CRYOGENICS: ELECTRONIC PERPETUAL MOTION

POPULAR ELECTRONICS

DECEMBER 1964

35 CENTS

BONUS PROJECTS

Electric Fence Charger
Put Tree Lights to Music
Slim Hi-Fi Speaker System
Motor Speed Controller

MINIATURE SUPERHET POCKET RECEIVER

Voltmeter predicts auto battery failures (page 53)

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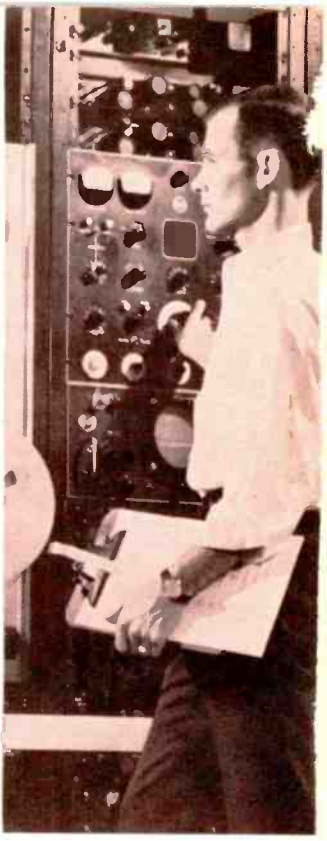

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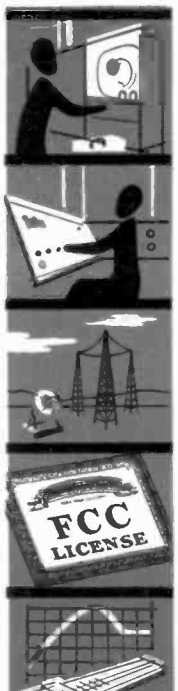

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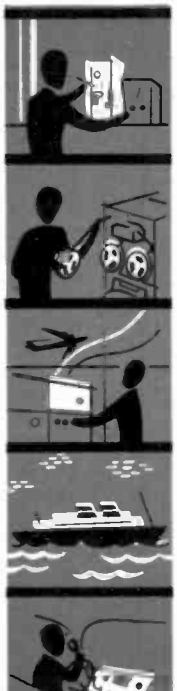

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ZIFF-DAVIS PUBLISHING COMPANY

POPULAR ELECTRONICS is indexed in the Readers' Guide to Periodical Literature

This month's cover photo by Bruce Pendleton

VOLUME 21 DECEMBER, 1964 NUMBER 6

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Electronic Features and New Developments

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Men 17-55

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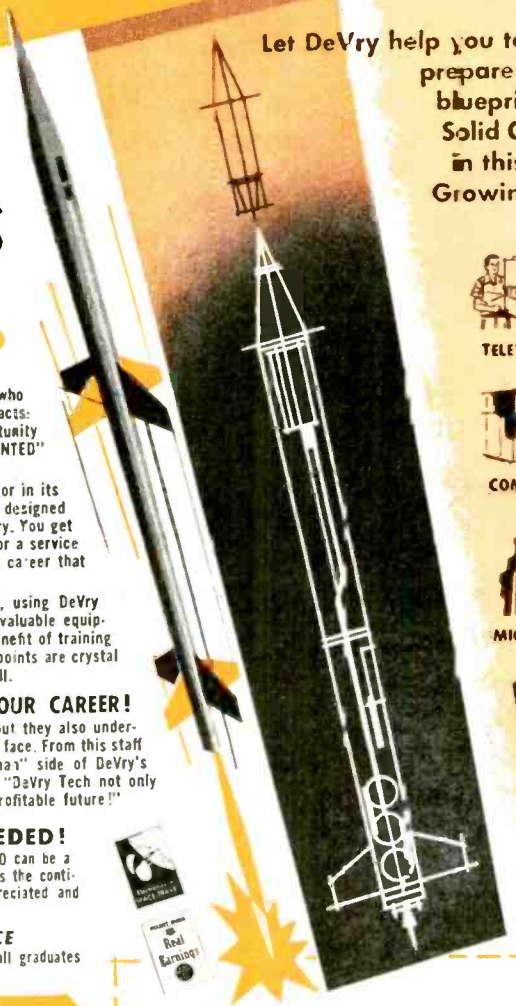

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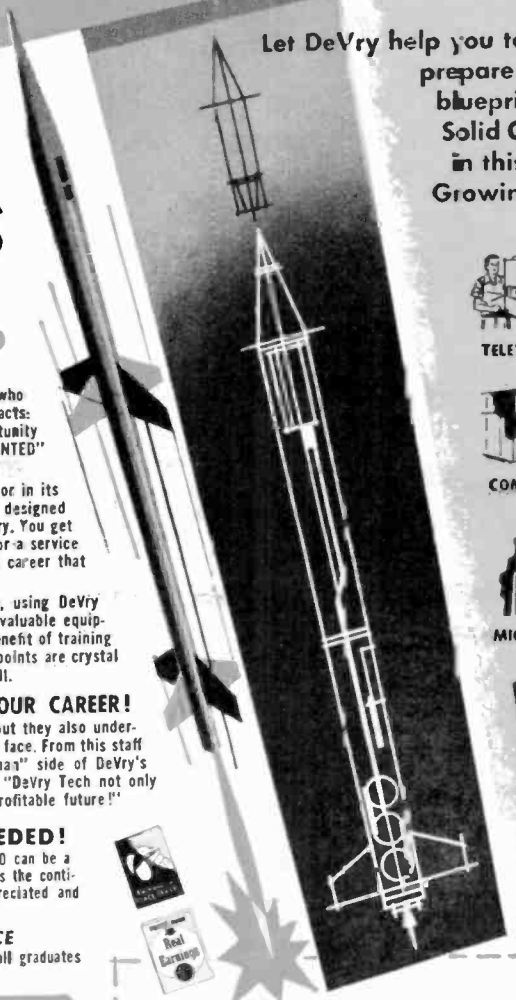

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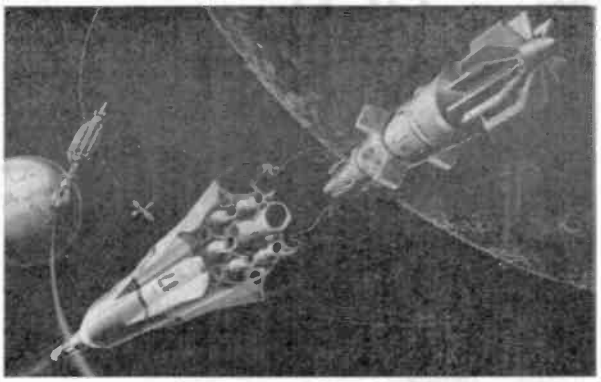

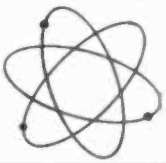

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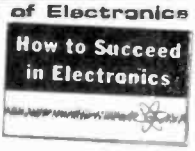

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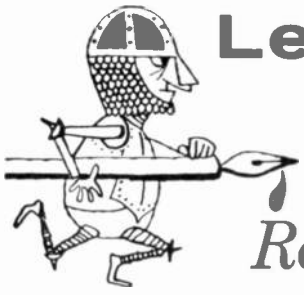

Letters *from our Readers*

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Compressor-Expander Lauded

■ At last you've done it—an excellent project for us hi-fi bugs. Of course I'm referring to the hi-fi compressor-expander ("Build a Hi-Fi Volume Compressor-Expander," October, 1964) which I'm in the process of building. Now, how about a real good reverberation unit, one which could be used on 117 volts a.c., or adapted to 6 or 12 volts d.c. for auto radio use?

CPL. STEPHEN M. HILSON
Virginia Beach, Va.

■ I must commend you on the special hi-fi construction feature, "Build a Hi-Fi Volume Compressor-Expander." It was sensational! One suggestion: I'd like to see more hi-fi articles in POPULAR ELECTRONICS.

BILL RIDLEHUBER
Groves, Texas

■ The volume compressor-expander makes my system sound like a million. How about an SCA background music adapter and a reverberation unit for the future?

TIM CONWAY
Upland, Calif.

Thanks very much for all your comments. We'll certainly see what we can do on those ideas for more hi-fi projects.

CB Rules Changes Defended

■ The primary purpose of CB radio is to provide deserving citizens with a legitimate means of supplementing other modes of *necessary* communications which might not at all times be adequate . . . This ham and CB'er fully supports FCC Docket 14843 and will be one of the very first to compliment the Commission when it (1) tightens up licensing requirements to require positive proof of need; (2) instigates some form of around-the-clock monitoring of CB stations, and (3) provides instant withdrawal of licenses for infractions of the rules. A great portion of the total CB activity could be eliminated at this moment without detrimental harm to "citizens' rights," the FCC, or anyone else. No one has a "right" to any portion of the radio spectrum; use of it is a privilege granted to the worthy. . .

WALTER R. YEARY, K4ABL, K5HZG, 10W3005
Louisville, Ky.

■ The Editor's Note on the recent CB rules changes ("New Rules to Govern CB," October, 1964) is not in accordance with my way of thinking. I feel the new Rules and Regulations are not overly suppressive, and that interstation communications should be given only five channels rather than seven. As a radio-TV serviceman, I got my sets to check on incoming calls while in the mobile. Unfortunately, there has been so much ragchewing going on that my wife has refused to leave the

A CREI Program helped Edward W. Yeagle advance to project engineer at Barnes Engineering Co., Stamford, Conn.

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44

Letters

(*Continued from page* 6)

base set turned on. Perhaps I will now be able to get some use from my equipment.

GEORGE H. LINDSLEY, 19W7068
Decatur, Mich.

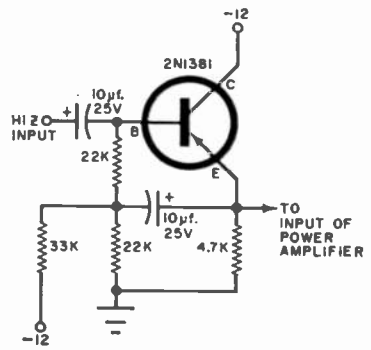
Stereo TV Sound: A Possibility?

■ Concerning the letter on the feasibility of stereo TV sound ("Letters from Our Readers," October, 1964), may I point out that it has been done. Robert B. Dome of GE, Syracuse, N.Y., holds the patents on a stereo TV sound system which uses the same sum-and-difference principle employed in the FM band. Of course, the system is not precisely the same due to the lesser swing of TV sound. It also differs in that it makes provision for, and minimizes beats with, both the horizontal scanning frequency and the color subcarrier. I think that before long we will see the establishment of stereo sound in TV—someone will simply have to sell the public on it.

THOMAS R. HASKETT
Cincinnati, Ohio

Bargain Page Amplifier

■ I enjoyed constructing Dan Meyer's "Bargain Page Amplifier" (October, 1964). Using junk box parts, I substituted a pair of 2N1381's for the 2N404, a 2N306 for the 2N1302, and a pair of 2N301's for the 27K1230 power transistors. One addition I made was the emitter follower shown in the diagram to make it possible to



feed the amplifier from a high impedance source. Incidentally, I feel that the regulated d.c. supply is a luxury—any low-impedance 12-volt power supply with a current capacity of 1 to 2 amps will suffice to power the amplifier.

NORMAN H. BUETTNER
Chicago, Ill.

"Great Debate" Great, He Says

■ I have just finished reading "The Great Debate" (October, 1964). My hearty congratulations to Mr. Bensen for this fine bit of timely satire.

WILLIAM ZECHMAN
McMinnville, Tenn.

"C Bridge" Tip

■ I have just constructed the capacitance bridge ("C Bridge," November, 1963) and am very satisfied with its operation. Incidentally, sharper nulls can be obtained by increasing the 6.3 volts a.c. to 60 or 70 volts —I used a variable transformer. Nulls can best be

(*Continued on page* 10)

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CIRCLE NO. 31 ON READER SERVICE PAGE

Letters

(*Continued from page* 8)

read with a VTVM, switching to lower ranges after obtaining the initial reading.

RONALD GUIDOTTI
Butler, Pa.

Two-Meter Transmitter Wanted

■ I was very interested in the "The Companion 6-Meter Transmitter" (September, 1964). How about a "Companion 2-Meter Transmitter" for us aspiring Novices? It sure would go great with P.E.'s "2-Meter Simple Superhet" (September, 1963).

BOB LAYTON, WN6MCY
Napa, Calif.

There's a 2-meter transmitter in the works, Bob. Look for it in one of our upcoming issues.

Game Hunting with Tubular Mike

■ I'm enclosing a photo of my tubular mike ("Build the Shotgun Sound Snooper," June, 1964) which I put together with 56 feet of .350 x .031 wall thickness aluminum tubing originally intended for use as percolator stems in large 80-cup coffee makers. Its range is about 300 feet in the city, and almost double in the country. I have picked up conversations behind closed

windows at 75 feet when background noise was favorable. As shown in the picture, I carry the lightweight unit as a "gun" for use in locating deer, birds, and other game. Thank you for a very interesting project.

WAYNE L. STEBBINS
Merrill, Wis.

Thank you for the photo, Wayne. As you suggest in your letter, background noise can be reduced somewhat by building a sound-absorbent housing for both the tubes and mike housing—the thicker the better.

Reader Service Page of Value

■ I'm very pleased with POPULAR ELECTRONICS' Reader Service Page. The information I secured through it made it possible for me to purchase my CB equipment.

RONNIE ROSS, KLN2868
Detroit, Mich.

Glad to be of . . . well, service, Ronnie (no pun intended). You'll find the Reader's Service Page on page 15 of every issue, including this one.

Here's Looking At You!

■ I have enjoyed many of the projects that have been published in POPULAR ELECTRONICS, especially the "Meterless VTVM" and the "C Bridge" (November 1963). Since I'd like to see some more "magic eye"

(*Continued on page* 20)

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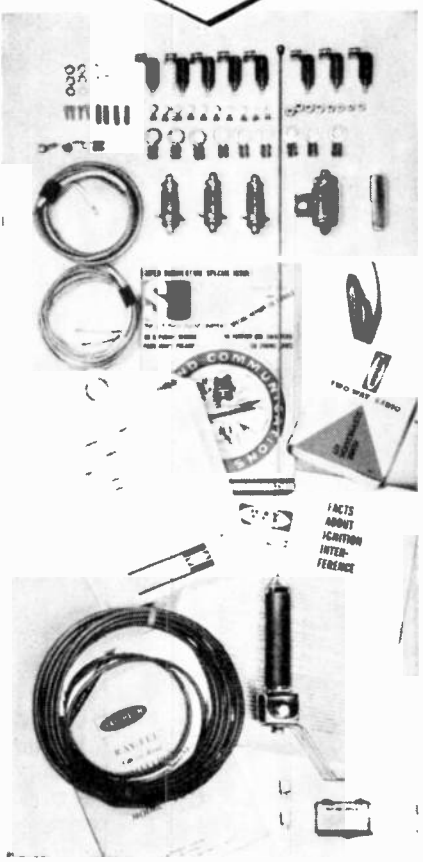

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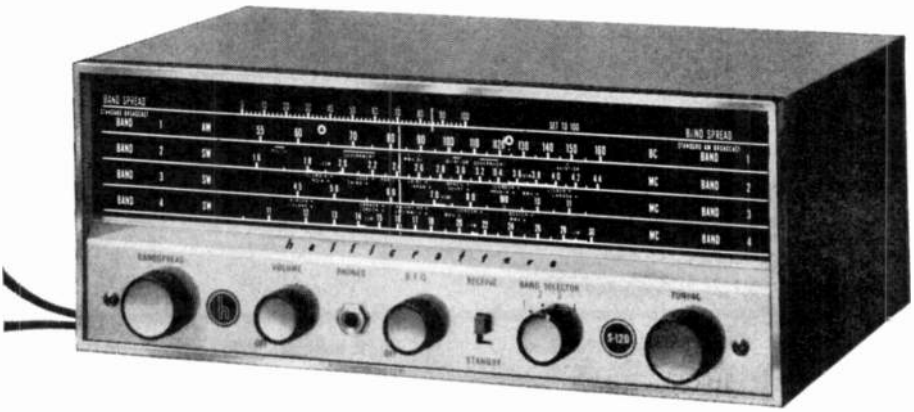

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CIRCLE NO. 11 ON READER SERVICE PAGE

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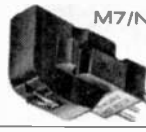
We trust this brief recitation of the significant features covering the various members of the Shure cartridge family will help guide you to the best choice for you.

THE CARTRIDGE	ITS FUNCTION, ITS FEATURES...	IS YOUR BEST SELECTION
 V-15	The ultimate! 15° tracking and Bi-Radial Elliptical stylus reduces Tracing (pinch effect), IM and Harmonic Distortion to unprecedented lows. Scratch-proof. Extraordinary quality control throughout. Literally handmade and individually tested. In a class by itself for reproducing music from mono as well as stereo discs.	If your tone arm tracks at 1½ grams or less (either with manual or automatic turntable)—and if you want the very best, regardless of price, this is without question your cartridge. It is designed for the purist . . . the perfectionist whose entire system must be composed of the finest equipment in every category. Shure's finest cartridge.
 M55E	Designed to give professional performance! Elliptical diamond stylus and new 15° vertical tracking angle provide freedom from distortion. Low Mass. Scratch-proof. Similar to V-15, except that it is made under standard quality control conditions.	If you seek outstanding performance and your tonearm will track at forces of ¾ to 1½ grams, the M55E will satisfy—beautifully. Will actually improve the sound from your high fidelity system! (Unless you're using the V-15, Shure's finest cartridge.) A special value.
 M44	A premium quality cartridge at a modest price. 15° tracking angle conforms to the 15° RIAA and EIA proposed standard cutting angle recently adopted by most recording companies. IM and Harmonic distortion are remarkably low . . . cross-talk between channels is negated in critical low and mid-frequency ranges.	If you track between ¾ and 1½ grams, the M44-5 with .0005" stylus represents a best-buy investment. If you track between 1½ and 3 grams, the M44-7 is for you. If you track between 3-5 grams, choose the M44-C. All have "scratch-proof" retractile stylus.
 M7/N21D	A top-rated cartridge featuring the highly compliant N21D tubular stylus. Noted for its sweet, "singing" quality throughout the audible spectrum and especially its singular recreation of clean mid-range sounds (where most of the music really "happens".) Budget-priced, too.	For 2 to 2½ gram tracking. Especially fine if your present set-up sounds "muddy." It is truly an outstanding buy. (Also, if you own regular M7D, you can upgrade it for higher compliance and lighter tracking by installing an N21D stylus.)
 M99	A unique Stereo-Dynetic cartridge head shell assembly for Garrard and Miracord automatic turntable owners. The cartridge "floats" on counterbalancing springs . . . makes the stylus scratch-proof . . . ends tone arm "bounce."	If floor vibration is a problem. Saves your records. Models for Garrard Laboratory Type "A", AT-6, AT-60 and Model 50 automatic turntables and Miracord Model 10 or 10H turntables. Includes head shell, .0007" diamond stylus.
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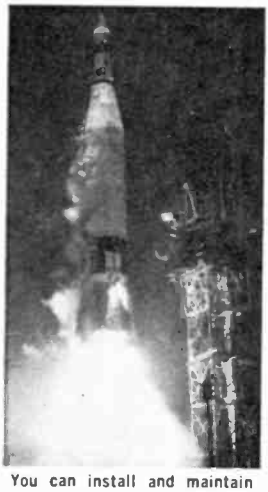

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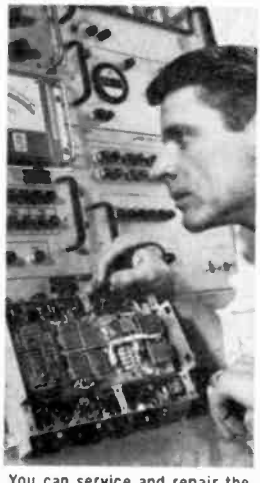

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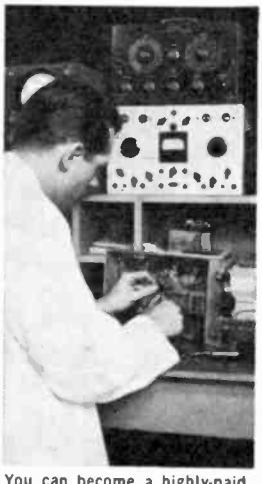

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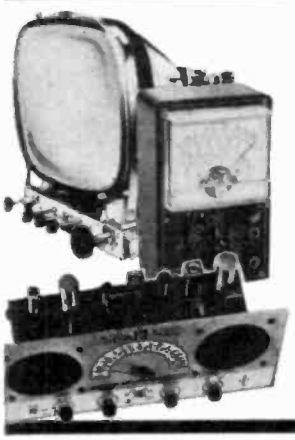

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Letters

(*Continued from page* 10)

tubes staring at me from my bench, how about a "meterless ohmmeter" and a "meterless ammeter?"

T. I. MOCHORUK
Prince George, B.C., Canada

We'll have a "magic eye" inductance bridge for you in the near future.

Project Award Supported

■ I certainly think the P.E. project award proposed by Robert "Bob" Brandon ("Letters from Our Readers," October, 1964) is a good idea. I'd be proud to have such an award on my construction projects.

GEORGE SUHY
Philadelphia, Pa.

■ How about a 'project of the month" award? Those who do a perfect job on a specified project would win it, and would be listed in a subsequent issue.

BILL WHITLEY, WA4ESH
Hialeah, Fla.

■ The idea of P.E. project awards is A.O.K. I have a number of projects, both new and old, that I would be more than glad to have certified.

THOMAS A. SHAFER
Columbus, Ohio

Reader Strikes It Rich

■ Knowledge gained over a period of time from P.E.'s excellent articles has enabled me to build a small magnetic assembly which will react to a magnetic field inside an ore sample. This will cause a gold nugget with a positive or negative magnetic field to cling to this device.

GENE YAWN
Nelson, Ga.

Well, congratulations, Gene, but it sure is news to us. How about letting us in on the secret?

Out of Tune

The Stereo S'Lector (*September*, 1964, *page* 75). In the paragraph of text describing how to connect the jacks, *J4*, *J5*, and *J6*, *J7* have been transposed. Jacks *J4* and *J5* should connect to the multiplex adapter, *J6* and *J7* to the stereo amplifier inputs.

Fido's Whistle-Controlled Flivvers (*October*, 1964, *page* 49). The modified PK-522 amplifier (shown in the schematic as a box outlined with a heavy black line) will have the connection broken between the top of the primary of the output transformer and the wire labeled "NC." The "NC" designation on this wire is incorrect, as it is connected to the amplifier circuitry. This modification is properly shown in the photos and described in the text.

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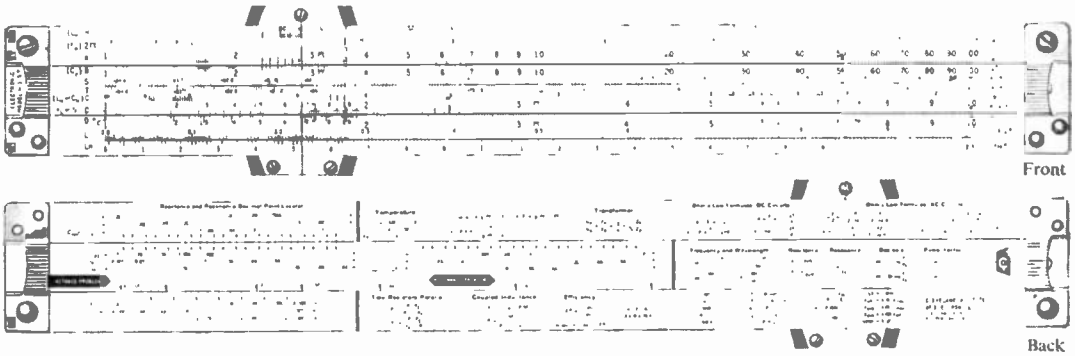

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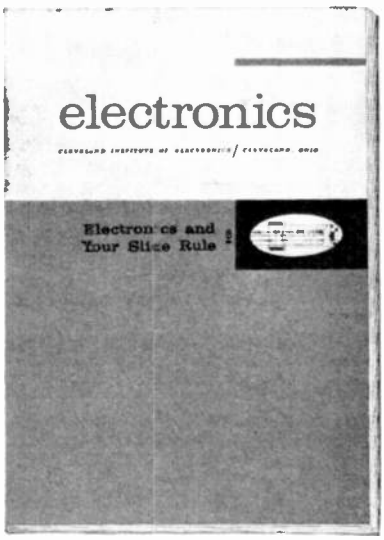

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Additional information on products covered in this section is available from the manufacturers. Each new product is identified by a code number. To obtain further details on any of them, simply fill in and mail the coupon which appears on page 15.

ROTARY SWITCH VARIATIONS

More that *two million* different variations of semi-custom rotary switches can be assembled using a new concept in rotary switch design and fabrication developed by the *Oak Manufacturing Company*. "Moduline" switches are obtained by means of a unique catalog and easy-to-use order card. The design characteristics of a switch are designated by a series of eight numbers (16 digits), which are selected from the catalog and written on the order card. When the order card is received by the company, prefabricated components already in stock are brought together for assembly. A delivery time of seven days after receipt of an order is claimed.

Circle No. 75 on Reader Service Page 15

STEREO CONTROL AMPLIFIER

Whitecrest Industries, Inc., has introduced a new stereo integrated control amplifier that is said to use oversize components working at a fraction of their ratings—in combination with proven circuitry design and rugged construction—to insure distortion-free performance, long life, and trouble-free operation. The frequency response of the APS-100 is 10

to 20,000 cycles ± 1 db; peak power output (both channels) 100 watts; music power output (IHFM, both channels) 60 watts; power output (r.m.s., per channel) 27.5 watts; sensitivity 300 mv. At rated output, harmonic distortion is .25%, intermodulation distortion .75%. Hum and noise level is 80 db below rated output. Price of the APS-100, $159.95; grained oil walnut cabinet, $19.95.

Circle No. 76 on Reader Service Page 15

ALL-BAND AMATEUR RECEIVER

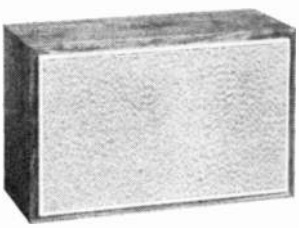
Operating on 10 through 160 meters, the *Hammarlund* HQ-88 covers all popular amateur bands, MARS frequencies, the Citizens Band, station WWV, and the marine band. Highly selective (2.2 kc. and 5 kc.) circuits with skirt ratios of better than 3 to 1, and

separate AM and SSB detectors make it an excellent unit for SSB, c.w., AM and RTTY. Sensitivity is a measurable 0.75 μv. for a 10 db AM signal-to-noise ratio, and better than 0.4 μv. for SSB and c.w. The HQ-88, a dual-conversion unit, features a "drift-free" crystal front end design. Price, $299.00.

Circle No. 77 on Reader Service Page 15

COMPACT SPEAKER SYSTEM

Intended for use where space and/or budget is limited, the *H. H. Scott* S-5 is a two-way speaker system employing a specially designed low-resonance woofer and high-frequency tweeter. It's extremely compact in size—just 10" wide by 16" high by 6¾" deep—but is capable of giving full



wide-range performance. Its response is ± 5 db from 60 to 15,000 cycles; impedance is 8 ohms. Other features include a crossover network and a high-frequency level control. Price, less than $60.00.

Circle No. 78 on Reader Service Page 15

AUDIO FLAT CABLE SYSTEM

With "Scotchflex" audio flat cable No. 800, introduced by the *3M Company*, amplifiers and speakers can be quickly mounted in any room or series of rooms at predetermined positions. Audio flat cable No. 800 has four conductors, each consisting of No. 22 AWG stranded wire, embedded in a flat vinyl strip, with an adhesive backing that will adhere to any clean, relatively smooth, firm surface. A series of accessories for termination, splicing and transition connections come with the wire. "Scotchflex" No. 800 is said to make possible

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1959...the RCA Mark VII
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and now 1964...

THE NEW RCA MARK NINE

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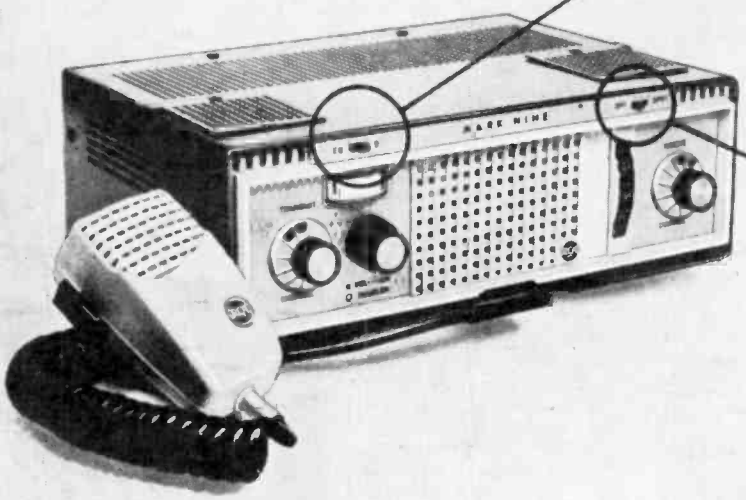

NEW! Combination "S" Meter and Relative RF Output Meter

"S" Meter indicates the relative strength of incoming signal in "S" units. RF Output Meter (EO) indicates relative strength of the signal being transmitted.

NEW! Spotting Switch

Permits precise manual tuning of receiver without use of receiver crystals. Receiver can be tuned (or "spotted") quickly to any incoming channel. This means, when you buy crystals for extra channels, you can (if you wish) omit the RECEIVE crystals and buy only TRANSMIT crystals.

NEW! External Speaker Jack

Lets you connect an external speaker to the set, so incoming calls can be heard in remote locations.

RCA, a pioneer in the development of citizens' band radio, has been providing quality equipment since the inception of the Class D Citizens' Radio Service in 1958. Now, these years of experience culminate in the great new RCA Mark Nine.

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- Push-to-talk ceramic mike with coiled cord

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New Products

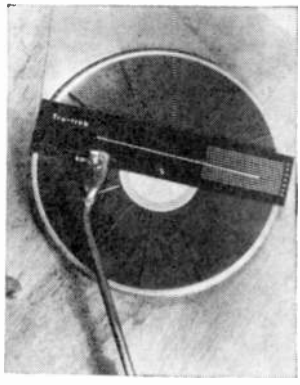
(*Continued from page 22*)

esthetically appealing sound system installations in a matter of minutes and hours rather than days and weeks, without defacing wall surfaces.

Circle No. 79 on Reader Service Page 15

TRACKING ERROR "READER"

A device that shows visually the amount of tracking error in record players and makes it possible to position the tone arm for optimum performance has been developed by *ALARD Products*. Made of Lucite, "TRU-TRAK" consists of a pointer assembly that attaches to the cartridge and a calibrated scale that fits over the turntable spindle. As the tone arm is moved across the turntable, the pointer indicates the tracking variations of the arm. The mounting position of the arm that produces the minimum amount of movement on the scale is the proper one for greatest fidelity with the particular tone arm and cartridge being tested. Price, $6.95 postpaid.



Circle No. 80 on Reader Service Page 15

HIGH-ACCURACY FREQUENCY METER

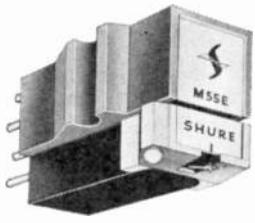
The new solid-state frequency meter announced by *Electronic Research Company* is suitable for a wide variety of applications. It provides direct linear reading of frequencies from 20 cycles to 200 kc. in six ranges, with each individually adjustable for calibration. The accuracy is ± 1% from 20 cycles to

100 kc., and ± 2% from 100 to 200 kc. Input impedance is 100,000 ohms. An output jack, designed for use either with an oscilloscope or earphones, provides a 15-volt, peak-to-peak square wave into a 50,000-ohm load. Price, $149.50.

Circle No. 81 on Reader Service Page 15

ELLIPTICAL STYLUS CARTRIDGE

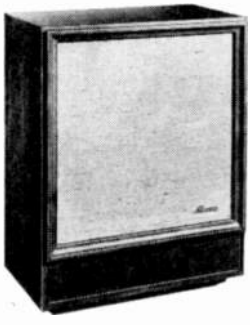
Shure Brothers, Inc., has announced a new 15° stereo dynetic cartridge with an elliptical diamond stylus developed especially for use with the new light-tracking automatic turntables. Called the M55E, it operates at tracking forces of from ¾ to 1½ grams, well within the tracking capability range of most of the new higher-priced automatic turntable models. The M55E has a frequency response of 20 to 20,000 cycles; output voltage is 6 mv. per channel at 1000 cycles at 5 cm/sec.; channel separation is nominally over 25 db at 1000 cycles. If excessive forces are applied to the stylus, it will momentarily retract, and a soft plastic safety bumper will come in contact with the record. Price, $35.50.



Circle No. 82 on Reader Service Page 15

FOUR-WAY SPEAKER SYSTEM

The "Tanglewood" four-way speaker system is the latest addition to the *Sherwood* hi-fi line. With six speakers, and a 200-, 600-, and 3500-cycle crossover, the system has an overall response of 29 to 17,500 cycles, ± 2½ db. Two 10" woofers have staggered 17½- and 18½-cycle resonances, and the low-frequency response is claimed to be 8 db greater than that available with any two-cubic-foot "bookshelf" system. The other speakers consist of a carefully matched 8" midwoofer, an 8" midrange, and two 3½" ring-radiator tweeters. All speakers are individually chambered and baffled to eliminate intermodulation distortion. Price of unit in walnut-veneered enclosure, $219.50 ($224.50 on the West Coast).



