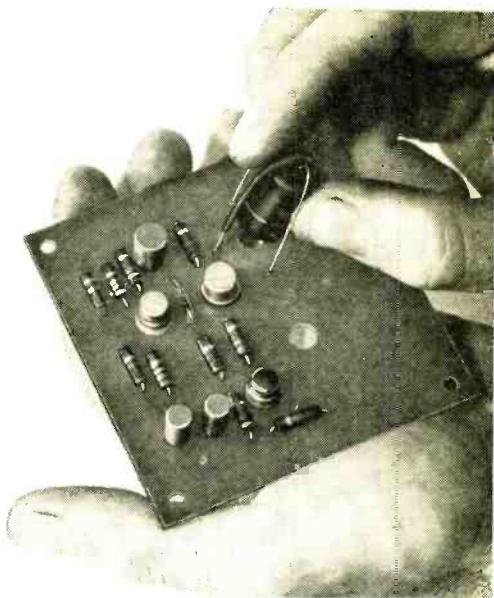
Using template above, you can etch your own circuit board—or you can get one from the author (see photo below). The author's address is given in the Parts List at left.



transistors is provided by *Q1*. The collector of *Q1* is fed directly to the base of *Q2* and through *D1* and *R5* to the base of *Q3*.

Diode *D1* performs two functions: it provides slight forward bias (with *R5*) and also acts as a temperature compensator. The voltage drop across the diode decreases as the temperature of the whole amplifier increases. This counteracts the thermal runaway possibilities of this type of circuit.

Both d.c. and a.c. feedback are used between the output and input transistors. Resistor *R2* provides a d.c. path



Using dirt-cheap transistors, this amplifier can produce 3 watts without a heat sink by running the power output transistors far below their maximum rating.

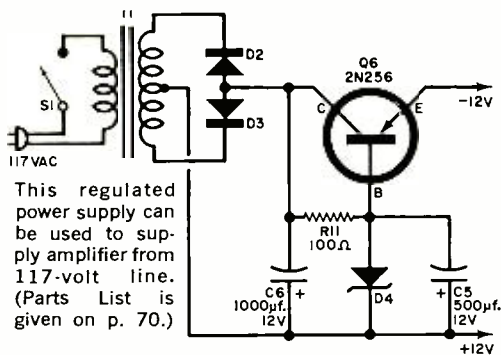
SPECIFICATIONS

(All measurements made at 1 kc. using a 4-ohm load)

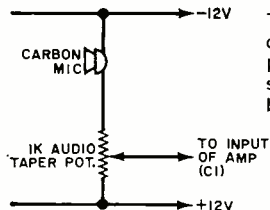
Supply Voltage	12 to 15 volts d.c.
Current Drain	Standby, 15 ma.; full power, 400 ma.
Power Output	3 watts
Total Harmonic Distortion	Less than 1%
Frequency Response	30-20,000 cycles (2.5 watt output)
Input Voltage for Full Output	0.5 volt r.m.s.
Input Impedance	1000 ohms
Output Impedance	Less than 1 ohm

and capacitor *C4* an a.c. path. Feedback lowers distortion, improves stability, and broadens the frequency response. Total feedback is about 20 db.

Construction. A printed circuit board on which to build this amplifier is available from the author at a modest charge. Construction time is thereby reduced to less than one hour and the chances of wiring errors or unwanted feedback are eliminated completely. A board can be made in your own workshop following the layout shown above. Point-to-point wiring with Vectorbord[®] and push-in terminals can be used if care is exer-

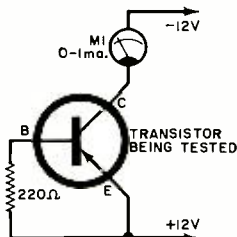


This regulated power supply can be used to supply amplifier from 117-volt line. (Parts List is given on p. 70.)



The amplifier can be driven from any source providing 0.5 volt of signal; connect a carbon mike as shown here.

Check your power transistors for leakage with the simple circuit at right. A zero reading, or more than 1 ma. of leakage current, indicates that the transistors will not work in the amplifier.



cised to reduce the possibility of the wiring introducing feedback.

Power transistors Q_4 and Q_5 are attached to the printed circuit board with $\frac{1}{4}$ "-long $\frac{1}{4}$ -28 bolts. The leads are then covered with short lengths of cambric tubing and inserted in the proper holes in the PC board. Note that the base lead passes between the collector and emitter leads.

You can make a number of possible substitutions at Q_1 , Q_2 , and Q_3 . Each must have at least a 12-volt breakdown (V_{ceo} in the RCA *Transistor Manual*), and in the case of Q_2 and Q_3 , a current gain of 50 or more. Transistors Q_4 and Q_5 are equivalent to 2N1038-1 transistors manufactured by Texas Instruments and selling for about \$3 apiece.

Testing and Installation. Before installing your bargain transistors, it is a good idea to test them for excessive leakage using the circuit shown above. If the meter reading is either zero or over 1 ma., the transistor should not be used in this amplifier. Transistors with leak-

age currents of between 0.1 and 0.8 ma. are O.K.

Another test to improve the fidelity of your "Bargain Page Amplifier" may be performed after it is assembled. Couple the amplifier to a 1000-cycle audio input source and a 4-ohm resistive output load. Also connect the input of an oscilloscope across the output and drive the amplifier from the 1000-cycle source until sine-wave clipping occurs. If the clipping is not symmetrical on the positive and negative portions of the waveform, temporarily replace 4700-ohm resistor R_3 with a 10,000-ohm potentiometer. Adjust for symmetrical clipping and measure the resistance in the potentiometer, and substitute a comparable value resistor.

If you lack the necessary test equipment, you can approximate the same results by substituting the 10,000-ohm potentiometer for R_3 and then measuring the voltage at the emitter of Q_4 . This is done with the input shorted and no signal applied. The desired reading at the emitter is 5 volts and the potentiometer should be so adjusted and a new resistor substituted at R_3 if necessary.

Using the Amplifier. The printed circuit board may be mounted on metal or insulated standoffs and bolted to an appropriate size chassis. The small size of the amplifier and the modest power requirements make it suitable for many applications. If a power supply for 117-volt a.c. operation is not available, a power supply with zener diode regulation can be built using the parts and circuit shown at the top of this page.

The power output of the "Bargain Page Amplifier" will depend upon the speaker impedance—even though the amplifier can be used with any 4-, 8-, or 16-ohm voice coil speaker. However, the amplifier is a good match for a 4-ohm speaker. If an 8-ohm speaker is used, the maximum power output will only be 1.5 watts; and with a 16-ohm speaker, the output will be 0.75 watt maximum. Of course, you can always parallel two 8-ohm speakers for optimum output.

WARNING: Do not short the output connections. Do not submit the amplifier to sine-wave inputs of 10 kc. or more for over two seconds.



Monthly Short-Wave Report

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

"WHICH RECEIVER SHOULD I BUY?"

MANY READERS of this column, often newcomers to the short-wave listening hobby, write in and say that they want to buy new communications-type receivers but before doing so would like to have your Short-Wave Editor's advice as to which would be the best buy. Some letters indicate that a reader has already made up his mind and all he wants is "verification" that his choice is correct. Other SWL's state how much money they have available and request comparative specifications on various receivers.

Undeniably, these requests are put forth by SWL's who sincerely desire information. Unfortunately, too many SWL's expect (and in some cases—demand!) that your Short-Wave Editor summarize his years of experience and state in no uncertain terms which receiver is best for the dollar spent. This cannot be done.

Like any other SWL, your Short-Wave Editor has personal preferences when it comes to selecting a receiver, such as a par-

ticular type of dial mechanism, a certain panel arrangement, or the flexibility offered by the more important and useful controls incorporated in the unit. These are things that may or may not be included in receivers selling between \$75 and \$300.00. But the point is that they represent personal preferences of just one SWL and may or may not agree with the personal preferences of another SWL.

Certainly, each manufacturer of short-wave receivers has reason to believe that his product is the ultimate and will perform as advertised. If you are among those who are about to purchase a receiver, it is strongly recommended that you first carefully screen all units that fall in your price range. Write to the manufacturers of the models you are interested in, and ask them for detailed specifications. Then, when all the information is available, make up your own comparative table.

Before finalizing your choice, go to your radio parts jobber or dealer and get the



The current record of Mark Lutzenberger, WPE9GWE, of Milwaukee, Wisc., is 130 veries from 26 countries. Mark uses a Hallicrafters SX-100 receiver and tape-records his reports on a Lafayette RK-142.

A Hammarlund HQ-100 does the receiving for H.K. Moubray, WPE8EOV, Akron, Ohio. Built into a homemace console is a Knight crystal calibrator, a speaker, headphone jack, and antenna switch. To date, "H.K." has 32 countries logged.



"feel" of the receiver. Look for such things as dial scale illumination, size and weight of the main tuning and bandspread knobs, etc. And always bear in mind that a communications type receiver is an instrument that is good for five to ten years. The more money you can spend, the better the product you will receive.

Jamming Ended. According to a recent United Press International news release, the British Broadcasting Corporation has announced that Communist jamming of BBC programs beamed to Europe has finally ceased. The Bulgarian language broadcasts were reportedly the last to be subjected to jamming. The Russian, Albanian, and Romanian programs have been free of jamming since the summer of 1963, while the

Czech, Slovak, Hungarian, and German programs have been in the clear since April, 1964.

Club Notes. A DX broadcast, produced by the Brooklyn (N.Y.) Chapter of the American Short-Wave Listeners Club, is now being aired on Saturdays at 1400 over Station WRUL on 11,940, 15,290, and 15,440 kc.

You will probably recall that the National Radio Club recently split into two separate organizations. One of them, the National Radio Club, Inc. (P. O. Box 5181, Terminal Annex, Denver, Colo. 80217) has changed its name to the "International Radio Club of America, Inc.," after receiving authorization to do so in a club election. The club will continue its previous policy of medium-wave coverage only.

(Continued on page 101)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

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

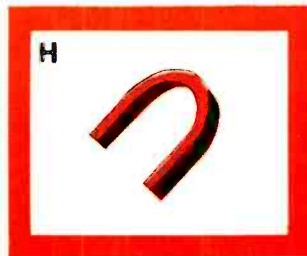
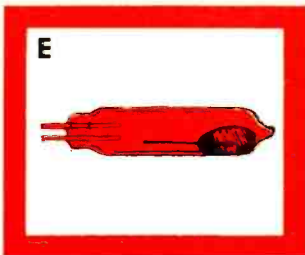
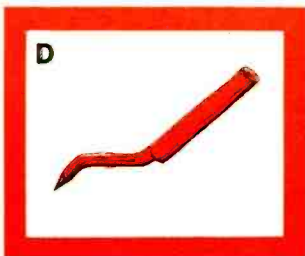
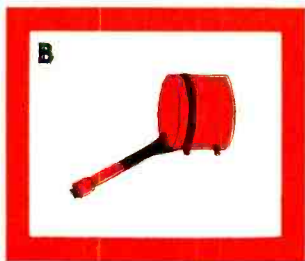
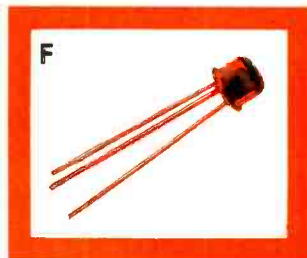
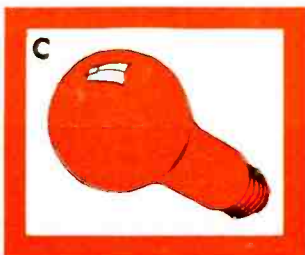
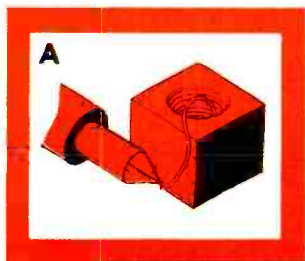
COUNTRY	STATION	FREQUENCY (kc.)	TIMES (EST)
Argentina	Buenos Aires	11,780, 9690, 6090	2200, 0100 (Mon.-Fri.)
Australia	Melbourne	17,840, 15,220 9580	2030, 2130, 2230 0745
Bulgaria	Sofia	9700, 9560 7290	1900, 2000, 2300 1630
Canada	Montreal	15,190, 11,760, 9585 9625, 5970	1800 (Caribbean) 0215, 0300 (W. Coast)
Congo (East)	Leopoldville	11,755	1630, 2100, 2230
Congo (West)	Brazzaville	15,190	1430
Czechoslovakia	Prague	11,990, 9795, 9550, 7345 (also 15,285 at 2030; 11,990 at 2230)	2030, 2230
Denmark	Copenhagen	15,165 9520	0700 2100
Finland	Helsinki	15,185	1530 (Mon.-Fri.)
West Germany	Cologne	11,925, 11,795, 9735 9640, 6075	1010 2035
Hungary	Budapest	11,795, 9735, 9575, 6145 11,905, 9833, 7215	0000 1930
Italy	Rome	9833, 7215, 6234 9575, 5960	2030, 2200, 2330 1930, 2205
Japan	Tokyo	15,285, 15,135, 11,780	1900
Lebanon	Beirut	9625	2130
Netherlands	Hilversum	17,810 15,445 11,950, 9590	1030 (Tues., Fri.) 1415 (Tues., Fri.)
Portugal	Lisbon	7125, 6085 6035, 5985	1630 (exc. Sun.) 2030 (exc. Sun.)
Romania	Bucharest	6185, 6025 11,810, 9510, 7225, 7195, 6190, 5990	2105, 2245 1730
Spain	Madrid	11,715, 9615, 6140	2200, 2100, 2000
Sweden	Stockholm	15,240 11,805	0900 2215, 2045
Switzerland	Berne	11,865, 9665, 9535 15,315	2015, 2315 0950
U.S.S.R.	Moscow	9740, 9730, 9700, 9680, 9650, 9620, 9610, 9570, 7320, 7310, 7240, 7200, 7150 (may not all be in use at any one time)	1730, 1900, 2000, 2100, 2300, 0040
Vatican City	Vatican City	11,740, 9645, 7250	1950