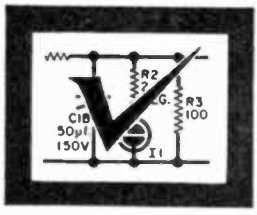
Circle No. 83 on Reader Service Page 15

ALLEN-TYPE SCREWDRIVER SET

Having trouble reaching those deep-set or awkwardly placed screws? The PS-99-40 compact Allen-type screwdriver set available from *Xcelite Incorporated* simplifies assembly and service work involving Allen hex recess set screws and cap screws. Included in the interchangeable blade set is a regular-size "Servicemaster" handle, nine blades, and a 4" extension shaft. The handle and extension shaft have a new positive-locking device —the blades fit snugly, are held firmly for turning, yet are easily removed. Price, $11.25.

Circle No. 84 on Reader Service Page 15

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. Don't send a return envelope; your response will come from fellow readers. Because we get so many inquiries, none can be acknowledged, and POPULAR ELECTRONICS reserves the right to publish only those requests that normal sources of technical information have failed to satisfy.

Schematic Diagrams

Tone Master BC-s.w. receiver, chassis B233207. (Jimmy Freeman, Box 224, Whitley City, Ky.)

Communications Co. Model DAV-2 walkie-talkie, Navy surplus. (Thomas F. Davis, 914 Wilson Ave., Johnson City, Tenn.)

Atwater Kent Model 4340 receiver using 5 01A's, circa 1923. **Stelnite** 1-band, 7-tube receiver, about 1930. (James Spreen, 2411 Tillman Rd., Ft. Wayne, Ind. 46806)

McMurdo Silver Model 906 "Silver" signal generator, early 1940's. (Michael Yurke, 4729 Leila Ave., Tampa, Fla. 33616)

Grebe "Synchrophase" receiver, type MU1, ser. CRCG, early 1920's. **Majestic** Model 25 "Screened Grid Superheterodyne" receiver, circa 1930. (Lee F. Brackett, East Madrid Rd., Phillips, Me.)

"Black Hawk" 7GM 3-band, 7-tube receiver, about 1935. (Norm Flasch, 5349 Washington St., Skokie, Ill. 60076)

Radio City Products Co. Model 345 VTVM. (Wendell White, 3134 S. 9 St., Abilene, Texas)

Stromberg Carlson BC-s.w. radio-phono console, ser. 590846, circa 1940. Has push-button tuning, 6 tubes. (Dick Rider, 224 Calabasas Rd., Watsonville, Calif.)

RCA Model 29K radio, ser. 038072. Tunes BC and s.w. bands. Has 8 tubes and push-button tuning. (J. W. Hynds, 721 West Kyle, Clute, Texas)

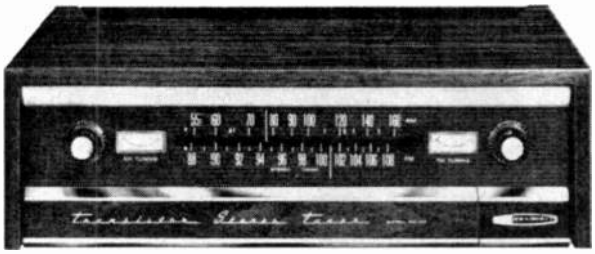
Atwater Kent Model 20 radio, ser. 483161. (A. U. Burnett, 1949 Bowie Drive, Corsicana, Texas)

Majestic Model 100-B radio-phono combination. Tunes BC and s.w. bands. Has 8 tubes. (Thomas Dagastino, 22 Chino Ave., Worcester 5, Mass.)

Stromberg-Carlson Model 1121 circa 1940 AM, FM and s.w. radio-phono combination, series 14. Has 11 tubes and push-button tuning. (David Stanowski, 108 Wilshire Dr., Wheeling, Ill.)

(Continued on page 28)

For The Stereophile With An Eye...



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Operation Assist

(*Continued from page* 26)

E. H. Scott Model A-446 4-band receiver, circa 1933. Tunes 550 kc. to 18 mc. Has 15 tubes including rectifier and Wunderlich detector tube. Built on 2 chassis. (T. M. Turner, 301 Sabin, Kalamazoo, Mich.)

Hallicrafters Model S-38B receiver. Tunes 550 kc. to 30.5 mc. Has 5 tubes. (Rashad Mohamed, 93 Mowbrays Rd., Madras 18, South India)

Morrow Model 2BC 80-10 meter converter. (D. C. Brown, 149 N.W. 30th Ave., Ft. Lauderdale, Fla.)

Rogers "Majestic" Model B-9933 2-band receiver, circa 1937. Made in Canada. Has 8 tubes. (R. P. Millard, 9619 McNaught Rd., Chilliwack, B. C., Canada)

Hallicrafters Model S-72L portable receiver, and **Philips Lamps Ltd.** Model PCR made in England, circa 1944. (George Kapsokavadis, Chemical Laboratory of the State of Corfu, Greece)

Zenith Model 6G001Y "Long Distance" receiver. (Kenneth Lang, 310 15th St., Union City, N.J.)

PYE table-model TRF receiver. Has 4 tubes. Tunes BC and 1 s.w. band. (N. Rushner, RCAF Stn., Sydney, N.S., Canada)

E. H. Scott Model 505 receiver. Has 30 tubes on 2 chassis. (Gary Rickert, 4121 Blanchan Ave., Brookfield, Ill. 60513)

Victor "Animatophone" Model 55 projector. Takes 16-mm. film. Made by Curtiss Wright. (Robert Earhart, 2401 E. 3rd, Joplin, Mo.)

Kellogg Model 516 receiver. Uses tapped vari-couplers. (J. N. Clapp, 1516 Elm St., Davenport, Iowa 52803)

Zenith Model S118695 receiver, circa 1935. Tunes 3 bands. Has 8 tubes. (Mike Clarson, 65 Richard St., Clark, N. J. 07066)

Zenith Model 7H822Z AM-FM receiver, circa 1940. Has 7 tubes. (Ronald Brown, 7536 Ives Lane, Baltimore, Md.)

RCA Model 262 receiver, circa 1935. Tunes 140 kc. to 36 mc. Has 10 tubes. (Robert Kando, 3 Carmen St., Dorchester, Mass. 02121)

Keystone Model K-100 tape recorder, circa 1955. (Joseph Frjelich, 13431 Ave. M, Chicago 33, Ill.)

Crosley Model 634 receiver, circa 1934. Has 6 tubes. Tunes AM and s.w. bands. (Jim Costov, 6005 Carew, Houston, Texas)

Philco Model 38-10 receiver, circa 1941. Tunes AM and s.w. bands. Has 5 tubes. (E. L. Whitescarver, Box 1042, Palestine, Texas)

Morrow Model 3BR-5 converter. Tunes 3 bands. (Jim Peterson, 623 S. Hill, Fort Scott, Kan. 66701)

Philco Model 46-1209 radio-phono combination, circa 1943. (John Kuc, 193 Hampshire St., Indian Orchard, Mass. 01051)

RCA Model AR-936 receiver, circa 1937. Has 7 tubes. (Gerald Welch, 34 Estabrook Rd., Weymouth, Mass.)

King Model MT666 motor tester, ser. 2555A. (Gene Picou, 1513 N. Ave. Q Palmdale, Calif. 23550)

Sola Model CF "Examiner." (Leo E. Smith, RD1, Box 375, Sandy, Utah 84070)

Motorola AM-FM-FM-s.w. receiver, circa 1943, model not known. Has 7 tubes. (James Swank, RD1, Apollo, Pa.)

R.M.E. Model 4305 CB transceiver. (Michael Cook, 7 Johnson St., Hart, Mich.)

EICO Model 470 oscilloscope. Has 7" screen. (Robert G. Pearson, 117 Elmar Drive, S.E., Vienna, Va.)

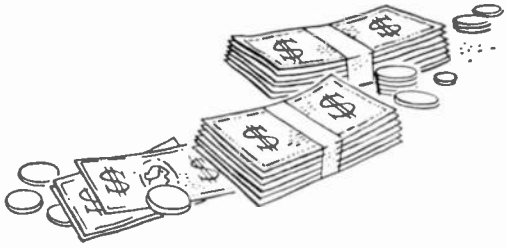
Zenith Model 5H40 "Trans-Oceanic" portable receiver. Tunes 7 bands. (Antonio P. Pacardo, 136 Jacob St., Naga City, Philippines)

Executone Model P-14 audio amplifier. (Tim Quill, 2975 Oaklawn St., Columbus, Ohio 43224)

Freed-Eiseman Model 32 radio-phono combination, circa 1946. Tunes FM-AM and s.w. Has 19 tubes and magic eye. (Albert W. Alley, 4130 N. Keystone, Chicago, Ill. 60641)

(*Continued on page* 30)

Regardless of what you pay for other Color TV



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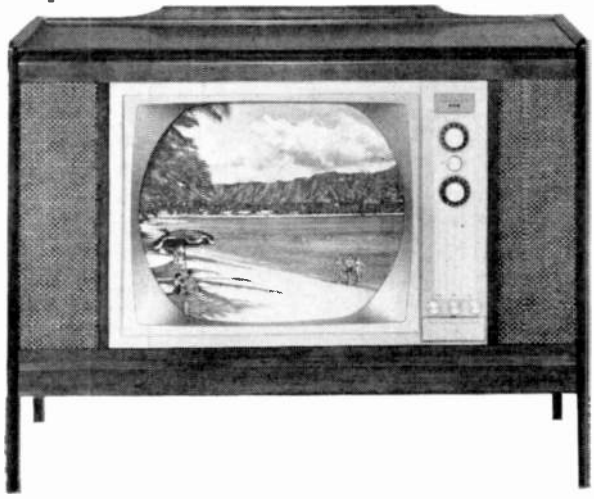

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(*Continued from page 28*)

Hallicrafters Model S-38 receiver. Tunes BC and s.w. bands. (James Jenson, Box 117, Regent, N. D.)

Emerson Model 544 receiver, ser. 46-9790093. Has 5 tubes. (Frank E. Prussa, RR#1, Atkinson, Nebr. 68713)

Link Model 1905 E.D. receiver, ser. 64311. (Albert D. Szekfu, Box 251, White Swan, Wash. 98952)

Philco Model A19056 receiver, circa 1933. Tunes 1.6 to 18 mc. on 3 bands. (Robert Landry, 11 Rutland St., Springfield, Mass. 01109)

Weston Model 983 oscilloscope. Has 18 tubes. (James Resorff, 7602 Sweetbriar Dr., College Park, Md. 20740)

Link Model 1905 receiver. (Robert Foster, Route 1, Box 555, Dixon, Calif.)

GE Model 51 wire recorder, circa 1945. (Mike Silverman, 3366 Clarendon Rd., Cleveland Heights, Ohio 44118)

Special Data or Parts

Saja Model Mk 5 tape recorder, circa 1947, has 5 tubes; made in West Germany. Power transformer and schematic needed. (Steve Benscies, 609 Fremont St., Pittsburgh, Pa.)

GE Model RP-2020 hi-fi phono with VM turntable. Parts for record player wanted. (James D. Fox, 123 Balt. St., Gettysburg, Pa.)

Harvey-Wells Model TBS-30C "Bandmaster Senior" transmitter; 160-2 meter bands; has 2 6AQ5's, 2 5881's and 1 5933. Schematic and manual needed. (A 3/c James A. Cannon III, CMR 1468, Carswell Air Force Base, Fort Worth, Texas 76127)

Philips Model A-BIX 75U receiver; other numbers 53553, A3 25680, and 00 452 5257. Schematic needed and info to convert 220-volt to 117-volt power supply. (Steve E. Hann, Lakewood, Calif.)

Atwater Kent Model 37 receiver. Type 26 tubes and schematic wanted. (Will Reid, 425 Ohio St., Joliet, Ill.)

Radio City Products Model 1322 tube tester. Data to test modern tubes wanted. (Jud Lindsey, RD#1, Pine City, N. Y. 14871)

Hollywood Model 1614 CRT tester and rejuvenator. Meter replacement and schematic needed. (C. Avery, 2127 Dillman St., Terre Haute, Ind. 47802)

GE Model H-31 radio-phono console. Original 78-rpm record player with accessories and manual needed. (Peter Rebuzzini, Tanners Marsh Rd., Guilford, Conn. 06437)

RCA "Radiola #3," circa 1924. WD-11 tube or equivalent needed. (James Lockard, 3185 E. 13th Ave., Columbus 19, Ohio 43219)

Vomax Model 900 meter. Range selector switch wanted. (Calvin Long, South & Carroll, Frederick, Md.)

Kolster Model K-20 receiver, circa 1928. Source for parts and info on dial stringing needed. (Floyd Smith, Jr., Box 163, Croton Falls, N. Y. 10519)

Canadian Marconi Model No. 9 Mk 1 receiver; tunes 1.8 to 5 mc. Schematic and power supply diagram needed. (Ronald Smeltzer, 805 Liege, Montreal 15, Que., Canada)

Hickok Model 550X tube tester. Tube chart and schematic needed. (C. W. Kunkelman, Hillcrest School of Oregon, 2450 Strong Rd., Salem, Ore.)

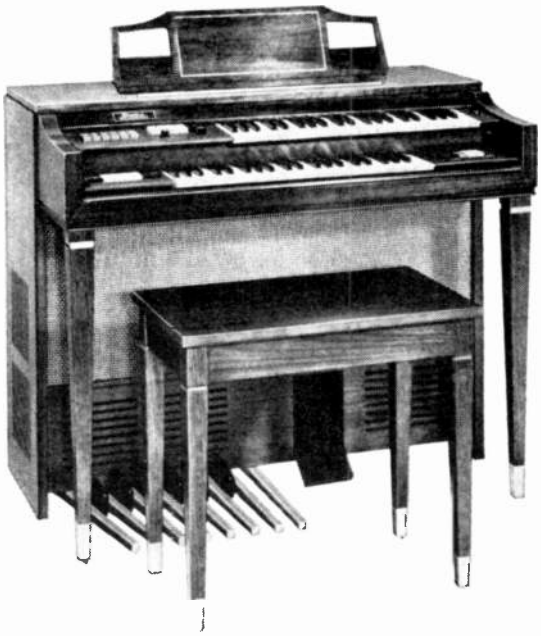
Ferret Model 720 sweep generator. Manual and schematic needed. (F. Kerns, 4555 50th St., San Diego 15, Calif.)

Inca Models T3 and T13 transformers. Current, wattage and impedance values of tapped windings wanted. (Paul A. Lindsey, 15 Bemis St., San Francisco, Calif.)

RCA Model 811K BC-s.w. receiver, chassis 8Q17B. Glass dial plate needed. (M. Kowalchuk, Jr., 1008 Berwick St., Easton, Pa. 18042)

GE Model L-53 a.c.-d.c. receiver, circa 1932-33; tunes 540-1710 kc., 2400-2500 kc. Operating instructions and schematic needed. (Chris Falvo, 2215 Halter Ave., N.W., Canton, Ohio 44708)

Jackson Electrical Instrument Co. Model 660 dynamic signal analyzer; 5 bands, 7 tubes, date unknown. Operating info and schematic needed. (John McDaniel, Explorer Post 73, 1302 Westridge, Abilene, Texas) —30—



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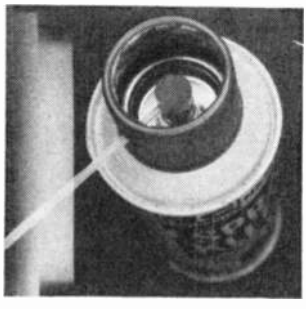
CIRCLE NO. 12 ON READER SERVICE PAGE

Tips and Techniques

CAP AEROSOL "WILDCATS" TO AVOID MESSY ACCIDENTS

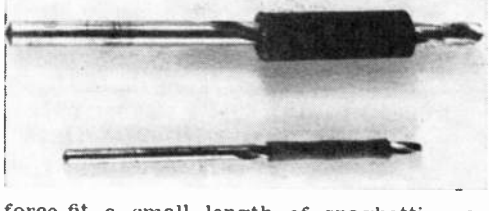
Don't discard the protective cap on the next can of aerosol tuner cleaner you buy—it can keep the contents of the can from being accidentally released, particularly when the can is carried from job to job. As slipping the cover on and off and attaching and detaching the extender for each job would be a nuisance, you can neatly trim out the top of the plastic cover with a small knife. Then drill or punch a hole on the side of the cap for the spray extender tube. When the can is empty, the modified cap can be transferred to a new can.



—Elmer C. Carlson

SPAGHETTI DRILL STOP PREGAUGES HOLE DEPTHS

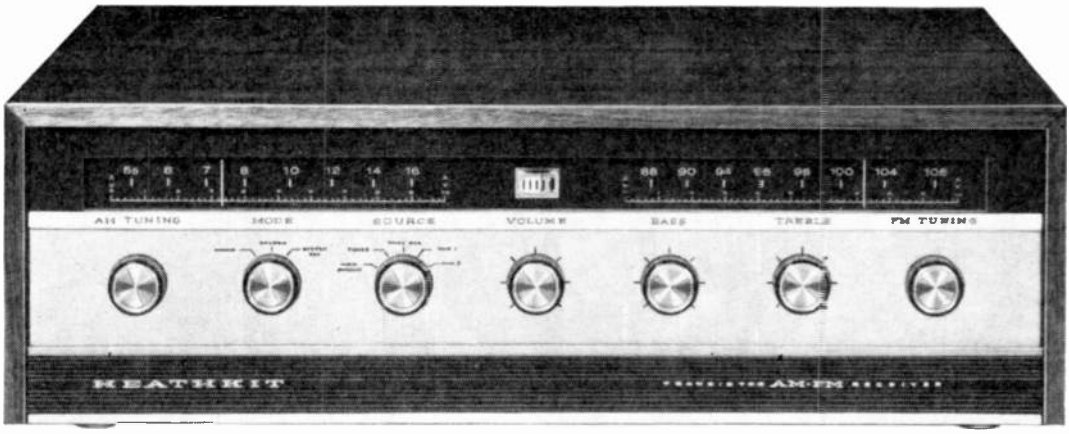
Drill stops are usually found on drill presses to control the depth of holes. With a hand-held drill, it is a time-consuming operation to stop and check the depth, and chances of obtaining equal depths are not good. An inexpensive solution to this problem is to force-fit a small length of spaghetti over the drill bit—the tighter the better—exposing as much of the bit as is needed. Several layers of tape wrapped around the bit at the proper place can serve the same purpose.



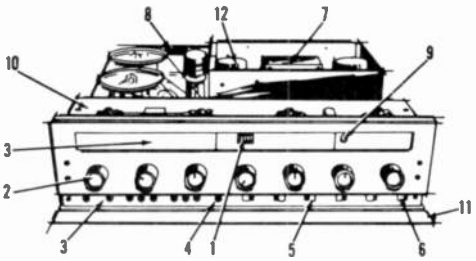
—Don Lancaster

(*Continued on page* 38)

first all-transistor stereo receiver kit!



Heathkit AR-13A All-Transistor Stereo Receiver Kit . . . Only $195.00!



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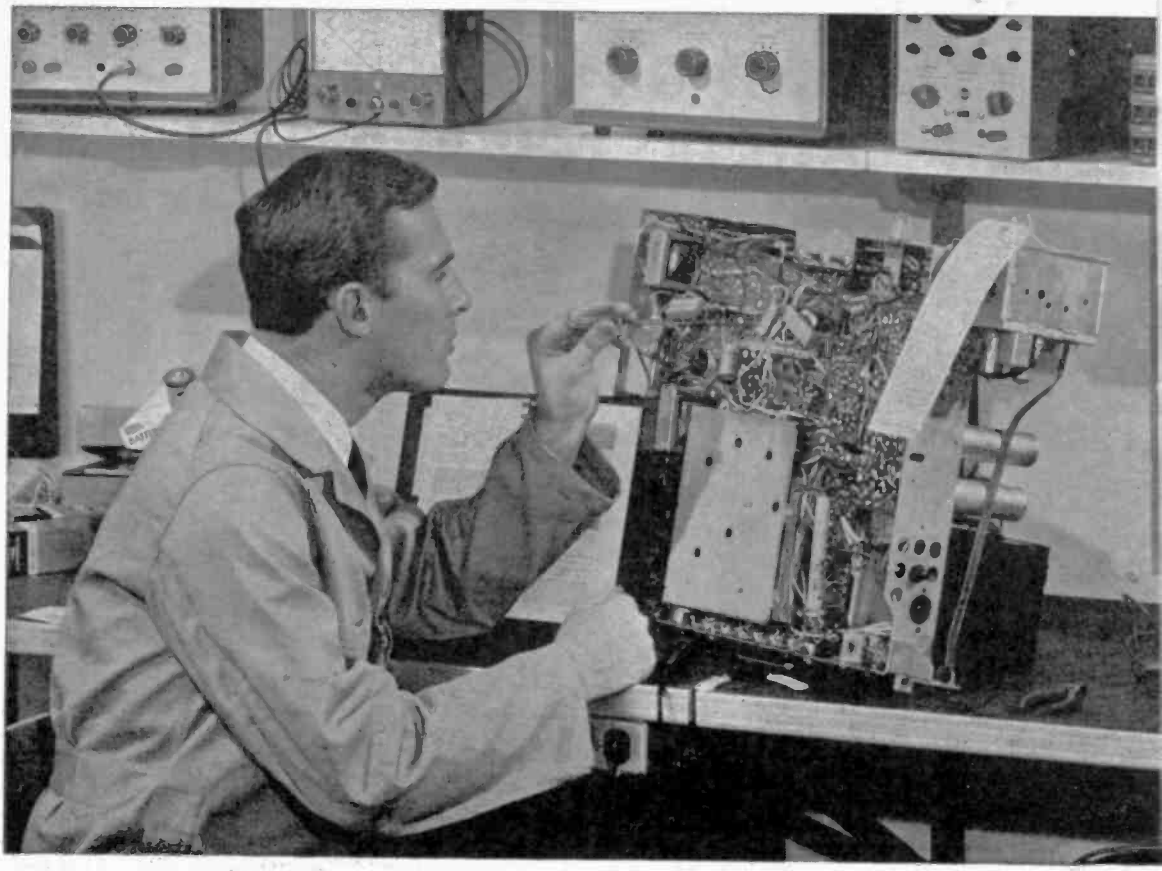

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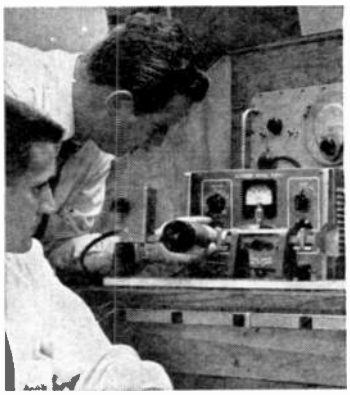

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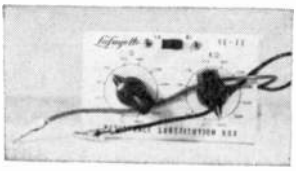
Tips

(*Continued from page* 32)

TWO HANDY TIPS ON SUBSTITUTION BOX LEADS

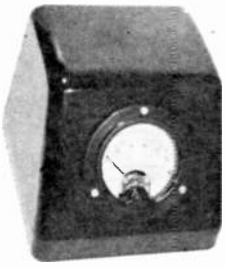
Substitution boxes frequently come equipped with long leads. In many circuits the length of these leads is unimportant, but long leads can upset i.f. and r.f. circuits. And even when the circuits are less critical, long leads can create a bench cluttering problem. The logical solution is to shorten the leads and attach the alligator clips that usually come with a substitution box to the shortened leads. Another good idea is to substitute Minigator clips for the alligators—they permit easier connection into miniature circuits. —*F. H. Frantz*



PLASTIC CASES HOLD METERS OR SPEAKERS

Discarded plastic TV booster or antenna rotor control cases of the type shown in the photo make excellent mounts for meters or for a miniature speaker. Strip the parts and chassis from the case, and, if you're lucky, the meter or speaker will fit in the hole left by the dial without further modifications. If necessary, enlarge the mounting hole with a hacksaw blade, and drill holes for mounting screws around the perimeter.

—*Carleton A. Phillips*



FELT-LINED ALLIGATOR CLIPS

Felt-lined clips will serve as non-scratch clamps for panels or etched circuit boards, and when saturated with water they act as excellent heat sinks for use in soldering transistors or diodes into circuits. All you need to make them is an old felt hat, a razor-blade or hobby knife, some general-purpose cement, and several alligator clips. Trim the felt to fit within both jaws of the clips and cement it in place with a minimum amount of cement (so the cement doesn't saturate the felt). Two or more layers of felt can be applied if necessary. Allow the cement to dry thoroughly before you use the clips. —*Eugene Richardson*

Share great moments with other great guys

Get a new set of wheels in the Army. Ten feet across or scooter size, there are more wheels in the Army than in any other organization in the Free World. Some are an adventure to drive, others take you to adventure—and, if you want, you can learn what makes each one roll.

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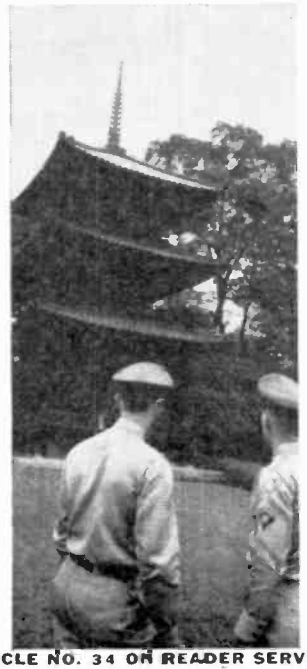
It's different from your home town. And who wouldn't expect it to be? After all, one of the reasons you join the Army is to see the world of differences.



You're not alone in today's action Army. Every experience you have is shared with other great guys. Regular guys who are learning, earning, growing, going, serving our Country, developing themselves. Just as you are.

But the wonder of these experiences is yours alone. No one can tell you how great it feels to master a difficult specialty like computer programming, missile repair, electronics, or construction. No one can live the excitement of landing in a foreign country for you. No one can know what *your* great moments in the Army will be. But you can be sure your life in today's Army will be full of great moments. Enough to add up to a great life.

Talk to your local Army recruiter. Let him tell you what the Army can do for you... and what you can do for the Army. Let him help you to that great moment, the moment you realize that...if you're good enough to get in, a proud future can be yours in today's *action*

Army

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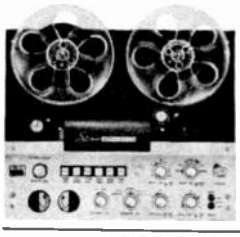

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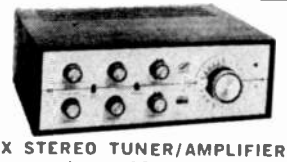
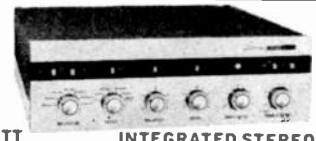


2536 FM MPX STEREO TUNER/AMPLIFIER Superb FM stereo-MPX tuner, plus a 36-watt stereo amplifier. "In tuning ease, general handling, and sound quality... leaves little to be desired." HIRCH-HOUCK LABS in ELECTRONICS WORLD. **Kit only $154.95. Wired $209.95.**



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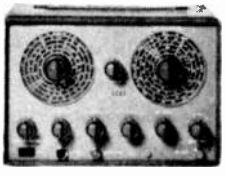

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CRYOGENICS

ELECTRONICS' FRIGID FRONTIER

By JAMES JOSEPH

Resistance vanishes, and electricity flows effortlessly forever at 450 degrees below

THE electronic technician, asbestos-gloved (the gloves protecting him from *cold*, not heat) unstoppers a thermos-like container. A cloud of vapor belches from its open end. Carefully, he tips the thermos. A sizzling cold, clear liquid spills—writhing as though alive—onto the concrete floor. For a moment it bubbles and boils. And suddenly it's gone—vaporized into thin air.

"Liquid helium," he says. "Its temperature is −450° F, a whisker above absolute zero, −459.6° F. The most revolutionary stuff in electronics."

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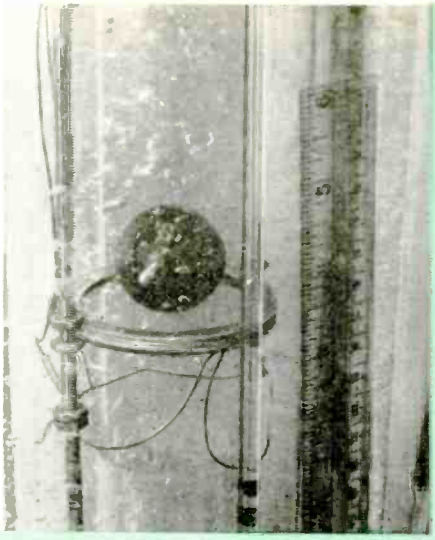


Although lead ball appears to be floating, it is actually riding on a cushion of magnetic force set up by the loop of wire below it in liquid helium. This opposition to any magnetic field is known as diamagnetism.

This device, the world's most powerful superconductive magnet at 107,000 gauss, is lowered into vapor-shrouded bottle of liquid helium. Despite the intense field it generates, it requires only an initial starting current.

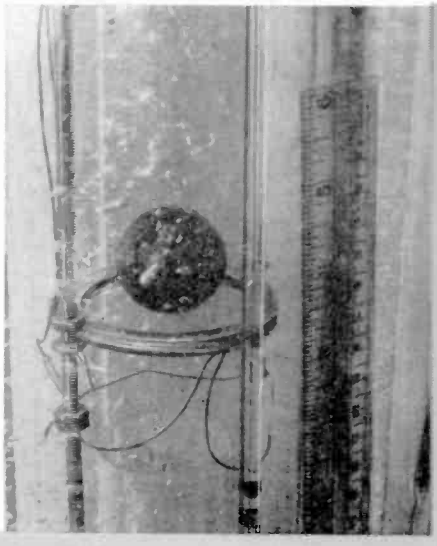
In fact, however, neither liquid helium (coldest of the so-called *cryogenic* supercold fluids), nor liquid nitrogen (−320°F) or even liquid oxygen (−297°F) are in themselves "revolutionary." They're merely quick and handy refrigerants.

What *is* revolutionary is how cryogenic "supercolds" affect electronic circuits and their components: chilled to near absolute zero, some conductors (tin and lead, for two examples) lose all resistance. They become *superconductors*. Set a dab of electricity coursing their chill, no-resistance circuits, and the current flows effortlessly—and forever.

Near absolute zero lies the weird world of *superconductivity*—a realm of zero resistance where current flows without hindrance (or heat); where a circuit's internal noise (caused by the random vibration of the very atoms which comprise its components) is hushed—and sometimes stilled; where magnetism behaves like an electronic faucet (turning current on and off); and where a new breed of printed circuits ("thin films") threaten to obsolete transistors and their solid-state brethren. But the realm of superconductivity is more than merely an abode of electronic deep-freeze. It is a lilliputian world of micro-miniaturization—its components measured not in centimeters or millimeters, as in room-temperature electronics, but in *microns* (a mere ten-thousandths of a centimeter) and in *angstrom units* (a microscopic one-hundredth-millionth of a centimeter).

In this weird world of supercold, "perfect" is a word even cautious scientists use. For *perfect conductivity* is one property of superconductors. It's the reason, in fact, they're called "super." Another is *perfect diamagnetism*—opposition to any magnetic field. If you place a superconductive lead ball atop a cryogenically chilled loop of wire through which current is flowing, the ball—repelled by the wire's magnetic field—will float in midair, riding a cushion of magnetic force. You've created a frictionless bearing—a ball (it can be made to spin) "lubricated" by air.

General Electric is developing a cryogenic gryoscope, its supercold rotor suspended within a magnetic field. Such gyros should suffer none of the bearing-



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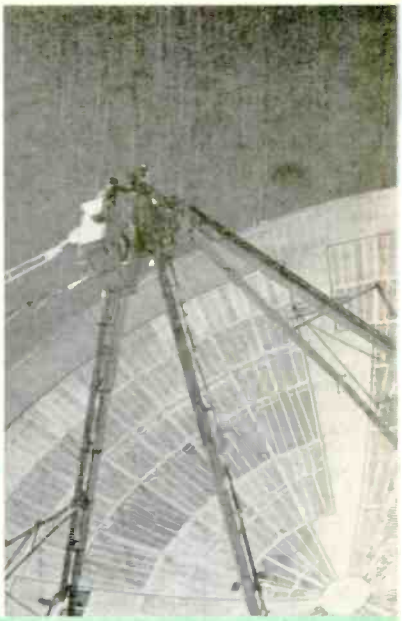
Many superconductive materials, as niobium-tin, can't be bent or shaped—they're just too brittle. Bell Labs solved the problem by enclosing the raw ingredients in a pure niobium tube, drawing tube into a thin wire (see above) and shaping it into a coil, and then putting it into a 1000° C furnace to fire it.

Hughes' maser microwave amplifier has ruby and magnet at bottom. Unit is installed in coolant container (above, right) to supercool ruby near absolute zero.



NASA parabolic antenna catches fleeting signals from space; they're amplified by supercooled ruby maser mounted in front.