ELECTRONICS METALS QUIZ

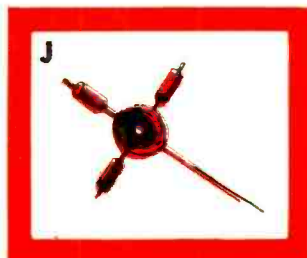
By ROBERT P. BALIN

- 1 Alnico _____
- 2 Bronze _____
- 3 Germanium _____
- 4 Lead-Tin _____
- 5 Cesium _____

Various metals are used in making electronic devices. Can you match the names of the metals listed at left (1-10) with the drawings of components (A-J) utilizing their special properties?



- 6 Tungsten _____
- 7 Osmium _____
- 8 Mercury _____
- 9 Nickel-Cadmium _____
- 10 Nichrome _____



(Answers on page 95)

THE GREAT DEBATE

GOOD EVENING, ladies and gentlemen. Welcome to 'The Great Debate.' I am your host, Frank G. Stillman. For the next sixty minutes, you will be watching the two candidates for president of the United States answer and debate questions asked them on the current issues facing the country. This debate follows in the tradition of the Kennedy-Nixon debates of 1960.'

I watched Stillman in the viewfinder of my camera, gradually panning across the stage and zooming out to take in the whole scene. The two candidates stood almost facing each other at twin lecterns, both visibly sweating under the hot lights. I gently swung the camera around again, focusing to the left and slightly behind Stillman. There it was—International Computer Research Corporation's HBE-779—the most complex, sophisticated thinking machine ever to come from the hand of man.

I panned in for a close-up view of some of the details of the machine and then held it while the control room cut to a video tape of the National Anthem.

WELL, that's how it started. Everyone liked the idea of having the two candidates challenge each other on TV, and all would have gone well if the boys from International Computer hadn't stuck their two cents in. Me? As far as I was concerned, it was a big honor for Bill Finch, TV cameraman, to work the show. If I'd known what was

bound to happen when you mix politics and binary digits, though, I wouldn't have felt that way.

Stillman, always a bit of a ham with his deep, resonant voice and handsome profile, ran through the intro right on cue. As he went into the candidates' qualifications, I focused my camera on the two faces that had become so familiar across the country, the faces of Governor Frank L. Jason of California and Senator George C. Casper of Illinois. Then, while the camera across the way was shooting Stillman, I watched Casper fiddle with a gold-plated cufflink. Jason was outwardly calm; inside, he was probably in a turmoil—I'd know him to blow his top—out of camera range—on more than one occasion. Stillman was still talking.

"Tonight, the questions will be put to our candidates by one of science's most miraculous inventions, the HBE-779 computer. The HBE-779, developed by ICRC, has a memory capacity more than a thousand times greater than any previous computer. For months, a distinguished panel of educators, scientists, foreign policy experts, military men, and political analysts have worked on 'educating' the HBE-779. In addition, the great mass of accumulated knowledge stored in computer banks across the country has been fed into it. Even more impressive is the fact that the HBE-779 has the ability to instantly store and analyze any kind of data—including that to be presented here to-



It was a rough night for everybody except the computer. But the computer wasn't "somebody"—or was it? By ROBERT BENSEN, WA9DCN

night. Ladies and gentlemen, for the first time in history, we have an ultimately qualified, completely impartial entity to put questions of vital interest to our two candidates!"

That was my cue to take a close-in shot of the HBE-779 and its operator. "Governor Jason has won the coin-toss," Stillman was saying, "and has elected to take the first question."

I could feel the suspense growing as the neatly tailored ICRC operator activated the HBE-779 computer. A bank of lights blinked in a seemingly random pattern and the machine responded with a typewritten inquiry. The operator handed the question to a page boy, who conveyed it to Stillman. As Stillman read the question, another camera su-

perimposed a picture of the typewritten letters on the screen. It read like this:

XXX XXX QUESTION FOR GOVERNOR JASON: HOW SHOULD WE DEAL WITH THE MORGUANDAY CRISIS? XXX XXX

Jason frowned, cleared his throat, and began. "I'm glad you asked that question," he said with a smile and a mock bow toward the machine. "The Morguanday situation has grave implications for all of us, and as I am deeply concerned with the security and freedom of nations everywhere . . ."

He never got a chance to finish. A red indicator light and a buzzer activated by the HBE-779 disrupted his

(Continued on page 96)





Across the Ham Bands

By **HERB S. BRIER**, W9EQO
Amateur Radio Editor

BOUNCING SIGNALS OFF THE MOON AND OTHER SATELLITES

ON April 11, 1964, Bill Conkel, W6DNG, Long Beach, Calif., and Lenna Suominen, OH1NL, Nakkila, Finland, established a successful two-way radio contact on 144 mc. by bouncing their signals off the moon. This first EME (earth-moon-earth) contact on the 2-meter band was the culmination of several years of regular schedules between W6DNG and OH1NL. Many of their earlier skeds were partially successful, but it was not until April 11 (April 12 in Europe) that they made—and recorded on tape—a complete two-way contact

W6DNG transmits with a final amplifier using a pair of 4X250B's driven to 1000 watts input. His stabilized crystal oscillator has not been shut off since June, 1962. The W6DNG antenna is a 56-element, horizontally polarized beam which has an honest, measured gain of over 18 db and is adjustable both horizontally and vertically. This is the 59th 2-meter beam Bill has built since 1952!

For reception, Bill uses a 416B r.f. amplifier into a nuvistor converter, into a Collins 75A4 receiver modified to incorporate automatic frequency control and noise blanking and clipping. The 75A4 then feeds a tape recorder and headphones through an 80-cycle audio filter.

In Finland, OH1NL's completely home-constructed station consists of an 800-watt transmitter feeding a 24-element beam antenna with a screen reflector and a claimed power gain of 21 db. Full details of Lenna's receiver are not available.

Lenna, who is 46, has been a ham since 1935, and is the technical manager of a leather factory. W6DNG is 48 and is an electronics project leader for Douglas Aircraft Company; he has been "fooling around" with the VHF's since 1932, and with "moon-bounce" since 1956.

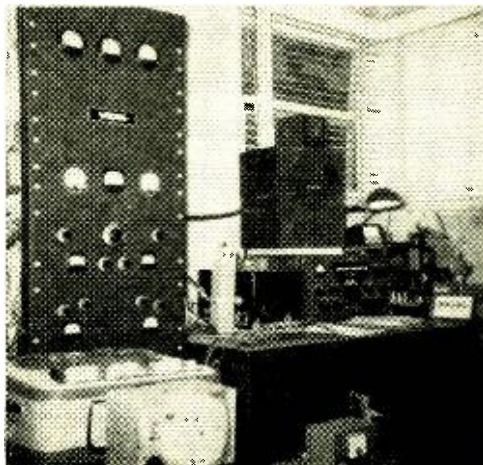
The next time you hear someone say that "amateur radio is just a hobby," think of OH1NL and W6DNG. In the best ham tradition, they have done something that some experts thought impossible!

Telstar II and Maser Amplifier. While discussing W6DNG's and OH1NL's EME record with Denny, W8TTT, an Ohio Bell Telephone Company engineer, we got onto the topic of signal-to-noise ratios and active satellites such as Telstar. Will amateurs ever be able to participate in experiments such as those conducted by AT&T we wondered? But after Denny pointed out that AT&T used a gigantic 400-ton horn antenna with a 3600-square-foot opening and tons of tracking and auxiliary equipment to transmit to Telstar, we immediately withdrew the idea.

A more practical goal would be a maser (microwave amplification by stimulated emission of radiation) amplifier. For example, when Telstar's 2¼-watt signal (on 4170

Amateur Station of the Month -----

The accompanying story of the record-breaking "moon-bounce" contact between W6DNG and OH1NL will explain why Bill Conkel's station has been chosen as the current Amateur Station of the Month. (That's his famous antenna on the right.) Bill will receive a free one-year subscription to POPULAR ELECTRONICS. If you would



The first "Radioman Submariner" award certificate was presented to Jack Frye, WA8DFF, by Captain Walter A. McGuinness, USN, Commander of Submarine Squadron Twelve, at the Squadron's Amateur Radio Club, Key West, Florida.

Official U.S. Navy Photograph



mc.) reaches a ground station, it is so weak that no ordinary communications receiver can bring it up to a usable level. But a super-cooled ruby maser operating at a temperature of -456 degrees F brings the Telstar signal up out of the noise to commercial TV quality.

If a maser amplifier could do that to a 6-mc. wide TV signal, imagine what it could do to a narrow UHF ham signal. W8TTT reports that experimental masers are available for around \$1200—less accessories, of course.

Transmitting via Oscar III. If you have an AM, c.w., SSB, or RTTY transmitter capable of operating within 25 kc. of 144.1 mc., and a receiver capable of tuning 145.9

mc. \pm 25 kc., you don't need a maser or other exotic equipment to participate in a two-way satellite communications experiment. Watch for the forthcoming launch of Oscar III (if it has not actually occurred by the time you read this).

During the estimated two to four weeks that Oscar III will be in orbit, it will pick up all signals heard near 144.1 mc. and retransmit them near 145.9 mc. Every time Oscar passes overhead, you can work other 2-meter amateurs 500 to 1500 miles away. But keep the contacts short; Oscar will be within range only about four minutes on each pass. If possible, tape-record and time accurately everything you hear via Oscar.

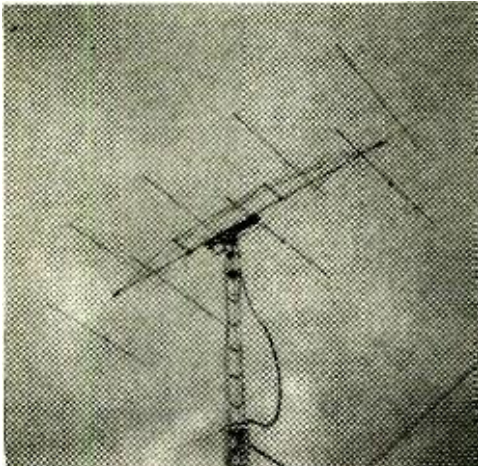
K2US at World's Fair. In K2US's first six weeks on the air, 2510 licensed amateurs signed the guest book of "the voice of amateur radio at the World's Fair" located in the Coca Cola pavilion. Over 900 of these licensed visitors remembered to bring their *original* FCC licenses with them and were able to operate K2US. They made over 4800 contacts in 50 states and 29 countries.

During the same period, K2US answered 2225 incoming QSL cards. Incidentally, K2US verifies all valid SWL reports received, as well as QSL cards. The QSL address is: Amateur Radio K2US, P.O. Box 337, World's Fair, New York, N.Y. 11380.

"Radioman Submariner" Award. Because of the decrease in the number of active amateurs on U.S. submarines, requirements for the "Radioman Submariner" award have been liberalized. You now need only three contacts to qualify. Two of them must have taken place with U.S. submarines since January, 1962, and the other one must be with either W4YVS, the club station of Submarine Squadron Twelve, or with WA4KMH on the *USS Bushnell* (AS-15) since January, 1963.

Send your award application with QSL's or notarized log entries of the contacts (any
(Continued on page 91)

like to enter the contest, send us a clear picture of your station—preferably showing you at the controls—along with some information about yourself, your equipment, and your operating achievements. All contest entries should go to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, Box 678, Gary, Indiana 46401.