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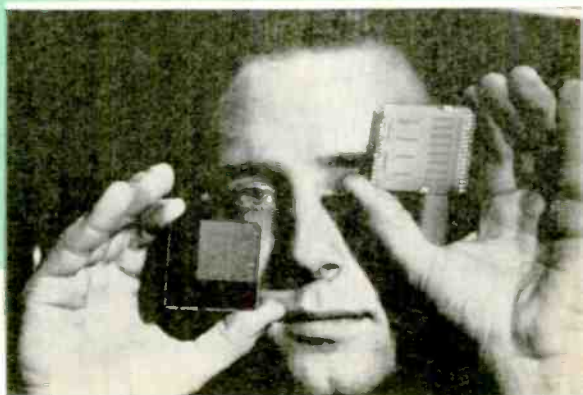
The Jet Propulsion Laboratory, which is also working with supercold gyros, hopes to use them to guide spacecraft to the moon and planets with pinpoint accuracy.

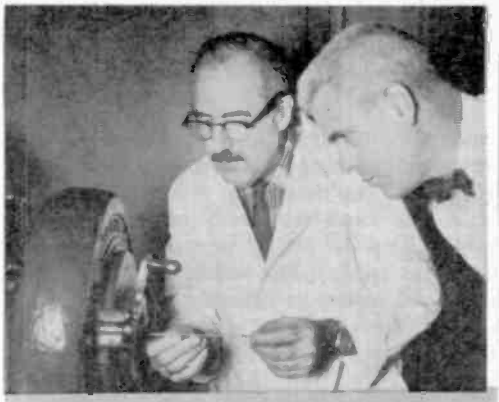
Some even foresee superconducting motors (for spaceships, or possibly even for locomotives). And, in the future, a transcontinental throughway (a superconducting trough) over which superfast vehicles will ride on frictionless magnetic bearings. For a compressed magnetic field, its force increasing as the *square* of its field strength, can support great weight—perhaps (as that lead ball) hold a fully loaded train a fraction of a frictionless inch above a superconductive rail.

But superconductivity is fragile. Two things can destroy it: (1) any rise in temperature much above absolute zero and, oddly, (2) strong magnetic fields, applied either externally or created internally by passing too much current through a frigid superconductor.

Superconducting Magnets. Not too long ago, researchers at Bell Telephone Lab-

It's just cold logic: At right is one of the first cryogenic associative memories for computers, this one developed in 1962 by General Electric. It contained 81 cryotrons and had a storage capacity of three three bit words. Just two years later, the superconductive memory plane at left, below, can store 16,384 bits of information. The other device (both were made by RCA) is superconductive logic.





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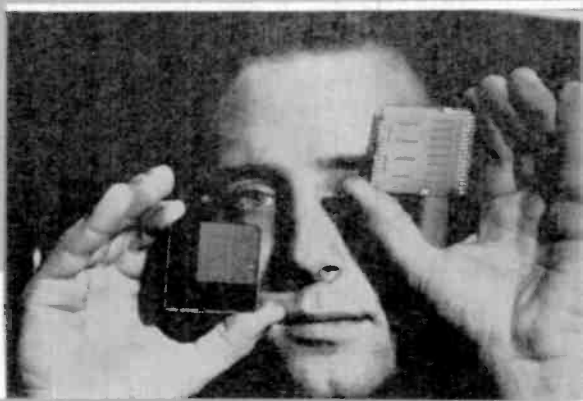


CRYOGENICS

Since 1953, 24 elements, alloys and compounds capable of becoming superconductive have been discovered—most by Bell Labs' Dr. B. T. Matthias (left). Here, he and Dr. J. E. Kunzler point to niobium on the periodic table.

oratories succeeded in building miniature electromagnets with field strengths as high as 70,000 gauss (the field strength of a toy horseshoe magnet is about 200 gauss). Turned superconductive in a liquid bath of near absolute zero helium, the magnet's no-resistance magnetic windings needed only enough current to establish the magnetic field. Since there was no resistance, the current flowed continuously—self-sustaining the field.

In February of this year, Westinghouse announced the first superconducting magnet with a field strength of 100,000 gauss—roughly 200,000 times the average magnetic field strength of the earth—with a one-eighth inch bore (the hole through the center where the field exists). Then, in May, RCA reported a magnet which would develop 107,000 gauss—with a bore of one inch. Once immersed in a superconducting bath, either of the magnets can be started by momentarily connecting six-volt storage batteries.

By contrast, a veritable powerhouse (more than 1.6 million watts) is needed to sustain a 100,000-gauss field in an enormous, but otherwise conventional, electromagnet. Most of this huge—and costly—energy is dissipated; wasted in the resistance of the magnetic windings. So great is the resistive heat, in fact, that 1000 gallons of water per minute are needed just to cool the windings.

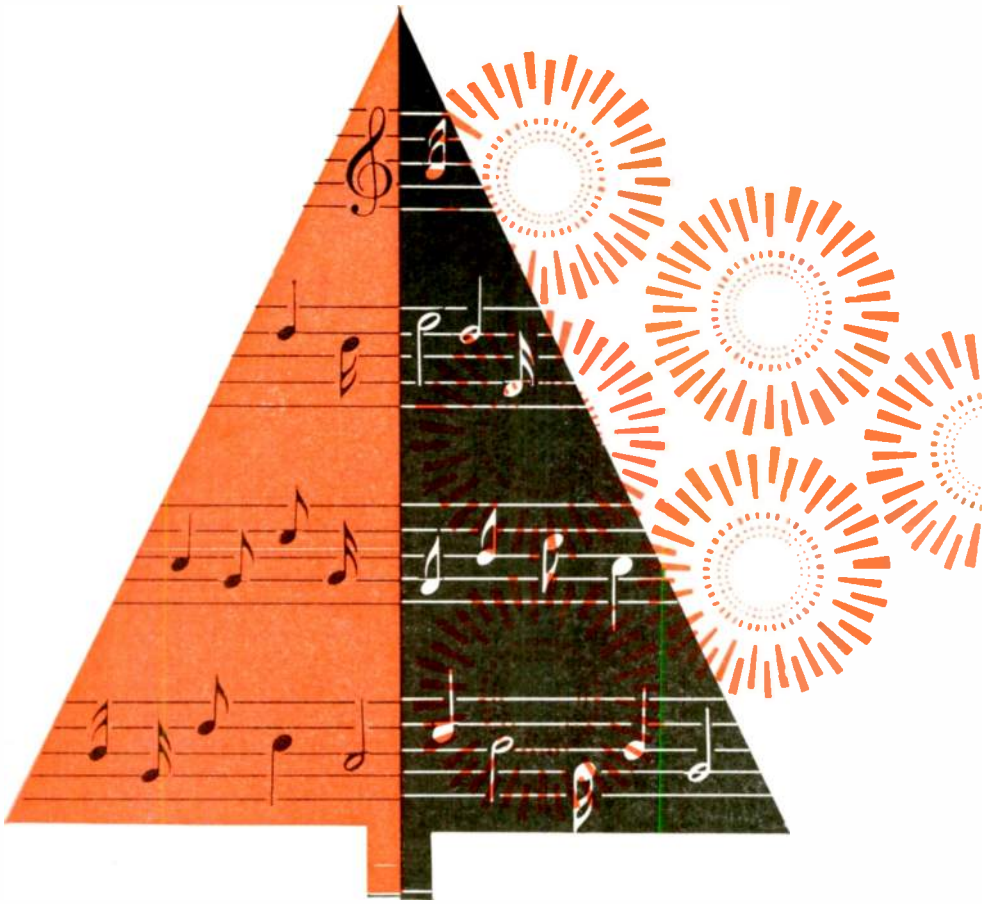
The huge and inherent resistive losses through magnetic windings explain why today few commercial electromagnets are rated at more than about 20,000 gauss. Yet it's predicted that superconductive magnets can be built with strengths of 400,000—or even 1,000,000—gauss.

Their uses are myriad: as particle accelerators in cyclotrons, as tools of production (their powerful field strengths—a 300,000-gauss field would exert 50,000 pounds of pressure per square inch—could extrude hot steel as though it were spaghetti), and in controlling the hitherto uncontrollable. In this latter category fall the unbelievably hot 100-million-degree-centrigrade gases from atomic fusion power plants which no known metal today can contain. Superconductive fields, arranged to form "containers within containers," will guide and bend the super-hot (and atomically lethal) ionized gas streams, preventing them from ever touching the pipes through which they flow.

Similarly, superconductive magnets in bores of one to two feet will be used to shape the plasmas of plasma jet propulsion engines for powering expeditions deep into outer space. Other magnets, many feet in diameter, may well serve as electromagnetic safety devices, shielding space travelers from the extremely hazardous high-energy protons emanating from solar flares. Although superconductive magnets of this size are still well in the future, they can be expected to follow improvements in materials, cryogenics, and space technology.

One of the problems with materials is to find superconductive metals that can withstand huge magnetic fields and still remain perfect conductors. That—and materials that can be worked into electronically useful shapes, such as

(*Continued on page* 86)



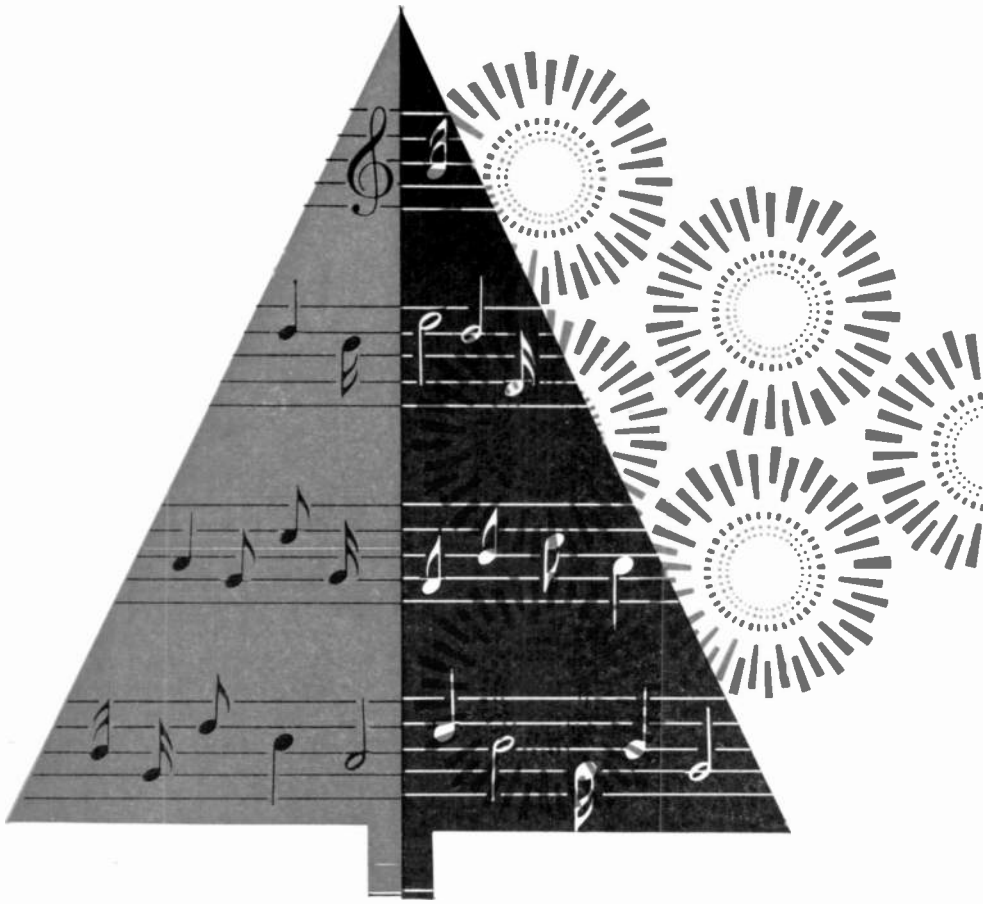
Add a new dimension to your holiday lighting—just use any radio or record player and the "Rhythmicon"

Christmas Lights Twinkle to Music

By LEON A. WORTMAN

HERE'S a little project we have dubbed the "Rhythmicon," for with it you can make your Christmas lights twinkle in time to the music from your radio, phonograph, hi-fi or p.a. amplifier. The possibilities the Rhythmicon offers are endless: Use it to control tree lights, floodlights, spotlights, or conventional electric bulbs—indoors or out.

Simply connect the two clip leads from the Rhythmicon to the loudspeaker leads of the sound source, and play carols or other seasonal material through it. The lights plugged into the socket on the box will automatically fol-



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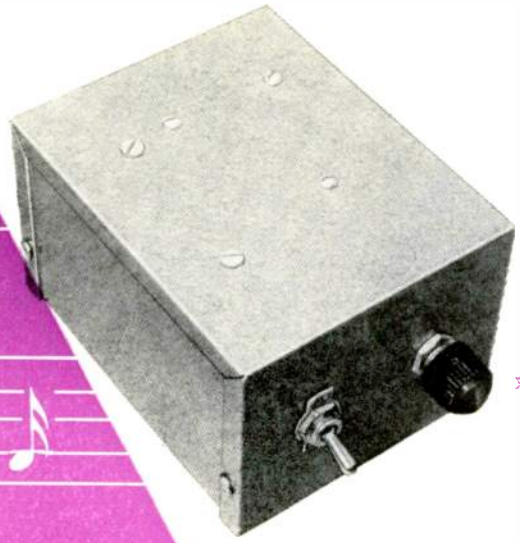


low the sounds, going from off to full on, getting instantly brighter and dimmer as the music gets louder and softer; going off completely when the music stops. The music plays, and the lights dance automatically.

Construction. Basically, the Rhythmicon makes use of the ability of a silicon controlled rectifier to act as a "rheostat," controlling large amounts of current in a circuit in response to pulses applied to its "gate" electrode. Unijunction transistor *Q2*, in combination with *Q1*, acts as a pulse generator to turn *SCR1* on. The pulse frequency (and, consequently, the brightness of the lamps controlled by *SCR1*) depends on the amplitude of the audio signal applied to *T1* (see "How It Works," page 48).

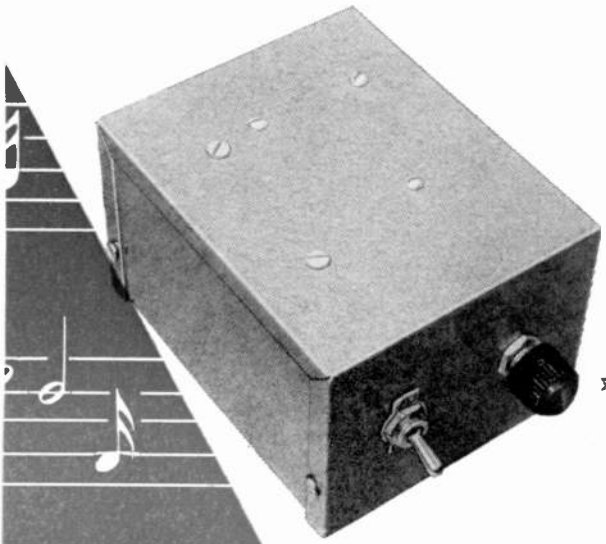
A 3" x 4" x 5" Minibox holds all of the circuitry and components for the Rhythmicon. The SCR and the four silicon rectifier diodes must be mounted on a heat sink. First, fabricate the heat sink from a piece of 1/16" aluminum, cutting it to 2½" x 3¾". A ¼" flange is bent along the 3¾" dimension for mounting the heat sink, and five holes are drilled in it for mounting *SCR1* and *D2-D5*. The holes must be large enough for complete clearance of the mounting studs.

Referring to the photos on page 47, mount *D2* and *D3* directly in the two center holes without insulating washers. A solder lug is placed under the mounting nut of *D2* to connect the cathodes of *D2* and *D3* directly to the lamp socket, *SO1*. Diodes *D4* and *D5* (as well as *SCR1*) must be electrically insulated from the heat sink with mica washers on either side. Between the mica washers and the bodies of these three semiconductors, use solder lugs as shown in the upper photo on page 47. Use heavy metal washers between the outer mica washers and the mounting nuts. When *SCR1* and *D4* and *D5* are mounted, check with an ohmmeter to insure that their cases are not shorted to the heat sink.

The heat sink *must* be electrically isolated from the Minibox. In the author's unit, *6-32* holes for machine screws were drilled and tapped into opposite sides of a 3¾" x ½" x ½" bar of Bakelite. The heat sink was mounted on the Bakelite through holes in the ¼" flange made previously, and the Bakelite was then secured to the inside of the Minibox in the same way. Polystyrene or any similar insulating material can also be used for this, or the heat sink can be mounted with machine screws using extruded shoulder washers to insulate it.

As shown in the top photo, most of the remaining components are mounted to a 2¼" x 3½" piece of perforated circuit board (with the exception of *SO1*, *F1*, *T1*, *S1*, and *R1*, which are mounted at the ends of the box). "Flea clips" are inserted into the perforated board at suitable points to provide rigid terminals for connecting the transistors and other components. The perforated circuit board is mounted to the box with several machine screws and ½" stand-

Christmas Lights Twinkle to Music



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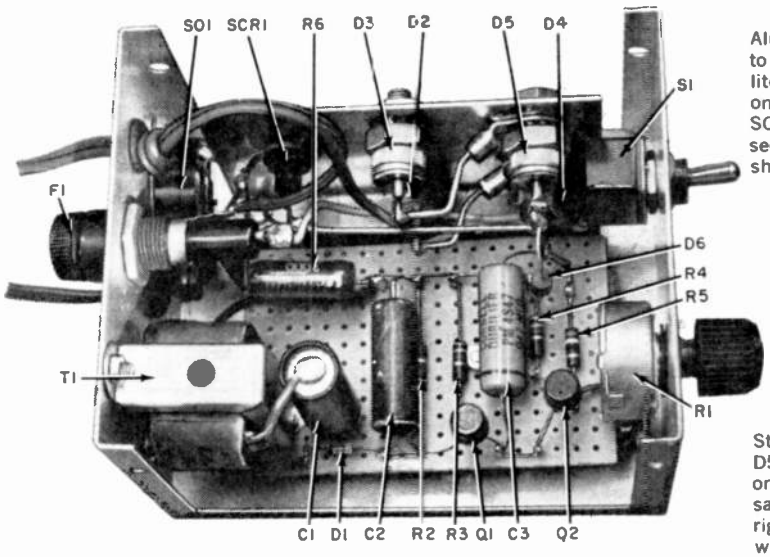
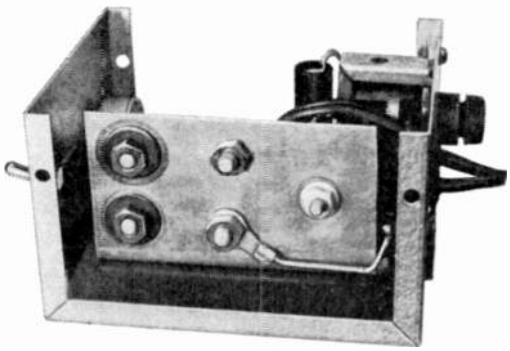


Aluminum heat sink is mounted to one side of box on a Bakelite strip; PC board is mounted on ½" spacers. Only rear of SO1—the socket for lights—is seen. Heat sink and components should not contact metal box.



Studs at left (below) are D4-D5. Mount with mica washers on both sides of heat sink; use same method for SCR1 seen at right. At center are D2-D3; no washers are needed for them.

offs to provide clearance for the tips of the "flea clips" which protrude through the board.

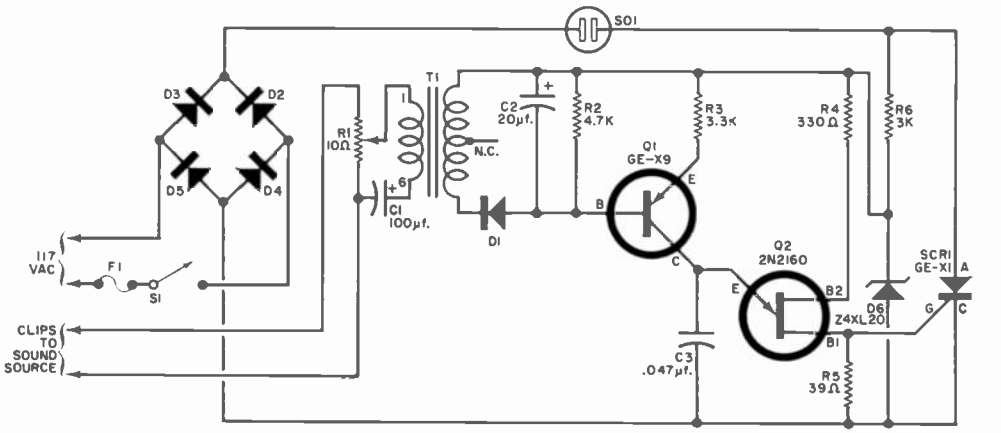
Before mounting the circuit board and heat sink, drill holes in the Minibox for the remaining components. At one end of the box, mount *SO1*, *F1*, and *T1*; at this same end, drill holes for the a.c. line cord and audio clip leads (these can also be made with a.c. lamp cord), and line them with rubber grommets. Drill holes for *S1* and *R1* in the opposite end of the box.

Final Wiring. Because some of the components of the Rhythmicon are at the potential of the a.c. line, it is essential that no part of the circuit makes electrical contact with the Minibox. The one exception to this is the audio lead which is connected to the bottom end of *R1*; connect this lug of *R1* to the box by placing a solder lug on the control shaft. Also, connect the ground terminal of *C1* directly to the box (rather than to the lower terminal of *R1*) using a lug under one of the nuts holding the perforated circuit board.

Transformer *T1*, a universal push-pull-plates-to-voice-coil audio output type, is used to couple the audio source to the Rhythmicon. It is connected so the secondary or voice coil side becomes the *input*. Connect the center lug of *R1* and the positive terminal of *C1* to the transformer terminals that give the highest impedance—with the unit used by the author, terminals 1 and 6. Connect the push-pull plate side as shown in the schematic; the center tap is not used and can be cut short.

Since transistors *Q1* and *Q2* are soldered into the circuit, be sure to use alligator clips or other heat sinks to avoid heat damage. Observe similar precautions with the diodes and *SCR1*. Component values are not critical, and may vary plus or minus 10%; it is desirable to select a resistor for *R6* that is within 5% of 3000 ohms, however.

Operation. It takes less than half watt of audio at 4 ohms impedance to operate the Rhythmicon, and even a transistor radio can be used to demon-



Rhythmicon consists of bridge rectifier, audio pulsing circuit (Q1-Q2), and power control (SCR1)

PARTS LIST

C1—100 μf., 50-volt electrolytic capacitor
C2—20 μf., 25-volt electrolytic capacitor
C3—.047 μf., 200-volt paper capacitor
D1—1N34A germanium diode
D2-D5—Silicon diode rectifier (GE-X4 or Lafayette Stock No. 19G4208 or equivalent)
D6—20-volt, 1-watt zener diode (GEZ4XL20 or equivalent)
F1—5-ampere, 125-volt "slow-blow" fuse and fuseholder (Littlefuse Type 3AG or equivalent)
Q1—GE-X9 pnp transistor
Q2—2N2160 unijunction transistor (GE)
R1—10-ohm, 5-watt wire-wound potentiometer
R2—4700-ohm, ½-watt resistor
R3—3300-ohm, ½-watt resistor
R4—330-ohm, ½-watt resistor
R5—39-ohm, ½-watt resistor
R6—3000-ohm, 5-watt wire-wound resistor, 10% or better
S1—S.p.s.t. toggle switch
SCR1—Silicon controlled rectifier (GE-X1 or equivalent)
SO1—Panel-mounting a.c. socket
T1—Universal push-pull output transformer (Lafayette 33G7503 or equivalent—see text)
1—3" x 4" x 5" Minibox
Misc.—Sheet of 1/16" aluminum for heat sink; perforated circuit board; flea clips; Bakelite bar for mounting heat sink; mica washers for mounting SCR1, D4 and D5; solder lugs; 6-32 hardware; ½" spacers; alligator clips; line cord; grommets; wire; solder, etc.

strate its functioning. No modification is required at the audio source; simply connect the clip leads to the amplifier speaker terminals, or to the voice coil leads of a speaker. Any impedance between 4 and 16 ohms will do, with 8 ohms as optimum.

Potentiometer *R1* is the sensitivity or light amplitude control for the Rhythmicon. After setting the audio amplifier for the best listening level, adjust *R1* to the point where the lights follow variations in sound volume; turn it too high and the lights will stay on with little variation, going off when the sound stops.

Lovely lighting effects can be created by connecting up to four 100-watt Par-38 lamps (available in red, blue, and green) at the base of the Christmas tree, or as part of an outdoor display. Plugging in strings of conventional tree lights further enhances the effect. The 4.7-ampere rating of *SCR1* gives a total of 450 watts of power handling capability—that's a lot of dancing, twinkling, decorative light! —30—

HOW IT WORKS

Audio is applied to *T1*, and rectified and filtered by *D1-C2*; the resulting polarized voltage appearing across *R2* biases *Q1*, following audio amplitude variations. Unijunction *Q2*, *C3*, *R4*, and *R5* comprise a pulse generator. The frequency of the pulses depends on the d.c. potential applied to *Q2*'s emitter by *Q1*. The greater the audio amplitude, the higher the pulse rate. Resistor *R6* and zener diode *D6* form a voltage divider across the output of the bridge rectifier (*D2-D5*), and provide stable, low potentials for *Q1-Q2*. The *SCR* begins conducting when a pulse is applied to its gate; current flows until the pulsating d.c. delivered by *D2-D5* reaches zero. At that point, another pulse from *Q2* is required to again start conduction. The greater the pulse rate, the higher the average current through *SCR1* and the lights connected to *SO1*.

Miniature I.F. Module Superheterodyne Pocket Receiver

By CHARLES CARINGELLA

Modern electronics module concept gets more elements into less space and greatly reduces number of tie points. Two i.f. amplifiers and detector take up only 0.375 cubic inch.

ROUND-THE-CLOCK listening pleasure will be your reward for doing a good building job on this modern transistor superheterodyne broadcast-band radio. It is a complete unit and can be put into your pocket. It can also give your phonograph or tape recorder the ability to sound off with broadcast-band programs. No test or alignment equipment is needed to construct the radio.

A pre-aligned i.f. amplifier module only 1½" x ½" x ½" in size speeds construction and simplifies wiring. The module contains 24 parts including a ceramic filter, two transistors, two transformers and a diode detector.

COVER STORY

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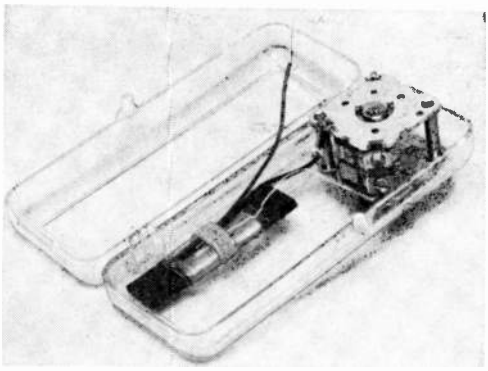
COVER STORY

Fig. 1. Variable capacitors C1a and C1b are held in place by machine screws. The antenna loopstick can be cemented to the case, or just allowed to "float" in place.



Except for the antenna loopstick, variable capacitor and phono jack, all components including the i.f. module are mounted on a small board, measuring just 2⅞" x 1⅜", as shown in Fig. 2. This is not a printed circuit. All the components are hand-wired.

How It Works. Transistor *Q1* serves as an r.f. amplifier, local oscillator and mixer. (See Fig. 4.) The input circuit, consisting of a variable capacitor (*C1a*) and an antenna ferrite loopstick (*L1*), tunes the broadcast band. Local oscillator coil *L2* is tuned by variable capacitor *C1b* to a frequency that is always 455 kc. above the frequency of the incoming signal. Capacitors *C1a* and *C1b* are ganged.

The incoming r.f. signal and the local oscillator signal are mixed in transistor *Q1*. Sum and difference frequencies as well as the r.f. and oscillator signals appear at the output of *Q1*. The miniature i.f. transformer (*L3*) is tuned to 455 kc., and allows only the difference frequency to pass on to the next stage. The primary of *L3* is part of the collector load circuit of *Q1;* the tap on this winding is not used.

The next two i.f. stages are in the module, as is the detector stage, as shown in Fig. 6. Bandwidth is fairly narrow, thanks to the ceramic filter between pin 2 and the 390-ohm resistor, but not narrow enough to prevent good reception of music. The bandwidth is about 8 kc. at −6 db. It is therefore possible to obtain good selectivity. The 455-kc. i.f. signal is amplified by each of the two pre-tuned transistor stages and then demodulated by the crystal diode detector. The audio signal goes through a low-pass filter to pin 7 and then to the top of the volume control, potentiometer *R6*. From the volume control the signal is fed directly to an earphone jack. Additional transistor stages can be added, if desired, to drive a loudspeaker. A patch cord could be used to connect the radio earphone jack to the input of a tape recorder or phonograph. A feedback loop from the detector to the base of the first transistor in the module provides a.v.c. action. Overall gain of the i.f. module is about 55 db.

A loudspeaker is usually preferred, but there are several advantages to using an earphone: fewer transistors are needed, battery life is longer because power consumption is lower, and you can listen without disturbing anybody. An earphone can also provide exceptionally good fidelity—bass notes, which can not be reproduced by a small speaker, can be heard in an earphone, because the earphone is directly coupled to the ear and does not have to move a large vol-

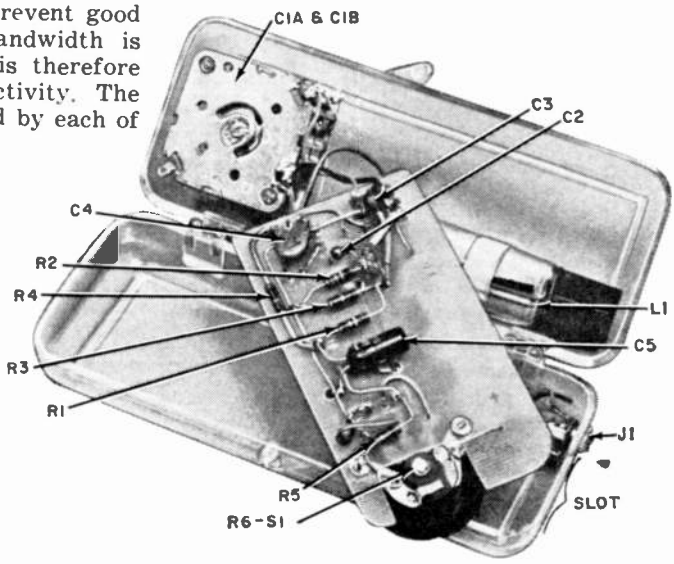


Fig. 2. Bottom view of the circuit board. Notch permits volume control to work without undue stress. The slot in the case allows volume control knob to turn freely.

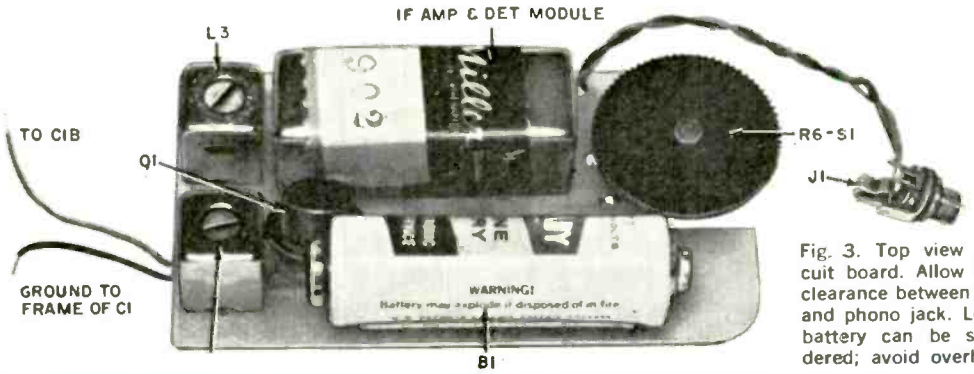
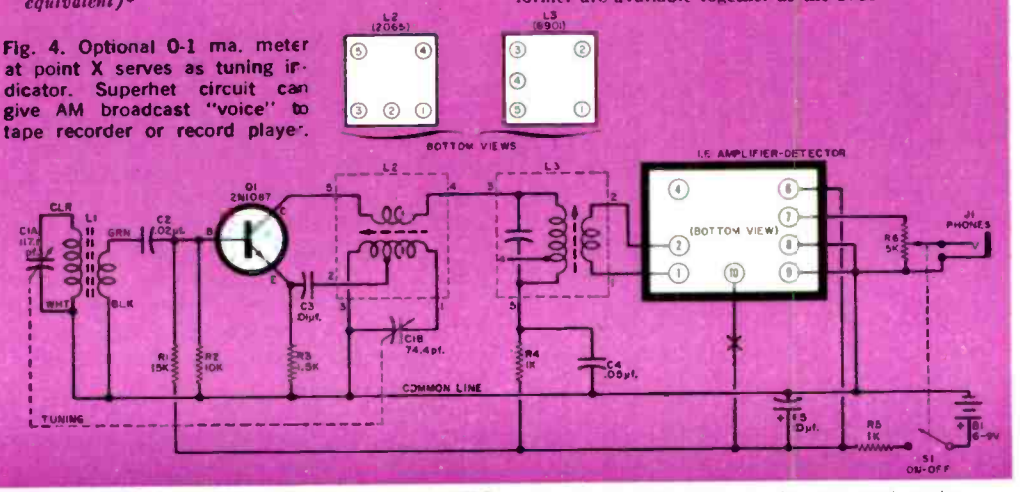


Fig. 3. Top view of circuit board. Allow enough clearance between battery and phono jack. Leads to battery can be spot-soldered; avoid overheating.

B1—6- to 9-volt transistor radio battery (NEDA 1606 or equivalent)
C1a/C1b—Miniature 2-gang variable capacitor; 117.1-pf. r.f. section, and 74.4-pf. osc. section
C2—0.02 μf., 3 volts
C3—0.01 μf., 3 volts
C4—0.05 μf., 10 volts
(C2–C4: miniature ceramic disc capacitors)
C5—10-μf., 12-volt electrolytic capacitor
J1—Phono jack, subminiature type
L1—Ferrite antenna loopstick (Miller 2010 or equivalent)
L2—Oscillator coil, miniature (Miller 2065 or equivalent)
L3—I.f. transformer, miniature (Miller 8901 or equivalent)*
Q1—2N1087 transistor
R1—15,000 ohms
R2—10,000 ohms
R3—1500 ohms
R4, R5—1000 ohms
(R1–R5: all resistors, ¼ watt, ±10%)
R6—5000-ohm potentiometer with s.p.s.t. switch (Lafayette 99 G 6019 or equivalent)
S1—S.p.s.t. switch (on R6)
1—I.f. amplifier module (Miller 8902)*
1—2⅞" x 1 9/16" phenolic or laminated board
1—3000- to 7000-ohm dynamic earphone
1—4¼" x 1¾" x 1" plastic box

*The Miller 8902 module and the Miller 8901 transformer are available together as the 8903

Fig. 4. Optional 0-1 ma. meter at point X serves as tuning indicator. Superhet circuit can give AM broadcast "voice" to tape recorder or record player.



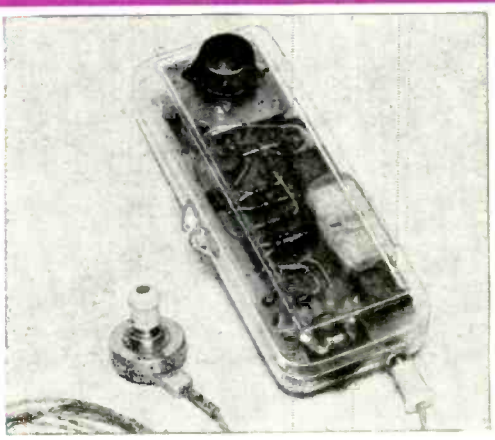
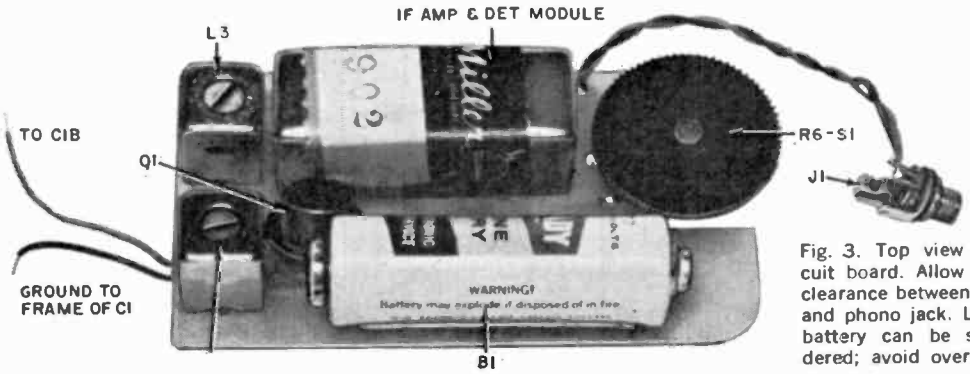


Fig. 5. Tuning dial can be mounted under knob on finished radio. High-impedance earphone provides good audio frequency response.

ume of air as a loudspeaker does. Earphone impedance should be anywhere from 3000 to 7000 ohms. Do not use a low-impedance phone, as it will load down the output circuit excessively.

If you wish, you can add a tuning meter to the circuit. Insert a 0-1 milliampere meter in series with the lead going to terminal 10 on the i.f. module.



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C1a/C1b—Miniature 2-gang variable capacitor; 117.1-pf. r.f. section, and 74.4-pf. osc. section
C2—0.02 μf., 3 volts } *miniature ceramic*
C3—0.01 μf., 3 volts } *disc capacitors*
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C5—10-μf., 12-volt electrolytic capacitor
J1—Phono jack, subminiature type
L1—Ferrite antenna loopstick (Miller 2010 or equivalent)
L2—Oscillator coil, miniature (Miller 2065 or equivalent)
*L3—I.f. transformer, miniature (Miller 8901 or equivalent)**
Q1—2N1987 transistor
R1—15,000 ohms
R2—10,000 ohms } *all resistors,*
R3—1500 ohms } *¼ watt, ±10%*
R4, R5—1000 ohms
R6—5000-ohm potentiometer with s.p.s.t. switch (Lafayette 99 G 6019 or equivalent)
S1—S.p.s.t. switch (on R6)
*1—i.f. amplifier module (Miller 8902)**
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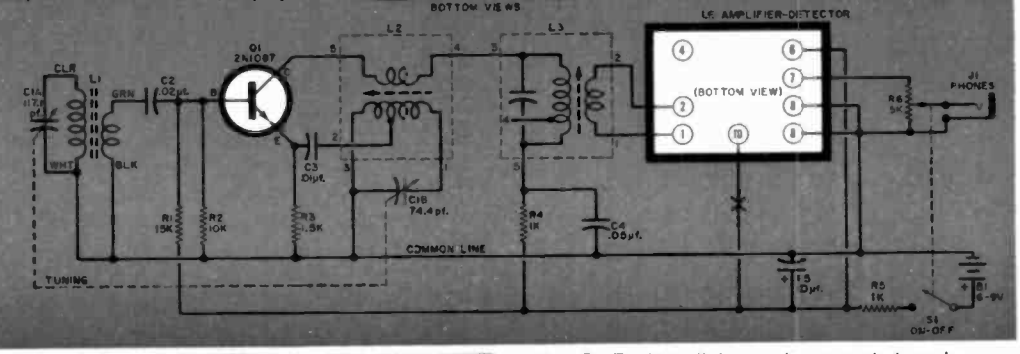

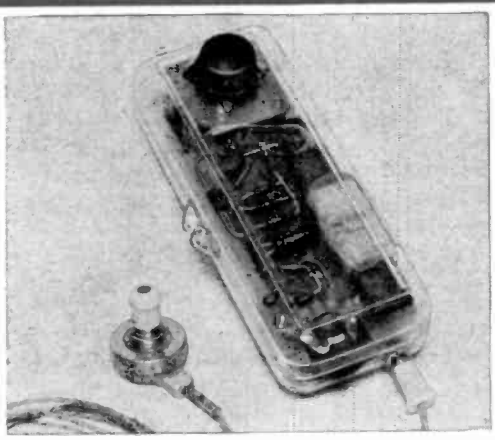

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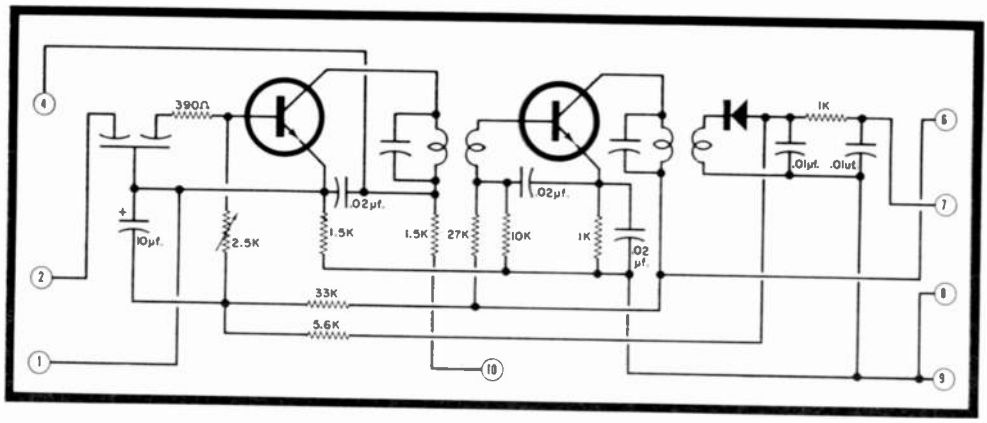
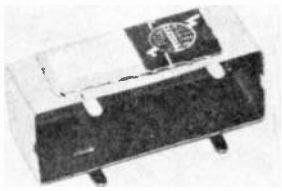
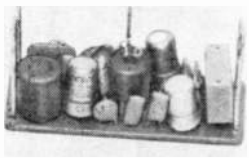


Fig. 6. Miniature i.f. strip is pre-aligned and pre-packaged. A detector stage is also included. A ceramic filter limits i.f. response to improve receiver selectivity without damaging audio quality. Overall gain is 55 db and output is sufficient to direct-drive an earphone. Bandwidth is 8 kc. at—6 db. Photo at right shows how actual components were fitted into can.





(See point *X* in Fig. 4.) The radio draws only 3 milliamperes.

Construction. The completed broadcast radio is shown in Fig. 5. It was built to fit into a small plastic box, which is readily available. You can choose any size box, as long as all the parts fit and are arranged in an orderly manner—the best thing to do is follow the photographs. Do not use a metal case. A shielded antenna usually develops into a situation of apparent radio silence.

Mount *C1* directly to the case. *L1* can be held in place by a dab of cement or just allowed to "float." The black and white wires from *L1* are soldered directly to the capacitor frame. The clear wire is soldered to *C1a,* the capacitor with a greater number of plates. The green lead is attached to *C2* on the circuit board later.

The circuit board assembly is shown in Figs. 2 and 3. Parts location is not critical, but here again it is best to follow the layout as shown. Keep the leads short and avoid overheating the transistors when soldering. Notch out the board to allow the volume control (*R6*) to be mounted without undue stress or strain. Enough of the knob should protrude so that it can be easily reached when the assembly is finally placed into the case. A ¾" x ⅛" slot is cut out on the side of the case to allow the knob to stick out about 1/16".

Connect all the metal cans to a common ground line. This line is also connected to the frame of the variable capacitor. Short leads can be soldered directly to the battery. Next to the slot in the case, install the miniature phono jack.

Position the board in the case when completed. Connect the green wire to *C2* and two wires from the volume control to the phono jack.

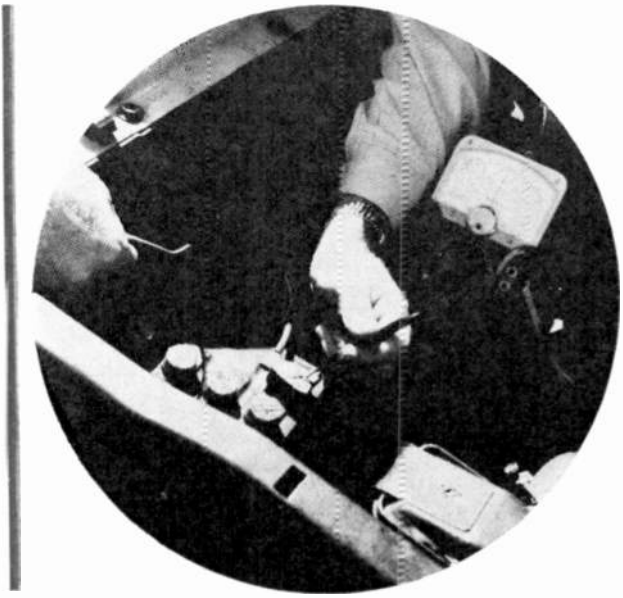
Alignment. If all is well with your radio, you will hear background noise or, hopefully, a radio station or two when you first turn it on. The alignment and peaking adjustments are made from off-the-air signals. All you need is a non-metallic screwdriver. Do not force any of the screws or slugs; they should turn easily. Try to get any station and adjust *L3* for maximum. In the absence of a station, adjust for maximum noise.

Rotate the knob until the plates are almost fully meshed. This is the low end of the broadcast band. With the aid of another radio, as a "standard," locate a station at the lowest end of the band. Adjust the slug in oscillator coil *L2* until

(*Continued on page* 97)

AUTO VOLTMETER SHOWS YOU'LL GO

Keep tabs on your charging system— catch battery failures before they happen



By JOSEPH TARTAS

EVER stop to wonder what your automobile battery voltage is? "Why twelve volts, of course," you say (unless you have a 6-volt system and answer "six"). It seems like a silly question—until you examine it closely. The fact of the matter is that battery voltage varies over a range centered around 12 (or 6) volts: Exactly what it is, and when, are facts that can tell you a great deal about the health of your car's electrical system.

If your car or boat is equipped with an ammeter or indicator light, you might automatically assume that you need only be concerned when the "Battery" light stays on, or if the meter shows discharge when the engine is running. While it is important to know, as these devices indicate, that your generator is supplying a charging current to the battery, it is equally important to know the battery voltage under load and no-load conditions, as well as the voltages actually available at the starter, ignition system, etc. Voltage drop across cables can be enough to cause trouble. The voltmeter can tell you where your trouble is without "cutting" into any of the circuits. It can also alert you to potential trouble.

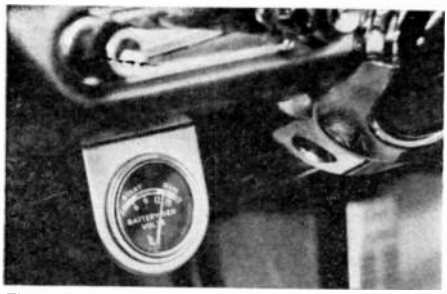
Storage Battery Theory. Let's review, for a moment, the typical characteristics of a lead-acid storage battery. It consists of several cells each having a potential of about 2 volts. The exact voltage of each cell will depend on the proportion of acid to water in the electrolyte, and the condition of charge or discharge of the cell.

One standard method of checking a lead-acid cell is to measure the specific gravity of the electrolyte. This electrolyte is a mixture of sulphuric acid and distilled water with a specific gravity of 1.260 at 77° F for automotive service, and ranging from 1.275 for heavy industrial uses to 1.210 for batteries in standby or emergency service. The specific gravity is measured by means of a hydrometer. The *open-circuit* voltage of the cell is directly related to its specific gravity:

$$Voltage = specific\ gravity + .84$$

A voltmeter, therefore, can be used to continuously monitor the specific gravity of the battery as a whole.

Because the proportion of water to acid is increasing as the cell discharges, the specific gravity is gradually reduced (water alone has a specific gravity of



This illuminated voltmeter is one of several types for use in cars. Panel meters will also serve; in some cars, they can be mounted in dash. Meter above is sold by Lafayette Radio.

1.000) and the relative state of charge will be indicated by the hydrometer reading. For the sake of accuracy, the correct specific gravity is designated at 77° F, with a small correction factor of about 15 points for temperature variations over the usually encountered range of 32 to 110°. Some hydrometers have a built-in thermometer with the necessary correction indicated.

As a cell discharges, the terminal voltage begins to drop due to internal resistance. The heavier the current, the greater the internal voltage drop and the lower the terminal voltage due to the heating effect on the battery resistance. If there is excessive resistance in the battery cables due to broken strands in the conductors or poor terminal connections (due to loose or corroded joints), there is a further drop under high current drain conditions, and little voltage appears at the starter terminals or at other equipment such as the radio or lights.

One voltage appears at the battery terminals under no-load conditions, a lower voltage under starting conditions (or with the lights, heater, or radio on) and a still lower voltage at the starter or equipment due to the normal cable drop. When an ammeter is used as the indicator, it will show at a glance whether or not there is a load on the battery by its discharge rate, but it does not give any indication of the battery voltage or its condition of charge, nor does it indicate excessive *IR* drops.

The "idiot light" does not even give this amount of information, but usually tells no more than the fact that there is an output from the generator. When it is lit, the generator output is nil or inadequate. When the light is out, the generator output exceeds some preset current level *at the generator terminals.* Neither the ammeter nor the light necessarily show battery condition.

Enter the Voltmeter. A d.c. voltmeter connected *directly* to the battery terminals will tell you at a glance the charge condition of the battery, the condition of your voltage and current regulator, and if the generator is functioning properly.

A typical 6-volt battery will read 6.3 volts with no load when fully charged. If it reads below that, the percentage of charge left will depend upon current drain, the length of time the discharge occurs, and the final voltage acceptable (the point at which the battery is considered discharged but not damaged). The final voltage, below which the cells are considered exhausted, depends upon the time and discharge current rate. This final voltage may vary from 1.0 to 1.85 volts per cell, but the most used value is 1.75 volts for typical applications.

Any of several voltmeters can be used in an automobile or boat. An 8- or 10-volt d.c. voltmeter is suitable for a 6-volt system, and a 15-volt meter for a 12-volt system. There are a number of special meters available from automotive supply and electronics parts houses, some types already mounted in brackets, with or without a panel light, and some types that include trouble-shooting charts. These meters have expanded scales to make it easy to read battery voltage while driving.

One type that includes both illumination and trouble-shooting information is the Lafayette Radio "Volt-Test" (Stock No. 11 G 8001); another is the Stewart-Warner "Volt-Guard." The latter is advertised as a voltmeter and electrical system analyzer, which, in effect, is what it really is. The Stewart-Warner meter has a meter bracket and light socket, but these are sold separately as accessories.

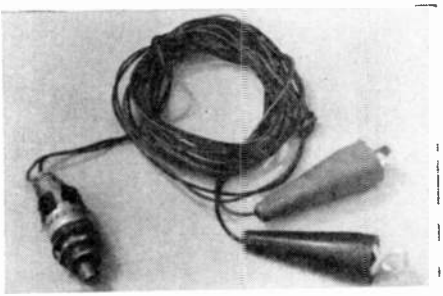
Unlike the regular d.c. panel voltmeter, the automotive types draw about 50 ma. of current, but this small drain is insignificant compared to the current capacity of a car battery. The normal leakage across the top of the battery

due to dirt and acid probably equals or exceeds this drain. The meter is wired directly to the battery terminals with small-gauge insulated wire (#20 is more than adequate); alternatively, the ground lead can be connected to the engine block where the battery is connected. In either case, the meter leads should be soldered to solder-lugs and connections to the battery or block should be *clean and tight.*

It is a good idea to check voltages at the various terminals (battery, engine block, voltmeter on panel) with a portable voltmeter or VOM to determine if there are any undesirable voltage drops in the cables or connections after the meter is installed. You may avert trouble later on.

What the Readings Mean. Each time you start your car you should check your indicator lights and watch the voltmeter for abnormal indication. Remember that the battery drain is heavier in winter and the battery voltage (if you keep your car outside) will be lower to start with.

(*Continued on page* 84)



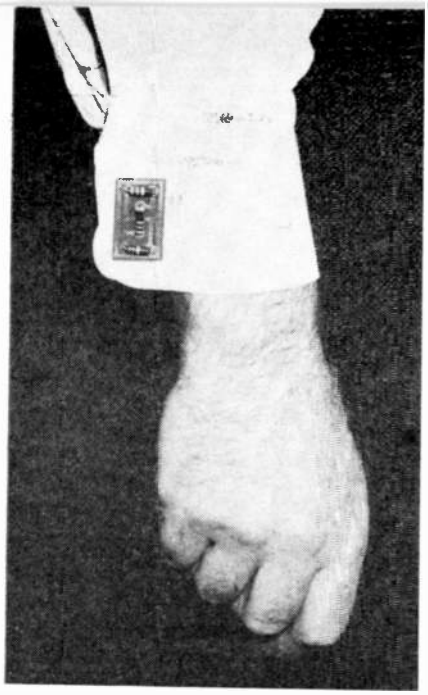
Simple gadget for turning over engine consists of two clip leads connected to normally-open push-button switch. Leads are connected to starter control terminals of starter solenoid.

BATTERY VOLTAGE TABLE

BATTERY VOLTS[1]		ENGINE OFF OR IDLING[2]	ENGINE STARTING (Battery Condition)	ENGINE RUNNING[3] (Generator Condition)
Below 5.0	Below 10 or no reading	Dead or disconnected battery, meter disconnected or not wired properly	Disconnected, defective, or improperly wired meter. If the engine will start, or run, the battery is not at fault	
4.5-6.0	9-12	Undercharged battery; engine might not start	Normal range for winter and summer	Generator not charging, regulator not working, or current drain from equipment (lights, radio, etc.) exceeds generator output
6-6.4	12-12.8	Fully charged battery. Generator and regulator operating properly		Battery fully charged, but generator or regulator not working properly
6.7-7.6	13.5-15.2	Normal for short period after driving due to battery "surface charge," or meter reads high		Normal when battery, generator, and regulator are working properly. Meter reading varies with charge in battery, engine speed, temperature, and regulator setting
Above 7.6	Above 15.2			Voltage regulator contacts stuck together, or voltage regulator set too high. File and clean contacts and check battery fluid for level and specific gravity

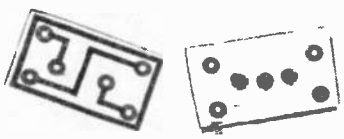
1. The minimum voltage reading possible will depend upon the type of meter used.
2. Idling speed below that which causes the cut-out relay to pull in.
3. Normal driving speeds.

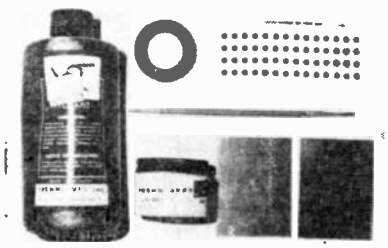
All voltages are approximate, and will vary with temperature, condition of regulator contacts, accuracy of meter, and other conditions.



GIVE HIM (or HER) ELECTRONIC JEWELRY

Standard printed circuit boards are used to create unusual jewelry. Below is shown the board used to make cuff link above. resist materials, blank laminate, brush, etchant.





DISTINCTIVE cuff links for the electronics buff and ear rings and other accessories for the YL or XYL are easy to make with bits of printed circuit board and colorful resistors and other components from the junk box. "Electronic Jewelry" is both attractive and an interesting conversation piece—and you'll enjoy making it for yourself or as a gift.

As a foundation, secure copper-clad laminate with copper on both sides. One side is used for a decorative pattern, while a cuff-link stud, ear-ring loop or other fastener is soldered to the back. The materials used to etch a pattern in the copper are the same as those used in making printed circuits: etchant, resist tape, resist circles, and liquid resist. If you would like to gold-plate your jewelry, also obtain a bottle of plating solution such as "Liqua Gold" (available from Lafayette Radio, Stock No. 14G2902, $1.66).

Design possibilities are limited only by your imagination. Cut out pieces of laminate in the form of circles, oblongs, diamonds, etc. using a fine-tooth coping saw. Dress edges with a fine file. Carefully clean the top copper surface with steel wool and apply a pattern to it with resist tape and circles, and resist paint. Use tape of varying thicknesses for lines, and add spots, dots, and circles as required. For a really way-out pattern, thin the resist paint with some turpentine and use it with a small brush or a pen.

Before etching, turn the laminate over and mark areas with resist paint for anchoring components and soldering on a cuff-link stud or other piece of jewelry hardware. Etch the copper in a glass dish—without agitation to hasten the process it should take no more than half an hour. Wash the pieces in cold water and remove the tape; paint can be removed with turpentine.

Drill small holes for component leads and deburr them. You can use resistors, glass diodes, capacitors, transistors, etc. Run the leads through the holes and solder on the back of the board. Trim off excess lead wires and file down the solder blobs for a neater appearance.

Mix the gold plating solution according to the instructions, and heat it on a stove as described. Add your jewelry, and you will have a lovely gold-plated surface over all metal, including the copper, lead wires, and solder.

—Byron G. Wels

ELECTRIC

FENCE CHARGER

Marauder monitor curbs canine capers. Stop garden invasions and garbage can inspections at four o'clock in the morning

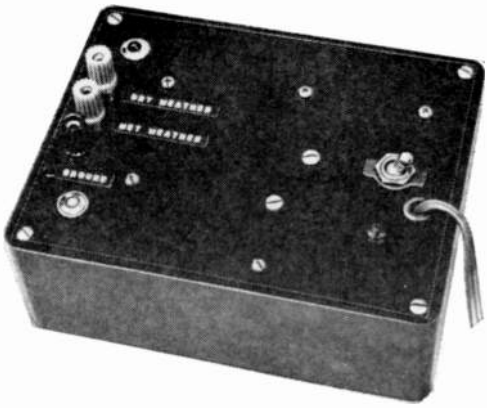
By LYMAN E. GREENLEE

KEEP your disposition from going to the dogs by charging up a few things. You can build a small fence charger that will deliver a wallop big enough to make any self-respecting dog or cat think twice before investigating the contents of your garbage can a second time. The punch is a high-voltage shock of short duration and is harmless to man or beast. Cost of construction is low —you may already have most of the parts on hand.

How It Works. A small isolation transformer (*T1*) isolates the fence charger from the house power line for safety, as shown in the schematic diagram. A ⅛-ampere "slow-blow" fuse carries the small normal load of the charger and also withstands the initial current surge which may occur when the unit is first turned on. This is normal for equipment having capacitor input filtering in the power supply.

Capacitors draw relatively large current as they go from 0-to-operating voltage levels. The output from the transformer secondary goes through a current limiting resistor (*R1*) to the silicon rectifier (*D1*). Resistor *R1* protects the rectifier from starting current surges. The rectifier's pulsating d.c. output is smoothed by capacitors *C1* and *C2* and by resistor *R3*. The NE-2 neon light (*I1*) serves as a pilot light—it not only shows whether

ELECTRIC FENCE CHARGER



Small unit teaches hounds to behave. Short duration pulses are harmless.

the charger is on or off, it also tells you if the B+ power supply is working up to this point in the circuit. Resistor *R2* limits the amount of current that can be passed by the neon light. Output from this half-wave rectifier power supply is approximately 140 volts.

The relay coil (*K1*) is a normally-closed s.p.s.t. type with a coil resistance of from 3000 to 8000 ohms. Upon application of power, the relay tends to become energized almost immediately and to open the circuit through itself and transformer *T2*. Since enough time must be allowed for the current to build up, and, in turn, for the magnetic field to go to maximum in transformer *T2*, capacitor *C4* is used to hold the relay armature down for about one second. Timing depends upon the values of the capacitor and the coil resistance, as well as the characteristics of the relay. Spring tension on the relay armature can be changed to increase or decrease the on-off time. Relays with coil resistance varying from 1000 to 10,000 ohms have been tried by the author and all of them have worked. Variations in hold-down time ranged from about 0.1 to 3 seconds.

When the relay points open, current ceases to flow through *T2*, the magnetic field collapses and induces a voltage across what is now the transformer's secondary winding, and the voltage appears at terminals *BP1* to *BP3*. The quicker the magnetic field collapses and the higher the turns ratio of the transformer, the higher the voltage produced.

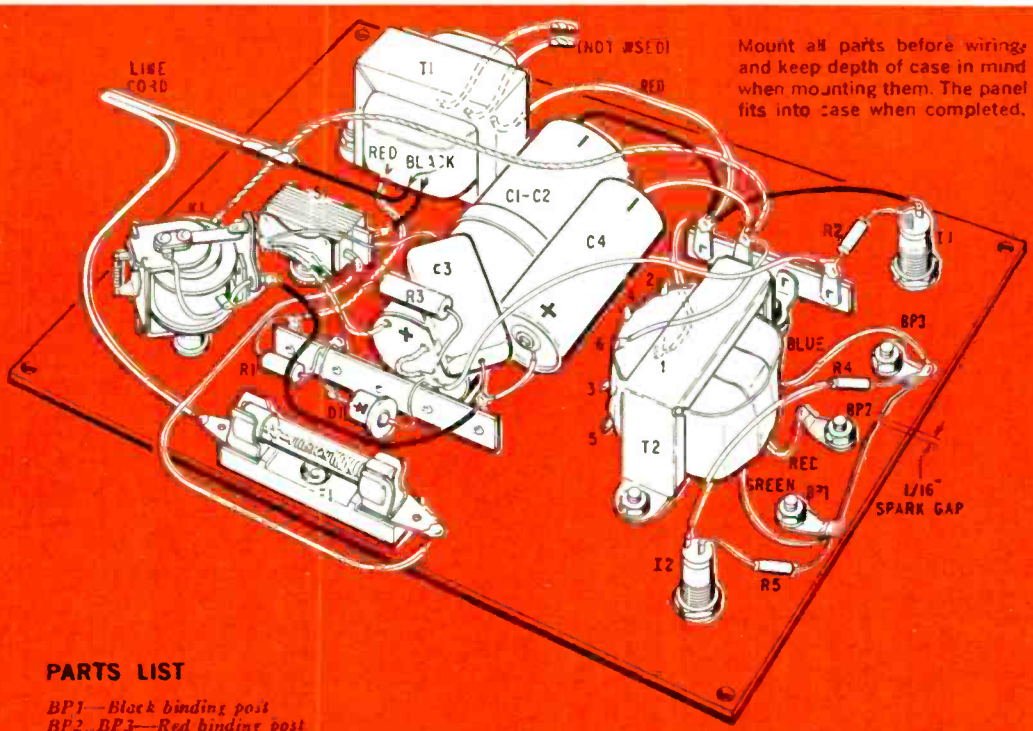
Note that this transformer was originally intended for audio output work and is used in the reverse manner in this project. Therefore, what was originally the primary winding is now the secondary.

Capacitor *C3* serves the same purpose as the capacitor across the points in a conventional automobile ignition system. It overcomes the inertial effects of the current, minimizes arcing across the points, and takes on a charge which series-aids the voltage from the power supply when the contacts close.

The second neon light (*I2*) connected across the secondary of *T2* flashes momentarily with each pulse applied to the fence if all is well. Resistors *R4* and *R5* are current limiters for *I2*. The spark gap protects the transformer against damage from internal arcing and also from electrostatic or lightning charges that might be picked up on a long length of fence wire connected to the charger.

The shock pulse generated is completely safe due to its short duration. Any possibility of a dangerous or lethal voltage being applied to the fence because of component failure is remote. Transformer *T2* can pass only a small current and is isolated from the house power line. The B+ component is "chopped up" by the relay. If the relay contacts stick open or closed, no high voltage can be developed on the fence. Should transformer *T1*, diode *D1*, or capacitors *C1*, *C2*, and *C4* short, the fuse would probably blow or resistor *R1* would burn out. In any event, there would still be no high voltage on the fence.

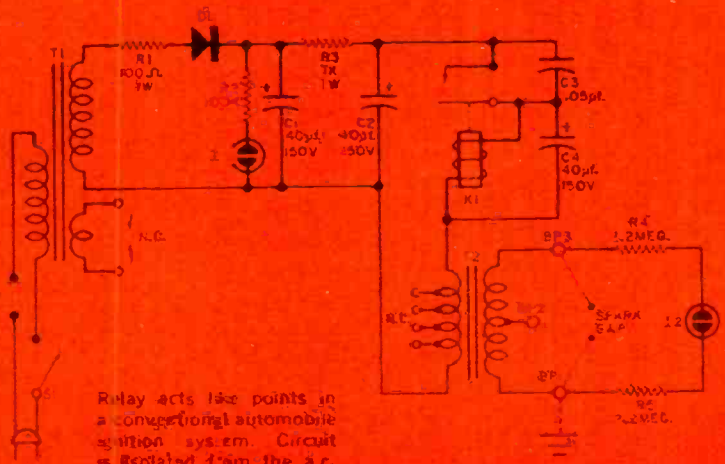
Construction. The charger should be built in a Bakelite or plastic box, or at least on an insulated board, as shown in the illustrations. Provide a good ground connection for terminal *BP1*. All parts are mounted on the cover. Keep in mind the 2⅛" space between the cover and the bottom of the case when



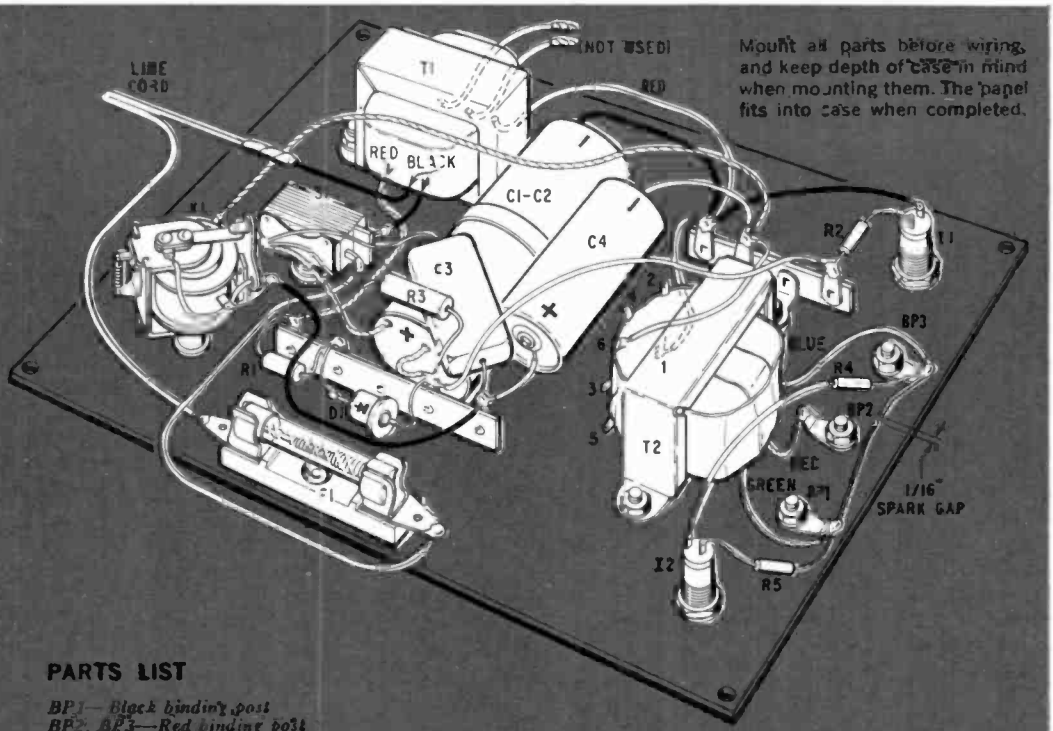
Mount all parts before wiring and keep depth of case in mind when mounting them. The panel fits into case when completed.