On the Citizens Band

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

WITHIN MINUTES after a tornado hit the Mount Clemens, Mich., area last spring, the Macomb CB'ers Club, Inc. had an emergency communications system set up and operating. The station of club president Vincent L. Cuker, WA8BIJ/19W9224,

was immediately established as the control center for all CB communications. Some 16 CB units were used, with an additional 8 or 10 standing by in fringe areas. Volunteers

worked from 5:15 p.m. until 4:30 a.m. the following morning assisting victims, municipal officials, and governmental agencies.

Among the many calls placed through the control center after the disaster were relays from the Red Cross director of Chesterfield Township (hardest hit) to the Red Cross in both Mount Clemens and Detroit requesting that all emergency equipment be sent into that area, and one from a Michigan Bell Telephone Company field engineer also requesting emergency equipment.

The control center passed along information on downed power line transformers, handled messages of reassurance from residents inside the disaster area to relatives outside, and dispatched mobile units to trace lost persons and to deliver and set up numerous power units and floodlights. Up-to-the-minute weather bulletins were sent to

search teams and sheriff department officials, and news reports were relayed to the United Press offices from a UP reporter at the scene.

The Macomb CB'ers, assisted by three mobile units from the Southeastern Michigan 11-Meter Club, were subsequently lauded by civil defense officials, the area sheriff's department, utility companies, and local news media for their efficiency in this emergency.

Sky-Diving CB'ers. There's a "talkie" in the sky minus an airplane. It's ingeniously attached to the headgear of a sky diver! Members of the Akron Sky Diver Sport Parachuting Club, of Akron, Ohio, have rigged a 1-watt CB transceiver into a crash helmet in order to give instructions to stu-

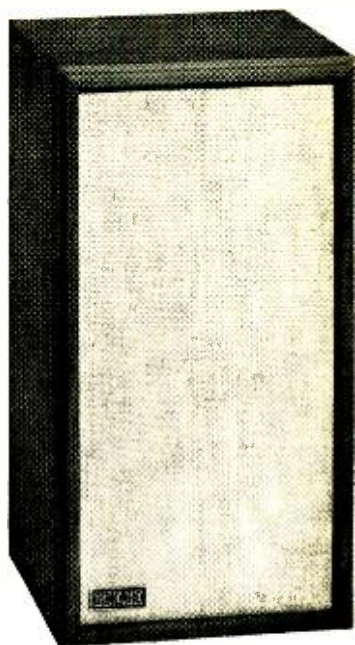
CB'ERS AID IN TORNADO DISASTER

Another CB "first"! At the 1964 Indianapolis 500-Mile Classic, three helicopters like the one shown here were available to speed the evacuation of injured drivers. Each helicopter was equipped with a Regency "Range Gain" CB transceiver in a shock mount for rapid communication with the emergency hospital at the track and the nearby Methodist Hospital. The two hospitals were CB-equipped.



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is field serviceable. The grille cloth can be changed in a snap. The LCR crossover network is designed as an integral part of the system and permits an increase or decrease of 2.5 db in the high frequency level without acoustical 'shelving'. The Seventeen has, by far, the lowest harmonic distortion in the bass of any speaker in its price range.

But no description of the Seventeen, no matter how detailed, can tell you how it sounds. You've got to hear it. Only then will you be able to understand what an unusual achievement the Seventeen is, in high performance at low cost. The Seventeen is at your dealer's now. Listen to it. We think you'll agree it's the breakthrough speaker of the year.

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CIRCLE NO. 17 ON READER SERVICE PAGE



Norman Runion, KHA0268, calls home from his mobile. Marilyn Runion, KHD-4757, operates the fixed unit. See text below for details on this CB-minded family.



dent jumpers as they approach the ground and maneuver their chutes for landing. An Olson "Spotter 2" owned by H. P. Weyand, Jr. serves as the group's mobile base station.

According to H. P., the "walkie-talkied-helmet" adds a measure of safety to the operation as beginners learn the art of sky diving. The mobile base station operator is in direct contact with the airplane at all times, and has talked with a jumper in a free fall from as high as 7200 feet—up, that is! CB'er Weyand further states that the ground unit works fine all the time but the crash helmet transceiver sometimes gets a little "shook" on landing.

If you have a yen for high places, or are interested in tuning-in or watching these sky divers, the jump site of the club is Shady Grove Airport, Route 93, Massillon, Ohio. We'll watch from here!

Meet the Runions. There are six of them in all: Marilyn, KHD4757; Norman, KHA0268; and Linda, Alice, Debra and Norm Jr. The two older Runions belong to the Maumee Valley CB Club, Fort Wayne,

Ind., for which Marilyn was recording secretary at one time. But Norm and Marilyn also belong to the DeKalb County CB Club in Garrett, Ind. (their home town).

Marilyn handled the refreshment arrangements for the DeKalb organization for more than a year, and Norm is presently chairman of special events and a member of the board of directors, the volunteer fire department and the DeKalb County Sheriff's Mounted Posse. Norm also takes movies of club activities which are later used at club meetings for entertainment.

These two CB'ers are also credited with having started the DeKalb club's monthly newspaper, the *DeKalb Static*, the first issue of which appeared in July, 1962. From the samples we saw, we'd say they did a stellar job of tackling a project with which they had no previous experience, right down to the hand-drawn illustrations.

The Runions are obviously CB-active

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CIRCLE NO. 24 ON READER SERVICE PAGE

where it counts the most. That's the kind of "activity" that holds CB clubs together and helps them grow.

Stolen! A Cadre 510, serial #10778, disappeared from the mobile unit of KID5503 in the vicinity of Mt. Oliver, Pa., on April 16. If you have any information on this set, contact Jeff Wilhelm, 868 Glass Run Rd., Pittsburgh 36, Pa., who is offering a \$25 reward for it.

A Johnson CB mobile unit was also stolen from the truck of Al Miller, 19A6226, while he attended a CB club meeting. Unfortunately Al did not make a record of the serial number, but if you have any information as to the whereabouts of such a unit, by any chance, send it to 19A6226 in care of the Macomb CB'ers Club, Inc., Box 55, Mt. Clemens, Mich.

Both of these incidents bring up a point. Not only should you be sure to record the serial numbers of your equipment to aid police or others in locating same if need be, but you should also be sure that your mobile equipment is covered by your automobile insurance. You'd be surprised how many units are *not* covered unless so specified in the policy or by attachment of a statement. Although it may cost a few dollars more to insure your equipment, it's well worth it considering the size of most investments in this area of communications.

Club Chatter. The Browning CB rig of Wilma and Don Cortwright sits atop their TV set, since, more often than not, *both* are monitored simultaneously—the CB set on channel 11. Don, 19B0553, is the editor of *CB Chatterbox*, the excellent club newspaper of the Cereal City Citizens Radio



Club, Battle Creek, Mich. (The CCCRC, an active, highly successful group, has been a loyal contributor to OTCB for almost three years.) When last seen, Don and Wilma were on their way to the New York World's

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Fair with, among other things, two Leicas with assorted lenses and a Johnson 1½-watt hand-held transceiver strapped to each of them to avoid any "lost time."

The CB'ers in Rockford, Ill., have organized a new association known as the Rock River Valley CB Radio Club. Membership (charter-type) in the first month was 135, with the 200 mark expected to be reached shortly due to a membership drive now in progress. Shown seated (left to right) are Irv Camp, KHB0004, president; Wes Williams, KHA5230, vice president; George Davis, KLJ9558, secretary; and Keith



Weaver, KHD8473, treasurer. Standing (left to right) are members of the club's board of directors: Dutch LaBounty, KHC0306; Bob Krenek, KLJ2886; Jack Waterson, KHD3165, editor of *Static Pusher*, the club's newspaper; Pierre LaBounty, 18Q3647; and Russ Nathews, KHC1896.

CB Club Roster. The following new clubs have been added to the 1964 OTCB Club Roster this month:

- Washington State Citizens Band Association, Centralia, Wash. Officers: Al Danner, 14Q0303, president; Walter S. Burr, KFI1746, western vice president and editor of the club newspaper, the *WSCBA News*; Dean Jones, eastern vice president; and Harold Brown, 14Q0918, treasurer.

- Shoreline Radio Club, Sarasota, Fla. Officers: Carl Haymes, president; Elmer Birchfield, vice president; Paul Maeder, corresponding secretary; Earnie Cadle, secretary; Bonnie Howell, treasurer; Everett Lough, sergeant at arms; and Muriel Kelly, parliamentarian.

- The Bay State Five Watters, Arlington, Mass. Officers: Malcolm Reale, KDB4173, president; Winslow Bancroft, KBD3468, vice president; and Raymond Dick, 1Q0974, secretary/treasurer.

- Relay Knights, Adelphi, Mo. All members of this newly organized club are licensed amateurs as well as CB operators.

If you have not yet sent us the full story on your club (officers, activities, pictures, etc.), let us hear from you soon.

I'll CB'ing you.

—Matt, KHC2060



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RADIO ASTRONOMY AND HOW TO BUILD YOUR OWN TELESCOPE

by John Heywood

At first glance, this book appears to answer many of the nagging questions about amateur experimentation with radiotelescopes. Further examination proves disappointing, however. Although the British author has had the opportunity to perform many of the tests and experiments he has outlined, he somehow never gets the reader to the point of actually building the necessary "hardware." For example, various receiver
(Continued on page 90)

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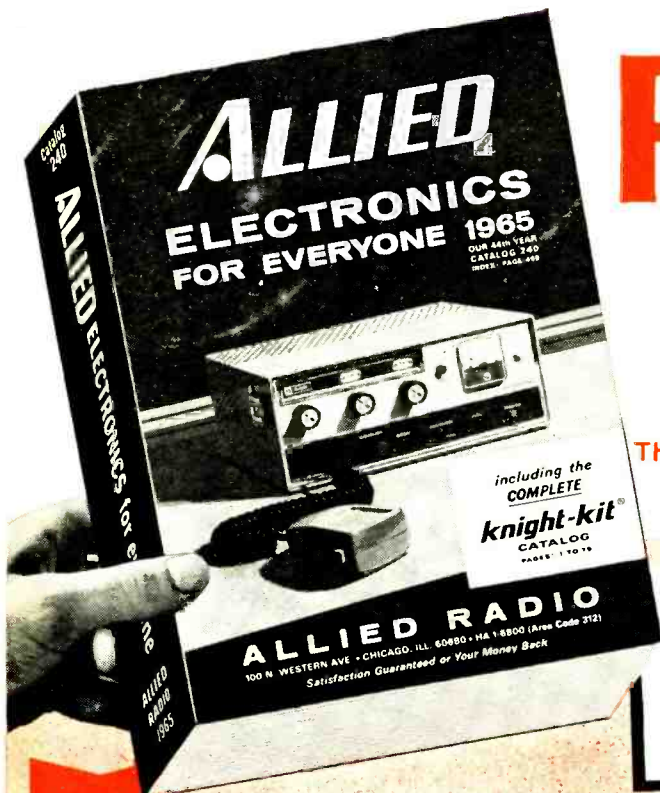
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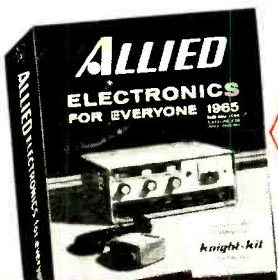
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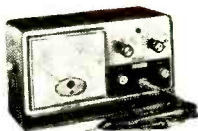
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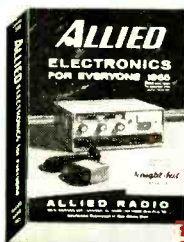
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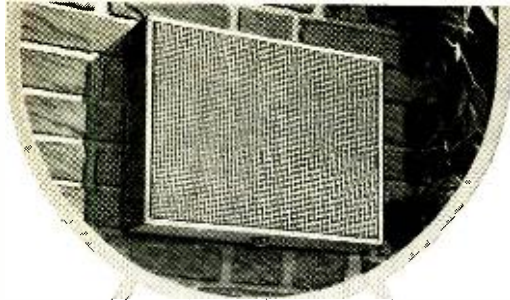
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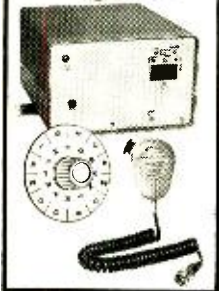
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Checks operating performance of 24 circuits including filament, plate and input voltages, transmitter forward and reflected power, modulation, etc. This "years ahead" built-in test feature makes tune-up and servicing easy. Switch, located on transmitter/receiver unit, is used for selecting circuits. The 750-HB2 has 23-crystal controlled channels. Operates on 115 vac or 6-12 vdc.



15 NORTH LEE, OKLA. CITY, OKLA.

CIRCLE NO. 15 ON READER SERVICE PAGE

● **WRITE FOR THE**
NAME OF YOUR
NEAREST DEALER.

Bookshelf

(Continued from page 85)

circuits are shown, but important parts values are always missing. On the other hand, the sections on the theory of extra-terrestrial noise and on antennas are both good, and make the inexpensive paperback edition of this book a worthwhile investment.

Published by *ARCO Publishing Co., Inc.*, 480 Lexington Ave., New York 17, N.Y. 154 pages. With soft cover, 95 cents; with cloth binding, \$2.50.



RCA TRANSISTOR MANUAL, Second Edition

Taking its place alongside the popular *RCA Tube Manual* is the *Transistor Manual*—now available in a brand-new second edition. Just as no experimenter or technician would be without an up-to-date *Tube Manual*, so every electronics enthusiast should consider this expanded *Transistor Manual* a "must." Containing technical details on 600 transistors, SCR's, varactors, rectifiers, and tunnel diodes, this edition also includes 45 suggested semiconductor circuits. For quick reference, the manual has a "Selection Chart" classifying various semiconductors by function and performance level.

Published by *RCA Electronic Components and Devices, Harrison, N.J.* 384 pages. Soft cover. \$1.50.

Free Literature

The complete line of pre-wired master power control outlet boxes made by Waber Electronics Inc., Hancock and Somerset Sts., Philadelphia, Pa. 19133, is described in a new eight-page, two-color brochure. There are over 100 different models ready to be plugged in for instant use . . . And Newcomb Audio Products Co., 6824 Lexington Ave., Hollywood 38, Calif., has put out a four-page brochure on its TX10 series of stereo tape recorders and accessories. Four models of the TX10 are available . . . Something for everybody can be found in the 1964 "Edu-Kit" Electronics Catalog. Published by Progressive "Edu-Kits" Inc., 1186 Broadway, Hewlett, N.Y., it illustrates and describes wired instruments as well as kits—intended for amateurs, hi-fi fans, experimenters, car owners, TV viewers, and photographers. Also covered in this 52-page booklet (plus 12 loosely inserted "bargain" pages) are various parts, books, tools, etc.

—50—

Across the Ham Bands

(Continued from page 79)

mode or band) to: President, Submarine Squadron Twelve Amateur Radio Club, Key West, Fla.

VK/ZL DX Contest. All amateurs and SWL's are invited to participate in the annual VK/ZL DX contest. The dates and times are as follows. Phone: 1000 GMT (4:00 a.m., EST), October 3, to 1000 GMT, October 4. C.W.: 1000 GMT, October 10, to 1000 GMT, October 11.

Amateurs should exchange serial numbers consisting of the normal signal report and a three-digit group, starting with 001 for the first contact, with each station worked. You earn two points for each VK or ZL worked, one point for other South Pacific contacts. Your total score will equal the total number of QSO points multiplied by the sum of the number of different VK/ZL call areas worked per amateur band. Keep a separate log for each band, underlining each new call area worked. Then prepare a summary sheet headed by your clearly printed call letters, showing your work per band and your total score. Include data on your station on this sheet.

Short-wave listeners should log all VK's and ZL's heard, with the information appearing in the following order: date, time (GMT), call letters of the VK or ZL heard, call of station being worked, the VK's or ZL's signal report, and the serial number sent by the VK or ZL.

Mail your score, large or small, in time to arrive at N.Z.A.R.T., Box 489, Wellington, New Zealand, by January 16, 1965. Attractive color photo certificates will be awarded to the leading contestants.

Banned Countries. Hearing a CO2 (Cuba) calling "CQ" with a conspicuous lack of takers reminded us that a constant worry of new DX chasers is that they might accidentally work one of the countries on the U.S. banned list. Actually, it is a very short list: Cambodia (XU), Indonesia (PK), Thailand (HS), and Viet Nam (3W8).

News and Views

Doug Decker, WA6TAD, 2837 "K" Ave., National City, Calif., reports that in the San Diego area there are about 35 stations on 146.84 mc. FM, several on 449.125 mc., and others on both 146.94 mc. and 52.525 mc., the ARRL 2- and 6-meter "calling" frequencies. . . . **John Morrice, WN61TM**, of 232 James St.,

October, 1964

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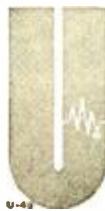
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CIRCLE NO. 13 ON READER SERVICE PAGE

Orange, Calif., closed out his Novice career with 40 states and six countries worked. A Johnson Viking I transmitter held down to 75 watts, a Hallicrafters SX-140 receiver, and a Hy-Gain 14AVS vertical antenna did the trick . . . **Kermit Hickman, WA0ILQ**, P. O. Box 114, Crocker, Mo., made the journey from Novice to General in two months. But he worked 27 states along the way. A Heathkit DX-20 transmitter and a Hammarlund "Super-Pro" receiver are backed up by a Harvey-Wells T-90 transmitter and R-9 receiver combination, feeding either a Hy-Gain 14AVS vertical or a home-brew horizontal antenna.

John Zuris, WA9ICQ, will be in California when you read this, but he ran up an impressive low-power record in Chicago. With an EICO 720 transmitter running 90 watts, a Knight-Kit R-100 receiver, and two antennas—a 20-meter dipole and a random-length wire—John worked 51 countries and all states. John likes to practice his skimpy Spanish on Latin American hams; it helps him get QSL cards, too . . . If you have worked **WN4CQJ** since May, 1962, Bruce P. Cox, WPE4HFU, P.O. Box 116, Oxford, N.C., says you have worked a phony who is using his brother's name and call letters. The FCC has been alerted, and Bruce would appreciate receiving any dope on your contacts with WN4CQJ, who has been operating on 7.17 mc . . . **Alan Senchal, WN9KQG**, 1003 7th St., Hudson, Wis., does most of his operating on 40-meter c.w. and on 2-meter phone. A home-brew 45-watt transmitter feeding a 20'-high, 40-meter dipole and a Hammarlund HQ-145X receiver have racked up 34 states and Canada on 40 meters. A Heathkit "Twoer" and stacked 2-meter beams handle 2 meters.

Chris Bienenman, WB2ODI, 661 Mill St., Williamsville 21, N.Y., has just moved to a new location and has been fooling around with a basement antenna. Contacts come hard, but he has worked 400 miles with it . . . There are lots of stories going around about the FCC's erroneously issuing General Class licenses to Novice applicants. On the other hand, Chris reports that WA8JJC got WN8JJC on his *General Class* ticket! Of course, the FCC quickly straightened out the error when it was called to their attention. If anything like that should happen to you, the FCC advises that you should return the license to them immediately with a notation of the error . . . **"Rich" Powell, WN9KLE**, Box 81, Perrysville, Ind., runs 75 watts on 40 meters to a home-brew transmitter and receives on a converted Zenith AM receiver. He has ten states worked on that band. On 2 meters, he uses a Heathkit "Twoer" feeding a corner-reflector type beam about 20' high; his record is three states worked. . . **Thomas Benoit**, 43 Lake St., Tupper Lake, N.Y., should be **WB2INF** when you read this. As WN2INF he worked 30 states on 80 meters, where he prefers to rag-chew compared to chasing DX. Tom's equipment includes a Heathkit DX-40 transmitter and a Hallicrafters SX-99 receiver backed up by a Knight-Kit R-55 now used for SWL'ing. The gear represents a lot of miles walked delivering newspapers in order to earn the money to pay for it.

Bob Zulinski, WA8MAM/WN8MAM, 1936 Wiltshire Rd., Berkley, Mich., gives the electrons in his antenna, receiver, and transmitter no rest. In 23 days, he has made 107 QSO's in 23 states and Canada. A Knight-Kit T-150 transmitter feeds a 46' antenna almost a dozen feet high, and he receives on a Hammarlund HQ-145 . . . **Bob Thompson, WN3AEW**, Box 107, Route 2, Mitchellville, Md., keeps all the Novice bands hopping: 80, 40, and 15 meters with a home-built 807 transmitter and a Hallicrafters SX-28 receiver; 2 meters with a Heathkit "Twoer" feeding a 5-element beam atop a 40' tower . . . **Betty Satta, K8TFL**, 795 W. Center St., Marion, Ohio 43305, shares a home-brew 16-wattter on 6 and a Heathkit Pawnee on 2 with her OM, Ben, K8BSO. Everybody "knows" that the VHF's are good only for local contacts; nevertheless, K8TFL/K8BSO have worked over 45 states, Canada, Cuba, and Puerto Rico. A 5-element beam at 62 feet helps. A Hammarlund HQ-110C receiver helps, too.

Let us have *your* picture and "News and Views" for next month! Also, we would appreciate being put on the mailing list to receive your club bulletin. The address is: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Ind. 46401. 73.

Herb, W9EGQ



Scouts attending the national Boy Scout Jamboree at Valley Forge, Pa., July 17-23, served as reporters for 2000 U.S. radio stations and 42 foreign countries by making on-the-spot tape recordings in English, Greek, Chinese, French, Japanese, Russian, German, Hebrew, and many of the different African dialects. Over 2000 Scouts used 150 Wollensak tape recorders and 12,000 reels of "Scotch" magnetic tape donated by the 3M Company. Busy with a recording session here is a group of Louisiana Scouts and a Canadian Scout.



October, 1964

HALF PRICE! 4 Transistor Ignition



New Heathkit® Version of Famous NELI "Trans-nition"® System... Only \$34.95

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Transistor Topics

(Continued from page 64)

start and maintain r.f. oscillation is obtained by means of $L1$'s tap and supplied to the base circuit through coupling capacitor $C1$. The modulating audio signal is obtained from a small microphone and applied to $Q1$'s base circuit. Operating power is supplied by $B1$, controlled by s.p.s.t. switch $S1$.

Readily available parts are used in the device. Antenna coil $L1$ is a tapped "vari-loopstick." Capacitors $C1$ and $C2$ are small ceramic or mica types while $R1$ and $R2$ are half-watt resistors. Transistor $Q1$ is a general-purpose pnp unit, such as a 2N107 or CK722. A crystal earphone (typically, a Lafayette MS-949) serves as a microphone. Battery $B1$ is a small 9-volter, such as a Burgess 2N6 or 2U6, while $S1$ is a push-button or slide switch.

The majority of builders will probably want to follow Ken's example, assembling their units on small phenolic "chassis" boards and mounting them in hand-sized plastic boxes. Wiring and layout are not critical. A relatively short (2- or 3-foot) "whip" type antenna can be used.

In operation, $L1$ is adjusted until the instrument's signal is picked up on a nearby broadcast-band receiver at a "dead" spot on its dial (where no local stations are received).

Transitips. If you own—or have access to—a transistor tester, you'll find it worthwhile to sort your stock of low-cost and used transistors, checking each for leakage and gain. They can then be grouped as low-, medium- and high-leakage and low-, medium- and high-gain types. If you find that two or more similar units have identical leakage and gain values, these can be identified with a spot of fingernail polish or model enamel and saved for use as "matched pairs" in push-pull or differential amplifier circuits.

Low-leakage units can be kept for critical applications and for d.c. and direct-coupled amplifiers, while medium-leakage types are suitable for most general-purpose applications, such as audio amplifiers. High-leakage units can be used, quite often, as "self-biased" amplifiers, as detectors, and in noncritical circuits.

Similarly, low-gain transistors can be used as audio oscillators and in emitter-follower circuits, while medium-gain units are suitable for most general-purpose applications. Finally, high-gain units can be

saved for preamplifiers, r.f. circuits, and other critical work.

You may find that some units have, for example, high gain, which is desirable, coupled with high leakage, which is undesirable. Again, these units can be suitably identified and used in appropriate circuits. On the other hand, you might well discover a few units which have exceptionally high gain and very low leakage.

Until next month . . .

—Lou

Metals Quiz Answers

(Quiz appears on page 75)

- 1 - H ALNICO is an alloy of iron, aluminum, nickel and cobalt, utilized in making permanent magnets.
- 2 - J Phosphor BRONZE springs are used in the manufacture of meter movements.
- 3 - F GERMANIUM doped with impurities such as arsenic or boron is employed in making transistors.
- 4 - A LEAD and TIN alloys are used in solder.
- 5 - B CESIUM is the photoemissive metal employed in the mosaics of television iconoscopes.
- 6 - C TUNGSTEN is used in lamp filaments.
- 7 - D OSMIUM is a hard metal utilized in phonograph stylii.
- 8 - E MERCURY is used to short the contacts of a mercury switch when the glass container is tilted.
- 9 - G NICKEL and CADMIUM are used in rechargeable battery cells.
- 10 - I NICHROME is a high-resistance alloy of nickel and chromium used for heater elements.