PARTS LIST

BP1—Black binding post
BP2, BP3—Red binding post
C1, C2—40-40 µf., 150-volt dual electrolytic capacitor
C3—0.05-µf., 600-volt mica capacitor
C4—40-µf., 150-volt electrolytic capacitor
D1—1N1763, 400-PIV, 500-ma silicon rectifier
F1—½-amp, "slow-blow" fuse
I1, I2—NE-2 neon light
K1—S.p.s.t., normally-closed relay with 5000-ohm coil (Potter & Brumfield LBS or equivalent)
R1—100-ohm, 1-watt resistor
R2—100,000-ohm, ½-watt resistor
R3—2000-ohm, 1-watt resistor
R4, R5—2.2-megohm, ½-watt resistor
S1—S.p.s.t. toggle switch
T1—Isolation transformer: primary, 117 volts; secondary, 325 volts @ 15 ma (Stancor PS8415 or equivalent)
T2—4-watt universal output transformer (Allied Radio 62CX023 or equivalent)
1—2 3/32" x 5 9/32" x 6 13/16" Bakelite instrument case with cover
Misc.—Line cord, ¼" grommets, fuse holder, 4-terminal strip, neon-light sockets, hookup wire, machine screws and nuts, etc.



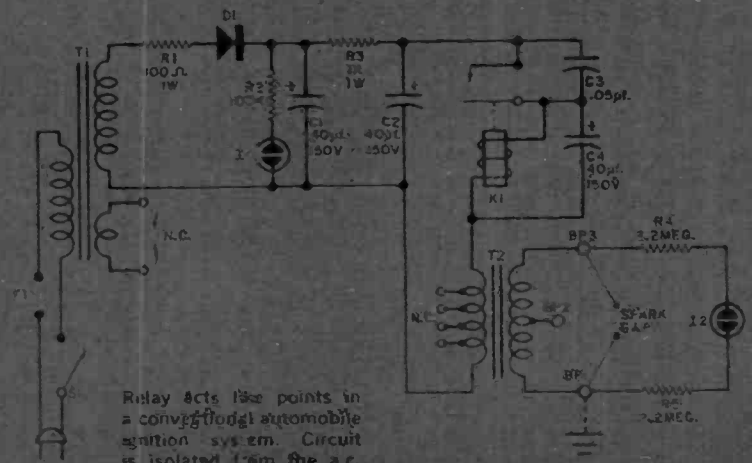
Relay acts like points in a conventional automobile ignition system. Circuit is isolated from the a.c. power line for safety.



Mount all parts before wiring, and keep depth of case in mind when mounting them. The panel fits into case when completed.

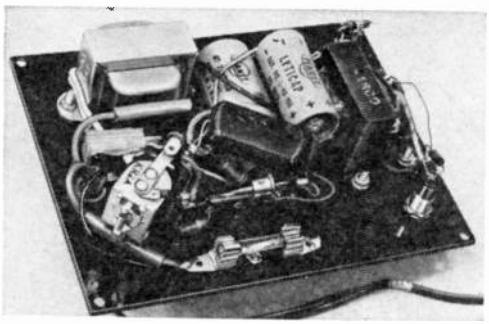
PARTS LIST

BP1—Black binding post
BP2, BP3—Red binding post
C1, C2—40-40 μf., 150-volt dual electrolytic capacitor
C3—0.05-μf., 600-volt mica capacitor
C4—40-μf. [illegible] electrolytic [illegible]
D1—1N1763, 400-[illegible], 500-ma. silicon rectifier
F1—¼-disc. "slow-blow" fuse
I1, I2—NE-2 pilot light
K1—S.p.s.t., normally closed relay with 5000-ohm coil (Potter & Brumfield RS or equivalent)
R1—100-ohm, 1-watt resistor
R2—100,000-ohm, ½-watt resistor
R3—2000-ohm, 1-watt resistor
R4, R5—3.2-megohm, ½-watt resistor
S1—S.p.s.t. toggle switch
T1—Isolation transformer: primary, 117 volts; secondary, 125 volts @ 35 ma. (Stancor PS8415 or equivalent)
T2—4-volt, 1.65-amp. output transformer (Allied Ratio 62-G-023 or equivalent)
1—2 31/32" x 5 9/32" x 6 13/16" Bakelite instrument case and cover
Misc.—Line cord, ¼" grommets, fuse holder, 4-terminal strip, neon-light sockets, hookup wire, machine screws and nuts, etc.

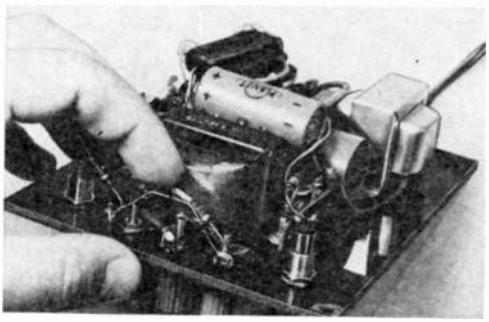


Relay acts like points in a conventional automobile ignition system. Circuit is isolated from the a.c. power line for safety.

ELECTRIC FENCE CHARGER



Spring tension on normally-closed relay should provide good contact. Tighten to increase "on" time.



Spark gap protects the transformer. Adjust size to prevent continual firing with no load attached.

mounting the various parts. The cover has to fit into the case when the instrument is completed.

Prearrange the parts in the cover, as shown in the photos, and mark the position of the various mounting holes. All parts should be mounted before wiring. The 6-volt filament wires from the isolation transformer are not used; the ends of these wires should be taped and folded around the transformer and tucked out of the way.

The output transformer has a series of taps for impedance matching. Locate the two outer ends of the tapped winding and wire them into the circuit. One way to identify the outer ends is to use an ohmmeter. Select the two terminals that have the most resistance between them.

The high-voltage side of the output transformer has three insulated wires which may be colored red for the center tap, blue for one end, and brown or green for the other end of the winding. Connect the brown or green wire to the black binding post (*BP1*), the red wire to the middle red binding post (*BP2*), and the blue wire to the end red binding post (*BP3*).

You can construct a spark gap by soldering a fairly stiff wire about 2" long to each lug on the outer binding posts. Shape the two wires so that their ends are about 1/16" apart and suspended in air away from other terminals and cabinet, as shown in the pictorial.

Check the wiring when completed. If you're satisfied with it, place the cover in the case, plug in the unit, and flip the switch. If all is well, the relay will start pulsing. Don't screw down the cover until you have checked the spark gap to see that it is not firing. Normally the gap should be just big enough to prevent no more than occasional arcing. You may also want to vary the armature tension by adjusting the spring to get the right timing cycle. Spring tension should be strong enough to insure a good contact when the relay trips out. The relay should stay closed for about 0.1 second.

Operation. Connect the black binding post to a suitable ground connection, and connect the fence to be charged to one of the red binding posts. Use the middle binding post for wet weather and the outer one for dry weather. On a dry day a higher voltage is needed to force current through dry ground. In wet weather a high voltage could be a disadvantage because the current would tend to leak across the insulators. The higher the voltage, the higher the leakage. When the ground is wet, a low voltage is just as effective. Approximately half the voltage and twice the amperage is available from the black and middle red post. Maximum high voltage is obtained from the black and outer red post.

To test for leakage in the fence circuit, connect a NE-2 neon light in series with the fence and the red binding post being used. The higher the intensity of the flashes, the greater the leakage. To

(*Continued on page* 99)

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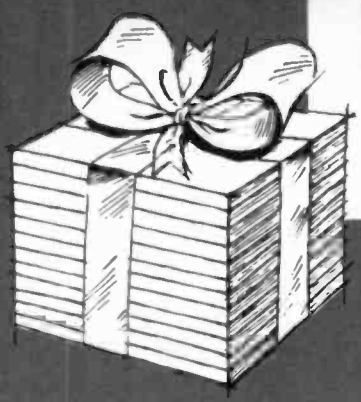

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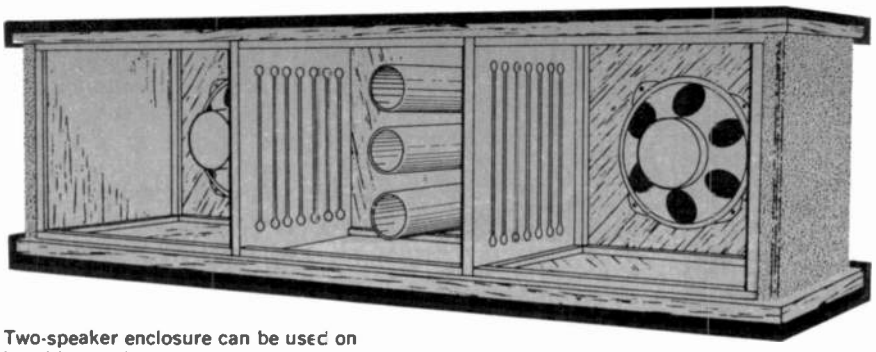
THE SLIM TWOSOME



Two-speaker enclosure can be used on its side as above, or on end as seen below. Novel filters (the slotted boards) and ports furnish bass boost.

For big bass from a small box, try this unique enclosure using center decompression chamber

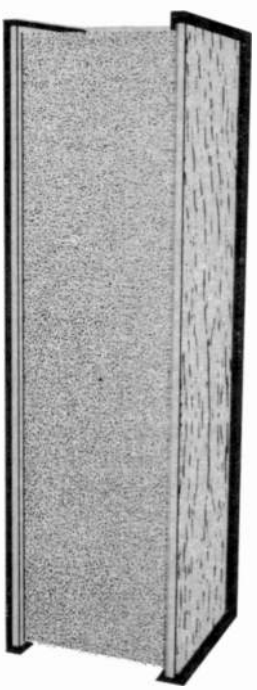
By HAROLD HUFNAGEL

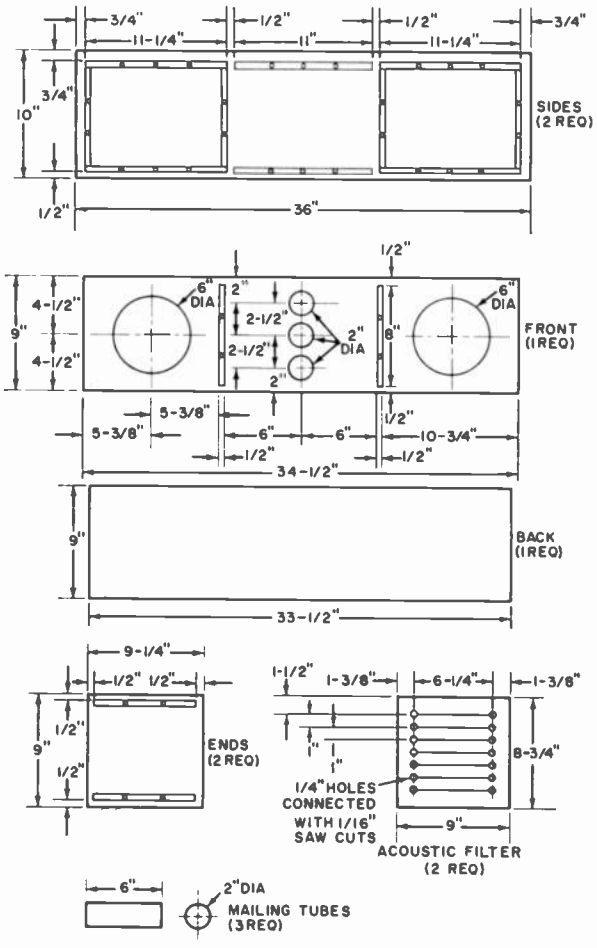
WANT to know how to pack good, strong bass, as well as clear, sparkling highs, into a speaker cabinet measuring just 10″ x 10″ x 36″? Interested in economy? Would you like to have a speaker system that can proudly take its place among your living room furniture, or on a convenient bookshelf? If your answer is "yes" to these questions, "The Slim Twosome" is for you.

A combination of filters and a decompression chamber increase air column length and enhance bass response without detracting from the highs. Two full-range 8″ speakers pumping in phase can move as much air as a larger speaker. The filters dampen speaker action without a build-up of excessive back pressure. The ports relieve the cabinet of internal pressures and, when properly tuned, can improve bass response, as in a bass-reflex enclosure.

Construction. Ordinary ½″ plywood can be used for the front, back, sides, and ends. However, you may choose—as did the author—to use hardwood or veneered plywood for the "sides" (top and bottom if the cabinet is laid flat). The remaining exposed surfaces are covered with grille cloth.

First cut the two 10″ x 36″ side panels, taking care not to mar the outside surfaces. The cleats used to hold the





Construction of enclosure is detailed at left. All panels can be made from ½" plywood, with ½"-square stock making up the cleats. Cut all pieces exactly to size; place cleats as shown for easy assembly.

enclosure sections together are made of ½"-square stock. Cut enough pieces of the right length for the two sides, and place them exactly as shown in the detail construction drawings above. Secure them in place with glue and screws. Cut the front, back, and ends from ordinary plywood, and fasten cleats to the front and ends as shown.

The end pieces are glued and screwed to the cleats on the side pieces using ¾" flat-head #6 wood screws. Drill holes for the screws through the ends, countersinking the holes ⅛" so the screw heads will be below the outside surface of the enclosure. (Note: The cleats on the *end pieces* are later used to mount the front and back.)

Glue and screw the front in place, countersinking screw holes as before. After drilling and cutting the filter slots in the filters, slide them in place between the cleats as shown, and firmly screw them to the adjacent cleats to prevent any vibration.

Final Assembly. The ports are made of three 6" pieces of mailing tube 2" in diameter. First give them several coats of shellac, then glue them in place, filling any openings around them with sawdust and glue. Line the speaker chambers with a ¾" layer of acoustic padding on the ends, sides, and the back panel area that will cover the speaker chambers; no padding is placed on the filters or in the decompression chamber.

The front and ends of the author's cabinet were finished by covering them with grille cloth after the bare wood was painted flat black so that shadows would not show through the cloth. The side panels can be finished to your liking.

If plywood is used for the sides, you can finish the edges very easily by covering them with "flexible wood trim" available from most lumberyards. The trim is simply glued in place with contact cement. Fit grille cloth between the sides, stapling it to the rear edge of the ends and near the edges around the front. Gold cording or molding will conceal the staples.

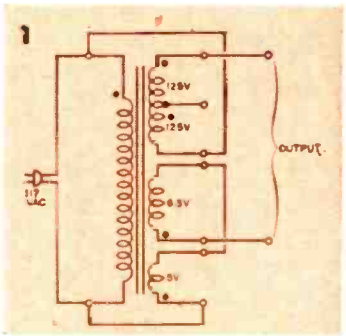
While the exact type of speakers you choose for your "Slim Twosome" is not overly critical, be sure to get wide-range types such as the Lafayette Radio 21 G 4722, priced at $6.25. There are other similar units which can be used.

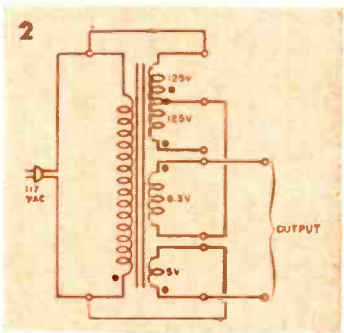
Install the speakers, and wire them to a terminal strip on the rear panel, taking care to connect them both in the same phase—i.e., so both cones move in or out together. Small both in terms of size and the investment required, "The Slim Twosome" can be counted on to give big listening pleasure. -30-

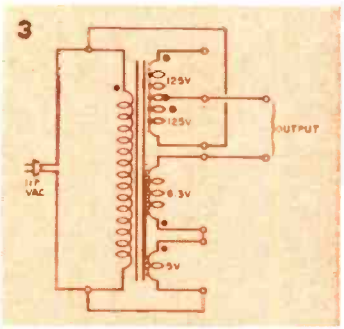
TRANSFORMER WINDING QUIZ

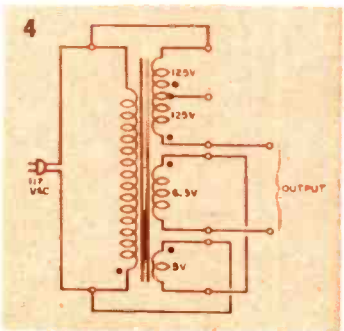
By ROBERT P. BALIN

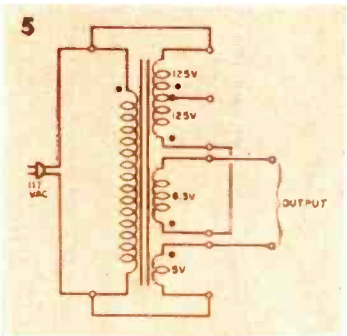
The same transformer is employed in each circuit on this page but the windings are connected differently to provide a variety of output voltages. In every case the primary winding and input voltage is 117 volts. Secondary windings are: 5 volts, 6.3 volts, and 250 volts center-tapped. The dots indicate the relative polarity of the windings. By carefully observing the additive or the subtractive effects of the windings it is possible to calculate the output voltage of each circuit. Can you?

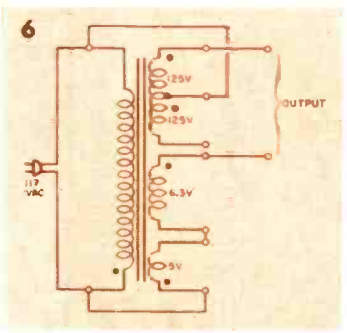
1 

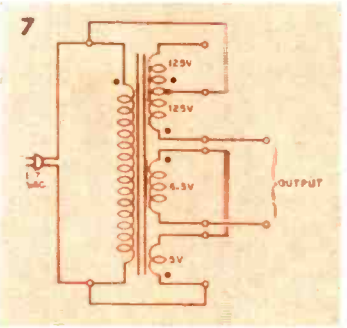
2 

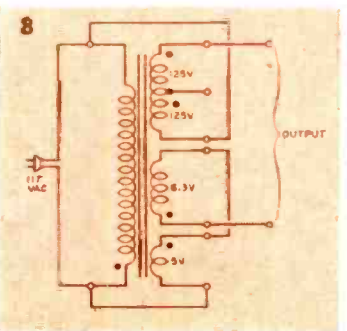
3 

4 

5 

6 

7 

8 

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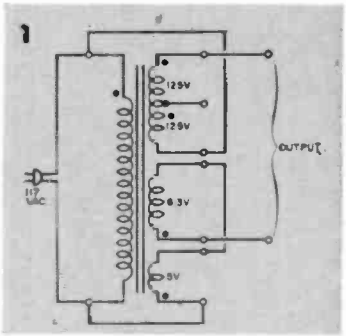
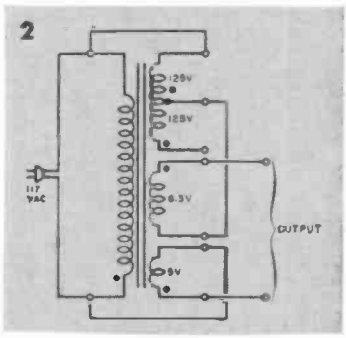
(*Answers on page 97*)

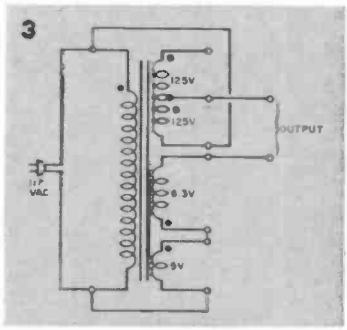
TRANSFORMER WINDING QUIZ

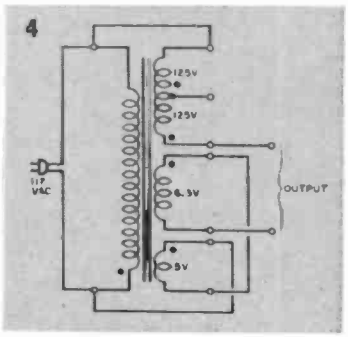
By ROBERT P. BALIN

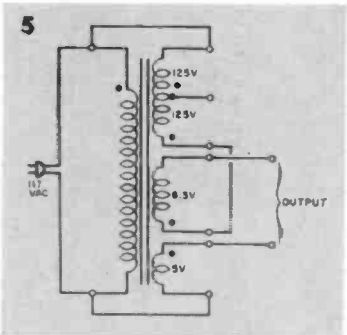
The same transformer is employed in each circuit on this page but the windings are connected differently to provide a variety of output voltages. In every case the primary winding and input voltage is 117 volts. Secondary windings are: 5 volts, 6.3 volts, and 250 volts center-tapped. The dots indicate the relative polarity of the windings. By carefully observing the additive or the subtractive effects of the windings it is possible to calculate the output voltage of each circuit. Can you?

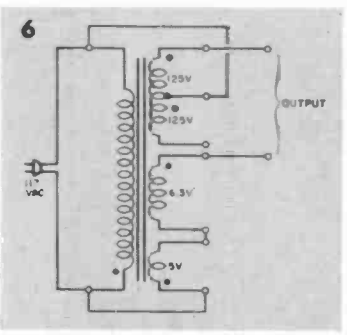
1 

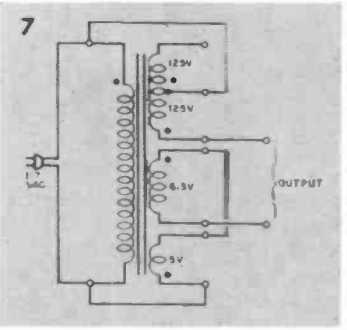
2 

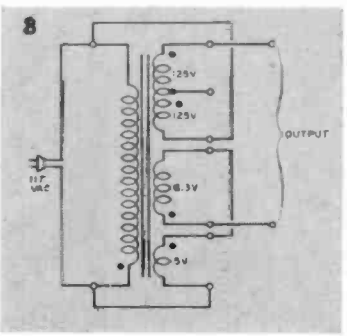
3 

4 

5 

6 

7 

8 

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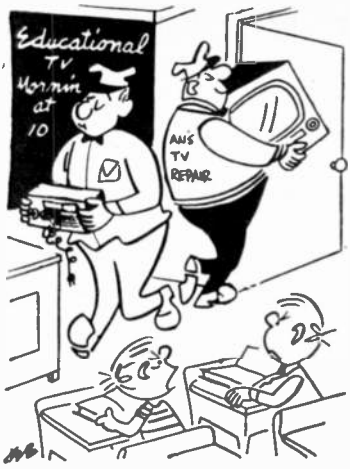
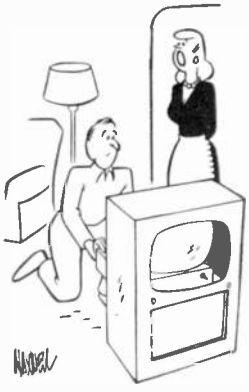
(*Answers on page* 97)

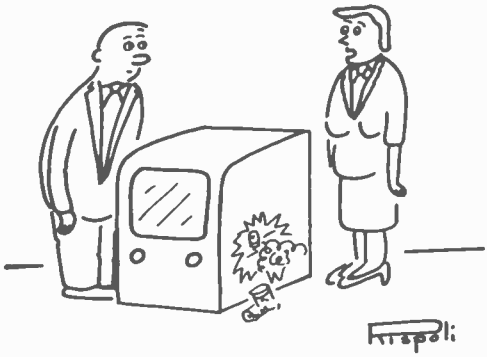
TV SCREAMS



"I hate substitute teachers."

"A cold solder joint? Well, it doesn't surprise me . . . there's been a draft in here all day."

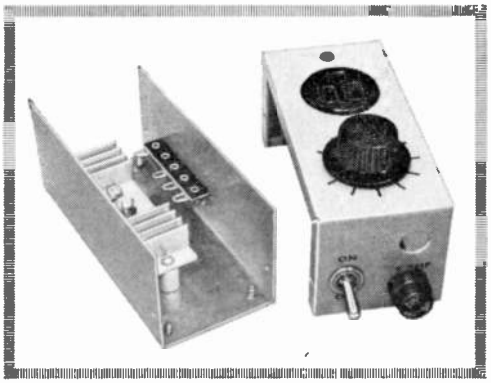




"How many times must I tell you not to kick the set when it gives trouble?"

"It belonged to a little old lady schoolteacher who used it only to watch 'Romper Room.' "

"With your diploma, you'll each find a list of snappy answers to use when your customers say they want their TV set the same evening!"



LOW-COST SCR MOTOR SPEED CONTROL

New $1.62 silicon-controlled rectifier increases versatility of power tools with universal series-wound motors

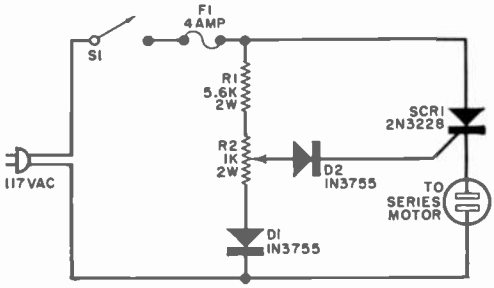
ALTHOUGH the price of speed controllers for power tools has dropped from $25 to $10 in the past two years, you can still build your own at a very substantial saving. The "secret ingredient" is a brand-new silicon-controlled rectifier with a 5-ampere rating which sells for $1.62. It is the RCA Type 2N3228 and is now commonly available either by mail order or from many local electronics stores.

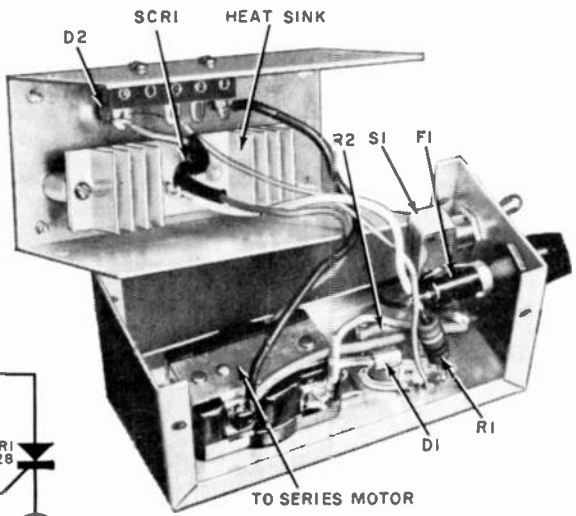
The circuit shown below was taken from the RCA "Application Note" SMA-34. Technically, the circuit is that of a half-wave motor speed control with regulation. Users of SCR speed controllers will find regulation of value, since it varies the amount of current fed to the motor (at a particular speed setting) according to the load. Motor speed is initially controlled by adjustment of the gate bias of *SCR1*. Counter voltage generated by the motor is rectified by diode *D1* and used to further control (feedback arrangement) the firing of the SCR. As the load increases, less counter voltage is generated and more current is permitted to flow into the motor.

The speed control illustrated in the photos was carefully fitted into an aluminum box measuring 2¼" x 2¼" x 5". The line cord grommet, fuse *F1* (in holder), and switch *S1* are mounted in one end of the box cover. Speed control

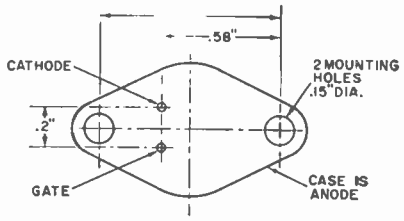
PARTS LIST

D1, D2—Silicon diode, 200 PIV, 125 ma. (RCA 1N3755 or equivalent)
F1—4-amp, 3AG fuse in holder
R1—5600-ohm, 2-watt resistor
R2—1000-ohm, 2-watt potentiometer
S1—S.p.s.t. toggle switch
SCR1—Silicon-controlled rectifier (RCA 2N3228)
Misc.—Aluminum box, 3-prong, a.c. outlet socket, 6' three-conductor heavy-duty a.c. line cord, small heat sink, 4-terminal tie strip, solder, a.c. cap, knob, ceramic stand-off insulators, etc.





The heat sink in the speed control must be insulated from the aluminum box; use H. H. Smith Type 2645 ceramic insulators. Position sink so that it will not short out to the metal back of the outlet.



Bottom view of the RCA 2N3228 rectifier. In this speed control circuit, the rectifier is bolted to the heat sink and insulated from the metal box.

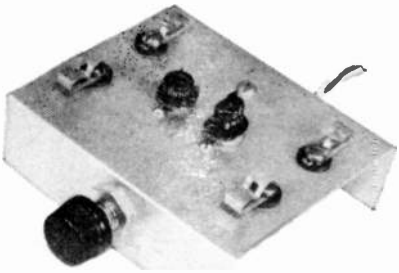
potentiometer *R2* and a three-prong outlet socket are mounted on top of the cover.

Attached to the U-shaped bottom of the box by means of ¾" insulated spacers is a small heat sink. The center of the heat sink is reamed out to pass the gate and cathode terminals of *SCR1*. The case of *SCR1* is bolted to the heat sink—possibly making it "hot" since it is connected to one side of the a.c. line.

Although a variety of three-prong outlet sockets are available in radio supply houses, the cheapest socket you can use is an Eagle 817, with the ears clipped off and the socket attached to the box with *6-32* machine screws. If you position the heat sink carefully, the parts will fit snugly into the box and not short out.

Be sure not to stall the motor by operating at a very slow speed and high load. A stalled motor will draw excessive current and within a matter of two or three seconds the SCR may be permanently damaged—if the fuse has not blown. If the motor does stall, quickly turn off the speed controller. Lessen the load and try again at a higher speed setting of potentiometer *R2*. —30—

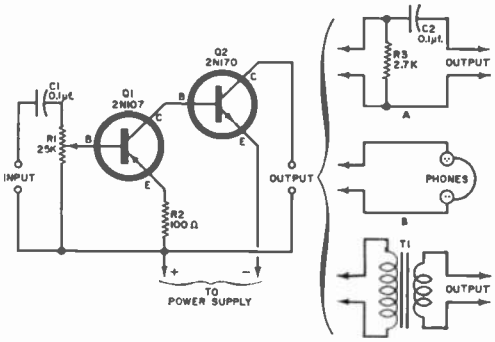
Utiliamp— An All-Purpose Audio Amplifier



One capacitor, one pot, two transistors, and one resistor add up to a versatile little amplifier. Capacitor C1 should be rated at 50 volts; resistor R2, ½ watt.

YOU'LL be surprised at the number of uses you can find around the shop for this small amplifier —as the audio section of a simple receiver, as a test amplifier, as an audio or r.f. signal tracer, or as a basic preamp for test instruments or power amplifiers.

Any small chassis will serve for mounting the components of the "Utiliamp," a simple two-stage *pnp-npn* complementary unit utilizing a bare minimum of parts. No special precautions need be taken with layout or wiring other than to keep input and output leads isolated from each other. Sockets were used for *Q1-Q2*, but can be dispensed with if you employ heat sinks when you solder the transistors. The input and output terminals are Fahnestock clips mounted with screws and insulated from the chassis with fiber washers.



Any power supply or battery delivering 3 to 9 volts will power the Utiliamp. If for any reason you want to interchange *Q1* and *Q2*, simply reverse battery polarity. Capacitor *C1*, which should have a 50-volt rating, may be larger or smaller; a fairly large capacitance is necessary for good low frequency response. Use an audio-taper potentiometer for *R1*, mounting it below the chassis as shown.

Any of several output loads can be used. If the Utiliamp is employed as a preamp, use either a resistive or matching transformer load as shown at "A" and "C". Moderate-impedance phones (2000 ohms) can be direct-coupled ("B"). —*E. G. Louis*

THE WONDERFUL WORLD OF LIDS

What was Pheobus Sharney's strange preoccupation? Here, it stands revealed for every YL to read

By CARROLL MOON

I SHALL NOT reveal how I met Pheobus Sharney, nor why I have chosen to distinguish him from the many others of his ilk by writing about him. Suffice it to say that I am acquainted with a gentleman who is, believe it or not, a typical radio nut.

During the day he is employed in a computer foundry. There has always been some question as to whether he simply tolerates the incessant pound, pound, pound of square waves on the shore, or just considers it something that any red-blooded American ham should do. For his spare time is spent in a like manner—sweating over a hot cathode, oblivious to anything but ham radio.

Recently, I spent a soul-wrenching Sunday morning with him before the cyclotron he sardonically calls his "linear amateur radio rig." "Let's try fifteen first," he said competently, although why he picked that particular number I will never know. He twisted the dials, read the cyclotron's meters, and then a speaker began to emit weird chirps and snorts. Finally, I began to distinguish voices speaking some odd language that seemed to make sense to Pheobus.

"There's a contest on," he explained, "a big phone contest."

I've heard of endurance contests where people line up outside a phone booth to wait for some teen-ager with a pocket full of nickels to get off the phone, but this phone contest was a horse of a different color. Some loudmouth was shouting something that sounded like "Seek you the axe, seek you the axe!", but this seemingly strange advice was actually given in a Brooklyn accent that came out "Seek you de axe!" I waited patiently for an explanation.

"You see," Pheobus began, "every so often an organization called the American Radiator Delay League notifies all the gang that a phone contest will be held on a certain date between such and such hours. There's one this weekend, and hams all over the world are trying to contact other hams. The one who makes the most and best contacts gets top honors. Some contacts count more than others, especially de axe. Sometimes a real operator wins, but there are a lot of accomplished fakirs in the ham world."