The prospect of electronics experimenters building their own subminiature radio receivers has moved closer to reality. The J. W. Miller Co. (Los Angeles, Calif.) revealed in late



July that it had taken the first steps toward offering a 455-kc. i.f. amplifier to experimenters for \$4.75. In the tiny package, known as Part No. 8902, is a ceramic filter

for selectivity, two transistors, two i.f. transformers, and a diode detector. Gain of the complete i.f. system is rated at 55 db and the bandwidth is 6 kc. at 25 db down. A project using this prealigned i.f. system is scheduled for early publication in POPULAR ELECTRONICS.



Amateur stations W1ZLX/1 and WA1A-AO/1 report that they are planning a "DX-pedition" to the rare Massachusetts counties of Dukes and Nantucket in October. The frequency used will be 7040 kc., with alternates of 7035 and 7037 in case of heavy QRM. Both stations will be on alternately from Dukes County between 1600 and 2400 GMT Oct. 17, and between 0000 and 1800 GMT Oct. 18. Nantucket county will be heard from on Oct. 24 (2000 to 2400) and Oct. 25 (0000-1600). On Oct. 18 and 25, the two operators will work Novices only on 7160 kc. at 0000-0100 and 0500-0600. QSL's should be sent, along with a SASE, to the home QTH of the station worked.



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CIRCLE NO. 39 ON READER SERVICE PAGE

The Great Debate

(Continued from page 77)

train of thought, and he stood there helplessly as the machine ground out a tersely worded typewritten message.

XXX XXX RESPONSE CONTRARY TO PUBLISHED STATEMENTS OF CANDIDATE. THE GOVERNOR HAS STATED TEN TIMES IN PAST SIX MONTHS THAT MORGUANDAY PROBLEMS ARE OF NO CONCERN TO U.S. XXX XXX

The governor's face reddened, and the cords in his neck stood out, but he managed to continue. "The free and sovereign state of Morguanday has suffered dire threats against her security, largely due to subversion from within. I have the utmost confidence in her leaders and their ability to stabilize the situation, but..."

Again the HBE-779 clicked, and another typewritten message slid from its maw.

XXX XXX GOVERNOR VACATIONED WITH DICTATOR OF MORGUANDAY. OWNS 30 PERCENT INTEREST IN SUGAR REFINERY. MORGUANDAY PER CAPITA INCOME LOWEST IN AMERICAS. REVOLUTION JUSTIFIED. XXX XXX

"What is this? What is it trying to do to me?" screamed Jason.

Stillman looked at the ICRC operator, and a sound man quickly moved a microphone over the operator's head to catch his words.

"I believe the machine also scans Spanish language newspapers," he offered meekly.

Jason started toward him, and I quickly panned my camera to catch the motion, but halfway across the stage the governor changed his mind, and stomped back to a chair behind the lectern. There he sat, fists clenched, purple with rage.

"Ladies and gentlemen, let's continue," Stillman said quickly, trying to repair the damage. "Governor Jason,

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CIRCLE NO. 25 ON READER SERVICE PAGE

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Model 8902 pre-tuned 455 KC IF strip provides excellent gain (55 db) and selectivity (6 db bandwidth: 8 KC) No alignment is required. Included among the 21 components on the PC board are a mechanical filter, 2 transistor amplifiers and a diode detector capable of driving earphones. Overall dimensions: $\frac{1}{2}$ " x $\frac{1}{2}$ " x $1\frac{1}{2}$ ".

Model 8901 input IF transformer adapts the IF strip for use with a converter in capacity detectors, AM and CB receivers. Both units are included for \$5.75 net.



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CIRCLE NO. 20 ON READER SERVICE PAGE

we thank you for your answer. We will now move on to Senator Casper."

Again the bank of lights blinked, and the HBE-779 ground out a question.

XXX XXX SENATOR CASPER,
EXPLAIN RECENT STOCK
TRANSFER TO BROTHER-IN-
LAW XXX XXX

Casper leaped to his feet, one arm upraised, almost defensively. "I can explain that. You see, when I decided to stand for public office, I felt that I should eliminate all possibility of a conflict of interests. As the corporation in which I was a major shareholder did business with the Defense Department, I transferred those stocks to my brother-in-law to keep myself free and independent . . ."

XXX XXX INDIVIDUAL RE-
FERRED TO AS BROTHER-IN-
LAW IS IN THE SENATOR'S
EMPLOY. XXX XXX

"That's a dirty lie!" Casper shouted, his face twisted with anger and hate. "I . . . I *have* no real brother-in-law!"

The words and intent were out and could not be recalled. I looked at Casper, now speechless with the enormity of his confession. He sat down in confusion, started to pull on a cuff-link, then put a shaky hand into his pocket, pulled out a vial and quickly swallowed several large white pills.

Stillman, his handsome face showing bewilderment, looked from one candidate to the other, unsure as to whether or not he should or could continue. As always, the lure of the bright lights won over his traditionally small quotient of good sense. "Gentlemen, gentlemen," he said, "let's not quibble over little misunderstandings. Let's give the HBE-779 another chance."

For a moment, it looked like he had made the right decision; the HBE-779's second question to Jason seemed both simple and direct.

XXX XXX WHY DO YOU WANT
TO BE PRESIDENT? XXX XXX

Jason listened to Stillman read the question, rose to his feet with dignity and composure, and started to speak.



**"\$59.95?
Must be an import"**

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It's the Cadre C-60!"**

Not an import—not a toy—a full fledged 100 milliwatt transceiver with all the features found in units selling at \$20 to \$50 more.

Here's the tremendous value you get in the new Cadre C-60. Two crystal-controlled channels. Sensitive superhet receiver (1 microvolt). Powerful transmitter that delivers over 70 milliwatts to the antenna. Features: AGC, earphone jack, speech clipping, high impact plastic case, telescoping antenna. Includes channel 11 crystals. Uses standard penlight cells or special rechargeable nickel-cadmium batteries. **\$59.95.**

FOR GREATER RANGE—The Cadre C-75 1.5 watts, 2 crystal-controlled channels. **\$99.95.** See Cadre CB transceivers and the new Consort FM Wireless Microphone. For free catalog, write:

CADRE Industries Corp., Commercial Products Div., Endicott, N. Y.
CIRCLE NO. 7 ON READER SERVICE PAGE

"I have always felt that it is my duty to serve my country in whatever capacity I can. It is a feeling of duty—not ambition—that impels me to run for president. As you know, I accepted a 'draft'..."

XXX XXX ANALYSIS OF PRE-CONVENTION DATA REVEALS BEHIND SCENES MOVES BY CANDIDATE TO INSURE HIS NOMINATION. COLLOQUIALLY CANDIDATE A VOLTAGE STARVED CIRCUIT. XXX XXX

"Voltage starved circuit," the ICRC operator mused to himself into the microphone above his head which had inadvertently been left open. "Undoubtedly the machine is searching for a semantic equivalent for 'power-hungry.'"

"Power-hungry!" shrieked Jason. "Why you..."

Without thinking, I panned my camera to follow the action. Jason was attacking the man from ICRC with his fists, while Casper, head in his hands, was mumbling into the microphone words like "communist plot," "senatorial investigation," and "sue."

When the control room faded us out, it was too late. The HBE-779 had made fools out of both presidential candidates before a hundred million viewers.

A FEW days later, I was on my lunch hour when the announcement came through. Stillman—still on top despite the fiasco—broke in to make the announcement.

"We interrupt this program to bring you a special bulletin. Since the 'Great Debate' held three days ago, a deluge of letters and telegrams has been steadily arriving at the ICRC offices. These letters indicate a new trend which has just been confirmed by a nationwide poll.

"Ladies and gentlemen, the HBE-779 computer now has the active support of eighty-four per cent of the American voters for the office of president of the United States. The HBE-779 computer is in the studio today and would like to comment."

I sat there with the sandwich poised halfway to my mouth, my jaws agape. The cameraman dollied in for a close shot of the computer, as it blinked and

FREE GIANT NEW 1965 CATALOG



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Dept. 70, 1012 McGee St., Kansas City 6, Mo.

Rush me FREE 1965 B-A Catalog

Name

Address

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SEND FOR IT TODAY

FREE

CIRCLE NO. 6 ON READER SERVICE PAGE

NATION-WIDE TUBE CO.



024	6AN8	6DV4	6X4	12AX4
1A7	6AQ5	6J5	7A5	12AU7
1N3	6AU4	6J6	7A7	12AX7
1N5	6AV6	6K6	7B6	12BN6
1K3	6AV5	6A7	7B8	12BE6
1L6	6AV6	6SC7	7C5	12BH7
1W5	6AW5	6SF7	7E5	12CV7
1N5	6AX4	6SG7	7F7	12CS
1A5	6BA6	6SH7	7Q7	12CA5
1U4	6BC5	6SJ7	7J4	12L6
1X2	6BE			12RS
2CW4	6BH6	FREE WITH AD		12SA7
2D54	6BK7	CHEATER CARD		12BT7
2D4V	6BL7	with every		12SK7
3B2E	6BN6	order of \$6		12SQ7
3D7G	6BQ5	or more		12W6
3V4	6CQ6			18FV6
4BQ7	6C97			18FX6
5A7B	6C4	6SK7	8AW8	22DE4
5J6	6CR6	6SL7	8CQ7	25L6
5U4	6CD6	6N7	9AU7	25Z6
5Y3	6CG7	6S07	10DE7	32L7
6A7	6CM7	6U3	11CV7	50A5
6AB4	6CY5	6U5	12AD6	50C5
6AC7	6DA4	6V5	12AF6	50L6
6AF4	6DE5	6W4	12AT7	12L7
6AG5	6DM6	6W6	12AV6	11T23
6AH4	6DQ6			
6AL5	6DS4			
6AM8				

For all type
TUBES

ANY TYPE NOT LISTED MAY ALSO BE ORDERED AT 33¢ each. (\$30 per 100)

\$30
per
HUNDRED

ANNUAL 1¢ SALE
Buy 1 tube at regular price of 33¢ and get 1 extra tube for only 1¢ (From this special list only)
6AU6 6SN7GTB
6CG7 6AX4GTE
6J6 12AU7
6AC7

Offer Ends Dec. 31, 1965
TERMS: Free Postage in USA on prepaid orders. Add 50¢ for handling on orders under \$5. Send 25¢ deposit on 'CO' orders. Send approx. Postage of Canadian & Foreign orders.

Money refunded in 5 days if not completely satisfied
Tubes are new, used or seconds are so marked

Send for special details on self-service tube testers and CRT Prices. Dept PE10.

NATION WIDE TUBE CO.

406 HARRISON AVENUE, HARRISON, NEW JERSEY HU 4-9848
CIRCLE NO. 23 ON READER SERVICE PAGE

NEW - - by KUHN

AM/FM VHF RECEIVER

New model now covers 26-54 and 88-174 MC in eight overlapping calibrated bands with large full vision dial. New circuitry. High sensitivity. Ideal for listening to Aircraft, CB, Police, Fire, Amateur, or other signals as well as regular FM broadcast stations. Completely self-contained with headphone jack for private listening.



353B \$59.95
inc. FET

AIRCRAFT • POLICE • FIRE



348A
Complete
\$34.95

Transistorized, direct-tuneable converter. Powered with self-contained mercury cell. Excellent sensitivity and stability. Designed for car, home or portable receivers.

315-B
5-54 MC
\$17.95



115-160 MC
\$18.95

Converts home or car radios to receive Fire, Police, Aircraft, CB, SW, etc. Exceptional sensitivity on High and Low Bands. High Band type adjusts to bracket 115-160 MC. Low Band type should be ordered for 33-47 MC, 40-52 MC, 26-30 MC, 9-12 MC, etc. May be adapted for transistorized car radios.

Order today or send for free catalog on full line of converters and receivers for every application.



20 GLENWOOD
CINCINNATI 17,
OHIO

CIRCLE NO. 18 ON READER SERVICE PAGE

CORNELL TUBES

1 YR. GUARANTEED

Mutual Conductance Lab tested. Individually boxed. Brand and Code Data

33¢
PER TUBE

100 TUBES OR MORE:
30¢ PER TUBE

OZ4	6A7B	6C7	6SA7	7A8	12BH7
183	6AU4	6CG8	6SC7	7B6	12BL6
1J31K3	6AU5	6CM7	6SH7	7B7	12BY7
1H5	6AU6	6CZ5	6SJ7	7B8	12C5
1L4	6AV6	6D6	6SK7	7C5	12CA5
174	6AW8				125N7
1U4	6AX4				12SQ7
1X2	6BA6				25L6
3CB6	6BC5				25Z6
5U4	6BD6				35W4
6B8	6BG6				35Z3
5Y3	6BH6	6DA4	6SL7	7M7	35Z5
6A6	6BJ6	6DE6	6SN7	7Y4	50L6
6A8	6BL7	6DD6	6SQ7	12AD6	24
6AB4	6BN4	6E45	6SR7	12AE6	27
6AC7	6BN4	6F6	6U7	12AF6	41
6AG5	6BN6	6HG	6UB	12A77	45
6BQ6	6BQ6	6J5	6V6	12A77	47
6AK5	6BZ6	6J5	6V6	12A77	47
6AL5	6C4	6J6	6W4	12AX7	75
6AN8	6C6	6K6	6W6	12BA6	77
6AQ5	6C86	6K7	6X5	12BD6	78
6AS5	6C96	6L6	6Y5	12BE6	84
6AT6	6CF6	6S4	7A7	12RF6	84-6Z4

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NO SUBSTITUTIONS WITHOUT YOUR PERMISSION

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21 INCH PICTURE TUBES 13.95

1 Yr. Guar. • Aluminized • F.O.B. San Diego

Pay Dud Deposit CDD or Send Dud with Order

5-DAY MONEY BACK OFFER!