"What do they talk about?" I asked innocently. "They sound like they're fresh out of the funny factory."

"Just lissen," Pheobus commanded. "I'll explain as we go along."

HE twisted something called a "gain control" and another knob that was supposed to multiply the Q, and a voice with a Spanish accent began shouting through the speaker.

"My nomber two you oh man is five zero, my report is are nine plus. Do you copy? Do you copy? See oh eight are hell with kay eight bloozy, doozy, choosy . . . Come in oh man!"

Pheobus turned off his standby in order to comment. "That's a Cuban ham talking with a ham in our eighth district. He gave a contest number and signal report. Notice how fast he's working. Wants to make as many contacts as possible before the show is over."

He turned on the kilocycle control, only to find the Cuban still spouting. "O.K. oh man. Thank you werry much. So long and best of lock in de contast. See oh eight are hell is cue are zed on de band looking for any possibles. Kay somebody please."

Pheobus broke in over the noise. "He's telling any possible listeners who might want to contact him that he's now ready to talk with them. That's what cue are zed stands for. Now let's get up on the American part of the band and listen to the lids up there . . ."

"Scratch, squawk, zzzz . . . fine business zed ess two able baker. I'm running 50 watts on homebrew with a zepp outside the shack. How do you copy? Double you four umptsy bumptsy whiskey over two zed ess two able baker victor."

Pheobus turned down the kilocycle control again and shook his head in disgust. "That joker is running with damn near a full keg. He always pulls that crud on some poor, unsuspecting foreigner. Last week he was bragging about his full keg and tribander on an eighty-foot mast."

All I could envision was some guy living in a shack and drinking homebrew—a whole keg of it—but what was a zeppelin doing parked at the eighty-foot mast outside?

". . . I'm writing out your cue ess hell card right now old man, be sure to send yours. Pea a zero alpha better papa. Your number is seventy-nine and your sigz are nine plus. Do you copy? Kay a seven papa please America two pea a zero alpha better papa. Come in oh m."

"That louse," Pheobus muttered, "hasn't got any cue as hell cards. Never had any, but tries to collect all the foreign cards he can get. I heard him explain it on the air last week. Thinks it's funny but it gives the rest of us American hams a bad name."

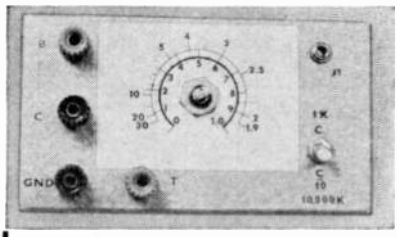
THE stand-near switch was thrown again, and Pheobus fiddled with the dials. Suddenly a voice, speaking in an obscure Choctaw dialect grated through the speaker. "Single Sideband," Pheobus observed.

I nodded in wonderment and awe, for how could he tell just by listening whether Mr. Sideband was married or single? The voice became intelligible, interrupting my thoughts.

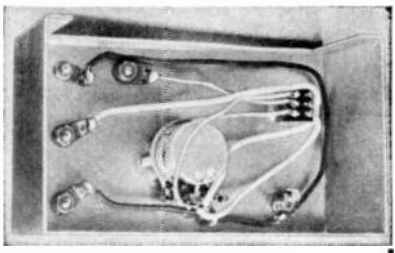
"Seek you, seek you. This is whiskey baker two yellow banana peel. Kay somebody plz."

"I'll just give him a shout to see if

(*Continued on page* 112)



Knob is removed to show scale in photo at left. Jack J1 is for signal generator input; terminal posts serve as test points and outputs.



THE EXALTED POT

Sometimes even the simplest of electronic gadgets can save you countless hours of needless effort

By FORREST H. FRANTZ, Sr.

THE VERSATILE "Exalted Pot" is so simple you'll wonder why you didn't think of it yourself. All that's required to build the unit are two ganged potentiometers, a d.p.d.t. switch, assorted connectors, and a small aluminum box.

You can use it as a 1000-ohm and a 10,000-ohm resistance adjustable divider, as a substitution adjustable resistor for any value up to 10,000 ohms, or as a substitute volume control in transistor circuits. In combination with a VTVM and an audio signal generator, you can even use it for measuring capacity and inductance.

Construction Details. The unit is housed in a 2⅛" x 3" x 5¼" Minibox. The dual potentiometer (*R1-R2*) is made by using a 10,000-ohm linear unit (IRC-CTS Q11-116) and an add-on multi-section (IRC-CTS M11-108) which is a linear 1000-ohm unit. After cutting the shaft of *R2* (the 10,000-ohm unit), attach *R1* to the back of *R2*, but be careful that the wiper arm finger of *R1* is properly seated in the wiper slot of *R2* before bending the tabs and sealing the units together.

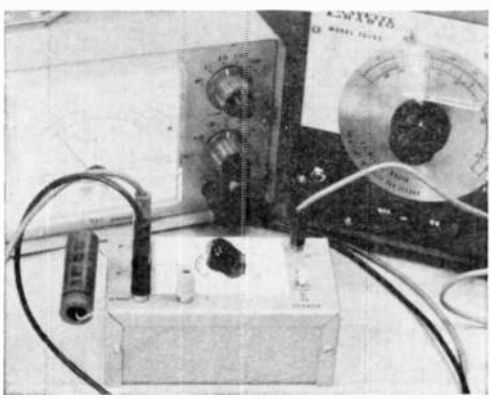
Now attach this ganged pot to the Minibox cover, and place the knob on the shaft, repositioning the potentiometer as necessary to maintain the same overshoot at each end of rotation.

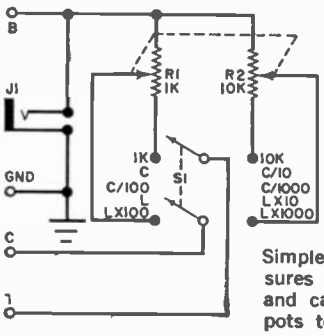
Terminal posts *B*, *C*, *T* and *GND* are available from Lafayette Radio in a kit of 10 pieces (MS-566), and each requires a 3/16" hole. The *GND* post is grounded to the Minibox, but the other three are insulated with fiber washers. Subminiature phone jack *J1* is a Lafayette 99 G 9905, and needs a 3/16" hole also. Switch *S1* is a d.p.d.t. miniature toggle switch and requires a ¼" hole. Mount all components and wire them as shown in the diagram on the next page.

Calibration. The "Exalted Pot" dial scale can be calibrated by measuring resistance at various knob settings with an ohmmeter of known accuracy. The inner scale will be calibrated from zero at one extreme to 1.0 at the other, and interpreted to mean 1000 ohms full scale or 10,000 ohms full scale, depending on the setting of switch *S1*.

The outer (capacity) scale is calibrated from 1.9 to 30μf. These capaci-

If you have an audio signal generator and a VTVM you can use the "Exalted Pot" to determine capacitor values fairly accurately. The unit will also perform many other functions as described in text.





Simple instrument measures values of coils and capacitors. Adjust pots to match voltage across unknown parts.

RESISTANCE SCALE CALIBRATIONS

Mark Scale	S1 at 1K (ohms)	S1 at 10K (ohms)
0	0	0
1	100	1000
2	200	2000
3	300	3000
4	400	4000
5	500	5000
6	600	6000
7	700	7000
8	800	8000
9	900	9000
10	1000	10000

tor markings actually correspond to capacitive reactance at a test frequency of 100 cycles. Potentiometers *R1* and *R2*, as well as the test frequencies of 100 and 10,000 cycles, were selected to provide a wide range of measurements without having to resort to many scales. Capacitance values of 0.0019 to 30 μf. can be measured.

While not shown in the photo, the dial can also be calibrated to read values of inductance. For the values of the resistors and frequencies selected, the instrument's range is from 1 mh. to 15 h. (15,000 mh.).

First calibrate the resistance scale. Set *S1* in the *1K* position. Rotate the control and mark the dial at each 100-ohm point. Do this carefully and use a good ohmmeter to measure the resistance as you proceed around the dial. No further calibration is needed for resistance. The other range is essentially now cali-

(*Continued on page* 98)

CAPACITANCE SCALE CALIBRATIONS

		100-cycle signal		10,000-cycle signal	
Mark Scale	Resistance (ohms)	S1 at C (μf.)	S1 at C/10 (μf.)	S1 at C/100 (μf.)	S1 at C/1000 (μf.)
1.9	836	1.9	0.19	0.019	0.0019
2	800	2	0.2	0.02	0.002
2.5	640	2.5	0.25	0.025	0.0025
3	530	3	0.3	0.03	0.003
4	400	4	0.4	0.04	0.004
5	320	5	0.5	0.05	0.005
7.5	212	7.5	0.75	0.075	0.0075
10	160	10	1	0.1	0.01
15	106	15	1.5	0.15	0.015
20	80	20	2	0.2	0.02
30	53	30	3	0.3	0.03

INDUCTANCE SCALE CALIBRATIONS

		10,000-cycle signal		100-cycle signal	
Mark Scale	Resistance (ohms)	S1 at L (mh.)	S1 at Lx10 (mh.)	S1 at Lx100 (h.)	S1 at Lx1000 (h.)
1	62.8	1	10	0.1	1
2	125.6	2	20	0.2	2
3	188.4	3	30	0.3	3
4	251.2	4	40	0.4	4
5	314	5	50	0.5	5
6	376.8	6	60	0.6	6
7	439.6	7	70	0.7	7
8	502.4	8	80	0.8	8
9	565.2	9	90	0.9	9
10	628	10	100	1	10
11	690.8	11	110	1.1	11
12	753.6	12	120	1.2	12
13	816.4	13	130	1.3	13
14	879.2	14	140	1.4	14
15	942	15	150	1.5	15

On the Citizens Band

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

THE Department of Transport (Canada's equivalent to our FCC) has taken the first step in opening the door to Canadian/U.S. reciprocal CB licensing. The General Radio Service (similar to our Citizens Radio Service) was authorized for Canadians in April, 1962, almost four years after the FCC authorized CB here in the same 11-meter band. The two systems parallel one another to the extent that both are low-power, short-range communications services, and both services were established for use in *necessary* business or personal communications. The operational regulations of the GRS are much the same as our CB rules and regulations, but operating frequencies are available on only 19 of the 23 channels used for CB in this country—ranging from 27.005 to 27.230 mc. (U.S. CB channels 4 through 22).

CANADA GIVES U.S. CB'ERS PRIVILEGES

The similarity of the two services gave a few CB operators living along the border in both Canada and the United States the impression that the General Radio Service and the Citizens Radio Service were related. As we explained in the March, 1963, edition of this column, hopes were high then that the FCC and the DOT (Department of Transport) would soon come to some sort of agreement authorizing CB'ers and GRS operators to communicate across the international boundary. Now, millions of transmissions and two years later, the DOT has introduced a new service to be known as the "Tourist Radio Service," making any legally licensed U.S. CB'er eligible for a temporary license to use his CB gear while in Canada.

There is no fee for this service but the license is not transferable and must be in the operator's possession at all times while he is in Canada. It remains valid for a period of one year, at which time it must be renewed by the U.S. citizen who expects to continue having a need to use his CB equipment over the border.

Persons in this country interested in using the "TRS" must apply to the Regional Superintendent of Radio Regulation, Department of Transport, 25 Sinclair Ave., Ontario, Canada, at least 30 days prior to their entry into the country. The DOT requires the U.S. CB'er's name, address, CB call-sign, and the period of time he intends to be in Canada. Each CB'er will be permitted to use only the Canadian GRS channels 4 through 22, and will be bound by the regulations of the DOT as established for the General Radio Service.

Canadian CB'ers are quite happy about the "lifting of the gate," so to speak, and their big question is "now that we've made the first move, when is the U.S. going to follow through with similar privileges for us Canadians?" Soon, we hope! Canadian

The efforts of CB-XM, Canada's national CB monthly newspaper, may have been instrumental in making it possible for U.S. CB'ers to use their gear there.

GRS users have already requested that U.S. CB'ers petition the FCC for reciprocal authorization to be issued to those in need of communication facilities while visiting this country.

Two Canadian CB publications, the *Modulation*, news monthly of the Metro CB Club, Toronto, and *CB-XM*, the national CB monthly newspaper, feel that their editorial comments over the last several months have played a part in making the new service available to U.S. CB'ers. We have lauded Jim DeZorzi, XM41-085, in the past for his editorial efforts in the *Modulation*, a clean-cut, well-written CB news vehicle for Canadians. Bob Watson, XM41-241, publisher of *CB-XM*, is now in line for an equal amount of kudos for the job his paper has been doing news-wise throughout Canada. Each issue of *CB-XM* appears to cover just about anything that has, is, or will be happening among GRS users. And hardly an event goes by that isn't covered by the *CB-XM* photographer, Harold Merton, XM44-042.

Other rule changes that involve the use of Citizens Band equipment in Canada have been announced in favor of walkie-talkies or any CB equipment with a final input of 100 mw. or less. Kits, home-brewed or manufactured units that had previously been banned, may now be used on any frequency between 26.97 and 27.27 mc. The units need not be licensed and are exempt from the use of call-signs, DOT approval and age restrictions.

Stacked Shack. Meet CAP Captain Don G. Kinne Sr., pictured here with his gear. Don is about as "radio-active" as you can possibly get! Starting on the rooftop, Don employs five different types of antennas: ground plane, base-loaded vertical, 329KC radio aviation weather, super beacon CBB-1, and a BQ1206-C. As for equipment, Don uses gear made by Hallicrafters, Metrotek, and Heath. He is active in EAR Emergency Services for the U.S. Air Force and the Civil Air Patrol in the eastern portion of South Carolina. Combining all of his "communicativities," Don is on 11 meters (CB); 2 meters (VHF); 80 meters (HF); 10 meters (26.620 HF); and 145.26, 145.50, 147.09 (VHF).

In addition to a CB license, Don Kinne, KDD7231, also has three others: Civil Air Patrol KK206 and SK206 mobile, and Civil Defense WA41CB Unit 34. His many "communicativities" are described above.

CB Rescue in New York. SWL Axel W. Berggren, Jamestown, N.Y., has reported another life-saving credited to Citizens Band radio. A Jamestown man lying flat on his back trapped in a mud-filled drainage ditch, unable to move, was spotted by a youngster named Jerry Movio who had been out looking for worms. Realizing there was nothing he alone could do for the man, he returned home to tell his uncle, Howard C. States, about it.

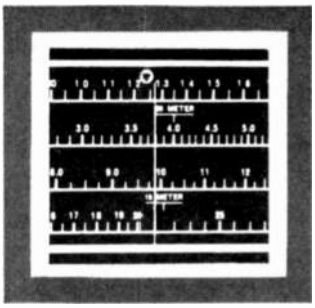
States and the boy returned to the scene with a flashlight but were unable to reach the man since the ditch was close to ten feet wide. At this point only the man's face showed above the mud. With no telephone nearby, States placed a plea for help on his mobile CB rig which was picked up by Joseph A. Russo. Russo relayed the information to the police.

In short order a rescue team of seven men arrived on the scene to find that a group of on-lookers had collected in an attempt to help, but without success. By this time only the man's mouth and nose remained above the surface of the mud. The rescue group put a ladder across the ditch but the man was unable to grab hold of it in his exhausted state.

Patrolman George Thompson then crawled out on the ladder and succeeded in grabbing the victim and pulling him to safety. He was taken to Jamestown General Hospital, treated for exposure and released. The man is undoubtedly alive today due to one quick-thinking boy and two Citizens Band operators!

1964 OTCB Club Roster. This month's listing of new CB clubs which follows completes the 1964 round-up of information that has been sent in by new and active organizations across the country and Canada. In an early 1965 issue we will publish the results of this year's campaign to find out how many clubs are actually CB-active, how many members the average club has, total of clubs by state, types of rescue groups, and any additional pertinent information of interest to the Citizens Band clan.

(*Continued on page* 100)



Across the Ham Bands

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

AMATEURS AID IN SEARCH AT SEA

EARLY on the afternoon of August 4, 1964, VEØMU, maritime-mobile on the thirty-foot motor sailer *John Peer* in the Atlantic Ocean, broke in on WA4ECY on 20-meter SSB asking for help. The operator, Eric Lamberg, VO1FL/VP9FM, reported that he and his wife, Joan, en route from Bermuda to Newport, R.I., were exhausted from continuously battling a severe storm for three days, and they could not hold out much longer without relief. Making the picture still more grim, the storm had blown them far off course, and Eric had only the haziest idea of their position.

WA4ECY, located at the Jacksonville, Fla., Naval Training Station, immediately notified the U.S. Navy and Coast Guard of the *John Peer*'s plight. Coast Guard "weather" gave WA4ECY a course to relay to Eric that would get him out of the storm area, and by nightfall the *John Peer* was in an area of calmer seas and lower winds—but still lost. In the meantime, a huge search and rescue operation directed by the Commander of the U.S. Second Fleet got under way.

All communications with the *John Peer* were via amateur radio on 14,265 kc., because of the limited range on the commercial frequencies on which the *John Peer* could operate. WA4ECY, manned by WAØBDM, K4YCW, and several other hams, stayed on the air continuously for 27 hours and acted as the net control station for the emergency net that was organized. A few of the many hams who participated in the net were: K1WTI/MM (USS *Purdy*), W2BO,

Amateur Station of the Month

No, you're not seeing double—or quadruple! W. Rex Sterling, VØ1HF, St. John's, Newfoundland, owns FIVE receivers—ranging from a National SW-54 to an NC-188—each with its own antenna. His transmitter is a Heathkit DX-60 and his main antenna is a 75-meter dipole. Alaska is his best DX—not bad for such low power on 75 meters! VØ1HF will receive a one-year subscription to POPULAR ELECTRONICS for submitting the winning photo in the Amateur Station of the Month contest for December. If you would like to enter the contest, just send us a clear picture of your station—preferably with 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.

WA2WAU, WA4GHA/Aeronautical Mobile, W4SAW/MM (the aircraft carrier *Enterprise*), K4UOT, W8NGO, W8ZXN, W9EGQ, WA9AKM, KP4BQV, and VP9BN. The latter kept Eric's mother and son informed of the progress of the search operation.

One thing that made communicating with VEØMU on the *John Peer* difficult was that when signals were weak the ignition noise from his auxiliary motor prevented Eric from hearing stations that heard him. But his emergency batteries were good for only 15 minutes with the motor off. When the 15 minutes were up, Eric had to shut down and start the motor to charge the batteries, which took a minimum of 30 minutes.

Shortly after noon on August 5, Coast Guard and Navy search planes finally crisscrossed close enough to the boat to obtain accurate position fixes in the 2-mc. marine band. Minutes later, they were circling the *John Peer*, and it was only a matter of time until the nearest rescue ship reached Eric and Joan. Thus, the operation ended after 27 hours with the rescue of the Lambergs who were worn out but otherwise OK. Their boat was also OK except for its almost empty fuel tanks.

Hams and Local Laws. Several hams have recently been involved in extensive proceedings to protect their legal rights—and, by implication, those of all hams. In summary, here are the highlights of what we consider the most important cases.

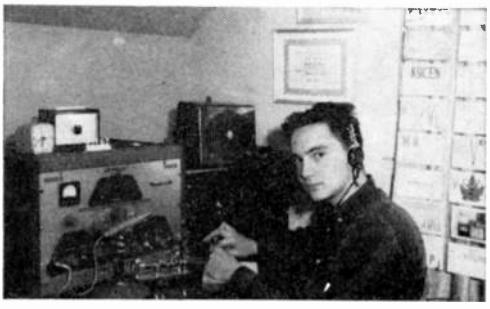
Two years ago in Elizabeth, Pa., Charles "Butch" Seaman, K3IOP, a 15-year-old Technician operating on the 50-mc. band, received so many TVI complaints that the FCC forced him to take his General Class examination under FCC Amateur Regulation 97.25, even though his transmitter checked out "clean." He was issued a General Class license with the restriction that he could not operate on 50 mc. After protracted hearings and negotiations, Butch (now 17) has voluntarily given up 50 mc., so the case is virtually closed. The ARRL, however, is still attempting to have the 50-mc. restriction removed from Butch's license for legal reasons.

When Mace, WØJRQ, purchased his home in Denver, Colo., he signed a covenant not to erect outside antennas. But he has had an outside antenna for several years. Recently, four new neighbors sued him for $8000, claiming that WØJRQ's tri-band beam on a 47′ tower depreciated their property values. The signed covenant makes this a particularly difficult situation from the ham standpoint; as this is written, the case has not yet been decided.

Last winter, the city of Chicago, Ill., ordered Jerry, K9GRH, to dismantle his antenna and tower which were deemed to be in violation of the city's zoning laws. Jerry complied with the order on the advice of his attorney, but challenged its legality; this matter also is still in the courts. As written, the city ordinance actually forbids all outside TV receiving antennas, CB antennas, and amateur antennas in Chicago residential areas. Since Jerry's case was started, the city has ordered approximately 25 hams and CB'ers to dismantle their antennas and cease all radio operations. But the Chicago City Council is now considering an amendment to the zoning code that will permit outside antenna installations as a "special use" upon the payment of a $100 fee! The Chicago Area Radio Club Council and the ARRL are vigorously fighting this case on all fronts.

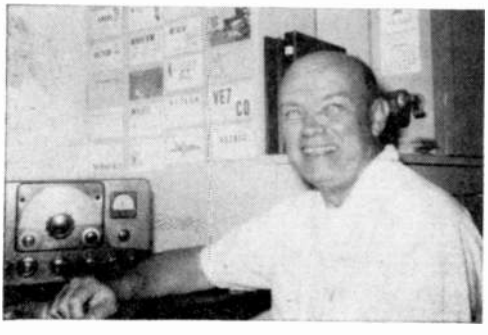
Other amateurs involved in similar antenna cases include Dr. Sam Rosen, WA2RAU, New Rochelle, N.Y.; Peter McManus, K3DSF, Farless Hills, Pa.; and the Weber

(*Continued on page* 95)



You'll probably recognize the Heathkit DX-100 phone and c.w. transmitter in the shack of Tom Hale, K1FQY, Arlington, Mass. (he prefers 20-meter c.w.). His receiver is a Scott that once resided in an old merchant ship's radio shack.

The shack wall of Bob Jackson, WN6GEQ, Sherman Oaks, Calif., is almost covered with QSL cards from 47 states and many DX stations. Space has been saved for his General license.



Transistor Topics

By **LOU GARNER,** Semiconductor Editor

THE Holiday Season brings with it the annual practice of selecting gifts for friends. Books make excellent gifts. If you select interesting and useful books, you will be well thought of long past gift-giving time. As with any gift, keep your friends' interests in mind.

Our mail indicates that a great many hobbyists enjoy working with transistors and that they have completed dozens of projects. They are interested in how semiconductors operate, and they are constantly looking for more and more transistorized circuits to build. They like to work from easy-to-read, and easy-to-understand instructions, pictorials and schematics. Quite a few books on transistors have been published recently which would make fine gifts.

The books on transistors which were recommended in "POP'tronics Bookshelf" this past year are listed here for your convenience together with the month in which they were reviewed: *RCA Transistor Manual,* Second Edition, published by RCA Electronic Components and Devices (October); *Transistorized Miniature Amplifier and Tuner Applications,* by Rufus P. Turner (July); *The Transistor Radio Handbook,* by Donald L. Stoner and L. A. Earnshaw (June); *How to Build Tiny Electronic Circuits,* by Morris Moses; *Transistor Ignition Systems Handbook,* by Brice Ward; *Diodes and Transistors,* by G. Fontaine; *Transistor Specifications and Substitution Handbook,* published by Tech Press Publications (all in May); and *Getting Started with Transistors,* by your Semiconductor Editor (March).

There are many other good books on transistors available, of course, including the various transistor handbooks put out by most of the leading manufacturers of semiconductor products.

Reader's Circuit. There are a number of control and alarm installations where a latching or "self-holding" action is required, that is, a circuit which—when momentarily energized—will apply and maintain power to such loads as a lamp, signaling device, solenoid or small motor. This type of action may be obtained by using a mechanical or electrical latching-type relay, by using a SCR or Trigistor, or, as reader, experimenter and author Ronald L. Ives has suggested, by using a relatively simple two-transistor circuit.

An *npn* (*Q1*) and a *pnp* (*Q2*) transistor in a direct-coupled hookup are shown in Fig 1. Transistor *Q1*'s base bias is initially supplied by *B2* through *R2* and *R3*. The base bias of *Q2* comes off a voltage-divider, *R4* and *R6*, and includes *Q1*'s emitter-collector circuit. Resistors *R2* and *R5* serve as

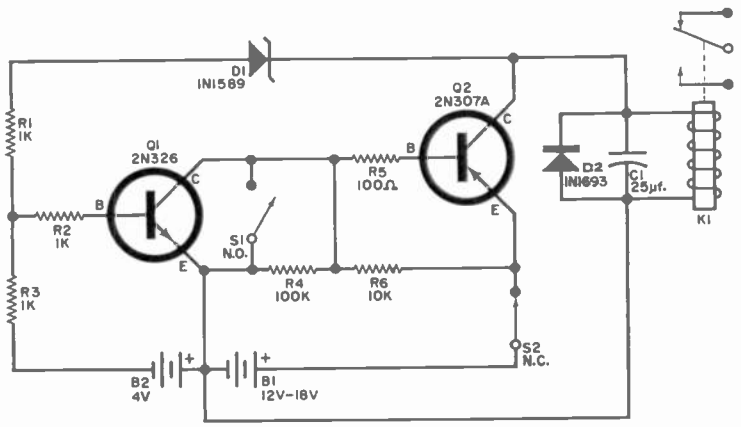


Fig 1. Reader Ronald L. Ives employs transistors to latch relays and other control devices. Circuit stays off until triggered by momentarily closing switch S1. Circuit stays on until switch S2 is temporarily opened or until the power is removed.

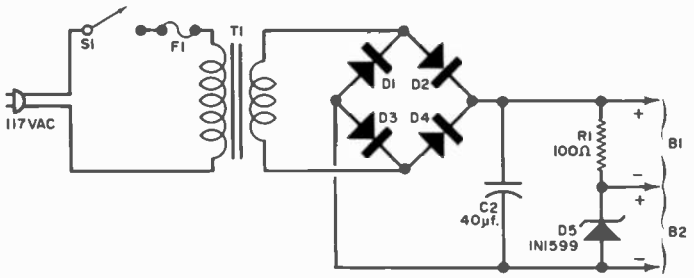


Fig. 2. A power supply can be used in lieu of batteries in the latching circuit. A zener diode doubles as part of a voltage divider and regulator.

base current limiters. The output load in this case is a standard relay coil shunted by *C1* and *D2*. Operating power supplied by *B1* is controlled by normally closed *S2* and by circuit action.

Neither *Q1* nor *Q2* conduct appreciably until the circuit is energized by closing *S1 momentarily*. When this happens, *Q2*'s base becomes forward-biased by *B1* and permits collector current to flow through the relay, causing it to close. The voltage developed on *Q2*'s collector appears across zener diode *D1* and causes it to conduct, applying more forward bias to *Q1*'s base through *R1* and *R2*. This, in turn, causes *Q1* to conduct and apply forward bias to *Q2*'s base through *R5*. Transistor *Q2* is held in a conducting state which, in turn, holds *Q1* in a conducting attitude and everything stays "on" until power is interrupted, as by momentarily opening *S2*, at which time the entire circuit reverts back to an inactive condition.

Transistors *Q1* and *Q2* are a 2N326 and a 2N307A, respectively. Diode *D1* is a 1N1589, 4.7-volt, 3.5-watt zener diode and *D2* a 1N-1693 diode. The relay (*K1*) is a Potter and Brumfield MR-11-D with a 6-volt coil. Resistor *R4* is a half-watt unit while all other resistors are rated at one watt. Capacitor *C1* is a 25-volt, 25-μf electrolytic. Both *S1* and *S2* are push-button s.p.s.t. switches, with *S1* a "N.O." (normally open) and *S2* a "N.C." (normally closed) type.

Operating power can be supplied either by batteries or, if preferred, by a line-operated supply as shown in Fig. 2. Switch *S1* is a s.p.s.t. toggle or slide switch, *R1* a 100-ohm, 2-watt resistor, and *C1* a 2000-μf., 30-volt electrolytic capacitor. A 1-ampere fuse (*F1*) is used. Transformer *T1* is a 117- to 25-volt, 1-ampere filament transformer (Stancor P-6469 or equivalent). The bridge rectifier, *D1, D2, D3,* and *D4,* is made up of four Sarkes-Tarzian M-500 diodes. Finally, *D5* is a 3.8-volt, 10-watt 1N1599 zener diode.

With neither parts arrangement nor lead dress critical, the entire circuit, including the suggested power supply, can be assembled on a conventional chassis and placed in a small case or cabinet as desired. Good wiring practice should be observed, or course, with leads kept short and direct, and ample separation provided between power handling components.

Circuit Modifications. Several modifications may be made in the basic circuit of Fig. 1 for special applications. For example, a solenoid, a lamp bulb, or a suitable signaling device can serve in place of the relay as *Q2*'s load. A thermostat or microswitch might be used in place of *S1*—the former for, say, fire protection, and the latter for a burglar alarm.

If increased sensitivity is needed, a simple preamp can be added to the basic design. Typical circuits are illustrated in Fig. 3. In each case, *Q3* is a 2N34 or equivalent *pnp* transistor. Resistors *R1* and *R3* are half-watt

(*Continued on page* 94)

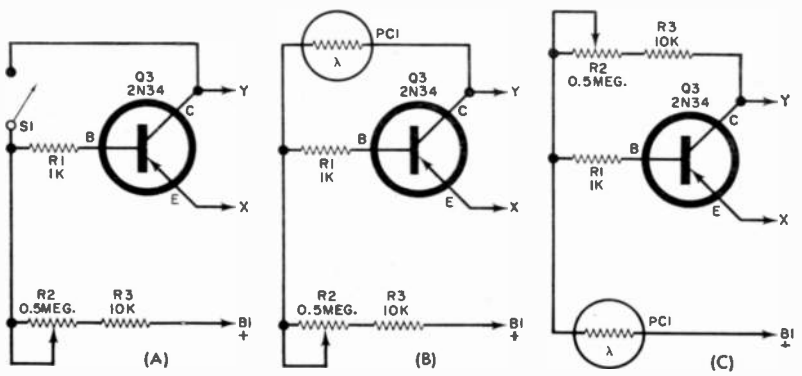


Fig. 3. Preamps increase sensitivity of latching circuit. Different control mechanisms can be used. Shown here are a low-current switch-controlled circuit (A), and a light-sensitive arrangement which closes relay when light increases (B), opens relay when light increases (C).

Monthly Short-Wave Report

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

SPECIAL PROGRAM FOR DX'ERS

The Association of North American Radio Clubs (ANARC), a federation of all major listeners clubs in the U.S. and Canada, has arranged with the staff of Radio Gambia, Bathurst, Gambia, to broadcast a special program for DX'ers from 1500 to 1545 EST on December 15. The program, consisting of music and announcements in English, will be transmitted on Radio Gambia's regular 4820-kc. frequency. All reception reports will be answered and correct loggings will be verified. Reception reports, and inquiries concerning the broadcast, should be directed NOT to Radio Gambia but to: Special Broadcast, Association of North American Radio Clubs, Box 372, Kenosha, Wisconsin. Eventually, all reports that are received by the ANARC will be forwarded to Radio Gambia for the station's files.

VICTOR SYLVESTER AND HIS ORCHESTRA

THE first broadcast made by Victor Sylvester and his Ballroom Orchestra took place in 1937. Since that time, he has been on the air regularly, topping every dance music poll taken by the Listener Research Department of the British Broadcasting Corporation. His extremely popular "Music for Dancing" program, in which he plays requests for listeners all over the world, has now run every week for 16 years.

Said to be the leading authority on strict-tempo dance music, Victor originally taught dancing at a time when very few recordings of the proper tempo for dancing were available. He was able to convince the Columbia Gramaphone Company that strict-tempo records would prove a worthwhile venture. They turned out to be an immediate success, and in 1963 Columbia presented Victor with a platinum disc denoting the sale of 30 million single records.

Victor started a "Television Dancing Club" in 1946; during these telecasts he conducts the orchestra and gives brief dancing lessons. Well over a million copies of his book, "Modern Ballroom Dancing," have been sold. In 1961, Victor was made an Officer of the most excellent Order of the British Empire by Her Majesty the Queen for his services to ballroom dancing. He is currently president of the Imperial Society of Teachers of Dancing, the largest dancing organization in the world—it has over 9000 members.

When chatting to his listeners, Victor's manner is friendly, his voice persuasive and

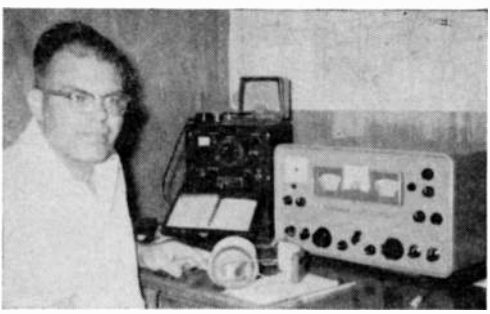
One of the most popular programs heard on the short-wave bands features Victor Sylvester and his Ballroom Orchestra. The weekly program is beamed out of London to every country in the world.

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	2030, 2130, 2230
		9580	0745
Bulgaria	Sofia	9700	1900, 2000, 2300
		7290	1630
Canada	Montreal	15,190, 11,760, 9585	1800 (Caribbean)
		9625, 5970	0215, 0300 (W. Coast)
Congo (East)	Leopoldville	11,755	1630
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	0730
		9520	2100
Finland	Helsinki	15,185	1530 (Mon.-Fri.)
West Germany	Cologne	11,925, 11,795, 9735	1010
		9640, 6075	2035
		11,795, 9735, 9575, 6145	0000
Hungary	Budapest	11,905, 9833, 7215	1930
		9833, 7215, 6234	2030, 2200, 2330
Italy	Rome	9575, 5960	1930, 2205
Japan	Tokyo	15,285, 15,135, 11,780	1900
Jordan	Amman	9555	2015
Lebanon	Beirut	9625	2130
Netherlands	Hilversum	17,810, 15,425	0930 (Tues., Fri.)
		15,425, 11,730	1535 (Tues., Fri.)
		15,425, 11,730	1630 (exc. Sun.)
		9715, 6085	2330 (exc. Sun.)
		800 (via Bonaire)	1940 (exc. Sun.)
Portugal	Lisbon	6185, 6025	2105, 2245
Romania	Bucharest	11,810, 9510, 7225, 7195, 6190, 5990	1730
Spain	Madrid	11,715, 9615, 6140	2200, 2100, 2000
Sweden	Stockholm	15,240	0900
		11,805	2215, 2045
Switzerland	Berne	11,865, 9665, 9535	2015, 2315
Turkey	Ankara	15,165	1700
U.S.S.R.	Moscow	9700, 9680, 9660, 9650, 9640, 9620, 9610, 9570, 7440, 7390, 7360, 7310, 7290, 7240, 7170, 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

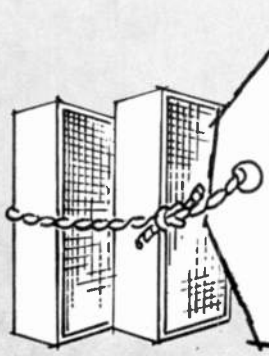
After some three years of DX'ing, Warren Nordgren, WPE9DGI, Waukegan, Ill., has 78 countries logged, 51 verified. His receiver is a Hammarlund HQ-180.



encouraging, his details clear, his instruction expert and concise. The gentlemen who make the music, according to Mr. Sylvester, are Charles Pude, Jack Phillips, Oscar Grasso, Edward Pogson, Tony Mozr, Victor Parker, Bob Falloon, Bob Roberts, and Ben Edwards.

As we go to press, one of the best times to tune in Victor Sylvester is at 1815 EST on Mondays on 9510, 9580, 11,750, 11,780, 12,095, 15,070, 15,140, 15,260, 15,300, or 15,410 kc. Both the time and frequencies change occasionally, however, so it's a good idea to check the BBC program previews for upcoming schedules.

(*Continued on page* 102)



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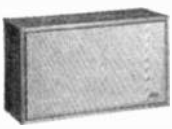
- Handsome 24" x 19" x 5⅞" walnut cabinet.
- Graceful brass legs.
- Audiofile net each—**$54.95**; pair **$99.95**.

Save $14.90



TX-4 three-way deluxe speaker system

- Covers the full tonal range from 35-17,000 cycles.
- Has 12" woofer; 8" solid back midrange; 3½" direct radiator type tweeter.
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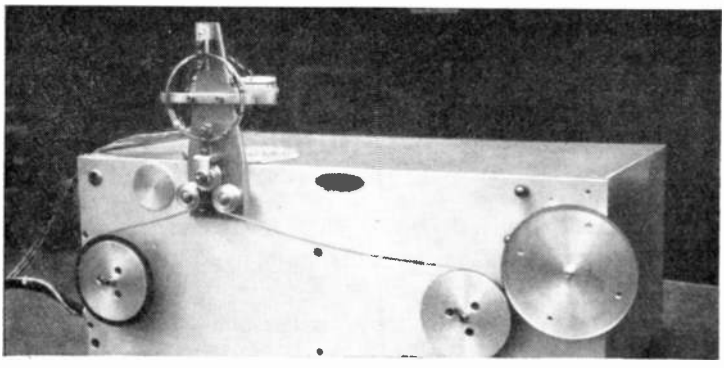
Quality by design in sound reproduction

CIRCLE NO. 2 ON READER SERVICE PAGE

Some plain talk from Kodak about tape:

physical testing and tape performance



The High Speed Tensile Tester is designed to break tape under load . . . and gather a lot of useful data besides.

Magnetic tape is subject—day-in, day-out—to a wide variety of stresses and strains. That's why we are more than casually interested in its tensile properties. Tape is much like a rubber band. Put under tension, it will stretch. When the tension is released, it will snap back to its original shape. It will, that is, unless you've stretched it beyond its yield point. For if over a certain amount of longitudinal stress has been placed on a tape, the tape will lose its ability to recover and will, in fact, remain permanently elongated. Stretch it even further and, naturally, the tape will break.

Deformed tape will not reproduce sound faithfully. And tape that breaks too easily is just a plain nuisance. So we set our sights high and developed a special triacetate—called Durol base—that's exceptionally tough, yet breaks clean without "necking down." In order to prove its worth *and keep it that way,* we developed a tight set of specs for our quality-control boys—specs which were a direct outgrowth of the conditions under which a tape is to be used. For example, the shock of going from fast wind to fast rewind. Or the shock generated on a running recorder when the supply spool jams.

We think that tape should be able to take this sort of punishment routinely. So, of course, we double, triple, even quadruple the requirements! And just to make sure that the tape performs we build torture tests that would have delighted Attila the Hun.

Here is one tester that is outstanding in its fiendishness. It's called the High Speed Tensile Tester and is designed to break tape under load.

But like any good one-man band, it does a lot more than just one job. It not only breaks tape but gathers scads of very useful data as well—data which completely describes a tape's tensile properties. Here's how it works. It's built like a tape deck with the tape attached to one half of a split-ring electrical strain gauge. We run the deck and then jam on the brakes on the supply reel but keep the take-up reel going. The strain gauge takes the full load and the split ring spreads and deforms. This deformation causes the gauge to change resistance and causes the DC voltage on it to pulse. We monitor the pulse on a scope and measure the duration. This gives us a figure of merit in terms of tensile strength.

Just how good is Durol base? Well, consider this data. Yield strength for Durol base is 47% greater than regular triacetate and 70% greater than diacetate (the two most common plastic support materials). Break strength is 43% greater than triacetate and 80% greater than diacetate. And this is the kind of test that almost duplicates actual use conditions on your tape equipment.

But any torture test one engineer can devise, another engineer can improve upon. Take the Toughness Tester, for example. This is an instrument designed to determine a tape's strength (toughness) by measuring the force required to break a sample. A measured length of tape is held securely between two clamps. Then it is struck and broken by a falling pendulum. Because it has been raised to a fixed height, the pendulum always delivers a precise and repeatable amount of impact. The energy absorbed by the tape at impact controls the height of the

Auto Voltmeter

(*Continued from page* 55)

Once the engine is running, the voltage should rise to full charge at higher speeds, gradually coming down to the lower running limit, which indicates that the battery has fully recharged from the starting drain. The final regulated voltage varies with temperature due to the temperature-sensitive elements built into the voltage regulator itself, so it's a good idea to consult the service manual for your own car to acquaint yourself with the range of voltages for the expected range of temperatures normally encountered by the accessories under the hood. Temperature could vary from 20° below zero to 150° F when you start off on a subzero morning and then drive in the early afternoon sun with a 180° thermostat in the cooling system. An occasional idling period at a long traffic light or busy intersection could send the temperature up quite high, even in cold weather.

Acquaint yourself with the high and low voltage limits for a good battery with the engine running, for both summer and winter, as well as the meaning of abnormal indications and how to recognize them. The battery voltage table shows typical voltage ranges for both 6- and 12-volt systems. Note the relationship between the two sets of figures: The values for a 12-volt system are approximately double those of the 6-volt system. This is understandable, when you consider that both are made up of the same type of individual 2-volt cells.

Because of normal deterioration in the plates of the battery, small particles flake off and fall to the bottom of the cell. As this process continues, the resistance of the battery goes up, and it is often possible to predict failure of a battery long before it dies. Under the usual starting conditions, the battery drain is not too excessive, and the battery will charge up normally. However, the time that it takes to regain the charge will increase as deterioration gets worse.

When the first cold weather comes, the demand upon the battery is considerably greater, and due to the large internal resistance, the voltage at the battery terminals is small. The battery must dissipate the power expanded in its internal resistance in the form of heat. If this heat is great, the plates buckle and the cell shorts and breaks down. It is interesting to note that most battery troubles show up during the first cold spell of winter.

A thorough check of a doubtful battery can be made as follows:

1. Check the liquid level, and measure the specific gravity of each cell before adding any water. Regardless of the state of charge (as indicated by the specific gravity), they should all read about the same. (The gravity will vary with the level of liquid.)

2. Unless the battery is discharged or near the lower limit voltage, measure the voltage across *each cell* while turning the engine over by means of the starting switch. (Disconnect the high-voltage lead from the coil to prevent the engine from starting.) This puts a heavy load on the battery and simulates actual starting conditions. If, under these conditions, each cell reads low but there is less than .1 volt difference between any two cells, the battery is good. If the voltage is low, the battery needs charging. If the cell measurements differ by more than .1 volt, the battery should be replaced.

3. Reconnect the high-voltage lead to the coil and start the engine. Measure the voltage across the battery with the engine idling. Now race the engine. The voltage should rise sharply from open-circuit voltage to normal charging voltage (depending on the state of charge of the battery) and drop back again as the engine slows down.

If the voltage does not increase sharply, the fault lies in the charging system (either the generator or voltage regulator). If it increases but remains high when the battery is known to be fully charged and good, the voltage regulator contacts are stuck closed. Prolonged running under these conditions can damage the battery. One symptom of this trouble is the need for excessive refilling of the cells with distilled water.

The lack of charging may indicate nothing more than worn generator brushes (or open rectifiers in alternator circuits), a dirty commutator, or burned or pitted contacts in the voltage regulator (the voltage regulator consists of a cutout relay, a current regulator element, and a voltage regulator unit, all with contacts). The correct method of cleaning and adjusting these contacts is outlined in the manufacturer's service manual. Quite often, a gas-station attendant will replace the whole unit rather than attempt a minor adjustment or cleaning of the contacts in a voltage regulator.

A convenient gadget for turning over the engine while working under the hood consists simply of a momentary-contact push-button switch, a pair of wire leads long enough to reach across the car (about 6 feet should be adequate) and a small battery clip on the end of each lead. The leads are connected across the starter control terminals of the starter solenoid. The push-button then does the same job as the ignition switch, but the engine will not start with the ignition switch in the off position. With this gadget, the high voltage lead need not be disconnected from the ignition coil.

The Payoff. You may be interested to hear that, as this article was being written, the author discovered that his charging system was not functioning—with the help of a panel-mounted voltmeter. The "Charge" panel light would come on, but as the engine speed increased with the car rolling along the highway, the light became very dim and appeared to have gone out. As a matter of fact, everything seemed normal—except the voltmeter reading, which was slightly under 12 volts.

Naturally, the charging system failed on a Saturday when the auto service department was closed (according to "Murphy's Law"). However, close and continuing checks of battery voltage showed that there was adequate charge left in the battery to last the weekend if all driving was done during the day, and if accessories were not used. By Monday, the voltmeter had more than earned its keep! -30-

Cryogenics

(*Continued from page 44*)

coils and windings. For most of the exotic superconductive metals and alloys (24 have been discovered to date) are too brittle, even at room temperature, to bend or shape without breaking.

Niobium-tin—a superconductive alloy that remains superconductive in high fields (as high as 200,000 gauss, researchers believe)—went into the Bell and RCA magnets. Westinghouse used another exotic—niobium-zirconium—for its device. Vanadium-gallium—a superconductive newcomer—shows promise of withstanding 400,000 gauss or more.

As for forming the too-brittle? Bell researchers turned the trick by enclosing the raw ingredients of superconductive niobium-tin (finely powdered niobium and tin) in an easy-to-shape pure niobium tube, then "drawing" the tube into a wire, winding it into a coil, and popping it into a 1000° C furnace to chemically unite the tin and niobium. The RCA process involves depositing a pure crystalline compound of niobium and tin on a moving substrate of stainless steel alloy.

Hushing Circuit Noise. Cryogenic cold can vastly improve the signal-to-noise ratio in many high-frequency receivers (100 mc. and above) by quieting the random and "noisy" collision of atoms within circuit components.

For example, NASA's great worldwide net of space-signal receiving antennas (the same antennas which tracked the fleeting transmissions from our recent lunar and Venus probes) owe their sensitivity in large part to cryogenics. The ruby "heart" of each antenna's ruby maser (tuned to the spacecraft's transmitted frequency) is immersed in a tank of liquid helium. The supercold helium (−450°F) freezes to immobility the ruby's usually "noisy" (and vibrating) atoms—noise which, if not hushed, might drown out the weak signals from distant space. Cryogenic cold cuts in half the ruby's internal noise, and thus in effect *doubles* the receiver's signal-over-noise ratio. Result: with their signal-detecting

rubies quieted, NASA's antennas can detect almost unbelievably weak signals.

Hughes Aircraft's "electronic ear"—the synthetic ruby of its 25-pound maser amplifier chilled to −452°F—was designed to increase by ten times the sensitivity, and thus the "hearing range," of Army electronic systems, particularly anti-ICBM radar.

Cryotron Supercold Switches. In 1956, a young MIT professor—Dudley A. Buck—put two and two together (the fact that superconductors have zero resistance, yet this perfect conductivity can be destroyed by a magnetic field) and came up with the *wire-wound cryotron*, a superconductive switch in which a small current in one wire (the cryotron "control") creates a magnetic field that shuts off a larger current in an adjacent wire (the cryotron "gate") by turning the gate wire resistive.

Crude as Buck's switch was (he actually wound a thin niobium-tin "control" wire around a thick tantalum "gate" wire), it was the forerunner of today's "thin film" computer memory and calculating cryotrons. It also proved that cryotrons behave like amplifiers—they exhibit "gain," a small current controlling a larger, and thus no further amplification is needed.

Thin Film Cryotrons. Hottest breakthrough in electronics is supercold "thin film" circuits, some so small that ten million individual switching devices (cryotrons and their components) can be crammed into a single cubic foot, the thin film switches operating at the fantastic speed of nearly one-billionth of a second (a *nanosecond*).

Thin film circuits—a giant advance over simple printed circuits or Buck's wire-wound cryotron—are made by depositing metal films (often only a few hundred *angstron units* thick) on an insulator, such as glass. As many as 20 or more circuits can be wafered (a layer of insulation and film, then another layer of insulation and film), one atop another. Not only are thin film circuits faster than conventional computer ferrite-core "memories" (a number can be read from a core memory in about 1000 nanoseconds, but in 100 to 200 nanoseconds from thin film), but the computer's whole thinking process is

(*Continued on page* 91)

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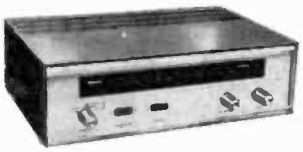

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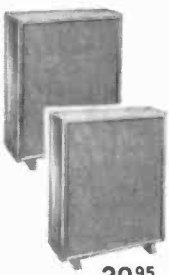

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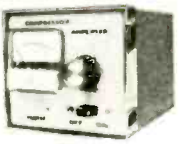

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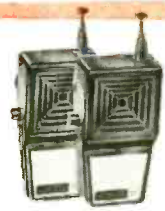

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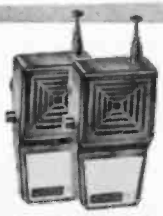

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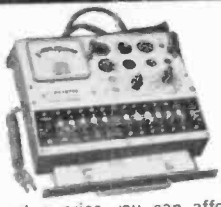

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speeded. Reason: electrical energy can travel only 1 foot in a billionth of a second. So in conventional computers signals spend more time traveling from core to core than being worked upon. Densely packed thin film circuits reduce transit time, speed up data processing, and capsule the size of computers.

Thin-film cryotrons depend, just as do simple wire-wound cyrotrons, on the fact that zero resistance superconductivity can be destroyed (turned resistive) by a magnetic field.

Do-It-Yourself Cryogenics. Electronics' fantastic new frontier—cryogenic superconductivity—needn't be relegated to the commercial laboratory. You can, right now, put superconductivity to the test—and perhaps even to use—at your own workbench. With a minimum amount of equipment, you can devise a number of fascinating experiments, either for your own enjoyment or as the basis for a science fair project.

All you need is some cryogenic refrigerant and an insulated container (a good thermos will do) to hold it. A sizzling-cold quart of −450°F liquid helium (available locally from cryogenic manufacturers or lab suppliers) costs as little as $15, and while it lasts (its life is measured in minutes or days depending on how well its container is insulated), lets you experiment with the electronic McCoy: superconductivity.

Lower-cost liquid nitrogen (−320°F), while not cold enough to wring all the resistance from conductors (nor to turn them superconductive), is often cold enough to quiet the vibration of their atoms, hushing noise which nothing but supercold can quiet. Liquid nitrogen—about $1.50 a quart—is becoming available from many local truck-stop service stations (hundreds of refrigerated trucks now chill their cargoes with cryogenic cold). Bring your own container, such as a Dewar flask or an *unstoppered* thermos bottle.

A simple way to demonstrate the *threshold* of superconductivity is to merely place any carbon resistor in a container with a bit of liquid nitrogen. Bring leads out to an ohmmeter: The resistor's resistance will demonstrate a fantastic drop. A similar experiment can be performed by connecting a resistance in series with a small flash-

light bulb and battery, using a resistance high enough to keep the bulb from lighting brightly. Place only the resistor in the liquid nitrogen and watch the bulb grow brighter.

In the event that you would like to experiment with supercold components or circuits, keep the following precautions in mind: (1) Although liquid gases are not dangerous in small quantities, they tend to boil away rapidly. Work in a well-ventilated area. (2) Low-temperature burns may result if a liquid gas comes in contact with your skin—wear a pair of gloves and a long-sleeved shirt for protection. (3) Certain materials become brittle and may shatter when exposed to cryogenic cold. For this reason, always wear a pair of goggles or a face mask. (4) DO NOT try to seal a container of liquid gas; never allow the liquid to become trapped in a closed area.

Superconductivity: Past and Future. To put superconductivity to work, you've got to throw away your Fahrenheit thermometer—and some of electronic's basic rules.

Let's begin with that thermometer. In the chill world of cryogenic superconductivity, it's the Kelvin scale you use. On Lord Kelvin's low-low temperature thermometer, *zero* is absolute zero (−459.6°F). The higher up the scale you go, the warmer it gets. But in cryogenic supercold, it's always unbelievably cold—always below −200°F, or about 144°K. By contrast, on the coldest day ever recorded (in the Antarctic), the temperature plummeted to a mere −100°F.

Actually, the realm of zero resistance superconductivity lies near the bottom of Kelvin's scale . . . roughly, between 0°K (absolute zero) and about 20°K.

To understand why, peek over the shoulder of Dutch physicist Heike Kamerlingh Onnes as, one day in 1911, he tested—at increasingly lower temperatures—the conductivity (thus resistance) of mercury. Achieving temperatures within reach of absolute zero was, in itself, a feat in 1911. But Onnes managed the trick . . . he was, at least, able to reach temperatures a few degrees above absolute zero. Now a sample of mercury (frozen solid, of course), shivered in his chill-chamber.

Things were going predictably: as he lowered the chamber's temperature, the mercury's conductivity grew better, its resistance less (but still measurable), and the metal itself grew ever more hard and brittle.

Suddenly, as Onnes dropped the temperature but another 1/10 degree, all electrical resistance vanished. Onnes didn't believe his eyes, much less his instruments. Perfect conductivity—zero electrical resistance? Impossible!

Onnes had indeed stumbled upon a phenomenon—and he called it *superconductivity*. Somewhere near 0°K—usually a few degrees above absolute zero—the resistance of some metals and materials doesn't simply grow less; it vanishes completely. The material becomes a perfect conductor. The drop-off point—the precise degree K at which a material turns superconductive—is called its *critical temperature*.

For each of the 24 elements, alloys and compounds discovered, since 1953, to possess superconductivity (notably by Bell Telephone Laboratories), the critical temperature is slightly different: Tin becomes a perfect conductor at 3.7°K (just a whisper above absolute zero); mercury, at 4.2°K; lead at 7.2°K; compounds of vanadium-silicon at 17°K and niobium-tin (the compound with the highest known critical temperature) at 18°K.

Onnes' elation—for he envisaged his superconductive mercury as capable, since it possessed no resistance, of carrying huge and nearly unlimited current—was short-lived. Shortly he discovered a second phenomenon which, though it punctured the dream of supercold wires carrying supercurrents, makes superconductivity today's hottest electronic tool; namely, that the flow of high current through a superconductive wire kills superconductivity. More correctly, a material—no matter how cold—reverts to its resistive state at a certain current flow. Current itself is not the culprit—magnetism (caused by the current) is.

For each of the superconductive materials thus far discovered, there's a *critical field strength*—the maximum magnetic field in which the superconductor can operate and still remain superconductive. Happily, this critical field strength is high (at least as high as 600,000-gauss) for some superconductive materials—vanadium-gallium, for one.

Moreover, the discovery only in 1962 that super-pure molybdenum was superconducting (the first new superconducting element found since 1953) has reopened research on many other materials previously tested and discarded. The answer is unbelievably purity. A trace of impurity (as little as one part per million) can conceal a material's ability to become superconductive. Now many metals once believed non-superconductive are being looked into again . . . in their purest state. It is likely that some will prove able to withstand greater current flow, stronger magnetic fields and higher temperatures (above the present 18°K) than any known superconductive material.

For the frontiers of the weird world of cryogenic supercold have hardly been explored. More—much more—awaits the electronic researcher there near the bottom of the bulb: absolute zero. —30—

Transistor Topics

(*Continued from page 78*)

units. A 500,000-ohm potentiometer (*R2*) serves as a *sensitivity* control. Switch *S3* is a s.p.s.t. normally open push-button type and *PC1* a Clairex CL-3 photoconductive cell. Point "X" connects to the junction of *R4*, *R5* and *R6* and point "Y" to *Q1*'s emitter. Remove *S1*.

In practice, the circuit shown in Fig. 3(a) is used where a very small control current is needed—less than 1.0 ma. through *S1* as compared to approximately 15 ma. through *S1* in Fig. 1. The circuits given in Figs. 3(b) and 3(c) are used where light-sensitive operation is desired, as in machine control, smoke detection, and burglar alarm applications.

Transitips. Many readers have asked for tips on identifying *pnp* and *npn* transistor types when the type numbers are either illegible or missing entirely, as in some "bargain" assortments. This is not a difficult job.

First, identify the emitter, collector and base leads. Most of the popular handbooks contain this information—typically, either the RCA or GE *Transistor Manuals*.

Next, using a low-voltage ohmmeter, connect the *negative* lead to the unknown transistor's *base* terminal and the *positive* lead to its emitter as shown in Fig. 4, and note the reading. Reverse the test leads and note the second reading. If the transistor is in good condition, an appreciable difference in readings will be observed when the leads are reversed.

If a lower reading is obtained with the negative test lead on the base, the transistor is a *pnp* type. If the reading is higher, the transistor is a *npn* unit. This technique is similar to that used to determine the front-to-back resistance ratio of a diode.

Best wishes for the happiest of Happy Holidays. . .

—Lou

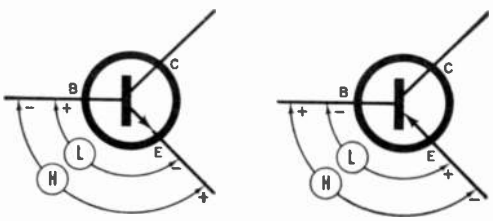

Fig. 4. To separate npn from pnp transistors when markings are missing, measure front-to-back resistance ratio between emitter and base. Readings are lower when the n element "sees" a negative voltage.

Across the Ham Bands

(*Continued from page 76*)

family, K6GHU, K6KCI, and WA6IBR, in Santa Barbara, Calif.

Fighting these legal battles requires a lot of money. If you'd like to supply some ammunition, you might want to contribute to one of these embattled hams. Personally, your Amateur Radio Editor thinks that the Chicago case is of the greatest fundamental importance, so that is where he sent his contribution—to the CARCC Tower Fund, 318 Adams St., Chicago, Ill. 60606.

Notes from Club Bulletins. Have we passed the low point of the current sunspot cycle? WØHJL says "yes" in the August, 1964, issue of *Round Table*, which is put out by the Denver (Colorado) Radio Club, Inc. He interprets the CRPL, U.S. Bureau of Standards Radio Propagation Predictions, as predicting a smoothed sunspot number of 17.5 for September, 1964—a half point better than for the preceding month. Others, using the same propagation charts, come up with a smoothed number of 12 for September, and estimate that the low point may not be reached until April, 1965. Whoever is right, many hams will be refurbishing their 10- and 15-meter beams next summer.

According to the *HARC News*, W5FJS, an experienced electronics instructor, has opened a "do-it-yourself" electronics business in Houston, Texas, where hams can go to work on their equipment. A complete stock of tools and test equipment is available, with W5FJS on hand to give necessary instruction in the use of the test equipment.

If you hear about the public hanging of an Indiana ham, the victim will probably be a member of the Indiana MARS program. At last report, the 52 members had compiled a record of 100 percent participation for 11 consecutive months. Reading the Indiana MARS bulletin gives one the distinct impression that the member who spoils this record will be lucky if the other members do nothing more drastic than hanging him.

News and Views

John Babbitt, WN2LUX, Houghton, N.Y., also known as "Mr. Clean," transmits on a Knight-Kit T-150 held down to 75 watts. He receives on a Hallicrafters SX-99, and an 80-, 40-, and 15-meter dipole antenna is the go-between. Twenty states and two Canadian provinces worked plus a regular sked with California prove that the combination works . . . **John Anderson, WB6DFA,** 5050 Collis Ave., South Pasadena, Calif., announces the formation of the California CW Club. Check with him for

details . . . If he wasn't on the wrong coast, **Bix Doolittle, K1EPX,** would be a good prospect for membership. His code speed is 55 wpm.

Dave Warden, WN6LSZ, 15932 Del Prado Dr., Hacienda Heights, Calif., runs 75 watts to a Heathkit DX-60 transmitter feeding a 40-meter dipole, 5½' high. He receives on a Heathkit HR-10. Dave has 15 states, all worked on 40 meters . . . **Buddy Kimsey, WA4NIV,** 1707 Stuart St., Cleveland, Tenn., keeps his Hallicrafters HT-40 transmitter, SX-110 receiver, and Gotham V-80 vertical antenna busy. He is a net control station for two nets, likes to "rag chew" (he holds an R.C.C. certificate), and has QSL cards from 40 states and three countries. As a Novice, Buddy won the 1963 Novice Sweepstakes certificate for Tennessee . . . **Ronald E. Telsch, WN3BFR,** 153 Colonial Drive, Warminster, Pa., started out his ham career in overdrive. He made 24 contacts in 13 states his first two days on the air. He forgot to mention his present states worked total. But Ronnie uses an EICO 720 transmitter running 75 watts, a Hammarlund HQ-100 receiver, and a home-brew, multiband dipole on the lower frequency bands. On 144 mc., his Heathkit "Twoer" feeds a 10-element beam atop a 30' stick. His 2-meter DX is 55 miles.

Jerry Haley, WN4TKI, McMinnville, Tenn., started out as a ham by working 21 states and Canada in 21 days—not bad for an old Heathkit AT-1 transmitter running 10 watts! Since then, Jerry has been on the air only on weekends but has added another six states to his total. His receiver is a Lafayette HE-30, and his antenna is a doublet 38' high . . . **Charles F. Lambert, WA4EPH,** 314 Jamestown Rd., Williamsburg, Va., divides his time between 80- and 20-meter c.w. and 75-meter SSB. He receives on a Heathkit "Mohawk" and uses a Johnson "Viking II" transmitter on c.w. Charles didn't mention what transmitter he used on SSB, but his antenna is 40' high. He has 45 states and 320 different U.S. counties confirmed . . . From the *W4CA Log* via *Auto Call,* a ham was told that his c.w. signal had an undesirable keying chirp. When asked how his transmitter was keyed, he promptly replied "Through a hole in the front." . . . In our last batch of mail there was an interesting letter commenting on AM vs. SSB on 20 meters. The letter was not signed "for obvious reasons." For even more obvious reasons, it was promptly dropped in our wastebasket.

Gerald Van Loh, WNØJCV, Box 204, Lennox, S.D., will probably be signing his General call by the time you read this, but he will be glad to sked any ham who still needs a South Dakota QSL card on either 80 or 40 meters. Jerry's home-brew 40-watt transmitter has fed his signal into 27 states with the help of a vertical antenna and an inverted-V antenna. He receives on an old National NC-46 pepped up with a Q-multiplier and a home-built preselector . . . Have you been to the post office yet to stock up on the special commemorative stamp honoring amateur radio? Using these stamps to mail your QSL cards will add a note of distinction to your cards . . . **Jim Evans, Jr., WA9KLW,** 8724 Parkway Drive, Highland, Ind., believes in this axiom: "Use low power if you must, but get the best receiver you can

afford." He receives on a Hallicrafters SX-117 and transmits on a Heathkit DX-40. A 40-meter dipole does the radiating—into 31 states, France, and Mexico so far.

Mike Rhodes, WN8NBO, R.R. 5, Box 305, Celina, Ohio, uses a National HRO-7 receiver that is far older than he is. But his transmitter is a new EICO 720. The combination has agitated the loudspeakers of hams in 32 states and Canada in six weeks of operation . . . Without knowing the results of the presidential election (which has not yet taken place as this is written), we wish to compliment the great majority of the hams that call and work **Barry, K3UIG/K7UGA.** Although he is always in great demand on the air, the ill manners often displayed by a few hams chasing a rare station are almost completely absent when Barry is being called or worked. Of course, Barry's own tact and good operating have much to do with this happy condition. May it long continue!

We are looking for *your* "News and Views," photos, and club bulletins. The address is: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P. O. Box 678, Gary, Ind. 46401. 73,

Herb, W9EGQ

Module Pocket Receiver

(*Continued from page* 52)

this station is heard at maximum level. Now find a station at the high end of the band on the standard radio. Rotate the knob until the plates are fully open.

(Note: whether the plates should be fully open or less than fully open depends upon the actual position on the dial occupied by the station. The same is true for the position of the plates and the radio station at the low end of the band. If the standard radio has, say, 10% rotation from maximum, adjust the radio you have just built to 10% from maximum in a similar manner. Unless you are working with a premarked tuning dial, the exact position of the variable capacitors is not critical, so long as you can tune in all the stations.)

When the plates are fully open, the trimmer capacitors on *C1a* and *C1b* have their maximum effect. Adjust the trimmer on *C1b* until the station on the upper end of the band comes in, then adjust the trimmer on *C1a* for maximum volume.

Now go back to the low end of the band and repeat the entire procedure. "Rock" and peak all the adjustments. You can align the set in less than five minutes. If desired, either the case or a small dial mounted under the tuning knob can be marked to show the location of the stations in your area.

As the volume level goes up during the alignment procedure, reduce the level with the volume control to enable you to more easily detect variations in signal level. -30-

Transformer Quiz Answers

(*Quiz on page* 65)

1	365.7 volts	**5**	355.7 volts
2	9.3 volts	**6**	6.7 volts
3	243.3 volts	**7**	253.3 volts
4	134.3 volts	**8**	121.7 volts

Exalted Pot

(*Continued from page 72*)

brated also, because both pots are of the linear type. Simply switch *S1* to *10K* and multiply readings by 1000. With *S1* in the *1K* position, you would of course multiply the readings by 100.

To calibrate a capacitance scale, find the capacitance value and mark the appropriate resistance point. At 836 ohms, mark 1.9; at 800 ohms, mark 2; etc. No further calibration for capacitance is required. The other three ranges of capacitance fall into line because the controls are linear. With a 100-cycle test signal, the *C* or *C/10* scale applies, depending on *S1*'s position. With a 10,000-cycle signal, the ranges become *C/100* and *C/1000*. Simply flip *S1* to the desired range. Consult the calibration charts on page 72 as you work.

An inductance scale is calibrated similarly. At 62.8 ohms, mark 1; at 125.6 ohms, mark 2; etc. Refer to the first two columns in the calibration table. Here again, because the controls are linear, the other ranges do not require further calibration. With a test signal of 10,000 cycles, and with *S1* at position *L*, you can read 1 to 15 mh. directly. With *S1* in the *Lx10* position, multiply readings by 10 and read 10 to 150 mh. The ranges at 100 cycles are: *Lx100* for readings from 0.1 to 1.5 henrys, and *Lx1000* for values from 1 to 15 henrys.

Operation. Connect the generator output to jack *J1* and the unknown component to terminals *C* and *Gnd*. Connect your VTVM first to *C* and *Gnd*, and then to *B* and *C*. Adjust the knob to obtain the same voltage readings. When the voltages are equal, the scale can be read. Keep in mind that the applicable scale depends upon using the correct test frequency and position of the range switch. Also remember that electrolytic capacitors are polarized and are designed for d.c. operation—you may not be able to determine their values with this technique.

To use the "Exalted Pot" as a variable resistor, terminals *B* and *C* are employed. For 0-1000 ohms, set *S1* to the

1K position. For 0-10,000 ohms, set *S1* to the *10K* side.

To operate the unit as a low-current voltage divider, apply the voltage to terminals *B* and *T*. Take the divided voltage from terminals *B* and *C*. Either the 1000-ohm or 10,000-ohm potentiometer can be used depending upon the position of *S1*. Do not exceed the ½-watt rating of *R1* and *R2*. -30-

Electric Fence Charger

(*Continued from page* 60)

find out if the fence is being charged, connect the neon tester between the ground and the fence. The higher the intensity of the flash, the greater the charge. To minimize the possibility of shock, first connect the tester's lead to ground.