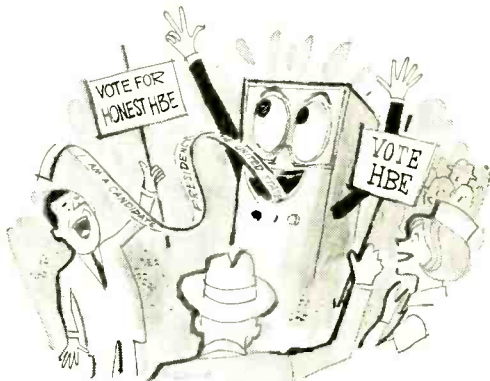
TERMS: Add 3c per tube shipping. Orders under \$5.00 add 3c per tube shipping plus 50c handling. Canadian orders add approximate postage. Send 25% deposit on C.O.D. orders. No C.O.D. orders under \$5.00 or to Canada. No 24 hour free offer on personal check orders.

CORNELL ELECTRONICS CO.
DEPT. FE10 4217 University Ave., San Diego, Calif. 921 0 5

CIRCLE NO. 47 ON READER SERVICE PAGE

clicked in a grass-roots sort of way. The tape came out printed in red, white and blue with this message:

XXX XXX UP TO THIS TIME, I HAVE NOT ANNOUNCED MY CANDIDACY FOR PRESIDENT OF THE UNITED STATES. HOWEVER, SINCE THE POPULAR OPINION IS THAT I SHOULD RUN, I AM NOW AVAILABLE. . .



Build the AUX-9

(Continued from page 67)

case. Select an uncrowded area, preferably close to the battery. Cut the battery "hot" lead and wire it to the jack contacts as shown in the schematic, then wire from the jack to the radio circuit.

If your transistor radio has an earphone jack (a closed-circuit one—that shuts off the speaker when the earphone is plugged in), you may be able to use that jack by sacrificing the earphone function. To do this, remove the two wires from the earphone jack, connect them together, and tape. Then the set will operate on loudspeaker only, and the jack can be wired for power.

Modifications. The circuit can be converted to provide a 6-volt output by substituting a 1N703 zener diode for D2 and a 2200-ohm resistor for R3. Performance characteristics will be the same as for the 9-volt version. If any changes are made, be sure not to exceed the 400 mw. power dissipation in the zener diode D2 and 250 mw. in the transistor.

Short-Wave Report

(Continued from page 74)

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to P.O. Box 333, Cherry Hill, N.J., 08034, in time to reach your Short-Wave Editor by the eighth of each month; be sure to include your WPE Monitor Registration and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

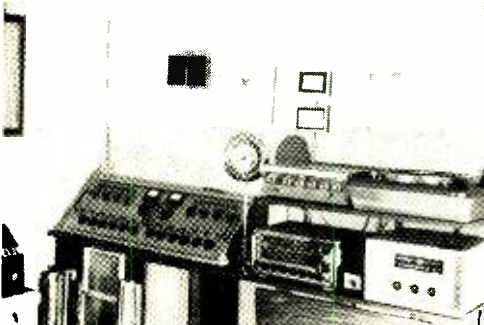
Andorra—European sources report that *R. des Vallees d'Andorre* can no longer be heard on 6305 kc., but there have been no reports indicating either a frequency change or that the short-wave outlet has been dropped.

Australia—*R. Australia* has dropped its 0100-0415 xmsn on 9570 kc. The xmsn to the British Isles, Europe, and South Pacific Isles is now scheduled at 0130-0400 on 7220 kc., and the station would like to receive reports on this xmsn.

Bolivia—Station CP58, *R. Chorelque*, Tupiza, has moved from 6028 kc. to 6134 kc. but announces as being on 6140 kc. An ID in Spanish follows a newscast at 2055.

Bonaire—*Trans World Radio* has been testing on 800 kc. "using full power" (525,000 watts) according to on-the-air anmts; it has been noted during the mid-evening test periods overriding nearly all other signals on that channel. There is still no official word as to the frequencies to be used by the 260,000-watt short-wave outlet although an unconfirmed report from Eastern Canada lists the station as being heard at 0000 on 9710 kc. The schedule as issued by *R. Nederland* lists Spanish at 1830-1920, Dutch news at 1920-1940, and Eng. from 1940 to 2030.

Brazil—A rarely reported station is ZYW32, *R. Caraja*, Anapolis, 2420 kc. Listen around



Equipment in the shack of Ken Austin, VE3PE1JD, Toronto, Ontario, includes a Trio 9R-59 receiver, a Browning FM tuner, and a Heath AA-100 amplifier.

new concepts

increase efficiency
and range...

MARK ANTENNAS

MARK V Colinear Gain Omnidirectional

◀ CB Base Station Antenna

Advanced concept utilizes full legal height of 20 ft. Has two in-phase elements, with feed point internally at center of antenna. Offers unusually low angle of radiation and maximum omnidirectional gain for extended range and coverage. Provides precise internal 52-ohm match and low VSWR over greater bandwidth. Extremely rugged.

MARK SM-27 Monowhip Sleeve Monopole Center-Fed Mobile CB Antenna ▶

Unique mid-point excitation greatly lowers the angle of radiation to concentrate the maximum signal where you need it, provides most effective longer-range communications. Raised feedpoint helps overcome radiation pattern distortion and provides more uniform omnidirectional coverage. Low VSWR (less than 1.5:1) at 52-ohms impedance. Internally connected 17 ft. coaxial cable. Overall height is 6 ft. Extremely rugged. No insulator required. (Patent Applied for)

Advanced Line of CB and HAM Antennas

The advanced-design MARK line includes a wide choice of unique base station, mobile, portable, and marine antennas—to improve efficiency in citizens band and amateur radio communications.

See your B&K/MARK Distributor
or write for Catalog HW21-P

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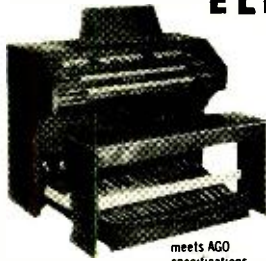
DIVISION OF DYNASCAN CORPORATION

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CIRCLE NO. 3 ON READER SERVICE PAGE

Assemble the finest instrument your money can buy
NEW ALL-TRANSISTOR Schober®

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New Recital Model compares musically to instruments costing 4 times the price!



PIPE ORGAN VOICING—separate, distinct—32 in Recital Model. LIBRARY OF STOPS™ Kit feature adds extra plug-in voices



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REVERBATAPE® Unit—adds "auditorium" depth and power

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How is it possible to acquire the skill needed to build a splendid organ—without any previous knowledge of electronics or music?

While the complete organ is a complex instrument, Schober Organ kits are specially designed for do-it-yourselfers. Printed circuitry eliminates a lot of the work and makes errors almost impossible. Many parts come preassembled. You simply follow detailed illustrated instructions for easy assembly, then place in assembled and pre-finished cabinet.

You save costly factory assembly, retail store mark-up—put every penny into fine musical parts. You enjoy the finest instrument your money can buy.

Schober Organ kits cost as little as \$550 in kit form, and you may spread this cost by ordering in sections.

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Please send me without cost or obligation FREE SCHOBER ORGAN Booklet describing models. FREE 7-inch "sampler" record included.

Enclosed find \$2 for high-quality LP 10" SCHOBER RECORD DEMONSTRATING all three models with different music (\$2 refunded with purchase of first kit).

NAME _____
 ADDRESS _____
 CITY _____ STATE _____ ZIP NO. _____

CIRCLE NO. 49 ON READER SERVICE PAGE

1900-1945 when U.S. pop tunes are featured. This station is definitely interested in receiving reports from the U. S. A.

Brunei—The Brunei Broadcasting Service is said to be on the air daily at 1730-0100 on 4865 kc. with a 10-kw. xmtr. Has anyone heard it?

Burundi—*R. Cordac* is a low-powered religious station operating on 3971 and 3985 kc. with 250 watts and programs in Kirundi, Swahili, French, and Eng. daily at 0100-0200 and 1500-1615.

Canal Zone—A good way to log this country is via NBA, 11,570 kc. It is often noted around 2000 with a running marker on single sideband. A QSL from Lt. W. E. Wells, USN, Exec. Officer, U. S. Naval Comm. Sta., Balboa, C. Z., states that he will be pleased to verify future intercepts.

Ceylon—The Commercial Service from Colombo is noted on 15,225 kc. at 2030-2230 with ads and music; this xmsn is in English.

England—*R. Vannin*, a projected station, will be placed in operation if *R. Caroline* does not turn up in the Irish Sea. It is to be located at Douglas Head, Isle of Man, and is rated at 20 kw. Four medium-wave channels are available.

Germany (East)—*R. Berlin International* is scheduled to Eastern N.A. at 2000-2030 and 2130-2200 on 9560 and 11,800 kc., and to Western N.A. at 2245-2315 and 2345-0015 on 9645 and 11,920 kc. Reports indicate that all of the listed xmsns are being received at good level.

Germany (West)—*Deutsche Welle* is now issuing two Eng.-language schedules. One is a 16-page booklet, the other an 8-page newspaper. Despite the fact that they bear the same date, the schedules listed for N.A. conflict. Two of the xmsns are listed as being at 2035-2115 on 6075 and 9640 kc. and at 1010-1050 on 9735, 11,795, and 11,925 kc.; the third xmsn, on 6145, 9575, 9735, and 11,795 kc., is aired at either at 2345-0035 or 0044-0135. Another widely reported xmsn is heard at 1710-1720 on 9735, 11,945, and 15,205 kc., with the latter channel being very heavily reported. The new Eng. schedules can be obtained by writ-

QSL Cards For You?

The SWL QSL Bureau is currently holding QSL cards for the following WPE Monitors. If your WPE registration is listed here, send a stamped, self-addressed envelope to Mr. LeRoy Waite, 39 Hannum St., Ballston Spa, N.Y. 12020, and your card(s) will be forwarded to you.

WPE5ACB	WPE6ECV	WPE8BXy
WPE5AWK	WPE6EMS	WPE8CBC
WPE5AWV		WPE8CBG
WPE5BPX	WPE7AKB	WPE8CMK
WPE5CFE	WPE7AQB	WPE8DIG
WPE5CNR	WPE7AQZ	WPE8DLL
WPE5CQF	WPE7AWQ	WPE8DQF
WPE5DMQ	WPE7BEM	WPE8EUJ
WPE5RJ	WPE7BGH	WPE8EWI
		WPE8FFB
WPE6BJW	WPE8BAU	WPE8FOA
WPE6CRJ	WPE8BGP	WPE8FXT
WPE6CWY	WPE8BTP	

Beacon Stations

This is a continuation of the list of beacon stations that was started in the August issue. With careful tuning and patience, you may be able to log a number of these stations. For the most part, they are low-powered and do not operate continuously. They identify in slow-speed Morse code by call-sign. Located in Central and South America, the stations are listed by frequency in kilocycles. To be concluded next month.

1615	PSO, Pasto, Colombia, 750 watts
1625	QIT, Quito, Ecuador, 50 watts TIKX, San Jose, Costa Rica, 50 watts
1630	AUR, Guatemala City, Guatemala, 50 watts MTR, Montera, Colombia, 400 watts
1635	PPN, Popayan, Colombia, 50 watts
1640	SOG, Sogamoso, Colombia, 1000 watts
1650	CH, Chinaja, Guatemala, 50 watts UIB, Quibdo, Colombia, 50 watts
1670	TIPM, Palmar, Costa Rica, 50 watts
1675	ULQ, Tulua, Colombia, 50 watts
1680	CA, Carmelita, Guatemala, 100 watts
1702	TBU, Tibu, Colombia, 200 watts
1708	CUE, Cuenca, Ecuador, 75 watts
1720	TQN, Tres Esquinas, Colombia, 300 watts
1750	PLT, Plato, Colombia

ing to the station at P. O. Box 344, Cologne, Federal Republic of Germany.

Ireland—American interests are said to be trying to persuade the Irish Government to set up a high-powered commercial station that could be heard in Britain and Europe.

Ivory Coast—*R. Cote d'Ivoire, Radiodiffusion Abidjan*, is scheduled, according to their QSL card, at 0130-0300, 0715-0830, and 1300-1900 (Sundays at 0200-0300 and 0715-1900) on 11,820 and 4940 kc. There is an Eng. xmsn from 1330 to 1400.

Japan—*R. Japan* is now using 200 kw. for xmsns to the Middle East, Africa, and to N.A. and Latin America, as well as for a portion of the General Service. The power has also been increased for xmsns for Australia and New Zealand, the Philippines, Indonesia, and Asia.

Kenya—The *Voice of Kenya* now produces all of its own news broadcasts and no longer has any BBC relays.

Korea (South)—The latest schedule from Seoul reads as follows: Eng. at 2200-2230, 0230-0300, and 0900-0930 on 11,925 kc. and at 0530-0600 on 9640 kc.; French at 0200-0230 and 0930-1000 on 11,925 kc.; Spanish at 2230-2300 on 11,925 kc. with Korean music for 15 minutes; Japanese at 0400-0500, Chinese at 0500-0530 and 0800-0830, Korean at 0600-0630 and 0700-0800, and Russian at 1745-1800 and 0845-0900, all on 9640 kc. The s/on and s/off IS is the "Ari-rang," a popular Korean folk song melody.

Lebanon—The newest schedule from Beirut shows the following xmsns: to N. A. (including Mexico and The Antilles) and Europe at 2030-2100 in French, to 2130 in Arabic, to 2200 in Eng., to 2230 in Arabic, and to 2300 in Spanish, all on 9625 kc. The African xmsn is broad-

(Continued on page 110)

FULLY EQUIPPED FOR
IMMEDIATE OPERATION
ON ALL 23 CHANNELS



The satisfaction you get from CB-ing with the new *Cobra* CAM-88 is a richly rewarding everyday experience. It's rugged, handsome to have in your car or home base—and it operates like you want it to—for personal, professional or business 2-way communications in the 27 mc Citizens Band.

Outstanding Features

- Fully-Equipped for Immediate 23-channel Transmit and Receive
- Double Conversion Superheterodyne Receiver
- Transistorized 117V AC/12V DC Power Supply
- Maximum Talk Power
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- Modulation Indicator
- Plug-in Microphone
- Convertible for Public Address

Carefully engineered design makes the *Cobra* completely reliable and easy to operate. Completely self-contained. No additional crystals needed. \$214.95

See your Distributor or Write for Bulletin No. 641-P

B & K/MARK

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LAFAYETTE HI-FI COMPONENTS

NEW!

Just Add Speakers and Enjoy FM, FM Stereo
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LAFAYETTE 70-WATT COMPLETE AM-FM STEREO RECEIVER

199⁵⁰

99-0005WX

Model LR-800

- A powerful 70-Watt Amplifier plus Complete Pre-amplifier Control Facilities plus a Standard AM Tuner plus a sensitive FM Tuner plus an FM Stereo Tuner—all on One Compact chassis
- Amazing FM "Stereo Search" Circuit Signals Presence of Stereo Broadcasts
- Tuned Nuvistor "Front End" provides Greater Sensitivity, Lower Noise, Less Heat
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- Variable AFC Control • Imported



NEW! LAFAYETTE AM/FM STEREO TUNER

Features New Audible Tone Stereo Search System. Two 3-Gang Tuning Condensers With added Tuned RF Stage For Superb Sensitivity and Selectivity.

93⁹⁵

99-0001WX

- 20-TUBE PERFORMANCE—12 TUBES PLUS TUNING EYE AND RECTIFIER AND 9 DIODES
- MPX SEPARATION 38 DB @ 400 CPS
- LESS THAN 1% DISTORTION
- DUAL TUNED CASCADE LIMITERS AND WIDE BAND RATIO DETECTOR
- GROUNDED GRID RF FRONT END FOR LOW NOISE
- VARIABLE AFC CONTROL
- FLYWHEEL TUNING
 - STEREO NOISE FILTER SWITCH
 - AUTOMATIC STEREO MODE INDICATOR
 - IMPORTED



Model LT-325

NEW LAFAYETTE 70-WATT STEREO AMPLIFIER

99⁵⁰

99-0007WX

Model LA-350



- Tape Monitor Switch
- Stereo Headphone Jack on Front Panel
- Separate Channel Tone Controls
- Style-matched to LT-325 Tuner
- Imported
- Six Pairs of Stereo Inputs For All Sources
- Handsome Extruded Aluminum Front Panel
- DC On Preamp Filaments For Minimum Hum

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1965 Catalog No. 650

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C.B. WALKIE-TALKIE Model HE-100**

39⁹⁵

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- Variable Squelch Reduces Background Noise
- Separate Microphone and Speaker for Better Modulation and Increased Range
- Optional Plug-in 117 Volt AC Power Pack
- With Leather Case, Earphone, Telescoping Antenna, Batteries, Crystals for Channel 10 • Imported



99-3022

**NEW! LAFAYETTE ALL-TRANSISTOR
C.B. "WALKIE-TALKIE" Model HA-70**

10⁹⁵

2-for- 21.00

- Great Fun for Kids too! At a Price Every one Can Afford
- Ideal for Picnicking, Fishing, Hunting, Camping, etc.
- Complete with Telescoping Antenna, Transmit Crystal, Battery, Plastic Carrying Case • Imported



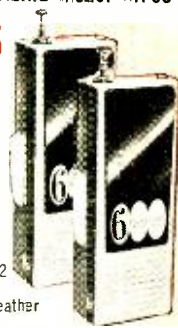
99-3011

**NEW! LAFAYETTE 6-TRANSISTOR
C.B. WALKIE-TALKIE Model HA-85**

19⁹⁵

2-for-38.75

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- Crystal-Controlled Transmit and Receive
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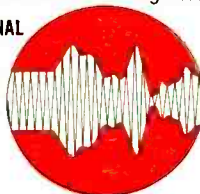
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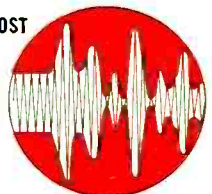
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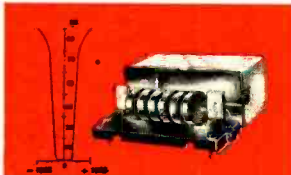
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1X2	.82	6BG6	1.70	12AD6	.57
29N4	.64	6BN4	.62	12AT7	.76
3B6	.56	6BN8	.76	12AU7	.61
3CB6	.56	6DQ6	1.12	12AV6	.41
3V4	.63	6HQ7	1.00	12AX4	.67
4BQ7	1.01	6RS8	.95	12AX7	.63
5AT8	.83	6RB6	.55	12AZ7	.86
5CG8	.81	6OC7	.61	12BE6	.50
5CL8	.76	6CL6	.94	12BE6	.53
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5U8	.84	6DQ6	1.10	12BL6	.56
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6AK5	.95	6L6	1.06	25BQ6	1.17
6AL5	.47	6SA	.52	25L6	.51
6AM8	.78	6SL7	.84	35C5	.57
6AN8	.93	6SN7	.65	35W4	.42
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CIRCLE NO. 12 ON READER SERVICE PAGE

SHORT-WAVE ABBREVIATIONS

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

cast on 15,380 kc. at 1330-1530, with Eng. at 1330-1400. The South American xmsn is on 11,900 kc. at 1800-2000; no Eng. is listed.

Malawi—This is the region that was formerly called Nyasaland. Blantyre, 3955 kc., has been noted from 2256 with non-stop drums and an ID at 2300. After a time check, there is a musical period (some Eng.) and a native language newscast at 2315.

Mali—*Radiodiffusion Nationale du Mali* is a new outlet on 4745 kc. A news bulletin in French is given at 1435-1445; s/off is at 1800. There is heavy QRM at times from a point-to-point circuit.

Netherlands—Eddie Startz recently told his listeners in Europe that the Eng., French, and German "Touring Club" could be tuned at 0700-0730 on "300 meters." This, presumably, is *R. Nederland's* 120-kw. outlet on 1007 kc.

New Zealand—Arthur Cushen's "DX World" is scheduled for the first Wednesday of the month at 2045 and 0030 on 9540 and 6080 kc. and is repeated the following Saturday at 1500 on 15,110 and 11,780 kc.

Nigeria—The Foreign Service of *The Voice of Nigeria* is listed at 0900-1000 in Eng., at 1000-1100 in Arabic, and at 1100-1200 in French on 9690 and 7275 kc.; and at 1200-1400 in Eng. and at 1400-1500 in French on 11,900 and 15,255 kc. However, numerous reports indicate that the 0900 xmsn can also be heard on 15,255 kc.

Norway—Oslo has been noted broadcasting in Norwegian to the North Atlantic, N. A. and Caribbean areas at 1000-1130 on 15,175 kc. "Norway This Week" is aired on Sundays only in Eng. at 2100-2130 on 9610, 11,850, and 15,175 kc.

Peru—*R. Madre de Dios*, Puerto Maldonado, 4951 kc., is currently operating dual to 3960 kc. and, at times, in Spanish to 2226/close. The power is rated at 1000 watts.

A new station is *Radiodifusora el Centro*, Jauja, 3385 kc., with a call tentatively ID'd as OBZ4M. There is a listener's request program in Spanish that closes around 2200 although it may run to as late as 2230.

A report from Brazil indicates two Peruvians operating just one kilocycle apart: OAZ4C, *R. Andina*, Huancayo, on 6244 kc.; and *R. Universidad de Arequipa* on 6243 kc. Best listening time for the first station is after 2200 when the other one is off. Programs noted have been listeners' request shows.

Portugal—The *R. Portugal* DX Club is being aired during the second and fourth weeks of each month as follows: on Fridays to S. E. Asia at 0815 on 17,895 and 15,380 kc., to Africa at 1315 on 15,380 and 11,935 kc., and to Europe at 1315 on 6025 kc. (also on the medium waves

to Europe at 1800 on 755 and 1061 kc.); on Sundays to the U.S. at 2115 and 2315 on 6025 and 6185 kc. Membership can be obtained by sending in five separate reception reports on either short-wave or medium-wave broadcasts. Once a member, you are expected to send in a minimum of one report every two weeks. A monthly bulletin is to be issued.

Spain—At press time, conflicting reports are being received concerning *R. Nacional Espana's* N.A. xmsns. Some late reports indicate both a time and frequency change, with the schedule reading 2000-2045, 2100-2145, and 2200-2245 on 6140, 9615, and 11,715 kc. These xmsns would appear to replace the 2215, 2315, and 0015 xmsns (45 minutes each) on 6130 and 9645 kc.

Spanish Guinea—WPEOJJ reports receiving a QSL from Bata for reception at 1707 in February. His reception report was actually for Portuguese Guinea at 1716 and in January, but he incorrectly sent the report to Bata!

The latest schedule for *Emisora De Radio-*

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 Mike Larkin (WPE1FNO), Lexington, Mass.
 Clifford Stott (WPE1FNQ), W. Springfield, Mass.
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 David Pyatt (WPE6GII), Indianapolis, Ind.
 Stuart Grade (WPE6DDO), Sioux City, Iowa
 Leon Johnson (WPE6DHY), Holland, Mo.
 Richard Henke (WPE6DYZ), Kansas City, Mo.
 Gerry Dexter (WPE6JJ), West Bend, Wis.
 Joe Kasser (G2PES), London, England
 Jack Perolo (PY2PEIC), Sao Paulo, Brazil
 Michael Brickell (VE2PEIDE), St. Hilaire Station, Que., Canada
 Fred Parsons (VE3PIZI), Welland, Ont., Canada
 Augustin Ortiz (XE1PEIG), Mexico City, Mexico
 George Bennett, Anderson, Ind.
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diffusion de Santa Isabel is; 7160 kc. (700 watts), 6345 kc. (1800 watts), and 6250 kc. (5000 watts) at 0230-0330, 0700-1030, and 1300-1700. Reports go to *Emisora De Radiodiffusion*. EAJ205, Apartado Correos N° 195, Santa Isabel (Fernando Poo), Spanish Guinea.

Swaziland—The British Army will operate *R. Tiger* from Matsapa with 250 watts. Other details are not known.

Sweden—The newest schedule from *R. Sweden* lists Eng. to N.A. at 0900 on 15,240 kc., and at 2045 (East Coast) and 2215 (West Coast) on 11,805 kc.

Togo—*R. Togo*. Lome, operates Monday to Friday at 0030-0300 and 1230-1730 on 5047 kc. and at 0700-0830 on 6155 kc.; Saturdays at 0030-0300 and 0700-1800; and Sundays at 0200-1730. A new 100-kw. xmtr has been delivered which will be operated in the 49-meter band.