To keep a garbage can from being raided, place a small sheet of thin plastic material (the kind that plastic bags are made of) under the can. The plastic sheet should be just large enough to insulate the garbage can from the ground.

If the can is to be placed on a dry cement or gravel walk, first lay down a piece of metal screen, about 2′ x 2′, to serve as a ground. It should be big enough so that a dog will have to stand on it when he reaches out a paw for the can. Cover the screen with a piece of cardboard, then place the sheet of plastic over the cardboard, and then place the can over this "sandwich." The cardboard keeps the screen from puncturing or tearing the plastic. Both the cardboard and the piece of plastic are just a little bit bigger than the can but not big enough to prevent the dog from standing on the bare screen.

Run an insulated wire from the garbage can to the red post on the charger, and either a bare or insulated wire from the ground to the black binding post. (Better turn off the charger before the garbage collector arrives, or he may decide to take you in along with the garbage.)

One shock per invader should be enough. You will probably see some of the most surprised pooches you ever saw in your life. -30-

On the Citizens Band

(*Continued from page 74*)

If you have not forwarded information regarding your club *this year*, chances are you may not be included in the actual tabulation, which, of course, will not give us accurate results. *All* clubs are now requested to forward the latest officers' names, club address, activities engaged in or planned, photographs, etc., regardless of whether they have been sent prior to 1964.

Since this material will not be analyzed until after Jan. 1, 1965, those of you who are not as yet represented by information sent to the roster *this year* should forward the details before Dec. 31, 1964, to: 1964 OTCB Club Roster, POPULAR ELECTRONICS, One Park Avenue, New York, N.Y. 10016.

● Parkersburg Area CB Club, Parkersburg, W.Va. Officers: M. H. (Windy) Mercer, KLM6947, president; Carolyn Griffith, KHJ-6265, secretary. Recently organized, this club holds meetings on the first and third Tuesday of each month.

● Conemaugh Valley Communication Association, Johnstown, Pa. Officers: Robert Yeager, KID2795, president; H. K. Rummel, KLP2147, vice president; Donald Hamilton, Sr., KLP6213, secretary; James L. Lear, KIC7911, corresponding secretary; Gustuv Simanski, KID9068, treasurer; Harry Caufield, KLP6044, control director. Meetings are held every first and third Wednesday at 7 p.m.

● Ten-Ten CB Club, Eastland, Texas. Jessie True, KKV1689, secretary. Jessie should be contacted at 114 N. Seaman, Eastland, by those in the area interested in joining this group.

● New York City Citizens Band League, New York, N.Y. This club is a reorganization of a club in Queens that was disbanded. Kenneth Doerbecker, KBI7329, requests interested parties to call him by landline at VI7-5031.

● Northern Rhode Island REACT, Woonsocket, R.I. Composed of five divisions covering emergency CB service to nine towns, this group consists of 80 REACT members and 14 directors and deputy directors, with Peter E. Branconnier acting as control director.

● Town & Country Radio Club, Lakeville, N.Y. Officers: Don Richards, president; Clifford Cisco, vice president; Carl Gilbert, secretary; Peg Richardson, treasurer. There is also an executive committee of five, plus five directors, an editor-in-chief, an advertising manager, and seven contributing editors to the club paper, *The Whip*.

● Hopkins County Radio & Rescue Association, Madisonville, Ky. This emergency group conducts searches, establishes lines of communication, handles traffic control and recovery of drowned persons. A county directory listing CB'ers by calls is published, cross-referenced by alphabetical listings. Officers: Justice Rhodes, president; Charles Jenkins, vice president; Joe McWhorter, secretary/treasurer. The Association monitors channel "9."

● Seacoast Citizens Radio Club, West Atlantic City, N.J. Officers: Russ Stokes, KCC1719, president; Tom Gallo, KCC3013, vice president; Warren Fox, 3Q0059, second vice president; Dot Stokes, KCC1852, treasurer; and Jean Truman, KCC2378, secretary. The group publishes *Seacoaster's News*, has an editor and three reporters. Meetings are held monthly at the West Atlanta Volunteer Fire Company quarters, West Atlanta.

● Colorado County Citizens Band Radio Club, Cat Spring, Texas. Officers: Nolan L. Renz, KED0038, president; Buster Mooney, KED0228, vice president; Franklin Reese, KEE2150, secretary/treasurer; plus three net control officers and five directors. Meetings are on the second Wednesday of each month.

● Marshall County CB Radio Club, Guntersville, Ala. Officers: L. C. Mitchell, 6Q3852, president; Johnny Dunn, KDB5040, vice president. There are also three board members and an emergency team coordinated through police and other civic groups by the president.

● Citizens Emergency Radio Patrol, North Tonawanda, N. Y. Officers: John McKnight, 20Q4712, president; Vernon Batt, KIC5311, secretary; Ronald Beu, KID3474, treasurer; and Wayne Shoen, KIC5821, sergeant at arms. This emergency group works closely with the Frontier Fire Company, holds practice emergencies, and expects to put two or three skin-diving teams plus marine units in action by next summer.

● Civil Defense Citizens Band Radio Club, Concordia, Kan. Officers: Derald Deal, president; Kenneth Bulleigh, vice president; Wm. Rae Heffner, secretary; and Dallas Hockett, scribe. They publish a call book covering a 50-mile radius of Concordia.

● South Georgia C Bees, Brunswick, Ga. Officers: Matt Whorton, KDE1598, president; Harold Hood, KDD9269, vice president; Gene McDaniels, KKM3038, secretary; Ann Whorton, KDE1598, treasurer; Jimmy Jones, KDB7328, REACT commander. There are three board members, and *The CB Monitor* is put out by editor Ronald Weston, KHD5750, and three assistants.

That wraps it up—for the year! I'll CB'ing you in '65!

—Matt, KHC2060

From the staff of POPULAR ELECTRONICS

Short-Wave Report

(*Continued from page* 80)

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 all contributors.

Angola—*R. Angola,* Luanda, is on 4885 kc. and is heard in Eastern areas from 1645 with instrumentals. A combination of c.w. QRM and HIJP (Dominican Republic) on 4884 kc. make Luanda difficult to receive.

Basutoland—The Lesotho Broadcasting Corporation, Maseru, will broadcast on the short waves before the end of 1964, according to overseas sources. However, the official name will not be used at first since Basutoland will not become Lesotho until 1966.

Bolivia—A new station is *R. 21 de Diciembre,* Katavi, 5120 kc., reportedly operating from a mine near Llallagua. Programs consist mostly of Latin American and Bolivian music with few anmts from 2045 to 2202/close.

Another new Bolivian station is *R. Nueva America,* La Paz, 4795 kc. Noted broadcasting in Spanish, it has been heard from 2247 to 2302/close with many ads. According to some sources, reports go to Casilla 2431, La Paz.

Brazil—A rarely heard station is PSL, *Agencia Nacional,* Rio de Janeiro, on 7935 kc. It has been noted around 1730-1800 with operatic music but accompanied by very heavy RTTY QRM.

A new station is *R. Educadora Rural,* Campo Grande, 3295 kc. Noted after another Brazilian (in Uberlandia) signs off, it features Brazilian vocals and commercials until 2300/close.

R. Marajoara, Belem, 15,245 kc., has extended its schedule and is now heard well afternoons with s/off at 1600.

Chile—Station CE597, *R. Presidente Balmaceda,* on the new frequency of 5978 kc., has been noted from 2230 to 0005 s/off. There is a full ID in Spanish at 0000, during which reports are requested. There may be an anmt in Eng. at this time some days.

Cyprus—If you need this country, try for the *Cyprus Telecommunications Authority,* 10,141 kc. This station operates on single sideband for test purposes. A taped report to them brought a QSL in letter form which stated that reception reports were welcomed. The call-sign is 5BC46; the address is Box 1929, Nicosia, Cyprus; the power is 7500 watts; and the antenna is a three-wire rhombic 98′ high. Time of reception was 2222-2250.

Ecuador—Station HCEH3, *R. El Progreso,* Loja, listed for 4775 kc. but actually on 4700 kc., has been noted from 2145 with lengthy periods of local music to 2330/close. The only ID noted was at 2242.

El Salvador—Evidently reactivated, YSS, San Salvador, has been found on 6010 kc. at 2250-2328 with music and Spanish but accompanied by considerable QRM.

England—The British Broadcasting Corp. is carrying out experimental xmsns on single sideband, relaying the General Overseas Service, at 2200-0000 on 9317 kc., at 0100-0300 and 0415-0445 on 15,913 kc., and at 0830-1245 and 1300-1715 on 12,182 kc.

A special Australian xmsn was noted on 15,105 kc. at 1220 with a cricket match and at 1415 with Eng. lessons in French to Europe.

Fiji—Present short-wave operations of *R. Fiji* are in Eng. at 1300-1630 and 2300-0530 on 3230 kc. and at 1630-2300 on 4756 kc., and in native language during the same time periods on 3284 and 4785 kc.

Germany (West)—*Deutsche Welle,* Cologne, has been found on 11,785 kc. with Eng. to Africa at 1515-1548; it goes into French at 1550.

Gibraltar—This is another difficult country to log. Look for MLU, a station of the British Royal Air Force, on 4615 kc. It's a c.w. station which has been noted around 0030 with a reasonably slow running marker. Reports go to: Chief Operator, Radiotelegraph Station MLU, British Royal Air Force, Gibraltar, Gibraltar. A companion station, MLU2, operates on 11,655 kc., but this one has not yet been logged.

Guinea—Conakry on 9670 kc. is heard at 1715-1730 with continuous African music and anmts in French.

Honduras—Station HRST, *R. 1° de Mayo,* Tela, can be noted on 4790 kc. with Latin American pop tunes and commercials from about 2125 to 2158/close, but don't confuse it with *R. Atalaya,* Guayaquil, Ecuador, on 4789 kc.

Station HRVL, *R. Lux,* Olanchita, Yoro, 4890 kc., operates at 0700-2200 with 1000 watts. Not likely to be heard in most of N.A. is their 1230-1300 daily Eng. feature, "Norteamerica y su Musica."

India—*All India Radio* has Eng. on 15,225 kc. at 0830-1000 (news at 0831, commentary at 0840). Reports go to Box 500, New Delhi. Also

A Knight R-100 receiver is the most important piece of equipment in the shack of Mike Jungman, WPE5DQM, located at Randolph Air Force Base in Texas.

logged recently were Eng. xmsns to East Asia and China at 0500-0600 on 9520, 11,770, 15,105, and 17,855 kc.; at the same time to Australia and New Zealand on 11,710 and 15,165 kc.; and to the British Isles and Europe at 1445-1545 on 6130 kc. (replacing 5995 kc.) and on 9915 kc.

Iran—*R. Iran*, Teheran, is noted on 15,205 kc. at 1330 in Arabic, at 1500 in French, and at 1430 and 1530 in Eng., dual to 11,730 kc. This is the station being widely reported behind *R. Nederland's* Sunday program on 11,730 kc. There is an Eng. newscast at 1530.

Israel—The 1515-1545 Eng. xmsn from *The Voice of Israel* is noted at good level on 9009 and 9620 kc.

Korea (South)—Seoul has Eng. at 2200-2230 and 0230-0300 on 11,925 kc., and at 0530-0600 on 9640 kc. in the General Service, and at 0900-0930 on 11,925 kc. to S. E. Asia. French to Europe is aired at 0200-0230 and to S. E. Asia at 0930-1000 on 11,925 kc. Spanish to L.A. can be heard at 2230-2300 on 11,925 kc.

Kuwait—*R. Kuwait* was noted recently as late as 1650 with Arabic chanting and talks on 4967.5 kc. This station has Eng. at 1300-1400 (news at 1315) on the above outlet in parallel with 9520 kc.

Leeward Islands—*R. Montserrat*, Box 51, Plymouth, 885 kc., has been noted around 1800-1900. Their schedule reads: daily at

DX COUNTRY AWARD RULES

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, verfication 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.

DX States Awards Presented

To be eligible for one of the DX States Awards designed for WPE Monitor Certificate holders, you must have verified stations (any frequency or service) in 20, 30, 40, or 50 different states in the U. S. The following DX'ers have qualified for and received awards in the categories indicated.

Fifty States Verified

Ron Kusmack (VE4PE4U), Winnipeg, Man., Canada
John Toikkanen (WPE8FFD), Conneaut, Ohio
Jack Winther (WPE6BJD), Moraga, Calif.
Walter Smart (WPE9EKW), Pittsfield, Ill.
Paul Larsen (WPE9DYE), Tinley Park, Ill.
Michael Mandrick (WPE2GVF), Rochester, N. Y.
James Pierce (WPE9EYQ), Mt. Vernon, Ill.
David Algeo (WPE8ELZ), Dayton, Ohio
Joseph McDaniel, Jr. (WPE3CXY), Hagerstown, Md.

Forty States Verified

Edward Semrad (WPE9GTP), Milwaukee, Wis.
Michael Fletcher (WPE4DPS), Waco, Texas
Robert Berg (WPE5ANO), Fort Worth, Texas
R. Maybaum (WPE6AUV), San Francisco, Calif.
George Hemingway (WPE1DYC), Taftville, Conn.
Craig Larson (WPE9GJE), Indianapolis, Ind.
Ray Schubnel (WPE1AGS), North Adams, Mass.

Thirty States Verified

Edward Craven (WPE1FUA), Hartford, Conn.
David Kaplan (WPE1FIJ), Hartford, Conn.
Gene McAvoy (WPE3FSR), Lutherville, Md.
Jessee Ring (WPE4GLK), Narrows, Va.
Joseph Sudol (WPE2JHP), Garfield, N. J.
John Day (WPEØAXQ), Kinmundy, Ill.

Twenty States Verified

Ronald Shopinski (WPE3DKA), Mt. Carmel, Pa.
Jack Pleska (WPE3EUN), Simpson, Pa.
Mike Rhodes (WPE8GAY), Celina, Ohio
James Jordan (WPE5CYL), Laurel, Miss.
Mal Gogel (WPE2LQD), Huntington Station, N. Y.
Mike Fisher (WPE3FOD), Pottsville, Pa.
Henry Brown, Jr. (WPE1EXZ), Falmouth, Mass.
David Kaplan (WPE1FIJ), Hartford, Conn.
William Steckiel (WPE3FPX), Pottsville, Pa.
George Hall (WPE2KOR), Saddle Brook, N. J.
Philip Drago (WPE6FAV), Santa Monica, Calif.
Michael Hoffberg (WPE2KMX), Bronx, N. Y.
Conrad Durocher (WPE1ASP), N. Smithfield, R. I.
Alan Zattiero (WPE4HMY), Hampton, Va.
Billy Akin (WPE4EUW), Columbia, Tenn.
Ray Hartman (WPE9GON), New Berlin, Wis.
Elliott Block (WPE8HGD), Cincinnati, Ohio
Tim Kerfoot (VE3PE1TH), Toronto, Ont., Canada
Nick Oliviero (WPE1FMD), New Britain, Conn.
Steven Russell (WPE3EWZ), Bethesda, Md.
Edwin Bolton, Jr. (WPE2KWQ), Wayne, N. J.
Merlin Bakke (WPE9DJC), Westby, Wis.
Edward Hudgens (WPE6FNE), Gardena, Calif.
Timothy Pawlak (WPE8HQZ), Bay City, Mich.
David Evans (WPE8GCX), Pataskala, Ohio
James Peshock (WPE5DQD), Richardson, Texas
Stephen Dionne (WPE2LOU), Binghamton, N. Y.
Dick Schier (WPE4HIO), Chattanooga, Tenn.
Richard Shaw (WPE2KIT), N. Bergen, N. J.
Don Van Wienen (WPE8HBN), Allendale, Mich.
Kenneth Feldman (WPE6DUX), Los Angeles, Calif.
Tom Rupe (WPE9DJH), Park Ridge, Ill.
Jim Russell (WPE9GYH), Monmouth, Ill.
Peter Hartquist (WPE6FNY), Fairfield, Calif.
Bob Thrower (VE7PE7W), Vancouver, B. C., Canada
Sonny Lea (WPE4GPV), Rocky Mount, N. C.
Vincent Yucas (WPE1FJA), S. Boston, Mass.
Neal Yermish (WPE3FMH), Philadelphia, Pa.
Jim Skatoff (WPEØCHB), St. Louis, Mo.
Joel Resnick (WPE2LMZ), New York, N. Y.
Arthur Bonito (WPE2DZE), Secaucus, N. J.
Michael Sevigny (WPE1FTC), Biddeford, Maine
Stephen Berlinski (WPE1FTF), Bridgeport, Conn.
Robert Read (WPE4HPB), Atlanta, Ga.
Thumper Peniston (WPE2LYJ), Chester, N. J.
Peter Bartlett (WPE1FSX), Marshfield Hills, Mass.
Robert Ramlow (WPE9FTQ), West Allis, Wis.
C. R. Schwesig (VE2PE1CM), Verdun, Que., Canada
Brian Derx (WPE2IEF), Hastings-On-Hudson, N. Y.
Douglas Byron (WPE2LQR), Poughkeepsie, N. Y.
Joe Beals III (WPE1FRF), Marshfield, Mass.
Glen Wright (WPE9EQP), Findlay, Ill.
Michael Cripps (WPEØDTV), St. Louis, Mo.
Charles Wohlers (WPE2IRQ), Mountain Lakes, N. J.
Bob Wallenhorst (WPE8HFM), St. Bernard, Ohio
Warren Leach (WPE8HOK), St. Clair Shores, Mich.
George Virtue (WPE6FKE), Waterford, Calif.
David Husom (WPEØCQK), Richfield, Minn.
Andrew Durosky, Jr. (WPE2KVN), Richmond Hill, N. Y.
Rick Hoebee (WPE6EJB), Sunnyvale, Calif.
Arthur Harris (WPE2MJS), Hollis, N. Y.

0500-0700, 1030-1145, and 1730-2100; Saturdays at 0500-0700, 0900-1100, and 1730-2100; Sundays at 1530-1845.

Maldives—From the *New Zealand DX Times*: "The British Broadcasting Corporation's Engineering Department advises that the relay station in the Maldives is not yet in operation. Quite apart from the technical requirements and the building of such a relay base extension, some time must elapse for various political arrangements to be completed."

Mozambique—Station CR7RA, *R. Pax*, Beira, opens at 2300 weekdays on 3960 kc. and has been noted to 2345 or later with pop tunes and all-Portuguese anmts.

Netherlands Antilles—Reports are pouring in on PJB, *Trans-World Radio*, Bonaire, with excellent reception being noted on the West Coast for the 800-kc. outlet. The daily schedule for this frequency, as given by the station, is as follows: Portuguese at 0330-0430, Spanish at 0430-0530, Eng. at 0530-0735, Dutch at 1715-1730 (Fridays only), Spanish at 1730-1815, German at 1800-1815 (Thursdays only), Portuguese at 1815-1830, and Eng. at 2030-2200. The schedule for Sundays reads the same except that Eng. is given at 0530-1700 and Spanish at 1700-1815. However, the schedule as released by *R. Nederland* lists "The Happy Station Program" in Eng. on Sundays at 1940-2030; has anyone heard it yet?

Station PJB has been testing on 5955 and 9705 kc. at 1900-0130 in Eng. and Spanish. Reports are requested and return postage is not required. A late report indicates that 11,855 kc. may be another test channel, for it was noted at 0900-1000.

Peru—A new station is *R. Jaen*, Jaen, Provincia de Cajamarca, logged at 2145 on 5005 kc. The ID is *La Voz de la Frontera*.

Portugal—*The Voice of the West*, Lisbon, has a DX program on the second and fourth Sundays of each month at 2115 and 2315 on 6025 and 6185 kc.

Portuguese Guinea—Bissau is back on 5017 kc. and was noted at 1600 with Portuguese music and both male and female announcers.

Uganda—*R. Uganda*, Kampala, is weak at 1600 on 5026 kc. with a woman giving final anmts in Eng.; s/off is at 1604.

U.S.A.—Keith Glover of *R. Australia* reports that the U. S. intends to establish a communications station in the Indian Ocean. The U.S. has evidently conferred with British officials on the plan. The station will be built on an island and its purpose will be to help facilitate traffic in that part of the world.

U.S.S.R.—A new type of jamming has been noted, consisting of Russian-language programs with frequency modulation. This is apparently being used on some jammed channels in addition to the usual type of jamming.

SHORT-WAVE ABBREVIATIONS

anmt—Announcement	N.A.—North America
c.w.—Morse code	QRM—Station interference
Eng.—English	QSL—Verification
ID—Identification	R.—Radio
IS—Interval signal	RTTY—Radioteletype
kc.—Kilocycles	s/off—Sign-off
kw.—Kilowatts	xmsn—Transmission

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.

WPE1CYI	WPE2IMJ	WPE4GIG
WPE1DVT	WPE2IPH	WPE4GUL
WPE1DXG	WPE2IPM	
WPE1EKE	WPE2IQK	WPE5BZD
WPE1ESB	WPE2IVS	WPE5CHE
WPE1FDW	WPE2KXG	WPE5CUC
WPE1FGM	WPE2LNI	WPE5DAX
WPE2CFM	WPE3DNC	WPE6CJ
WPE2CON	WPE3DOV	WPE6DQD
WPE2DMN	WPE3DVE	WPE6DRR
WPE2FG	WPE3DYL	WPE6FCN
WPE2GQD	WPE3EFF	
WPE2HHK	WPE3ESC	WPE7BLZ
WPE2HXV	WPE3FKR	WPE9FCQ
WPE2IAR	WPE3FO	
WPE2IAV		DL1PE1AP
WPE2IJB	WPE4FCS	DM1PE1AE
WPE2IKU	WPE4FPL	TA3PE1J

Vatican City—*Vatican Radio,* 15,290 kc., is good at 1000-1010 with world-wide religious news; after an IS hymn, played on a celesta, Polish was heard. This xmsn was dual to 7250, 9645, and 11,740 kc. The latter three channels were also heard well at 1940-2005 with religious news in English.

Vietnam (North)—*The Voice of Vietnam* cannot be reached by mail as the Universal Postal Union will not deliver incoming mail to Hanoi. (In similar instances in the past, particularly in connection with mail service to Iron Curtain countries, reports addressed to the station *in care of Radio Moscow* have usually reached their destination—*Ed.*).

Yemen—A Maryland reporter writes: "In the local newspaper, I read that Yemen, Arabia, and other countries have signed a radio pact, thus adding more assurance to my earlier report that Yemen was, in fact, setting up a station." Meanwhile, information gathered at the Yemen pavilion at the New York World's Fair reveals that *R. Sanaa,* 5950 kc., is now up to 70 kw. (it was 25 kw.) and is scheduled to operate at 2200-0100, 0600-1000, and 1100-1700.

Clandestine—Some time back we stated that a listed address for *Radio Libertad,* 2113 Ocean View Drive, Miami Beach, Fla., was fictitious since that location turned out to be a section of open beach. However, a correction now indicates that the proper address is Box 2113, Ocean View Branch, Miami Beach, Fla. Reports may also be sent to Box 5650, Caracas, Venezuela. The station is now being noted afternoons on 15,050 kc. and on 7308 kc. at 0100 and 2020, but these frequencies may vary.

Kiss Me Honey has been logged on 9555, 11,700, and 11,950 kc. at 0800. The afternoon xmsn, usually ending around 1345, is often noted behind *Peyk-e Iran* until that station signs off, then is in the clear. For those who have not logged *Kiss Me Honey,* the station makes no anmts whatever and the recording from which the station derives its nickname

SHORT-WAVE MONITOR CERTIFICATE APPLICATION

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

All certificates are filled in and lettered before mailing; they are mailed flat and unfolded. If you want to register and receive your WPE identification sign, fill in the application blank below before January 15, 1965. Mail with 25 cents in coin to: Monitor, POPULAR ELECTRONICS, One Park Avenue, New York, N. Y., 10016. Canadians should use their own currency. All other applicants not in the U. S. A. should use five International Postal Reply Coupons. Allow 4-6 weeks for processing.

(Please Print) (Do not fill out)

Name . . . . . .

Street, City and Zone . . . . . .

State and Zip . . . . . .

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

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

Age Occupation . . . . . .

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

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

I use the following antennas . . . . . .

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

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

(Good only until January 15, 1965)

is played in a manner that would indicate it to be a continuous tape.

Radiofonikos Stathmos I Foni Til Alithias (Voice of the Truth), a quasi-clandestine Greek station, has been noted in Europe on 8071 kc. at 1255. It is believed to be operating in Eastern Europe, probably in Leipzig.

Voice of the Turkish Cyprus Fighters is listed by some groups as being in operation at 0300-0445, 0800-1040, and 1430-1630 on "41, 44, and 48 meters" in Turkish. No exact frequencies are given but one is thought to be 6700 kc.

International Waters—*R. Albatross*, a converted minesweeper, is to start operations for 18 hours daily from *The Wash* beamed to East Anglia. No frequency was listed.

R. Noordzee, a new pirate station beamed to the Dutch from a platform in the North Sea, operates on 1400 kc. and is currently scheduled at 0400-0600 and 1100-1500. This station reportedly will open a TV outlet with an ID of *Television North Sea*. -30-

SHORT-WAVE CONTRIBUTORS

Nick Oliviero *(WPE1FMD)*, New Britain, Conn.
Mike Larkin *(WPE1FNO)*, Lexington, Mass.
Clifford Stott *(WPE1FNQ)*, West Springfield, Mass.
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David Leibowitz *(WPE2JWF)*, Bronx, N. Y.
William Graham *(WPE2LMU)*, Binghamton, N. Y.
Harvey Liss *(WPE2LUV)*, Brooklyn, N. Y.
Ira Stoler *(WPE2LZG)*, Brooklyn, N. Y.
Jim Matis *(WPE2MHL)*, Fords, N. J.
Doug Lamerson *(WPE2MNN)*, Richmond Hill, N. Y.
Charles Schwartzbard *(WPE2TA)*, Passaic, N. J.
Marshall Salt *(WPE3ERC)*, Reading, Pa.
George Cox *(WPE3NF)*, Wilmington, Del.
Grady Ferguson *(WPE4BC)*, Charlotte, N. C.
John Brunst *(WPE4BQ)*, Neptune Beach, Fla.
Tom Palmer *(WPE4GEL)*, Sanford, Fla.
Jessee Ring *(WPE4GLK)*, Narrows, Va.
Darrell Garrison *(WPE5AIBD)*, Houston, Texas
Jack Keene *(WPE5BMP)*, Houston, Texas
Jack Petree *(WPE5CRQ)*, Houston, Texas
John Hopkins *(WPE5DPN)*, New Orleans, La.
Shaler Hanisch *(WPE6BPN)*, Hartford, Conn.
Dave Brown *(WPE6EMI)*, Woodland Hills, Calif.
Jim Young *(WPE6ENA)*, Wrightwood, Calif.
Eugene Aker *(WPE6EVR)*, Eureka, Calif.
Trev Clegg *(WPE6FAF)*, Fresno, Calif.
Fran Young *(WPE6FHD)*, Wrightwood, Calif.
Jess Dyer *(WPE8COJ)*, Dearborn, Mich.
Robert Sabin *(WPE8DB)*, Wilmington, Ohio
Robert Eddy *(WPE8EQW)*, Newport, Ohio
Robert French *(WPE8FGH)*, Bellaire, Ohio
Marlin Field *(WPE8FRE)*, Benton Harbor, Mich.
Robert Daniloxich *(WPE8PLF)*, River Rouge, Mich.
Ray Fansler *(WPE9CQC)*, Fairfield, Ill.
Warren Nordgren *(WPE9DGI)*, Waukegan, Ill.
Howard Chapman *(WPE9DJV)*, Chicago, Ill.
Robert Schultze *(WPE9GOU)*, Whiting, Ind.
John Zumbauch *(WPE9GVM)*, Garrett, Ind.
Dick McEachern *(WPE9DIUM)*, St. Louis, Mo.
Jack Perolo *(PY2PEIC)*, Sao Paulo, Brazil
Fred Parsons *(VE3PE1ZI)*, Welland Ont., Canada
Bert Pestor *(VE3PE9L)*, Sudbury, Ont., Canada
D. Dawson *(VE6PE4K)*, Penny, B. C., Canada
Margaret Hinkson *(VP4PE1B)*, Port of Spain, Trinidad & Tobago
Grant Cooper *(VP9PE1G)*, Smiths Parish, Bermuda
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Alan Campbell, Pittsburgh, Pa.
Joe Esser, New Kensington, Pa.
John Fournelle, Bethesda, Md.
Frank Germinario, Hoboken, N. J.
Russell Hawkins, La Vergne, Tenn.
Bruce Horlick, Los Angeles, Calif.
Michael Poore, Bethesda, Md.
Radio New York Worldwide, New York, N. Y.
Sweden Calling DX'ers Bulletin, Stockholm, Sweden

INDEX

TO VOLUME 21

July-Dec., 1964

HI-FI/STEREO AND AUDIO

PHOTOGRAPHY

PRODUCT REPORTS

SHORT-WAVE LISTENING

TELEVISION

TEST EQUIPMENT

TRANSISTORS

—30—

POPULAR ELECTRONICS December 1964 ADVERTISERS INDEX

The Wonderful World of Lids

(*Continued from page 70*)

the rig is working," Pheobus said hurriedly as he twisted dials, threw meters, and stepped on the accelerator.

"Whiskey baker two yellow banana peel, this is kay two brown spotted zebra. What say old man?"

"How do you know he's an old man?" I asked. "And is brown spotted banana peel a code name?" Pheobus just grimaced and looked pained as he listened to his microphone, waiting for a reply.

"Sorry brown spotted zebra," the voice came back. "I can barely read you—you're way down in the mud . . ."

Before I could ask him what this "mud" business was about, Pheobus went into action. "Cue are X there, I'm running in my bare feet. I'm switching over to the linear."

Pheobus' feet were not bare, but I thought it would be better not to remind him, for he was in a frenzy. Lights came on, dials began to spin, and the air smelled like ozone.

"How do you read me now, old man?" Pheobus asked the cyclotron.

"Sorry brown spotted zebra," said the voice. "Your sigz are three by four. Sorry I can't stick around as I have a sked coming up with Yankee victor three papa whiskey, and he'll be looking for me. Seventy-three. Kay two brown spotted zebra, whiskey baker two yellow banana peel is cue are zed."

"Three by four!" Pheobus raged. "He must be using a crystal set. Why that lid . . . I ought to . . ."

WHEN I left, Pheobus Sharney was seated morosely before his monster, staring out into space and occasionally mumbling something that sounded like "lid." I have pondered this term and the many others used during this strange, revealing session. Dictionaries do not seem to carry them.

I can only conclude that radio hams live in a world of their own, and have invented a special language to baffle casual intruders. To use their strange word of approval, I call it "The Wonderful World of *Lids*." -30-

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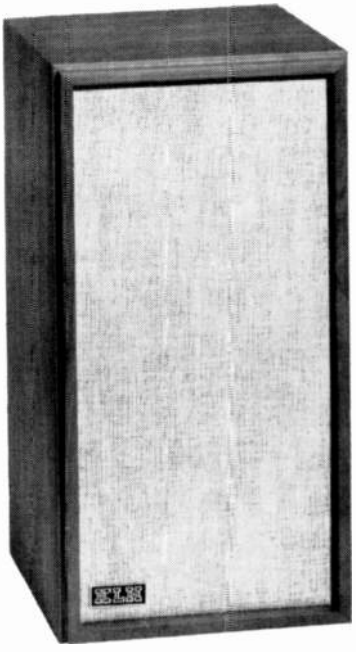

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On the other hand, the artistic school of loudspeaker design has depended on the judgement of a handful of experts whose "golden ears" were the final yardstick of perfection. If you didn't agree with the experts, your ear was "uneducated" and not discriminating. But too often the measured response of the expert's system fell woefully short of reasonable performance—proof that even trained listeners can delude themselves when listening to loudspeakers.

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To this end, experts in music and sound from coast to coast were invited to judge and criticize the E-V FOUR exhaustively before its design was frozen. Adjustments in response were made on the spot—in the field—to determine the exact characteristics that define superb performance. It was not enough to say that a unit needed "more bass". What kind of bass? How much? At what frequencies? These are some of the more obvious questions that were completely settled by immediate adjustment and direct comparison.

The new E-V FOUR is the final result of this intensive inquiry into the character of reproduced sound. According to wide-spread critical comment, the E-V FOUR sound is of unusually high calibre. And careful laboratory testing reveals that there are no illusions—the measurements confirm the critics' high opinion of this new system.

Of course, it is one thing to design an outstanding prototype—and something else to produce an acoustic suspension system in quantity at a fair price. It is here that extensive production facilities, combined with creative engineering approaches, guarantee the performance of each E-V FOUR. And these same facilities ensure reasonable value. For instance, the E-V FOUR sells for but $151.87 with oiled walnut or mahogany finish and just $136.25 in unfinished birch. Yet, in judging its sound qualities, it was successfully compared with speaker systems costing as much as $200.00.

We urge you to make your own analysis of E-V FOUR compact speaker performance. Visit your E-V high fidelity showroom and compare, carefully, this new system. We feel certain that you will agree with the engineers and the critics that the new E-V FOUR offers a truly full measure of high fidelity satisfaction.

E-V FOUR components include: 12" acoustic suspension woofer / Ring-diaphragm mid-range driver / 5" dynamic cone tweeter / Etched circuit crossover

ELECTRO-VOICE, INC.
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Electro-Voice®
SETTING NEW STANDARDS IN SOUND

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