U.S.A.—The National Bureau of Standards station, WWV, is now asking listeners (at 15 and 45 minutes past the hour) to send in post-cards explaining why they listen to WWV. The cards are expected to help the station improve the service. Be sure to include your return address when writing to: WWV, Listener's Study, Greenbelt, Maryland.

Clandestine—You can contact *R. Libertad* through the *Radio Free Russia* office. Send your report to *R. Libertad*, c/o NTS, 125 bis rue Blomet, Paris 15, France. You will re-

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Are you eligible to apply for a 25, 50, 75, 100, or 150 Countries Verified Award? Here is a brief resume of the rules and regulations.

(1) You must be a registered WPE Short-Wave Monitor and show your call on your application.

(2) You must submit a list of stations for which you have received verifications, one for each country heard. You must also supply the following information in tabular form: (a) country heard; (b) call-sign or name of station heard; (c) frequency; (d) date the station was heard; (e) date of verification. All of the above information should be copied from the station's verification. Do not list any verifications you cannot supply for authentication on demand. Do not send any verifications at this time. Should any verifications need to be sent in for checking, we will notify you and give you instructions on how to send them.

(3) A fee of 50 cents (U. S. coin) must accompany the application to cover the costs of printing, handling, and mailing. This fee will be returned in the event an applicant is found to be ineligible. Applicants in countries other than the U.S. may send the equivalent of 60 cents (U.S.) in coins of their own country if they wish.

(4) Apply for the highest DX award for which you are eligible. If, at a later date, you are eligible for a higher award, then apply for that award.

(5) Send your application, verification list, and fee to: Hank Bennett, Short-Wave Editor, P. O. Box 333, Cherry Hill, N. J. 08034. Do not include an application for a Short-Wave Monitor Certificate (you are not eligible for any of the awards until you have a Short-Wave Monitor Certificate in your possession). Reports, news items, or questions should be mailed in a separate envelope.

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Stephen Hawley (WPE4GXJ), Central City, Ky.
John Fagyas (WPE2IQM), Buffalo, N. Y.
Jerry Drott (WPE4ECG), Charleston, Miss.

Forty States Verified

John Rose (WPE9FXU), La Grange Park, Ill.
Carl Larson (WPE0GA), Knoxville, Iowa
Louis Daigle (VE2PE1GK), Laval-Sur-Le-Lac, Que., Canada
Bill Knochel (WPE4HEL), Kingsport, Tenn.
Richard George (WPE0BLM), Wichita, Kan.
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Dan Tognetti (WPE6DHV), San Rafael, Calif.
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James Dionne (WPE1LB), Westwood, Mass.
Evan Hodgden (WPE3FEK), Wilmington, Del.
Robert Andrews (WPE3EWC), Gaithersburg, Md.
James Gill (WPE3CGF), Philadelphia, Pa.
John De Haven (WPE3FON), Lutherville, Md.
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Curt Cochran (WPE4HDV), Kingston, Tenn.
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International Waters—Non-licensed stations located off the English coast continue to multiply. *R. Sutch*, "Britain's First Teenager Station," is operating at 0600-0815, 1100-1400, and 1815-2015; no frequency is listed but presumably it is around 1500 kc. Four Kent

businessmen are planning a station to be located off the coast of Kent. *R. Manx* is said to be nearly ready to go on the air. *R. Caroline* operates at 0000-1500 and 1800-2100 on 1520 kc. *R. Red Rose* (or *R. Mary Rose*) is scheduled to commence broadcasting shortly off the Lancashire coast beamed to Liverpool and N. W. England.

-30-

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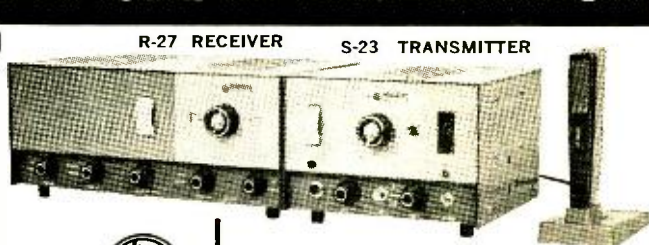


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CIRCLE NO. 5 ON READER SERVICE PAGE



Hi-Fi Compressor-Expander

(Continued from page 45)

chassis, insulation must be used between them and the chassis.

Assembly of the two photocell-lamp units is easy. As shown on page 45, cut a $\frac{7}{8}$ " length of $\frac{5}{8}$ "-i.d. polystyrene tubing for each. Push a #49 lamp into a $\frac{3}{8}$ " grommet and insert the grommet and bulb into one end of the tube. Wrap $\frac{1}{4}$ " wide tape around each photocell, using enough so they will fit smoothly in the ends of the tubes opposite the bulbs. Cement each assembly in place. Both of the assemblies should be painted black so that external light won't affect the resistance of the photocells. To make sure they are light-tight, measure the resistance of the photocell-lamp assemblies in normal reading light—if it's less than one megohm, check for leaks. Caulking compound is a good material for sealing leaks around the bulbs and photocells.

Wiring the Unit. Two separate grounding systems are used in the compressor-expander to avoid possible hum loops in the amplifier to be used with it. The speaker ground leads and power supply ground form one system; the shielded leads for the input-output circuit and photocell section form the other system.

Wiring is straightforward. Use different colors of wire for leads associated with the left and right channels to make checking the circuit easy; use shielded wire for the input-output circuit connections. Polarity of *D1* and *C1*, *C2* and *C3* must be observed. Resistors associated with the input-output circuit should be accessible as you may want to experiment with the amount of expansion and compression in the future. As finishing

touches, add rubber feet to the cabinet, and label the controls with decals.

Hookup and Final Adjustments. Connect the compressor-expander into your stereo system as shown in the drawing below. The amplifier input impedance should range between 50,000 ohms and 1 megohm. The transistor portion of the circuit must be connected to the power amplifier speaker terminals; be sure to connect the ground of the speaker terminals to the ground of the transistor circuit. In addition to the possible compressor-expander hookups shown here, the unit may also be connected between the output of a preamplifier and the input of the power amplifier.

To use the compressor-expander, turn it on and set the amplifier volume con-

HIRSCH-HOUCK REPORT

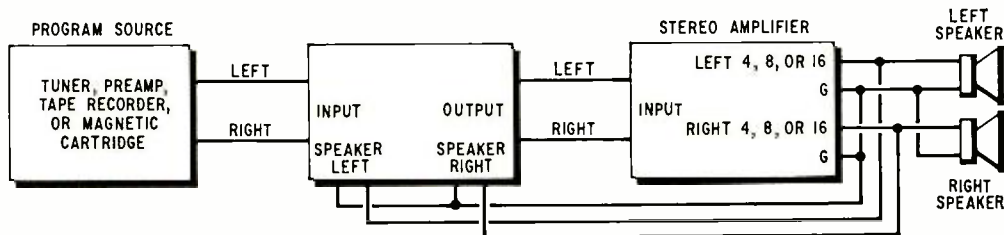
The 6 db expansion was definitely more pleasing than the 8.5 db of a comparison commercial unit. The compression was more than adequate. Under conditions of compression or expansion there was no high-frequency loss. The unit was easy to install and adjust, and did all that could be expected. Well planned and constructed . . .

trol to zero. Adjust the d.c. balance controls (*R1* and *R2* at the rear of the case) so the corresponding front panel lamps, *I1* and *I2*, just go out. Next, set the front-panel threshold controls, *R3* and *R4*, to maximum clockwise and turn up the amplifier volume to a normal listening level. Expansion or compression can then be selected.

Optimum setting of the threshold controls has been found by the author to vary from one type of program material to another. On the average, they are set to produce full illumination on the loud parts and no illumination on the soft parts.

Needless to say, the unit will greatly enhance your listening pleasure. —30—

Simply connect compressor-expander between audio source and amplifier.



Whistle-Controlled Flivvers

(Continued from page 51)

terminals 4 and 5 of *K3* connected in series with it.

Adjustment. With the control unit mounted in *your* model, turn on *S2*. A light pressure on the armature of *K1* should cause *K2* and *K3* to lock "on" and start the model's motor. A second push on *K1* should stop the motor. Adjust the slug of *L1* until its threaded brass rod extends $\frac{3}{8}$ " beyond the end of the coil form. Set *R4* at midrange and turn on *S1*. Blow the whistle a few inches away from the microphone; *K1* should close and the motor start.

In order to achieve the greatest separation between car and whistle while still maintaining reliable control action, *L1* and *C2* must be tuned to the whistle's exact frequency. Vary the position of the coil slug to see if you can increase the control distance. If the slug must be screwed all the way in or all the way out for best results, the whistle frequency is too low or too high. If you have this problem, tune the whistle itself with the screw adjustment on the end so that best results are obtained with the slug about halfway into *L1*.

Turn *R4* fully on. It is remotely possible that *K1* will lock down when *R4* is advanced due to amplifier oscillation. If this happens, simply disconnect the yellow input lead of *T1* running to the PK-522 and use the green transformer wire. When the car growls, runs erratically, or stops of its own accord, vibration is the culprit. Make certain that the mike is free floating with no part of its metal case touching a solid object. If the difficulty persists, reduce the setting of *R4* slightly. You should now be able to control the car at a distance of at least 20 feet.

Whether you decide to install whistle control in a model army tank, a bulldozer, a boat, or a mechanical monster, you can be certain that the finished project will prove highly entertaining not only to the junior members of the family, but also to visiting adults who will exclaim over your successful attempt at electronic wizardry. —50—

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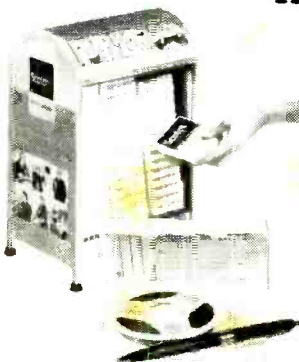


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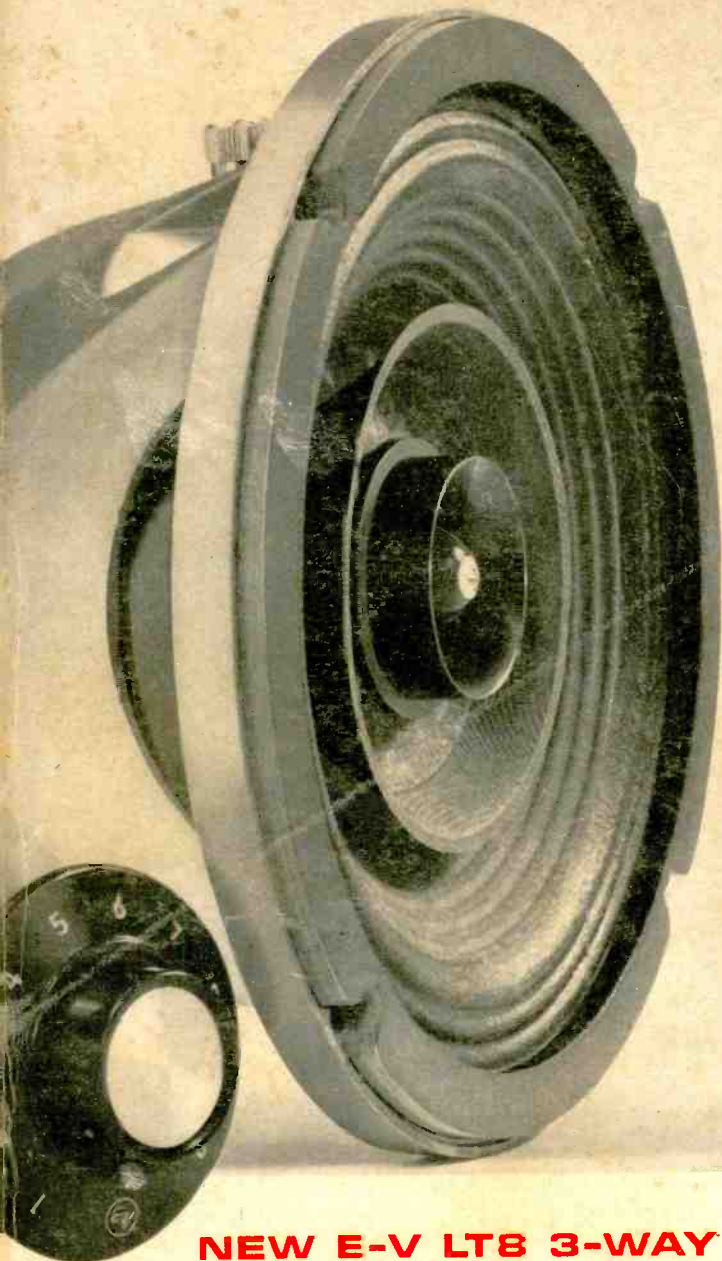


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